Groundsure INSIGHTS

Site Details:

526698 184030

Client Ref: New_Mews_St_Johns_Wood_Park_NW8_6NN
Report Ref: HMD-2531065
Grid Ref: 526690, 183998

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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Production date: 14 October 2015

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Appendix C Ground and Water Ltd Ground Investigation Report for the site at Land Off Middlefield

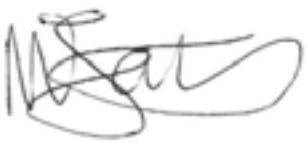
GROUND INVESTIGATION REPORT

for the site at

LAND OFF MIDDLEFIELD, SOUTH HAMPSTEAD, LONDON NW8 6NE

on behalf of

LIV-INTERNATIONAL

Report Reference: GWPR1403/GIR/November 2015		Status: FINAL
Issue:	Prepared By:	Verified By:
V1.03 NOVEMBER 2015		
	Megan James BSc. (Hons) Geotechnical Engineer	Francis Williams M.Geol. (Hons) FGS CEnv AGS MSoBRA Director
File Reference: Ground and Water/Project Files/ GWPR1403 Land off Middlefield, South Hampstead, London.		

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1.0 INTRODUCTION

1.1 General

Ground and Water Limited were instructed by Liv-International on the 22nd September 2015 to undertake a Ground Investigation on the land off Middlefield, London NW8 6NE. The scope of the investigation was detailed within the Ground and Water Limited fee proposal ref.: GWQ2589, dated 10th September 2015 and a further e-mail and phone call, dated 22/09/15.

1.2 Aims of the Investigation

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

The investigation was to be undertaken to provide parameters for the design of foundations by means of in-situ and laboratory geotechnical testing undertaken on soil samples recovered from trial holes.

The requirements of the London Borough of Camden, Camden Geological, Hydrogeological and Hydrological Study, Guidance for Subterranean Development (November 2010) was reviewed with respect to this report.

Included within the fee proposal was an allowance to undertake chemical laboratory testing on soil samples recovered from the site to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any potential contamination identified.

A Desk Study and full scale contamination assessment were not part of the remit of this report.

The techniques adopted for the investigation were chosen considering the anticipated ground conditions and development proposals on-site, and bearing in mind the nature of the site, limitations to site access and other logistical limitations.

1.3 Conditions and Limitations

This report has been prepared based on the terms, conditions and limitations outlined within Appendix A.

2.0 SITE SETTING

2.1 Site Location

The site comprised an approximately 590m^2 rectangular shaped plot of land, orientated in a west to east direction, located to the rear of No. 1 – 13 Middlefield. The site was located on the western side of the St Johns Wood Park, opposite Marion Court. The site was located in the South Hampstead/Primrose Hill area of north-west London within the London Borough of Camden.

The national grid reference for the centre of the site was approximately TQ 26682 83992. A site location plan is given within Figure 1. A plan showing the boundary of the site is provided in Figure 2.

2.2 Site Description

The site was occupied by a terrace of 14No single storey lock up residential garages. The remainder of the site comprised tarmac hard landscaping, accessed via double gates of St Johns Wood Park. Mature trees were noted in the north-east corner of the site with two-storey residential houses with off-road parking and private rear gardens were noted to the south.

An aerial view of the site is provided within Figure 3.

2.3 Proposed Development

At the time of reporting, November 2015, the full extent of proposed development was not known to Ground and Water Limited however the development was understood to include the construction of a basement founded at 5.00 – 6.00m bgl.

2.4 Geology

The BGS Geological Map (Solid and Drift) for the North London area (Sheet No. 256), and Figures 3 and 4 of the Camden Geological, Hydrogeological and Hydrological Study, revealed that the site was underlain by the London Clay Formation.

London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of Gypsum (Selenite) are often found within the weathered part of the London Clay Formation, and precautions against sulphate attack to concrete are sometimes required. The lowest part of the formation is a sandy bed with black rounded gravel and occasional layers of sandstone and is known as the Basement Bed.

A Ground Investigation, undertaken by Ground and Water Limited, on the neighbouring site revealed the following ground conditions:

Made Ground was proved from ground level to 0.50 – 1.10m bgl. Soils described as representative of Head Deposits were encountered underlying the Made Ground within TP/FE1. The deposits comprised a mid to dark brown, orange brown and grey mottled gravelly silty clay. The gravel was occasional, fine to medium, sub-angular to rounded flints. The base of the Head Deposits was not proven within TP/FE1, which was excavated to a depth of 1.50m bgl.

Soils described as the London Clay Formation were encountered underlying the Made Ground within BH1 for the remaining depth of borehole, a maximum of 12.50m bgl. The deposits encountered were described as a mid to dark brown, orange brown and locally light grey mottled silty clay becoming a dark brown to dark grey silty clay, with fine selenite crystals and claystones, at depth.

The London Clay Formation was shown to have very low to very high undrained shear strength (20 – 190kPa).

No groundwater was encountered during drilling although shallow groundwater levels were noted within the well installed on subsequent visits.

Roots were noted to 0.80m bgl by the supervising engineer. Geotechnical testing identified fine rootlets to 1.50m bgl.

A BGS borehole ~60m north of the site, drilled to 11.12m bgl, revealed ~0.50m of Made Ground to overlie firm to stiff brown, becoming grey with depth, silty clays. Claystone bands and selenite crystals were noted at depth.

No areas of Made Ground or Worked Ground were noted within a 250m radius of the site.

2.5 Slope Stability and Subterranean Developments

The site was not situated within an area where a natural or man-made slope of greater than 7^{o} was present (Figure 16 Camden Geological, Hydrogeological and Hydrological Study).

Figure 17 of the Camden Geological, Hydrogeological and Hydrological Study indicated that the site was not situated within an area prone to landslides.

Figure 18 of the Camden Geological, Hydrogeological and Hydrological Study indicated that the Jubilee Underground Line was situated beneath the extreme west of the site running north to south. An underground section/tunnel of the London Overground was situated running east to west ~50m north of the site. No other major subterranean infrastructure (including existing and proposed tunnels) were noted within close proximity to the site.

2.6 Hydrogeology and Hydrology

A study of the aquifer maps on the Environment Agency website, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, revealed the site to be located on **Unproductive Strata** relating to the bedrock deposits of the London Clay Formation. No designation was given for any superficial deposits due to their likely absence.

Superficial (Drift) deposits are permeable unconsolidated (loose) deposits, for example, sands and gravels.The bedrock is described as solid permeable formations e.g. sandstone, chalk and limestone.

Unproductive strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

Examination of the Environment Agency records, and Figure 8 of the Camden Geological, Hydrogeological and Hydrological Study, showed that the site fell within a Groundwater Source Protection Zone 2 (Outer Zone) as classified in the Policy and Practice for the Protection of Groundwater.

A Groundwater Source Protection Zone 2 (Outer Zone) is defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction. A Groundwater Source Protection Zone 1 (Inner Zone) was noted ~830m south-east.

No surface water features were noted within a 250m radius of the site.

From analysis of hydrogeological and topographical maps groundwater was anticipated to be encountered at depth (>10m below existing ground level (bgl)) and it was considered that the groundwater was flowing in a south-easterly direction in alignment with the groundwater source protection zones, towards the inner zone.

Examination of the Environment Agency records showed that the site was **not** situated within flood zone or flood warning area.

2.7 Radon

BRE 211 (2007) Map 5 of the London, Sussex and west Kent area revealed the site was located within an area where mandatory protection measures against the ingress of Radon were **unlikely to be** required. The site **was not** located within an area where a risk assessment was required.

3.0 FIELDWORK

3.1 Scope of Works

Fieldwork was undertaken on the 25th and 28th September 2015 and comprised the drilling of two Premier Windowless Sampler Boreholes (WS1 and WS2) to a depth of 12.45m bgl and the hand excavation of one trial pit foundation exposure (TP/FE1). Standard Penetration Testing was undertaken within both boreholes at 1.00m intervals. Two Super Heavy Dynamic Probes (SHDP) (DP1 and DP2) were undertaken through the base of WS1 and WS2 (12.50m bgl) to a depth of 16.20m and 16.30m bgl respectively.

Two small diameter combined bio-gas and groundwater monitoring well were installed within WS1 and WS2 to 5.00m bgl. The construction of the wells installed can be seen tabulated below.

Combined Bio-gas and Groundwater Monitoring Well Construction				
Trial Hole	**Depth of Installation (m bgl)**	**Thickness of slotted piping with gravel filter pack (m)**	**Depth of plain piping with bentonite seal (m bgl)**	**Piping external diameter (mm)**
WS1	5.00	4.00	1.00	63
WS2	5.00	4.00	1.00	63

The approximate locations of the trial holes can be seen within Figure 4.

Prior to commencing the ground investigation, a walkover survey was carried out to identify the presence of underground services and drainage. Where underground services/drainage were suspected and/or positively identified, exploratory positions were relocated away from these areas.

Upon completion of the site works, the trial holes were backfilled and made good/reinstated in relation to the surrounding area.

3.2 Sampling Procedures

Small disturbed samples were recovered from the trial hole at the depths shown on the trial hole records. Soil samples were generally retrieved from each change of strata and/or at specific areas of concern. Samples were also taken at approximately 0.5m intervals during broad homogenous soil horizons.

A selection of samples were despatched for geotechnical testing purposes. A selection of samples were despatched for geotechnical testing purposes. A programme of chemical laboratory testing, scheduled by Ground and Water Limited and carried out by QTS Environmental Limited, was undertaken on samples recovered from the trial holes.

4.0 ENCOUNTERED GROUND CONDITIONS

4.1 Soil Conditions

All exploratory holes were logged by James Dalziel and Francis Williams of Ground and Water Limited generally in accordance with BS EN 14688 'Geotechnical Investigation and Testing – Identification and Classification of Soil'.

The ground conditions encountered within the trial holes constructed on the site generally conformed to that anticipated from examination of the geology map. Made Ground was noted to overlie Head Deposits (possibly Made Ground) and the London Clay Formation.

The ground conditions encountered during the investigation are described in this section. For more complete information about the Made Ground, Head Deposits (possibly Made Ground) and the London Clay Formation at particular points, reference must be made to the individual trial hole logs within Appendix B.

The trial hole location plan can be viewed in Figure 4.

For the purposes of discussion the succession of conditions encountered within the trial holes in descending order can be summarised as follows:

Made Ground
Head Deposits (possibly Made Ground) (TP/FE1 and WS2 only)
London Clay Formation (WS1 and WS2 only)

Made Ground

Made Ground was encountered from ground level within all trial holes. The Made Ground was noted to comprise a layer of tarmac overlying a reddish-brown, and locally black, very gravelly medium to coarse grained sand to a depth of 0.30 - 0.40m bgl. The gravel was abundant, fine to coarse, sub-rounded to sub-angular brick, concrete, tarmac, limestone and carbonaceous material (clinker/tarmac/ash). From 0.40m to 0.65m bgl within WS2 the Made Ground comprised a mid to dark brown gravelly silty clay. The gravel was occasional, fine, sub-angular to sub-rounded brick and carbonaceous material (clinker/ash).

Head Deposits (possibly Made Ground)

Soils described as representative of Head Deposits, possibly Made Ground, were encountered underlying the Made Ground within WS2 from 0.65m to 1.50m bgl and for the remaining depth of TP/FE1, from 0.30m to 0.70m bgl. The deposits comprised a mid-brown to orange brown clayey gravelly sand, locally a sandy gravelly clay. The sand was medium to coarse grained. The gravel was fine to medium, sub-angular to rounded flint. From 0.50m bgl within TP/FE1 the deposits comprised a mid-brown very slightly gravelly silty clay. The gravel was rare, fine, sub-angular to sub-rounded flint.

London Clay Formation

Soils described as representative of the London Clay Formation were encountered underlying the Made Ground within WS1 from 0.40m bgl and the Head Deposits (possibly Made Ground) within WS2 from 1.50m bgl. The London Clay Formation was proved for the remaining depth of both boreholes, a maximum of 12.45m bgl. The deposits generally comprised mid to light brown, with light grey mottling, silty clays. Claystones, fine selenite crystals and sandy/silty lenses were noted

with depth. From 10.00m bgl within WS1, and from 9.50m bgl within WS2, the deposits were noted to become dark grey brown to dark grey and rare shell fragments were noted within WS2.

For details of the composition of the soils encountered at particular points, reference must be made to the individual trial hole logs within Appendix B.

4.2 Foundation Exposures

A description of the foundation layout and ground conditions encountered within the hand dug trial pit foundation exposure is given within this section of the report.

TP/FE1

Trial pit foundation exposure TP/FE1 was hand excavated from ground level in front of an existing garage. The exact location of the trial hole can be seen in Figure 4 with a section drawing of the foundation encountered in Figure 5. Photographs of the foundation exposure are given in Figure 6.

The foundation layout encountered consisted of a brick wall to ground level. The brick wall continued from ground level to a depth of 0.20m bgl and was noted to rest upon a concrete footing which stepped out by 0.15m and was 0.50m in thickness. The foundation was noted to rest on Head Deposits (possibly Made Ground) at 0.70m bgl, described as mid-brown very slightly gravelly silty clay. The gravel was rare, fine, sub-angular to sub-rounded flint. The ground conditions encountered directly surrounding the foundation are shown in Figure 5. Photographs of the foundation exposure are given in Figure 6.

4.3 Roots Encountered

Roots were noted to 2.70m and 2.00m bgl in WS1 and WS2 respectively. Black, fibrous, possibly decaying roots/rootlets were noted to 3.00m bgl within WS2.

It must be noted that the chance of determining actual depth of root penetration through a narrow diameter borehole is low. Roots may be found to greater depths at other locations on the site, particularly close to trees and/or trees that have been removed both within the site and its close environs.

4.4 Groundwater Conditions

No groundwater was encountered during the construction of the boreholes. Standing water was noted at the base of the trial pit foundation exposure during construction.

The standing groundwater level noted during two return visits to the site can be seen tabulated overleaf.

Groundwater Observations					
Project Ref	**Site Location**	**Borehole Ref.**	**Groundwater reading (m bgl)**	**Depth to base of borehole (m bgl)**	**Date**
GWPR1403	Land off Middlefield	WS1	2.59	5.10	23/10/2015
GWPR1403	Land off Middlefield	WS2	0.52	4.45	23/10/2015
GWPR1403	Land off Middlefield	WS1	0.94	5.10	03/11/2015
GWPR1403	Land off Middlefield	WS2	0.23 (some water flowed into well when bung was taken off)	4.45	03/11/2015

The standing water levels recorded within the monitoring wells during the two return visits is likely to represent surface water or perched groundwater migrating through the Made Ground, granular Head Deposits (possibly Made Ground), claystone bands and/or the silty/sandy lenses in the London Clay Formation and collecting within the installed standpipe.

A rising head test was undertaken within WS2 to provide an indication as to the rate of water ingress into the monitoring well. The water within WS2 was bailed out to a standing level of 4.01m bgl. The standing water level was monitored over time to determine a rate of infiltration.

Results of Rising Head Test Within WS2	
Time (mins)	**Depth to water (m bgl)**
0	4.01
1	3.96
2	3.90
3	3.88
4	3.84
5	3.82
10	3.73

An infiltration rate of 5.82×10^{-6}m/s was recorded (standing water level rose 0.28m in 10 minutes).

Exact groundwater levels may only be determined through long term measurements from monitoring wells installed on-site. It should be noted that changes in groundwater level do occur for

a number of reasons including seasonal effects and variations in drainage.

The site investigation was conducted in September, October and November 2015, when groundwater levels should be rising from their annual minimum (i.e. lowest) and towards their annual maximum (i.e. highest). The long-term groundwater elevation might increase at some time in the future due to seasonal fluctuation in weather conditions. Isolated pockets of groundwater may be perched within any Made Ground found at other locations around the site.

4.5 Obstructions

No artificial or natural sub-surface obstructions were noted during construction of the trial holes.

5.0 INSITU AND LABORATORY GEOTECHNICAL TESTING

5.1 In-Situ Geotechnical Testing

Standard Penetration Testing (SPT) was undertaken within both boreholes at 1.00m intervals to a depth of 12.45m bgl. The results of the SPT's have not been amended to take into account hammer efficiency, rod lengths and overburden pressure in accordance with Eurocode 7. Two Super Heavy Dynamic Probes (SHDP) (DP1 and DP2) were undertaken through the base of WS1 and WS2 (12.50m bgl) to 16.20m and 16.30m bgl respectively.

Windowless Sampler Boreholes provide samples of the ground for assessment but they do not give any engineering data.

The Standard Penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5 kg falling through a distance of 760 mm. The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm up to a depth of 450 mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Super Heavy Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. *(The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).*

The granular soils of the Head Deposits (possibly Made Ground) was classified based on the table below.

Correlation between normalised SPT blow counts $(N_1)_{60}$ or equivalent 'SPT's derived from SHDP results and granular classification.	
Classification	**Equivalent SPT Blow Counts (N1)**
Extremely Dense	>58
Very Dense	42 – 58
Dense	25 – 42
Medium	8 – 25
Loose	3 – 8
Very Loose	0 – 3

The cohesive soils of the London Clay Formation were classified based on the table overpage.

Undrained Shear Strength from Field Inspection/ SPT blow counts $(N_1)_{60}$ or equivalent 'SPT's derived from SHDP results Cohesive Soils (EN ISO 14688-2:2004 & Stroud (1974))		
Classification	**Undrained Shear Strength (kPa)**	**Field Indications**
Extremely High	>300	-
Very High	150 – 300	Brittle or very tough
High	75 – 150	Cannot be moulded in the fingers
Medium	40 – 75	Can be moulded in the fingers by strong pressure
Low	20 – 40	Easily moulded in the fingers
Very Low	10 – 20	Exudes between fingers when squeezed in the fist
Extremely Low	<10	-

An interpretation of the in-situ geotechnical testing results is given in the table below.

Interpretation of In-situ Geotechnical Testing Results (SPT and SHDP)					
Strata	**SPT "N" Blow Counts/Equivalent SPT "N" Blow Counts derived from SHDP**	**Equivalent Undrained Shear Strength (kPa) Cohesive Soils**	**Soil Type**		**Trial Hole/s**
			Cohesive	**Granular**	
Granular Head Deposits (possibly Made Ground)	18	-	-	Medium	WS2 (0.65 – 1.50m bgl)
London Clay Formation	7 - 42	35 - 210	Low – Very High	-	WS1 (0.40 – 12.45m bgl) WS2 (1.50 – 12.45m bgl)
Assumed London Clay Formation*	17 - 177	85 - >300	High – Extremely High	-	DP1 (12.50 – 16.20m bgl) DP2 (12.50 – 16.30m bgl)

*based on results of the dynamic probing.

It must be noted that field measurements of undrained shear strength are dependent on a number of variables including disturbance of sample, method of investigation and also the size of specimen or test zone etc.

The test results are presented on the trial hole log within Appendix B.

5.2 Laboratory Geotechnical Testing

A programme of geotechnical laboratory testing scheduled by Ground and Water Limited and carried out by K4 Soils Laboratory and QTS Environmental Limited was undertaken on samples recovered from the London Clay Formation. The results of the tests are presented in Appendix C.

The test procedures used were generally in accordance with the methods described in BS1377:1990.

Details of the specific tests used in each case are given overpage.

Standard Methodology for Laboratory Geotechnical Testing		
Test	**Standard**	**Number of Tests**
Atterberg Limit Tests	BS1377:1990:Part 2:Clauses 3.2, 4.3 & 5	6
Moisture Content	BS1377:1990:Part 2:Clause 3.2	8
Swelling Test	BS1377:1990:Part 5:Clause 3 & 4	1
BRE Special Digest 1 (incl. Ph, Electrical Conductivity, Total Sulphate, W/S Sulphate, Total Chlorine, W/S Chlorine, Total Sulphur, Ammonium as NH4, W/S Nitrate, W/S Magnesium)	BRE Special Digest 1 "Concrete in Aggressive Ground (BRE, 2005).	2

5.2.1 Atterberg Limit Tests

A précis of Atterberg Limit Tests undertaken on six samples of the London Clay Formation can be seen tabulated below.

Atterberg Limit Tests Results Summary							
Stratum/Trial Hole/Depth (m bgl)	**Moisture Content (%)**	**Passing 425 µm sieve (%)**	**Modified PI (%)**	**Soil Class**	**Consistency Index (Ic)**	**Volume Change Potential**	
						BRE	**NHBC**
London Clay Formation WS1/2.70	31	100	47.00	CV	Stiff	High	High
London Clay Formation WS1/6.00	30	100	40.00	CH	Stiff	High	High
London Clay Formation WS1/11.00	27	100	52.00	CV	Stiff	High	High
London Clay Formation WS2/3.00	31	100	52.00	CV	Stiff	High	High
London Clay Formation WS2/7.60	29	100	48.00	CV	Stiff	High	High
London Clay Formation WS2/11.60	27	99	45.54	CV	Stiff	High	High

NB: NP – Non-plastic
BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
Soil Classification based on British Soil Classification System.
Consistency Index (Ic) based on BS EN IS0 14688-2:2004.

5.2.2 Comparison of Soil's Moisture Content with Index Properties

5.2.2.1 Liquidity Index Analyses

The results of the Atterberg Limit tests undertaken on six samples of the London Clay Formation were analysed to determine the Liquidity Index of the samples. This gives an indication as to whether the samples recovered showed a moisture deficit and their degree of consolidation. The results are tabulated overpage.

The test results are presented within Appendix C.

Liquidity Index Calculations Summary					
Stratum/Trial Hole/Depth	**Moisture Content (%)**	**Plastic Limit (%)**	**Modified Plasticity Index (%)**	**Liquidity Index**	**Result**
London Clay Formation **WS1/2.70m bgl** (Brown and grey silty CLAY with traces of selenite crystals)	31	30	47.00	0.02	Heavily Overconsolidated
London Clay Formation **WS1/6.00m bgl** (Brown silty CLAY with numerous selenite crystals)	30	28	40.00	0.05	Heavily Overconsolidated
London Clay Formation **WS1/11.00m bgl** (Dark grey silty CLAY)	27	25	52.00	0.04	Heavily Overconsolidated
London Clay Formation **WS2/3.00m bgl** (Brown and grey silty CLAY)	31	28	52.00	0.06	Heavily Overconsolidated
London Clay Formation **WS2/7.60m bgl** (Brown silty CLAY with traces of selenite crystals)	29	27	48.00	0.04	Heavily Overconsolidated
London Clay Formation **WS2/11.60m bgl** (Dark grey silty CLAY with rare fine gravel)	27	25	45.54	0.04	Heavily Overconsolidated

The samples of the London Clay Formation tested were shown to be heavily overconsolidated.

5.2.2.2 Liquid Limit

A comparison of the soil moisture content and the liquid limit can be seen tabulated overpage.

Moisture Content vs. Liquid Limit				
Strata/Trial Hole/Depth/Soil Description	**Moisture Content (MC) (%)**	**Liquid Limit (LL) (%)**	**40% Liquid Limit (LL)**	**Result**
London Clay Formation **WS1/2.70m bgl** (Brown and grey silty CLAY with traces of selenite crystals)	31	77	30.8	MC > 0.4 x LL (Not Significantly Desiccated)
London Clay Formation **WS1/6.00m bgl** (Brown silty CLAY with numerous selenite crystals)	30	68	27.2	MC > 0.4 x LL (Not Significantly Desiccated)
London Clay Formation **WS1/11.00m bgl** (Dark grey silty CLAY)	27	77	30.8	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **WS2/3.00m bgl** (Brown and grey silty CLAY)	31	80	32	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **WS2/7.60m bgl** (Brown silty CLAY with traces of selenite crystals)	29	75	30	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**
London Clay Formation **WS2/11.60m bgl** (Dark grey silty CLAY with rare fine gravel)	27	71	28.4	**MC < 0.4 x LL** **(Potential Significant Moisture Deficit)**

The results in the table above indicated that a potential significant moisture deficit was present within four samples of the London Clay Formation tested (WS1/11.00m, WS2/3.00m, WS2/7.60m and WS2/11.60m bgl). The moisture content values were below 40% of the liquid limits.

The samples were described as a brown to dark grey silty clay with traces of selenite crystals noted within the samples at WS1/2.70m, WS1/6.00m and WS2/7.60m bgl and rare fine gravel noted within the sample at WS2/11.60m bgl. Roots were noted to 2.70m and 2.00m bgl in WS1 and WS2 respectively. Therefore the potential moisture deficits recorded within the samples are likely to be associated the heavily overconsolidated nature of the soils and the presence of fine gravels within the sample at WS2/11.60m bgl rather than the moisture demand from roots/trees. Black, fibrous, possibly decaying roots/rootlets were noted to 3.00m bgl within WS2 and therefore the moisture deficit noted within the sample at WS2/3.00m bgl could be associated with the moisture demand from roots/trees.

5.2.3 Moisture Content Profiling

Moisture content versus depth plots for WS1 and WS2 can be seen within Figure 6 and Figure 7 respectively.

The moisture content profile for WS1 shows an expected decrease in moisture content with depth with subtle variations in moisture content likely caused by minor variations in geology. The results of the moisture content profiling therefore do not indicate a potential moisture deficit within the soils of WS1.

The moisture content profile for WS2 shows a variation in moisture content with depth. The moisture content was noted to increase with depth to 3.00m bgl indicating a slight moisture

deficit at the near surface. Roots were noted to 2.00m bgl with black, fibrous, possibly decaying roots/rootlets noted to 3.00m bgl. Therefore the potential moisture deficit noted is likely to be associated with the moisture demand from roots/trees.

5.2.4 Swelling Test

A one dimensional Swelling Test was undertaken on a disturbed sample obtained from WS1 at a depth of 3.70m bgl.

The results of the test are tabulated below.

One Dimensional Consolidation Test – Swelling									
Stratum/Depth		**Height (mm)**	**Moisture Content (%)**	**Bulk Density (Mg/m^3)**	**Dry Density (Mg/m^3)**	**Void Ratio**	**Degree of Saturation (%)**	**Particle Density (Mg/m^3)**	**Swelling Pressure (kpa)**
London Clay Formation WS1/3.70m bgl (Brown and orangish brown mottled bluish grey slightly fissured silty CLAY with occasional selenite crystals)	Initial	16.00	30.2	1.86	1.43	0.89	91	2.70	50
	Final	16.51	36.3	1.88	1.38	0.95	103	-	-

It must be noted that the sample was remoulded and this must be taken into account in final design.

5.2.5 BRE Special Digest 1

In accordance with BRE Special Digest 1 'Concrete in Aggressive Ground' (BRE, 2005) two samples of the London Clay Formation (WS1/4.00–4.45m and WS2/9.80m bgl) were scheduled for laboratory analysis to determine parameters for concrete specification.

The results are given within Appendix D and a summary is tabulated below.

Summary of Results of BRE Special Digest Testing			
Determinand	**Unit**	**Minimum**	**Maximum**
pH	-	7.8	8.2
Ammonium as NH_4	mg/kg	9.9	32.8
Sulphur	%	0.44	0.66
Chloride (water soluble)	mg/kg	157	187
Magnesium (water soluble)	mg/l	68	240
Nitrate (water soluble)	mg/kg	<3	<3
Sulphate (water soluble)	mg/l	957	3220
Sulphate (total)	mg/kg	3117	9168

5.3 Chemical Laboratory Testing – Human Health Risk Assessment

A programme of chemical laboratory testing, scheduled by Ground and Water Limited and carried out by QTS Environmental Limited, was undertaken on two samples of Made Ground (WS1/0.25m and WS2/0.25m bgl).

A Desk Study and full scale contamination assessment were not part of the remit of this report. However, two soil samples were sent off for analysis for a broad range of contaminants in accordance with DEFRA/CLEA methodologies. The samples tested and the reasons for testing can be seen tabulated below.

