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# PHASE 2: GROUND INVESTIGATION REPORT

# THIRTEEN GROUP

# PROPOSED RESIDENTIAL DEVELOPMENT

# LAND AT AMBERLEY STREET & HARROGATE STREET

# <u>HENDON</u>

# **SUNDERLAND**

# <u>SR2 8ES</u>

## Project No: 20-794

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23/07/2021

23/07/2021

The information and/or advice contained in this Phase 2: Ground Investigation Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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Report Type:- Phase 2: Ground Investigation Report. Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group





# **CONTENTS**

1.0	INTRODUCTION	Page 3
2.0	SITE DETAILS	Page 3
3.0	SCOPE OF WORKS	Page 3
	3.1 – Investigation Rationale 3.2 – Sampling & Site Protocols	Page 4 Page 4
4.0	GROUND CONDITIONS	Page 5
	4.1 – Soil Profile 4.2 – Groundwater and Stability	Page 5 Page 5
5.0	INSITU TESTING	Page 6
	5.1 – Insitu Hand Shear Vane Tests 5.2 – Insitu Standard Penetration Tests 5.3 – Insitu TRL Dynamic Cone Penetrometer Tests 5.4 – Insitu Gas & Water Monitoring	Page 6 Page 6 Page 6 Page 7
6.0	LABORATORY TESTING	Page 7
	<ul> <li>6.1 – Determination of pH &amp; SO<sub>4</sub></li> <li>6.2 – Determination of Liquid &amp; Plastic Limits</li> <li>6.3 – Determination of Particle Size Distribution</li> <li>6.4 – Contamination Screening</li> </ul>	Page 9 Page 10 Page 10 Page 11
7.0	GROUND CONTAMINATION RISK ASSESSMENT	Page 12
	<ul> <li>7.1 – Methodology</li> <li>7.2 – Revised Conceptual Site Model (CSM)</li> <li>7.3 – Screening Strategy</li> <li>7.4 – Level 1 Generic Quantitative Risk Assessment – Human Health</li> <li>7.5 – Level 1 Generic Quantitative Risk Assessment – Controlled Waters</li> <li>7.6 – Waste Disposal Classification</li> </ul>	Page 12 Page 12 Page 14 Page 14 Page 17
8.0	<b>CONCLUSIONS &amp; RECOMMENDATIONS</b>	Page 18
	<ul> <li>8.1 – Ground Conditions</li> <li>8.2 – Groundwater &amp; Stability</li> <li>8.3 – Foundation Options</li> <li>8.4 – Hazardous Ground Gas Risk Assessment</li> <li>8.5 – Ground Contamination</li> <li>8.6 – Preliminary Remediation Statement</li> <li>8.7 – General Comments</li> </ul>	Page 18 Page 18 Page 19 Page 20 Page 20 Page 21 Page 21

# **APPENDICES**

Appendix I	Location Plan, Aerial Photograph, Existing Site Layout Plan,
	Proposed Development Layout Plan
Appendix II	Borehole and Trial Pit Location Plan (Existing & Proposed),
	Borehole and Trial Pit Record Sheets, DCP Test Reports
Appendix III	Gas and Water Monitoring Certificate
Appendix IV	Laboratory Results (Geotechnical and Ground Contamination)
Appendix V	Revised Conceptual Site Model (CSM)
Appendix VI	Waste Classification Report (HazWasteOnlineTM)



# 1.0 Introduction

As requested by Engie Regeneration, on behalf of Thirteen Group, and in conjunction with a Phase 1: Desk Top Study & Coal Mining Risk Assessment Report completed for this site by Arc Environmental Ltd (Ref. No. 20-794, March 2021), Phase 2: Ground Investigation works have been carried out on land located at Amberley Street & Harrogate Street, Sunderland, where proposals have been made to redevelop the site for residential use comprising the construction of c.103 residential dwellings with private gardens and areas of hardstanding.

The intrusive investigation works comprised the sinking of 10 no. windowless sampling boreholes (WS01 to WS10) including 3 no. ground gas / groundwater monitoring standpipes (WS01, WS04 & WS07), the excavation of 22 no. mechanically excavated trial pits (TP01 to TP22), the excavation of 3 no. mechanically excavated trial trenches (TT01 to TT03) and 3 no. Dynamic Cone Penetrometer (DCP) tests (TPA/DCPA to TPC/DCPC). The positions of the investigation locations can be seen on the Borehole and Trial Pit Location Plan, a copy of which can be seen in Appendix II. It should be noted that this plan is for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale.

# 2.0 Site Details

<u>Table 2.1</u>	N = north, $S = south$ , $E = east$ , $W = west$
Site Name & Address:	Amberley Street & Harrogate Street, Hendon, Sunderland, SR2 8ES.
National Grid Reference:	440230, 5562520 – representative for the centre of the site.
Description of Location:	The site is located off Mowbray Road within the Hendon area of Sunderland.
Site Boundaries:	N= Residential dwellings, E= Medical Centre and carpark, S = Ward Court with
	residential properties beyond, W = Salem Street with residential properties beyond.
Site Shape & Area:	The site is irregular in shape and occupies an approximate area of c.3.1 Hectares.
Proposed Development	Proposals involve the construction c.103 residential dwellings with private gardens and
Details:	areas of hardstanding.
General Topography:	No topographical survey was available at the time of writing this report. The
	reconnaissance (walkover) indicated that the site displays a slight fall in gradient to the
	south-east.
Site surfacing:	The site is mainly covered in grass surfacing although the current road / footpath
	infrastructure remains.
Above Ground Structures:	None present on site.
Below Ground Structures:	Relic foundations / floor slabs may be present across the site associated with the former
	residential dwellings recorded on site. In addition, services (i.e. drains, water, electric, gas,
	etc.) may be present associated with the former dwellings.

# 3.0 Scope of Works

#### <u>Table 3.1</u>

Client:	Thirteen Group.
Project type:	Proposed Residential Development.
Site Location plan:	See Appendix I.
Aerial Photograph:	See Appendix I.
Layout plans (existing):	See Appendix I.
Layout plans (proposed):	See Appendix I.
Investigation Works:	10 no. windowless sampling boreholes (WS01 to WS10).
-	3 no. ground gas / groundwater monitoring standpipes (WS01, WS04 & WS07).
	22 no. mechanically excavated trial pits (TP01 to TP22).
	3 no. mechanically excavated trial trenches (TT01 to TT03).
	3 no. Dynamic Cone Penetrometer (DCP) tests (TPA/DCPA to TPC/DCPC)
Laboratory Testing:	Geotechnical & Ground Contamination.
CLEA End-Use	Level 1 GQRA – Residential With Home Grown Produce.
Classification:	



# 3.0 Scope of Works (Cont'd)

The information contained in this report is limited to the area of the proposed development, as indicated on the Existing Site Layout Plan shown in Appendix I, and to those areas accessible during the ground investigation. When considering the full scope of the development any features and / or issues not specifically mentioned in this report cannot be assumed to have been covered.

#### 3.1 Investigation Rationale: -

This ground investigation has been designed to provide information on the general ground and groundwater conditions where access would allow, in the area of the proposed development. The boreholes and trial pits were created primarily for geotechnical purposes to assist in the design of new foundations for the proposed development with contamination screening undertaken to aid in assessing the risks to Human Health, Controlled Waters and for off site disposal. The rationale behind the location of each exploratory hole is summarised in Table 3.2 below.

#### Table 3.2

Potential issue	Exploratory Hole
Determine the nature of the underlying ground conditions, including shallow	WS01 – WS10
groundwater.	TP01 – TP22
Determine the sites ground gas regime.	WS01, WS04 & WS07
Determine the insitu strength / density of the underlying deposits to provide	TPA/DCPA to TPC/DCPC
characteristic design CBR values.	
Locate potential fault on site.	TT01 to TT03
Determine the levels of contamination present within the initial deposits with a view to	WS01 – WS10
determining the risks posed towards the future site end-users and Controlled Waters.	TP01 – TP22

#### 3.2 Sampling & Site Protocols: -

All works associated with this ground contamination assessment and investigations have generally been completed in accordance with BS10175:2011 + A2:2017: British Standard Code of Practice for the Investigation of Potentially Contaminated Sites (2011) & Environment Agency (EA) Land Contamination Risk Management (LCRM), October 2020, which superseded CLR11, with the following precautions specific to this project.

#### 3.2.1 Contamination Sampling: -

Samples were recovered by a representative of ARC Environmental Ltd. during the intrusive investigation works. All samples were stored at approximately 2°C - 8°C using cool boxes and ice packs prior to delivery to a UKAS / MCERTS accredited laboratory. Sampling was carried out in accordance with 'Technical Policy Statement 63: UKAS Policy on Deviating Samples'.

#### 3.2.2 Onsite Health & Safety Requirements: -

All site representatives wore relevant and appropriate PPE including (where appropriate) safety footwear, high visibility jacket/vest, hard hat, eye protection and overalls. In addition, disposable latex gloves were used when handling any potentially contaminated materials and when rinsing all sampling tools. Each site vehicle contained a suitable First Aid kit with hand wash station/cleansing products (i.e. sanitary wipes).

#### 3.2.3 Avoiding Cross-Contamination between Sample Locations: -

To avoid cross-contamination of materials between soil horizons, drill casing was used to seal off the made ground. In addition, disposable plastic liners were used to collect samples from the windowless sampling boreholes carried out. With regards to the trial pits, the samples were recovered manually using dedicated



disposable plastic gloves, replaced between each sample recovery with the equipment being cleaned between each investigation position.

# 4.0 Ground Conditions

For an accurate description of the ground conditions encountered at each investigation position, reference should be made to the borehole and trial pit logs in Appendix II. It should be noted that there is always the possibility of variation in the ground conditions around and between the excavation locations. A UXO engineer was present during the investigation works to monitor all exploratory holes across the site.

## 4.1 Soil Profile: -

A summary of the soil profile for this site can be found in Table 4.1 below.

Type of Strata	Depths Recorded	Description & General Comments
	<u>(BGL)</u>	
MADE GROUND	From 0.00m up to	Made ground materials were encountered across the site and comprised grass
(1 Layer Recorded):	c.0.80m and	overlying dark brown sandy gravelly clayey soil (Layer A). Anthropogenic debris
	c.2.30m.	(i.e. brick, concrete, metal, etc.) was noted throughout the made ground materials.
DRIFT GEOLOGY:	From 0.80m and	Comprising firm and stiff (medium and high strength) sandy gravelly CLAY were
(Glaciolacustrine	c.2.30m to c.1.30m	encountered within TP's 01 -09, 13 - 14, 16, 21, 22 and WS's 01 - 04, 06 - 08 &
Deposits)	to c.>5.00m	10. Occasional thin bands of sand were also recorded. The remaining positions
		encountered solid deposits directly below the made ground materials.
SOLID GEOLOGY:	From c.1.30m to	Weathered LIMESTONE becoming less weathered with depth and recovered as
(Roker Formation)	c.>3.50m	sandy clayey limestone gravel.

As anticipated from the historic land uses highlighted in the Phase 1: Desk Top Study & Coal Mining Risk Assessment Report produced for the site, made ground was encountered to a depth of between c.0.80m and c.2.30m and comprised 1 layer as detailed in Table 4.1 above.

There was no visual or olfactory evidence of significant or 'gross' contamination (fuel, oils or asbestos) noted on or below the site during the ground investigation works. However, occasional fragments of ash were recorded within the made ground present on site.

Based on the Trial Trenches carried out, although there was evidence of variable thicknesses to limestone deposits and variable quality of limestone potentially associated with a fault, no evidence of dissolution, fracturing, voiding or fault re-activation was noted in the area of the fault across the north eastern margin of the site. Notwithstanding, it is deemed prudent to incorporate structural measures within proposed foundations across this area.

## 4.2 Groundwater and Stability: -

During the investigation works, no water ingresses were noted within any of the excavations undertaken on site. Combined ground gas & groundwater monitoring wells were installed at the locations of WS01, WS04 & WS07 in order to carry out a subsequent programme of gas and groundwater monitoring. The results are discussed further in Section 5.4

However, it would be prudent to allow for the introduction of adequate groundwater control techniques, to take care of any surface water ingresses and pockets of trapped surface drainage within the made ground and natural deposits during the construction period, especially during the wetter periods of the year.

Owing to the nature of the made ground and natural drift deposits present across the development area, adequate lateral trench support will be required for excavations, to prevent trench wall collapse or over excavations, as well as to create a safe working environment, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time. Reference to CIRIA 97 'Trenching Practice'



would be beneficial to establish a suitable means of support or battering of excavation sides during construction.

# 5.0 Insitu Testing

## 5.1 Insitu Hand Shear Vane Tests: -

Insitu hand vane tests were carried out using a portable hand vane tester (upper limit 120kN/m<sup>2</sup>) on the natural clays encountered in the boreholes. The insitu hand vane tester takes direct readings of shear strength. Three vane sizes allow for the direct determination of undrained shear strength of extremely low to high strength clays.

The peak vane value is determined by a calibrated scale ring built into the head assembly. The cross handle/dial is used both to push the vane to the desired test depth and apply the shearing torque. The results are summarised in Table 5.1 below and can also be found adjacent to the appropriate sample level, on the graphic borehole & trial pit record sheets in Appendix II.

#### <u>Table 5.1</u>

Type of Strata	Range of Shear Strength Values (kN/m <sup>2</sup> )	Result Details
SANDY GRAVELLY CLAY	$40 kN/m^2$ to $120 kN/m^2$	Medium & high strength deposits

#### 5.2 Insitu Standard Penetration Tests: -

Insitu standard penetration tests (SPT's) were carried out on the natural drift and solid geological deposits encountered within the boreholes, to determine their density / relative strength using a normal split spoon sampler. The results are shown as uncorrected 'N' values on the graphic borehole record sheets (Appendix II), adjacent to the appropriate sample level, and are also summarised in Tables 5.2 below.

#### Table 5.2

<u>Type of strata</u>	Range of SPT 'N' Values	Density / Strength
DRIFT GEOLOGY:	5 - 14	Indicative of firm and stiff deposits.
(Glaciolacustrine Deposits)		
SOLID GEOLOGY:	17 & 50 - 75 Blows for limited	Indicative of medium dense and dense
(Roker Formation)	penetration	deposits.

## 5.3 Insitu TRL Dynamic Cone Penetrometer Tests: -

In total, 3 no. Dynamic Cone Penetrometer (DCP) tests were undertaken directly below the existing access roads to determine the insitu strength / density of the underlying deposits to provide characteristic design CBR values.

The DCP uses an 8kg hammer dropping through a height of 575mm to penetrate a  $60^{\circ}$  cone (20mm Ø) into the underlying ground. Readings are taken following a set number of blows or change in strength / density to determine the penetration of the cone. The DCP field results are analysed using the UK DCP 3.1 software package to calculate the thickness and strength / density of differing layers. The calculated results provided comprise penetration rates (mm/blow) and CBR values (%). The DCP test results, including a graphical representation, can be seen within the DCP test reports attached, and a summary of the results of the tests undertaken can be seen in Table 5.3 below.

1	<u>able 5.3</u>			Bcgl's = Below current ground levels, MG = Made Ground, NS = Natural Strata.		
Position Strata De		Depth to base of test	Penetration	CBR Value over		
			(mm bcgl's) / Layer	Indices	<u>test depth (%)</u>	
			<u>Thickness (mm)</u>	<u>(mm/blow)</u>		
	DCPA	MG	350 / 110	2.69	106	
	DCPA	NS	970 / 530	35.00 - 77.50	3 – 7	
	DCPB	MG	875 / 655	1.20 - 14.64	18 - 249	

Report Type:- Phase 2: Ground Investigation Report.

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



ĺ	DCPC	MG	495 / 215	15.00 - 35.00	1 – 17
	DCPC	NS	770 / 275	1.18 - 4.55	61 – 253

# 5.0 Insitu Testing (Cont'd)

## 5.3 Insitu TRL Dynamic Cone Penetrometer Tests (Cont'd): -

A summary of the DCP tests results is as follows: -

- CBR values ranging from 1% to 249% have been recorded for the initial made ground.
- CBR values ranging from 3% to 253% have been recorded for the initial made ground

When considering the higher CBR values noted, it is felt that these have been influenced by the coarse nature of the materials tested and occasional presence of cobbles. Therefore, if the existing road infrastructure is to be used within the proposed development a conservative design CBR value of 4% should be taken the existing subbase whilst a design CBR value of 4% taken for the initial natural drift deposits.

