By Email

Our ref: 24-276.01L

Matthew Norris
One17 Design
The Dyehouse
Armitage Bridge
Huddersfield
Est Yorkshire
HD4 7DP

Arc Environmental Ltd
Solum House
Unit 1 Elliott Court
St Johns Road
Meadowfield
Durham
DH7 8PN

27th November 2024

Dear Matthew,

Re: Proposed Residential Development – 4 Caledonian Road, Dewsbury, WF12 9NT – Hazardous Ground Gas Risk Assessment

Following completion of the recent investigation works at the above location, we have pleasure in providing you with our brief ground investigation report. The following documents are attached with this report;

- Borehole Location Plan
- Borehole Record Sheets (WS01 – WS03)
- Ground Gas and Water Monitoring Certificate

1.0 Introduction:-

Arc Environmental Limited were commissioned by One17 Design on behalf of Mr Farook Asmal, to undertake a hazardous ground gas risk assessment at 4 Caledonian Road, Savile Town, Dewsbury where proposals have been made to demolish the existing property and construct a replacement dwelling in its place. The purpose of the investigation was to confirm the potential risk to the development from hazardous ground gas and to establish if gas protection measures are required.

The intrusive investigation works, undertaken by Arc Environmental Limited, comprised 3 no. window sampling boreholes (WS01 – WS03) accompanied by the installation of combined ground gas and groundwater monitoring wells.

The borehole positions can be seen on the Borehole Location Plan attached and this plan should be used for orientating purposes only, as the positions shown are approximate and the plan is not to a standard scale. The information contained in this report is limited to the area of the site as indicated on the borehole location plan attached, and to those areas accessible during the ground investigation.

2.0 Ground Conditions: -

For an accurate description of the ground conditions encountered, reference should be made to the Borehole Record Sheets attached. It should be noted that there is always the possibility of variation in the ground conditions around and between the borehole locations. A summary of the soil profile for the boreholes drilled can be seen in Table 1 below.

Table 1

Type of strata	Depths recorded (bgl)	Description
MADE GROUND:	From 0.00m up to c.0.40m to c.0.60m.	Comprising grass over dark brown slightly gravelly clayey soil and dark brown sandy silty gravelly clay with fragments of brick, concrete and plastic.
SUPERFICIAL DEPOSITS: (Residual Soil)	From c.0.40m to c.0.60m up to c.2.00m to c.2.20m.	Comprising firm becoming stiff sandy silty gravelly CLAY .
SOLID GEOLOOCIAL DEPOSITS (LCM)	From c.2.00m to c.2.20m up to at least c.3.11m.	Comprised variable bands of extremely weak and very weak MUDSTONE and SILTSTONE.

3.0 Groundwater: -

Water ingresses were not encountered within the boreholes, which remained dry and stable throughout the excavation period.

As a result, significant ground water ingress should not be experienced during future construction related excavations. However, it would be prudent to allow for the introduction of groundwater control measures (i.e. pumping equipment), in order to take care of any surface water ingresses and pockets of trapped surface drainage within the made ground and natural strata, particularly during the wetter periods of the year.

4.0 Insitu Testing: -

4.1 Insitu Ground Gas & Groundwater Monitoring: -

Combined ground gas & water monitoring standpipes were installed within the boreholes to assess the site from potential on and off-site sources of hazardous ground gases.

4.0 Insitu Testing (Cont'd): -

4.1 Insitu Ground Gas & Groundwater Monitoring (Cont'd): -

A standard 50mm diameter HDPE standpipe, with gravel and geo-wrap 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. A bentonite seal was installed to prevent excessive surface water ingress or venting of soil gas, with the resulting response zone covering the remaining depths of the installations. Monitoring has been undertaken using a Gas Data GFM series infra-red gas analyser, with integral flow meter, and an electronic free-phase dipmeter.

Based on the findings of the intrusive works, and also in accordance with CIRIA Report C665, November 2007, BS8485:2015 + A1:2019 and BS8576:2013, it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- The proposed residential development has been characterised as *high* sensitivity (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 has been characterised as very low (assessment based on the findings of the intrusive works).
- When taking into consideration the sensitivity and the generation potential of a source this equates to 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).
- A targeted and phased programme of gas monitoring has been completed, which has obtained 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).

A summary of the results for the visits undertaken are presented in Table 2 below and continued on the following page, with a copy of the monitoring results attached.

Table 2 Note – Atmospheric pressure trend taken from www.weatheronline.co.uk for Leeds Bradford Airport.