Methodology for Sampling Locations and Chemical Laboratory Testing		
Trial Hole	**Depth (m bgl)**	**Sampling Strategy**
WS1	0.25m	Representative sample of Made Ground
WS2	0.25m	Representative sample of Made Ground

The site comprised a rectangular shaped plot of land, ~590m^2 (0.059 ha) in area with two sampling locations, given an unknown hotspot shape, the sampling density means that a hotspot with an area of approximately 442.5m^2 and a radius of approximately 11.9m would be encountered (CLR 4).

Soil sampling depths were chosen to reflect the receptors of concern, human health, and typically comprised a surface or near surface sample and then at approximately 0.50m depth increments thereafter, extending into the underlying natural soils. The receptors relevant to the sampling depths can be seen below:

Near surface samples	Direct ingestion, dermal contact and dust inhalation. Protection of end-users and maintenance workers e.g. Landscape Gardeners. Protection of shallow rooted plants.
>0.5m below ground level	Protection of deep rooted plants.

The depth of soil sampling can be seen within the trial hole logs presented in Appendix B.

The analysis suite is presented below and comprised:

- Semi Metals and Heavy Metals incl. Arsenic, Cadmium, Chromium (incl. Hexavalent Chromium), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, (WS1/0.25m and WS2/0.25m bgl);
- Asbestos Screen (WS1/0.25m and WS2/0.25m bgl);
- Polycyclic Aromatic Hydrocarbons (PAHs) incl. Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(ghi)perylene (WS1/0.25m and WS2/0.25m bgl);
- Fuel Oils – Speciated TPH including full aliphatic/aromatic split (WS2/0.25m bgl);
- BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) and MTBE – used as marker compounds for Volatile Organic Compounds (VOCs) (WS2/0.25m bgl).

The chemical laboratory results are presented in Appendix D.

5.3.1 Soil Assessment Criteria

The derivation of Soil Assessment Criteria used within this report can be seen within Appendix E.

5.3.2 Determination of Representative Contamination Concentration

At the time of reporting, November 2015, the full extent of proposed development was not known to Ground and Water Limited however the development was understood to include the construction of a basement founded at 5.00 – 6.00m bgl.

The results of the chemical laboratory testing were compared to the LQM/CIEH Suitable 4 Use Levels (S4UL), and C4SL LLTC for Lead, for a ***'Residential with homegrown produce'*** land-use scenario, as this was considered the most appropriate land-use scenario. The C4SL LLTC for Lead was compared to a ***'Residential with homegrown produce'*** land-use scenario.

Where no LQM/CIEH S4UL/C4SL LLTC was available for a particular determinant then preliminary reference was made to the laboratory detection limit of the determinant. If a positive concentration was noted then further risk assessment was undertaken.

For Cyanide, where no SGC/GAC or C4SL LLTC was available a Site Specific Assessment Criteria of 10mg/kg was adopted. This is based on ICRCL 59/83, TCL, ATRISK (SOIL) Screening Value and Dutch Intervention Value (ranging from 20 – 34mg/kg). Therefore, a SSAC of ~10mg/kg is considered conservative.

Where a contaminant of concern's LQM/CIEH S4UL/C4SL LLTC varies according to the Soil's Organic Matter (SOM), the SOM recorded for each soil sample was used to derive the appropriate SGV/GAC. The average SOM of the samples analysed was 2.7% (SOM ranged between 2.5 - 2.8%).

The results of the comparison of the representative contaminant concentrations are presented in the table overpage:

Soil Guideline Values and General Acceptance Criteria Results	
Substance	**Sample Location Where available LQM/CIEH S4UL/, CSL4 LLTC or GAC were exceeded for relevant land-use scenario**
	"Residential with home-grown produce" and "Residential with plant uptake" Land-Use Scenarios
Arsenic	None
Boron	None
Cadmium	None
Chromium (III)	None
Hexavalent Chromium (VI)	None
Copper	None
Lead	None
Mercury (Elemental)	None
Nickel	None
Selenium	None
Vanadium	None
Zinc	None
Cyanide (Total)	None
Total Phenol	None
Naphthalene	None
Acenapthylene	None
Acenapthene	None
Fluorene	None
Phenanthrene	None
Anthracene	None
Fluoranthene	None
Pyrene	None
Benzo(a)anthracene	None
Chrysene	None
Benzo(b)fluoranthene	None
Benzo(k)fluoranthene	None
Benzo(a)pyrene	None
Indeno(1,2,3-cd)pyrene	None
Dibenz(a,h)anthracene	None
Benzo(ghi)perylene	None
TPH C5 – C6 (aliphatic)	None
TPH C6 – C8 (aliphatic)	None
TPH C8 - C10 (aliphatic)	None
TPH C10 - C12 (aliphatic)	None
TPH C12 - C16 (aliphatic)	None
TPH C16 - C21 (aliphatic)	None
TPH C21 - C34 (aliphatic)	None
TPH C5 – C7 (aromatic)	None
TPH C7 – C8 (aromatic)	None
TPH C8 – C10 (aromatic)	None
TPH C10 – C12 (aromatic)	None
TPH C12 – C16 (aromatic)	None
TPH C16 - C21 (aromatic)	None
TPH C21 - C35 (aromatic)	None
Benzene	None
Toluene	None
Ethylbenzene	None
Xylene (o, m & p)	None
MTBE	None
Asbestos Screen	None

Chemical laboratory testing of the Made Ground revealed no elevated levels of

determinants above the guideline levels for a '***Residential with homegrown produce'*** land-use scenarios.

In addition, the intrusive investigation did not reveal any visual or olfactory evidence to suggest any hydrocarbon-type contamination in the trial holes excavated on the site. The chemical laboratory results have verified that no elevated concentrations of aliphatic/aromatic hydrocarbons (C_5-C_{35}) or BTEX compounds are present in the soils underlying the site.

6.0 ENGINEERING CONSIDERATIONS

6.1 Soil Characteristics and Geotechnical Parameters

Based on the results of the intrusive investigation and geotechnical laboratory testing the following interpretations have been made with respect to engineering considerations.

- Made Ground was proved from ground level to 0.30 – 0.65m bgl.

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

  Made Ground may be found to deeper depth at other locations on the site, especially close to former structures/foundations and service runs.

- Soils described as representative of Head Deposits, possibly Made Ground, were encountered underlying the Made Ground within WS2 from 0.65m to 1.50m bgl and for the remaining depth of TP/FE1, from 0.30m to 0.70m bgl. The deposits comprised a medium dense mid-brown to orange brown clayey gravelly sand, locally a sandy gravelly clay. The sand was medium to coarse grained. The gravel was fine to medium, sub-angular to rounded flint. From 0.50m bgl within TP/FE1 the deposits comprised a mid-brown very slightly gravelly silty clay. The gravel was rare, fine, sub-angular to sub-rounded flint.

  The medium granular Head Deposits, possibly Made Ground was considered likely to have **low volume change potential** in accordance with BRE240 and NHBC Standards Chapter 4.2.

  The cohesive Head Deposits, possibly Made Ground was considered likely to have **medium to high volume change potential** in accordance with BRE240 and NHBC Standards Chapter 4.2.

  Given their variable and limited thickness and that the basement construction will likely bypass these soils, the Head Deposits (possibly Made Ground) have not been considered as a founding stratum for the proposed development.

- Soils described as representative of the London Clay Formation were encountered underlying the Made Ground within WS1 from 0.40m bgl and the Head Deposits (possibly Made Ground) within WS2 from 1.50m bgl. The London Clay Formation was proved for the remaining depth of both boreholes, a maximum of 12.45m bgl. The results of the dynamic probing indicated that the London Clay Formation was proved for the remaining depth of DP1 and DP2, a maximum depth of 16.20m and 16.30m bgl respectively.

  The deposits generally comprised a mid to light brown, with light grey mottling, silty clay. Claystones, fine selenite crystals and sandy/silty lenses were noted with depth. From 10.00m bgl within WS1 and from 9.50m bgl within WS2 the deposits were noted to become dark grey brown to dark grey and rare shell fragments were noted within WS2.

The London Clay Formation was shown to have low to very high undrained shear strength (35 – 210kPa). The assumed London Clay Formation from the results of the dynamic probing was shown to have high to extremely high undrained shear strength (85 – >300kPa).

Geotechnical testing revealed the soils of the London Clay Formation to have a **high volume change potential** in accordance with both BRE240 and NHBC Standards Chapter 4.2. Consistency Index calculations indicated these soils to be soft to stiff. The deposits of the London Clay Formation were shown to be heavily overconsolidated cohesive soils.

Potential significant moisture deficits were present within four samples of the London Clay Formation tested (WS1/11.00m, WS2/3.00m, WS2/7.60m and WS2/11.60m bgl). The moisture content values were below 40% of the liquid limits. The samples were described as a brown to dark grey silty clay with traces of selenite crystals noted within the samples at WS1/2.70m, WS1/6.00m and WS2/7.60m bgl and rare fine gravel noted within the sample at WS2/11.60m bgl. Roots were noted to 2.70m and 2.00m bgl in WS1 and WS2 respectively. Therefore the potential moisture deficits recorded within the samples are likely to be associated the heavily overconsolidated nature of the soils and the presence of fine gravels within the sample at WS2/11.60m bgl rather than the moisture demand from roots/trees. Black, fibrous, possibly decaying roots/rootlets were noted to 3.00m bgl within WS2 therefore the moisture deficit noted within the sample at WS2/3.00m bgl could be associated with the moisture demand from roots/trees. The moisture content profile for WS2 also indicated a slight moisture deficit at the near surface (<3.0m bgl) which was likely to be associated with the moisture demand from roots/trees.

The heavily overconsolidated cohesive soils of the London Clay Formation were considered a suitable bearing stratum for moderately loaded footings/foundations. Settlements on loading are likely to be moderate.

The final design of foundations will need to take into account the volume change potential of the soil, the depth of root penetration and/or desiccation and the likely serviceability and settlement requirements of the proposed structure. These parameters for design are discussed in the next section of this report.

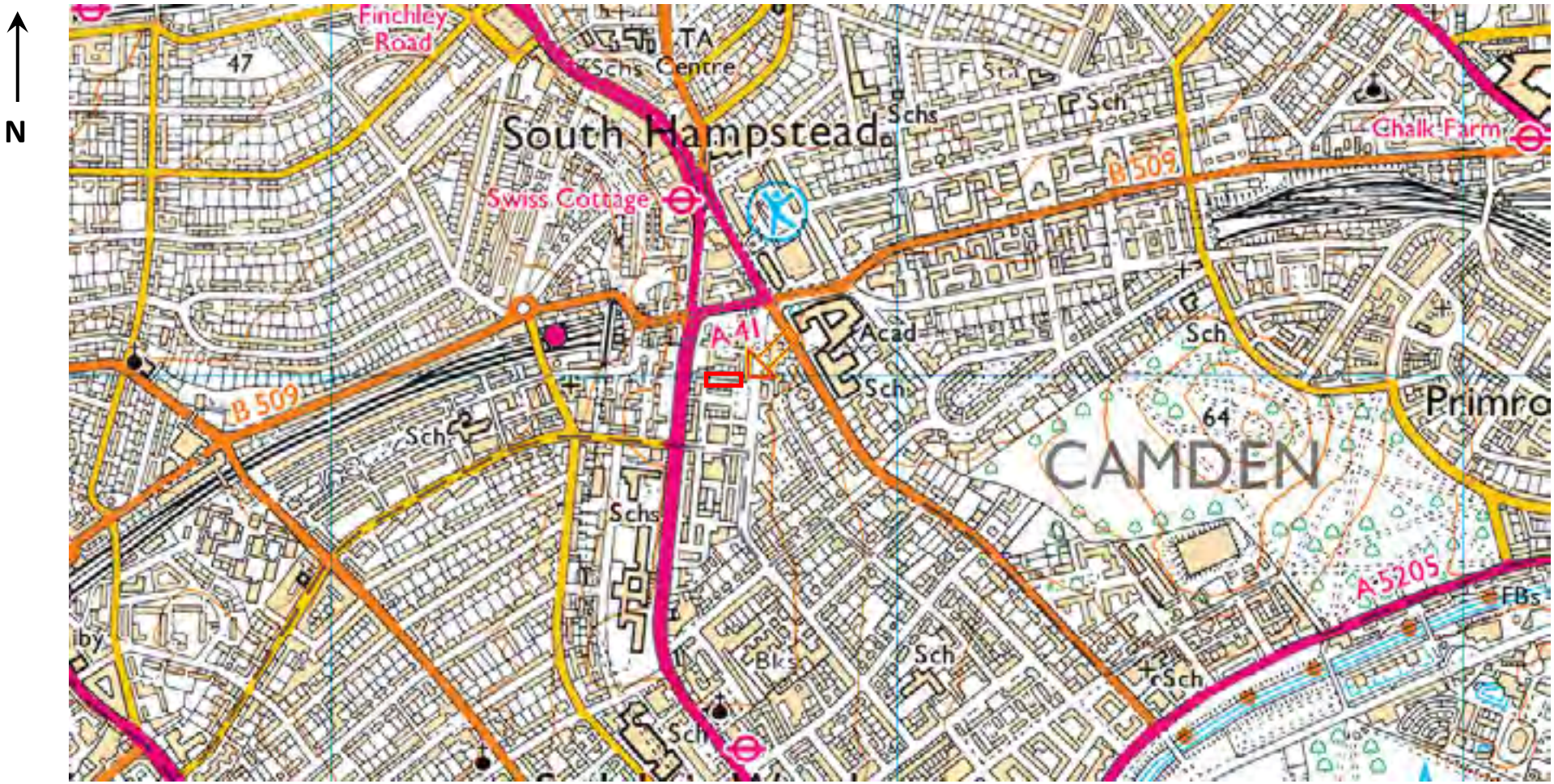
- No groundwater was encountered during the construction of the trial holes. During two return visits to the site, standing water levels of 2.59m and 0.94m bgl were recorded within WS1 with water levels of 0.52m and 0.23m bgl recorded within WS2. Standing water was noted at the base of the trial pit foundation exposure during construction.

  The standing water levels recorded within the monitoring wells during the two return visits are likely to represent surface water or perched groundwater migrating through the Made Ground, granular Head Deposits (possibly Made Ground), claystone bands and/or the silty/sandy lenses in the London Clay Formation and collecting within the installed standpipe. Standing water was noted at the base of the trial pit foundation exposure during construction.

  A rising head test was undertaken within WS2 to provide an indication as to the rate of water ingress into the monitoring well. An infiltration rate of 5.82×10^{-6} was recorded (standing water level rose 0.28m in 10 minutes).

- Roots were noted to 2.70m and 2.00m bgl in WS1 and WS2 respectively. Black, fibrous,

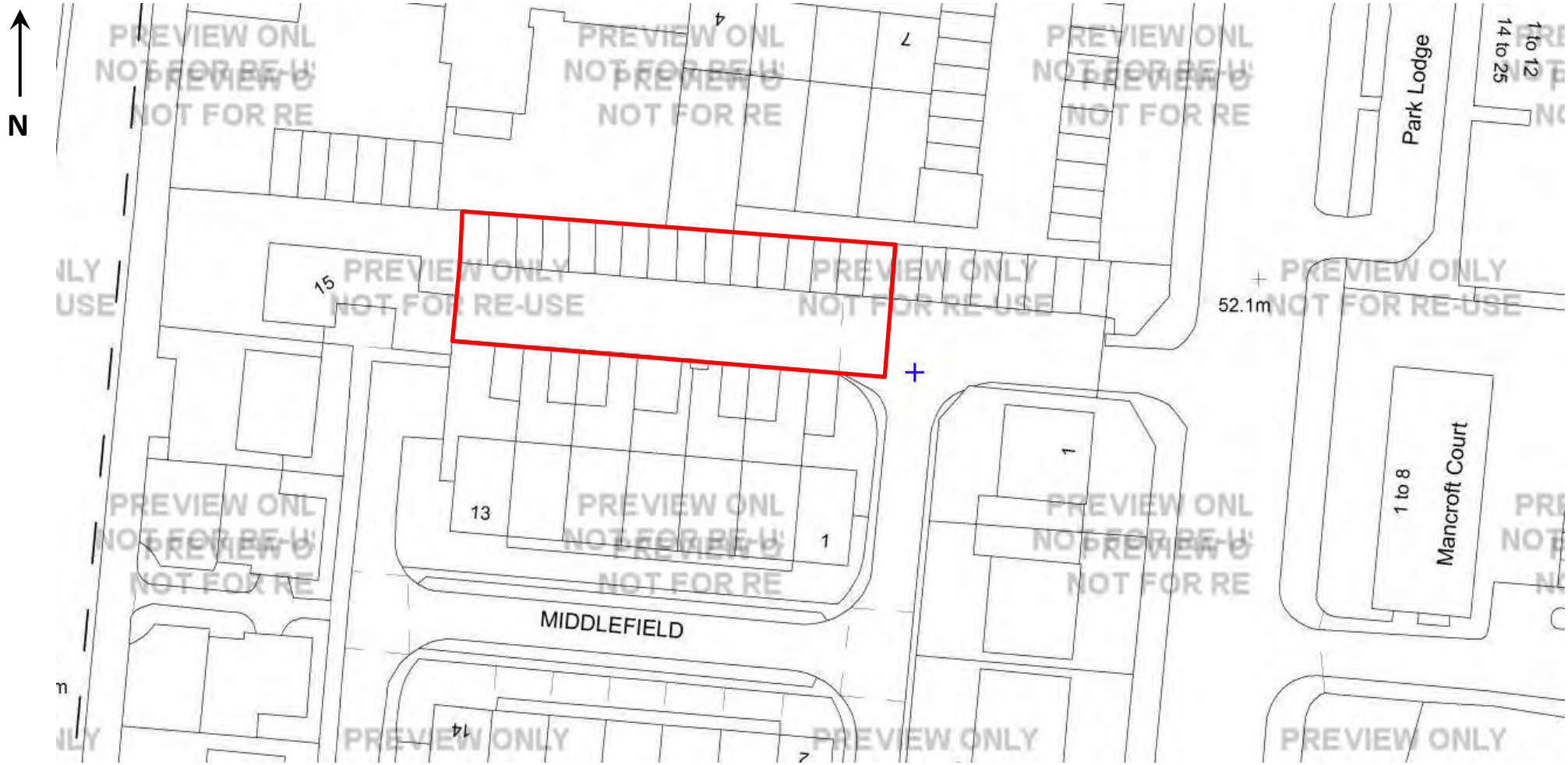
possibly decaying roots/rootlets were noted to 3.00m bgl within WS2.



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land off Middlefield, South Hampstead, London NW8 6NE		**Figure 1**
Client: Liv-International	**Date:** November 2015	ground&water
Site Location Plan	**Ref:** GWPR1403	



APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land off Middlefield, South Hampstead, London NW8 6NE	**Figure 2**
Client: Liv-International	**Date:** November 2015
Site Development Area	**Ref:** GWPR1403

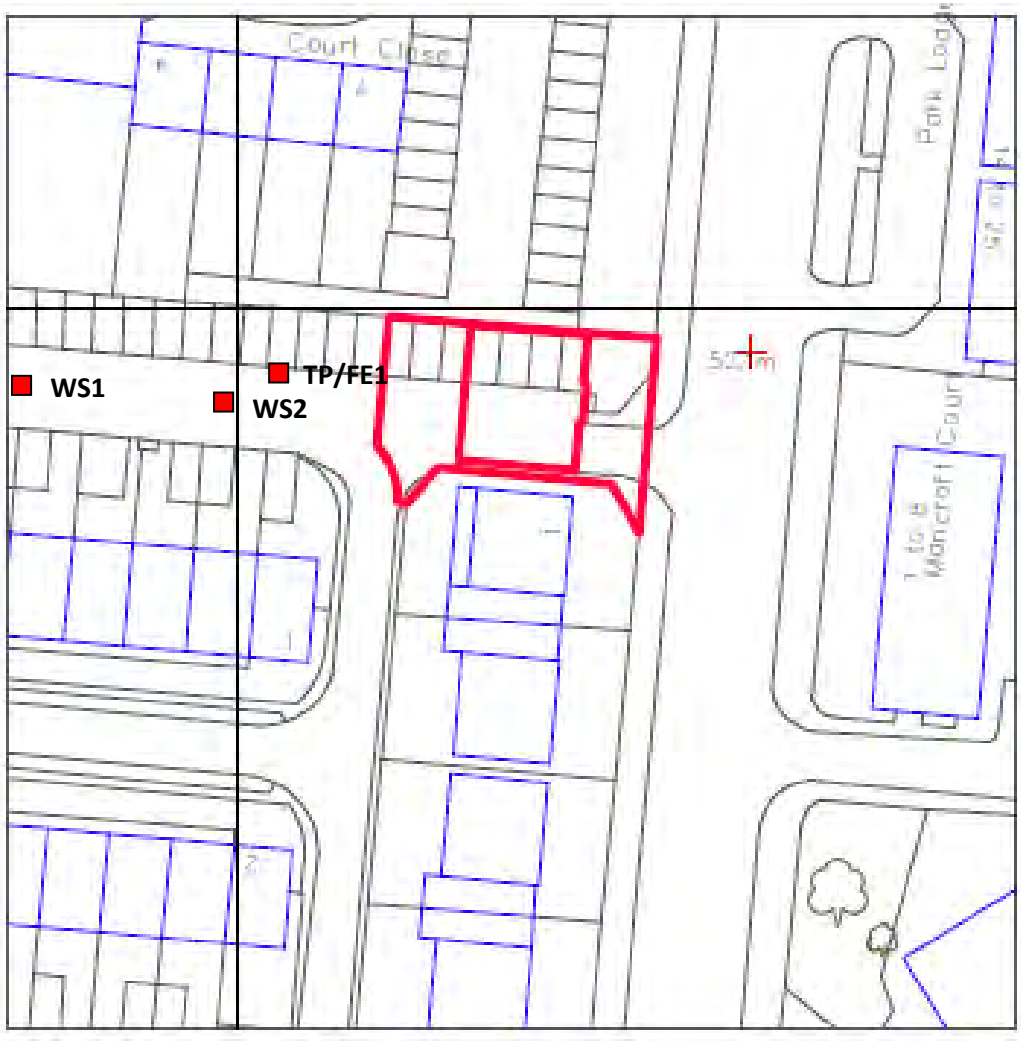
ground&water

APPROXIMATE SITE BOUNDARY

NOTE: NOT TO SCALE

Project: Land off Middlefield, South Hampstead, London NW8 6NE		Figure 3
Client: Liv-International	Date: November 2015	ground&water
Aerial View of Site	Ref: GWPR1403	

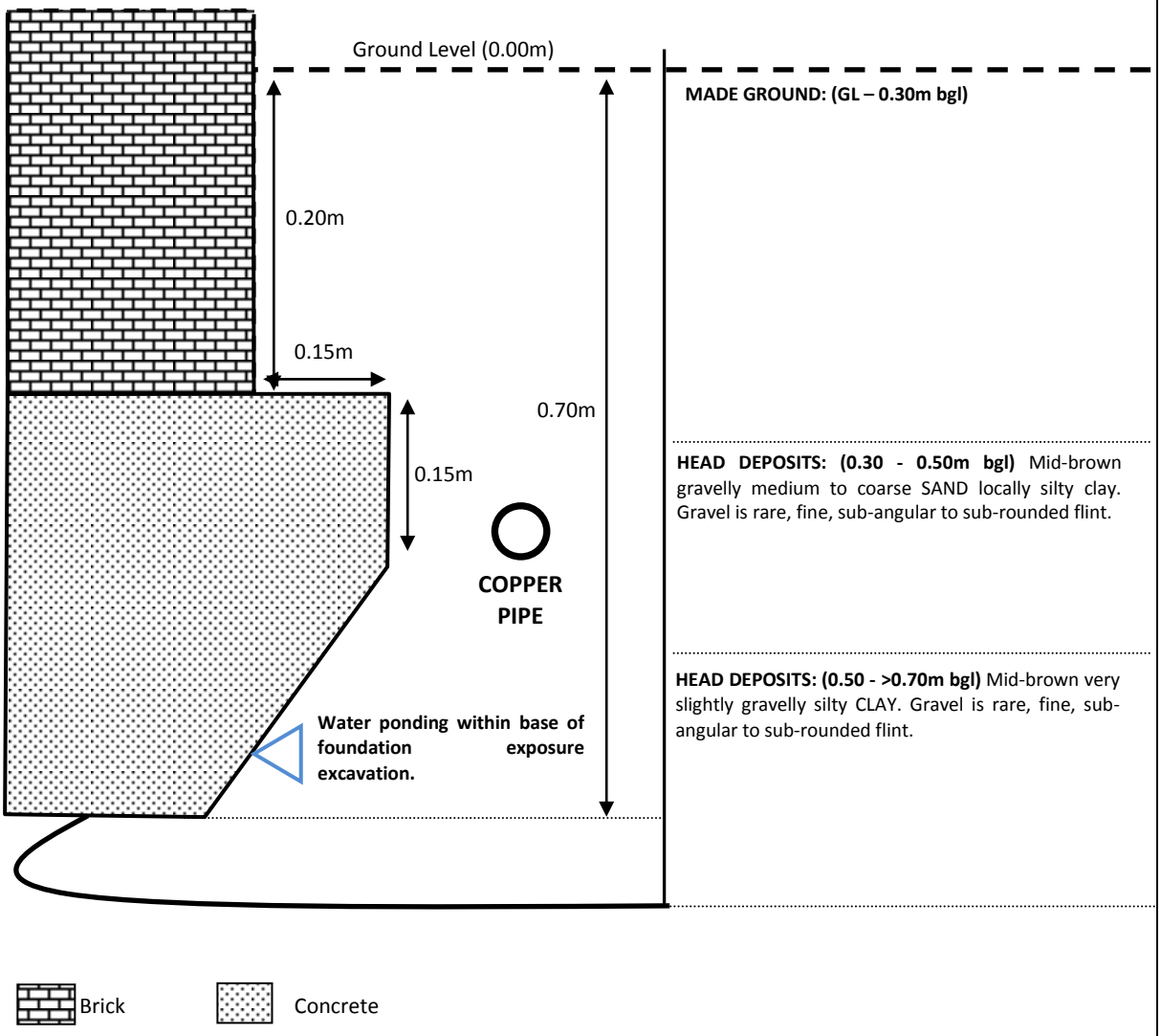
N



NOTE: NOT TO SCALE

Project: Land off Middlefield, South Hampstead, London NW8 6NE	**Figure 4**
Client: Liv-International	**Date:** November 2015
Trial Hole Location Plan	**Ref:** GWPR1403

ground&water



NOT TO SCALE

Project: **Land off Middlefield, South Hampstead, London NW8 6NE**		**Figure 5**
Client: **Liv-International**	**Date:** **November 2015**	ground&water
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR1403**	

Project: **Land off Middlefield, South Hampstead, London NW8 6NE**		**Figure 6**
Client: **Liv-International**	**Date:** **November 2015**	
Photographs: Foundation Exposure TP/FE1	**Ref:** **GWPR1403**	ground&water

APPENDIX A
Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been samples or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to the land off Middlefield, South Hampstead, London NW8 6NE.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

APPENDIX B
Fieldwork Logs

Ground and Water Ltd
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email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No
WS1
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land off Middlefield,	GWPR1403		WLS
Location: South Hampstead, London NW8 6NE		Level: -	Scale 1:50
Client: Liv International		Dates: 25/09/2015	Logged By JD

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.10	D		0.20			MADE GROUND: Tarmac
		0.25	D		0.40			MADE GROUND: Reddish-brown very gravelly sand. Sand is medium to coarse grained. Gravel is abundant, fine to coarse, sub-rounded to sub-angular brick, concrete and tarmac
		0.50	D					
		0.80	D					LONDON CLAY FORMATION: Light brown silty CLAY with light grey mottling from ~0.80m bgl.
		1.00	SPT	N=7				
		1.00	SPTLS	(1,0/ 1,2,2,2)				Yellow-orange sandy inclusions noted from ~1.00m bgl. Claystone noted with depth.
		1.70	D					Selenite crystals noted from ~2.00m bgl becoming larger and more abundant from ~6.00m bgl.
		2.00	SPT	N=9				
		2.00	SPTLS	(1,2/ 2,2,2,3)				Colour becomes dark grey-brown from ~10.00m bgl.
		2.70	D					
		3.00	SPT	N=13				
		3.00	SPTLS	(2,3/ 3,3,3,4)				
		3.70	D					
		4.00	SPT	N=21				
		4.00	SPTLS	(3,4/ 5,6,5,5)				
		4.70	D					
		5.00	SPT	N=18				
		5.00	SPTLS	(4,4/ 4,5,4,5)				
		5.70	D					
		6.00	SPT	N=27				
		6.00	SPTLS	(5,6/ 6,7,7,7)				
		6.70	D					
		7.00	SPT	N=27				
		7.00	SPTLS	(5,6/ 7,7,6,7)				
		7.70	D					
		8.00	SPT	N=35				
		8.00	SPTLS	(6,7/ 8,9,9,9)				
		8.70	D					
		9.00	SPT	N=34				
		9.00	SPTLS	(7,7/ 8,9,8,9)				
		9.70	D					
		Type		Results				

Continued next sheet

Remarks: No groundwater encountered.
Thin, fibrous roots noted to 2.70m bgl.
50mm combined bio-gas and groundwater monitoring well installed to 5.00m bgl.
SHDP undertaken from base of borehole (12.00m bgl) to 16.20m bgl.

