

023/1750/LIZ/at

31st July 2019

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Dear Adam

Goldthorpe Colliery – Gas risk assessment

Further to issue of our Geoenvironmental Appraisal Report (No. 1750/1, dated May 2019), gas monitoring at the above site has now been completed and we are able to issue this supplementary letter report, together with copies of the monitoring results. This letter, which should be read in conjunction with Report No 1750/1, reviews soil-gas conditions, assesses risks and details any mitigation measures required to render the site suitable for the proposed development.

Background

The site is located approximately 10 km east of Barnsley town centre at NGR SE 469 043. The site comprises an area of land of approximately 4.3 hectares (11 acres).

The site can be divided into 2 areas based on ground conditions. Area A is previously undeveloped and is directly underlain by natural arisings; Area B is underlain by colliery spoil and included a railway siding until approximately 1994, when it was no longer shown on historic maps.

In relation to hazardous gas, the above-mentioned report found:

- Area B is underlain by between 1 to 3.7m of made ground which was found to be predominantly inert but that could give rise to low levels of ground gas
- Former underground coal workings are recorded in the area, at approximately 45m, but are not thought to directly underlay the site

Based on the above, it was considered that the site might be at risk from hazardous gas and therefore monitoring wells were installed in 10 boreholes. Details of the individual installations are provided in Report No 1750/1.

The proposed residential development comprises 138 no. 2 & 3 storey dwellings, associated gardens, POS and adoptable roads and sewers, as shown on Drawing 1750/2 in Report No 1750/1. The houses will likely be founded on traditional strip / trenchfill in Area A and a combination of strip / trench fill and piles in Area B, depending on the depth of made ground.

Scope of works

The generation potential of the gas source was initially considered to be Very Low and this has been confirmed by the monitoring results obtained. Consequently, in accordance with CIRIA Report C665, given the proposed residential end use, 6 visits have been completed over a 3 month period, between April and July 2019.



A standard procedure was followed in accordance with CIRIA guidance; this procedure involved measurement, in the following order of:

- Atmospheric temperature, pressure and ambient oxygen concentration on site immediately prior to and on completion of monitoring
- Methane, oxygen and carbon dioxide concentrations and flow rates using a Gas Data GFM430 infra-red gas analyser
- Standing water level using a dipmeter

Gas monitoring results

The monitoring results are enclosed and summarised below:

Monitoring well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
Area A				
WS01	1.5m to 2.5m (coal measures)	N.D	0.3 to 1.6	N.D
WS02	0.5m to 1.5m (granular residual soil)		0.5 to 2.2	
WS03	0.5m to 1.6m (cohesive residual soil & coal measures)		0.5 to 0.9	
WS04	1.0m to 2.0m (cohesive residual soil & coal measures)		0.2 to 1.5	
Area B				
WS05	0.5m to 1.3m (colliery spoil & ash & clinker)	N.D	0.7 to 3.5	N.D
WS06	1.0m to 2.5m (colliery spoil & ash & clinker)		0.0 to 3.1	
WS07	0.8m to 2.8m (colliery spoil & ash & clinker)		0.6*	
WS08	0.5m to 1.0m (colliery spoil)		0.7 to 2.5	
WS09	1.0m to 2.7m (colliery spoil)		0.0 to 1.8	
WS10	0.5m to 1.0m (colliery spoil)		0.3 to 0.9	

Note: Atmospheric pressures varied between 989mb and 1017mb. * Well destroyed after first visit

In accordance with the DETR approach, a default value of 0.1 litres/hour has been used in the absence of any recorded sustained flows; i.e. the limit of detection of the flow rate equipment.

During 3 of the 6 monitoring visits, atmospheric pressure was falling. Plots of atmospheric pressure versus time, with the monitoring visits indicated, are appended to this letter report.

Current guidance

Generic Notes (01 Site Characterisation) outlining how monitoring results are interpreted are enclosed.

Current gas regime

The proposed residential development comprises low rise residential housing. Consequently, the gas regime has been characterised in accordance with the Situation B (traffic light) methodology outlined in CIRIA Report C665.

Based on worst-case (peak) gas concentrations and steady flows, Gas Screening Values (GSVs) for methane and carbon dioxide are both 0.0. This GSV equates to a Green gas regime (traffic light) for this site.

Where Green, Lithos also consider the site in accordance with Situation A methodology (which does not assume a ventilated sub-floor) to check whether or not it lies within Characteristic Situation 1 (in which case no measures would be appropriate), or Characteristic Situation 2 (in which case a ventilated sub-floor void and membrane should be required).

The gas regime for this site is connected to the ground conditions and as such, the gas regime can be considered separately for Area A and Area B.

Area A

No elevations of methane or carbon dioxide were recorded, and no ground gas flows detected. The area is directly underlain by natural strata.

Area A can be classed as Green / Characteristic Situation 1.

Area B

No elevations of methane were recorded, low concentrations of carbon dioxide (max 3.5%v/v) were detected, but no concentration exceeded the Amber 1 lower threshold (5%). No sustained ground gas flows were detected.

The area is underlain by up to 3.7m of made ground and logs indicate made ground is directly underlain by relict topsoil. Relict topsoil typically has a high organic content and can produce low concentrations of carbon dioxide. Whilst neither the made ground, relict topsoil, or potential for shallow mine workings in the area present a significant gas risk, increased protection is recommended.

Area B can be classed as Green / Characteristic Situation 2.

Scope of protection measures

Based on the site characterisation discussed above, Lithos consider that the following protective measures should be incorporated in all new dwellings:

Traffic light classificn and “score” req’d by BS8485#	Floor slab (BS8485 “score”)	Protective measures	
		Sub-floor ventilation (BS8485 “score”)	Membrane
			Type (BS8485 “score”)
Area A			
Green & CS1 (Wilson & Card) 0	Well constructed ground-bearing or suspended	Not required for ground bearing slab, otherwise to comply with Building Regulations (Part C).	Waterproof DPM
Area B			
Green & CS2 (Wilson & Card) 2.5*	Select one from: i. Block & Beam – (0). ii. Reinforced ground bearing slab – (0.5). iii. Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – (1.5). iv. Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – (1.5).	Select one from: Passive sub-floor ventilation; venting layer could be: i. A min. 150mm clear void (2.5), or ii. A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 (2.5), or iii. Min. 300mm thick blanket of min. 20mm single size gravel (1.0). Min. ventilation = 1,500 mm²/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.	Waterproof DPM (2000 gauge polyethylene). Lapped & sealed in accordance with BR 414. (0)

Footnotes:

Scores are broadly based on those outlined in BS8485:2015+A1:2019 (for Characteristic Situations 2 & 3, and Building Type A).