## 5.4 Insitu Gas & Water Monitoring: -

When considering the areas of infilled land within a plausible distance to the site (as identified within the Phase 1: Desk Top Study previously completed for this site), ground gas & water monitoring standpipes were installed within WS01, WS04 & WS07, primarily to check for the possible presence of hazardous ground gases, and to monitor any shallow water levels. A standard 50mm diameter HDPE standpipe, with gravel and geowrap surround, bentonite seal, gas valve cap and security cover, was installed within each borehole, and ground gas and water levels were allowed to reach equilibrium, prior to the first monitoring visit. Monitoring was undertaken using a Gas Data GFM series soil gas analysers, with integral flow meter, and a Geotechnical Instruments electronic dipmeter. The response zones were designed to target any ground gas from on and off site sources.

Based on the DTS and findings of the intrusive investigation works, in accordance with CIRIA Report C665, November 2007, Report Edition No. 04, March 2007 and BS8485:2015+A1 2019 – Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- The development has been considered as **high sensitivity** i.e. residential type development (Tables 5.5a & 5.5b Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).
- The risk associated with the generation potential of a source is considered as **very low** (Based on the findings of intrusive works).
- Monitoring over a **minimum** of **three months** with **six recorded** readings (Tables 5.5a & 5.5b Typical /idealised frequency and period of monitoring after Wilson et al, 2005).
- **Negligible** flow rates are recorded during the monitoring period (Table 8.5 Modified Wilson & Card classification).
- A targeted and phased programme of gas monitoring will be completed, which will obtain gas monitoring readings during varying atmospheric conditions, which covers the 'worst case' scenario for ground gas emissions to occur, particularly during rapid falls in atmospheric pressure (i.e. from c.1020mb and c.1010mb), and also during low atmospheric pressure events (i.e. c.1000mb and below).

For this site, the monitoring visits undertaken to date were taken during variable atmospheric pressure trends. Proposed monitoring visits will also be undertaken at variable atmospheric pressure trends to correlate with differing conditions. Monitoring of the weather conditions and predicated atmospheric pressures (Met Office Surface Pressure Charts) will be carried out up to 72 hours in advance of proposed monitoring visits, in order that a reasonable period of data is obtained to determine atmospheric trends, and also to target the 'worst case' scenario.



# 5.0 Insitu Testing (Cont'd)

## 5.4 Insitu Gas & Water Monitoring (Cont'd): -

A summary of the results for the visits undertaken to date, compared with the 'inert' background gas levels is presented in Table 5.4 below, whilst a copy of the monitoring certificate is attached in Appendix III. A further three monitoring visits have been scheduled and the results along with the final recommendations will be issued as an addendum report.

Table 5.3	<u>Lable 5.3</u>								
Position	<u>Date</u>	<u>Atmospheric</u> Pressure	<u>Water</u> (m bgl)	<u>CH4</u> <u>(%v/v)</u>	<u>LEL</u> <u>(%v/v)</u>	<u>CO2</u> (%v/v)	<u>O2</u> (%v/v)	<u>Flow Rate</u> <u>(1/hr)</u>	
		(mbar)	<b>→ 8</b> /	<del>,,</del>	<u>, , , , , , , , , , , , , , , , , , , </u>	<del>, , . , ,</del>	<del>,,</del>	<del>~~~~/</del>	
Background				0	0	0	21.0	< 0.1	
WS01			Dry	0.0	0.0	1.8	17.8	< 0.1	
WS04	02/06/21	997 Falling	Dry	0.0	0.0	0.4	18.4	< 0.1	
WS07			Dry	0.0	0.0	3.1	17.9	< 0.1	
WS01			Dry	0.0	0.0	2.8	16.7	< 0.1	
WS04	16/06/21	999 Steady	Dry	0.0	0.0	1.2	17.5	< 0.1	
WS07			Dry	0.0	0.0	3.4	18.5	< 0.1	
WS01			Dry	0.0	0.0	2.9	15.1	< 0.1	
WS04	09/07/21	1011 Rising	Dry	0.0	0.0	0.9	17.6	< 0.1	
WS07			Dry	0.0	0.0	3.8	16.5	<0.1	
	3 no. outstanding visits to be completed – results to follow as Addendum Letter Report.								

\* Note – Atmospheric trend taken from www.weatheronline.co.uk for Newcastle International. Airport.

From the results undertaken to date, no levels of Methane (CH<sub>4</sub>) have been recorded during the monitoring period. However, detectible concentrations of Carbon Dioxide (CO<sub>2</sub>) have been recorded, up to a maximum recorded level of 3.8% v/v, with associated oxygen (O<sub>2</sub>) concentrations (minimum 15.1% v/v). A negligible flow rate of <0.11/hr has been recorded during the monitoring period undertaken to date.

Based on the results undertaken to date, in accordance with CIRIA Report C665, an initial risk assessment has been completed for this site, by converting the results in Table 5.3 above to a gas screening value (GSV), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates (after Wilson & Card). Using the maximum values recorded, as no increased levels of Methane have been recorded, the GSV for Carbon Dioxide only has been calculated, the results of which are shown below:

## Carbon Dioxide GSV = 0.038 (3.8%) x 0.1 = 0.0038 1/hr

When considering these results, in accordance with CIRIA C665, and considering the NHBC Traffic light system (low rise housing with ventilated underfloor void), the GSV value for CO<sub>2</sub> is below the assessment GSV of 0.78 l/hr (Green classification), resulting in no gas protection measures being required. Alternatively, if the proposed development were to comprise ground bearing floor slabs within the structures, in accordance with CIRIA C665, the GSV for CO<sub>2</sub> would also fall below the lower target concentration of 0.07l/hr and would equate to a Characteristic Situation 1 (CS1) site classification, resulting in no gas protective measures being required for the proposed development.

However, following completion of the remaining 3 no. gas monitoring visits, a final assessment of these results and recommendations will follow as an addendum to this report.

No water levels have been recorded within the monitoring wells installed on site.

Notwithstanding, it is considered prudent to allow for the introduction of temporary groundwater control techniques (i.e. pumping equipment), in order to take care of any localised ingresses of surface water which



may occur, during the construction period, especially if construction takes place during the wetter periods of the year.

# 6.0 Laboratory Testing

All geotechnical testing was carried out in accordance with BS1377:1990: Parts 1-9 by Professional Soils Laboratory Limited (PSL) of Doncaster, South Yorkshire (UKAS accredited). Ground contamination was undertaken by Chemtech Environmental of Stanley, Co. Durham (UKAS & MCERTS accredited).

## 6.1 Determination of pH & SO4: -

Forty-two samples including samples of the made ground and natural material recovered from the investigation were tested to determine their pH value and soluble sulphate  $(SO_4)$  levels. The results are shown in Table 6.1 below, and are also contained in the Chemtech Environmental Limited Analytical Report (ref. no.: 96936(1)), a copy of which can be seen in Appendix IV.

<u>Table 6.1</u>						
<b>Position</b>	Depth (m)	<u>Strata</u>	<u>SO4 (mg/l)</u>	<u>pH value</u>	<u>Design SO4 Class</u>	ACEC Class
TP01	0.80	MG	100	8.0	DS-1	AC-1
TP01	2.40	NS	124	8.0	DS-1	AC-1
TP02	0.60	MG	87	8.2	DS-1	AC-1
TP03	0.50	MG	356	8.1	DS-1	AC-1
TP03	1.00	NS	167	8.0	DS-1	AC-1
TP04	1.00	MG	108	8.0	DS-1	AC-1
TP05	0.75	MG	31	8.4	DS-1	AC-1
<b>TP06</b>	0.60	MG	44	8.6	DS-1	AC-1
TP07	0.90	MG	591	9.1	DS-2	AC-2
TP07	2.50	NS	190	8.3	DS-1	AC-1
<b>TP08</b>	1.20	MG	1230	8.5	DS-2	AC-2
<b>TP08</b>	1.80	NS	581	8.1	DS-2	AC-2
<b>TP09</b>	1.00	MG	1601	7.9	DS-3	AC-3
<b>TP10</b>	0.80	MG	361	8.4	DS-1	AC-1
TP11	0.30	MG	96	8.5	DS-1	AC-1
TP11	1.30	NS	90	8.8	DS-1	AC-1
TP12	1.50	MG	1643	8.2	DS-3	AC-3
TP13	0.60	MG	106	8.4	DS-1	AC-1
TP14	0.30	MG	21	8.1	DS-1	AC-1
TP14	1.50	NS	81	8.8	DS-1	AC-1
TP15	1.00	MG	220	8.6	DS-1	AC-1
TP16	0.30-0.50	MG	1600	8.2	DS-3	AC-3
TP17	0.80-1.00	MG	370	8.5	DS-1	AC-1
TP17	2.00-2.20	NS	557	8.6	DS-2	AC-2
TP18	0.60-0.80	MG	73	8.3	DS-1	AC-1
TP18	1.40-1.60	NS	13	8.5	DS-1 DS-1	AC-1
TP19	0.00-0.25	MG	56	8.5	DS-1 DS-1	AC-1
TP20	0.70-0.90	MG	529	8.2	DS-2	AC-2
TP20	1.30-1.50	NS	70	8.7	DS-1	AC-1
TP21	0.70	MG	119	8.2	DS-1 DS-1	AC-1
TP22	0.60	MG	66	8.2	DS-1 DS-1	AC-1
TT01	1.00	MG	1495	8.0	DS-2	AC-2
TT02	0.75	MG	1646	8.0	DS-3	AC-3
WS02	1.05-1.20	NS	206	8.3	DS-1	AC-1
WS02 WS04	2.00-2.75	NS	368	8.6	DS-1 DS-1	AC-1
WS04 WS05	1.40	NS	155	8.5	DS-1	AC-1
WS05 WS06	1.02-1.20	NS	192	8.5	DS-1	AC-1
WS07	1.50-2.00	NS	158	8.6	DS-1 DS-1	AC-1
WS08	0.21-0.47	MG	1623	8.1	DS-3	AC-3
WS08	0.85-1.30	NS	1581	8.1	DS-3	AC-3
W 500	0.05-1.50	140	1301	0.1	100-0	110-5

						environmental
WS09	1.30	NS	139	8.7	DS-1	AC-1
WS10	1.90-2.41	NS	36	8.9	DS-1	AC-1

MG = Made Ground, NS = Natural Strata, ACEC = Aggressive Chemical Environment for Concrete site classification

# 6.0 Laboratory Testing (Cont'd)

# 6.1 Determination of pH & SO<sub>4</sub> (Cont'd): -

Based on the results obtained, and based on the mean of the highest 20% results, the site should be given a classification of Class DS-3, in accordance with BRE Special Digest 1: 2005 (3<sup>rd</sup> Edition) and the procedures for determining Sulphate Classification for brownfield locations. When considering the pH values of the materials tested, and assuming potentially mobile groundwater, the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for the site is AC-3.

## 6.2 Determination of Liquid & Plastic Limits: -

Seven representative samples of the natural clay deposits recovered from across the site, were tested in order to determine their liquid and plastic limits, so these materials could be classified. The results can be seen in Table 6.2 below, and are also contained in the PSL Report no. PSL21/4520, a copy of which can be found in Appendix IV.

<u>Table 6.2</u>							
<b>Position</b>	Depth (m)	<u>M/C</u>	LL	<u>PL</u>	<u>PI</u>	<u>Class</u>	<u>% Passing 425µm Sieve</u>
WS01	1.20-1.40	21	40	20	20	CI	92
WS06	1.40	19	46	22	24	CI	94
WS10	1.20	21	45	22	23	CI	93
TP05	1.80	20	47	23	24	CI	93
TP16	1.00-1.20	15	37	18	19	CI	94
TP21	1.50	18	43	21	22	CI	94
TP22	1.50	20	41	20	21	CI	93

M/C = Moisture Content (%), LL = Liquid Limit (%), PL = Plastic Limit (%), PI = Plasticity Index (%), CI = Clay Intermediate.

From these results the deposits tested are inorganic in nature, and when plotted on the plasticity chart, falls within the intermediate plasticity range, and from the resulting plasticity indices, have a low to moderate volume change potential, when taking into account the amount passing the 425µm sieve. Subsequently, the natural materials may undergo some changes in volume, if large changes in their natural moisture content were to occur due to seasonal variations or the like, and if new foundations were to be based within these materials, they would need to be taken down to a minimum depth of 0.90m below finished ground levels.

When considering the above, an increase in this minimum depth will be required where increased depths of made ground/fill and variable strength natural deposits are identified below the site. In addition, should the proposed building extend close to existing vegetation, an increase in the minimum foundation depth may also be required, even if trees are to be removed, to ensure no additional future shrinkage and swelling of these materials occurs. Reference should be made to BS5837:2012, "Trees in relation to design, demolition and construction" along with the NHBC Standards, 'Building near trees'.

## 6.3 Determination of Particle Size Distribution: -

Representative samples of the natural coarse deposits were tested in order to determine their particle size distribution (PSD) so that these materials can be classified. The results of the tests are represented both numerically and graphically on the analytical result sheets (Ref. PSL21/4520), copies of which are attached in Appendix IV and are also summarised in Table 6.3 below.

<u>Table 6.3</u>						]	Particle fractions expressed as %
Position	<u>Depth</u> ( <u>m)</u>	<u>Clay /</u> <u>Silt</u> <u>Fraction</u>	<u>Sand</u> Fraction	<u>Gravel</u> <u>Fraction</u>	Cobble Fraction	<u>Grading</u> <u>Characteristics</u>	Brief Soil Description

Report Type:- Phase 2: Ground Investigation Report.

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



WS04	1.20-2.00	4	5	91	0	Poorly	Sandy silty GRAVEL
TP06	2.00	24	60	16	0	Poorly	Gravelly clayey silty SAND
TP15	2.20	22	7	41	30	Poorly	Sandy silty cobbly GRAVEL

# 6.0 Laboratory Testing (Cont'd)

## 6.3 Determination of Particle Size Distribution (Cont'd): -

From the results of the grading analysis, it can be seen that the samples tested are generally poorly graded with the laboratory results/descriptions generally corresponding with the field descriptions of this material.

## 6.4 Contamination Screening: -

Representative samples (25 no.) of the 1 layer of made ground materials encountered within the trial pits and boreholes were passed onto Chemtech Environmental Ltd of Stanley, Co. Durham so that soil contamination screening could be carried out. The results of all the testing can be found in the Chemtech Analytical Report (ref. no.: 96936(1)), a copy of which can be found in Appendix IV.

Representative samples were screened using a standard generic contamination suite (based on the current CLEA SGV listed analytes with historical additions) which is used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris) of an unknown source.

Although no olfactory or visual evidence of gross contamination was encountered during the site investigation works, given the historic uses across the site and the occasional fragments of ash noted within the made ground, for completeness, speciated PAH, speciated TPH, BTEX and asbestos testing was also undertaken.

No visual evidence of PCB contamination was noted in the exploratory holes around the existing substation on the northern portion of the site therefore, PCB testing was not undertaken.

Owing to the lack of water ingresses during the investigation works within the exploratory holes undertaken on site, eight soil samples have also been subjected to leachate testing.

The contamination results have been used to carryout Level 1 Quantitative Human Health and Controlled Waters Risk Assessment for the ground contamination present and are discussed in Section 7.0.

The total analysis carried out is summarised below:

6.4.1 Soils: -

- 25 no. soil samples screened for a generic (metals and inorganics) soil suite which includes the following determinants; Arsenic, Cadmium, Chromium (III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, pH, and Total Organic Carbon (TOC).
- 25 no. soil samples screened for Speciated Polycyclic Aromatic Hydrocarbons (PAH's) based on the current USEPA 16 PAH's + Benzo(j)fluoranthene.
- 25 no. soil samples screened for Speciated Total Petroleum Hydrocarbons (Aliphatic / Aromatic + BTEX).
- 25 no. soil samples for asbestos.

#### 6.4.2 Leachate: -

- 8 no. soil samples screened for a generic (metals and inorganics) soil suite which includes the following determinants; Arsenic, Cadmium, Chromium (III & VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide, pH, and Total Organic Carbon (TOC).
- 8 no. soil samples screened for speciated Polycyclic Aromatic Hydrocarbons (PAH's) based on the current USEPA 16.



• 8 no. soil samples screened for speciated Total Petroleum Hydrocarbons (Aliphatic / Aromatic + BTEX).

# 7.0 Ground Contamination Risk Assessment

## 7.1 Methodology: -

Following completion of the contamination screening undertaken on various samples recovered from the boreholes and trial pits, a Level 1 generic quantitative ground contamination risk assessment has been undertaken, generally in accordance with Environment Agency (EA) Land Contamination Risk Management (LCRM), October 2020, which superseded CLR11: Model Procedures for the Management of Land.

This quantitative ground contamination risk assessment uses the current UK practice for assessing the risks from land contamination, which is based on the established source-pathway-receptor pollutant linkage methodology and 'suitable for use' approach (Part IIA, EPA 1990 - inserted through Section 57 EA 1995).