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Borehole No
WS1
Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land off Middlefield,	GWPR1403		WLS
Location: South Hampstead, London NW8 6NE		Level: -	Scale 1:50
Client: Liv International		Dates: 25/09/2015	Logged By JD

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.00	SPT	N=42				LONDON CLAY FORMATION: Light brown silty CLAY with light grey mottling from ~0.80m bgl.
		10.00	SPTLS	(9,9/ 9,12,12,9)				Yellow-orange sandy inclusions noted from ~1.00m bgl. Claystone noted with depth.
		10.70	D					Selenite crystals noted from ~2.00m bgl becoming larger and more abundant from ~6.00m bgl.
		11.00	SPT	N=38				Colour becomes dark grey-brown from ~10.00m bgl.
		11.00	SPTLS	(8,9/ 9,9,10,10)				
		11.70	D					
		12.00	SPT	N=37 (8,9/ 9,9,10,9)				
					12.45			End of Borehole at 12.45 m
		Type	Results					

Remarks: No groundwater encountered.
Thin, fibrous roots noted to 2.70m bgl.
50mm combined bio-gas and groundwater monitoring well installed to 5.00m bgl.
SHDP undertaken from base of borehole (12.00m bgl) to 16.20m bgl.

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Borehole No
WS2
Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land off Middlefield,	GWPR1403		WLS
Location: South Hampstead, London NW8 6NE		Level: -	Scale 1:50
Client: Liv International		Dates: 28/09/2015	Logged By FW

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.10	D					MADE GROUND: Concrete/tarmac over a black and red to pink brown sandy gravel. Gravel is fine to coarse, abundant, pink limestone, black limestone and black carbonaceous material (clinker, tarmac, ash)
		0.25	D		0.40			
		0.50	D		0.65			MADE GROUND: Mid to dark brown gravelly silty clay. Gravel is occcasional, fine, sub-angular to sub-rounded brick and carbonaceous material (ash/clinker)
		0.80	D					
		1.00	SPT	N=18				HEAD DEPOSITS (possible Made Ground): Mid brown to orange brown very clayey gravelly SAND locally a sandy gravelly clay. Sand is medium to coarse grained. Gravel is fine to medium, sub-angular to rounded flint.
		1.00	SPTLS	(3,3/ 4,5,5,4)				
		1.40	D		1.50			
		1.70	D					LONDON CLAY FORMATION: Mid brown with light grey mottley silty CLAY.
		2.00	SPT	N=11				Claystones noted from ~2.00m bgl and fine selinite crystals.
		2.00	SPTLS	(1,2/ 2,3,3,3)				Less grey mottling with depth.
		2.60	D					Rare fine sand and silt from ~3.00m bg.l
		3.00	SPT	N=14				
		3.00	SPTLS	(2,3/ 3,4,4,3)				
		3.80	D					
		4.00	SPT	N=17	4.00			LONDON CLAY FORMATION: Mid to dark brown silty CLAY with selenite crystals and claystones.
		4.00	SPTLS	(2,3/ 3,4,5,5)				
		4.80	D					
		5.00	SPT	N=20				
		5.00	SPTLS	(4,4/ 4,5,5,6)				
		5.70	D					
		6.00	SPT	N=26				
		6.00	SPTLS	(5,5/ 5,6,7,8)				
		6.70	D					
		7.00	SPT	N=29				
		7.00	SPTLS	(5,6/ 7,7,8,7)				
		7.60	D					
		8.00	SPT	N=33				
		8.00	SPTLS	(6,7/ 7,8,9,9)				
		8.70	D					
		9.00	SPT	N=34				
		9.00	SPTLS	(6,7/ 9,7,9,9)				
					9.50			LONDON CLAY FORMATION: Dark brown grey to dark grey silty CLAY with selenite crystals. Rare shell fragments noted.
		9.80	D					
		Type		Results				Continued next sheet

Remarks: No groundwater encountered.
White fine rootlets noted to ~2.00m bgl
Black, fibrous, possibly decaying roots/rootlets noted to 3.00m bgl.
50mm combined bio-gas and groundwater monitoring well installed to 4.50m bgl.
SHDP undertaken from base of borehole (12.45m bgl) to 16.30m bgl.

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Borehole No **WS2** Sheet 2 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land off Middlefield,	GWPR1403		WLS
Location: South Hampstead, London NW8 6NE		Level: -	Scale 1:50
Client: Liv International		Dates: 28/09/2015	Logged By FW

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		10.00	SPT	N=38				LONDON CLAY FORMATION: Dark brown grey to dark grey silty CLAY with selenite crystals. Rare shell fragments noted.
		10.00	SPTLS	(9,9/ 10,9,10,9)				
		10.60	D					
		11.00	SPT	N=37				
		11.00	SPTLS	(9,10/ 9,9,10,9)				
		11.60	D					
		12.00	D					
					12.45			End of Borehole at 12.45 m
			Type	Results				

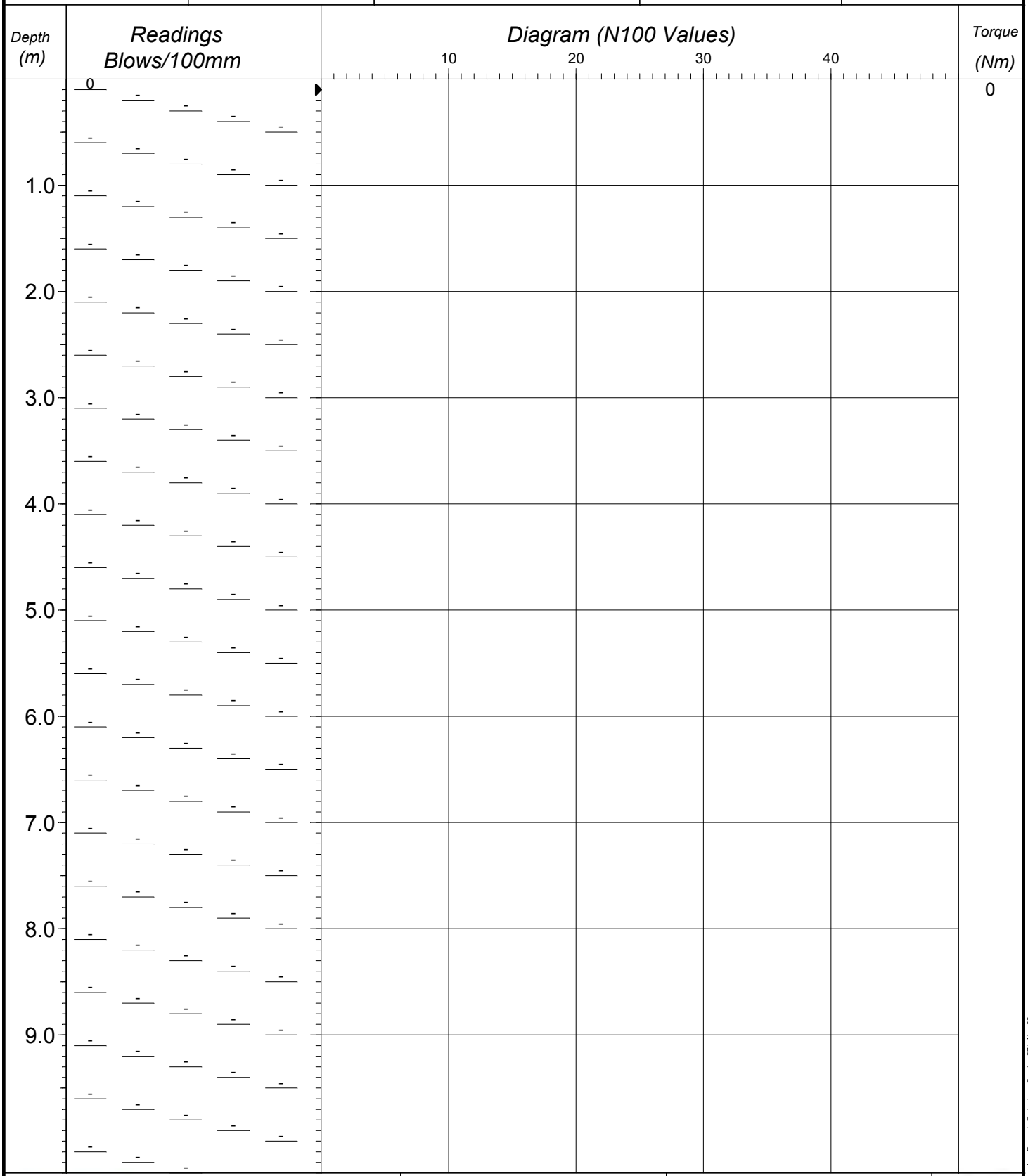
11 12 13 14 15 16 17 18 19

Remarks: No groundwater encountered.
White fine rootlets noted to ~2.00m bgl
Black, fibrous, possibly decaying roots/rootlets noted to 3.00m bgl.
50mm combined bio-gas and groundwater monitoring well installed to 4.50m bgl.
SHDP undertaken from base of borehole (12.45m bgl) to 16.30m bgl.

AGS

DYNAMIC PROBING

Probe No **DP1**			
Client **Liv International**			Sheet 1 of 2
Site **Land off Middlefield,**			Project No **GWPR1403**
E -	N -	Level -	Date **25/09/2015**	Logged by **J Hogg**



ground &water

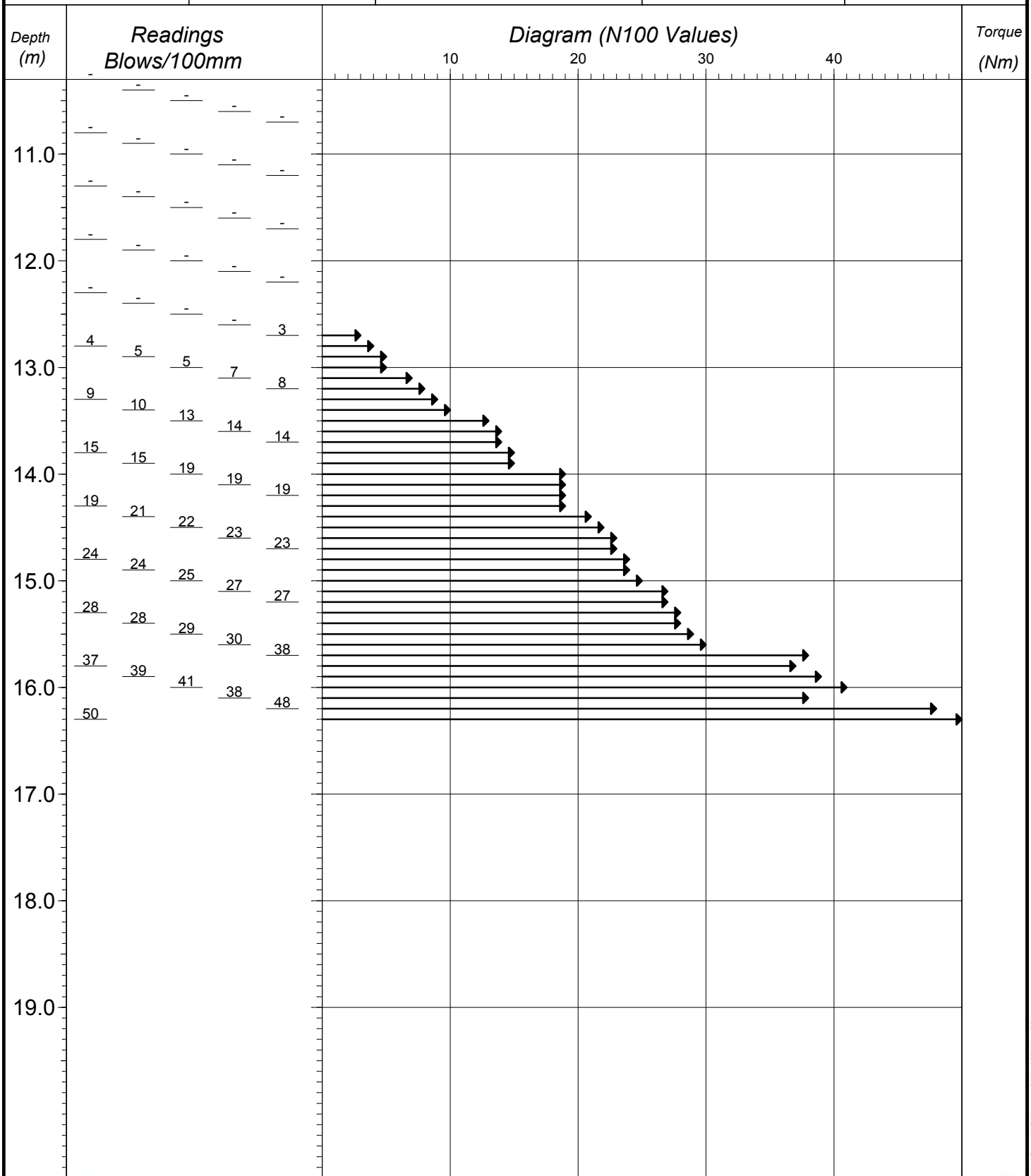
Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Fall Height	750	Cone Base Diameter	43
Hammer Wt	63.50	Final Depth	16.20
Probe Type	DPSH	Log Scale	1:50

AGS

DYNAMIC PROBING

Probe No **DP1**			
Client **Liv International**			Sheet 2 of 2
Site **Land off Middlefield,**			Project No **GWPR1403**
E -	N -	Level -	Date **25/09/2015**	Logged by **J Hogg**



ground &water

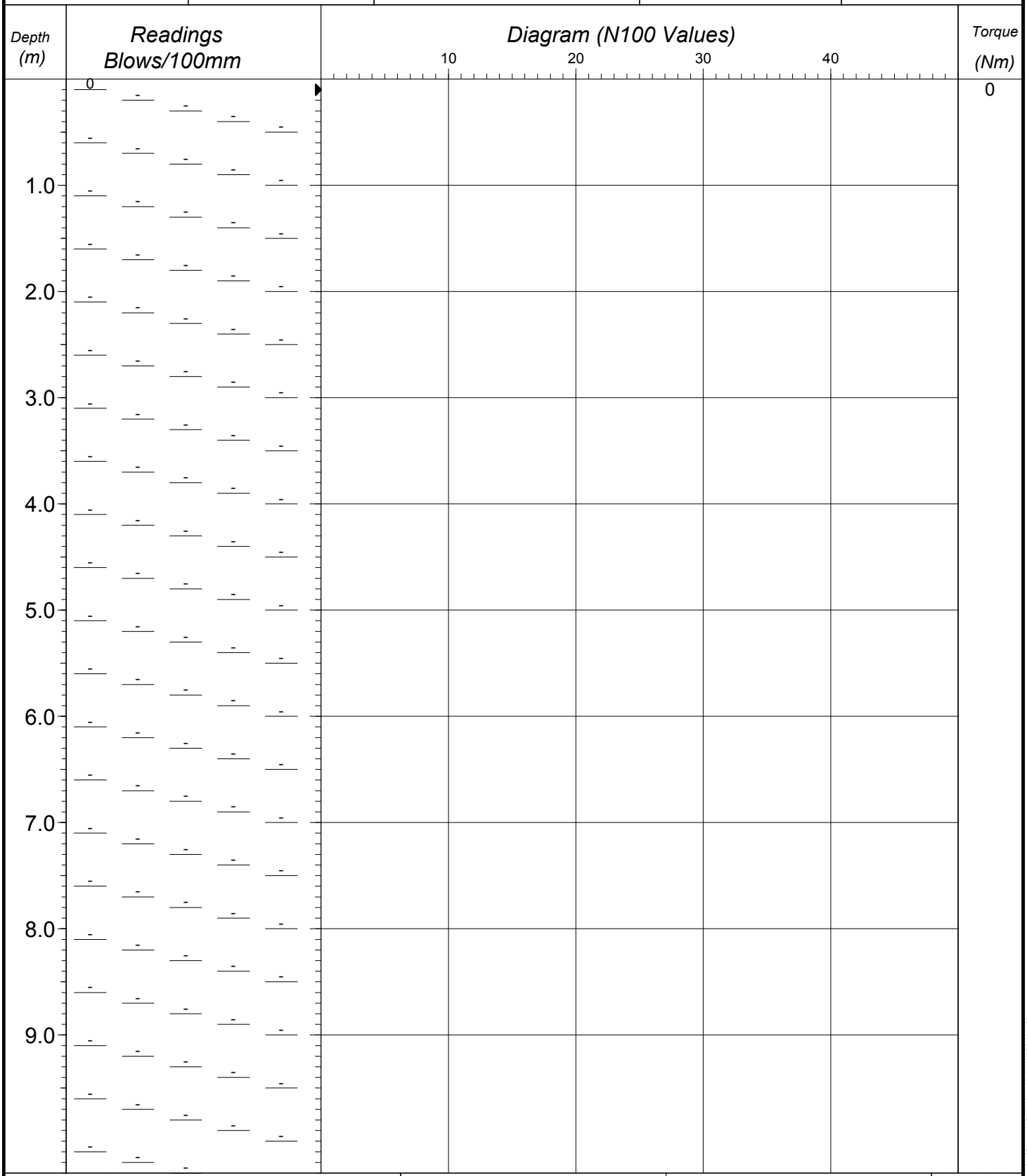
Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Fall Height	750	Cone Base Diameter	43
Hammer Wt	63.50	Final Depth	16.20
Probe Type	DPSH	Log Scale	1:50

AGS

DYNAMIC PROBING

Probe No **DP2**			
Client **Liv International**			Sheet 1 of 2
Site **Land off Middlefield,**			Project No **GWPR1403**
E -	N -	Level -	Date **28/09/2015**	Logged by **J Hogg**



ground &water

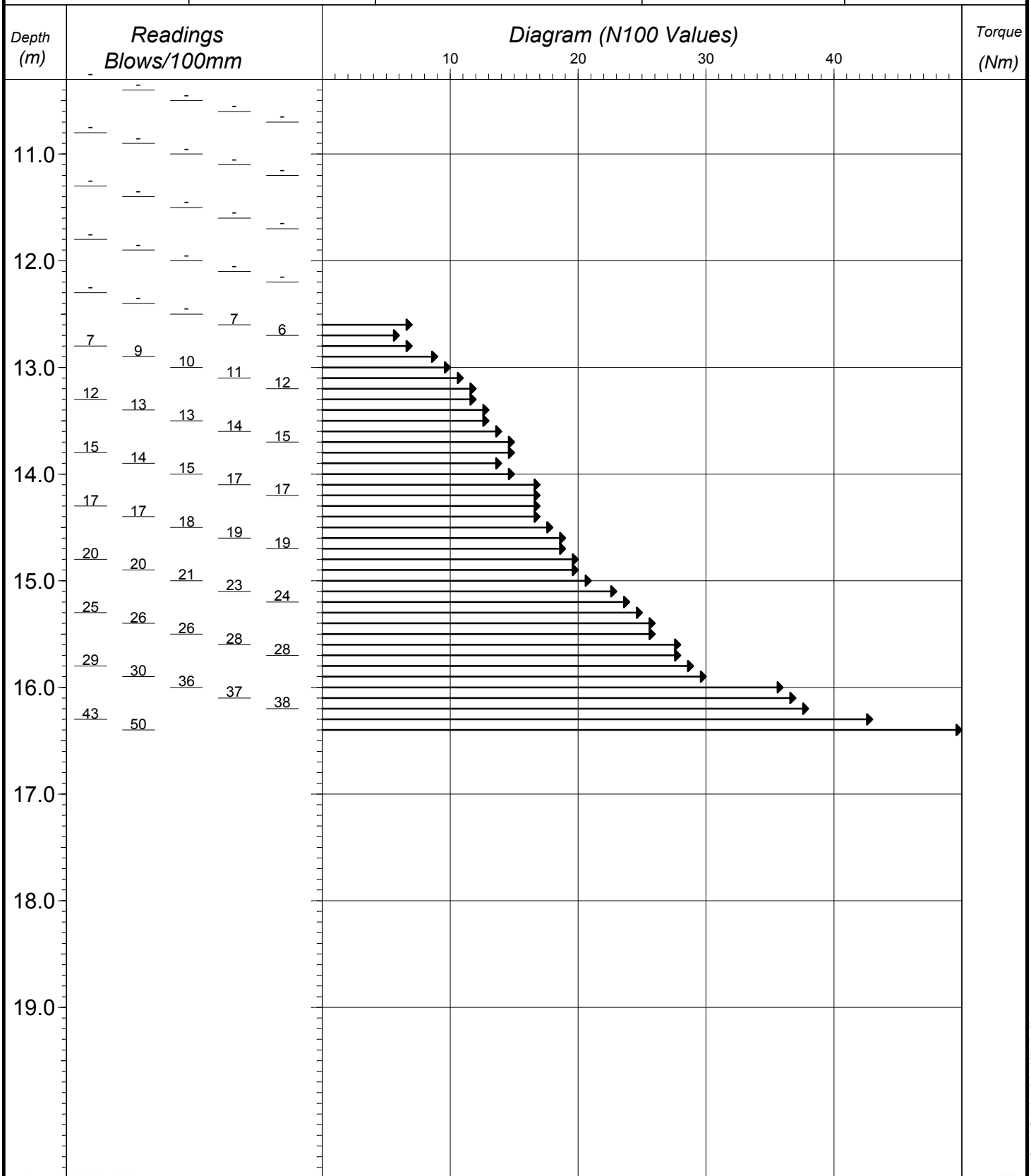
Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Fall Height	750	Cone Base Diameter	43
Hammer Wt	63.50	Final Depth	16.30
Probe Type	DPSH	Log Scale	1:50

AGS

DYNAMIC PROBING

Probe No **DP2**			
Client **Liv International**			Sheet 2 of 2
Site **Land off Middlefield,**			Project No **GWPR1403**
E -	N -	Level -	Date **28/09/2015**	Logged by **J Hogg**



ground &water

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Fall Height	750	Cone Base Diameter	43
Hammer Wt	63.50	Final Depth	16.30
Probe Type	DPSH	Log Scale	1:50

AGS

APPENDIX C
Geotechnical Laboratory Test Results

Summary of Classification Test Results

Job No.	Project Name	Programme	
19639	Land adjacent to 1B St Johns Wood Park, NW8	Samples received	08/10/2015
		Schedule received	08/10/2015
Project No.	Client	Project started	09/10/2015
GWPR1403	Ground and Water Ltd	Testing Started	23/10/2015

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
WS1		0.80		D	Brown silty CLAY with rare fine gravel and sandstone fragments	33					
WS1		1.00		D	Brown silty CLAY with rare fine gravel	31					
WS1		1.70		D	Brown with orangish brown staining silty CLAY	30					
WS1		2.00		D	Brown with grey staining silty CLAY	29					
WS1		2.70		D	Brown and grey silty CLAY with traces of selenite crystals	31	100	77	30	47	
WS1		3.00		D	Brown with grey staining silty CLAY	27					
WS1		6.00		D	Brown silty CLAY with numerous selenite crystals	30	100	68	28	40	
WS1		11.00		D	Dark grey silty CLAY	27	100	77	25	52	
WS2		1.70		D	Brown with grey staining silty CLAY with traces of fine rootlets	26					
WS2		2.00		D	Brown with grey staining silty CLAY with traces of fine rootlets	29					
WS2		2.60		D	Brown and grey mottled and orangish brown staining silty CLAY with traces of roots and rootlets	30					
WS2		3.00		D	Brown and grey silty CLAY	31	100	80	28	52	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

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

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 27/10/2015

Summary of Classification Test Results

Job No.	Project Name	Programme	
19639	Land adjacent to 1B St Johns Wood Park, NW8	Samples received	08/10/2015
		Schedule received	08/10/2015
Project No.	Client	Project started	09/10/2015
GWPR1403	Ground and Water Ltd	Testing Started	23/10/2015

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
WS2		7.60		D	Brown silty CLAY with traces of selenite crystals	29	100	75	27	48	
WS2		11.60		D	Dark grey silty CLAY with rare fine gravel	27	99	71	25	46	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

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

Tel: 01923 711 288
Email: James@k4soils.com

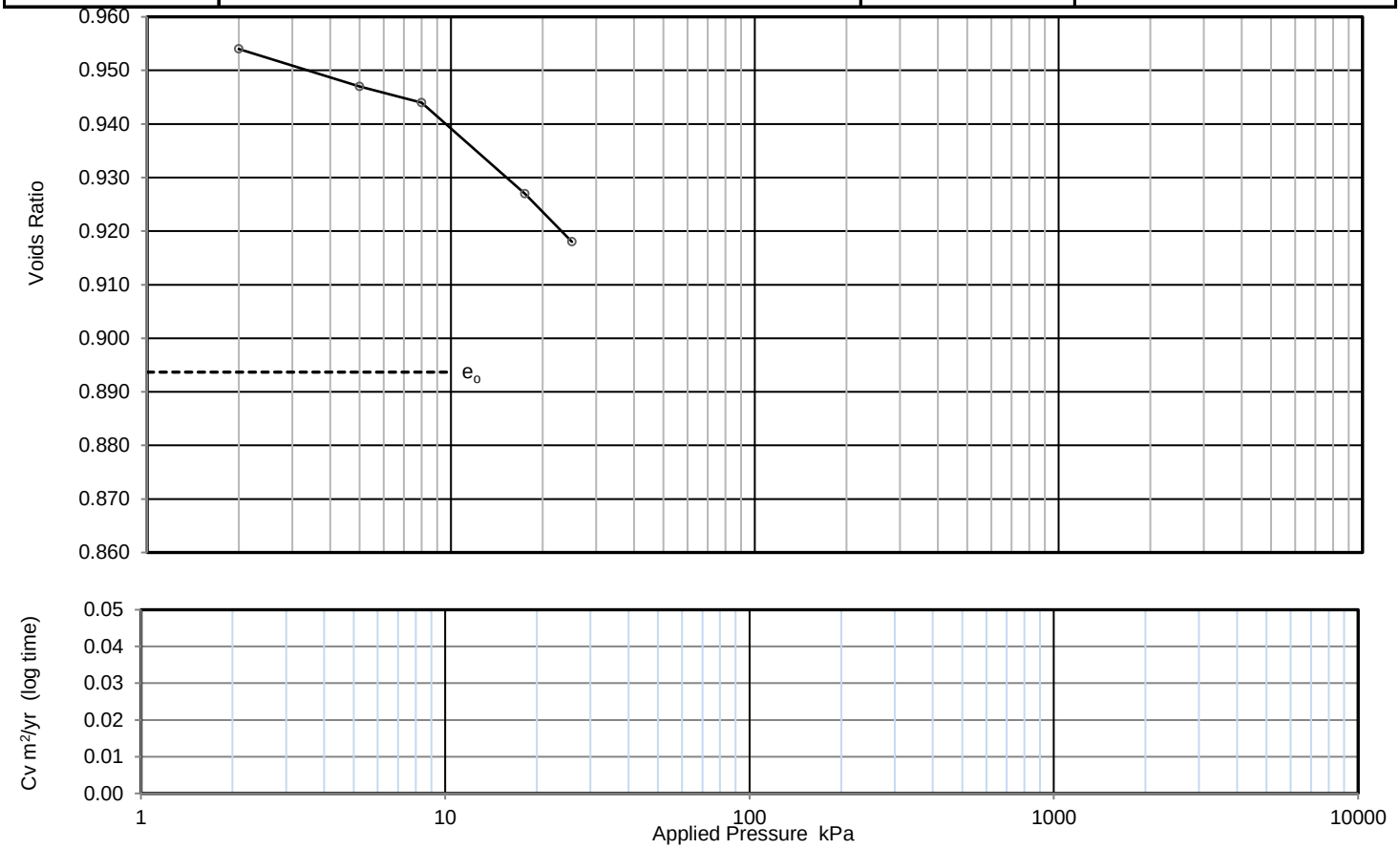
Checked and Approved

Initials **J.P**

Date: 27/10/2015

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	19639
				Borehole/Pit No.	WS1
Site Name	Land adjacent to 1B St Johns Wood Park, NW8			Sample No.	-
Project ID	GWPR1403	Client	Ground and Water Ltd	Depth	3.70
Soil Description	Brown and orangish brown mottled bluish grey slightly fissured silty CLAY with occasional selenite crystals			Sample Type	D
				Sample Received	08/10/2015
				Schedule received	08/10/2015
				Project Started	09/10/2015
Test Method	BS1377:Part 5:1990, clause 3			Date Test started	13/10/2015



Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
50.0	0.894	-	-	-	-
25	0.918	0.51			
18	0.927	0.66			
8	0.944	0.94			
5	0.947	0.41			
2	0.954	1.2			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m3

Specimen details	Initial	Final	
Diameter	74.98	-	mm
Height	16.00	16.51	mm
Moisture Content	30.2	36.3	%
Bulk density	1.86	1.88	Mg/m3
Dry density	1.43	1.38	Mg/m3
Voids Ratio	0.894	0.954	
Saturation	91	103	%
Average temperature for test	20.0		oC
Swelling Pressure	50		kPa
Settlement on saturation			%

Remarks

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

Checked and Approved

Initials K.P

Date: 26/10/2015

2519

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

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
19639	Land adjacent to 1B St Johns Wood Park, NW8	Samples received	08/10/2015
		Schedule received	08/10/2015
Project No.	Client	Project started	09/10/2015
GWPR1403	Ground and Water Ltd	Testing Started	14/10/2015

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top	Base	Type		%	g/l	g/l		
WS1		1.70		D	Brown with orangish brown staining silty CLAY	100	0.33	0.39	7.96	
WS2		2.60		D	Brown and grey mottled and orangish brown staining silty CLAY with traces of roots and rootlets	100	0.66	0.79	7.89	

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

Checked and Approved

Initials J.P

Date: 27/10/2015

APPENDIX D
Chemical Laboratory Test Results

Francis Williams
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB

QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 15-36274

Site Reference:	Land adjacent 1b St Johns Wood Park, NW8
Project / Job Ref:	GWPR1403
Order No:	None Supplied
Sample Receipt Date:	08/10/2015
Sample Scheduled Date:	08/10/2015
Report Issue Number:	1
Reporting Date:	14/10/2015

Authorised by:

Russell Jarvis
Director
On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director
On behalf of QTS Environmental Ltd

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate							
QTS Environmental Report No: 15-36274	**Date Sampled**	25/09/15	28/09/15	25/09/15	28/09/15		
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied		
Site Reference: Land adjacent 1b St Johns Wood Park, NW8	**TP / BH No**	WS1	WS2	WS1	WS2		
Project / Job Ref: GWPR1403	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	**Depth (m)**	4.00 - 4.45	9.80	0.25	0.25		
Reporting Date: 14/10/2015	**QTSE Sample No**	171170	171171	171172	171173		

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025			Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	7.8	7.9	8.2	8.3	
Total Cyanide	mg/kg	< 2	NONE			< 2	< 2	
Total Sulphate as SO_4	mg/kg	< 200	NONE	9168	3117			
Total Sulphate as SO_4	%	< 0.02	NONE	0.92	0.31			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	3220	957	423	418	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	3.22	0.96	0.42	0.42	
Total Sulphur	%	< 0.02	NONE	0.44	0.66			
Organic Matter	%	< 0.1	MCERTS			2.8	2.5	
Total Organic Carbon (TOC)	%	< 0.1	MCERTS			1.6	1.4	
Ammonium as NH_4	mg/kg	< 0.5	NONE	9.9	32.8			
Ammonium as NH_4	mg/l	< 0.05	NONE	0.99	3.28			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	187	157			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	93.5	78.4			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	< 3			
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	< 1.5			
Arsenic (As)	mg/kg	< 2	MCERTS			4	8	
W/S Boron	mg/kg	< 1	NONE			1.8	1.4	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS			< 0.2	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS			14	49	
Chromium (hexavalent)	mg/kg	< 2	NONE			< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS			6	22	
Lead (Pb)	mg/kg	< 3	MCERTS			45	39	
W/S Magnesium	mg/l	< 0.1	NONE	240	68			
Mercury (Hg)	mg/kg	< 1	NONE			< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS			6	9	
Selenium (Se)	mg/kg	< 3	NONE			< 3	< 3	
Vanadium (V)	mg/kg	< 2	NONE			27	105	
Zinc (Zn)	mg/kg	< 3	MCERTS			50	50	
Total Phenols (monohydric)	mg/kg	< 2	NONE			< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

The material description shall be regarded as tentative and is not included in our scope of UKAS Accreditation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

Asbestos Analyst: Marcus Jones

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis $^{(S)}$

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

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Soil Analysis Certificate - Speciated PAHs							
QTS Environmental Report No: 15-36274	**Date Sampled**	25/09/15	28/09/15			
Ground & Water Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Land adjacent 1b St Johns Wood Park, NW8	**TP / BH No**	WS1	WS2			
Project / Job Ref: GWPR1403	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	0.25	0.25			
Reporting Date: 14/10/2015	**QTSE Sample No**	171172	171173			

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1			
Phenanthrene	mg/kg	< 0.1	MCERTS	1.82	0.13			
Anthracene	mg/kg	< 0.1	MCERTS	0.25	< 0.1			
Fluoranthene	mg/kg	< 0.1	MCERTS	7.58	0.45			
Pyrene	mg/kg	< 0.1	MCERTS	5.82	0.42			
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	2.43	0.28			
Chrysene	mg/kg	< 0.1	MCERTS	2.62	0.37			
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	2.97	0.93			
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	1.31	0.38			
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.33	0.34			
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	1.32	0.67			
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.21	0.13			
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	1.14	0.65			
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	28.8	4.7			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

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Soil Analysis Certificate - TPH CWG Banded							
QTS Environmental Report No: 15-36274	Date Sampled	28/09/15					
Ground & Water Ltd	Time Sampled	None Supplied					
Site Reference: Land adjacent 1b St Johns Wood Park, NW8	TP / BH No	WS2					
Project / Job Ref: GWPR1403	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	0.25					
Reporting Date: 14/10/2015	QTSE Sample No	171173					

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	78				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	78				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	52				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	52				
Total >C5 - C35	mg/kg	< 42	NONE	129				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
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Soil Analysis Certificate - BTEX / MTBE							
QTS Environmental Report No: 15-36274	**Date Sampled**	28/09/15					
Ground & Water Ltd	**Time Sampled**	None Supplied					
Site Reference: Land adjacent 1b St Johns Wood Park, NW8	**TP / BH No**	WS2					
Project / Job Ref: GWPR1403	**Additional Refs**	None Supplied					
Order No: None Supplied	**Depth (m)**	0.25					
Reporting Date: 14/10/2015	**QTSE Sample No**	171173					

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	< 5				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	< 2				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 5				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

QTS Environmental Ltd
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Maidstone
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Tel : 01622 850410

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Soil Analysis Certificate - Sample Descriptions	
QTS Environmental Report No: 15-36274	
Ground & Water Ltd	
Site Reference: Land adjacent 1b St Johns Wood Park, NW8	
Project / Job Ref: GWPR1403	
Order No: None Supplied	
Reporting Date: 14/10/2015	

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 171170	WS1	None Supplied	4.00 - 4.45	20.5	Light brown sandy clay
171171	WS2	None Supplied	9.80	19.1	Brown sandy clay
$ 171172	WS1	None Supplied	0.25	7	Brown sand with concrete and brick
171173	WS2	None Supplied	0.25	6.6	Light brown sand with brick and concrete

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

$ samples exceeded recommended holding times

QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
QTS Environmental Report No: 15-36274
Ground & Water Ltd
Site Reference: Land adjacent 1b St Johns Wood Park, NW8
Project / Job Ref: GWPR1403
Order No: None Supplied
Reporting Date: 14/10/2015

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

D Dried
AR As Received

APPENDIX E
Soil Assessment Criteria

Appendix E
Soil Guideline Values and Genera Assessment Criteria

E1 Assessment Criteria

The Contaminated Land Regime reflects the UK Government's stated objectives of achieving sustainable development through the 'suitable for use approach'.

E1.1 Contaminated Land Exposure Assessment Model (CLEA)

Current United Kingdom risk assessment practice is based on the Contaminated Land Exposure Assessment Model (CLEA).

The CLEA Guidance comprises the following documents:

1) EA Science Report SC050021/SR2: *Human health toxicological assessment of contaminants in soil.*
2) EA Science Report SC050021/SR3: *Updated technical background to the CLEA model.*
3) EA CLEA Bulletin (2009).
4) CLEA software version 1.06 (2009)
5) Toxicological reports and SGV technical notes.

The CLEA guidance and tools:

- *do not cover other types of risk to humans, such as fire, suffocation or explosion, or short-term and acute exposures.*
- *do not cover risks to the environment, such as groundwater, ecosystems or buildings.*
- *do not provide a definitive test for telling when human health risks are significant.*
- *are not a legal requirement in assessing land contamination risks. They are not part of the legal regime for Part 2A of the Environmental Protection Act 1990.*

The CLEA guidance derives soil concentrations of contaminants above which (in the opinion of the EA) there may be a concern that warrants further investigation. It does not provide a definitive test for establishing that the risk is significant.

E1.2 Land-use Scenarios

The CLEA model uses a range of standard land-use scenarios to develop conceptual exposure models as follows:

1 Residential (with home grown produce) (RwHP)

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil and indoor dust ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
- Building type is a two-storey small terraced house.

A sub-set of this land-use is residential apartments with communal landscaped gardens where the consumption of home grown vegetables will not occur. (Residential without homegrown produce (RwoHP)).

2) Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

3) Commercial/Industrial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

E1.4 LQM/CIEH SUITABLE 4 USE LEVELS (S4UL)

For derivation of these S4UL reference must be made to:

Nathanial, P., McCaffrey, C., Gillet, A., Ogden, R., Nathanial, J.,. *The LQM/CIEH S4UL's for Human Health Risk Assessment*. **Land Quality Press**. 2015

The LQM/CIEH S4UL for a given land use is the concentration of the contaminant in soil at which the predicted daily exposure, as calculated by the CLEA software, equals the Health Criteria Value.

The final output for each contaminant represents a synthesis of new toxicological (and fate and transport) reviews published since the preparation of the 2nd edition LQM/CIEH GAC's (Nathanial et al., 2009).

In the derivation of LQM/CIEH S4UL's the principles of 'minimal' or 'tolerable' risk enshrined in SR2, which has not been withdrawn, has been maintained.

S4UL's have been derived for the basic CLEA land-uses, as described above, and for two new land uses:

- Public Open Spaces near Residential Housing (POSresi)
- Public Park (POSpark).

Public Open Spaces near Residential Housing (POSresi)
Includes the predominantly grassed areas adjacent to high density housing, the central green area on many 1930's – 1970's housing estates, and smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soils with planting. It is assumed that the close proximity to the place of residence will allow tracking back of soil to occur.

Public Park (POSpark)
An area of open space, usually owned and maintained by the local authority, provided for recreational uses including family visists and picnics, children's play area, informal sporting activities (not a dedicated sports pitch), and dog walking. It is assumed that tracking back of soils into places of residence will be negligible.

E1.5 Category 4 **Screening Levels (C4SLs)**
In the case of Lead, no SGV or GAC has been published to date. This is likely to be due to the toxicity review that is currently being undertaken by the Environment Agency. In the absence of updated toxicity information the SGV derived using CLEA 1.06 methodology and related toxicity will be used.

The overall objective of the C4SLs research project was to assist the provision of technical guidance in support of Defra's revised Statutory Guidance (SG) for Part 2A of the Environmental Protection Act 1990 (Part 2A) (Defra, 2012a). Specifically, the project aimed to deliver:

• A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
• A demonstration of the methodology, via the derivation of C4SLs for six substances – arsenic, benzene, benzo(a)pyrene, cadmium, chromium (VI) and lead.

To help achieve a more targeted approach to identifying and managing contaminated land in relation to the risk (or possibility) of harm to human health, the revised SG presented a new four category system for considering land under Part 2A, ranging from Category 4, where there is no risk that land poses a

significant possibility of significant harm (SPOSH), or the level of risk is low, to Category 1, where the risk that land poses a significant possibility of significant harm (SPOSH) is unacceptably high. More specific guidance on what type of land should be considered as Category 4 (Human Health) is provided in Paragraphs 4.21 and 4.22 of the revised SG, as follows:

"4.21 The local authority should consider that the following types of land should be placed into Category 4: Human Health:
(a) Land where no relevant contaminant linkage has been established.
(b) Land where there are only normal levels of contaminants in soil, as explained in Section 3 of this Guidance.
(c) Land that has been excluded from the need for further inspection and assessment because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of this Guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of this Guidance.
(d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed in the normal course of their lives).

4.22 The local authority may consider that land other than the types described in paragraph 4.21 should be placed into Category 4: Human Health if following a detailed quantitative risk assessment it is satisfied that the level of risk posed is sufficiently low."

The C4SLs are intended as "relevant technical tools" (in relation to Paragraph 4.21(c)) to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

"The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land."

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):
"SGVs are guidelines on the level of long-term human exposure to individual chemicals in soil that, unless stated otherwise, are tolerable or pose a minimal risk to human health."

The implication of Paragraph 47(h) of the IA is that minimal risk is well within Category 4 and that the C4SLs should describe a higher level of risk which, whilst not minimal, can still be considered low enough to allow a judgement to be made

that land containing substances at, or below, the C4SLs would typically fall within Category 4. This reflects Paragraph 4.20 of the revised SG, which states:

"4.20 The local authority should not assume that land poses a significant possibility of significant harm if it considers that there is no risk or that the level of risk posed is low. For the purposes of this Guidance, such land is referred to as a "Category 4: Human Health" case. The authority may decide that the land is a Category 4: Human Health case as soon as it considers it has evidence to this effect, and this may happen at any stage during risk assessment including the early stages."

C4SLs, therefore, should not be viewed as "SPOSH levels" and they should not be used as a legal trigger for the determination of land under Part 2A.

The generic screening values referred to before usually take the form of risk-based Soil Guideline Values (SGVs) or other Generic Assessment Criteria (GACs) that are most typically derived using the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model, as described in the Environment Agency's SR2, SR3 and SR7 reports (EA, 2009b & c; EA, 2008). It is anticipated that C4SLs will be used in a similar manner; as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the SGVs.

The suggested approach to the development of C4SLs consists of the retention and use of the CLEA framework, modified according to considerations of the underlying science within the context of Defra's policy objectives relating to the revised SG. Within this context, it is suggested that the development of C4SLs may be achieved in one of three ways, namely:

- By modifying the toxicological parameters used within CLEA (while maintaining current exposure parameters);
- By modifying the exposure parameters embedded within CLEA (while maintaining current toxicological "minimal risk" interpretations); and
- By modifying both toxicological and exposure parameters.

There is also a suggested check on "other considerations" (e.g., background levels, epidemiological data, sources of uncertainty) within the approach, applicable to all three options.

It is suggested that a new term is defined for the toxicological guidance values associated with the derivation of C4SLs – a Low Level of Toxicological Concern (LLTC). A LLTC should represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as SPOSH.

E1.6 CL:AIRE Generic Assessment Criteria (GAC)

For derivation of the CL:AIRE Generic Assessment Criteria (GAC) reference should be made to the following report:

CL:AIRE, *The Soil Generic Assessment Criteria for Human Health Risk Assessment.* **Contaminated Land: Applications in the Real Environment**. 2009.

Within this report CL:AIRE provided Generic Assessment Criteria (GAC's) in accordance with the CLEA software and the principles outlined above for a further 35 contaminants sometime encountered on land affected by contamination.

E1.7 Detailed Quantitative Risk Assessments (DQRA)
Where the adoption of an S4UL/GAC/C4SL is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses then a DQRA may be undertaking to develop site specific values for relevant soil contaminants.

⇒ Establishing the plausibility that generic exposure pathways exist in practice by measurement and observation.

⇒ Developing more accurate parameters using site data.

E1.8 Phytotoxicity
CLEA guidance only addresses human health toxicity; assessment of plant toxicity (phytotoxicity) is based on threshold trigger values obtained from the following source:

- ICRCL 70/90: *Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing*.

E1.8 Statistical Tests
DEFRA R&D Publication CLR 7 (DOE 1994) addressed the statistical treatment of test results and their comparison to Soil Guideline Values.

Consideration must be given to the appropriate area of land to be considered termed the critical averaging area.

For a communal open space or commercial land-use, the critical averaging area will depend on the proposed layout. For a residential use with private gardens the averaging area is the individual plot.

It may be appropriate to compare the upper 95th percentile concentration with the Soil Guideline Value, subject to applying a statistical test to establish that the range of concentrations are reasonably consistent and belonging to the same underlying distribution of data.

The DEFRA discussion paper Assessing risks from land contamination – a proportionate approach ('the way forward') (CLAN06/2006) aimed to increase understanding of the role that statistics can play in quantifying the uncertainty attached to the estimates of the mean concentration of contaminants in soil. In direct response CLAIRE/CIEH published a joint report, *Guidance in comparing soil contamination data with a critical concentration* (CLAIRE/CIEH 2008). A software implementation of the statistical techniques given in the report was published by ESI International (2008).

Treatment of Hot-Spots
⇒ A statistical test is applied to establish whether the data is a part of a single set, or whether data outliers are present.

⇒ Provided that the data is based on random sampling and no distinct contamination source was present at the sampling location, the hot-spot(s) may be excluded and the mean of the remaining data assessed.

E2 Ground and Water Limited Soil Assessment Criteria

The Soil Assessment Criteria used in the preparation of this report are tabulated in the following pages:

C4SL Low Level of Toxicological Concern

C4SL Low Level of Toxicological Concern						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Lead	<210	<330	<84	<6000	<760	<1400

Phytotoxicity Recommendations

ICRCL 70/90 ***Restoration of metalliferous mining areas***

Phytotoxicity (Harmful to Plants) Threshold Trigger Values	
Copper	250mg/kg
Zinc	1000mg/kg
Notes: Many cultivars and specifically grasses have a high tolerance and there will be no ill-effect at the threshold trigger values given for neutral or near neutral pH. Site observation of plant vitality may give additional guidance.	

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LQM CIEH Suitable 4 Use Levels (S4UL's)

LQM/CIEH Suitable 4 Use Levels – Metals and Semi-metals						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Metals:						
Arsenic	37	40	43	640	79	170
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11000	45	240000	21000	46000
Cadmium	11	85	1.9	190	120	532
Chromium (III)	910	910	18000	8600	1500	33000
Chromium (VI)	6	6	1.8	33	7.7	20
Copper	2400	7100	520	68000	12000	44000
Elemental Mercury	1.2	1.2	21	58	16	30
Inorganic Mercury	40	56	19	1100	120	240
Methylmercury	11	15	6	320	40	68
Nickel	180	180	230	980	230	3400
Selenium	250	430	88	12000	1100	1800
Vanadium	410	1200	91	9000	2000	5000
Zinc	3700	40000	620	730000	81000	170000

LQM/CIEH Suitable 4 Use Levels – BTEX Compounds							
Contaminant	**Soil Organic Matter**	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Benzene	**1.0% SOM**	0.087	0.38	0.017	27	72	90
	2.5% SOM	0.170	0.70	0.034	47	72	100
	6.0% SOM	0.370	1.40	0.075	90	73	110
Toluene	**1.0% SOM**	130	880	22	56000	56000	87000
	2.5% SOM	290	1900	51	110000	56000	95000
	6.0% SOM	660	3900	120	180000	56000	100000
Ethylbenzene	**1.0% SOM**	47	83	16	5700	24000	17000
	2.5% SOM	110	190	39	13000	24000	22000
	6.0% SOM	260	440	91	27000	25000	27000
o-Xylene	**1.0% SOM**	60	88	**28**	6600	**41000**	**17000**
	2.5% SOM	140	210	**67**	15000	**42000**	24000
	6.0% SOM	330	480	**160**	33000	**43000**	33000
m-Xylene	**1.0% SOM**	59	82	31	6200	**41000**	17000
	2.5% SOM	140	190	74	**14000**	**42000**	24000
	6.0% SOM	320	450	170	31000	**43000**	33000
p-Xylene	**1.0% SOM**	**56**	**79**	29	**5900**	**41000**	**17000**
	2.5% SOM	**130**	**180**	69	**14000**	**42000**	**23000**
	6.0% SOM	**310**	**430**	**160**	**30000**	**43000**	**31000**
The most health protective value in each scenario for Xylene is highlighted in bold.							

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LQM/CIEH Suitable 4 Use Levels For TPH

Aliphatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-6	1.0% SOM	42	42	730	3,200 (304) [sol]	570,000 (304) [sol]	95,000 (304) [sol]
	2.5% SOM	78	78	1,700	5,900 (558) [sol]	590,000	130,000 (558) [sol]
	6.0% SOM	160	160	3,900	12,000 (1150) [sol]	600,000 [l]	180,000 (1150) [sol]
EC >6-8	1.0% SOM	100	100	2,300	7,800 (144) [sol]	600,000	150,000 (144) [sol]
	2.5% SOM	230	230	5,600	17,000 (322) [sol]	610,000	220,000 (322) [sol]
	6.0% SOM	530	530	13,000	40,000 (736) [sol]	620,000	320,000 (736) [sol]
EC >8-10	1.0% SOM	27	27	320	2,000 (78) [sol]	13,000	14,000 (78) [sol]
	2.5% SOM	65	65	770	4,800 (118) [vap]	13,000	18,000 (118) [vap]
	6.0% SOM	150	150	1,700	11,000 (451) [vap]	13,000	21,000 (451) [vap]
EC >10-12	1.0% SOM	130 (48) [vap]	130 (48) [vap]	2,200	9,700 (48) [sol]	13,000	21,000 (48) [sol]
	2.5% SOM	330 (118) [vap]	330 (118) [vap]	4,400	23,000 (118) [vap]	13,000	23,000 (118) [vap]
	6.0% SOM	760 (283) [vap]	770 (283) [vap]	7,300	47,000 (283) [vap]	13,000	24,000 (283) [vap]
EC >12-16	1.0% SOM	1,100 (24) [sol]	1,100 (24) [sol]	11,000	59,000 (24) [sol]	13,000	25,000 (24) [sol]
	2.5% SOM	2,400 (59) [sol]	2,400 (59) [sol]	13,000	82,000 (59) [sol]	13,000	25,000 (59) [sol]
	6.0% SOM	4,300 (142) [sol]	4,400 (142) [sol]	13,000	90,000 (142) [sol]	13,000	26,000 (142) [sol]
EC >16-35	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000
EC >35-44	1.0% SOM	65,000 (8.48) [sol]	65,000 (8.48) [sol]	260,000	1,600,000	250,000	450,000
	2.5% SOM	92,000 (21) [sol]	92,000 (21) [sol]	270,000	1,700,000	250,000	480,000
	6.0% SOM	110,000	110,000	270,000	1,800,000	250,000	490,000

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LQM/CIEH Suitable 4 Use Levels For TPH

Aromatic		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
EC 5-7 (Benzene)	1.0% SOM	70	370	13	26,000 (1220) [sol]	56,000	76,000 (1220 [sol]
	2.5% SOM	140	690	27	46,000 (2260) [sol]	56,000	84,000 (2260) [sol]
	6.0% SOM	300	1,400	57	86,000 (4710) [sol]	56,000	92,000 (4710) [sol]
EC >7-8 (Toluene)	1.0% SOM	130	860	22	56,000 (869) [vap]	56,000	87,000 (869) [sol]
	2.5% SOM	290	1,800	51	110,000 (1920) [sol]	56,000	95,000 (1920) [sol]
	6.0% SOM	660	3,900	120	180,000 (4360) [vap]	56,000	100,000 (4360) [vap]
EC >8-10	1.0% SOM	34	47	8.6	3,500 (613) [vap]	5,000	7,200 (613) [vap]
	2.5% SOM	83	110	21	8,100 (1500) [vap]	5,000	8,500 (1500) [vap]
	6.0% SOM	190	270	51	17,000 (3850) [vap]	5,000	9,300 (3580) [vap]
EC >10-12	1.0% SOM	74	250	13	16,000 (364) [sol]	5,000	9,200 (364) [sol]
	2.5% SOM	180	590	31	28,000 (899) [sol]	5,000	9,700 (889) [sol]
	6.0% SOM	380	1,200	74	34,000 (2150) [sol]	5,000	10,000
EC >12-16	1.0% SOM	140	1,800	23	36,000 (169) [sol]	5,100	10,000
	2.5% SOM	330	2,300 (419) [sol]	57	37,000	5,100	10,000
	6.0% SOM	660	2,500	130	38,000	5,000	10,000
EC >16-21	1.0% SOM	260	1,900	46	28,000	3,800	7,600
	2.5% SOM	540	1,900	110	28,000	3,800	7,700
	6.0% SOM	930	1,900	260	28,000	3,800	7,800
EC >21-35	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >35-44	1.0% SOM	1,100	1,900	370	28,000	3,800	7,800
	2.5% SOM	1,500	1,900	820	28,000	3,800	7,800
	6.0% SOM	1,700	1,900	1,600	28,000	3,800	7,900
EC >44-70	1.0% SOM	1,600	1,900	1,200	28,000	3,800	7,800
	2.5% SOM	1,800	1,900	2,100	28,000	3,800	7,800
	6.0% SOM	1,900	1,900	3,000	28,000	3,800	7,900

SOM = Soil Organic Matter Content (%)

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)

Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Acenapthene	1.0% SOM	210	3,000 (57.0) [sol]	34	84,000(57.0) [sol]	15,000	29,000
	2.5% SOM	510	4,700(141) [sol]	85	97,000(141) [sol]	15,000	30,000
	6.0% SOM	1100	6,000(336) [sol]	200	100,000	15,000	30,000
Acenapthylene	1.0% SOM	170	2,900(86.1) [sol]	28	83,000(86.1) [sol]	15,000	29,000
	2.5% SOM	420	4,600(212) [sol]	69	97,000(212) [sol]	15,000	30,000
	6.0% SOM	920	6,000(506) [sol]	160	100,000	15,000	30,000
Anthracene	1.0% SOM	2,400	31,000(1.17) [vap]	380	520,000	74,000	150,000
	2.5% SOM	5,400	35,000	950	540,000	74,000	150,000
	6.0% SOM	11,000	37,000	2,200	540,000	74,000	150,000
Benzo(a)anthracene	1.0% SOM	7.20	11	2.90	170	29	49
	2.5% SOM	11	14	6.50	170	29	56
	6.0% SOM	13	15	13	180	29	62
Benzo(a)pyrene	1.0% SOM	2.20	3.20	0.97	35	5.70	11
	2.5% SOM	2.70	3.20	2.00	35	5.70	12
	6.0% SOM	3.00	3.20	3.50	36	5.70	13
Benzo(b)flouranthene	1.0% SOM	2.60	3.90	0.99	44	7.10	13
	2.5% SOM	3.30	4.00	2.10	44	7.20	15
	6.0% SOM	3.70	4.00	3.90	45	7.20	16
Benzo(ghi)perylene	1.0% SOM	320	360	290	3,900	640	1,400
	2.5% SOM	340	360	470	4,000	640	1,500
	6.0% SOM	350	360	640	4,000	640	1,600
Benzo(k)flouranthene	1.0% SOM	77	110	37	1,200	190	370
	2.5% SOM	93	110	75	1,200	190	410
	6.0% SOM	100	110	130	1,200	190	440
Chrysene	1.0% SOM	15	30	4.10	350	57	93
	2.5% SOM	22	31	9.40	350	57	110
	6.0% SOM	27	32	19	350	57	120
Dibenzo(ah)anthracene	1.0% SOM	0.24	0.31	0.14	3.50	0.57	1.10
	2.5% SOM	0.28	0.32	0.27	3.60	0.57	1.30
	6.0% SOM	0.30	0.32	0.43	3.60	0.58	1.40

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LQM/CIEH Suitable 4 Use Levels For Polycyclic Aromatic Hydrocarbons (PAH's)

Determinants		RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Flouranthene	1.0% SOM	280	1,500	52	2,3000	3,100	6,300
	2.5% SOM	560	1,600	130	2,3000	3,100	6,300
	6.0% SOM	890	1,600	290	2,3000	3,100	6,300
Flourene	1.0% SOM	170	2,800 (30.9) ^{sol}	27	63,000(30.9) ^{sol}	9,900	20,000
	2.5% SOM	400	3,800(76.5) ^{sol}	67	68,000	9,900	20,000
	6.0% SOM	860	4,500(183) ^{sol}	160	71,000	9,900	20,000
Indeno(123-cd)pyrene	1.0% SOM	27	45	9.50	500	82	150
	2.5% SOM	36	46	21	510	82	170
	6.0% SOM	41	46	39	510	82	180
Napthalene	1.0% SOM	2.30	2.6	4.10	190 † (76.4) ^{sol}	4,900 †	1,200 † (76.4) ^{sol}
	2.5% SOM	5.60	5.6	10	460 † (183) ^{sol}	4,900 †	1,900 † (183) ^{sol}
	6.0% SOM	13	13	24	1,100 † (432) ^{sol}	4,900 †	3,000
Phenanthrene	1.0% SOM	95	1,300(183) ^{sol}	18	22,000	3,100	6,200
	2.5% SOM	220	1,500	38	22,000	3,100	6,200
	6.0% SOM	440	1,500	90	23,000	3,100	6,300
Pyrene	1.0% SOM	620	3,700	110	54,000	7,400	15,000
	2.5% SOM	1200	3,800	270	54,000	7,400	15,000
	6.0% SOM	2000	3,800	620	54,000	7,400	15,000
Coal Tar (Benzo(a)pyrene used as marker compound	1.0% SOM	0.79	1.2	0.32	15	2.20	4.40
	2.5% SOM	0.98	1.2	0.67	15	2.20	4.70
	6.0% SOM	1.10	1.2	1.20	15	2.20	4.80

^{vap} – GAC presented exceeds the vapour saturation limit, which is presented in brackets.
^{sol} – GAC presented exceeds the soil saturation limit, which is presented in brackets.