Position	Date	Atmospheric Pressure (mbar)	Water (m bgl)	CH_4 (%v/v)	LEL (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Flow Rate (l/hr)
WS01	11/009/24	1000-1001 Rising (1004-1026)	DRY	0.0	0.0	1.1	18.4	<0.1
WS02			DRY	0.0	0.0	0.8	19.6	<0.1
WS03			1.32	0.0	0.0	1.1	19.2	<0.1
WS01	25/09/24	994-995 Rising (1005-995)	2.37	0.0	0.0	1.8	19.1	<0.1
WS02			DRY	0.0	0.0	0.9	19.8	<0.1
WS03			1.78	0.0	0.0	4.5	15.7	<0.1

4.0 Insitu Testing (Cont'd): -

4.1 Insitu Ground Gas & Groundwater Monitoring (Cont'd): -

Table 2 (Cont'd) Note – Atmospheric pressure trend taken from www.weatheronline.co.uk for Leeds Bradford Airport.

Position	Date	Atmospheric Pressure (mbar)	Water (m bgl)	CH_4 (%v/v)	LEL (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Flow Rate (l/hr)
WS01	10/10/24	1001-1002 Rising (990-1013)	1.45	0.0	0.0	3.6	16.9	<0.1
WS02			2.00	0.0	0.0	1.7	18.5	<0.1
WS03			1.53	0.0	0.0	0.2	20.2	<0.1
WS01	23/10/24	1025 Steady (1012-1015)	1.43	0.0	0.0	4.5	15.9	<0.1
WS02			2.14	0.0	0.0	2.2	17.4	<0.1
WS03			1.74	0.0	0.0	2.3	17.6	<0.1
WS01	04/11/24	1030 Rising (1022-1030)	1.40	0.0	0.0	4.3	15.6	<0.1
WS02			DRY	0.0	0.0	1.4	17.1	<0.1
WS03			1.50	0.0	0.0	3.9	16.3	<0.1
WS01	18/11/24	1005 Falling (1010-998)	1.40	0.0	0.0	4.1	15.8	<0.1
WS02			2.10	0.0	0.0	1.6	18.4	<0.1
WS03			1.60	0.0	0.0	2.8	17.1	<0.1

From the monitoring visits completed, no detectable concentrations of Methane (CH_4) have been recorded. Concentrations of Carbon Dioxide (CO_2) have been recorded up to a maximum of 4.5% *v/v*, with reduced Oxygen (O_2) concentrations (minimum 15.6% *v/v)*. Negligible flow rates (<0.1l/hr) have been recorded within all monitoring wells during the monitoring visits.

For the purposes of assessing the proposed development, the site is characterised based on the limiting borehole hazardous gas flow rate (Q_{hg}) for Methane and Carbon Dioxide, known as the Gas Screening Value (GSV), which in turn determines the level of any gas protection required, in accordance with Table 2 in BS8485 and Tables 8.5 & 8.7 in CIRIA C665. Therefore, to complete the risk assessment, the maximum GSV for the CH_4 and CO_2 levels recorded have been determined as follows:

- Methane (CH_4) – Due to the lack of Methane recorded, a GSV cannot be calculated.
- Carbon Dioxide (CO_2) - multiplying the maximum concentration recorded (taken as 4.5%) by the maximum flow rate (0.1l/hr.) which gives a GSV of 0.0045 l/hr. (calculated from 4.5% (0.045) x 0.1 l/hr. maximum flow rate) for CO_2.

From these results obtained, the presence of hazardous ground gases does not exceed the GSV assessment value of 0.07 l/hr. (Characteristic Situation 1) for Carbon Dioxide, indicating that no gas protection measures are required for the proposed development.

5.0 General Comments: -

From the results of the groundwater monitoring carried out in the standpipes, standing water levels have been recorded between depths of c.1.32m and c.2.37m bgl. These levels are likely to be reflective of 'perched / trapped' water collecting within the standpipes which will be effectively acting as a conduit for trapped surface infiltration rather than representing a shallow continuous groundwater surface below the site.

We trust the contents of this report is to your satisfaction and if you require any further information or clarification, please do not hesitate to contact us.