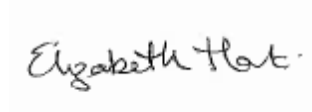
* Modified from BS8485:2015+A1:2019 by Lithos. Monitoring data has also been reviewed using Wilson & Card methodology and found to be Characteristic Situation 2; consequently a lapped/sealed membrane & ventilation are recommended.

1. A combination of two or more of the three types of protection measures (slab, ventilation & membrane) should be used to achieve the BS8485 score.
2. The membrane should always be lapped and sealed in accordance with BRE\Environment Agency Report BR 414 (2001) – "*Protective Measures for housing on gas-contaminated land*". The membrane should be **continuous** across internal walls & the cavity, and there should be a **cavity tray** in external walls.
3. In all cases there should be minimum penetration of floor slab by **services**; any penetrations should be suitably sealed.
4. Integral **garages** with occupied rooms above, or direct access through a doorway from the garage to the house, should be provided with the same protective measures as the rest of the dwelling. Buildings with basement car parks (with ventilation in accordance with Building Regulations) may not require gas resistant membranes.

BRE\Environment Agency Report BR 414 (2001) – "*Protective Measures for housing on gas-contaminated land*" provides a practical guide to good practice for the detailing and construction of passive soil gas protection measures for new residential development. Of particular relevance are a list of 'Watchpoints', which offer practical information for installation and buildability.

We trust the above is sufficient for your present needs, but should you have any queries please contact the undersigned.

Yours sincerely

A handwritten signature in black ink that reads "Elizabeth Hart".

Liz Hart
Associate Director
for and on behalf of
LITHOS CONSULTING LIMITED

Enclosures:

Drawing 1750/6A – Borehole Location Plan
Gas Monitoring Results
Plot of Atmospheric vs Time
Borehole Logs

APPENDIX A

General notes

Current guidance

CIRIA Report 151 (1995)ⁱ identified that there was inadequate guidance on trigger concentrations for ground gases. CIRIA concluded that the most important aspect of a gas regime below or adjacent to a site was the surface emission rate, i.e. how quickly the gas is coming out of the ground. The lower the surface emission rate the lower the risk. CIRIA Report C665 (2006)ⁱⁱ advocates two methodologies (both refer to Gas Screening Values - GSV) for characterising sites:

A – All developments except low rise housing. The advocated methodology is that proposed by Wilson & Card, 1999ⁱⁱⁱ.

B – Low rise housing. An alternative (traffic light) methodology, derived by Boyle and Witherington, 2006^{iv} for NHBC

A – All developments except low rise housing. (Wilson & Card, 1999)^v revised Table 28 of CIRIA 149^v in terms of borehole gas volume flow rate (now GSV) in order to achieve a more consistent design of protection measures. This was done to reflect the importance of recognising the gas surface emission rate. Wilson & Card then developed a method for classifying gassing sites (Table 1 below), which took into account the combined gas concentration and GSV.

Table 1 – Site classification (Wilson & Card)

Characteristic Situation (W&C, 1999)	Gas Screening Value, CH ₄ or CO ₂ (l/hr)	Additional limiting factors	Typical source of generation
1	<0.07	Methane not to exceed 1% v/v and carbon dioxide not to exceed 5% v/v	Natural soils with low organic content
2	<0.7	Borehole air flow rate not to exceed 70 litre/hr otherwise increase to Characteristic Situation 3	Natural soil, high peat/organic content
3	<3.5		Old landfill, inert waste, mineworking flooded.
4	<15	Quantitative Risk Assessment required to evaluate scope of protection measures.	Mineworking – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	<70		Mineworking unflooded, inactive
6	>70		Recent landfill site

Notes:

Borehole flow rate = volume of gas (regardless of composition) which is escaping from well (l/hr).

Gas Screening Value (litre/hour) = gas concentration (%) / 100 x borehole flow rate (l/hr).

To facilitate design implementation, the limiting values for both methane and carbon dioxide are identical.

B – Low rise housing. NHBC have developed a characterisation system similar to that of Wilson & Card above, but specific to low-rise housing development (Boyle and Witherington) (Table 8.7). This approach compares measured gas emission rates with generic “Traffic Lights”. The Traffic Lights include “Typical Maximum Concentrations” for initial screening, and risk-based Gas Screening Values (GSVs) for consideration of situations where the Typical Maximum Concentrations are exceeded. Calculations are carried out for both methane and carbon dioxide and the worst case adopted in order to establish the appropriate protection measures.

Table 8.7 NHBC Traffic light system for 150 mm void

Traffic light	Methane ¹		Carbon dioxide ¹	
	Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,4,6} (litres per hour)	Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,3,4,5} (litres per hour)
Green	{	1	5	0.78
Amber 1		5	10	1.56
Amber 2		20	30	3.13
Red				

Generic notes – gas risk assessments

Notes:

1. The **worst gas-regime** identified at the site, either methane or carbon dioxide, recorded from monitoring in the worst temporal conditions, will be the decider for which Traffic Light and GSV is allocated.
2. Generic GSVs are based on guidance contained within "The Building Regulations: Approved Document C" (2004) and assume a sub-floor void of 150 mm thickness.
3. The small room is considered to be a downstairs toilet, with dimensions of 1.50 × 1.50 × 2.50 m, with a soil pipe passing into the sub-floor void.
4. The GSV, in litres per hour, is as defined in Wilson and Card (1999) as the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered.
5. The Typical Maximum Concentrations can be exceeded in certain circumstances should the conceptual site model indicate it is safe to do so. This is where professional judgment will be required, based on a thorough understanding of the gas regime identified at the site where monitoring in the worst temporal conditions has occurred.
6. The GSV thresholds should not generally be exceeded without completion of a detailed gas risk assessment taking into account site-specific conditions.

i Harries CR, Witherington PJ and McEntee JM (1995). *Interpreting measurements of gas in the ground*. CIRIA Report 151
ii CIRIA (2006) – *Assessing risks posed by hazardous ground gases to buildings*.
iii Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.
iv Boyle & Witherington (2006) – *Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights"*. Report Ref. 10627-R01-(02), for NHBC
v Wilson SA and Card GB (February 1999). *Reliability and Risk in Gas Protection Design*. Ground Engineering.