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Chloroalkanes & alkenes						
1,2 Dichloroethane						
1.0% SOM	0.0071	0.0092	0.0046	0.67	29	21
2.5% SOM	0.011	0.013	0.0083	0.97	29	24
6.0% SOM	0.019	0.023	0.016	1.70	29	28
1,1,2,2 Tetrachloroethane						
1.0% SOM	1.60	3.90	0.41	270	1,400	1,800
2.5% SOM	3.40	8.00	0.89	550	1,400	2,100
6.0% SOM	7.50	17	2.00	1,100	1,400	2,300
1,1,1,2 Tetrachloroethane						
1.0% SOM	1.20	1.50	0.79	110	1,400	1,500
2.5% SOM	2.80	3.50	1.90	250	1,400	1,800
6.0% SOM	6.40	8.20	4.40	560	1,400	2,100
Tetrachloroethene						
1.0% SOM	0.18	0.18	0.65	19	1,400	810 ^{sol}(424)
2.5% SOM	0.39	0.40	1.50	42	1,400	1,100 ^{sol}(951)
6.0% SOM	0.90	0.92	3.60	95	1,400	1,500
1,1,1 Trichloroethane						
1.0% SOM	8.80	9.00	48	660	140,000	57,000 ^{vap}(1425)
2.5% SOM	18	18	110	1,300	140,000	76,000 ^{vap}(2915)
6.0% SOM	39	40	240	3,000	140,000	100,000 ^{vap}(6392)
Tetrachloromethene						
1.0% SOM	0.026	0.026	0.45	2.90	890	190
2.5% SOM	0.056	0.056	1.00	6.30	920	270
6.0% SOM	0.130	0.130	2.40	14	950	400
Trichloroethene						
1.0% SOM	0.016	0.017	0.041	1.20	120	70
2.5% SOM	0.034	0.036	0.091	2.60	120	91
6.0% SOM	0.075	0.080	0.210	5.70	120	120
Trichloromethane						
1.0% SOM	0.91	1.20	0.42	99	2,500	2,600
2.5% SOM	1.70	2.10	0.83	170	2,500	2,800
6.0% SOM	3.40	4.20	1.70	350	2,500	3,100
Vinyl Chloride						
1.0% SOM	0.00064	0.00077	0.00055	0.059	3.50	4.80
2.5% SOM	0.00087	0.00100	0.00100	0.077	3.50	5.00
6.0% SOM	0.00014	0.00150	0.00180	0.120	3.50	5.40

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Explosives						
2,4,6 Trinitrotoluene						
1.0% SOM	1.60	65	0.24	1,000	130	260
2.5% SOM	3.70	66	0.58	1,000	130	270
6.0% SOM	8.10	66	1.40	1,000	130	270
RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)						
1.0% SOM	120	13,000	17	210,000	26,000	49,000(18.7)^{sol}
2.5% SOM	250	13,000	38	210,000	26,000	51,000
6.0% SOM	540	13,000	85	210,000	27,000	53,000
HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)						
1.0% SOM	5.70	67,00	0.86	110,000	13,000	23,000(0.35)^{vap}
2.5% SOM	13	67,00	1.90	110,000	13,000	23,000(0.39)^{vap}
6.0% SOM	26	67,00	3.90	110,000	13,000	24,000(0.48)^{vap}
Atrazine						
1.0% SOM	3.30	610	0.50	9,300	1,200	2,300
2.5% SOM	7.60	620	1.20	9,400	1,200	2,400
6.0% SOM	17.40	620	2.70	9,400	1,200	2,400
Pesticides						
Aldrin						
1.0% SOM	5.70	7.30	3.20	170	18	30
2.5% SOM	6.60	7.40	6.10	170	18	31
6.0% SOM	7.10	7.50	9.60	170	18	31
Dieldrin						
1.0% SOM	0.97	7.00	0.17	170	18	30
2.5% SOM	2.00	7.30	0.41	170	18	30
6.0% SOM	3.50	7.40	0.96	170	18	31
Dichlorvos						
1.0% SOM	0.032	6.40	0.0049	140	16	26
2.5% SOM	0.066	6.50	0.0100	140	16	26
6.0% SOM	0.140	6.60	0.0220	140	16	27
Alpha - Endosulfan						
1.0% SOM	7.40	160(0.003)^{vap}	1.20	5,600(0.003)^{vap}	1,200	2,400
2.5% SOM	18	280(0.007)^{vap}	2.90	7,400(0.007)^{vap}	1,200	2,400
6.0% SOM	41	410(0.016)^{vap}	6.80	8,400(0.016)^{vap}	1,200	2,400

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds

Contaminant	RwHP (mg/kg)	RwoHP (mg/kg)	Allotment (mg/kg)	Commercial (mg/kg)	POSresi (mg/kg)	POSpark (mg/kg)
Pesticides						
Beta - Endosulfan						
1.0% SOM	7.00	190(0.00007)[vap]	1.10	6,300(0.00007)[vap]	1,200	2,400
2.5% SOM	17	320(0.0002)[vap]	2.70	7,800(0.0002)[vap]	1,200	2,400
6.0% SOM	39	440(0.0004)[vap]	6.40	8700	1,200	2,500
Alpha - Hexachlorocyclohexanes						
1.0% SOM	0.23	6.90	0.035	170	24	47
2.5% SOM	0.55	9.20	0.087	180	24	48
6.0% SOM	1.20	11	0.210	180	24	48
Beta - Hexachlorocyclohexanes						
1.0% SOM	0.085	3.70	0.013	65	8.10	15
2.5% SOM	0.200	3.80	0.032	65	8.10	15
6.0% SOM	0.460	3.80	0.077	65	8.10	16
Gamma - Hexachlorocyclohexanes						
1.0% SOM	0.06	2.90	0.0092	67	8.2	14
2.5% SOM	0.14	3.30	0.0230	69	8.2	15
6.0% SOM	0.33	3.50	0.0540	70	8.2	15
Chlorobenzenes						
Chlorobenzene						
1.0% SOM	0.46	0.46	5.90	56	11,000	1,300(675)[sol]
2.5% SOM	1.00	1.00	14	130	13,000	2,000(1520)[sol]
6.0% SOM	2.40	2.40	32	290	14,000	2,900
1,2-Dichlorobenzene						
1.0% SOM	23	24	94	2,000 (571)[sol]	90,000	24,000(571)[sol]
2.5% SOM	55	57	230	4,800 (1370)[sol]	95,000	36,000(1370)[sol]
6.0% SOM	130	130	540	11,000 (3240)[sol]	98,000	51,000(3240)[sol]
1,3-Dichlorobenzene						
1.0% SOM	0.40	0.44	0.25	30	300	390
2.5% SOM	1.00	1.10	0.60	73	300	440
6.0% SOM	2.30	2.50	1.50	170	300	470
1,4-Dichlorobenzene						
1.0% SOM	61	61	15	4,400 (224)[vap]	17,000[g]	36,000 (224)[vap]
2.5% SOM	150	150	37	10,000 (540)[vap]	17,000[g]	36,000 (540)[vap]
6.0% SOM	350	350	88[g]	25,000 (1280)[vap]	17,000[g]	36,000 (1280)[vap]
1,2,3,-Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134[vap]
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330)[vap]
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)[vap]

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Chlorobenzenes						
1,2,3,- Trichlorobenzene						
1.0% SOM	1.50	1.50	4.70	102	1,800	770(134)[vap]
2.5% SOM	3.60	3.70	12	250	1,800	1,100(330[lvap]
6.0% SOM	8.60	8.80	28	590	1,800	1,600(789)[vap]
1,2,4,- Trichlorobenzene						
1.0% SOM	2.60	2.60	55	220	15,000	1,700(318)[vap]
2.5% SOM	6.40	6.40	140	530	17,000	2,600(786)[vap]
6.0% SOM	15	15	320	1,300	19,000	4,000(1880)[vap]
1,3,5,- Trichlorobenzene						
1.0% SOM	0.33	0.33	4.70	23	1,700	380(36.7)[vap]
2.5% SOM	0.81	0.81	12	55	1,700	590(90.8)[vap]
6.0% SOM	1.90	1.90	140	130	1,800	860(217)[vap]
1,2,3,4,- Tetrachlorobenzene						
1.0% SOM	15	24	4.40	1,700(122[lvap]	830	1,500(122)[vap]
2.5% SOM	36	56	11	3,080(304)[vap]	830	1,600
6.0% SOM	78	120	26	4,400(728)[vap]	830	1,600
1,2,3,5,- Tetrachlobenzene						
1.0% SOM	0.66	0.75	0.38	49(39.4)[vap]	78	110(39)[vap]
2.5% SOM	1.60	1.90	0.90	120(98.1)[vap]	79	120
6.0% SOM	3.70	4.30	2.20	240(235)[vap]	79	130
1,2,4, 5,- Tetrachlobenzene						
1.0% SOM	0.33	0.73	0.06	42(19.7)[sol]	13	25
2.5% SOM	0.77	1.70	0.16	72(49.1)[sol]	13	26
6.0% SOM	1.60	3.50	0.37	96	13	26
Pentachlrobenzene						
1.0% SOM	5.80	19	1.20	640(43.0)[sol]	100	190
2.5% SOM	12	30	3.10	770(107)[sol]	100	190
6.0% SOM	22	38	7.00	830	100	190
Hexachlorobenzene						
1.0% SOM	1.80(0.20)[vap]	4.10 (0.20)[vap]	0.47	110(0.20)[vap]	16	30
2.5% SOM	3.30(0.50)[vap]	5.70 (0.50)[vap]	1.10	120	16	30
6.0% SOM	4.90	6.70 (1.2)[vap]	2.50	120	16	30

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LQM CIEH General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds						
Contaminant	**RwHP (mg/kg)**	**RwoHP (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**	**POSresi (mg/kg)**	**POSpark (mg/kg)**
Phenols & Chlorophenols						
Phenols						
1.0% SOM	280	750	66	760[dir](31,000)	760[dir](11,000)	760[dir](8,600)
2.5% SOM	550	1,300	140	1,500[dir](35,000)	1,500[dir](11,000)	1,500[dir](9,700)
6.0% SOM	1100	2,300	280	3,200[dir](37,000)	3,200[dir](11,000)	3,200[dir](11,000)
Chlorophenols (4 Congeners)						
1.0% SOM	0.87	94	0.13	3,500	620	1,100
2.5% SOM	2.00	150	0.30	4,000	620	1,100
6.0% SOM	4.50	210	0.70	4,300	620	1,100
Pentachlorophenols						
1.0% SOM	0.22	27(16.4)[vap]	0.03	400	60	110
2.5% SOM	0.52	29	0.08	400	60	120
6.0% SOM	1.20	31	0.19	400	60	120
Others						
Carbon Disulphide						
1.0% SOM	0.14	0.14	4.80	11	11,000	1,300
2.5% SOM	0.29	0.29	10	22	11,000	1,900
6.0% SOM	0.62	0.62	23	47	12,000	2,700
Hexachloro-1,3-Butadiene						
1.0% SOM	0.29	0.32	0.25	31	25	48
2.5% SOM	0.70	0.78	0.61	68	25	50
6.0% SOM	1.60	1.80	1.40	120	25	51

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CL:AIRE Soil Generic Assessment Criteria				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Metals:				
Antimony	ND	550	ND	7500
Barium	ND	1300	ND	22000
Molybdenum	ND	670	ND	17000

ND – Not Derived.
NA – Not Applicable

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
1,1,2 Trichloroethane				
1.0% SOM	0.60	0.88	0.28	94
2.5% SOM	1.20	1.8	0.61	190
6.0% SOM	2.70	3.9	1.40	400
1,1-Dichloroethane				
1.0% SOM	2.40	2.50	9.20	280
2.5% SOM	3.90	4.10	17	450
6.0% SOM	7.40	7.70	35	850
1,1-Dichloroethene				
1.0% SOM	0.23	0.23	2.80	26
2.5% SOM	0.40	0.41	5.60	46
6.0% SOM	0.82	0.82	12	92
1,2,4-Trimethylbenzene				
1.0% SOM	0.35	0.41	0.38	42
2.5% SOM	0.85	0.99	0.93	99
6.0% SOM	2.00	2.30	2.20	220
1,2-Dichloropropane				
1.0% SOM	0.024	0.024	0.62	3.3
2.5% SOM	0.042	0.042	1.20	5.9
6.0% SOM	0.084	0.085	2.60	12
2,4-Dimethylphenol				
1.0% SOM	19	210	3.10	16000*
2.5% SOM	43	410	7.20	24000*
6.0% SOM	97	730	17	30000*
2,4-Dinitrotoluene				
1.0% SOM	1.50	170*	0.22	3700*
2.5% SOM	3.20	170	0.49	3700*
6.0% SOM	7.20	170	1.10	3800*
2,6-Dinitrotoluene				
1.0% SOM	0.78	78	0.12	1900*
2.5% SOM	1.70	84	0.27	1900*
6.0% SOM	3.90	87	0.61	1900*
2-Chloronapthalene				
1.0% SOM	3.70	3.80	40	390*
2.5% SOM	9.20	9.30	98	960*
6.0% SOM	22	22	230	2200*

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CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Biphenyl				
1.0% SOM	66*	220*	14	18000*
2.5% SOM	160	500*	35	33000*
6.0% SOM	360	980*	83	48000*
Bis (2-ethylhexyl) phthalate				
1.0% SOM	280*	2700*	47*	85000*
2.5% SOM	610*	2800*	120*	86000*
6.0% SOM	1100*	2800*	280*	86000*
Bromobenzene				
1.0% SOM	0.87	0.91	3.2	97
2.5% SOM	2.0	2.1	7.6	220
6.0% SOM	4.7	4.9	18	520
Bromodichloromethane				
1.0% SOM	0.016	0.019	0.016	2.1
2.5% SOM	0.030	0.034	0.032	3.7
6.0% SOM	0.061	0.070	0.068	7.6
Bromoform				
1.0% SOM	2.8	5.2	0.95	760
2.5% SOM	5.9	11	2.1	1500
6.0% SOM	13	23	4.6	3100
Butyl benzyl phthalate				
1.0% SOM	1400*	42000*	220*	940000*
2.5% SOM	3300*	44000*	550*	940000*
6.0% SOM	7200*	44000*	1300*	950000*
Chloroethane				
1.0% SOM	8.3	8.4	110	960
2.5% SOM	11	11	200	1300
6.0% SOM	18	18	380	2100
Chloromethane				
1.0% SOM	0.0083	0.0085	0.066	1.0
2.5% SOM	0.0098	0.0099	0.13	1.2
6.0% SOM	0.013	0.013	0.23	1.6
***Cis* 1,2 Dichloroethene**				
1.0% SOM	0.11	0.12	0.26	14
2.5% SOM	0.19	0.20	0.50	24
6.0% SOM	0.37	0.39	1.0	47

Cont'd Overleaf:

Cont'd from previous page:

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Dichloromethane				
1.0% SOM	0.58	2.10	0.10	270
2.5% SOM	0.98	2.80	0.19	360
6.0% SOM	1.70	4.50	0.34	560
Diethyl Phthalate				
1.0% SOM	120*	1800*	19*	150000*
2.5% SOM	260*	3500*	41*	220000*
6.0% SOM	570*	6300*	94*	290000*
Di-*n*-butyl phthalate				
1.0% SOM	13*	450*	2.00	15000*
2.5% SOM	31*	450*	5.00	15000*
6.0% SOM	67*	450*	12	15000*
Di-*n*-octyl phthalate				
1.0% SOM	2300*	3400*	940*	89000*
2.5% SOM	2800*	3400*	2100*	89000*
6.0% SOM	3100*	3400*	3900*	89000*
Hexachloroethane				
1.0% SOM	0.20	0.22	0.27	22*
2.5% SOM	0.48	0.54	0.67	53*
6.0% SOM	1.10	1.30	1.60	120*
Isopropylbenzene				
1.0% SOM	11	12	32	1400*
2.5% SOM	27	28	79	3300*
6.0% SOM	64	67	190	7700*
Methyl *tert*-butyl ether				
1.0% SOM	49	73	23	7900
2.5% SOM	84	120	44	13000
6.0% SOM	160	220	90	24000
Propylbenzene				
1.0% SOM	34	40	34	4100*
2.5% SOM	82	97	83	9700*
6.0% SOM	190	230	200	21000*
Styrene				
1.0% SOM	8.10	35	1.60	3300*
2.5% SOM	19	78	3.70	6500*
6.0% SOM	43	170	8.70	11000*

Cont'd Overleaf:

Cont'd from previous page:

CL:AIRE General Assessment Criteria: Volatile and Semi-Volatile Organic Compounds				
Contaminant	**Residential (mg/kg)**	**Residential without plant uptake (mg/kg)**	**Allotment (mg/kg)**	**Commercial (mg/kg)**
Total Cresols (2-, 3-, and 4-methylphenol)				
1.0% SOM	80	3700	12	160000
2.5% SOM	180	5400	27	180000*
6.0% SOM	400	6900	63	180000*
***Trans* 1,2 Dichloroethene**				
1.0% SOM	0.19	0.19	0.93	22
2.5% SOM	0.34	0.35	1.90	40
6.0% SOM	0.70	0.71	0.24	81
Tributyl tin oxide				
1.0% SOM	0.25	1.40	0.042	130*
2.5% SOM	0.59	3.10	0.100	180*
6.0% SOM	1.30	5.70	0.240	200*

Notes: *Soil concentration above soil saturation limit

APPENDIX F
Waste Hazard Assessment

Waste Classification Report

RKVNA-3NEE9-RPDBP

Job name

GWPR1403

Waste Stream

Ground and Water V2 PA

Comments

Project

GWPR1403 Land adjacent 1b St Johns Wood Park, NW8

Site

Land adjacent 1b St Johns Wood Park, NW8

Classified by

Name:
Allvey , Phillip
Date:
06/11/2015 16:30 UTC
Telephone:
07740110219

Company:
Ground and Water
15 Bow Street
Alton
GU34 1NY

Report

Created by: Allvey , Phillip
Created date: 06/11/2015 16:30 UTC

Job summary

Classification of sample: WS1/0.25

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
WS1/0.25
Sample Depth:
0 m
Moisture content: **0%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands (Moisture content: 0%, no correction)

pH: (Whole conc. entered as: 8.2 pH, converted to conc.:8.2 pH or 8.2 pH)
salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.768 mg/kg or <0.000377%) IGNORED Because: "<LOD"
arsenic trioxide: (Cation conc. entered: 4 mg/kg, converted to compound conc.:5.281 mg/kg or 0.000528%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: 1.8 mg/kg, converted to compound conc.:24.174 mg/kg or 0.00242%)
cadmium sulfide: (Cation conc. entered: <0.2 mg/kg, converted to compound conc.:<0.257 mg/kg or <0.0000257%, Note 1 conc.: <0.00002%) IGNORED Because: "<LOD"
Chromium (III) Sulphate: (Whole conc. entered as: 14 mg/kg or 0.0014%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.846 mg/kg or <0.000385%) IGNORED Because: "<LOD"
copper (I) oxide: (Cation conc. entered: 6 mg/kg, converted to compound conc.:6.755 mg/kg or 0.000676%)
lead chromate: (Cation conc. entered: 45 mg/kg, converted to compound conc.:70.192 mg/kg or 0.00702%, Note 1 conc.: 0.0045%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.:<1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"
nickel dihydroxide: (Cation conc. entered: 6 mg/kg, converted to compound conc.:9.477 mg/kg or 0.000948%)
selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex: (Cation conc. entered: <3 mg/kg, converted to compound conc.:<7.661 mg/kg or <0.000766%) IGNORED Because: "<LOD"
divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 27 mg/kg, converted to compound conc.:48.2 mg/kg or 0.00482%)
zinc chromate: (Cation conc. entered: 50 mg/kg, converted to compound conc.:138.707 mg/kg or 0.0139%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
phenanthrene: (Whole conc. entered as: 1.82 mg/kg or 0.000182%)
anthracene: (Whole conc. entered as: 0.25 mg/kg or 0.000025%)
fluoranthene: (Whole conc. entered as: 7.58 mg/kg or 0.000758%)
pyrene: (Whole conc. entered as: 5.82 mg/kg or 0.000582%)
benzo[a]anthracene: (Whole conc. entered as: 2.43 mg/kg or 0.000243%)
chrysene: (Whole conc. entered as: 2.62 mg/kg or 0.000262%)
benzo[b]fluoranthene: (Whole conc. entered as: 2.97 mg/kg or 0.000297%)

benzo[k]fluoranthene: (Whole conc. entered as: 1.31 mg/kg or 0.000131%)
benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: 1.33 mg/kg or 0.000133%)
indeno[123-cd]pyrene: (Whole conc. entered as: 1.32 mg/kg or 0.000132%)
dibenz[a,h]anthracene: (Whole conc. entered as: 0.21 mg/kg or 0.000021%)
benzo[ghi]perylene: (Whole conc. entered as: 1.14 mg/kg or 0.000114%)

Legend

- This determinand has one or more of its Hazard Statements and Risk Phrases defined and maintained by the Classifier

Notes utilised in assessment

C14: Step 5
"identify whether any individual ecotoxic substance is present at or above a cut-off value ..." , used on:

Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "arsenic trioxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "copper (I) oxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "nickel dihydroxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "zinc chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "phenanthrene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "anthracene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "pyrene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]anthracene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "chrysene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[b]fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[k]fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]pyrene; benzo[def]chrysene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "dibenz[a,h]anthracene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[ghi]perylene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "divanadium pentaoxide; vanadium pentoxide"

Note 1 , used on:

Test: "HP 5 on STOT SE 2; H371, STOT RE 2; H373" for determinand: "lead chromate"
Test: "HP 7 on Carc. 1B; H350, Carc. 1A; H350, Carc. 1B; H350i, Carc. 1A; H350i" for determinand: "lead chromate"
Test: "HP 10 on Repr. 1A; H360, Repr. 1B; H360, Repr. 1B; H360F, Repr. 1A; H360F, Repr. 1A; H360D, Repr. 1B; H360D, Repr. 1B; H360FD, Repr. 1A; H360FD, Repr. 1A; H360Fd, Repr. 1B; H360Fd, Repr. 1B; H360Df, Repr. 1A; H360Df" for determinand: "lead chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"

Determinand notes

Note 1 , used on:

determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

Classification of sample: WS2/0.25

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
WS2/0.25
Sample Depth:
0 m
Moisture content: **0%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands (Moisture content: 0%, no correction)

pH: (Whole conc. entered as: 8.3 pH, converted to conc.:8.3 pH or 8.3 pH)
salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.768 mg/kg or <0.000377%) IGNORED Because: "<LOD"
arsenic trioxide: (Cation conc. entered: 8 mg/kg, converted to compound conc.:10.563 mg/kg or 0.00106%)
boron tribromide/trichloride/trifluoride (combined): (Cation conc. entered: 1.4 mg/kg, converted to compound conc.:18.802 mg/kg or 0.00188%)
cadmium sulfide: (Cation conc. entered: <0.2 mg/kg, converted to compound conc.:<0.257 mg/kg or <0.0000257%, Note 1 conc.: <0.00002%) IGNORED Because: "<LOD"
Chromium (III) Sulphate: (Whole conc. entered as: 49 mg/kg or 0.0049%)
chromium(VI) oxide: (Cation conc. entered: <2 mg/kg, converted to compound conc.:<3.846 mg/kg or <0.000385%) IGNORED Because: "<LOD"
copper (I) oxide: (Cation conc. entered: 22 mg/kg, converted to compound conc.:24.77 mg/kg or 0.00248%)
lead chromate: (Cation conc. entered: 39 mg/kg, converted to compound conc.:60.833 mg/kg or 0.00608%, Note 1 conc.: 0.0039%)
mercury dichloride: (Cation conc. entered: <1 mg/kg, converted to compound conc.:<1.353 mg/kg or <0.000135%) IGNORED Because: "<LOD"
nickel dihydroxide: (Cation conc. entered: 9 mg/kg, converted to compound conc.:14.215 mg/kg or 0.00142%)
selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex: (Cation conc. entered: <3 mg/kg, converted to compound conc.:<7.661 mg/kg or <0.000766%) IGNORED Because: "<LOD"
divanadium pentaoxide; vanadium pentoxide: (Cation conc. entered: 105 mg/kg, converted to compound conc.:187.444 mg/kg or 0.0187%)
zinc chromate: (Cation conc. entered: 50 mg/kg, converted to compound conc.:138.707 mg/kg or 0.0139%)
phenol: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
naphthalene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthylene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
acenaphthene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluorene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
phenanthrene: (Whole conc. entered as: 0.13 mg/kg or 0.000013%)
anthracene: (Whole conc. entered as: <0.1 mg/kg or <0.00001%) IGNORED Because: "<LOD"
fluoranthene: (Whole conc. entered as: 0.45 mg/kg or 0.000045%)
pyrene: (Whole conc. entered as: 0.42 mg/kg or 0.000042%)
benzo[a]anthracene: (Whole conc. entered as: 0.28 mg/kg or 0.000028%)
chrysene: (Whole conc. entered as: 0.37 mg/kg or 0.000037%)
benzo[b]fluoranthene: (Whole conc. entered as: 0.93 mg/kg or 0.000093%)

benzo[k]fluoranthene: (Whole conc. entered as: 0.38 mg/kg or 0.000038%)
benzo[a]pyrene; benzo[def]chrysene: (Whole conc. entered as: 0.34 mg/kg or 0.000034%)
indeno[123-cd]pyrene: (Whole conc. entered as: 0.67 mg/kg or 0.000067%)
dibenz[a,h]anthracene: (Whole conc. entered as: 0.13 mg/kg or 0.000013%)
benzo[ghi]perylene: (Whole conc. entered as: 0.65 mg/kg or 0.000065%)
benzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
toluene: (Whole conc. entered as: <5 mg/kg or <0.0005%) IGNORED Because: "<LOD"
ethylbenzene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
xylene: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]: (Whole conc. entered as: <2 mg/kg or <0.0002%) IGNORED Because: "<LOD"
diesel petroleum group: (Whole conc. entered as: 78 mg/kg or 0.0078%)
TPH (C6 to C40) petroleum group: (Whole conc. entered as: 129 mg/kg or 0.0129%)