Yours sincerely,

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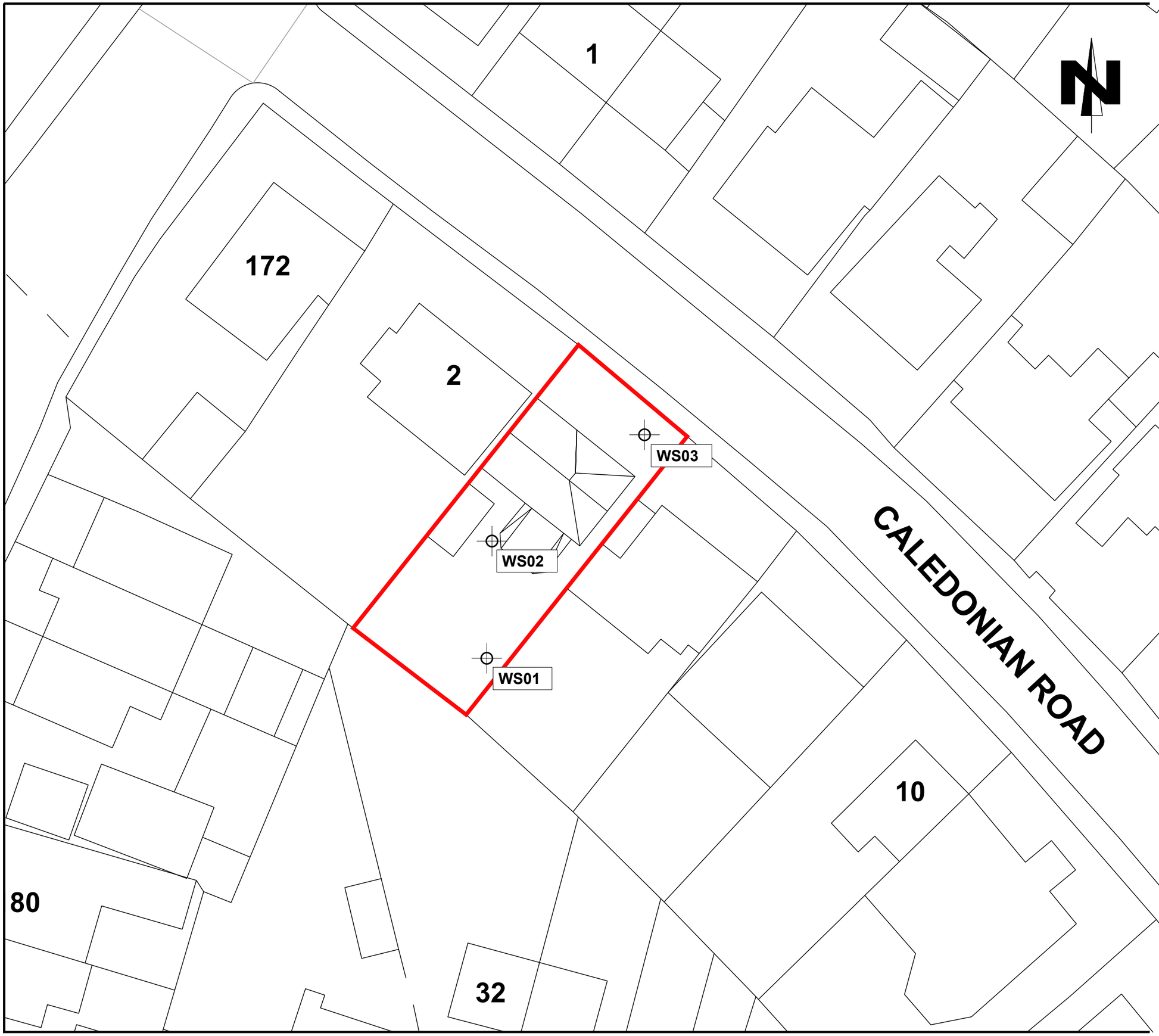
For and on behalf of Arc Environmental Ltd
Darren McGrath MIEnvSc FGS Tech IOSH
Director

Borehole Location Plan



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The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.
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LEGEND	
	APPROXIMATE SITE BOUNDARY
	WINDOWLESS SAMPLING BOREHOLE POSITION

rev.	date	amendments	drawn	chckd

Client:
ONE17 DESIGN

Project Title:
Proposed Replacement Dwelling
4 Caledonian Road, Savile Town
Dewsbury, WF12 9NT