APPENDIX B

Drawings



NOTES		
 WINDOW SAMPLE LOCATION		
 GRASS & OVERGROWN AREAS		
 APPROXIMATE SITE BOUNDARY		
REV.	DESCRIPTION	DATE



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CLIENT

COUNTRYSIDE
PROPERTIES

JOB TITLE

GOLDTHORPE
COLLIERY

DRAWING TITLE

GAS WELL LOCATIONS

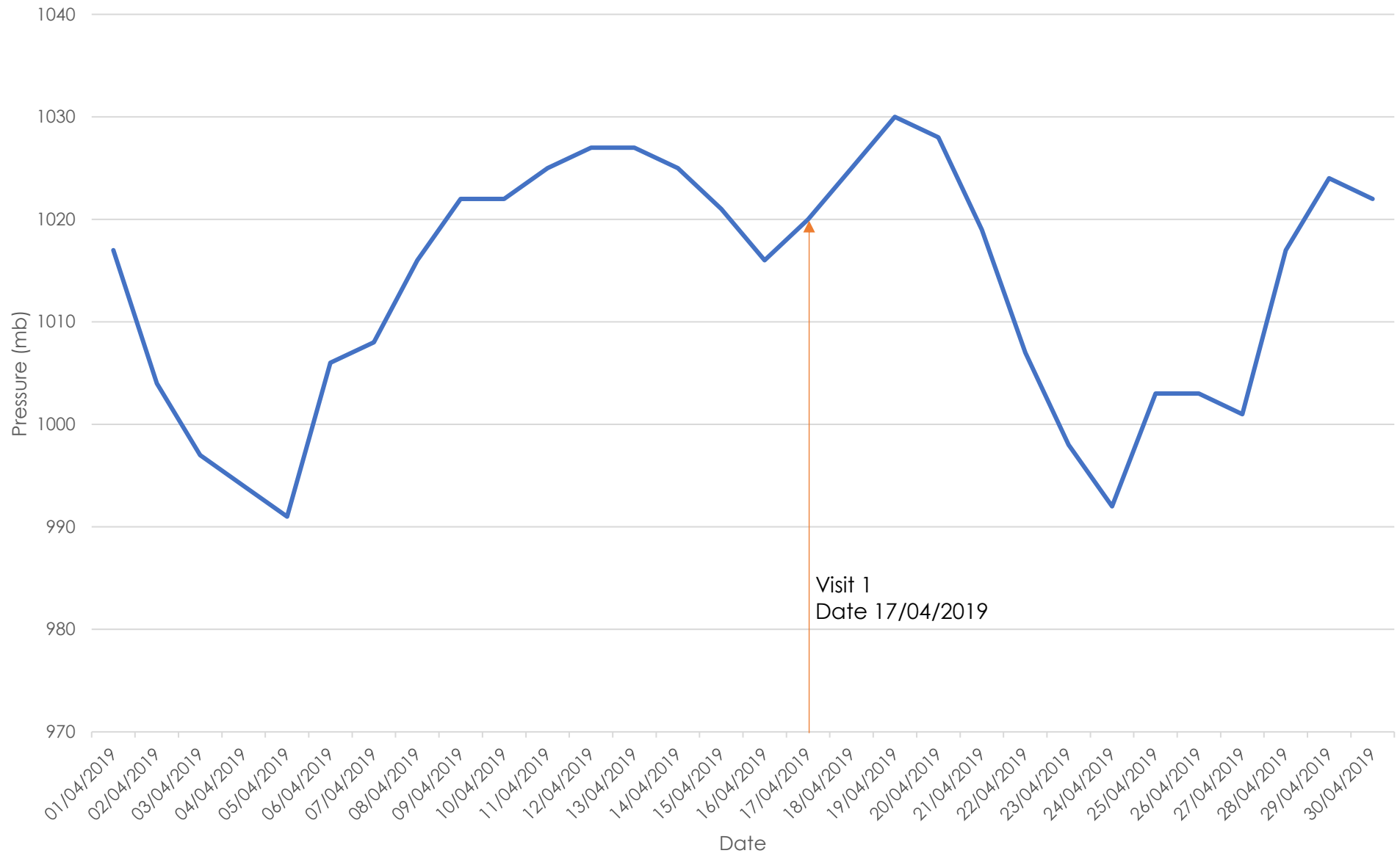
DRAWN	JBR	DATE	12/04/2019	STATUS
CHECKED	ASw	DATE	12/04/2019	FOR COMMENT ☐
				FOR APPROVAL ☐
				DRAFT ☐
				FINAL ☒

SCALE	1:1250	SHEET	A3	DRAWING NO.	1750/6	REVISION	
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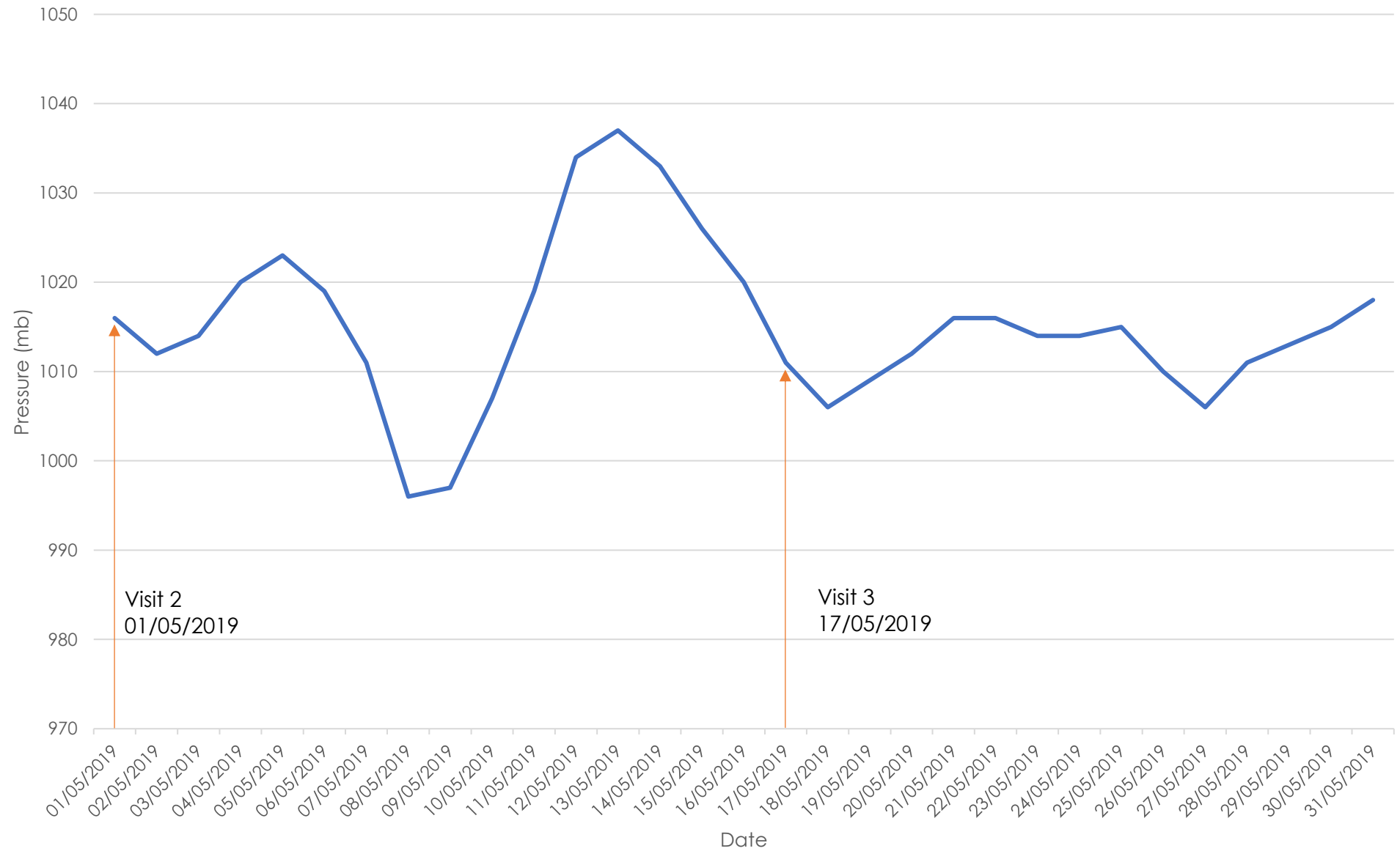
APPENDIX C