Based on the Revised Conceptual Site Model (CSM) for this site (described further in the following Section 7.2), a site-specific screening strategy for the site has been developed (see Section 7.3) and the risks from potential contaminants has been assessed for Human Health and Controlled Waters. The results of the risk assessments can be found in Sections 7.4 (Human Health) and 7.5 (Controlled Waters).

## 7.2 Revised Conceptual Site Model (CSM): -

Following the results of the intrusive investigation works, a Revised Conceptual Site Model (CSM) has been developed for this site, and is represented graphically in Appendix V. In addition, Table 7.1 below summarises the source(s), pathways and potentially sensitive receptors for this site, assuming no remediation, additional protection measures and/or removal of the sources contamination takes place.

Table					
	<u>Sources (S)</u>		<u>Pathways (P)</u>		<u>Receptors (R)</u>
S1	Made ground deposits associated	P1	Ingestion & Dermal	R1	Human health (End users and
	with the construction and demolition		Contact		construction workforce)
	of the previous buildings on site and	P2	Air – Inhalation of Vapour	R2	Groundwater anticipated at
	also historical site use - Recorded to		and Direct Contact with		depth within the solid geology
	a depth of between c.0.80m and		Dust		(Principal Aquifer).
	c.2.30m.				
S2	Potential for localised 'hot spots' of	P3	Plant Uptake & attached	R3	Building materials &
	PCB contamination associated with		soil		protection of water pipes*.
	the electricity Substation on the	P4	Migration through services	R4	Adjacent sites
	northern portion of the site – $No$				
	visible evidence of PCB				
	contamination recorded.				
S3	Potential hazardous ground gas	P5	Surface runoff &	R5	Flora and fauna
	migration associated with off-site		Infiltration		
	sources (infilled land) – No elevated	P6	Direct contact with building		
	readings recorded to date		materials		

#### Table 7.2

\* = Not included in the Human Health & Controlled Waters Risk Assessment

#### 7.2.1 Sources: -

The investigation and this model have identified the potential for land contamination to exist on this site, comprising made ground materials. One layer of made ground has been encountered across the site as detailed in Table 7.1 below;

#### Table 7.1

Made Ground Layer	Encountered
Report Type:- Phase 2: Ground Investigation Report.	Page 12 of 22

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



	<u>TP</u>	<u>WS</u>	<u>TT</u>
A: Grass overlying dark brown sandy gravelly clayey soil with anthropogenic debris noted throughout (Layer A).	01 - 22	01 - 10	01 - 03

# 7.0 Ground Contamination Risk Assessment (Cont'd)

## 7.2 Revised Conceptual Site Model (CSM) (Cont'd): -

#### 7.2.2 Pathways: -

When considering the proposed end use (*Residential With Home Grown Produce*), and without considering treatment, removal or protection measures, there are some potential plausible pathways available for direct contact, dermal contact, ingestion, inhalation, wind (dust / particulate), volatilization, and vertical and lateral transportation below the site.

Within the CLEA Risk Assessment Model for Human Health, there are 3 exposure mediums considered for on site receptors, comprising ingestion of soil containing contaminants, inhalation of contaminated dust/vapours and dermal contact, with up to 10 no. exposure pathways considered, as shown below.

Ingestion of soil and indoor dust 2. Consumption of home-grown produce and attached soil 3. Dermal contact (indoor)
 Dermal contact (outdoor) 5. Inhalation of dust (indoor) 6. Inhalation of dust (outdoor) 7. Inhalation of vapour (indoor)
 Inhalation of vapour (outdoor) 9. Oral background intake 10. Inhalation background intake.

Where the future site has hard cover and below new structures, a number of these pathways may not be available. In addition, when considering the potential pathways for leachate migration, where either hard cover and/or future surface water drainage systems are present, the potential effects of surface infiltration or contaminated surface water runoff will be greatly reduced.

Similarly, when considering the construction work force, exposure pathways through direct contact, ingestion and dust inhalation will be available during part of the construction process, and therefore adequate PPE should be provided to protect the work force during this period.

#### 7.2.3 Receptors: -

Within the CLEA Risk Assessment Model for Human Health, the potential receptors are assessed initially on site end use, followed by a delineation of age category (i.e. child or adult), with default settings for *Residential, Allotment* and *Public Open Space (Park)* end uses based on a child aged 0 to 6 years, *Public Open Space (Residential)* based on a child aged 3 to 9 and *Commercial* end uses based upon an adult working exposure period of up to 49 years (i.e. age 16 to age 65).

Key generic assumptions for Residential and Public Open Space (Residential) are based upon a typical residential property, consisting of a two-storey small terraced house, with private garden, and a Commercial end use based upon a typical commercial or light industrial property, consisting of a three-storey office building (pre-1970). No buildings are anticipated for Allotment or Public Open Space (Park) end uses.

Within the CLEA Risk Assessment Model for Human Health there are 6 no. generic end use categories presently in use, as follows;

Residential - with home grown produce, 2) Residential - without home grown produce, 3) Allotments, 4) Commercial
 Public Open Space - Residential, 6) Public Open Space - Park

When considering the proposed end use of this site, the Level 1 Risk Assessment has taken as:

1) Residential - with home grown produce



For Controlled Waters and assuming a worst case scenario, the primary receptor for this Level 1 Risk Assessment is potential deep groundwater within the underlying solid deposits designated as a Principal Aquifer.

# 7.0 Ground Contamination Risk Assessment (Cont'd)

## 7.3 Screening Strategy: -

Representative samples of the recorded layer of made ground from across the site were screened using a standard generic contamination suite (metals, metalloids and in-organics), which is used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris) of an unknown source. This made ground layer is detailed in Section 7.2.1.

There was no visual, olfactory or analytical evidence of significant heavy or gross contamination, such as waste oils, fuels, etc. or the like found across the site. However, owing to the history of the site and the occasional presence of ash within the made ground, for completeness the samples have also been screened for speciated PAH, speciated TPH, BTEX and asbestos.

No visual evidence of PCB contamination was noted in the exploratory holes around the existing substation on the northern portion of the site, so PCB testing was not undertaken.

As no olfactory or visual evidence of hydrocarbon solvent type contamination was identified across the site during the completion of the fieldworks, it was not considered necessary to undertake a Photoionization Detector meter (PID) for the presence of hydrocarbons or laboratory screening for volatile organic compounds (VOC's) or semi-volatile organic compounds (SVOC's).

To assess the risk posed from the made ground materials to Controlled Waters owing to the lack of water ingresses during the investigation works, representative soil samples of the recorded layer of made ground across the site have also been screened using a standard generic contamination leachate suite and targeted for leachable speciated PAH's & leachable speciated TPH's and BTEX.

## 7.4 Level 1 Generic Quantitative Risk Assessment - Human Health: -

The soil screening results from across the site have been assessed by comparing the maximum values recorded for each analyte to the critical concentration values adopted for this site i.e. based on a residential end use with home grown produce. The results of the testing are contained in Appendix IV, and the risk assessment has been summarised in Table 7.3 below and continued on the following page.

Arrahrta	Critical Conc.	No. of Samples	<u>Max. Conc. (C<sub>M</sub>)</u>	No. of Samples >
Analyte	<u>(Cc)</u>	Screened	Recorded	<u>C</u>
Arsenic	37(1)	25	22	0
Cadmium	11(1)	25	0.6	0
Chromium III	910(1)	25	70	0
Chromium VI	6(1)	25	<1	0
Copper	2400(1)	25	72	0
Lead	200(2)	25	843	11
Mercury	40(1)	25	1.2	0
Nickel	180(1)	25	42	0
Selenium	250(1)	25	1.6	0
Zinc	3700(1)	25	260	0
Cyanide	34(3)	25	<1	0
Speciated PAH's				
Acenaphthene	510(1)	25	0.15	0
Acenaphthylene	420(1)	25	0.12	0

Table 7.3

Report Type:- Phase 2: Ground Investigation Report.

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



Anthracene	5400(1)	25	0.49	0
Benzo(a)anthracene	11(1)	25	1.15	0
Benzo(a)pyrene	2.7(1)	25	1.33	0
Benzo(b)fluoranthene	3.3(1)	25	1.63	0

(1) = LQM CIEH Suitable 4 Use Levels (S4UL Nov 2014 (Revised August 2015)) – Residential with home grown produce – 2.5% SOM, <sup>(2)</sup> = C4SL Values (Residential with home grown produce), <sup>(3)</sup> = ATRISK<sup>SOIL</sup> SSV. NAD = No Asbestos Detected, **Bold** = result exceeds critical concentration, Note = All units are mg/kg.

# 7.0 Ground Contamination Risk Assessment (Cont'd)

## 7.4 Level 1 Generic Quantitative Risk Assessment - Human Health (Cont'd): -

#### Table 7.3 (Cont'd)

Angleta	Critical Conc.	No. of Samples	<u>Max. Conc. (C<sub>M</sub>)</u>	<u>No. of Samples &gt;</u>
Analyte	<u>(C<sub>C</sub>)</u>	Screened	Recorded	<u>C</u>
Benzo(ghi)perylene	340(1)	25	1.06	0
Benzo(k)fluoranthene	93(1)	25	0.56	0
Chrysene	22(1)	25	1.11	0
Dibenz(ah)anthracene	0.28(1)	25	0.26	0
Fluoranthene	560(1)	25	2.12	0
Fluorene	400(1)	25	0.31	0
Indeno(123cd)pyrene	36(1)	25	1.15	0
Naphthalene	5.6(1)	25	1.11	0
Phenanthrene	220(1)	25	1.69	0
Pyrene	1200(1)	25	1.76	0
Asbestos	Presence	25	NAD	0
BTEX				
Benzene	0.17(1)	25	< 0.01	0
Toluene	290(1)	25	< 0.01	0
Ethylbenzene	110(1)	25	< 0.01	0
m & p-Xylene	130(1)	25	< 0.02	0
o-Xylene	140(1)	25	< 0.01	0
Speciated TPH's				
VPH Aliphatic (>C5-C6)	78(1)	25	<0.1	0
VPH Aliphatic (>C6-C8)	230(1)	25	< 0.1	0
VPH Aliphatic (>C8-C10)	65(1)	25	< 0.1	0
EPH Aliphatic (>C10-C12)	330(1)	25	5	0
EPH Aliphatic (>C12-C16)	2400(1)	25	7	0
EPH Aliphatic (>C16-C35)	92000(1)	25	119	0
EPH Aliphatic (>C35-C44)	92000(1)	25	92	0
VPH Aromatic (>EC5-EC7)	140(1)	25	< 0.01	0
VPH Aromatic (>EC7-EC8)	290(1)	25	< 0.01	0
VPH Aromatic (>EC8-EC10)	83(1)	25	< 0.01	0
EPH Aromatic (>EC10-EC12)	180(1)	25	2	0
EPH Aromatic (>EC12-EC16)	330(1)	25	<1	0
EPH Aromatic (>EC16-EC21)	540(1)	25	7	0
EPH Aromatic (>EC21-EC35)	1500(1)	25	8	0
EPH Aromatic (>EC35-EC44) (1) = LQM CIEH Suitable 4 Use Levels (S4UL No	1500(1)	25	2	0

(1) = LQM CIEH Suitable 4 Use Levels (S4UL Nov 2014 (Revised August 2015)) – Residential with home grown produce – 2.5% SOM, (2) = C4SL Values (Residential with home grown produce), (3) = ATRISK<sup>SOIL</sup> SSV. NAD = No Asbestos Detected, **Bold** = result exceeds critical concentration, Note = All units are mg/kg.

The results have identified the following:

- The  $C_M$  value for lead exceeds the  $C_C$  value for this site at 11 locations across the site.
- When considering these results, the made ground across the site represents a potential risk to the proposed end users and therefore either treatment, removal, protection measures and / or further risk assessment will be required.

## 7.5 Level 1 Generic Quantitative Risk Assessment - Controlled Waters: -



Eight soil samples from the made ground, were subjected to leachable screening for metals, metalloids, inorganics, speciated PAH, speciated TPH & BTEX. The results have been used to complete a Level 1 Risk Assessment for the potential impact on Controlled Waters. The results are summarised in Table 7.4 on the following page.

# 7.0 Ground Contamination Risk Assessment (Cont'd)

## 7.5 Level 1 Generic Quantitative Risk Assessment - Controlled Waters (Cont'd): -

Analyta	Target Conc. (C <sub>T</sub> )		<u>Max. Conc. (См)</u>	<u>No. of Samples &gt; <math>C_T</math></u>
<u>Analyte</u>	<u>(μg/1)</u>	Screened	recorded	<u>No. of Samples <math>&gt; C_T</math></u>
Arsenic	10(1)	8	5.71	0
Boron	1000(1)	8	58	0
Cadmium	5(1)	8	< 0.07	0
Chromium	50(1)	8	14.7	0
Copper	2000(1)	8	6.1	0
Lead	25-10(1)	8	14.8	0
Mercury	1(1)	8	0.039	Ō
Nickel	20(1)	8	< 0.5	Õ
Selenium	10(1)	8	0.64	Ő
Zinc	5000 <sup>(1)</sup>	8	4	0
Sulphate	250mg/l <sup>(1)</sup>	8	1099	1
Cyanide	50 <sup>(1)</sup>	8	<20	0
Speciated PAH's	500	0	~20	0
	0.1(1)	0	0.9	8
Acenaphthene	$0.1^{(1)}$ $0.1^{(1)}$	8	<b>0.9</b> <0.1	
Acenaphthylene Anthracene		8		0 7
	$\begin{array}{c} 0.1^{(1)} \\ 0.1^{(1)} \end{array}$	8	0.5 0.3	7
Benzo(a)anthracene		8		1
Benzo(a)pyrene	$0.01^{(1)}$	8	<0.1	0
Benzo(b)fluoranthene	$0.1^{(1)}$	8	<0.1	0
Benzo(ghi)perylene	$0.1^{(1)}$	8	<0.1	0
Benzo(k)fluoranthene	$0.1^{(1)}$	8	<0.1	0
Chrysene	0.1(1)	8	0.1	0
Dibenz(ah)anthracene	0.1(1)	8	< 0.1	0
Fluoranthene	0.1(1)	8	0.2	5
Fluorene	0.1(1)	8	1.0	8
Indeno(123cd)pyrene	0.1(1)	8	<0.1	0
Naphthalene	0.1(1)	8	0.5	0
Phenanthrene	0.1(1)	8	2.4	8
Pyrene	0.1(1)	8	0.2	1
BTEX				
Benzene	1(1)	8	<1	0
Toluene	50(2)	8	<1	0
Ethylbenzene	300(3)	8	<1	0
m & p-Xylene	30(2)	8	<1	0
o-Xylene	30(2)	8	<1	0
Speciated TPH's				
VPH Aliphatic (>C5-C6)	10(1)	8	<1	0
VPH Aliphatic (>C6-C8)	10(1)	8	<1	0
VPH Aliphatic (>C8-C10)	10(1)	8	<1	0
EPH Aliphatic (>C10-C12)	10(1)	8	<1	0
EPH Aliphatic (>C12-C16)	10(1)	8	3	0
EPH Aliphatic (>C16-C35)	10(1)	8	29	8
EPH Aliphatic (>C35-C44)	10(1)	8	<1	0
VPH Aromatic (>EC5-EC7)	10(1)	8	<1	$\overset{\circ}{0}$
VPH Aromatic (>EC7-EC8)	10(1)	8	<1	0
VPH Aromatic (>EC8-EC10)	10(1)	8	<1	0
EPH Aromatic (>EC10-EC12)	10(1)	8	1	0
EPH Aromatic (>EC10-EC12) EPH Aromatic (>EC12-EC16)	10(1)	8	3	0
ELETATIONALC (~ECIZ-ECIO)	10(-7	0	5	U

Report Type:- Phase 2: Ground Investigation Report.

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



EPH Aromatic (>EC16-EC21)	10(1)	8	4	0
EPH Aromatic (>EC21-EC35)	10(1)	8	<1	0
EPH Aromatic (>EC35-EC44)	10(1)	8	<1	0

(1) = UK Drinking Standard, (2) = EQS Freshwater, (3) = WHO Health. **Bold** = result exceeds target concentration, Note = All units are µg/l unless stated.

## 7.0 Ground Contamination Risk Assessment (Cont'd)

#### 7.5 Level 1 Generic Quantitative Risk Assessment - Controlled Waters (Cont'd): -

The results have identified the following:

• The Maximum Concentration (C<sub>M</sub>) values for sulphate, several speciated PAHs and TPH Aliphatic (C16-C35) are recorded to slightly exceed the Target Concentration (C<sub>T</sub>) values taken for this site.