Drawing Title:
Exploratory Hole Location Plan

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	12.09.24	P.D	B.E

Job Ref:	Drg no:	Rev:
24-276	–	–

Borehole Record Sheets

Arc Environmental

BOREHOLE LOG

Project				BOREHOLE No
4 Caledonian Road, Dewsbury				**WS01**
Job No: 24-276	Date: 09-06-24	Ground Level (m)	Co-Ordinates ()	
Contractor: Arc Environmental Limited				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					(0.40) 0.40	Grass overlying dark brown slightly gravelly sandy clayey topsoil (MADE GROUND)		
						(0.40) 0.80	Firm light brown mottled orange and dark brown slighlty gravelly silty very sandy CLAY (RESIDUAL SOILS)		
1.00-1.45	CPT	N=20				(0.70) 1.50	Firm becoming stiff light brown mottled grey and orange sandy silty gravelly CLAY (RESIDUAL SOILS)		
1.50-1.80	B					(0.30) 1.80	Stiff brown mottled dark brown, orange and grey, silty sandy CLAY (RESIDUAL SOILS)		
						(0.20) 2.00	Stiff brown mottled grey and orange silty sandy CLAY (RESIDUAL SOILS)		
2.00-2.45	CPT	N=40				(0.45) 2.45	Extremely weak highly weathered light brown / brownish grey silty sandy MUDSTONE / SILTSTONE (PENNINE LOWER COAL MEASURES)		
2.70-2.80	B					(0.64) 3.09	Very weak becoming weak brownish grey, dark grey / black interbedded MUDSTONE and SILTSTONE (PENNINE LOWER COAL MEASURES)		
3.00-3.09	CPT	75 Blows							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
09-06-24	00.00	3.09	1.00	115mm							Water Observations: Borehole remained dry.

All dimensions in metres Scale 1:21.875	Client: Farook Asmal	Method/ Plant Used: Windowless Sampling	Logged By: BRE

Arc Environmental

BOREHOLE LOG

Project				BOREHOLE No
4 Caledonian Road, Dewsbury				**WS02**
Job No: 24-276	Date: 09-06-24	Ground Level (m)	Co-Ordinates ()	
Contractor: Arc Environmental Limited				Sheet: 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	B					(0.60) 0.60	Dark brown sandy silty gravelly clay with fragments of bricks and plastic (MADE GROUND)		
0.40-0.60	B								
1.00-1.45	CPT	N=12				(0.90) 1.50	Firm becoming stiff light brown mottled grey and orange slightly gravelly silty sandy CLAY (RESIDUAL SOILS)		
1.20-1.50	B								
						(0.50) 2.00	Stiff brown mottled dark brown, orange and grey slighty sandy silty CLAY (RESIDUAL SOILS)		
2.00-2.45	CPT	N=42				(0.45) 2.45	Extremely weak highly weathered light brown / brownish grey silty sandy MUDSTONE / SILTSTONE (PENNINE LOWER COAL MEASURES)		
2.60-3.00	B					(0.61) 3.06	Very weak becoming weak brownish grey, dark grey / black interbedded MUDSTONE and SILTSTONE (PENNINE LOWER COAL MEASURES)		
3.00-3.06	CPT	75 Blows							

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
09-06-24	00.00	3.06	1.00	115mm						

GENERAL REMARKS

Water Observations:
Borehole remained dry.

All dimensions in metres Scale 1:21.875	Client: Farook Asmal	Method/ Plant Used: Windowless Sampling	Logged By: BRE

Arc Environmental

BOREHOLE LOG

Project				BOREHOLE No
4 Caledonian Road, Dewsbury				**WS03**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
24-276	09-06-24			
Contractor				Sheet
Arc Environmental Limited				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10-0.30	B					(0.50) 0.50	Dark brown sandy silty gravelly clay with fragments of bricks and concrete (MADE GROUND)		
1.00-1.45	CPT	N=16				(1.70) 2.20	Firm becoming stiff light brown mottled grey slightly sandy slightly gravelly silty CLAY (RESIDUAL SOILS)		
1.50-1.70	B								
2.00-2.45	CPT	N=32							
						(0.30) 2.50	Extremely weak highly weathered light brown / brownish grey silty sandy MUDSTONE / SILTSTONE (PENNINE LOWER COAL MEASURES)		
2.80-3.00	B					(0.61) 3.11	Very weak becoming weak brownish grey, dark grey / black interbedded MUDSTONE and SILTSTONE (PENNINE LOWER COAL MEASURES)		
3.00-3.11	CPT	75 Blows							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
09-06-24	00.00	3.11	1.00	115mm							Water Observations: Borehole remained dry.