Gas monitoring results

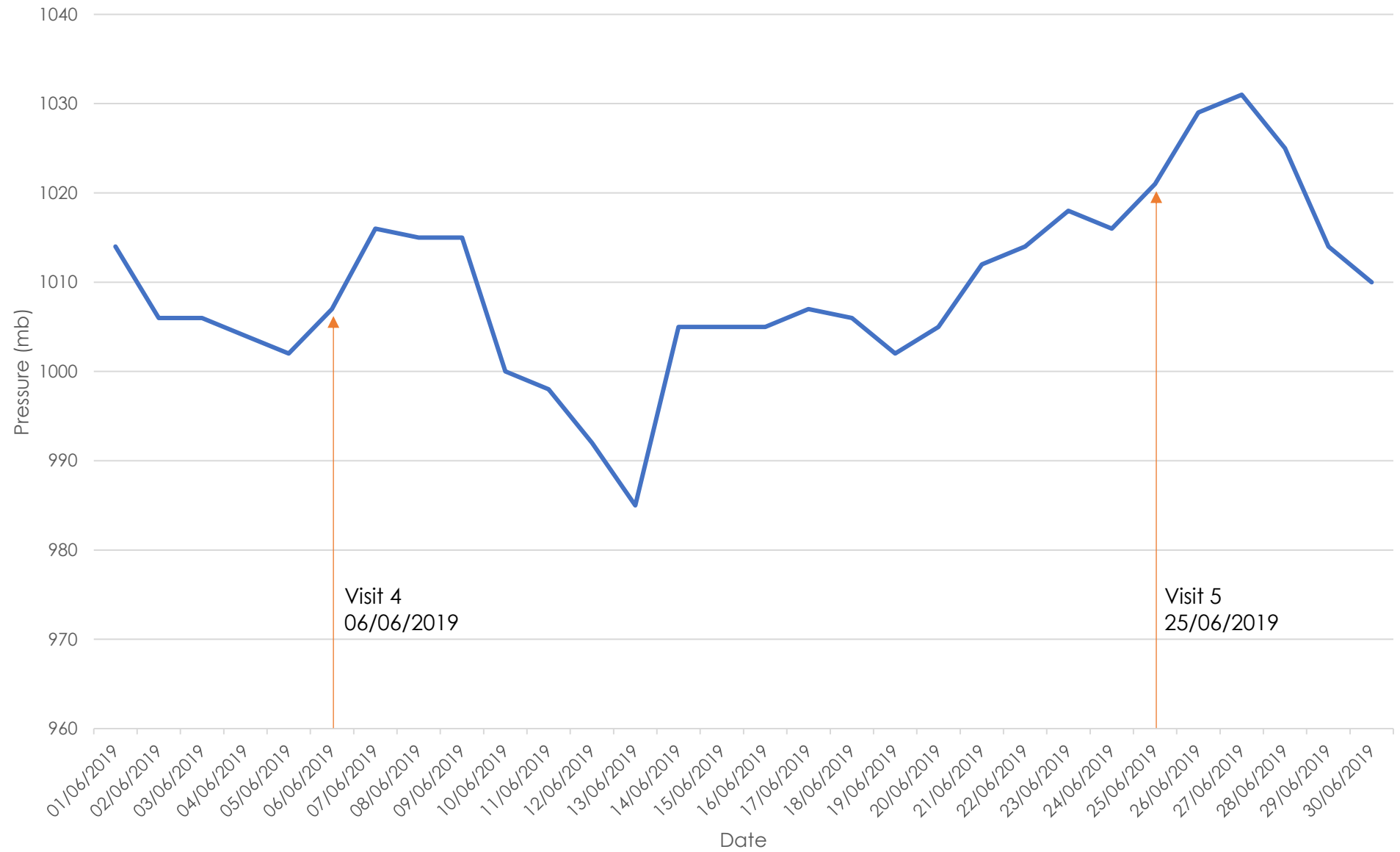
April 2019 Atmospheric Pressure Graph



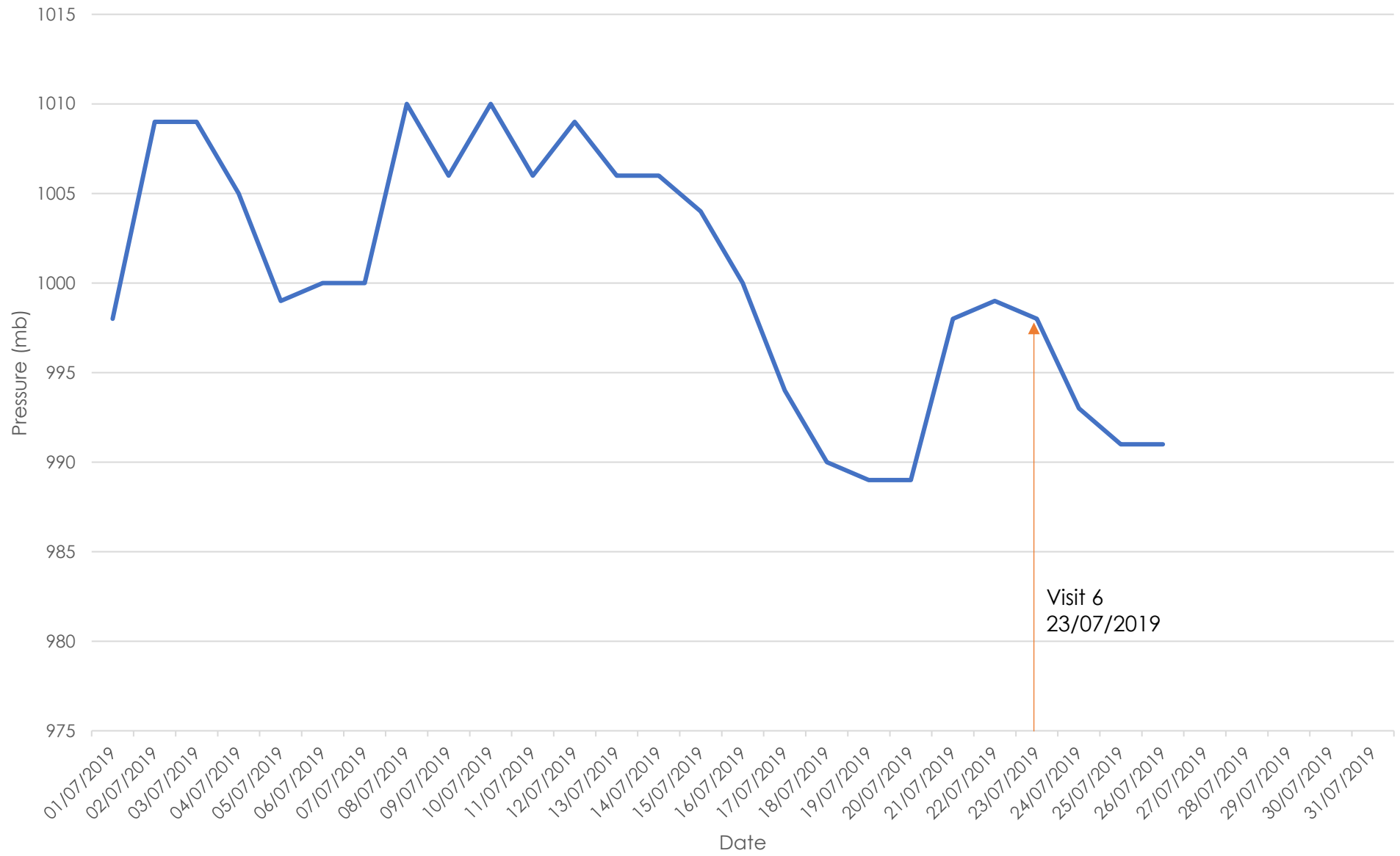
May 2019 Atmospheric Pressure Graph



June 2019 Atmospheric Pressure Graph



July 2019 Atmospheric Pressure Graph



Job Title:							Job No:					
Goldthorpe Colliery							1750					
Client:							Sheet :					
Countryside Properties.							1 of 1					
Date:		Arrival Time:		Depart Time:		Operator:						
17/04/2019		09:20		10:25		A Taylor						

Gas Monitoring Results:														
Ambient Concentration (% Volume):			CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.0	

Monitoring Point	Groundwater level (m) bgl	Concentrations					Gas Flow Rates			Bottom of well m	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	ND	ND	0.5	ND	0.5	18.5	ND	ND	ND	2.49	
WS02	ND	ND	1.5	ND	1.5	19.0	ND	ND	ND	1.53	
WS03	ND	ND	0.5	ND	0.5	19.7	ND	ND	ND	1.62	
WS04	ND	ND	0.8	ND	0.8	19.5	ND	ND	ND	2.04	
WS05	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	1.19	Casing removed on arrival - Bung reinstalled 10:03. Remonitored 10:25
WS06	ND	ND	2.8	ND	2.8	17.2	ND	ND	ND	2.43	
WS07	ND	ND	0.6	ND	0.6	19.5	ND	ND	ND	2.65	
WS08	ND	ND	1.9	ND	1.9	17.6	ND	ND	ND	0.88	
WS09	ND	ND	0.7	ND	0.7	19.8	ND	ND	ND	2.58	
WS10	ND	ND	0.5	ND	0.4	19.9	ND	ND	ND	1.00	

Notes

Equipment Used:			Next Calibration Date			Key		
Gas Data GFM436 Infrared Gas Analyser			12/02/2020			ND None Detected		
Geotechnical Instruments Dipmeter						NR Not Recorded		
						1.0 Recorded value does not breach trigger levels		
						5.0 Recorded value breaches trigger level 1		
						10.0 Recorded value breaches trigger level 2		

Site Data:			Weather Station Data (Kilnhurst Weather Station)										
Temp (°C):	9 to 11.		Barometric Pressure Trend:			Steady							
Time:	09:20	10:15	10:25	00:04	05:04	09:19	10:14	10:24	17:04	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1015	1014	1014	1003	1002	1004	1004	1004	1003	Trigger level 2	5.0	10.0	10.0

Weather Conditions:		Overcast.	
Surface Ground Conditions:		Dry.	

Remarks:

Job Title:							Job No:																				
Goldthorpe Colliery							1750																				
Client:							Sheet :																				
Countryside Properties.							1 of 1																				