Legend

- This determinand has one or more of its Hazard Statements and Risk Phrases defined and maintained by the Classifier

Test Settings

HP 3(i) on Flam. Liq. 1; H224, Flam. Liq. 2; H225, Flam. Liq. 3; H226: Force this test to non hazardous because: "Not high enough concentration to be flammable"

Notes utilised in assessment

C14: Step 5

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..." , used on:

Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "arsenic trioxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "copper (I) oxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "nickel dihydroxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "zinc chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "phenanthrene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "pyrene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]anthracene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "chrysene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[b]fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[k]fluoranthene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[a]pyrene; benzo[def]chrysene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "dibenz[a,h]anthracene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "benzo[ghi]perylene"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "divanadium pentaoxide; vanadium pentoxide"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "diesel petroleum group"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "TPH (C6 to C40) petroleum group"

Note 1 , used on:

Test: "HP 5 on STOT SE 2; H371, STOT RE 2; H373" for determinand: "lead chromate"
Test: "HP 7 on Carc. 1B; H350, Carc. 1A; H350, Carc. 1B; H350i, Carc. 1A; H350i" for determinand: "lead chromate"
Test: "HP 10 on Repr. 1A; H360, Repr. 1B; H360, Repr. 1B; H360F, Repr. 1A; H360F, Repr. 1A; H360D, Repr. 1B; H360D, Repr. 1B; H360FD, Repr. 1A; H360FD, Repr. 1A; H360Fd, Repr. 1B; H360Fd, Repr. 1B; H360Df, Repr. 1A; H360Df" for determinand: "lead chromate"
Test: "HP 14 on R50, R52, R53, R50/53, R51/53, R52/53" for determinand: "lead chromate"

Determinand notes

Note 1 , used on:

determinand: "lead chromate"

Note A , used on:

determinand: "zinc chromate"

WM3: Unknown oil , used on:

determinand: "TPH (C6 to C40) petroleum group"

Appendix A: Classifier defined and non CLP determinands

pH

Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: None.
Hazard Statements: None.

boron tribromide/trichloride/trifluoride (combined) (CAS Number: 10294-33-4, 10294-34-5, 7637-07-2)

Conversion factor: 13.43
Comments: Combines the hazard statements and the average of the conversion factors for boron tribromide, boron trichloride and boron trifluoride
Data source: N/A
Data source date: 06/08/2015
Risk Phrases: R14, T+; R26/28, C; R34, C; R35
Hazard Statements: EUH014, Acute Tox. 2; H330, Acute Tox. 2; H300, Skin Corr. 1A; H314, Skin Corr. 1B; H314

Chromium (III) Sulphate (CAS Number: 10101-53-8)

Comments:
Data source: 10101-53-8
Data source date: 23/06/2015
Risk Phrases: None.
Hazard Statements: None.

acenaphthylene (CAS Number: 208-96-8)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R22, R26, R27, R36, R37, R38
Hazard Statements: Acute Tox. 4; H302, Acute Tox. 1; H330, Acute Tox. 1; H310, Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315

acenaphthene (CAS Number: 83-32-9)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R36, R37, R38, N; R50/53, N; R51/53
Hazard Statements: Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Aquatic Acute 1; H400, Aquatic Chronic 1; H410, Aquatic Chronic 2; H411

fluorene (CAS Number: 86-73-7)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: N; R50/53
Hazard Statements: Aquatic Acute 1; H400, Aquatic Chronic 1; H410

phenanthrene (CAS Number: 85-01-8)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: R22, R36, R37, R38, R40, R43, N; R50/53
Hazard Statements: Acute Tox. 4; H302, Eye Irrit. 2; H319, STOT SE 3; H335, Carc. 2; H351, Skin Sens. 1; H317, Aquatic Acute 1; H400, Aquatic Chronic 1; H410, Skin Irrit. 2; H315

anthracene (CAS Number: 120-12-7)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17/07/2015
Risk Phrases: R36, R37, R38, R43, N; R50/53
Hazard Statements: Eye Irrit. 2; H319, STOT SE 3; H335, Skin Irrit. 2; H315, Skin Sens. 1; H317, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

fluoranthene (CAS Number: 206-44-0)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21/08/2015
Risk Phrases: Xn; R22, N; R50/53
Hazard Statements: Acute Tox. 4; H302, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

pyrene (CAS Number: 129-00-0)

Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21/08/2015
Risk Phrases: Xi; R36/37/38, N; R50/53
Hazard Statements: Skin Irrit. 2; H315, Eye Irrit. 2; H319, STOT SE 3; H335, Aquatic Acute 1; H400, Aquatic Chronic 1; H410

indeno[123-cd]pyrene (CAS Number: 193-39-5)

Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06/08/2015
Risk Phrases: R40
Hazard Statements: Carc. 2; H351

benzo[ghi]perylene (CAS Number: 191-24-2)

Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23/07/2015
Risk Phrases: N; R50/53
Hazard Statements: Aquatic Acute 1; H400, Aquatic Chronic 1; H410

ethylbenzene (CAS Number: 100-41-4)

CLP index number: 601-023-00-4
Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)
Additional Risk Phrases: None.
Additional Hazard Statements: Carc. 2; H351
Reason:
03/06/2015 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

diesel petroleum group (CAS Number: 68334-30-5, 68476-34-6, 94114-59-7, 1159170-26-9)

Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: R40, R51/53, R65, R66
Hazard Statements: Flam. Liq. 3; H226, Skin Irrit. 2; H315, Acute Tox. 4; H332, Carc. 2; H351, Asp. Tox. 1; H304, STOT RE 2; H373, Aquatic Chronic 2; H411

TPH (C6 to C40) petroleum group

Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25/05/2015
Risk Phrases: R10, R45, R46, R51/53, R63, R65
Hazard Statements: Flam. Liq. 3; H226, Asp. Tox. 1; H304, STOT RE 2; H373, Muta. 1B; H340, Carc. 1B; H350, Repr. 2; H361d, Aquatic Chronic 2; H411

Appendix B: Notes

C14: Step 5

from section: WM3: C14 in the document: "WM3 - Waste Classification"

"identify whether any individual ecotoxic substance is present at or above a cut-off value ..."

Note 1

from section: 1.1.3.2, Annex VI in the document: "CLP Regulations"

"The concentration stated or, in the absence of such concentrations, the generic concentrations of this Regulation (Table 3.1) or the generic concentrations of Directive 1999/45/EC (Table 3.2), are the percentages by weight of the metallic element calculated with reference to the total weight of the mixture."

Note A

from section: 1.1.3.1, Annex VI in the document: "CLP Regulations"

"Without prejudice to Article 17(2), the name of the substance must appear on the label in the form of one of the designations given in Part 3. In Part 3, use is sometimes made of a general description such as '... compounds' or '... salts'. In this case, the supplier is required to state on the label the correct name, due account being taken of section 1.1.1.4."

WM3: Unknown oil

from section: Chapter 3: 4. Waste oils and other wastes containing or contaminated with oil in the document: "WM3 - Waste Classification"

"If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic due to the presence of oil if all three of the following criteria are met:

- the waste contains **benzo[a]pyrene (BaP)** at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.2 of the CLP for BaP)
- this has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D, and
- the analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel

"

Appendix C: Version

Classification utilises the following:

- CLP Regulations - Regulation 1272/2008/EC of 16 December 2008
- 1st ATP - Regulation 790/2009/EC of 10 August 2009
- 2nd ATP - Regulation 286/2011/EC of 10 March 2011
- 3rd ATP - Regulation 618/2012/EU of 10 July 2012
- 4th ATP - Regulation 487/2013/EU of 8 May 2013
- Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
- 5th ATP - Regulation 944/2013/EU of 2 October 2013
- 6th ATP - Regulation 605/2014/EU of 5 June 2014
- WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
- Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014
- WM3 - Waste Classification - May 2015
- 7th ATP - Regulation 2015/1221/EU of 24 July 2015
- POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004
- 1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010
- 2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

HazWasteOnline Engine: WM3 1st Edition, May 2015
HazWasteOnline Engine Version: 2015.308.2983.5979 (04 Nov 2015)
HazWasteOnline Database: 2015.308.2983.5979 (04 Nov 2015)

Appendix D Ground and Water Ltd Ground Investigation Report Borehole Records 1b St John's Wood Park

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No **BH1** Sheet 1 of 2

Project Name	Project No.	Co-ords: -	Hole Type
Land adjacent to 1b St John's Wood Park	GWPR1319		WLS
Location: London NW8 6QS		Level: -	Scale 1:50
Client: Liv International		Dates: 01/07/2015	Logged By SJM

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.30	D					MADE GROUND: TARMAC over crushed brickwork.
		0.50	D		0.50			LONDON CLAY FORMATION: Soft orange brown silty CLAY.
		0.80	D					
		1.00	SPT	N=4				
		1.00	D	(1,1/ 1,1,1,1)				
		1.50	D					
		2.00	SPT	N=10				
		2.00	D	(1,1/ 2,2,3,3)				
		2.50	D					
		3.00	SPT	N=11				
		3.00	D	(2,2/ 2,3,3,3)				
		3.50	D		3.60			LONDON CLAY FORMATION: Firm brown silty CLAY
		4.00	SPT	N=17				
		4.00	D	(2,3/ 4,4,4,5)				
		4.50	D					
		5.00	SPT	N=15				
		5.00	D	(3,3/ 3,4,4,4)				
		5.50	D					
		6.00	SPT	N=20				
		6.00	D	(3,4/ 5,5,5,5)				
		6.50	D					
		7.00	SPT	N=25				
		7.00	D	(4,4/ 6,5,7,7)				
		7.50	D					
		8.00	SPT	N=27				
		8.00	D	(4,6/ 6,7,7,7)				
		8.50	D					
		9.00	SPT	N=29	9.00			LONDON CLAY FORMATION: Firm to stiff grey silty CLAY occasional claystone fragments.
		9.00	D	(5,5/ 7,7,7,8)				
		9.50	D					
		Type		Results				Continued next sheet

Remarks: Fine roots noted to 0.80m bgl.
No groundwater encountered.
As drillers logs. Subject to engineer review.

Ground and Water Ltd
Tel: 0333 600 1221
email: enquiries@groundandwater.co.uk
www.groundandwater.co.uk

Borehole No
BH1
Sheet 2 of 2

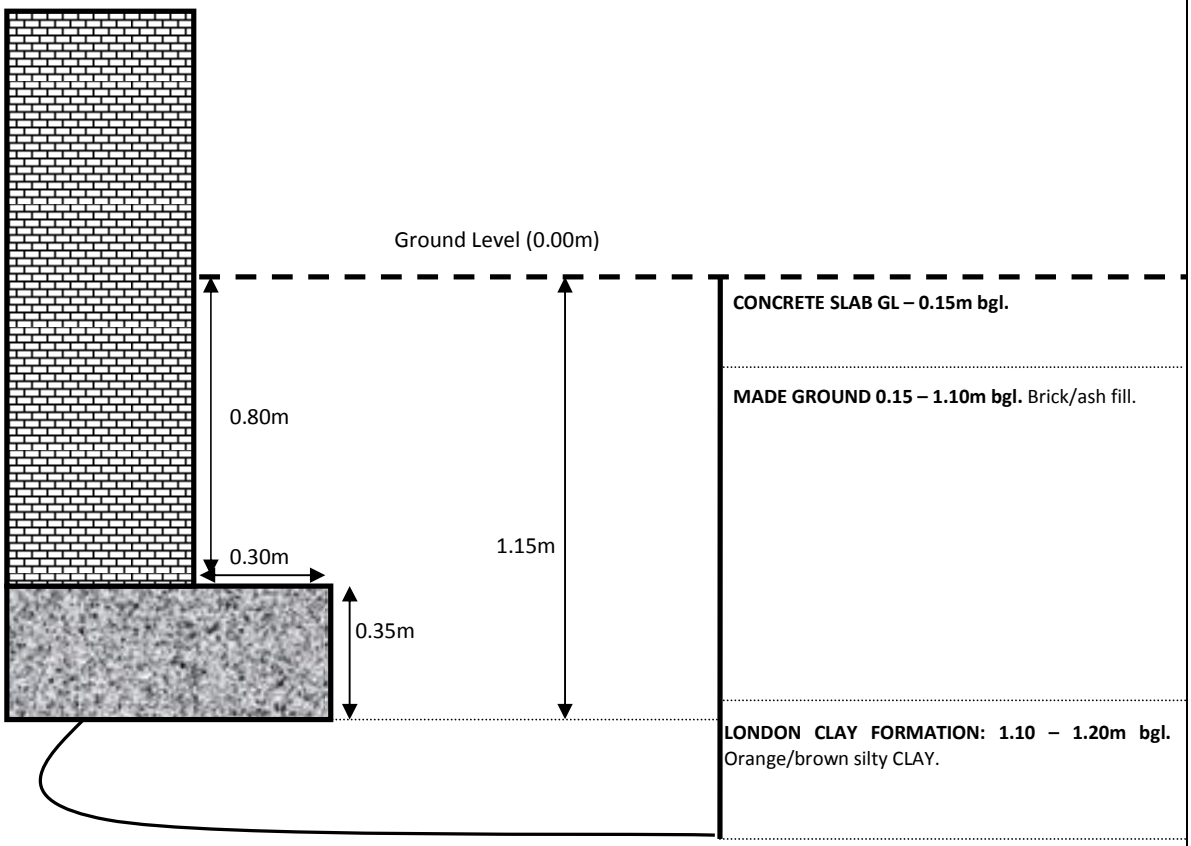
Project Name	Project No.	Co-ords: -	Hole Type
Land adjacent to 1b St John's Wood Park	GWPR1319		WLS
Location: London NW8 6QS		Level: -	Scale 1:50
Client: Liv International		Dates: 01/07/2015	Logged By SJM

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		10.00	SPT	N=30				LONDON CLAY FORMATION: Firm to stiff grey silty CLAY occasional claystone fragments.
		10.00	D	(6,7/ 7,7,8,8)				
		10.50	D					
		11.00	SPT	N=32				
		11.00	D	(7,7/ 8,7,8,9)				
		11.50	D					
		12.00	SPT	N=38				
		12.00	D	(8,9/ 9,10,9,10)				
		12.50	D		12.50			End of Borehole at 12.50 m
			Type	Results				

11 12 13 14 15 16 17 18 19

Remarks: Fine roots noted to 0.80m bgl.
No groundwater encountered.
As drillers logs. Subject to engineer review.

AGS

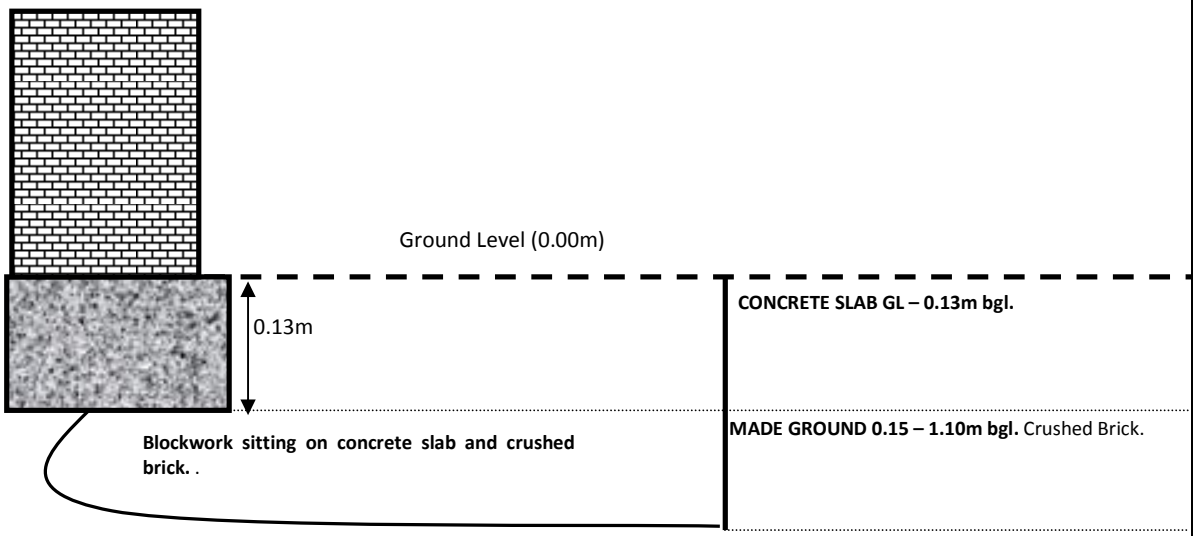


NOTE: NOT TO SCALE

Brick Concrete

Project: **1A St John's Wood Park, St John's Wood, London NW8 6QS**	**Figure 2**
Client: **Liv International**	**Date:** **July 2015**
Section Drawing: Foundation Exposure TP/FE1	**Ref:** **GWPR1319**

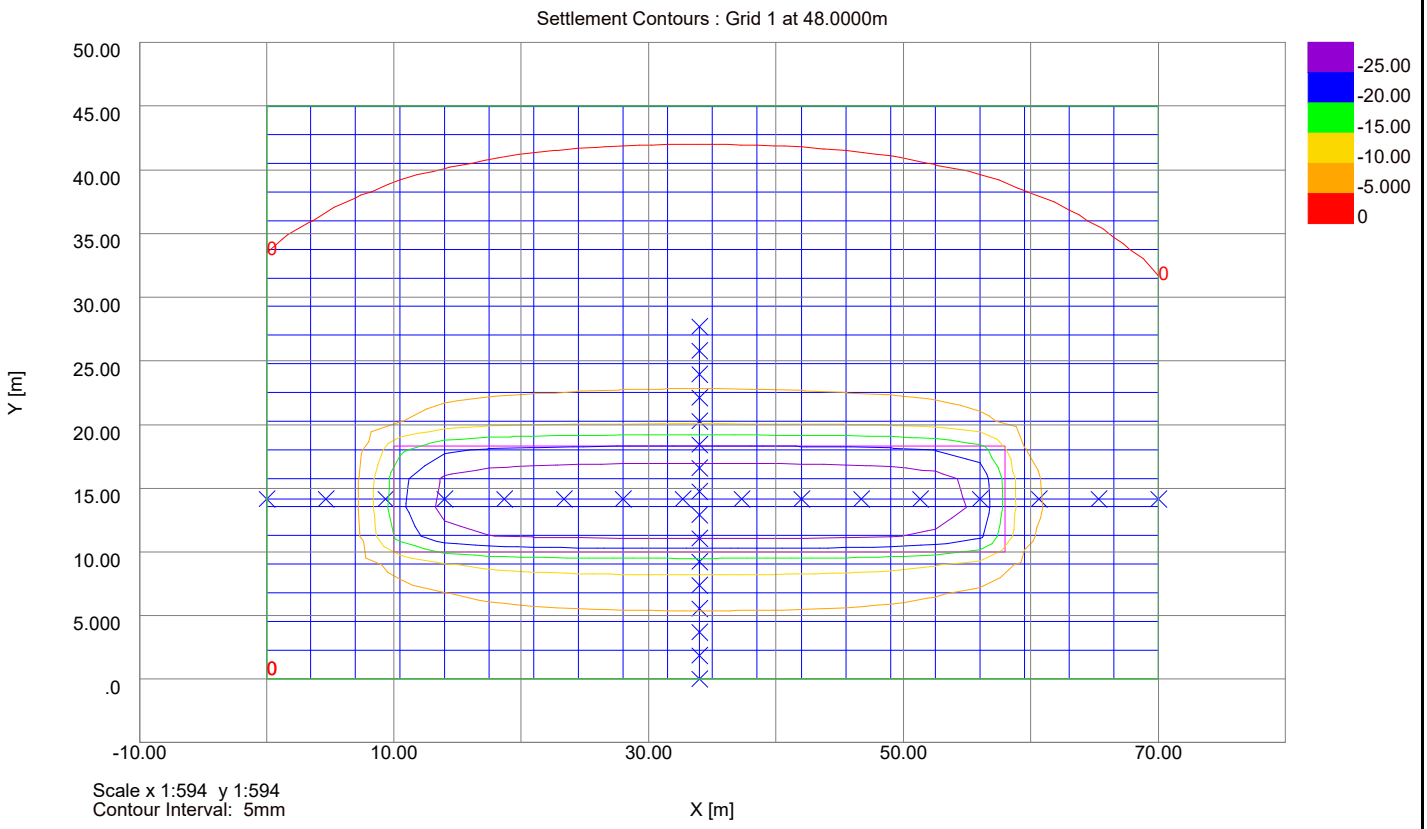
ground&water



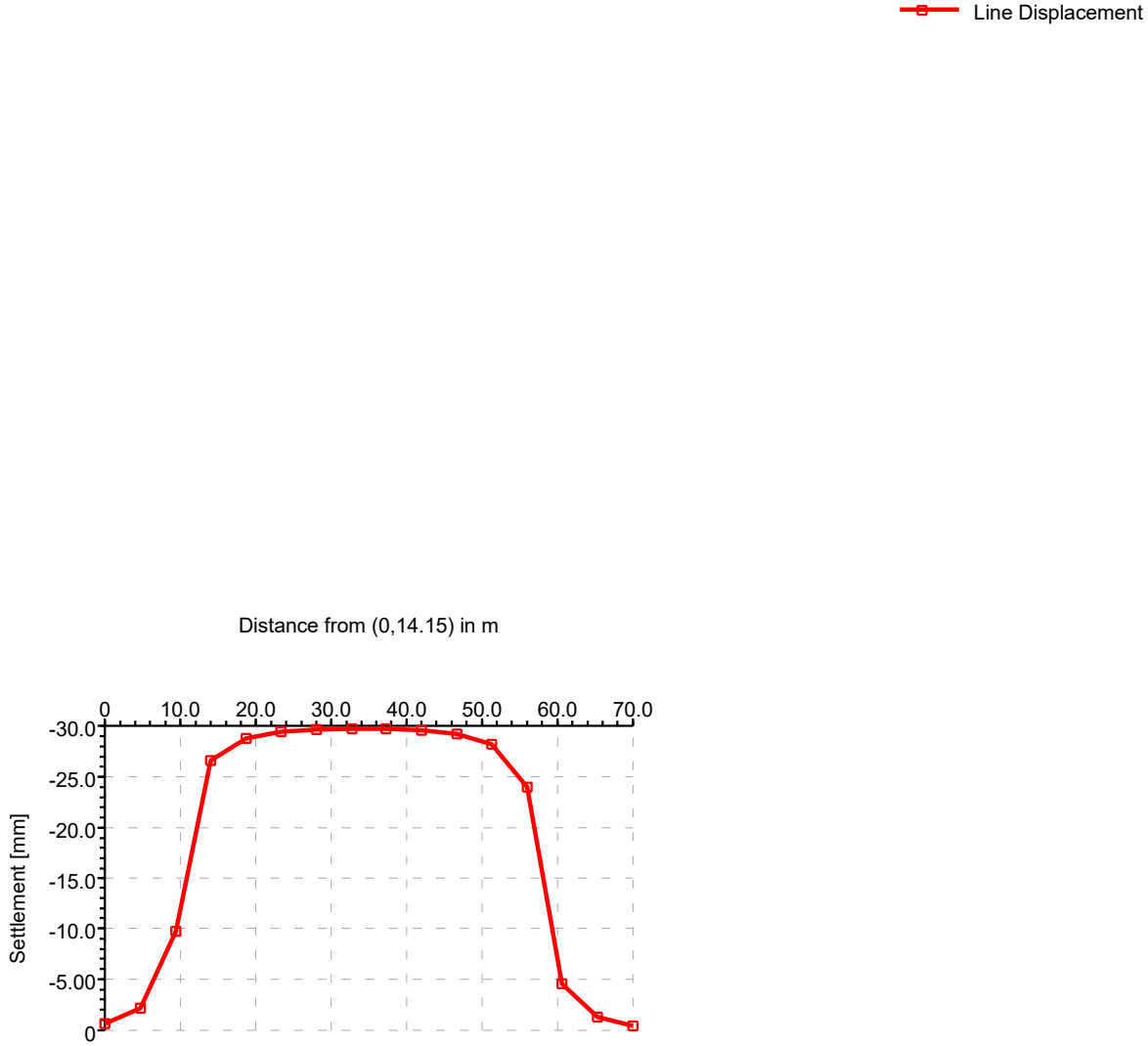
NOTE: NOT TO SCALE Brick Concrete

Project: **1A St John's Wood Park, St John's Wood, London NW8 6QS**		**Figure 3**
Client: **Liv International**	**Date:** **July 2015**	ground&water
Section Drawing: Foundation Exposure TP/FE2	**Ref:** **GWPR1319**	