The following hydrogeological and hydrological issues have been taken into consideration when assessing the risks towards the Controlled Waters;

- A continuous groundwater surface (water table) is anticipated at depth within the solid deposits.
- There are no Source Protection Zones (SPZs) recorded on or within 1km of the site.
- There are no Water Abstractions recorded on site or within 500m of the site.
- There are no surface water features within c.250m of the site.

When taking into account the above, the site setting, the proposed end use and based on the leachate screening results, the risk to Controlled Waters is deemed to be negligible and therefore no further risk assessment is required in this regard. Furthermore, remedial works across the site will further reduce the risk.

#### 7.6 Waste Disposal Classification: -

The made ground materials encountered on this site, and which may have to be discarded as a waste to landfill, have been assessed using Technical Guidance WM3 'Guidance on the classification and assessment of Waste' (Version 1.1), in conjunction with the on-line waste classification software tool HazWasteOnline<sup>TM</sup>. Each sample has been assessed separately in order to determine whether all the made ground can be considered as a single waste stream or whether different areas of the made ground represent separate waste streams.

Based on the physical (visual and olfactory) inspection of the all the samples, the made ground has been initially assessed as either 17 05 03 (waste soil and stones containing hazardous substances) or 17 05 04 (waste soil and stones other than those mentioned in 17 05 03) from the WM3 List of Waste (LoW).

In order to determine which waste code applies to each sample, the results of the laboratory testing have been assessed using the HazWasteOnline<sup>TM</sup> software. The results of this assessment are summarised in Table 7.5 on below and continued on the following page, with the full Waste Classification Report attached in Appendix VI.

<b>Position</b>	Depth (m)	WM3 Waste Classification	Waste Code
TP01	0.80	Non-Hazardous	17 05 04
TP02	0.60	Non-Hazardous	17 05 04
TP03	0.50	Non-Hazardous	17 05 04
TP04	1.00	Non-Hazardous	17 05 04
TP05	0.75	Non-Hazardous	17 05 04
TP06	0.60	Non-Hazardous	17 05 04
TP07	0.90	Non-Hazardous	17 05 04

## Table 7.5

Project:- 20-794 – Proposed Residential Development, Amberley Street & Harrogate Street, Sunderland Prepared For: - Thirteen Group



TP08	1.20	Non-Hazardous	17 05 04
TP09	1.00	Non-Hazardous	17 05 04
<b>TP10</b>	0.80	Non-Hazardous	17 05 04
TP11	0.30	Non-Hazardous	17 05 04

# 7.0 Ground Contamination Risk Assessment (Cont'd)

## 7.6 Waste Disposal Classification (Cont'd): -

<u>L'able 7.5</u> (Cont'd)					
<b>Position</b>	Depth (m)	WM3 Waste Classification	Waste Code		
TP12	1.50	Non-Hazardous	17 05 04		
TP13	0.60	Non-Hazardous	17 05 04		
TP14	0.30	Non-Hazardous	17 05 04		
TP15	1.00	Non-Hazardous	17 05 04		
TP16	0.30-0.50	Non-Hazardous	17 05 04		
TP17	0.80-1.00	Non-Hazardous	17 05 04		
TP18	0.60-0.80	Non-Hazardous	17 05 04		
TP19	0.00-0.25	Non-Hazardous	17 05 04		
TP20	0.70-0.90	Non-Hazardous	17 05 04		
TP21	0.70	Non-Hazardous	17 05 04		
TP22	0.60	Non-Hazardous	17 05 04		
TT01	1.00	Non-Hazardous	17 05 04		
TT02	0.75	Non-Hazardous	17 05 04		
WS08	0.21-0.47	Non-Hazardous	17 05 04		

The results of this assessment have identified that the made ground analysed can be classified as Non-Hazardous (waste code 17 05 04).

When considering the values of Total Organic Carbon (TOC) recorded for the majority of the made ground, this is unlikely to meet the Inert Waste criteria, and if these soils are to be removed from site as a waste, they are likely to have to be disposed of at a Non-Hazardous Landfill.

# 8.0 Conclusions & Recommendations

## 8.1 Ground Conditions: -

One distinct layer of made ground was identified across the site and comprised grass overlying dark brown sandy gravelly clayey soil (Layer A) with anthropogenic debris noted throughout the made ground materials to a depth of between c.0.80m and c.2.30m.

Drift deposits generally comprising firm and stiff (medium and high strength) sandy gravelly clay were encountered within TP's 01 - 09, 13 - 14, 16, 21, 22 and WS's 01 - 04, 06 - 08 & 10 to a depth of between c.1.30m and c.>5.00m. Occasional thin bands of sand were also recorded. The remaining positions encountered solid deposits directly below the made ground materials.

Solid deposits comprising weathered limestone becoming less weathered with depth and recovered as sandy clayey limestone gravel were encountered from a depth of c.1.30m to in excess of c.3.50m.

## 8.2 Groundwater & Stability: -



During the investigation works, no water ingresses were noted within any of the excavations undertaken across the site. Furthermore, no water levels have been recorded within the monitoring wells installed on site during the monitoring visits undertaken to date.

Notwithstanding, pockets of trapped surface water should be anticipated within the made ground materials and natural drift deposits below the site and it would be prudent to allow for the introduction of suitable groundwater control measures, to take care of any water ingresses within the made ground and natural strata, particularly during the wetter periods of the year.

# 8.0 Conclusions & Recommendations (Cont'd)

## 8.2 Groundwater & Stability (Cont'd): -

Owing to the nature of the made ground and natural deposits present across the site, adequate lateral trench support will be required for excavations, to prevent trench wall collapse or over excavations, as well as to create a safe working environment, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time. Reference to CIRIA 97 'Trenching Practice' would be beneficial to establish a suitable means of support or battering of excavation sides during construction.

## 8.3 Foundation Options: -

When considering the ground conditions recorded and proposed development, Table 8.1 below details the varying foundations deemed acceptable for the proposed units on site.

Units	<b>Foundation</b>	<u>Bearing strata /</u>	ABP	<u>Comments</u>
	<u>Type</u>	Depth bcgl	<u>(kN/m<sup>2</sup>)</u>	
1-13	Traditional strip	Limestone / c.1.30m	250	~
	foundations and	to c.2.00m		
	mass trench fill			
14-19	Traditional shallow	Clay / c.0.90m to	140	~
	strip foundations	c.1.20m		
20-34	Traditional strip	Limestone / c.1.10m	250	Note: Additional reinforcement and a reduced
	foundations and	to c.1.60m		bearing pressure of 150 is required for units 31
	mass trench fill			& 32 due to inferred line of structural fault
35 & 36	Traditional shallow	Limestone / c.0.90m	150	Note: Additional reinforcement is required due
	strip foundations	to c.1.00m		to inferred line of structural fault
37-68	Traditional strip	Limestone / c.1.05m	250	Note: Additional reinforcement and a reduced
	foundations and	to c.2.30m		bearing pressure of 150 is required for units 65
	mass trench fill			& 66 due to inferred line of structural fault
69-76	Traditional shallow	Clay / $c.0.90m$ to	80	Note: Foundation for units 69 to 72 should be
	strip foundations	c.1.20m		widened and reinforced to consider the shallow
				sand layers.
77-89	Traditional strip	Clay / c.0.90m to	100	~
	foundations and	<b>c</b> .1.60m		
	mass trench fill			
90-98	Traditional shallow	Clay / Sand / 1.00m	75	Note: Foundation for units 90 to 98 should be
	strip foundations	to 1.20m		widened and reinforced to consider the shallow
				sand layers
99-103	Traditional shallow	Thin clay layer /	150	~
	strip foundations	1.30m to 1.50m		

#### <u>Table 8.1</u>

From the results of the pH and soluble sulphate testing carried out, future foundations and buried concrete should be constructed using a concrete design class of DS-3 and ACEC class of AC-3.



If the existing road infrastructure is to be utilised within the proposed development, then based upon the results of these intrusive works a design CBR value of 10.0% is recommended for the existing sub-base materials where these are to be used as an undisturbed subgrade.

If any new access roads, areas of hardstanding, car parking, etc., or ground bearing slabs are to be considered without any ground improvement taking place, then based upon the results of these intrusive works a design CBR value of 2.0% is recommended for the shallow deposits where these are to be used as an undisturbed subgrade.

# 8.0 Conclusions & Recommendations (Cont'd)

#### 8.3 Foundation Options (Cont'd): -

Furthermore, it is recommended that the sub-grade materials are 'proof rolled' to identify any potential 'soft spots' below this development area, and these can be dealt with by introducing an increased thickness of compacted sub-base and/or a geotextile reinforcement. In addition, it may also be prudent to allow for an engineer to attend site during the development works, to confirm the design CBR value of the materials to be utilised prior to construction (e.g. plate bearing tests or similar).

#### 8.4 Hazardous Ground Gas Risk Assessment: -

When considering these results detailed in Section 5.4, in accordance with CIRIA C665, and considering the NHBC Traffic light system (low rise housing with ventilated underfloor void), the GSV value for CO<sub>2</sub> is below the assessment GSV of 0.78 l/hr (Green classification), resulting in no gas protection measures being required. Alternatively, if the proposed development were to comprise ground bearing floor slabs within the structures, in accordance with CIRIA C665, the GSV for CO<sub>2</sub> would also fall below the lower target concentration of 0.07l/hr and would equate to a Characteristic Situation 1 (CS1) site classification, resulting in no gas protective measures being required for the proposed development.

However, following completion of the remaining 3 no. gas monitoring visits, a final assessment of these results and recommendations will follow as an addendum to this report.

#### 8.5 Ground Contamination: -

#### 8.5.1 Made Ground

From the results of the contamination screening, elevated levels of Lead have been recorded within the made ground at shallow depths within eleven locations across the site. Therefore, the made ground represents a potential risk to future end users, where exposure pathways are available. As a result, it is recommended that either treatment, removal, protection measures and / or further detailed quantitative risk assessment is required, potential remedial measures available are discussed further in Section 8.6.

No asbestos fibres have been identified within the samples screened. Consequently, there is no requirement for removal, treatment, protection measures and/or further risk assessment to protect the existing end users (i.e. no risk to Human Health) from potential asbestos fibres.

#### 8.5.2 Controlled Waters

When considering the contamination results, the levels of contaminants in the samples screened are not considered to represent a significant risk to controlled waters or adjacent sites, and as such no further treatment, removal, protection measures and/or DQRA is considered necessary in this regard.



#### 8.5.3 General

When considering the risks to the construction workforce, adequate PPE will be required to provide protection against the levels of contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations.

# 8.0 Conclusions & Recommendations (Cont'd)

#### 8.6 Preliminary Remediation Statement: -

From the results of the contamination screening, elevated levels of Lead have been recorded within the made ground at shallow depths within eleven locations across the site. Therefore, the made ground on site (Layer A) represents a potential risk to future end users, where exposure pathways are available.

In this instance, depending on finished ground levels, the simplest and most expedient remedial options would be to either install a robust clean cover system below all areas of soft landscaping or to fully remove the made ground from all areas of soft landscaping.

If a robust clean cover system is the preferred remedial option, this typically comprises 600mm layer of 'clean' materials comprising 150mm topsoil and 450mm subsoil. This should be placed in all gardens and soft landscaped areas.

Where buildings and areas of hardstanding are proposed then the source-pathway-receptor pollutant linkage will not exist and the made ground can remain in-situ with no requirement to incorporate clean cover materials.

In addition, it is recommended that a 'watching brief' is put in place by the Main Contractor to ensure that any unknown or unforeseen ground contamination that might be present on this site is dealt with appropriately.

Where future remediation works are undertaken, as well as completion of the 'watching brief', confirmatory validation works should be undertaken, i.e. sampling, screening and photographic evidence, etc., and submitted to the Local Authority on completion. Similarly, if remediation works are carried out, it is recommended that a Remediation Statement / Strategy is prepared and agreed with the LA, and validated by a suitably qualified Geo-environmental Engineer to ensure that all works are completed in strict accordance with the agreed Remediation Statement / Strategy.

#### 8.7 General Comments: -

The Phase 1: Desk Top Study Report concluded that the site is not at risk from coal mining or coal mine related activities.

For future site works, adequate lateral trench support will be required for excavations, to prevent trench wall collapse or over excavations, as well as to create a safe working environment, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time.

With regard to asbestos in soil, where we have sampled and tested for asbestos this is discussed in the report. Whilst we would target any asbestos sampling and testing in accordance with a Conceptual Site Model and site findings, there is always the possibility, along with other contamination, that undiscovered asbestos exists



between sample locations and the possibility of unknown asbestos exists on all sites, particularly brownfield sites where previous buildings have been demolished, there were previous features that were infilled (old hollows, pits etc) or where significant quantities of materials such as demolition and brick rubble exist. It is not uncommon for historical asbestos wastes to be deliberately buried on derelict sites, or imported old demolition rubble which could contain asbestos to be imported for use as hardstanding/hardcore. Unless otherwise stated we have not assessed any above or below ground features such as existing buildings, service ducts, basements, culverts, partly demolished or dilapidated structures, spoil heaps, fly tipped materials, security bunds, etc.

# 8.0 Conclusions & Recommendations (Cont'd)

# 8.7 General Comments (Cont'd): -

It is also recommended for the development of this site, adequate surface drainage should be designed and installed by a competent contractor, to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any existing or proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new or adjacent old foundation based at a higher level.

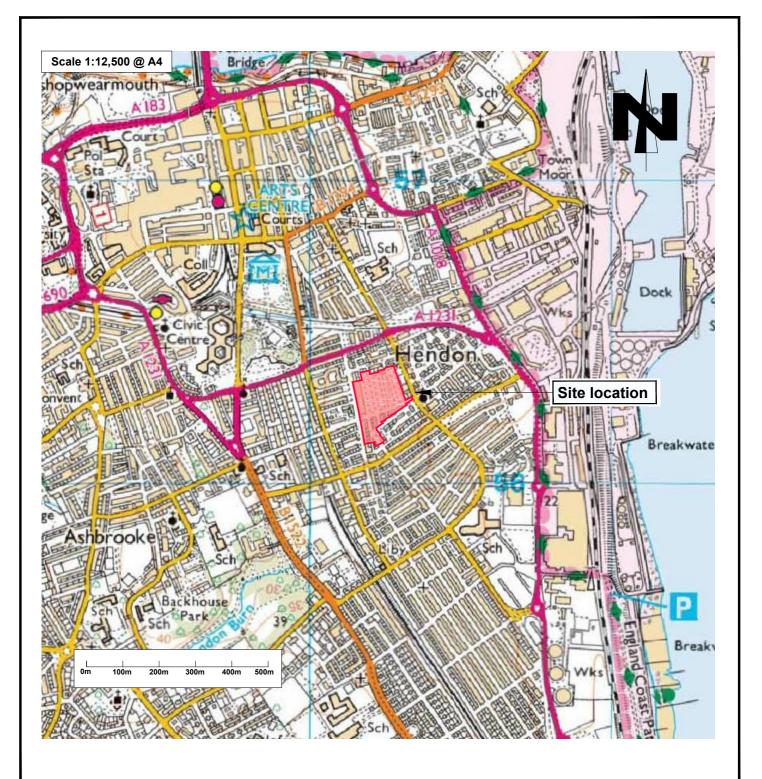
An "observational technique" can be applied to the design and construction of this site, and where ground conditions seem to vary from that indicated from the conceptual ground model derived from works to date, then advice from a suitably qualified Engineer should be sought.