Date:		Arrival Time:		Depart Time:		Operator:																					
17/04/2019		09:20		10:25		A Taylor																					
Gas Monitoring Results:																											
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.0													
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks																
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady																		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂																					
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr			secs	m														
WS01	ND	ND	0.5	ND	0.5	18.5	ND	ND	ND	2.49																	
WS02	ND	ND	1.5	ND	1.5	19.0	ND	ND	ND	1.53																	
WS03	ND	ND	0.5	ND	0.5	19.7	ND	ND	ND	1.62																	
WS04	ND	ND	0.8	ND	0.8	19.5	ND	ND	ND	2.04																	
WS05	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	1.19	Casing removed on arrival - Bung reinstalled 10:03. Remonitored 10:25																
WS06	ND	ND	2.8	ND	2.8	17.2	ND	ND	ND	2.43																	
WS07	ND	ND	0.6	ND	0.6	19.5	ND	ND	ND	2.65																	
WS08	ND	ND	1.9	ND	1.9	17.6	ND	ND	ND	0.88																	
WS09	ND	ND	0.7	ND	0.7	19.8	ND	ND	ND	2.58																	
WS10	ND	ND	0.5	ND	0.4	19.9	ND	ND	ND	1.00																	
Notes																											
Equipment Used:						Next Calibration Date			Key																		
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND		None Detected																
Geotechnical Instruments Dipmeter									NR		Not Recorded																
									1.0		Recorded value does not breach trigger levels																
									5.0		Recorded value breaches trigger level 1																
									10.0		Recorded value breaches trigger level 2																
		Site Data:		Weather Station Data (Kilnhurst Weather Station)																							
		Temp (°C):		9 to 11.		Barometric Pressure Trend:			Steady																		
Time:		09:20		10:15		10:25		00:04		05:04		09:19		10:14		10:24		17:04		Trigger level 1		1.0		5.0		16.0	
Pressure (mb):		1015		1014		1014		1003		1002		1004		1004		1004		1003		Trigger level 2		5.0		10.0		10.0	
		Weather Conditions:		Overcast.																							
		Surface Ground Conditions:		Dry.																							
Remarks:																											