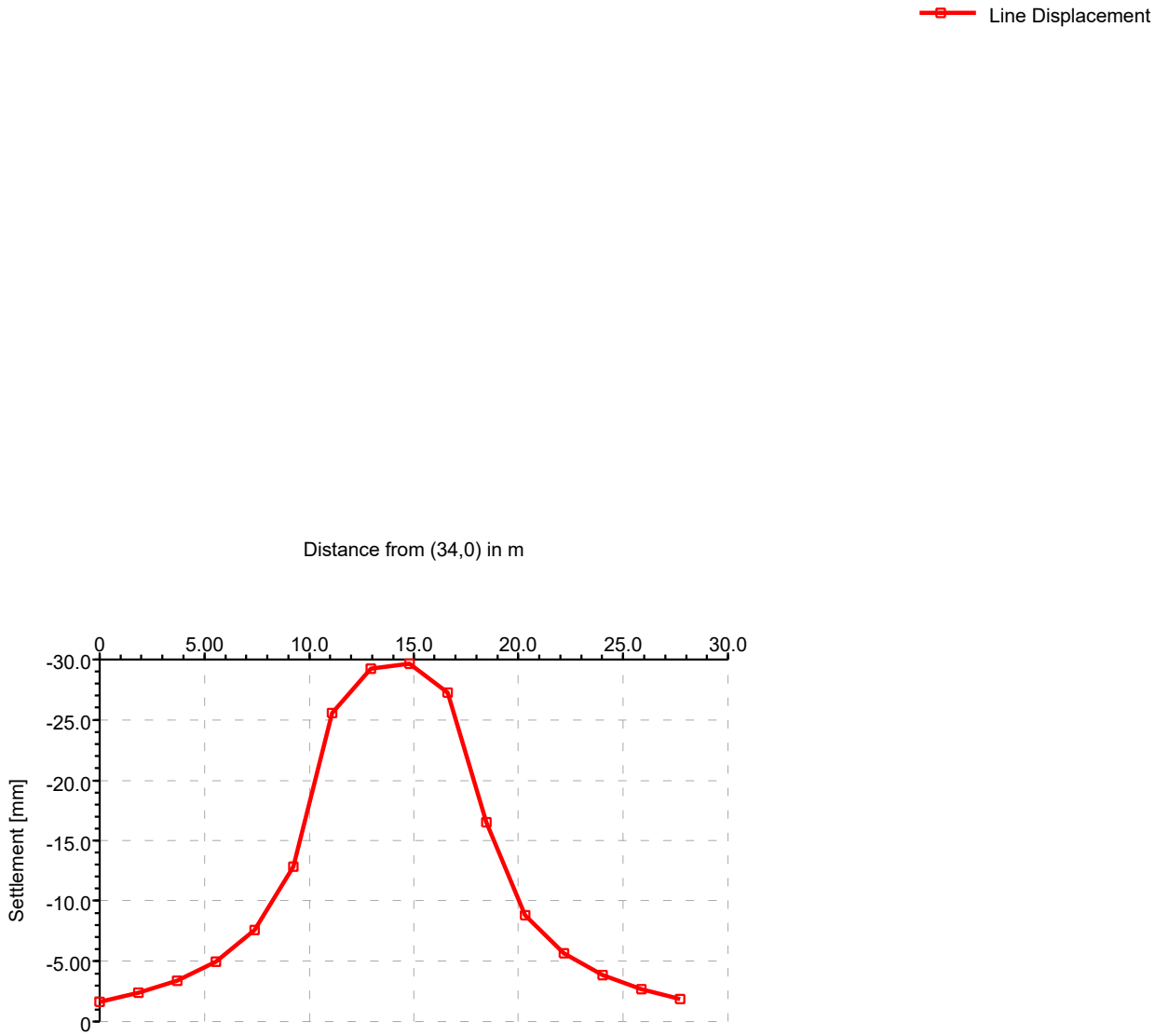
Appendix E Pdisp Analysis for heave from excavation


Settlement Contours : Grid 1 at 48.0000m
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.000
.0
Y [m]
-10.00
10.00
30.00
50.00
70.00
X [m]
-25.00
-20.00
-15.00
-10.00
-5.000
0
0
0
0
Scale x 1:594 y 1:594
Contour Interval: 5mm

Displacement for Line 1



Displacement for Line 2



RESULTS FOR GRIDS

Analysis: Boussinesq
Global Poisson's ratio: 0.30
Horizontal rigid boundary level: 20.00 [m OD]

The maximum displacement difference between
Boussinesq method (-16.539mm) and Mindlin method (-16.552mm)
occurs at point X=34.000m Y=18.467m Level 48.000mOD and is 0.013417mm

Name	Location			Stresses				
	X	Y	Z[Level]	Z	Calc Level	Vert Stress	Sum Princ	Vert Strain
	[m]	[m]	[mOD]	[mm]	[mOD]	[kN/m²]	[kN/m²]	[-]
Soil Excavation	34.00000	14.15000	48.00000	-29.763	47.914	-67.000	-171.88	-0.0030921
Grid 1	0.00000	0.00000	48.00000	-0.13767	47.914	0.0	-0.039651	1.0350E-6
	3.50000	0.00000	48.00000	-0.30732	47.914	-1.3159E-6	-0.056472	1.4740E-6
	7.00000	0.00000	48.00000	-0.54340	47.914	-2.4224E-6	-0.079776	2.0822E-6
	10.50000	0.00000	48.00000	-0.82359	47.914	-3.9504E-6	-0.10769	2.8107E-6
	14.00000	0.00000	48.00000	-1.0964	47.914	-5.3929E-6	-0.13459	3.5129E-6
	17.50000	0.00000	48.00000	-1.3162	47.914	-6.3473E-6	-0.15568	4.0632E-6
	21.00000	0.00000	48.00000	-1.4699	47.914	-6.8617E-6	-0.17014	4.4405E-6
	24.50000	0.00000	48.00000	-1.5672	47.914	-7.1186E-6	-0.17933	4.6806E-6
	28.00000	0.00000	48.00000	-1.6232	47.914	-7.2427E-6	-0.18477	4.8225E-6
	31.50000	0.00000	48.00000	-1.6501	47.914	-7.2962E-6	-0.18746	4.8927E-6
	35.00000	0.00000	48.00000	-1.6546	47.914	-7.3047E-6	-0.18791	4.9046E-6
	38.50000	0.00000	48.00000	-1.6378	47.914	-7.2722E-6	-0.18622	4.8603E-6
	42.00000	0.00000	48.00000	-1.5954	47.914	-7.1833E-6	-0.18205	4.7516E-6
	45.50000	0.00000	48.00000	-1.5176	47.914	-6.9943E-6	-0.17463	4.5577E-6
	49.00000	0.00000	48.00000	-1.3898	47.914	-6.6105E-6	-0.16263	4.2445E-6
	52.50000	0.00000	48.00000	-1.1986	47.914	-5.8664E-6	-0.14447	3.7707E-6
	56.00000	0.00000	48.00000	-0.94469	47.914	-4.6139E-6	-0.11971	3.1244E-6
	59.50000	0.00000	48.00000	-0.66067	47.914	-3.0474E-6	-0.091445	2.3868E-6
	63.00000	0.00000	48.00000	-0.40083	47.914	-1.7244E-6	-0.065676	1.7142E-6
	66.50000	0.00000	48.00000	-0.20219	47.914	0.0	-0.046101	1.2033E-6
	70.00000	0.00000	48.00000	-0.068941	47.914	0.0	-0.032581	0.0
	0.00000	2.25000	48.00000	-0.22468	47.914	-1.0094E-6	-0.047713	1.2454E-6
	3.50000	2.25000	48.00000	-0.47550	47.914	-2.2120E-6	-0.072537	1.8933E-6
	7.00000	2.25000	48.00000	-0.84801	47.914	-4.8544E-6	-0.11120	2.9024E-6
	10.50000	2.25000	48.00000	-1.3111	47.914	-9.1441E-6	-0.16173	4.2208E-6
	14.00000	2.25000	48.00000	-1.7575	47.914	-13.071E-6	-0.20972	5.4730E-6
	17.50000	2.25000	48.00000	-2.0968	47.914	-15.214E-6	-0.24375	6.3611E-6
	21.00000	2.25000	48.00000	-2.3188	47.914	-16.155E-6	-0.26468	6.9074E-6
	24.50000	2.25000	48.00000	-2.4519	47.914	-16.558E-6	-0.27694	7.2275E-6
	28.00000	2.25000	48.00000	-2.5257	47.914	-16.734E-6	-0.28382	7.4069E-6
	31.50000	2.25000	48.00000	-2.5603	47.914	-16.805E-6	-0.28711	7.4929E-6
	35.00000	2.25000	48.00000	-2.5660	47.914	-16.816E-6	-0.28766	7.5073E-6
	38.50000	2.25000	48.00000	-2.5445	47.914	-16.773E-6	-0.28560	7.4535E-6
	42.00000	2.25000	48.00000	-2.4894	47.914	-16.651E-6	-0.28041	7.3182E-6
	45.50000	2.25000	48.00000	-2.3849	47.914	-16.369E-6	-0.27077	7.0663E-6
	49.00000	2.25000	48.00000	-2.2050	47.914	-15.716E-6	-0.25405	6.6301E-6
	52.50000	2.25000	48.00000	-1.9182	47.914	-14.194E-6	-0.22616	5.9020E-6
	56.00000	2.25000	48.00000	-1.5115	47.914	-11.019E-6	-0.18359	4.7914E-6
	59.50000	2.25000	48.00000	-1.0404	47.914	-6.5601E-6	-0.13202	3.4455E-6
	63.00000	2.25000	48.00000	-0.62015	47.914	-3.1188E-6	-0.087258	2.2775E-6
	66.50000	2.25000	48.00000	-0.31821	47.914	-1.4044E-6	-0.056908	1.4854E-6
	70.00000	2.25000	48.00000	-0.12766	47.914	0.0	-0.038098	0.0
	0.00000	4.50000	48.00000	-0.32679	47.914	-1.4701E-6	-0.057277	1.4950E-6
	3.50000	4.50000	48.00000	-0.69085	47.914	-3.8673E-6	-0.094617	2.4695E-6
	7.00000	4.50000	48.00000	-1.2866	47.914	-11.260E-6	-0.16425	4.2865E-6
	10.50000	4.50000	48.00000	-2.0920	47.914	-27.736E-6	-0.27169	7.0890E-6
	14.00000	4.50000	48.00000	-2.8547	47.914	-41.873E-6	-0.37042	9.6647E-6
	17.50000	4.50000	48.00000	-3.3805	47.914	-47.262E-6	-0.42860	11.183E-6
	21.00000	4.50000	48.00000	-3.6942	47.914	-49.006E-6	-0.45910	11.979E-6
	24.50000	4.50000	48.00000	-3.8706	47.914	-49.626E-6	-0.47524	12.400E-6
	28.00000	4.50000	48.00000	-3.9644	47.914	-49.869E-6	-0.48376	12.623E-6
	31.50000	4.50000	48.00000	-4.0073	47.914	-49.961E-6	-0.48771	12.726E-6
	35.00000	4.50000	48.00000	-4.0142	47.914	-49.976E-6	-0.48837	12.743E-6
	38.50000	4.50000	48.00000	-3.9878	47.914	-49.921E-6	-0.48591	12.679E-6
	42.00000	4.50000	48.00000	-3.9186	47.914	-49.757E-6	-0.47959	12.514E-6
	45.50000	4.50000	48.00000	-3.7828	47.914	-49.346E-6	-0.46727	12.192E-6
	49.00000	4.50000	48.00000	-3.5363	47.914	-48.242E-6	-0.44410	11.588E-6
	52.50000	4.50000	48.00000	-3.1106	47.914	-44.935E-6	-0.39990	10.434E-6
	56.00000	4.50000	48.00000	-2.4419	47.914	-35.030E-6	-0.31856	8.3119E-6
	59.50000	4.50000	48.00000	-1.6161	47.914	-17.390E-6	-0.20711	5.4044E-6
	63.00000	4.50000	48.00000	-0.91460	47.914	-6.0832E-6	-0.11946	3.1177E-6
	66.50000	4.50000	48.00000	-0.45899	47.914	-2.1878E-6	-0.070464	1.8392E-6
	70.00000	4.50000	48.00000	-0.19413	47.914	0.0	-0.044259	1.1552E-6
	0.00000	6.75000	48.00000	-0.43748	47.914	-2.0883E-6	-0.067942	1.7734E-6
	3.50000	6.75000	48.00000	-0.94992	47.914	-6.8369E-6	-0.12400	3.2362E-6
	7.00000	6.75000	48.00000	-1.9150	47.914	-31.776E-6	-0.26170	6.8279E-6
	10.50000	6.75000	48.00000	-3.4649	47.914	-148.85E-6	-0.57160	14.905E-6
	14.00000	6.75000	48.00000	-4.8742	47.914	-233.98E-6	-0.83237	21.702E-6
	17.50000	6.75000	48.00000	-5.6851	47.914	-248.94E-6	-0.93701	24.432E-6
	21.00000	6.75000	48.00000	-6.1135	47.914	-252.10E-6	-0.98083	25.575E-6
	24.50000	6.75000	48.00000	-6.3381	47.914	-253.01E-6	-1.0015	26.115E-6
	28.00000	6.75000	48.00000	-6.4527	47.914	-253.33E-6	-1.0118	26.383E-6
	31.50000	6.75000	48.00000	-6.5038	47.914	-253.45E-6	-1.0164	26.503E-6
	35.00000	6.75000	48.00000	-6.5121	47.914	-253.46E-6	-1.0171	26.523E-6
	38.50000	6.75000	48.00000	-6.4807	47.914	-253.40E-6	-1.0143	26.448E-6
	42.00000	6.75000	48.00000	-6.3972	47.914	-253.19E-6	-1.0068	26.253E-6
	45.50000	6.75000	48.00000	-6.2278	47.914	-252.61E-6	-0.99150	25.854E-6
	49.00000	6.75000	48.00000	-5.9027	47.914	-250.81E-6	-0.96010	25.034E-6
	52.50000	6.75000	48.00000	-5.2846	47.914	-243.48E-6	-0.88927	23.186E-6
	56.00000	6.75000	48.00000	-4.1432	47.914	-201.44E-6	-0.70887	18.482E-6
	59.50000	6.75000	48.00000	-2.5240	47.914	-66.746E-6	-0.37357	9.7443E-6
	63.00000	6.75000	48.00000	-1.2925	47.914	-12.584E-6	-0.16755	4.3723E-6
	66.50000	6.75000	48.00000	-0.61751	47.914	-3.3516E-6	-0.086573	2.2596E-6
	70.00000	6.75000	48.00000	-0.26340	47.914	-1.1867E-6	-0.050697	1.3233E-6
	0.00000	9.00000	48.00000	-0.54365	47.914	-2.8040E-6	-0.078543	2.0500E-6
	3.50000	9.00000	48.00000	-1.2269	47.914	-11.405E-6	-0.15902	4.1498E-6
	7.00000	9.00000	48.00000	-2.7647	47.914	-102.96E-6	-0.44372	11.571E-6
	10.50000	9.00000	48.00000	-6.5888	47.914	-0.0056028	-2.6582	68.643E-6
	14.00000	9.00000	48.00000	-9.6137	47.914	-0.0087780	-3.9015	100.85E-6
	17.50000	9.00000	48.00000	-10.819	47.914	-0.0088183	-4.0878	105.71E-6
	21.00000	9.00000	48.00000	-11.373	47.914	-0.0088235	-4.1478	107.28E-6
	24.50000	9.00000	48.00000	-11.645	47.914	-0.0088248	-4.1731	107.94E-6
	28.00000	9.00000	48.00000	-11.778	47.914	-0.0088252	-4.1850	108.25E-6
	31.50000	9.00000	48.00000	-11.837	47.914	-0.0088253	-4.1902	108.38E-6
	35.00000	9.00000	48.00000	-11.846	47.914	-0.0088253	-4.1910	108.41E-6
	38.50000	9.00000	48.00000	-11.811	47.914	-0.0088252	-4.1879	108.32E-6
	42.00000	9.00000	48.00000	-11.714	47.914	-0.0088250	-4.1793	108.10E-6
	45.50000	9.00000	48.00000	-11.513	47.914	-0.0088242	-4.1611	107.62E-6
	49.00000	9.00000	48.00000	-11.106	47.914	-0.0088215	-4.1205	106.57E-6
	52.50000	9.00000	48.00000	-10.253	47.914	-0.0088066	-4.0115	103.72E-6
	56.00000	9.00000	48.00000	-8.2567	47.914	-0.0085500	-3.5415	91.480E-6
	59.50000	9.00000	48.00000	-4.0153	47.914	-506.78E-6	-0.86363	22.487E-6
	63.00000	9.00000	48.00000	-1.7286	47.914	-25.164E-6	-0.23317	6.0840E-6
	66.50000	9.00000	48.00000	-0.77546	47.914	-4.8341E-6	-0.10362	2.7043E-6
	70.00000	9.00000	48.00000	-0.32737	47.914	-1.4899E-6	-0.056712	1.4803E-6
	0.00000	11.25000	48.00000	-0.62661	47.914	-3.4453E-6	-0.087088	2.2730E-6
	3.50000	11.25000	48.00000	-1.4632	47.914	-16.339E-6	-0.19143	4.9952E-6
	7.00000	11.25000	48.00000	-3.6425	47.914	-228.46E-6	-0.67716	17.651E-6
	10.50000	11.25000	48.00000	-17.001	47.914	-66.928	-162.19	-0.0033370
	14.00000	11.25000	48.00000	-23.308	47.914	-66.995	-169.30	-0.0031591
	17.50000	11.25000	48.00000	-24.918	47.914	-66.995	-169.58	-0.0031517
	21.00000	11.25000	48.00000	-25.581	47.914	-66.995	-169.65	-0.0031497
	24.50000	11.25000	48.00000	-25.890	47.914	-66.995	-169.68	-0.0031490
	28.00000	11.25000	48.00000	-26.038	47.914	-66.995	-169.70	-0.0031486
	31.50000	11.25000	48.00000	-26.102	47.914	-66.995	-169.70	-0.0031485
	35.00000	11.25000	48.00000	-26.112	47.914	-66.995	-169.70	-0.0031485
	38.50000	11.25000	48.00000	-26.073	47.914	-66.995	-169.70	-0.0031486
	42.00000	11.25000	48.00000	-25.967	47.914	-66.995	-169.69	-0.0031488
	45.50000	11.25000	48.00000	-25.741	47.914	-66.995	-169.67	-0.0031493
	49.00000	11.25000	48.00000	-25.267	47.914	-66.995	-169.62	-0.0031506
	52.50000	11.25000	48.00000	-24.193	47.914	-66.995	-169.47	-0.0031545
	56.00000	11.25000	48.00000	-21.105	47.914	-66.995	-168.50	-0.0031799
	59.50000	11.25000	48.00000	-5.8987	47.914	-0.0022266	-1.8466	47.953E-6
	63.00000	11.25000	48.00000	-2.1240	47.914	-40.713E-6	-0.30012	7.8298E-6
	66.50000	11.25000	48.00000	-0.90275	47.914	-6.2532E-6	-0.11804	3.0807E-6

Name	Location X [m]	Location Y [m]	Z[Level] [mOD]	Z [mm]	Stresses Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
	70.00000	11.25000	48.00000	-0.37585	47.914	-1.7438E-6	-0.061331	1.6008E-6
	0.00000	13.50000	48.00000	-0.66768	47.914	-3.7874E-6	-0.091400	2.3855E-6
	3.50000	13.50000	48.00000	-1.5859	47.914	-19.128E-6	-0.20889	5.4508E-6
	7.00000	13.50000	48.00000	-4.1136	47.914	-283.15E-6	-0.79805	20.801E-6
	10.50000	13.50000	48.00000	-19.064	47.914	-66.931	-163.55	-0.0033018
	14.00000	13.50000	48.00000	-26.494	47.914	-67.000	-171.35	-0.0031059
	17.50000	13.50000	48.00000	-28.327	47.914	-67.000	-171.69	-0.0030971
	21.00000	13.50000	48.00000	-29.047	47.914	-67.000	-171.77	-0.0030950
	24.50000	13.50000	48.00000	-29.374	47.914	-67.000	-171.80	-0.0030942
	28.00000	13.50000	48.00000	-29.529	47.914	-67.000	-171.81	-0.0030938
	31.50000	13.50000	48.00000	-29.595	47.914	-67.000	-171.82	-0.0030937
	35.00000	13.50000	48.00000	-29.606	47.914	-67.000	-171.82	-0.0030936
	38.50000	13.50000	48.00000	-29.566	47.914	-67.000	-171.82	-0.0030937
	42.00000	13.50000	48.00000	-29.455	47.914	-67.000	-171.81	-0.0030940
	45.50000	13.50000	48.00000	-29.217	47.914	-67.000	-171.79	-0.0030945
	49.00000	13.50000	48.00000	-28.709	47.914	-67.000	-171.73	-0.0030959
	52.50000	13.50000	48.00000	-27.515	47.914	-67.000	-171.56	-0.0031004
	56.00000	13.50000	48.00000	-23.869	47.914	-66.999	-170.37	-0.0031313
	59.50000	13.50000	48.00000	-6.8174	47.914	-0.0025459	-2.1989	57.112E-6
	63.00000	13.50000	48.00000	-2.3344	47.914	-49.358E-6	-0.33697	8.7908E-6
	66.50000	13.50000	48.00000	-0.96691	47.914	-7.0325E-6	-0.12552	3.2757E-6
	70.00000	13.50000	48.00000	-0.39942	47.914	-1.8745E-6	-0.063597	1.6599E-6
	0.00000	15.75000	48.00000	-0.65640	47.914	-3.6919E-6	-0.090210	2.3545E-6
	3.50000	15.75000	48.00000	-1.5519	47.914	-18.346E-6	-0.20401	5.3236E-6
	7.00000	15.75000	48.00000	-3.9842	47.914	-270.29E-6	-0.76610	19.968E-6
	10.50000	15.75000	48.00000	-18.592	47.914	-66.931	-163.34	-0.0033071
	14.00000	15.75000	48.00000	-25.758	47.914	-66.999	-171.03	-0.0031144
	17.50000	15.75000	48.00000	-27.530	47.914	-66.999	-171.35	-0.0031059
	21.00000	15.75000	48.00000	-28.234	47.914	-66.999	-171.43	-0.0031038
	24.50000	15.75000	48.00000	-28.556	47.914	-66.999	-171.46	-0.0031030
	28.00000	15.75000	48.00000	-28.709	47.914	-66.999	-171.47	-0.0031027
	31.50000	15.75000	48.00000	-28.775	47.914	-66.999	-171.48	-0.0031025
	35.00000	15.75000	48.00000	-28.785	47.914	-66.999	-171.48	-0.0031025
	38.50000	15.75000	48.00000	-28.745	47.914	-66.999	-171.48	-0.0031026
	42.00000	15.75000	48.00000	-28.636	47.914	-66.999	-171.47	-0.0031029
	45.50000	15.75000	48.00000	-28.402	47.914	-66.999	-171.45	-0.0031034
	49.00000	15.75000	48.00000	-27.903	47.914	-66.999	-171.39	-0.0031048
	52.50000	15.75000	48.00000	-26.742	47.914	-66.999	-171.23	-0.0031091
	56.00000	15.75000	48.00000	-23.243	47.914	-66.998	-170.09	-0.0031387
	59.50000	15.75000	48.00000	-6.5776	47.914	-0.0024964	-2.1198	55.052E-6
	63.00000	15.75000	48.00000	-2.2758	47.914	-46.992E-6	-0.32671	8.5233E-6
	66.50000	15.75000	48.00000	-0.94921	47.914	-6.8139E-6	-0.12344	3.2216E-6
	70.00000	15.75000	48.00000	-0.39297	47.914	-1.8383E-6	-0.062976	1.6437E-6
	0.00000	18.00000	48.00000	-0.59571	47.914	-3.1984E-6	-0.083879	2.1892E-6
	3.50000	18.00000	48.00000	-1.3732	47.914	-14.372E-6	-0.17886	4.6675E-6
	7.00000	18.00000	48.00000	-3.2974	47.914	-178.07E-6	-0.58361	15.214E-6
	10.50000	18.00000	48.00000	-14.105	47.914	-66.646	-152.49	-0.0035582
	14.00000	18.00000	48.00000	-19.174	47.914	-66.999	-157.80	-0.0034256
	17.50000	18.00000	48.00000	-20.625	47.914	-66.699	-158.05	-0.0034192
	21.00000	18.00000	48.00000	-21.246	47.914	-66.699	-158.12	-0.0034174
	24.50000	18.00000	48.00000	-21.541	47.914	-66.699	-158.14	-0.0034167
	28.00000	18.00000	48.00000	-21.684	47.914	-66.699	-158.16	-0.0034164
	31.50000	18.00000	48.00000	-21.746	47.914	-66.699	-158.16	-0.0034162
	35.00000	18.00000	48.00000	-21.756	47.914	-66.699	-158.16	-0.0034162
	38.50000	18.00000	48.00000	-21.718	47.914	-66.699	-158.16	-0.0034163
	42.00000	18.00000	48.00000	-21.615	47.914	-66.699	-158.15	-0.0034165
	45.50000	18.00000	48.00000	-21.399	47.914	-66.699	-158.13	-0.0034171
	49.00000	18.00000	48.00000	-20.950	47.914	-66.699	-158.09	-0.0034182
	52.50000	18.00000	48.00000	-19.962	47.914	-66.699	-157.95	-0.0034217
	56.00000	18.00000	48.00000	-17.310	47.914	-66.699	-157.18	-0.0034419
	59.50000	18.00000	48.00000	-5.1539	47.914	-0.0015978	-1.4635	38.022E-6
	63.00000	18.00000	48.00000	-1.9715	47.914	-34.435E-6	-0.27373	7.1417E-6
	66.50000	18.00000	48.00000	-0.85496	47.914	-5.6989E-6	-0.11256	2.9377E-6
	70.00000	18.00000	48.00000	-0.35794	47.914	-1.6476E-6	-0.059618	1.5561E-6
	0.00000	20.25000	48.00000	-0.50049	47.914	-2.4985E-6	-0.074188	1.9363E-6
	3.50000	20.25000	48.00000	-1.1108	47.914	-9.3118E-6	-0.14391	3.7555E-6
	7.00000	20.25000	48.00000	-2.3824	47.914	-62.876E-6	-0.35436	9.2431E-6
	10.50000	20.25000	48.00000	-4.8618	47.914	-762.20E-6	-1.1280	29.359E-6
	14.00000	20.25000	48.00000	-6.9974	47.914	-0.0011579	-1.6959	44.138E-6
	17.50000	20.25000	48.00000	-8.0254	47.914	-0.0011850	-1.8433	47.983E-6
	21.00000	20.25000	48.00000	-8.0266	47.914	-0.0011893	-1.8962	49.366E-6
	24.50000	20.25000	48.00000	-8.7790	47.914	-0.0011904	-1.9196	49.976E-6
	28.00000	20.25000	48.00000	-8.9050	47.914	-0.0011908	-1.9309	50.269E-6
	31.50000	20.25000	48.00000	-8.9606	47.914	-0.0011909	-1.9358	50.399E-6
	35.00000	20.25000	48.00000	-8.9695	47.914	-0.0011909	-1.9366	50.420E-6
	38.50000	20.25000	48.00000	-8.9355	47.914	-0.0011909	-1.9336	50.340E-6
	42.00000	20.25000	48.00000	-8.8442	47.914	-0.0011906	-1.9255	50.128E-6
	45.50000	20.25000	48.00000	-8.6559	47.914	-0.0011900	-1.9084	49.684E-6
	49.00000	20.25000	48.00000	-8.2832	47.914	-0.0011877	-1.8718	48.727E-6
	52.50000	20.25000	48.00000	-7.5319	47.914	-0.0011764	-1.7800	46.332E-6
	56.00000	20.25000	48.00000	-5.9534	47.914	-0.0010602	-1.4701	38.257E-6
	59.50000	20.25000	48.00000	-3.2951	47.914	-195.06E-6	-0.58412	15.226E-6
	63.00000	20.25000	48.00000	-1.5417	47.914	-19.063E-6	-0.20378	5.3173E-6
	66.50000	20.25000	48.00000	-0.71056	47.914	-4.1857E-6	-0.096494	2.5184E-6
	70.00000	20.25000	48.00000	-0.30164	47.914	-1.3635E-6	-0.054282	1.4169E-6
	0.00000	22.50000	48.00000	-0.39038	47.914	-1.8095E-6	-0.063359	1.6537E-6
	3.50000	22.50000	48.00000	-0.83616	47.914	-5.3858E-6	-0.11070	2.8890E-6
	7.00000	22.50000	48.00000	-1.6227	47.914	-19.977E-6	-0.21282	5.5533E-6
	10.50000	22.50000	48.00000	-2.7778	47.914	-65.727E-6	-0.40052	10.448E-6
	14.00000	22.50000	48.00000	-3.8514	47.914	-102.18E-6	-0.56644	14.775E-6
	17.50000	22.50000	48.00000	-4.5279	47.914	-111.82E-6	-0.64777	16.897E-6
	21.00000	22.50000	48.00000	-4.9055	47.914	-114.30E-6	-0.68550	17.882E-6
	24.50000	22.50000	48.00000	-5.1094	47.914	-115.08E-6	-0.70421	18.370E-6
	28.00000	22.50000	48.00000	-5.2153	47.914	-115.37E-6	-0.71373	18.618E-6
	31.50000	22.50000	48.00000	-5.2630	47.914	-115.47E-6	-0.71807	18.732E-6
	35.00000	22.50000	48.00000	-5.2708	47.914	-115.49E-6	-0.71878	18.750E-6
	38.50000	22.50000	48.00000	-5.2414	47.914	-115.43E-6	-0.71610	18.680E-6
	42.00000	22.50000	48.00000	-5.1639	47.914	-115.24E-6	-0.70910	18.498E-6
	45.50000	22.50000	48.00000	-5.0087	47.914	-114.73E-6	-0.69508	18.132E-6
	49.00000	22.50000	48.00000	-4.7179	47.914	-113.26E-6	-0.66735	17.408E-6
	52.50000	22.50000	48.00000	-4.1876	47.914	-108.01E-6	-0.60924	15.892E-6
	56.00000	22.50000	48.00000	-3.2814	47.914	-86.193E-6	-0.48307	12.600E-6
	59.50000	22.50000	48.00000	-2.0870	47.914	-35.549E-6	-0.28466	7.4269E-6
	63.00000	22.50000	48.00000	-1.1231	47.914	-9.2232E-6	-0.14498	3.7837E-6
	66.50000	22.50000	48.00000	-0.54929	47.914	-2.8118E-6	-0.079520	2.0755E-6
	70.00000	22.50000	48.00000	-0.23426	47.914	-1.0608E-6	-0.047982	1.2524E-6
	0.00000	24.75000	48.00000	-0.28212	47.914	-1.2562E-6	-0.053067	1.3851E-6
	3.50000	24.75000	48.00000	-0.59406	47.914	-3.0433E-6	-0.084451	2.2042E-6
	7.00000	24.75000	48.00000	-1.0817	47.914	-7.7280E-6	-0.13817	3.6060E-6
	10.50000	24.75000	48.00000	-1.7139	47.914	-16.601E-6	-0.21431	5.5925E-6
	14.00000	24.75000	48.00000	-2.3180	47.914	-24.476E-6	-0.28551	7.4503E-6
	17.50000	24.75000	48.00000	-2.7549	47.914	-28.076E-6	-0.33157	8.6523E-6
	21.00000	24.75000	48.00000	-3.0268	47.914	-29.420E-6	-0.35759	9.3314E-6
	24.50000	24.75000	48.00000	-3.1842	47.914	-29.939E-6	-0.37200	9.7075E-6
	28.00000	24.75000	48.00000	-3.2693	47.914	-30.152E-6	-0.37981	9.9112E-6
	31.50000	24.75000	48.00000	-3.3086	47.914	-30.235E-6	-0.38348	10.007E-6
	35.00000	24.75000	48.00000	-3.3151	47.914	-30.248E-6	-0.38409	10.023E-6
	38.50000	24.75000	48.00000	-3.2908	47.914	-30.198E-6	-0.38180	9.9632E-6
	42.00000	24.75000	48.00000	-3.2276	47.914	-30.053E-6	-0.37597	9.8111E-6
	45.50000	24.75000	48.00000	-3.1055	47.914	-29.701E-6	-0.36482	9.5201E-6
	49.00000	24.75000	48.00000	-2.8888	47.914	-28.815E-6	-0.34461	8.9927E-6
	52.50000	24.75000	48.00000	-2.5279	47.914	-26.445E-6	-0.30833	8.0457E-6
	56.00000	24.75000	48.00000	-1.9880	47.914	-20.505E-6	-0.24740	6.4558E-6
	59.50000	24.75000	48.00000	-1.3425	47.914	-11.150E-6	-0.16907	4.4122E-6
	63.00000	24.75000	48.00000	-0.78022	47.914	-4.5464E-6	-0.10424	2.7207E-6
	66.50000	24.75000	48.00000	-0.39677	47.914	-1.8145E-6	-0.064395	1.6808E-6
	70.00000	24.75000	48.00000	-0.16536	47.914	0.0	-0.041596	1.0857E-6
	0.00000	27.00000	48.00000	-0.18591	47.914	0.0	-0.044122	1.1517E-6
	3.50000	27.00000	48.00000	-0.39896	47.914	-1.7658E-6	-0.065122	1.6998E-6
	7.00000	27.00000	48.00000	-0.70582	47.914	-3.5655E-6	-0.096068	2.5074E-6
	10.50000	27.00000	48.00000	-1.0787	47.914	-6.2602E-6	-0.13480	3.5183E-6
	14.00000	27.00000	48.00000	-1.4399	47.914	-8.7654E-6	-0.17188	4.4858E-6
	17.50000	27.00000	48.00000	-1.7222	47.914	-10.269E-6	-0.19949	5.2064E-6
	21.00000	27.00000	48.00000	-1.9127	47.914	-10.995E-6	-0.21737	5.6730E-6
	24.50000	27.00000	48.00000	-2.0298	47.914	-11.329E-6	-0.22824	5.9568E-6
	28.00000	27.00000	48.00000	-2.0957	47.914	-11.481E-6	-0.23448	6.1196E-6
	31.50000	27.00000	48.00000	-2.1269	47.914	-11.545E-6	-0.23751	6.1988E-6
	35.00000	27.00000	48.00000	-2.1321	47.914	-11.555E-6	-0.23802	6.2120E-6
	38.50000	27.00000	48.00000	-2.1127	47.914	-11.516E-6	-0.23612	6.1624E-6
	42.00000	27.00000	48.00000	-2.0631	47.914	-11.409E-6	-0.23138	6.0387E-6
	45.50000	27.00000	48.00000	-1.9705	47.914	-11.170E-6	-0.22273	5.8129E-6