## END OF REPORT



# APPENDIX I

Site Location Plan Aerial Photograph Existing Site Layout Plan Proposed Site Layout Plan



Client:

# **ENGIE REGENERATION**

<b>Project Title:</b> Proposed Residential Dev Land at Amberley Stree Harrogate Street, Hendo	t&	Drawing Location	
Job Reference: Drawing Nur 20-794 -		nber:	Revision: _
<b>Drawn by:</b> P.D	Date: 30.03.21		Scale at A4: As Shown
Checked by: D.M	Approved by: D.M		The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing. © Copyright Reserved



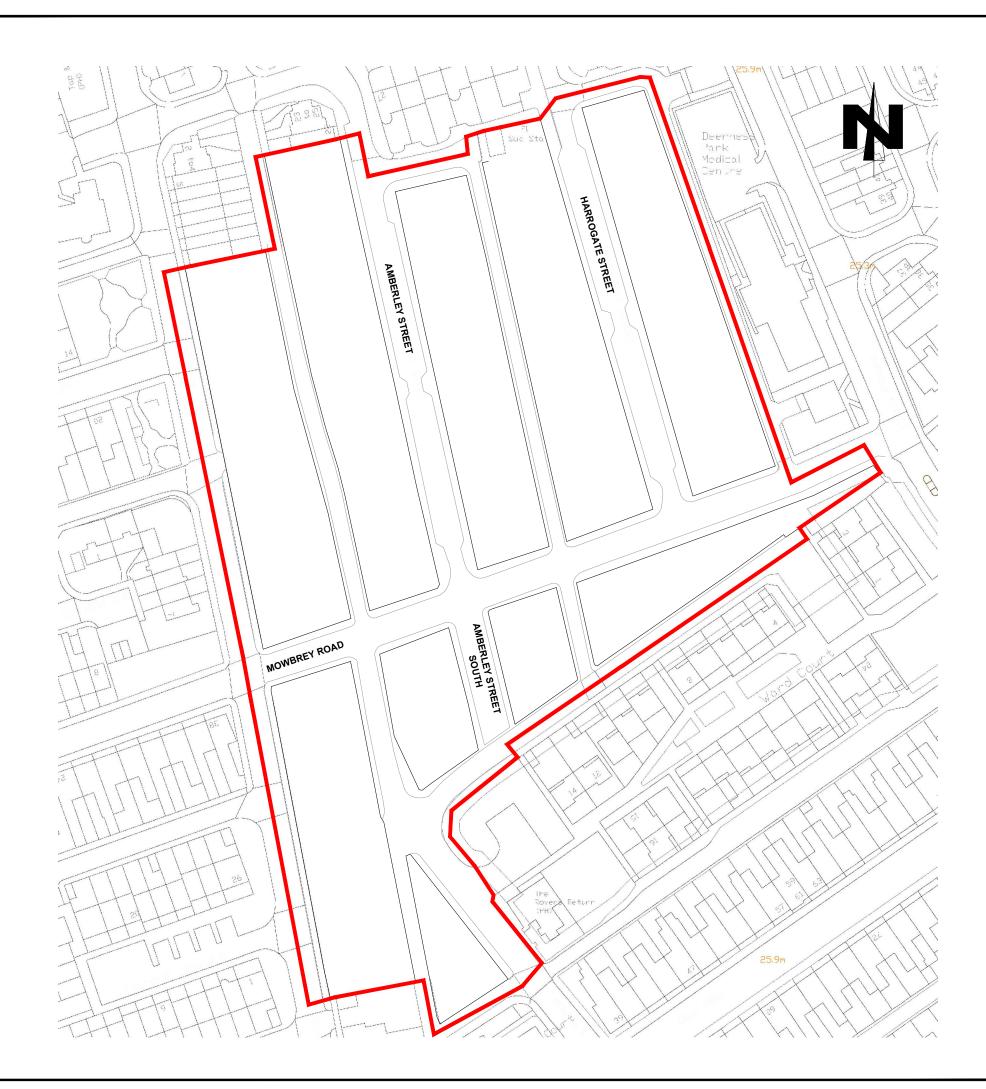
#### ARC ENVIRONMENTAL LTD Solum House Unit 1 Elliott Court St. John's Road Meadowfield Durham DH7 8PN Tel: (0191) 378 6380 Fax: (0191) 378 0494 e-mail: admin@arc-environmental.com

web: www.arc-environmental.com

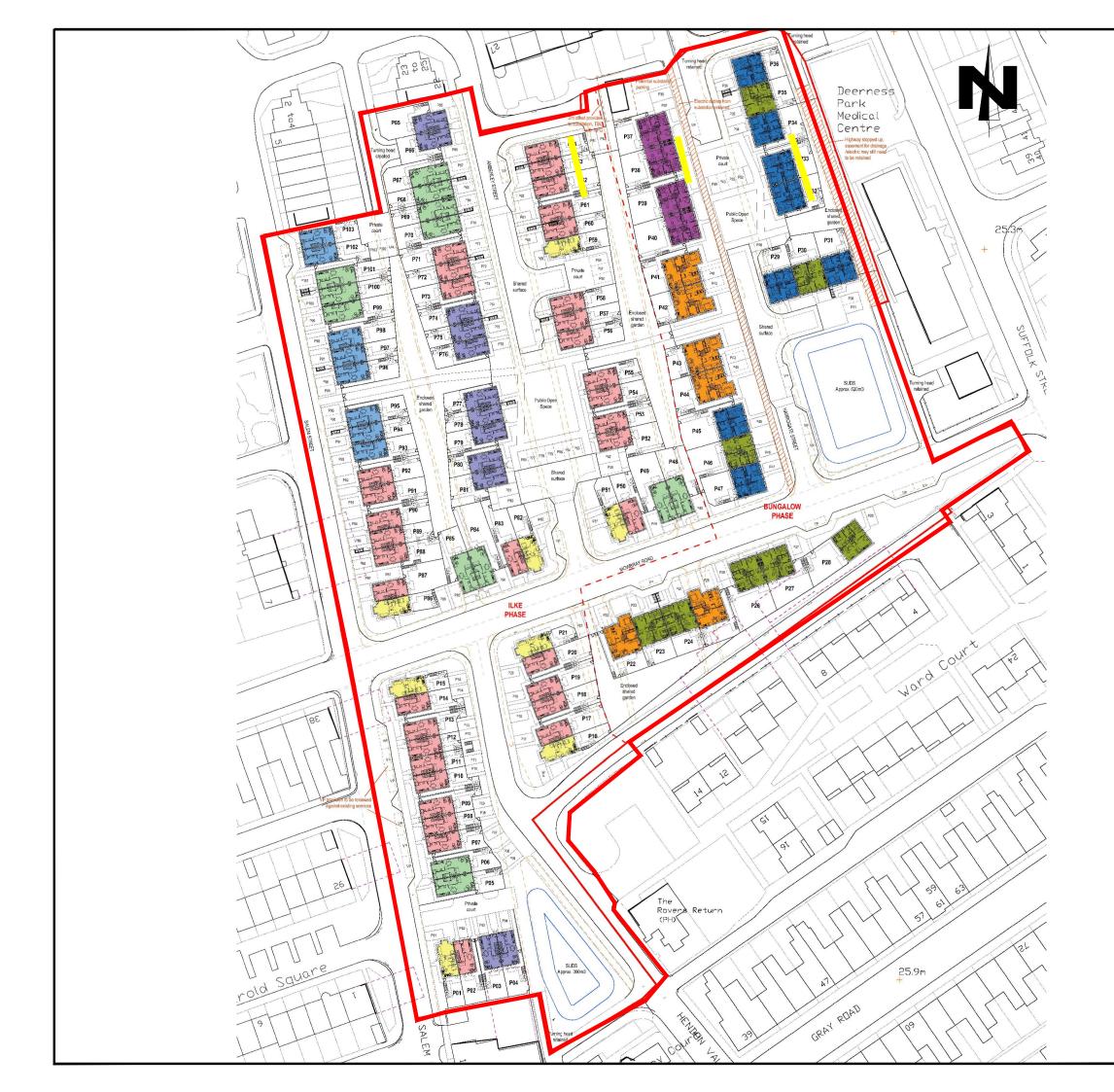




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rev. date amendments Client:	drawn chckd
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Drawing Title: Aerial Photograph	
Scale at A3:         Date:         Drawn by:         Ap           NTS @ A3         30.03.21         P.D         D.1           Job Ref:         Drg no:         Re           20-794         -         -	



Arc environmental court         Solum House         Unit 1 Elliott Court         St. John's Road         Meadowfield         Durham, DH7 8PN         Tei: (0191) 378 6380         Fax: (0191) 378 0494         e-mail: admin@arc-environmental.com         web: www.arc-environmental.com         Web: www.arc-environmental.com         Copyright Reserved         LEGEND         APPROXIMATE
SITE BOUNDARY
rev. date amendments drawn chckd
ENGIE REGENERATION
Project Title: Proposed Residential Development Land at Amberley Street & Harrogate Street Hendon, Sunderland, SR2 8ES
Drawing Title: Existing Site Layout Plan
Scale at A3:         Date:         Drawn by:         Approved by:           NTS @ A3         30.03.21         P.D         D.M           Job Ref:         Drg no:         Rev:           20 - 794         -         -
Drawing Title: Existing Site Layout Plan Scale at A3: Date: Drawn by: Approved by: NTS @ A3 30.03.21 P.D D.M



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20-794		_	0	1	



# APPENDIX II

Borehole & Trial Pit Location Plan (Existing & Proposed)

Borehole & Trial Pit Record Sheets

**DCP** Test Reports



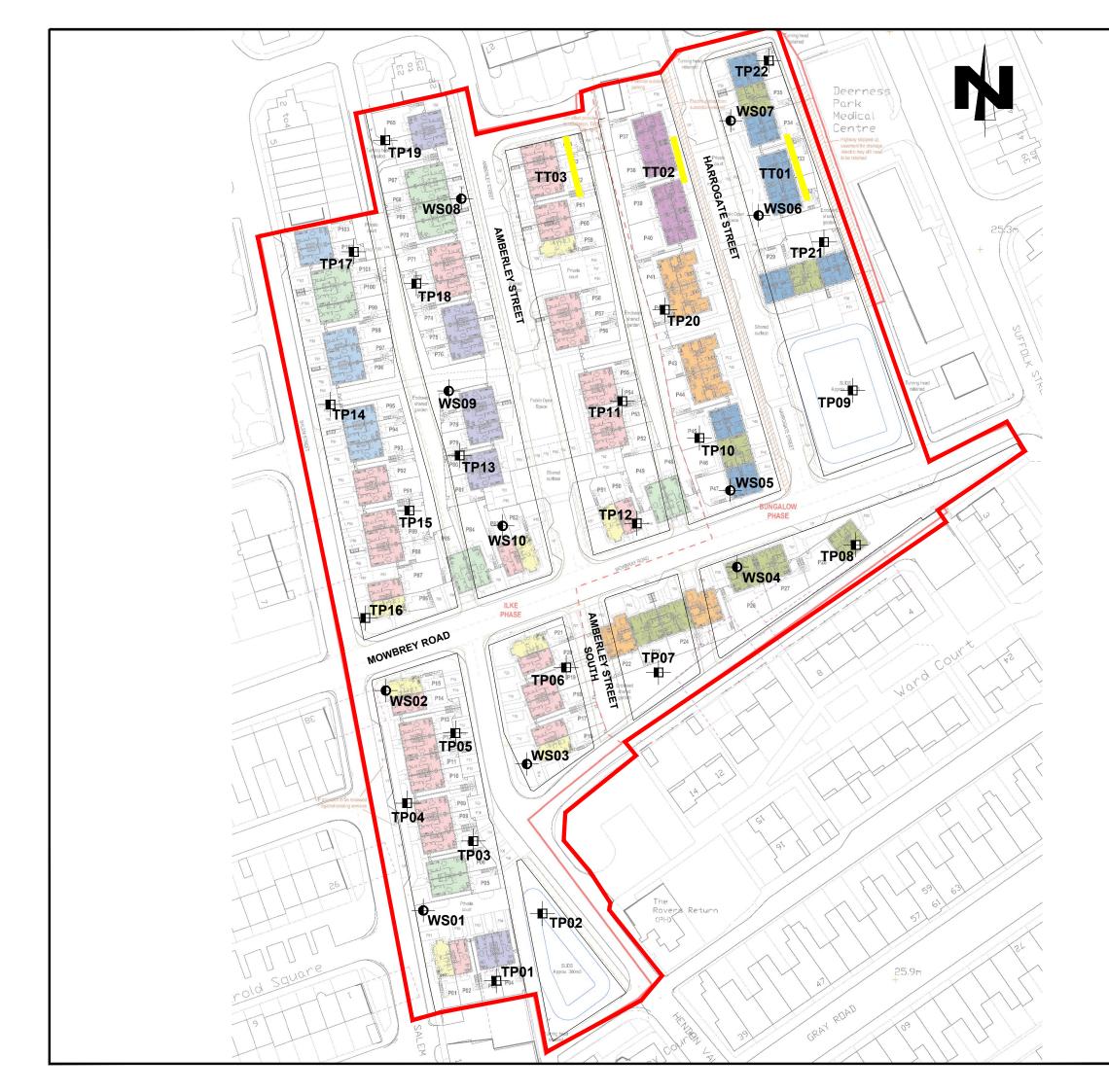
Land at Amberley Street & Harrogate Street

Hendon, Sunderland, SR2 8ES

Drawing Title:

Exploratory Hole Location Plan (Aerial)

Scale at A3: NTS @ A3	Date: 30.03.21	Drawn by: P.D	Approved by: D.M
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20-794		_	_



e-ma we	RC ENVIRONMENTAL LTD Solum House Unit 1 Elliott Court St. John's Road Meadowfield Durham, DH7 8PN Tel: (0191) 378 6380 Fax: (0191) 378 0494 ail: admin@arc-environmental.com
The contract of any	or shall check all dimensions on site before commencerr v works. No dimensions to be scaled off this drawing. © Copyright Reserved
LEGEND 	APPROXIMATE SITE BOUNDARY MECHANICALLY EXCAVATED TRIAL PIT POSITION
	WINDOWLESS SAMPLING BOREHOLE LOCATION 2 TRIAL TRENCH POSITION TO TARGE POTENTIAL FAULT ON SITE
01 28.04.22	Updated Proposed Layout Added P.D
	amendments drawn
rev. date Client:	

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Scale	1:37.5		-	281	-			Plant U	Jsed W	indowles	s Samplir	ng	SW	V	



Project												BOREH	OLE	No	
Prop	posed D	evelop	oment	, Harrog	gate Str	eet, Henc						\\/<	506		
Job No		Da	ate			Ground L	evel (m)	Co-Or	dinates ()						
	794		2	0-05-21					<u> </u>						
Contractor	Entire		1т:	.:								Sheet	£ 1		
	Enviro											1 0	of 1		
SAMPLI	ES & 1		ter –		1	Donth		STRA	TA				- SS	nent	
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick- ness)				RIPTION			Geology	Instrument/ Backfill	
0.28-0.71	В					× × × (1.02)	Grass over dar sandstone and GROUND).	rk browr concret	n sandy gra e and some	velly clayey wood and	y soil with b glass noted (	rick coal MADE			
- 0.71-1.02	В					× × 1.02									
- 1.02-1.20 - 1.20-1.65 - 1.40 - 1.60	B SPT B V	N=14 77kN/n				(1.38)	Firm becomin CLAY. Grave (GLACIOLAC	g stiff (h ls compi CUSTRI	iigh strengt rise medium NE DEPOS	h) brown an n to coarse SITS).	nd grey sand limestone	y gravelly			
2.00	B V	81kN/n	m <sup>2</sup>												
2.40-2.65	В				0.00	2.40	Dense light br	own san	dy GRAVI	EL of limes	tone. Possib	le highly			
- 2.65-2.65	SPT	50			0 1. 0	2.65	weathered lim Borehole term		t 2.65m due	e to refusal				2995	
	ng Proc							isollina		Wator	Added				
	ng Prog Time	Depth		ater Ob Casir Depth   1		Water Dpt	From	iselling To	Hours	From	To	GENE REMA			
Date	1 11110	Depth	<u> </u>	Depth 1	<u> Yia. mm</u>	Dpt		10	nouts	riom	10	Borehole remai completion.		y on	
All dimens	ions in m	netres	Client	Engi	e		Method	/	ind 1	a Qam. 1'	·	Logged By	<b>1</b> 7		
Scale	e 1:37.5						Plant Us	sed W	indowles	s Samplii	ng	SV	V		