Visit 2

Job Title:							Job No:						
Goldthorpe Colliery							1750						
Client:							Sheet :						
Countryside Properties.							1 of 1						
Date:	Arrival Time:		Depart Time:		Operator:								
01/05/2019	11:20		13:40		A Taylor								
Gas Monitoring Results:													
Ambient Concentration (% Volume):			CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.3					
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks		
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady				
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂							
		(m) bgl	% v/v	(%)	% v/v	(%)						(%)	litre/hr
WS01	2.31	ND	0.3	ND	0.3	20.1	ND	ND	ND	2.43	Case and bung missing on arrival. Bung replaced 11:53. Remonitored 13:17.		
WS02	ND	ND	0.5	ND	0.5	20.0	ND	ND	ND	1.52	Case and bung missing on arrival. Bung replaced 11:54. Remonitored 13:20.		
WS03	ND	ND	0.6	ND	0.6	19.9	ND	ND	ND	1.61			
WS04	ND	ND	0.2	ND	0.2	20.2	ND	ND	ND	2.03	Case and bung missing on arrival. Bung replaced 11:51. Remonitored 13:24.		
WS05	ND	ND	0.9	ND	0.9	19.3	ND	ND	ND	1.19	Case and bung missing on arrival. Bung replaced 12:23. Remonitored 13:26.		
WS06	ND	ND	ND	ND	ND	20.4	ND	ND	ND	2.50	Case and bung missing on arrival. Bung replaced 12:24. Remonitored 13:28.		
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.		
WS08	ND	ND	0.7	ND	0.7	19.6	ND	ND	ND	0.88	Case and bung missing on arrival. Bung replaced 12:28. Remonitored 13:31.		
WS09	ND	ND	0.6	ND	0.6	20.1	ND	ND	ND	2.58			
WS10	ND	ND	0.6	ND	0.3	20.2	0.8	ND	10.0	1.00			
Notes													
Equipment Used:						Next Calibration Date			Key				
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected				
Geotechnical Instruments Dipmeter									NR Not Recorded				
									1.0 Recorded value does not breach trigger levels				
									5.0 Recorded value breaches trigger level 1				
									10.0 Recorded value breaches trigger level 2				
		Site Data:		Weather Station Data (Near Castle Weather Station)									
		Temp (°C):		16 to 17.		Barometric Pressure Trend:		Falling					
Time:	11:20	13:18	13:40	00:04	05:29	11:19	13:19	13:39	16:59	Trigger level 1	1.0 5.0 16.0		
Pressure (mb):	1012	1011	1011	1009	1006	1006	1005	1005	1004	Trigger level 2	5.0 10.0 10.0		
		Weather Conditions:		Overcast.									
		Surface Ground Conditions:		Dry.									
Remarks:													

Job Title:							Job No:						
Goldthorpe Colliery							1750						
Client:							Sheet :						
Countryside Properties.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
17/05/2019		15:04		15:45		A Taylor							

Gas Monitoring Results:									
Ambient Concentration (% Volume):		CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.2		

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	2.42	ND	0.5	ND	0.4	19.9	ND	ND	ND	2.56	
WS02	ND	ND	0.8	ND	0.8	19.6	ND	ND	ND	1.56	
WS03	ND	ND	0.7	ND	0.7	19.7	ND	ND	ND	1.61	
WS04	ND	ND	0.7	ND	0.7	19.7	ND	ND	ND	2.02	
WS05	ND	ND	2.0	ND	2.0	18.2	ND	ND	ND	1.24	
WS06	ND	ND	0.7	ND	0.7	19.5	ND	ND	ND	2.47	
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.
WS08	ND	ND	1.8	ND	1.8	18.0	ND	ND	ND	0.92	
WS09	ND	ND	0.3	ND	0.3	20.2	ND	ND	ND	2.58	
WS10	ND	ND	0.6	ND	0.4	20.1	ND	ND	ND	1.02	

Notes									
Equipment Used:						Next Calibration Date		Key	
Gas Data GFM436 Infrared Gas Analyser						12/02/2020		ND None Detected	
Geotechnical Instruments Dipmeter								NR Not Recorded	
								1.0 Recorded value does not breach trigger levels	
								5.0 Recorded value breaches trigger level 1	
								10.0 Recorded value breaches trigger level 2	

Site Data:				Weather Station Data (Worsbrough Weather Station)					
Temp (°C):	18	Barometric Pressure Trend:			Falling.				
Time:	15:04	15:30	15:45	00:04	06:04	15:04	15:30	15:44	20:04
Pressure (mb):	1005	1005	1004	1017	1014	1010	1009	1009	1008
Weather Conditions:		Sunny.							
Surface Ground Conditions:		Dry.							

Remarks:	Wells WS01,02,04,05,06,08 were repaired using flush covers and postcrete.
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Job Title:							Job No:												
Goldthorpe Colliery							1750												
Client:							Sheet :												
Countryside Properties.							1 of 1												
Date:		Arrival Time:		Depart Time:		Operator:													
06/06/2019		13:20		14:25		J Brown													
Gas Monitoring Results:																			
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.5					
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks								
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady										
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂													
		(m) bgl	% v/v	(%)	% v/v	(%)						(%)	litre/hr	litre/hr	secs	m			
WS01	2.30	ND	0.9	ND	0.9	19.3	ND	ND	ND	2.55									
WS02	ND	ND	0.9	ND	0.9	19.8	ND	ND	ND	1.56									
WS03	MD	ND	0.5	ND	0.5	20.2	ND	ND	ND	1.61									
WS04	ND	ND	1.3	ND	1.3	19.4	ND	ND	ND	2.00									
WS05	1.21	ND	2.1	ND	2.1	18.7	ND	ND	ND	1.23									
WS06	ND	ND	3.1	ND	3.1	17.9	ND	ND	ND	2.47									
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Case and inner well completely removed. Unable to monitor.								
WS08	ND	ND	0.0	ND	0.0	20.5	ND	ND	ND	0.93									
WS09	ND	ND	1.8	ND	1.8	19.0	ND	ND	ND	2.59									
WS10	ND	ND	0.8	ND	0.8	19.9	0.2	ND	5.0	1.27	Fluctuating flow between 0.2 and ND.								
Notes																			
Equipment Used:						Next Calibration Date			Key										
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected										
Geotechnical Instruments Dipmeter									NR Not Recorded										
									1.0 Recorded value does not breach trigger levels										
									5.0 Recorded value breaches trigger level 1										
									10.0 Recorded value breaches trigger level 2										
		Site Data:		Weather Station Data (Kiln Hurst Weather Station)															
		Temp (°C):		20		Barometric Pressure Trend:			Rising										
Time:		13:20		13:50		14:25		00:04		06:04		13:19		13:49		14:24		18:04	
Pressure (mb):		1002		1001		1001		989.2		989.8		990.8		990.8		990.8		990.5	
		Weather Conditions:		Sunny with intermittent cloud.															
		Surface Ground Conditions:		Dry.															
Remarks:																			