Name	Location				Stresses			
	X [m]	Y [m]	Z[Level] [mOD]	Z [mm]	Calc Level [mOD]	Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
	49.00000	27.00000	48.00000	-1.8144	47.914	-10.649E-6	-0.20820	5.4337E-6
	52.50000	27.00000	48.00000	-1.5725	47.914	-9.5330E-6	-0.18503	4.8289E-6
	56.00000	27.00000	48.00000	-1.2400	47.914	-7.4342E-6	-0.15153	3.9548E-6
	59.50000	27.00000	48.00000	-0.86132	47.914	-4.6527E-6	-0.11214	2.9269E-6
	63.00000	27.00000	48.00000	-0.51927	47.914	-2.4067E-6	-0.077117	2.0128E-6
	66.50000	27.00000	48.00000	-0.26609	47.914	-1.1671E-6	-0.052026	1.3580E-6
	70.00000	27.00000	48.00000	-0.10174	47.914	0.0	-0.035679	0.0
	0.00000	29.25000	48.00000	-0.10600	47.914	0.0	-0.036698	0.0
	3.50000	29.25000	48.00000	-0.24920	47.914	-1.0712E-6	-0.051079	1.3332E-6
	7.00000	29.25000	48.00000	-0.44445	47.914	-1.8675E-6	-0.070284	1.8345E-6
	10.50000	29.25000	48.00000	-0.67309	47.914	-2.9187E-6	-0.092723	2.4202E-6
	14.00000	29.25000	48.00000	-0.89638	47.914	-3.9192E-6	-0.11443	2.9867E-6
	17.50000	29.25000	48.00000	-1.0795	47.914	-4.6183E-6	-0.13193	3.4434E-6
	21.00000	29.25000	48.00000	-1.2105	47.914	-5.0207E-6	-0.14435	3.7677E-6
	24.50000	29.25000	48.00000	-1.2950	47.914	-5.2330E-6	-0.15249	3.9799E-6
	28.00000	29.25000	48.00000	-1.3445	47.914	-5.3395E-6	-0.15739	4.1080E-6
	31.50000	29.25000	48.00000	-1.3684	47.914	-5.3864E-6	-0.15985	4.1721E-6
	35.00000	29.25000	48.00000	-1.3724	47.914	-5.3939E-6	-0.16026	4.1829E-6
	38.50000	29.25000	48.00000	-1.3574	47.914	-5.3652E-6	-0.15871	4.1424E-6
	42.00000	29.25000	48.00000	-1.3199	47.914	-5.2881E-6	-0.15493	4.0437E-6
	45.50000	29.25000	48.00000	-1.2518	47.914	-5.1291E-6	-0.14830	3.8706E-6
	49.00000	29.25000	48.00000	-1.1419	47.914	-4.8211E-6	-0.13785	3.5979E-6
	52.50000	29.25000	48.00000	-0.98104	47.914	-4.2603E-6	-0.12256	3.1987E-6
	56.00000	29.25000	48.00000	-0.77190	47.914	-3.3742E-6	-0.10237	2.6720E-6
	59.50000	29.25000	48.00000	-0.54033	47.914	-2.3006E-6	-0.079702	2.0803E-6
	63.00000	29.25000	48.00000	-0.32700	47.914	-1.3713E-6	-0.058745	1.5334E-6
	66.50000	29.25000	48.00000	-0.16082	47.914	0.0	-0.042276	1.1035E-6
	70.00000	29.25000	48.00000	-0.047072	47.914	0.0	-0.030479	0.0
	0.00000	31.50000	48.00000	-0.042739	47.914	0.0	-0.030662	0.0
	3.50000	31.50000	48.00000	-0.13761	47.914	0.0	-0.040776	1.0643E-6
	7.00000	31.50000	48.00000	-0.26235	47.914	-1.0721E-6	-0.053407	1.3940E-6
	10.50000	31.50000	48.00000	-0.40525	47.914	-1.5535E-6	-0.067550	1.7632E-6
	14.00000	31.50000	48.00000	-0.54565	47.914	-2.0177E-6	-0.081300	2.1221E-6
	17.50000	31.50000	48.00000	-0.66452	47.914	-2.3734E-6	-0.092922	2.4254E-6
	21.00000	31.50000	48.00000	-0.75322	47.914	-2.6042E-6	-0.10170	2.6546E-6
	24.50000	31.50000	48.00000	-0.81284	47.914	-2.7396E-6	-0.10778	2.8133E-6
	28.00000	31.50000	48.00000	-0.84880	47.914	-2.8132E-6	-0.11160	2.9130E-6
	31.50000	31.50000	48.00000	-0.86658	47.914	-2.8473E-6	-0.11357	2.9642E-6
	35.00000	31.50000	48.00000	-0.86957	47.914	-2.8529E-6	-0.11390	2.9730E-6
	38.50000	31.50000	48.00000	-0.85839	47.914	-2.8318E-6	-0.11265	2.9405E-6
	42.00000	31.50000	48.00000	-0.83080	47.914	-2.7771E-6	-0.10967	2.8626E-6
	45.50000	31.50000	48.00000	-0.78206	47.914	-2.6717E-6	-0.10462	2.7306E-6
	49.00000	31.50000	48.00000	-0.70633	47.914	-2.4863E-6	-0.097038	2.5328E-6
	52.50000	31.50000	48.00000	-0.60000	47.914	-2.1861E-6	-0.086609	2.2606E-6
	56.00000	31.50000	48.00000	-0.46701	47.914	-1.7614E-6	-0.073610	1.9214E-6
	59.50000	31.50000	48.00000	-0.32246	47.914	-1.2728E-6	-0.059382	1.5500E-6
	63.00000	31.50000	48.00000	-0.18782	47.914	0.0	-0.045912	1.1984E-6
	66.50000	31.50000	48.00000	-0.079480	47.914	0.0	-0.034671	0.0
	70.00000	31.50000	48.00000	-0.0025684	47.914	0.0	-0.026042	0.0
	0.00000	33.75000	48.00000	0.0054838	47.914	0.0	-0.025787	0.0
	3.50000	33.75000	48.00000	-0.056264	47.914	0.0	-0.033085	0.0
	7.00000	33.75000	48.00000	-0.13567	47.914	0.0	-0.041776	1.0905E-6
	10.50000	33.75000	48.00000	-0.22549	47.914	0.0	-0.051234	1.3373E-6
	14.00000	33.75000	48.00000	-0.31422	47.914	-1.1451E-6	-0.060446	1.5778E-6
	17.50000	33.75000	48.00000	-0.39106	47.914	-1.3398E-6	-0.068465	1.7871E-6
	21.00000	33.75000	48.00000	-0.45025	47.914	-1.4771E-6	-0.074789	1.9521E-6
	24.50000	33.75000	48.00000	-0.49132	47.914	-1.5644E-6	-0.079353	2.0713E-6
	28.00000	33.75000	48.00000	-0.51675	47.914	-1.6151E-6	-0.082317	2.1487E-6
	31.50000	33.75000	48.00000	-0.52954	47.914	-1.6395E-6	-0.083871	2.1892E-6
	35.00000	33.75000	48.00000	-0.53171	47.914	-1.6436E-6	-0.084140	2.1962E-6
	38.50000	33.75000	48.00000	-0.52362	47.914	-1.6283E-6	-0.083147	2.1703E-6
	42.00000	33.75000	48.00000	-0.50394	47.914	-1.5899E-6	-0.080808	2.1093E-6
	45.50000	33.75000	48.00000	-0.46996	47.914	-1.5198E-6	-0.076954	2.0087E-6
	49.00000	33.75000	48.00000	-0.41872	47.914	-1.4055E-6	-0.071394	1.8635E-6
	52.50000	33.75000	48.00000	-0.34908	47.914	-1.2354E-6	-0.064070	1.6724E-6
	56.00000	33.75000	48.00000	-0.26436	47.914	-1.0118E-6	-0.055275	1.4428E-6
	59.50000	33.75000	48.00000	-0.17351	47.914	0.0	-0.045790	1.1952E-6
	63.00000	33.75000	48.00000	-0.088419	47.914	0.0	-0.036664	0.0
	66.50000	33.75000	48.00000	-0.018603	47.914	0.0	-0.028725	0.0
	70.00000	33.75000	48.00000	0.032083	47.914	0.0	-0.022311	0.0
	0.00000	36.00000	48.00000	0.0410121	47.914	0.0	-0.021844	0.0
	3.50000	36.00000	48.00000	0.0018373	47.914	0.0	-0.027234	0.0
	7.00000	36.00000	48.00000	-0.048048	47.914	0.0	-0.033433	0.0
	10.50000	36.00000	48.00000	-0.10418	47.914	0.0	-0.040040	1.0452E-6
	14.00000	36.00000	48.00000	-0.15996	47.914	0.0	-0.046475	1.2131E-6
	17.50000	36.00000	48.00000	-0.20911	47.914	0.0	-0.052183	1.3621E-6
	21.00000	36.00000	48.00000	-0.24789	47.914	0.0	-0.056819	1.4831E-6
	24.50000	36.00000	48.00000	-0.27548	47.914	0.0	-0.060270	1.5732E-6
	28.00000	36.00000	48.00000	-0.29293	47.914	0.0	-0.062568	1.6332E-6
	31.50000	36.00000	48.00000	-0.30183	47.914	-1.0051E-6	-0.063793	1.6652E-6
	35.00000	36.00000	48.00000	-0.30335	47.914	-1.0081E-6	-0.064006	1.6707E-6
	38.50000	36.00000	48.00000	-0.29770	47.914	0.0	-0.063220	1.6502E-6
	42.00000	36.00000	48.00000	-0.28410	47.914	0.0	-0.061391	1.6025E-6
	45.50000	36.00000	48.00000	-0.26105	47.914	0.0	-0.058443	1.5255E-6
	49.00000	36.00000	48.00000	-0.22711	47.914	0.0	-0.054313	1.4177E-6
	52.50000	36.00000	48.00000	-0.18213	47.914	0.0	-0.049036	1.2800E-6
	56.00000	36.00000	48.00000	-0.12853	47.914	0.0	-0.042854	1.1186E-6
	59.50000	36.00000	48.00000	-0.071700	47.914	0.0	-0.036246	0.0
	63.00000	36.00000	48.00000	-0.018421	47.914	0.0	-0.029809	0.0
	66.50000	36.00000	48.00000	0.025692	47.914	0.0	-0.024040	0.0
	70.00000	36.00000	48.00000	0.057984	47.914	0.0	-0.019193	0.0
	0.00000	38.25000	48.00000	0.066302	47.914	0.0	-0.018638	0.0
	3.50000	38.25000	48.00000	0.042413	47.914	0.0	-0.022702	0.0
	7.00000	38.25000	48.00000	0.011892	47.914	0.0	-0.027251	0.0
	10.50000	38.25000	48.00000	-0.022537	47.914	0.0	-0.032025	0.0
	14.00000	38.25000	48.00000	-0.057014	47.914	0.0	-0.036668	0.0
	17.50000	38.25000	48.00000	-0.087837	47.914	0.0	-0.040837	1.0660E-6
	21.00000	38.25000	48.00000	-0.11262	47.914	0.0	-0.044292	1.1561E-6
	24.50000	38.25000	48.00000	-0.13059	47.914	0.0	-0.046921	1.2248E-6
	28.00000	38.25000	48.00000	-0.14214	47.914	0.0	-0.048706	1.2714E-6
	31.50000	38.25000	48.00000	-0.14811	47.914	0.0	-0.049671	1.2966E-6
	35.00000	38.25000	48.00000	-0.14914	47.914	0.0	-0.049840	1.3010E-6
	38.50000	38.25000	48.00000	-0.14534	47.914	0.0	-0.049218	1.2847E-6
	42.00000	38.25000	48.00000	-0.13628	47.914	0.0	-0.047789	1.2474E-6
	45.50000	38.25000	48.00000	-0.12115	47.914	0.0	-0.045522	1.1883E-6
	49.00000	38.25000	48.00000	-0.099276	47.914	0.0	-0.042414	1.1071E-6
	52.50000	38.25000	48.00000	-0.070849	47.914	0.0	-0.038530	1.0057E-6
	56.00000	38.25000	48.00000	-0.037542	47.914	0.0	-0.034053	0.0
	59.50000	38.25000	48.00000	-0.0025969	47.914	0.0	-0.029289	0.0
	63.00000	38.25000	48.00000	0.030023	47.914	0.0	-0.024604	0.0
	66.50000	38.25000	48.00000	0.056980	47.914	0.0	-0.020309	0.0
	70.00000	38.25000	48.00000	0.076527	47.914	0.0	-0.016589	0.0
	0.00000	40.50000	48.00000	0.083535	47.914	0.0	-0.016014	0.0
	3.50000	40.50000	48.00000	0.069947	47.914	0.0	-0.019132	0.0
	7.00000	40.50000	48.00000	0.052158	47.914	0.0	-0.022551	0.0
	10.50000	40.50000	48.00000	0.031824	47.914	0.0	-0.026093	0.0
	14.00000	40.50000	48.00000	0.011218	47.914	0.0	-0.029531	0.0
	17.50000	40.50000	48.00000	-0.0074583	47.914	0.0	-0.032641	0.0
	21.00000	40.50000	48.00000	-0.022702	47.914	0.0	-0.035254	0.0
	24.50000	40.50000	48.00000	-0.033922	47.914	0.0	-0.037275	0.0
	28.00000	40.50000	48.00000	-0.041226	47.914	0.0	-0.038667	1.0093E-6
	31.50000	40.50000	48.00000	-0.045030	47.914	0.0	-0.039427	1.0292E-6
	35.00000	40.50000	48.00000	-0.045684	47.914	0.0	-0.039561	1.0327E-6
	38.50000	40.50000	48.00000	-0.043260	47.914	0.0	-0.039070	1.0198E-6
	42.00000	40.50000	48.00000	-0.037510	47.914	0.0	-0.037949	0.0
	45.50000	40.50000	48.00000	-0.028009	47.914	0.0	-0.036196	0.0
	49.00000	40.50000	48.00000	-0.014467	47.914	0.0	-0.033829	0.0
	52.50000	40.50000	48.00000	0.0028694	47.914	0.0	-0.030915	0.0
	56.00000	40.50000	48.00000	0.022888	47.914	0.0	-0.027593	0.0
	59.50000	40.50000	48.00000	0.043630	47.914	0.0	-0.024067	0.0
	63.00000	40.50000	48.00000	0.062762	47.914	0.0	-0.020570	0.0
	66.50000	40.50000	48.00000	0.078293	47.914	0.0	-0.017306	0.0
	70.00000	40.50000	48.00000	0.089114	47.914	0.0	-0.014409	0.0
	0.00000	42.75000	48.00000	0.094590	47.914	0.0	-0.013850	0.0
	3.50000	42.75000	48.00000	0.087878	47.914	0.0	-0.016280	0.0
	7.00000	42.75000	48.00000	0.078444	47.914	0.0	-0.018900	0.0
	10.50000	42.75000	48.00000	0.067279	47.914	0.0	-0.021586	0.0
	14.00000	42.75000	48.00000	0.055720	47.914	0.0	-0.024184	0.0
	17.50000	42.75000	48.00000	0.045073	47.914	0.0	-0.026546	0.0
	21.00000	42.75000	48.00000	0.036267	47.914	0.0	-0.028549	0.0
	24.50000	42.75000	48.00000	0.029717	47.914	0.0	-0.030116	0.0

Name	Location X [m]	Y [m]	Z[Level] [mOD]	Z [mm]	Calc Level [mOD]	Stresses Vert Stress [kN/m²]	Sum Princ [kN/m²]	Vert Strain [-]
	28.00000	42.75000	48.00000	0.025422	47.914	0.0	-0.031207	0.0
	31.50000	42.75000	48.00000	0.023176	47.914	0.0	-0.031807	0.0
	35.00000	42.75000	48.00000	0.022789	47.914	0.0	-0.031913	0.0
	38.50000	42.75000	48.00000	0.024222	47.914	0.0	-0.031525	0.0
	42.00000	42.75000	48.00000	0.027610	47.914	0.0	-0.030643	0.0
	45.50000	42.75000	48.00000	0.033176	47.914	0.0	-0.029277	0.0
	49.00000	42.75000	48.00000	0.041038	47.914	0.0	-0.027454	0.0
	52.50000	42.75000	48.00000	0.050980	47.914	0.0	-0.025233	0.0
	56.00000	42.75000	48.00000	0.062292	47.914	0.0	-0.022719	0.0
	59.50000	42.75000	48.00000	0.073797	47.914	0.0	-0.020051	0.0
	63.00000	42.75000	48.00000	0.084122	47.914	0.0	-0.017386	0.0
	66.50000	42.75000	48.00000	0.092088	47.914	0.0	-0.014862	0.0
	70.00000	42.75000	48.00000	0.097014	47.914	0.0	-0.012578	0.0
	0.00000	45.00000	48.00000	0.10099	47.914	0.0	-0.012051	0.0
	3.50000	45.00000	48.00000	0.098805	47.914	0.0	-0.013971	0.0
	7.00000	45.00000	48.00000	0.094814	47.914	0.0	-0.016012	0.0
	10.50000	45.00000	48.00000	0.089590	47.914	0.0	-0.018084	0.0
	14.00000	45.00000	48.00000	0.083910	47.914	0.0	-0.020084	0.0
	17.50000	45.00000	48.00000	0.078536	47.914	0.0	-0.021905	0.0
	21.00000	45.00000	48.00000	0.074029	47.914	0.0	-0.023459	0.0
	24.50000	45.00000	48.00000	0.070659	47.914	0.0	-0.024685	0.0
	28.00000	45.00000	48.00000	0.068449	47.914	0.0	-0.025544	0.0
	31.50000	45.00000	48.00000	0.067298	47.914	0.0	-0.026020	0.0
	35.00000	45.00000	48.00000	0.067100	47.914	0.0	-0.026104	0.0
	38.50000	45.00000	48.00000	0.067834	47.914	0.0	-0.025796	0.0
	42.00000	45.00000	48.00000	0.069574	47.914	0.0	-0.025099	0.0
	45.50000	45.00000	48.00000	0.072440	47.914	0.0	-0.024027	0.0
	49.00000	45.00000	48.00000	0.076476	47.914	0.0	-0.022608	0.0
	52.50000	45.00000	48.00000	0.081530	47.914	0.0	-0.020892	0.0
	56.00000	45.00000	48.00000	0.087164	47.914	0.0	-0.018957	0.0
	59.50000	45.00000	48.00000	0.092683	47.914	0.0	-0.016902	0.0
	63.00000	45.00000	48.00000	0.097289	47.914	0.0	-0.014835	0.0
	66.50000	45.00000	48.00000	0.10030	47.914	0.0	-0.012855	0.0
	70.00000	45.00000	48.00000	0.10131	47.914	0.0	-0.011032	0.0
Line 1	0.00000	14.15000	48.00000	-0.66994	47.914	-3.8067E-6	-0.091639	2.3917E-6
	4.66667	14.15000	48.00000	-2.1484	47.914	-39.577E-6	-0.30191	7.8768E-6
	9.33333	14.15000	48.00000	-9.7280	47.914	-0.029399	-6.0238	153.92E-6
	14.00000	14.15000	48.00000	-26.631	47.914	-67.000	-171.40	-0.0031045
	18.66667	14.15000	48.00000	-28.787	47.914	-67.000	-171.78	-0.0030947
	23.33333	14.15000	48.00000	-29.445	47.914	-67.000	-171.85	-0.0030929
	28.00000	14.15000	48.00000	-29.684	47.914	-67.000	-171.87	-0.0030923
	32.66667	14.15000	48.00000	-29.759	47.914	-67.000	-171.88	-0.0030921
	37.33333	14.15000	48.00000	-29.740	47.914	-67.000	-171.88	-0.0030922
	42.00000	14.15000	48.00000	-29.609	47.914	-67.000	-171.87	-0.0030925
	46.66667	14.15000	48.00000	-29.243	47.914	-67.000	-171.83	-0.0030934
	51.33333	14.15000	48.00000	-28.190	47.914	-67.000	-171.70	-0.0030967
	56.00000	14.15000	48.00000	-23.986	47.914	-66.999	-170.42	-0.0031301
	60.66667	14.15000	48.00000	-4.5938	47.914	-419.26E-6	-0.96749	25.208E-6
	65.33334	14.15000	48.00000	-1.2937	47.914	-12.331E-6	-0.16719	4.3631E-6
	70.00000	14.15000	48.00000	-0.40071	47.914	-1.8818E-6	-0.063721	1.6632E-6
Line 2	34.00000	0.00000	48.00000	-1.6554	47.914	-7.3063E-6	-0.18800	4.9068E-6
	34.00000	1.84667	48.00000	-2.3727	47.914	-14.274E-6	-0.26501	6.9164E-6
	34.00000	3.69333	48.00000	-3.4124	47.914	-32.483E-6	-0.39767	10.377E-6
	34.00000	5.54000	48.00000	-4.9863	47.914	-95.943E-6	-0.66096	17.243E-6
	34.00000	7.38667	48.00000	-7.5751	47.914	-491.75E-6	-1.3484	35.144E-6
	34.00000	9.23333	48.00000	-12.829	47.914	-0.019478	-5.6084	144.20E-6
	34.00000	11.08000	48.00000	-25.561	47.914	-66.993	-169.12	-0.0031633
	34.00000	12.92667	48.00000	-29.204	47.914	-67.000	-171.66	-0.0030978
	34.00000	14.77333	48.00000	-29.621	47.914	-67.000	-171.83	-0.0030935
	34.00000	16.62000	48.00000	-27.259	47.914	-66.998	-170.63	-0.0031246
	34.00000	18.46667	48.00000	-16.539	47.914	-1.4512	-25.713	507.05E-6
	34.00000	20.31333	48.00000	-8.8216	47.914	-0.0010816	-1.8632	48.516E-6
	34.00000	22.16000	48.00000	-5.6780	47.914	-149.74E-6	-0.80759	21.065E-6
	34.00000	24.00667	48.00000	-3.8502	47.914	-44.518E-6	-0.46245	12.067E-6
	34.00000	25.85333	48.00000	-2.6677	47.914	-18.270E-6	-0.29990	7.8266E-6
	34.00000	27.70000	48.00000	-1.8612	47.914	-8.9658E-6	-0.20905	5.4562E-6