All dimensions in metres Scale 1:21.875	Client Farook Asmal	Method/ Plant Used Windowless Sampling	Logged By BRE

Ground Gas and Water Monitoring Certificate

Arc Environmental Ground Gas & Groundwater Monitoring Certificate

Site:	DEWSBURY
Ref:	24-276

Visit	Date	Time	Equipment	Weather	Initials	Comments	Borehole	Gas Flow (l/hr)	Atmospheric Pressure (mb)	Trend	Methane (% v/v)		Methane (% LEL)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Hydrocarbons (GFM 435 only)		Other Gases (PPM)			Depth to Water (m bgl)
											Initial	Steady	Initial	Steady	Initial	Steady	Initial	Steady	Hex %	PID Cf	PID (Isobutylene)	H_2S	CO	
1	11/09/24	9.45am	GFM435	CLOUDY	PR	WS03 BAILED x 3	WS01	<0.1	1001	Rising (1004-1026)		0.0		0.0		1.1		18.4				0.0	0.0	DRY
							WS02	<0.1	1000	Rising (1004-1026)		0.0		0.0		0.8		19.6				0.0	0.0	DRY
							WS03	<0.1	1000	Rising (1004-1026)		0.0		0.0		1.1		19.2				0.0	1.0	1.32
2	25/09/24	11.00am	GFM435	CLOUDY	PR	WS03 & 05 BAILED x 3	WS01	<0.1	995	Falling (1005-995)		0.0		0.0		1.8		19.1				0.0	0.0	2.37
							WS02	<0.1	995	Falling (1005-995)		0.0		0.0		0.9		19.6				0.0	0.0	DRY
							WS03	<0.1	994	Falling (1005-995)		0.0		0.0		4.5		15.7				0.0	0.0	1.78
3	10/10/2024	11.00am	GFM435	CLEAR	PR	WS03 & 05 BAILED x 5	WS01	<0.1	1002	Rising (990-1013)		0.0		0.0		3.6		16.9				0.0	0.0	1.45
							WS02	<0.1	1001	Rising (990-1013)		0.0		0.0		1.7		18.5				0.0	0.0	2.00
							WS03	5.4	1002	Rising (990-1013)		0.0		0.0		0.2		20.2				0.0	0.0	1.53
4	23/10/2024	10.30am	GFM435	CLOUDY	PR	WS03 & 05 BAILED x 3	WS01	<0.1	1025	Steady (1012-1015)		0.0		0.0		4.5		15.9				0.0	0.0	1.43
							WS02	<0.1	1025	Steady (1012-1015)		0.0		0.0		2.2		17.4				0.0	0.0	2.14
							WS03	3.1	1025	Steady (1012-1015)		0.0		0.0		2.3		17.6				0.0	0.0	1.74
5	04/11/2024	1.00pm	GFM430	CLOUDY	PR	WS03 BAILED x 5	WS01	<0.1	1030	Rising (1022-1030)		0.0		0.0		4.3		15.6				0.0	0.0	1.4
							WS02	<0.1	1030	Rising (1022-1030)		0.0		0.0		1.4		17.1				0.0	0.0	DRY
							WS03	<0.1	1030	Rising (1022-1030)		0.0		0.0		3.9		16.3				0.0	0.0	1.5
6	18/11/2024	10.145am	GFM435	CLOUDY	PR	WS03 & 05 BAILED x 3	WS01	<0.1	1005	Falling (1010-998)		0.0		0.0		4.1		15.8				0.0	0.0	1.4
							WS02	<0.1	1005	Falling (1010-998)		0.0		0.0		1.6		18.4				0.0	0.0	2.1
							WS03	<0.1	1005	Falling (1010-998)		0.0		0.0		2.8		17.1				0.0	0.0	1.6

Notes:

Detection limits - Methane = 0.0%, Carbon Dioxide = 0.0%, LEL = 0.0%, Oxygen = 0.0%, Flow = 0.1l/hr

Monitoring order is from **Left to Right** across table

Monitoring should be for **Not Less** than 3 minutes However, if high concentrations of gasses initially recorded, monitoring should be for up to 10 minutes

N/A = Not applicable = Off the scale

Cf = PID compensation Factor (1-10) - Must be used to multiply the PID reading to give an accuate measure of the total hydrocarbons in the borehole when methane is present

Hex = Hexane (Valid and in range up to 2.000%) - Recorded when abnormally high methane is present.

PID = Photo Ionisation Detector (Calibrated to Isobutylene)