Job Title:							Job No:						
Goldthorpe Colliery							1750						
Client:							Sheet :						
Countryside Properties.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
25/06/2019		09:50		11:50		Mawgan Naylor							

Gas Monitoring Results:										
Ambient Concentration (% Volume):				CH ₄ :	ND	ND	ND	O ₂ :	20.2	

Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady		
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂					
		% v/v	(%)	% v/v	(%)	(%)					
WS01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
WS02	ND	ND	2.2	ND	2.2	17.8	ND	ND	ND	1.56	
WS03	ND	ND	0.9	ND	0.9	18.7	ND	ND	ND	1.60	
WS04	ND	ND	1.5	ND	1.5	18.3	ND	ND	ND	1.96	
WS05	ND	ND	3.4	ND	3.4	15.2	ND	ND	ND	1.21	
WS06	ND	ND	2.9	ND	2.9	16.7	1.6	ND	5.0	2.45	
WS07	ND	NR	NR	NR	NR	NR	NR	NR	NR	1.40	Well pulled out. Could not monitor for gas but dipped well.
WS08	ND	ND	2.5	ND	2.5	16.0	ND	ND	ND	0.90	
WS09	ND	ND	0.0	ND	0.0	20.2	ND	ND	ND	2.55	No bung on arrival. Monitored with bung off.
WS10	ND	ND	0.9	ND	0.9	19.3	ND	ND	ND	1.02	

Notes										
Equipment Used:						Next Calibration Date			Key	
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected	
Geotechnical Instruments Dipmeter									NR Not Recorded	
									1.0 Recorded value does not breach trigger levels	
									5.0 Recorded value breaches trigger level 1	
									10.0 Recorded value breaches trigger level 2	

	Site Data:			Weather Station Data (Near Doncaster Weather Station)							CH ₄	CO ₂	O ₂
	Temp (°C):	14		Barometric Pressure Trend:			Steady						
Time:	09:50	11:00	11:50	00:04	06:59	09:49	10:59	11:49	18:04	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1015	1014	1014	1007	1007	1009	1009	1009	1011	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:			Rainy, windy									
	Surface Ground Conditions:												

Remarks:													
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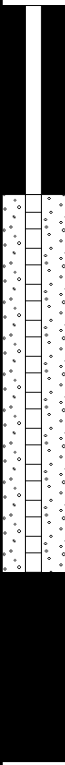
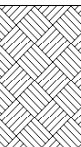
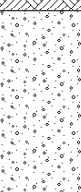
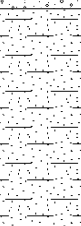
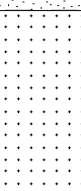
Job Title:							Job No:					
Goldthorpe Colliery							1750					
Client:							Sheet :					
Countryside Properties.							1 of 1					
Date:		Arrival Time:		Depart Time:		Operator:						
23/07/2019		14:10		15:30		A Taylor						
Gas Monitoring Results:												
Ambient Concentration (% Volume):				CH ₄ :	0.0	CO ₂ :	0.0	O ₂ :	20.6			
Monitoring Point	Groundwater level	Concentrations					Gas Flow Rates			Bottom of well	Remarks	
		Initial / Highest		Steady concentrations		Lowest concn	Initial / Maximum	Steady	Time to fall from highest to steady			
		CH ₄	CO ₂	CH ₄	CO ₂	O ₂						
		(m) bgl	% v/v	(%)	% v/v	(%)						(%)
WS01	2.42	ND	1.6	ND	1.6	19.0	ND	ND	ND	2.55		
WS02	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - Well lost under thick vegetation.	
WS03	ND	ND	0.5	ND	0.5	20.3	ND	ND	ND	1.58		
WS04	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - Well lost under thick vegetation.	
WS05	ND	ND	3.5	ND	3.5	17.3	ND	ND	ND	1.22		
WS06	ND	ND	0.1	ND	ND	20.8	ND	ND	ND	2.47		
WS07	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Well destroyed.	
WS08	ND	ND	0.9	ND	0.9	19.9	ND	ND	ND	0.92		
WS09	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Not recorded - unable to find well amongst vegetation. Possibly destroyed.	
WS10	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Well destroyed. Soil forced down bung.	
Notes												
Equipment Used:						Next Calibration Date			Key			
Gas Data GFM436 Infrared Gas Analyser						12/02/2020			ND None Detected			
Geotechnical Instruments Dipmeter									NR Not Recorded			
									1.0 Recorded value does not breach trigger levels			
									5.0 Recorded value breaches trigger level 1			
									10.0 Recorded value breaches trigger level 2			
		Site Data:		Weather Station Data (Near Doncaster Weather Station)								
		Temp (°C):		28 to 29.		Barometric Pressure Trend:			Falling.			
Time:	14:10	15:00	15:30	00:04	08:04	14:09	14:59	15:29	19:59	Trigger level 1	1.0 5.0 16.0	
Pressure (mb):	1012	1011	1011	1008	1008	1005	1004	1004	1002	Trigger level 2	5.0 10.0 10.0	
		Weather Conditions:		Sunny.								
		Surface Ground Conditions:		Dry.								
Remarks:												

				Borehole Log			Borehole No. WS01 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446653.00 - 404335.00		Hole Type WS
Location: Goldthorpe				Level:		Scale 1:20		
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		Dark brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies including mudstone and coal. (TOPSOIL)		
					0.60		Light brown clayey SAND. (GRANULAR RESIDUAL SOIL)		
	1.00			HVP=51 N=10 (2,2/2,2,2,4)	1.60		Firm light orangish brown sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of mixed lithologies including sandstone, mudstone and coal. (COHESIVE RESIDUAL SOIL)	1	
	2.00			N=42 (4,5/6,9,12,15)	2.20		Weak dark orangish grey MUDSTONE recovered as a slightly clayey angular to sub angular gravel. (WEATHERED COAL MEASURES)	2	
	2.50			50 (10,10/50 for 226mm)	2.90		Moderately strong dark grey and orange MUDSTONE recovered as angular fine to coarse gravel. (WEATHERED COAL MEASURES)		
							End of borehole at 2.90 m	3	
								4	

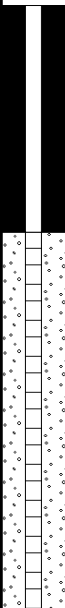
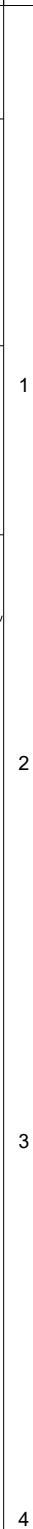
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.		
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				Borehole Log				Borehole No. WS02 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446705.00 - 404323.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20			
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC			