Project													BOREH	OLE	No
Prop	osed D	evelopr	nent	, Harrog	gate Str	eet, Hend	lon						۸۸/۹	507	
Job No		Dat				Ground L	evel (n	n)	Co-Oi	rdinates ()			~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	<b>3</b> 07	
20-7	794		2	0-05-21									~		
Contractor	Envino		т :	itad									Sheet	£ 1	
		nmental											10	of 1	
SAMPLE	<u> ES &amp; T</u>	ESTS	Water			Depth			STRA	TA				- VS	ment
Depth	Type No	Test Result	Wa	Reduced Level	Legend	I (Thick- ness)					RIPTION			Geology	Instrument/
0.00-0.43	В					× × ×	conc	s over d rete and DUND).	ark brown some wo	n sandy gra ood slate po	velly clayey ttery and co	y soil with b al noted (M	rick ash and ADE		
0.43-0.78	В					× (1.20)									
0.78-1.20	В					×									
- 1.20-1.50 - 1.20-1.65	B SPT	N=5				(0.30) (1.50)	Firm (GL/	dark br ACIOLA	own sand	y CLAY w NE DEPO	ith some fin SITS).	ne gravel			
1.50-2.00	В					- - - -	Loos	se light b	orown fine	e SAND (G	LACIOLA	CUSTRINE	DEPOSITS).		
- 2.00-2.45	SPT	N=9				(0.75)									
2.25-2.40	B B					2.25	Firm CLA	becomi	ng stiff (l	nigh strengt rise medium	h) brown an n to coarse	nd grey sand limestone	ly gravelly		
2.70	v	110kN/m	2				(UL2	ACIOL	CUSIKI	INE DEPOS	5115).				
- 3.00 - 3.00	B V	120kN/m	2			<u>.</u>									
- - -						(2.35)									
- 3.70 - 3.70	B V	120kN/m	2												
- 4.20	B														
- 4.20-4.60 	SPT	75 Blows			ـــــــــــــــــــــــــــــــــــــ	4.60	Bore	hole ter	minated a	t 4.60m due	e to refusal.				
- - 						- -									
- - -						-									
-															
Borir	l 1g Prog	gress and	 d W	ater Ob	servati	ons		C	hisellin	<u>g</u>	Water	Added	GENE	Γ R Δ I	
	Time	Depth		Casir Depth   I			Fi	rom	То	Hours	From	То	REMA		
													Borehole remain completion.	ned dr	y on
All dimensi	ions in m	etres (	lient	Engie	e			Metho					Logged By		
Scale	e 1:37.5			21151				Plant U	Jsed W	indowles	s Samplii	ng	SV	V	



Project									BORE					OLE	No
1	osed D	-		t, Harrog	gate Str								w<	<b>S0</b> 8	
Job No		D	ate		STRATA							000			
20-7	794		2	20-05-21									01 /		
Contractor	Enviro	monto	11 in	aitad									Sheet	of 1	
									07770				10		
SAMPLE	<u>-S&amp;T</u>		ter			Dopth			STRA	TA				S	ment
Depth	Type No	Test Result	Water	Reduced Level	Legend	(Thick-	0					· · · · · · · · · · · ·		Geology	Instrument/ Backfill
0.21-0.47	J/D					J ·	Gras and s	s over da some wo	od noted	n sandy gra (MADE G	velly clayey ROUND).	y soil with bri	ick concrete		
0.47-0.85	В					, e	Firm	dark bro	own very	sandy CLA	Y with sor	ne fine grave	1		
						(0.38)	(GLA	ACIOLA	CUSTRI	NE DEPOS	SITS).				
0.85-1.30	B				0.00	, <del> </del>	Dens	e light b	rown san	dy GRAVI	EL of limes	tone. Possible	e highly		
0.90-1.29	SPT	75 Blows	5		00.0	(0.45)	weat	hered lin	nestone.						
1.30-1.38	SPT	75 Blows			.000	- 1.30	Bore	orehole terminated at 1.30m due to refusal.							
		Diows	<b>`</b>			-									
			₽			-									
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Dorir	Drog	ross or	nd W	/ater Ob	Corructi	-		Cl	niselling	~	Watar	Added			
	Time	Depth		Casir Casir Depth		Water Dpt	F	om	To	Hours	From	To	GENE REMA		
Dutt	Time	Depu	· 1	Jeptn	Dia. mm	Dpt			10	liouis	110111		Borehole remai		v on
													completion.		
All dimensi Scale	ons in m 1:37.5	etres	Client	Engi	e			Method Plant U	¹∕ Jsed W	indowles	s Samnlii	12	Logged By SV	V	
Source											- ~p.m	0	51	÷	



Project												BOREH	OLE	No
Prop Job No	osed D			, Harrog	gate Str	eet, Hend			1			– ws	509	
JOB NO 20-	794	Dat		0-05-21		Ground L	evel (m)	0-01	dinates ()					
Contractor				0 00 21								Sheet		
Arc	Enviror	nmental	Lim	ited								1 0	of 1	
SAMPLE	ES & T	ESTS	<u> </u>					STRA	TA			L	_	ent/
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick- ness)			DESCI	RIPTION			Geology	Instrument/ Backfill
0.00-0.40	В					×	Grass over d slate and sor	ark brown	n sandy gra sh and coal	velly clayey	y soil with b	rick concrete		
0.40-1.00	В					× × × (1.30)	Side dife 501	ie gluss u		noted (ivit)				
1.00-1.30 1.00-1.45 1.30	B SPT B	N=12				× × ×1.30	Duccing	TONE		anh avaa tha		and alay		
1.30	В					- (1.10)	Buff LIMES infilling (RC	KER FO	RMATION	)	ring and occ	asional clay		
2.00	B SPT	75 Blows				2.40	Borehole ter		<u>+ 2 40m ha</u>	- to mf 1				
	ng Prog							hisellin	ĭ		Added	GENE		
	Time	Depth		Casir Depth I			From	То	Hours	From	То	Borehole remai	RKS	
All dimensi Scale	ons in me 1:37.5	etres C	lient	Engie	e	1	Metho Plant U	d/ Jsed W	indowles	s Samplir	ng	Logged By SV	V	



Project												BOREH	OLE	No
-	osed D	-		, Harrog	gate Str	eet, Hend			1° 4 0			- ws	<b>S10</b>	
Job No	794	Dat		0-05-21		Ground L	evel (m)	Co-Oi	rdinates ()		PTION			
Contractor	//-		2	0 05 21								Sheet		
Arc	Enviro	nmental	Lin	nited								1 c	of 1	
SAMPLE	ES & T	ESTS	L L					STRA	TA				_	ent/
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thick- ness)			DESCI	RIPTION			Geology	Instrument/ Backfill
0.00-0.37	В					×	Grass over da	rk brown	n sandy gra ass wood a	velly clayey	soil with co	ncrete slate		
0.37-0.70	В					× × × × × (1.20)		Source Br				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
0.70-1.20	В					* (1.20) * *								
1.00-1.45	SPT	N=7				1.20								
1.20	В					4	Stiff brown at	nd grey s	sandy grave	IIY CLAY.	Gravels com	prise medium		
						(0.70)	to coarse mite	stone (C		COSTRIN		<i>)</i> .		
1.65-1.90	В					- - - 1.90								
1.90-2.41	B SPT	75				-	Buff LIMEST infilling (ROI	ONE w	ith honeyco	mb weather	ring and occ	asional clay		
2.00-2.41	SPI	75 Blows				(0.51)	infilling (ROI	XER FUI	KMATION	)				
						2.41	Borehole tern	ninated a	t 2.40m due	e to refusal.				293
						-								
						-								
-						-								
						-								
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-						-								
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						-								
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						-								
						-								
Bori	10 Proo	ress and	l W	ater Ob	servati	ons	Ch	isellin	σ	Water	Added	GENE	DAT	
	Time	Depth		Casin Depth   I		Water Dpt	From	То	Hours			REMA		
		1			<u>Jia. IIIII</u>							Borehole remai	ned dr	y on
												completion.		
All dimensi	ons in m	etres C	lient	Engie	e		Method Plant U	/		- Cor1'		Logged By	7	
Scale	:1:37.5						Plant U	sea W	indowles	s Samplu	ıg	SV	V	



Project										TF	RIAL PIT No	
	pose		pment, Har	rogate Str							TP01	
Job No			Date		Ground Level (m	1)	Co-Ordinates ()				11 01	
	794		19-05	-21						~.		
Contractor	Б		1 1							Sheet		
Arc	Env		al Limited			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					1 of 1	
0		A		В		С		D	0	P	Legend	
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STRATA SA											S & TESTS	
Depth	No			3	DESCRI	PTION			Depth	No	Remarks/Tests	
0.00-1.25	110	Grass ove	rlying dark bi	own sandy	gravelly clavey soi		ken bricks, timber, i	nsulation	Deptil	110	Kennarks/Tests	
		and ceran	nic tile fragme	ents (MADE	GROUND)				0.20-0.30	В		
									0.80	J/D		
1.25-1.60		Orangish	brown very c	layey slightl	y silty SAND (GL	ACIOLAC	CUSTRINE DEPOS	SITS)				
1.60-3.00		Stiff (high	n strength) bro	own and gre	y mottled slightly	sandy slig	ntly gravelly CLAY.	Gravels	1.50	В		
		comprise	medium to co	arse subang	ular sandstone (Gl	LACIOLA	CUSTRINE DEPO	SITS)	1.80	V	$120 \text{kN/m}^2$	
2.50		Recovere	d as a friable	oravel from	2 50m				2.40	В		
2.00		10000010		Bravernom	2.0011							
									-			
Shoring/S	unn	ort:								G	ENERAL	
Stability:	~rP										EMARKS	
							N		Tr	ial pit	remained dry and completion.	
⊨							ł			uie on	completion.	
D			В				M					
		С	¥									
						M. 4 1/						
Shoring/S Stability: D All dimens Sca	ions le 1:	in metres	Client Er	ngie		Method/ Plant Use	d JCB 3	CX	Lo	gged H	By LJ	



Project	-										
-	osed Deve	lopment, Hai	rogate Str							TP02	
Job No		Date		Ground Level (n	1)	Co-Ordinates ()				11 02	
20-79	94	19-05	-21								
Contractor									Shee		
Arc E		ntal Limited			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					1 of 1	
0	A		В		С		D	0	٢	Legend	
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4	STRATA										
		1	ES & TESTS								
-	lo Creation			DESCRI				Depth	No	Remarks/Tests	
0.00-0.90	Grass of GROUN	ND)	rown sandy	gravelly clayey so	li with bro	ken bricks and timb	er (MADE				
								0.30-0.50			
								0.60	J/D		
0.90-2.70	Stiff (hi compris	igh strength) brokes medium to co	own and grey parse subang	y mottled slightly ular sandstone (G	sandy sligł LACIOLA	ntly gravelly CLAY. CUSTRINE DEPO	Gravels SITS)	1.00	v	78kN/m <sup>2</sup>	
1.40	Bricks e	extend to 1.40m	in eastern f	ace of trial pit							
								2.00	В		
								1			
12											
								<u> </u>			
Shoring/Suj	pport:									JENERAL EMARKS	
		<b>&gt;</b>				N A		T	rial pit table or	remained dry and completion.	
	А					Ŧ					
D		В				A					
Shoring/Suj Stability:	С	¥									
All dimensio Scale	ons in metres 1:50	Client E	ngie		Method/ Plant Use	d JCB 3	CX	I	ogged	By LJ	



Project									TI	RIAL PIT No
-	osed Deve	elopment, Ha	rrogate Str							<b>TP03</b>
Job No		Date		Ground Level (m	1)	Co-Ordinates ()				1105
20-7	94	19-05	5-21						~1	
Contractor		ental Limited							Sheet	
			В		C		D			1 of 1
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			SI		SA	MPLE	ES & TESTS			
-	No C		1	DESCRI		1 . 1 . 1	ause	Depth	No	Remarks/Tests
0.00-0.80	Grass	overlying dark b ND)	rown sandy	gravelly clayey so	il with brok	ken bricks and timb	er (MADE			
								0.30-0.50	) B J/D	
0.80-1.20	Firm o	rangish / gravisl	hrown very	candy clightly cilt		GLACIOLACUSTE	INIE	0.00	0,2	
0.00-1.20	DEPO	SITS)	-					1.00	в	
1.20-1.80	Stiff (h	high strength) br	own and gre	y mottled slightly s	sandy grav	elly CLAY. Gravels E DEPOSITS)	s comprise	]		
	meara		ingului sulluc		leopiidi			1.50 1.60	V B	100kN/m <sup>2</sup>
1.80	Trial p	it terminated at	1.80m due to	water ingress from	m possible	relic drain		1.00		
Shoring/Su	pport.							·	6	ENERAL
Stability:	r r • • • •									EMARKS
						N		S	light w	ater ingress from relic drain. Trial pit
⊨						1		r	emained	d stable on
	А	₹				T		<sup>c</sup>	ompleti	011.
D		В				~				
	С	¥								
Shoring/Su Stability: D All dimension Scale	ons in metro	s Client E	ngie		Method/				ogged	By
Scale	Ill dimensions in metres Scale 1:50     Client     Engie     Method/ Plant Used     Logged By       LJ     LJ									



Project									TF	RIAL PIT No	
		opment, Har	rogate Str							TP04	
Job No		Date		Ground Level (n	1)	Co-Ordinates ()				11 04	
20-794	4	19-05	-21						01		
Contractor		tal Limited							Sheet	t 1 of 1	
AICEI			D		<u> </u>						
	<u>A</u>		B		C		D				
	STRATA										
Depth No 0.00-1.10		erlving dork b	rown candy			ken hricks and timb		Depth	ı No	Remarks/Tests	
1.10-1.70	1.10       Grass overlying dark brown sandy gravelly clayey soil with broken bricks and timber (MADE GROUND)         1.70       Firm (medium strength) orangish / greyish brown slightly sandy slightly silty CLAY (GLACIOLACUSTRINE DEPOSITS)									70kN/m <sup>2</sup> >120kN/m <sup>2</sup>	
Shoring/Supj Stability: D All dimension Scale 1	Stability:										
All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX										By LJ	



Project	-											
-	sed Devel	opment, Hai	rogate Str						TP05			
Job No		Date		Ground Level (m)	Co-Ordina	ites ()			11 05			
20-79	94	19-05	-21					~				
Contractor								Sheet				
Arc E		ntal Limited							1 of 1			
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STRATA SAMPLES & T												
Depth N				DESCRIPTI			Depth	No	Remarks/Tests			
0.00-1.10	Grass or fragmen	verlying dark b ts (MADE GR	rown sandy ; OUND)	gravelly clayey soil w	ith broken bricks,	timber and coal						
		× ·	,									
							75	J/D				
							15	J/D				
1.10-1.50	Soft loc Gravels	ally firm (medi comprise medi	um strength)	orangish brown very subangular sandston	sandy slightly gra	velly CLAY.	20	В				
1.50-2.50	-(GLAC	IOLACUSTRI	VE DEPOSI	TS)		1.	40	V	40kN/m <sup>2</sup>			
1.00 2.00	Stiff (hi compris	gh strength) bro e medium to co	own and gre arse subang	y mottled slightly san ular sandstone (GLA	dy slightly gravelly	C DEDOGITO)	80	В				
	1		C C	X		1.	00	V	>120kN/m <sup>2</sup>			
Shoring/Sup	pport:								ENERAL			
Stability:								RE	MARKS			
5	N     Trial pit remained dry and stable on completion.											
									omprotion.			
	Α	▼			T							
D D		В			Я							
	С	¥										
		Cliant D			ethod/			age d D	,			
Shoring/Sup Stability:	ns in metres 1:50	Client E	ngie	M   Pl	ant Used	JCB 3CX		gged By	ĹIJ			



Project	-									
		opment, Har	rogate Str					TP06		
Job No		Date		Ground Level (m)	Co-Ordinates ()			IFUU		
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Contractor							Shee			
Arc Env		tal Limited						1 of 1		
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		S	AMPLE	ES & TESTS						
Depth No				DESCRIPTION		Dept	h No	Remarks/Tests		
0.00-1.20	Grass ove relic serv	erlying dark br ices and coal f	rown sandy fragments (N	gravelly clayey soil with b ADE GROUND)	oroken bricks, concrete	e, timber,				
			U (	,						
						0.60	J/D			
1.20-2.20	Orangish	brown slightly	y gravelly ve	ery clayey SAND with po subangular sandstone wi	ckets of soft very sand	ly clay.				
	Gravels c	comprise medi	um to coarse	subangular sandstone wi	th occasional sandstor	ne cobbles				
	(			-~)						
						2.00	В			
g Shoring/Supp	ort:						(	GENERAL		
Stability:							R	EMARKS		
					N		Trial pit	remained dry and completion.		
					1		stable of	r compiction.		
5 5	А	₮			T					
D		В								
	С	¥								
					J/		T. 1	D		
Shoring/Support: Stability: A C All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX C C Method/ Plant Used JCB 3CX										



Project									TI	RIAL PIT No	
		opment, Hari	ogate Str							TP07	
Job No		Date		Ground Level (n	n)	Co-Ordinates ()				11 07	
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		tal Limited	D		<u> </u>		D			1 of 1	
	A		B		C		D				
	SA	<u>MP</u> LE	ES & TESTS								
Depth No								Deptl	n No	Remarks/Tests	
Depth         No         DESCRIPTION         Depth           0.00-1.00         Grass overlying dark brown sandy gravelly clayey soil with broken bricks, concrete, timber and coal fragments (MADE GROUND)         0.90           1.00-1.75         Orangish brown slightly gravelly very clayey SAND with pockets of soft very sandy clay. Gravels comprise medium to coarse subangular sandstone with occasional sandstone cobbles (GLACIOLACUSTRINE DEPOSITS)         0.90           1.75-2.80         Stiff (high strength) greyish brown slightly sandy slightly gravelly CLAY with occasional coal fragments. Gravels comprise medium to coarse subangular sandstone (GLACIOLACUSTRINE DEPOSITS)         2.00           2.50         2.50									J/D V B	>120kN/m <sup>2</sup>	
Shoring/Supp Stability: D All dimensions Scale 1:	Stability:										
All dimensions in metres Scale 1:50     Client     Engie     Method/ Plant Used     Logged H											



Project	Project									
		pment, Harr	ogate Str							<b>TP08</b>
Job No		Date		Ground Level (m	1)	Co-Ordinates ()				
20-794 Contractor	1	19-05-2	21						Sheet	
	vironment	al Limited							Sneet	1 of 1
			P		C		D			
	A		B		C		D			
4		MPLE	S & TESTS							
Depth No				TRATA DESCRI	PTION					Remarks/Tests
0.00-1.50       Grass overlying dark brown sandy gravelly clayey soil with whole bricks, large timber beams and plastic fragments (MADE GROUND)       1.20         1.50-2.00       Stiff (high strength) greyish brown slightly sandy slightly gravelly CLAY with occasional coal fragments and pockets of very clayey sand. Gravels comprise medium to coarse subangular sandstone (GLACIOLACUSTRINE DEPOSITS)       1.80         2.00-2.30       Stiff (high strength) brown slightly sandy slightly gravelly CLAY. Gravels comprise medium to coarse subangular sandstone (GLACIOLACUSTRINE DEPOSITS)       1.80         2.30-2.60       Completely weathered LIMESTONE recovered as a buff very sandy clayey gravel. Gravels comprise medium to coarse limestone with occasional subrounded limestone cobbles (ROKER FORMATION)       2.50										80kN/m <sup>2</sup> >120kN/m <sup>2</sup> ENERAL
Shoring/Supj Stability: D All dimensions Scale 1	Stability: REMARKS Trial pit remained dry and stable on completion.									
All dimensions in metres Scale 1:50     Client     Engie     Method/ Plant Used     Log										<sup>Зу</sup> LJ



Project									T	RIAL PIT No
-		opment, Har	rogate Str							<b>TP09</b>
Job No		Date		Ground Level (m	1)	Co-Ordinates ()				11 05
20-79	94	19-05-	-21							
Contractor		. 1 1							Shee	
Arc E	A	tal Limited	В		C		D			1 of 1 Legend
3			S1	TRATA					AMPLE	ES & TESTS
Depth No DESCRIPTION Depth									h No	Remarks/Tests
1.25-2.10	fragment sandston	h strength) gre s and pockets e (GLACIOLA	of very claye CUSTRINE	ey sand. Gravels c E DEPOSITS)	omprise m	ly CLAY with occa edium to coarse sub	angular	1.00	J/D V	95kN/m <sup>2</sup>
2.10-2.60	Complete medium FORMA	to coarse limes	LIMESTON	E recovered as a bround	utt sandy led limeste	gravel. Gravels com one cobbles (ROKE)	prise R	2.20	В	
Shoring/Sup Stability: D All dimension Scale	pport: A	B				N + N			R	GENERAL EMARKS remained dry and completion.
	С	<u>¥</u>								
All dimension Scale	ns in metres 1:50	Client Er	ngie		Method/ Plant Use	d JCB 3	CX	]	Logged	By LJ



Project	TRIAL PIT No										
Proposed	<b>TP10</b>										
Job No	Date		Ground Level (m)	Co-Ordinates ()		IFIV					
20-794	19-05	-21									
Contractor						Sheet					
Arc Env	ironmental Limited					1 of 1					
0	Α	В				Legend					
					-						
1					- 1						
2											
3 —					-3						
4			MPLES & TESTS								
Depth No		Depth									
0.00-1.05	Grass overlying dark be concrete blocks, metal	rown sandy gra	DESCRIPTION welly clayey soil with b	roken bricks, timber,							
	concrete blocks, metal	fragments and	coal fragments (MADE	GROUND)							
					0.80	J/D					
1.05-1.40	Buff LIMESTONE wit FORMATION)	h honeycomb	weathering and occasio	nal clay infilling (ROk	XER 1.20	В					
	FORMATION)				1.20	D					
į l											
Shoring/Suppo Stability: D All dimensions i Scale 1:5	ort:					GENERAL					
Stability:	Stability:										
				N		Frial pit remained dry and stable on completion.					
►				1 1	,	sucre on completion.					
s	A			T							
D	В			~							
	C ±										
All dimonsions	n metres Client E1	ngie	Metho	1/	][]	Logged By					
Scale 1:5	All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX LJ										



Project	TRIAL PIT No									
Proposed I	Proposed Development, Harrogate Street									
Job No	Date	Ground Level (m)	Co-Ordinates ()		<b>TP11</b>					
20-794	19-05-21									
Contractor					Sheet					
Arc Enviro	nmental Limited				1 of 1					
	A B			0	Legend					
				-						
				Ē						
4	S	4	MPLES & TESTS							
Depth No		DESCRIPTION		Depth	No Remarks/Tests					
0.00-1.20 Gi	ass overlying dark brown sandy gments, ceramic tiles and conce	gravelly clayey soil with o rete (MADE GROUND)	ccasional brick and sandstone	0.30	J/D					
FC	off LIMESTONE with honeycon	nb weathering and occasion	nal clay infilling (ROKER	1.30	В					
Shoring/Support: Stability:	A B B									
All dimensions in n Scale 1:50	etres Client Engie	Metho Plant U	d/ Jsed JCB 3CX	L	ogged By LJ					



Project	TRIAL PIT No										
-	Proposed Development, Harrogate Street										
Job No	Date		ound Level (m)	Co-Ordinates ()		- TP12					
20-794	19-05	-21				~					
Contractor						Sheet					
Arc Env	ironmental Limited					1 of 1					
	A	B	C		D 0	Legend					
		STRA	TA		SA	AMPLES & TESTS					
Depth No 0.00-2.30	Grass overlying dark by relic services and coal		DESCRIPTION		Dept	h No Remarks/Tests					
2.30-2.50	Buff LIMESTONE wit FORMATION)				1.50	J/D					
Shoring/Suppo Stability: D All dimensions i Scale 1:5	ort: A C B			N + 		GENERAL REMARKS Trial pit remained dry on completion. Unstable and partially collapsing within the made ground materials.					
All dimensions i Scale 1:5	n metres Client E1	ngie	Method/ Plant Us	ed JCB 3	CX	Logged By LJ					



Proposed Development, Harrogate Street       TP13         Joh No       Date       Ground Favel (m)       Co-Odinate ( )       Site ( )         Arce Environmental Limited       I of 1       1 of 1       1 of 1         0       Arce Environmental Limited       I of 1       1 of 1         1       0       Arce Environmental Limited       I of 1       1 of 1         1       0       Arce Environmental Limited       I of 1       I of 1         1       0       Arce Environmental Limited       I of 1       I of 1         1       0       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1         1       I of 1       I of 1       I of 1       I of 1	Project									TI	RIAL PIT No		
100-10     Date     Determine (m)     Coolination (r)       20-794     19-05-21     Sheet     1 of 1       1     Arc Environmental Limited     0     1 of 1       0     A     B     C     D       1     -     A     B     C       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       2     -     -     -     -       3     -     -     -     -       3     -     -     -     -     -       3     -     -     -     -     -       1     -     -     -     -     -       2     -     -     -     -     -       1     -     -     -     -     -       1.00-1.00     -<	-	pose			rogate Str							TP13	
Contractor Arc Environmental Limited			1			Ground Level (m	1)	Co-Ordinates ()				11 10	
Are Environmental Limited       I of 1         0       Are Environmental Limited       I of 1         1       I of 1       I of 1         1       I of 1       I of 1         2       I of 1       I of 1         2       I of 1       I of 1         3       I of 1       I of 1         4       I of 1       I of 1         3       I of 1       I of 1         4       I of 1       I of 1         3       I of 1       I of 1         4       I of 1       I of 1         1       I of 1       I of 1		794		19-05	-21						CI		
A     B     C     D     Image: Constraint of the second of th		Env	ironmon	allimited							Shee		
0       0	Aic	EIIV					<u> </u>						
Image: state in the state	1												
Depth       No       Depth       No       Remarks/Tests         0.00-1.00       Grass overlying dark brown sandy gravelly clayey soil with broken bricks, concrete, timber and metal (MADE GROUND)       0.60       JD         1.00-1.60       Firm (medium strength) dark brown sandy slightly gravelly CLAY. Gravels comprise medium to coarse subangular sandstone (GLACIOLACUSTRINE DEPOSITS)       1.20       V       V       70kN/m²         1.60-3.60       Completely weathered LIMESTONE recovered as a buff slightly clayey sandy gravel. Gravels comprise medium to coarse limestone with occasional subrounded limestone cobbles (ROKER FORMATION)       3.00       B       4         Shoring/Suport:       Stability:	3												
0.00-1.00       Grass overlying dark brown sandy gravelly clayey soil with broken bricks, concrete, timber and metal (MADE GROUND)       0.60       J/D         1.00-1.60       Firm (medium strength) dark brown sandy slightly gravelly CLAY, Gravels comprise medium to coarse subangular sandstone (GLACIOLACUSTRINE DEPOSITS)       1.20       V       70kN/m <sup>2</sup> 1.60-3.60       Completely weathered LIMESTONE recovered as a buff slightly clayey sandy gravel. Gravels comprise medium to coarse limestone with occasional subrounded limestone cobbles (ROKER FORMATION)       3.00       B         Shoring/Support:       Stability:       3.00       B       Centered as a buff slightly clayey sandy gravel. Gravels completely weathered uses in metal of a slightly clayey sandy gravel. Gravels completely weathered as a buff slightly clayey sandy gravel. Gravels completely weathered uses in the coarse limestone with occasional subrounded limestone cobbles (ROKER FORMATION)       B         Shoring/Support:       Stability:       3.00       B         C       B       Centered as a buff slightly clayey sandy gravel. Gravels completely weathered uses completely as a slightly clayey sandy gravel. Gravels completely as a slightly clayey sandy gravel. Gravels completely weathered uses completely weathered uses completely as a slightly clayey sandy gravel. Gravels completely as a sl											1		
Image: Index of the index		No										Remarks/Tests	
Shoring/Support:   Stability:     A   C     Method/     Logged By	1.00-1.60		Firm (mea to coarse Complete comprise	dium strength subangular sa ly weathered medium to co	ID) ) dark brown ndstone (GI LIMESTON	1 sandy slightly gr ACIOLACUSTR E recovered as a l	avelly CL INE DEPO	AY. Gravels compris DSITS) y clayey sandy grav	se medium el. Gravels	-		70kN/m <sup>2</sup>	
Stability: REMARKS Trial pit remained dry and stable on completion. All dimensions in metres Client Engie Method/ Logged By										3.00	В		
A A C All dimensions in metres Client Engie Method/ Logged By	Shoring/S Stability:	Stability: REMARKS											
All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX Logged By	D										stable or	completion.	
	All dimens	ions le 1 :	in metres	Client Er	ngie		Method/ Plant Use	ed JCB 3	СХ		Logged	By LJ	



Project									TF	RIAL PIT No	
-	sed Devel	opment, Har	rogate Str							TP14	
Job No		Date		Ground Level (n	n)	Co-Ordinates ()				16.14	
20-79	4	19-05	-21								
Contractor									Sheet		
Arc Ei		ntal Limited								1 of 1	
0	A		В		С		D	0	Γ	Legend	
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2-								-2			
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								È,			
3								-3			
								F			
4		STRATA SAMPLES & TI									
			SA	MPLE	S & TESTS						
Depth No			Depth	No	Remarks/Tests						
0.00-0.80	Grass ov GROUN	/erlying dark bi VD)	rown sandy	gravelly clayey so	il with san	dy dolostone gravel	(MADE				
								0.30	J/D		
			11					-			
0.80-1.30	sandstor	rk brown sandy ne (GLACIOLA	CUSTRIN	LAY. Gravels com E DEPOSITS)	iprise medi	um to coarse subang	gular				
1.20				face of trial pit			/				
1.30-2.70						y clayey sandy grav ed limestone cobble		1.50	J/D		
	FORMA	TION)									
		<u> </u>			<u> </u>			-			
2.70	Limesto	ne becoming m	ore competa	ant at base of trial	pit						
-											
								<u> </u>			
Shoring/Sup	port:									ENERAL	
	Stability: REMARKS										
	N Trial pit remained dry and stable on completion.										
	A					Ŧ					
						<b>İ</b>					
		B									
-	С										
Shoring/Sup Stability:		Client E1	ngie		Method/		<u>a</u>	[]	Logged I	By	
g Scale	Scale 1:50 Plant Used JCB 3CX LJ										



Project	TF	RIAL PIT No									
	Proposed Development, Harrogate Street										
Job No	Date		round Level (m)	Co-Ordinates ()			TP15				
20-794	19-05	-21									
Contractor						Sheet					
Arc Env	ironmental Limited	В		2	D		1 of 1				
	A						Legend				
3		STR	ATA		4 S	AMPLE	S & TESTS				
Depth No											
2.00-2.30	0.00-2.00       Grass overlying brown sandy gravelly clayey soil with broken bricks, concrete, timber, metal and pockets of sandy gravelly reworked clay (MADE GROUND)       1.00       J/E										
Shoring/Suppo Stability: D All dimensions i Scale 1:5	ort: A C B					R	ENERAL EMARKS remained dry and completion.				
All dimensions in metres Scale 1:50     Client     Engie     Method/ Plant Used     Logged By       LJ											



Project									TF	RIAL PIT No	
-	Proposed Development, Harrogate Street										TP16
Job No		E	Date		Ground Level (n	n)	Co-Ordinates ()				
20-7	94		20-05-	-21						~	
Contractor			1 * * * 1							Sheet	
Arc	Enviro		al Limited			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					1 of 1
0		A		В		С		D	0	Б	Legend
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									E	-	
									F	 	
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2-									-2	-	
									E		
									F,		
3-									-3		
									E		
4		E_4									
	STRATA S									PLE	S & TESTS
1	No		DESCRIPTION rass overlying dark brown sandy gravelly clayey soil with broken bricks and concrete. Relic								Remarks/Tests
0.00-0.80	W	vall noted	on western f	ace of trial	pit (MADE GROU	II with bro JND)	ken bricks and conc	rete. Relic			
									0.30-0.50	J/D	
0.80-2.20		tiff (mod	ium erhich a	tuon oth) huo	war and anovy mottl	ad ali abili	sandy slightly grave		-		
0.80-2.20	6	Gravels co	omprise media	um to coarse	e subangular limes	stone (GLA	CIOLACUSTRINE	Elly CLAT.	1.00-1.20	В	
		DEPOSIT	5)						1.00	V	68kN/m <sup>2</sup>
									1.80-2.00	В	
									1.80	V	112kN/m <sup>2</sup>
2.20-2.40	B	Buff weat	hered clayey	LIMESTON	E (ROKER FOR	MATION			2.20-2.40	В	
									<u> </u> ]		
Shoring/Su Stability:	Shoring/Support: GENERAL DEMARKS										
Statility.											
L-			<b>-</b> 1				N			ble on	remained dry and completion.
	A		-1				Ŧ				
	1						Á .				
D			B								
	С										
Shoring/Su Stability: D All dimensic Scale	ons in 1	metres	Client Er	ngie		Method/	1	<u>OV</u>	Log	gged I	By
Scale	Scale 1:50     Plant Used     JCB 3CX										



Project									TR	IAL PIT No	
	Proposed Development, Harrogate Street										
Job No		1	Date		Ground Level (m)	Co-Ordinates ()				TP17	
20-7	794		20-05	-21							
Contractor	_								Sheet		
Arc	Env		tal Limited							1 of 1	
0		A		В	(	2	D	0	Γ	Legend	
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				S	ΓRATA			SAM	<b>IPLE</b>	S & TESTS	
-	No				DESCRIPTION			Depth	No	Remarks/Tests	
0.00-1.65		Grass ove (MADE C	rlying dark bi GROUND)	rown sandy	gravelly clayey soil with b	roken bricks, concrete	e and timber	0.20-0.20	J/D		
								0.80-1.00	I/D		
								0.80-1.00	J/D		
		<b>D</b> 00	1 110 55					1.40-1.60	J/D		
1.65-2.30		Buff wear	thered LIMES	STONE (RO	KER FORMATION)						
								2.00-2.20	В		
Shoring/Su	Shoring/Support: GENERAL Stability: REMARKS										
5											
						N A			al pit w	dry. Collapse of valls noted.	
		А				Ŧ					
			В			A					
		0									
Shoring/Su Stability: D All dimensi Scal		С									
All dimensi	onsi	n metres	Client Er	ngie	Metho Plant I	d/	CV	Lo	gged I	By DMC	
Scal	Scale 1:50 Plant Used JCB 3CX DMC										



Project									TF	RIAL PIT No	
	pose		pment, Hai	rogate Str						<b>TP18</b>	
Job No		1	Date		Ground Level (m)	Co-Ordinates ()				11 10	
	794		20-05	-21							
Contractor	_								Sheet		
Arc	Env		tal Limited							1 of 1	
0		A		В		С	D	0	Г	Legend	
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4-											
				S	FRATA			SAM	1PLE	S & TESTS	
Depth	No				DESCRIPTIC			Depth	No	Remarks/Tests	
0.00-1.10		Grass ove GROUN	erlying dark bi D)	rown sandy	gravelly clayey soil wit	h broken bricks and tin	nber (MADE	0.00-0.20	J/D		
0.40		Concrete	noted on sout	hern portion	of trial pit c.0.40m to	c.0.60m. Possible relic	floor slab /				
		foundatio	on.					0.60-0.80	J/D		
1.10-2.50		Buff com	pletely weath medium to co	ered LIMES	TONE recovered as ve ne with occasional sub	ry sandy clayey gravel. rounded limestone cobl	Gravels ples (ROKER				
		FORMA	ΓΙΟΝ)					1.40-1.60	В		
-								-			
Shoring/S	Shoring/Support: GENERAL										
Stability:	Stability: REMARKS										
						N		Tr sta	ial pit	remained dry and completion.	
						1					
		A	▼								
D			В								
Shoring/S Stability: D All dimens Sca		С	<b>X</b>								
All dimens	ions	in metres	Client Er	ngie	Met	hod/			ogged I	Зу	
Sca	Scale 1:50 Plant Used JCB 3CX DMC										



Project									TF	RIAL PIT No	
-	osed Deve	lopment, Ha	rrogate Str							TP19	
Job No		Date		Ground Level (m	1)	Co-Ordinates ()				1613	
20-7	794	20-05	5-21								
Contractor									Sheet		
Arc		ental Limited								1 of 1	
0	A		В		С		D	0	Γ	Legend	
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	STRATA									S & TESTS	
-	No	Depth	No	Remarks/Tests							
0.00-1.10	Grass of lime	overlying dark b stone (MADE (	rown sandy g GROUND)	gravelly clayey soi	l with bro	ken bricks, wire and	fragments	0.00-0.25	J/D		
			5110 01 (2)								
1.00	Dissis	- h h - ( - h t - h - ) -		- 11				0.80-1.00	J/D		
1.00	Black of Buff hi	able (electric) r	LIMESTON	n ogi. E. Becoming more	e compete	nt with depth (ROK	ER				
	FORM	ATION)		0	· · · · ·			1.50-1.70	В		
								1.50-1.70	Б		
<u>,</u>											
Shoring/St	innort:									ENERAL	
Shoring/Su	apport.								R	EMARKS	
5	N     Trial pit remained dry and stable on completion.										
						Ĩ.		st	able on	completion.	
	А	÷				+					
D	_	в				A					
	~										
	С										
Shoring/Su Stability: D All dimensi Scale	ons in metre	G Client E	ngie		Method/			L	ogged I	<sup>3y</sup> DMC	
g Scale	Scale 1:50 Plant Used JCB 3CX									DMC	



Project								TI	RIAL PIT No		
-	Proposed Development, Harrogate Street										
Job No		Date	G	round Level (m	)	Co-Ordinates ()				<b>TP20</b>	
20-794	4	20-05-21									
Contractor									Sheet		
Arc En		al Limited								1 of 1	
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4	I								MDI E	ES & TESTS	
Depth No			511	DESCRIP	TION			Depth		Remarks/Tests	
0.00-1.25	Grass ove	rlying dark brown	sandy grav			ken bricks, slate and	concrete	0.00-0.3			
	(MADE C	GROUND)									
								0.70-0.9	00 J/D		
1.25-1.60	Buff wea	thered LIMESTO	NE (ROKE	R FORMATIO	N)			1.30-1.5	50 B		
1											
Shoring/Sup Stability: D All dimensions Scale 1	horing/Support: GENERAL										
Stability:	Stability: REMARKS										
5						N			Trial pit stable or	remained dry and completion.	
		→				1				· •ompietion.	
	Α	T T									
D		В									
- L	С										
All dimensions	in matros	Client Engie	<u> </u>		Method/				[ ogoed ]	<sup>By</sup> DMC	
Scale 1	:50		,		Plant Use	ed JCB 3	CX			DMC	



Project									TR	RIAL PIT No
-		opment, Har	rogate Str							TP21
Job No		Date		Ground Level (n	n)	Co-Ordinates ()				
20-794 Contractor	1	19-05-	-21						Sheet	
	vironmen	tal Limited							Sheet	1 of 1
			В		C		D			
	A		В							
	STRATA								MPLE	S & TESTS
Depth No									n No	Remarks/Tests
0.90-1.90	0.00-0.90       Grass overlying dark brown sandy gravelly clayey soil broken bricks, concrete, timber and metal (MADE GROUND)       (         0.90-1.90       Firm (medium strength) yellowish brown very sandy CLAY with pockets of very clayey sand (GLACIOLACUSTRINE DEPOSITS)       (								J/D V B	44kN/m <sup>2</sup>
1.90-2.40	(GLACIO	OLACUSTRIN	NE DEPOSI	TS)	meanum u	coarse subangular	sanustone	2.20	в	
2.40-2.70	Complete comprise FORMA	e medium to co	LIMESTON aarse limesto	IE recovered as a ne with occasiona	buff slight ll subround	y clayey sandy grav ed limestone cobble	el. Gravels es (ROKER	2.50	В	
Shoring/Supp Stability:	Shoring/Support: Stability:								R	ENERAL EMARKS
									remained dry and completion.	
	All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX L									<sup>3</sup> y LJ



Project										T	RIAL PIT No
-	pose		pment, Har	rogate Str							<b>TP22</b>
Job No		I	Date		Ground Level (n	n)	Co-Ordinates ()				
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Contractor	г	. ,	1 7 1							Shee	
Arc	Env		al Limited			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					1 of 1
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4											
	STRATA										ES & TESTS
Depth 0.00-1.20	Depth         No         DESCRIPTION           0.00-1.20         Grass overlying dark brown sandy gravelly clayey soil with broken bricks, concrete, timber and							Dep	th No	Remarks/Tests	
0.00-1.20		metal (M	ADE GROUN	ND)	graveny crayey so	ai witti bio	ken oneks, concrete	, unider and			
									0.60	J/D	
									1.00	J/D	
1.20-2.00		Stiff (high	n strength) ora	angish brown	n sandy gravelly (	CLAY with	occasional pockets	of very	]		
		subround	ed limestone c	cobbles (GL	ACIOLACUSTR	INE DEPC	OSITS)	loccasional	1.50 1.50	B V	001 N/ <sup>2</sup>
									1.50	V	80kN/m <sup>2</sup>
2.00-3.10		Stiff (high	n strength) gre	eyish brown	slightly sandy gra	velly CLA	Y with occasional c occasional subround	oal			
		limestone	cobbles (GLA	ACIOLACU	STRINE DEPOS	ITS)	occasional subround	eu			
									2.50 2.50	B V	>120kN/m <sup>2</sup>
3.10-3.70		Light bro	wn very claye	y fine to me	dium SAND with	lamination	ns of stiff dark grey	very sandy			
		clay (GLA	ACIOLÁCÚS	I KINE DEI	/08118)				3.50	В	
									5.50	D	
Shoring/S Stability:	upp	ort:									GENERAL REMARKS
5 Studinty.											
			<b></b>				N A			stable of	remained dry and n completion.
		А	-1				Ŧ				
			В				A				
		С									
All dimens			Client Er	ngie		Method/	1 100.1			Logged	By
Shoring/Support:     3.50     B       Stability:     Image: Stability:     Image: Stability:     Image: Stability:       A     Image: Stability:     Image: Stability:     Image: Stability:       Image: Stability:     Image: Stability:     Image: Stability:     Image: Stability:       Image: Stability:     Image: Stability:     Image: Stability:     Image: Stability:       Image: Stability:     Image: Stability:     Ima										LJ	



Project								TR	IAL PIT No
	osed Deve	lopment, Ha	rrogate Str						TPA
Job No		Date		Ground Level (m)	Co-Ordinates ()				
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Contractor	<b>.</b> .							Sheet	
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								1 1	& TESTS
Depth 1 0.00-0.08	No Plaak (	DESCRIPTION Black asphalt (MADE GROUND)						No	Remarks/Tests
0.08-0.24				cobbled road (MADE	GROUND)				
0.24-0.30	Yellow	ish brown sand	y dolostone g	ravel sub base (MADI	E GROUND)		0.20-0.30	В	
0.30-0.65	Firm da	ark brown sand	y gravelly CI	AY. Gravels comprise	medium to coarse suban	igular			
0.52		t terminated at							
	1			1					
Shoring/Su Stability:	upport:							GE Re	ENERAL MARKS
s Subility.							117		Trial pit remained
					N		dry	/ and sta	able during
	A	-1			Ŧ			piorator	y period.
		в			<b>A</b>				
D	-	D D							
	С								
Shoring/Su Stability: D All dimensi Scale	ons in metre	G Client E	ngie	Met	hod/ ht Used Monually F	waawatad	Lo	gged By	
Scal	e 1:25			Plai	t Used Manually E	acavated			AB



Project										T	RIAL PIT No
	pose		opment, Ha	rrogate Str							TPB
Job No			Date		Ground Level (n	n)	Co-Ordinates ()				пъ
	-794		20-05	5-21							
Contractor			. 1							Shee	
Arc	: Env		tal Limited			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					1 of 1
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	STRATA								SA Deptl		ES & TESTS
Depth 0.00-0.02	No		DESCRIPTION (Black asphalt (MADE GROUND)							n No	Remarks/Tests
0.02-0.22			Grey concrete (MADE GROUND)								
0.22-0.65		Yellowis	h brown sand	y dolostone g	gravel sub base (N	IADE GRO	DUND)				
									0.30-0.5	50 B	
0.65		Trial pit	terminated at	c.0.65m due	to sidewall collap	se.					
		1			1						
Shoring/S	Supp	ort:								( D	JENERAL
Stability:									-		EMARKS
							N			wATEF dry, side	t: Trial pit remained walls collapsing 0.25m bgl.
							1			below c.	0.25m bgl.
		11					<b>İ</b>				
D			В								
		С	<u>+</u>								
Shoring/S Stability:	sions	in metres	Client E	ngie		Method/				Logged	Ву
Sc	Scale 1:25 Plant Used Manually Excavated									AB	



Project										T	RIAL PIT No
	pose		pment, Ha	rrogate Str							TPC
Job No			Date		Ground Level (n	n)	Co-Ordinates ()				II O
L	794		20-05	5-21						~ ~ 1	
Contractor	Eas		al Limited							Shee	
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2									$\Box_2$		
									MPLE	ES & TESTS	
Depth 0.00-0.03	No	Dissister	DESCRIPTION							No	Remarks/Tests
0.00-0.03			Black asphalt (MADE GROUND) Grey concrete (MADE GROUND)								
0.28-0.50		Vallowick	hrown cond	v dolostono /	gravel sub base (M						
0.28-0.50		I CHOWISI	i biowii sanu	y dolosione į	graver sub base (iv	IADE OK	JUND)		0.30-0.5	0 B	
0.50-0.70		Firm dark	brown sandy	y gravelly CI	AY. Gravels con	prise medi	um to coarse subang	gular			
0.70					atural deposits.						
0.70		i nai pit u	erminated at (	c.u. /um m n	atural deposits.						
Shoring/S	upp	ort:								0	GENERAL
Stability:	11									R	EMARKS
							N			WATER	C: Trial pit remained walls collapsing
┝ ┝━──							1		1	pelow c.	0.30m bgl.
		A	₹								
D			В								
		С	▼								
Shoring/S Stability: D All diment Sca	ions	in metres	Client E	ngie		Method/				Logged	By
Sca	All dimensions in metres Scale 1:25 Client Engie Method/ Plant Used Manually Excavated Log								00.00	AB	



Project								TF	RIAL PIT No	
-	osed Deve	lopment, Har	rogate Str						TT01	
Job No		Date		Ground Level (m)	Co-Ordina	ates ()			1101	
20-79	94	19-05	-21					01 4		
Contractor	Invironmo	ntal Limited						Sheet	1 of 1	
					<u> </u>	D				
-				TRATA DESCRIPT			0 		Legend	
0.00-1.70	No       DESCRIPTION         Grass overlying dark brown sandy gravelly clayey soil with broken bricks, concrete, timber and metal (MADE GROUND)       Image: Concrete data and the second datan							J/D B B V	100kN/m <sup>2</sup>	
2.50-2.90	0-2.90 Buff LIMESTONE with honeycomb weathering and occasional clay infilling (ROKER FORMATION)									
Shoring/Su Stability: D All dimensio Scale	A Trial trench remained dry and stable on completion.									
All dimensions in metres Scale 1:50 Client Engie Method/ Plant Used JCB 3CX I										



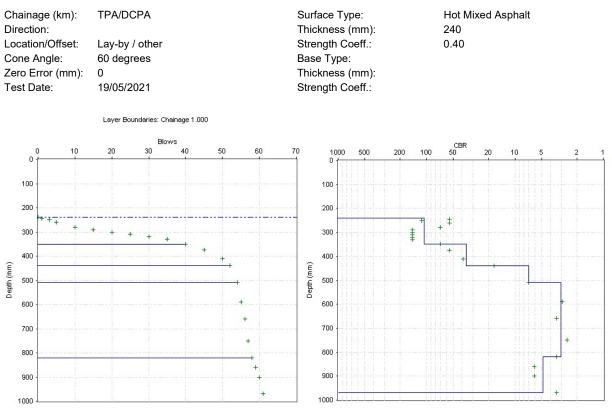
Project								TF	RIAL PIT No
-	-	ment, Harrogate St							TT02
Job No		ate	Ground Level (n	1)	Co-Ordinates ()				1102
20-794		19-05-21						01	
Contractor	vironmenta	1 Limited						Sheet	t 1 of 1
				<u> </u>					
	<u>A</u>	B		C		D			
4-]					C & TECTO				
Depth No	Depth     No     DESCRIPTION								CS & TESTS Remarks/Tests
0.00-1.10	metal (MA)	lying dark brown sandy DE GROUND)					0.75	J/D	
1.10-1.60	(GLACIOL Buff LIME	ly soft) orangish brown I. Gravels comprise mec ACUSTRINE DEPOS STONE with honeycon	TS)				1.20	В	
	FORMATI	ON)					2.00	в	
Shoring/Supp Stability: D All dimensions Scale 1::	ort:								JENERAL
Stability:	A		R	EMARKS nch remained dry le on completion.					
D	С	B			I				
All dimensions Scale 1::	in metres 50	]	Logged I	By LJ					



Project								TRIAL PIT No	
-		opment, Hai	rogate Str					ТТ03	
Job No		Date		Ground Level (m)	Co-Ordi	nates ()		1105	
20-794	f	20-05	-21						
Contractor								Sheet	
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4				TRATA			<u> </u>		
	MPLES & TESTS								
Depth No 0.00-0.90		No Remarks/Tests							
0.00-0.90	Grass overlying dark brown sandy gravelly clayey soil with broken bricks and occasional large concrete boulders (MADE GROUND)								
0.90-1.20	Buff wea	thered LIMES	STONE (RO	KER FORMATION)					
Shoring/Supp Stability:	oort:							GENERAL REMARKS	
stauliny.									
		<b>_</b>			N			rial pit remained dry and table on completion.	
	A	-			Ŧ				
					<b>A</b>				
D		В							
-	С								
All dimensions	in metres	Client E	ngie	Met	hod/			ogged By DMC	
Shoring/Support:   Stability:   A   D   C     All dimensions in metres     Client     Method/   Plant Used   JCB 3CX     Logged By   DMC								DMC	

#### UK DCP V3.1

# DCP Layer Strength Analysis Report Project Name: 20-794 Harrogate Street DCPs



Layer Boundaries Chart



#### Layer Properties

No.	Penetration	CBR	Thickness	Depth to
	Rate	(%)	(mm)	layer bottom
	(mm/blow)			(mm)
1	2.69	106	110	350
2	7.50	36	90	440
3	35.00	7	70	510
4	77.50	3	310	820
5	50.00	5	150	970

#### CBR Relationship:

TRL equation:  $\log_{10}(CBR) = 2.48 - 1.057 \times \log_{10}(Strength)$ 

Report produced by .....