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		N=9 (3,2/2,2,2,3)	0.40		 Dark grey sandy CLAY with occasional rootlets. (TOPSOIL)	1	
					0.90		 Light brown sandy subangular to subrounded fine to coarse GRAVEL of sandstone. (GRANULAR RESIDUAL SOIL)		
					1.50		 Light orangish grey clayey SAND. (GRANULAR RESIDUAL SOIL)		
					1.80		 Moderately strong light brown SANDSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED ACKWORTH ROCK)		
					2.00		End of borehole at 2.00 m		2
									3
									4

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.		
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				Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446714.00 - 404247.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20			
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC			

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		HVP=52	0.30		Dark grey slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone. (TOPSOIL)		
				N=27 (3,2/3,4,7,13)	0.90		Firm light orange and grey mottled slightly sandy CLAY with occasional rootlets. (COHESIVE RESIDUAL SOIL) <i>From 0.3m to 0.9m, 1 no. subvertical fissure, undulating, grey non-penetrative staining with occasional rootlets.</i>		
					1.40		Weak dark greyish brown MUDSTONE recovered as angular, tabular fine to medium gravel. (WEATHERED COAL MEASURES)		
				1.60		Moderatley strong light greyish brown fine grained SANDSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED COAL MEASURES) <i>Refusal at 1.6m.</i> End of borehole at 1.60 m			

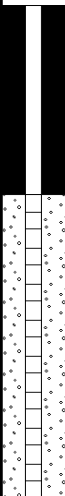
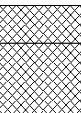
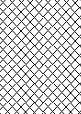
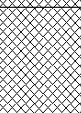
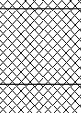
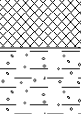
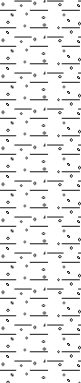
Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



LITHOS CONSULTING					Borehole Log			Borehole No. WS04 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446669.00 - 404272.00		Hole Type WS	
Location: Goldthorpe				Level:		Scale 1:20		Logged By CC	
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Dark greyish brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium of mixed lithologies including burnt shale and coal. (MADE GROUND TOPSOIL)	1
								Firm light orange and grey mottled slightly sandy CLAY with occasional rootlets. (COHESIVE RESIDUAL SOIL)	
	1.00			N=11 (2,2/2,2,3,4)	1.40			Weak dark greyish brown MUDSTONE recovered as angular, tabular, fine to medium gravel. (WEATHERED COAL MEASURES) <i>Thin laminations within mudstone 3mm spacing.</i>	
					1.80			Black COAL recovered as angular to subangular fine to medium gravel. (WEATHERED COAL MEASURES)	
		2.00		50 (25 for 77mm/50 for 4mm)	1.90			Weak light orangish grey SILTSTONE recovered as sandy, angular to subangular fine to medium gravel. (WEATHERED COAL MEASURES)	2
					2.13			End of borehole at 2.13 m	4

Remarks

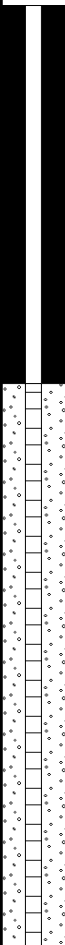
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

					Borehole Log			Borehole No. WS05 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446678.00 - 404221.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		2.00		N=13 (2,2/2,3,3,5)	0.10		 MADE GROUND: Dark brown slightly clayey slightly gravelly SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies including burnt shale and mudstone. (MADE GROUND TOPSOIL)	1	
					0.60	 MADE GROUND: Orangish red sandy angular to subrounded fine to coarse GRAVEL of burnt shale. (BURNT RED SHALE)			
					0.90	 MADE GROUND: Dark grown and black clayey, slightly sandy angular to subangular fine to coarse GRAVEL of coal and mudstone. (COLLIERY SPOIL)			
					1.10	 MADE GROUND: Black ashy subangular to subrounded fine to coarse GRAVEL of clinker, burnt shale and coal. (ASH & CLINKER)			
					1.30	 MADE GROUND: Orangish red and black gravelly ASH. Gravel is subangular to subrounded fine to coarse of burnt shale and coal. (BURNT RED SHALE)			
		2.80		N=35 (6,7/9,9,8,9)	2.50		 Firm light brown and grey mottled slightly gravelly slightly sandy CLAY. Gravel is subangular to subrounded fine to medium of sandstone. (COHESIVE RESIDUAL SOIL)	2	
					3.25		 Weak light grey SILTSTONE recovered as slightly clayey angular fine to coarse gravel. (WEATHERED COAL MEASURES) <i>From 2.7m, clay becoming more gravelly with depth.</i>	3	
							 Refusal at 3.25m.	4	
End of borehole at 3.25 m									

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



					Borehole Log			Borehole No. WS06 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446640.00 - 404188.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019		Logged By CC		

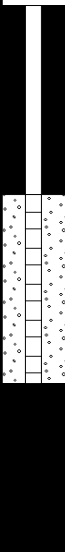
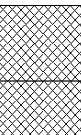
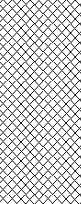
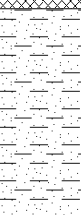
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10		MADE GROUND: Dark brown slightly clayey gravelly SAND with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including coal and burnt shale. (GRANULAR MADE GROUND) MADE GROUND: Black ashy, subangular to subrounded fine to medium GRAVEL of coal, burnt shale and clinker. (ASH & CLINKER)	1	
					0.60		MADE GROUND: Dark grey and orange slightly ashy, angular to subangular fine to coarse GRAVEL of mixed lithologies including mudstone, slag and coal. (COLLIERY SPOIL)		
					0.90		MADE GROUND: Black ashy, subangular to subrounded fine to coarse GRAVEL of mixed lithologies including coal, clinker and burnt shale. (ASH & CLINKER)		
					1.60		MADE GROUND: Light orangish brown and black ashy, angular to subangular fine to coarse GRAVEL of mixed lithologies including burnt shale, coal and slag. (COLLIERY SPOIL)	2	
					2.50		At 2.4m, unable to drill further due to obstruction. End of borehole at 2.50 m	3	
		2.00		N=25 (4,5/7,5,6,7)				4	

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.



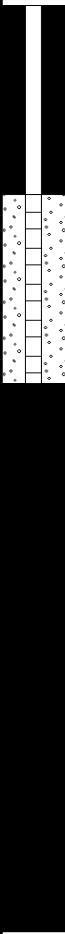


				Borehole Log			Borehole No. WS08 Sheet 1 of 1	
Project Name: Goldthorpe Colliery				Project No. 1750		Co-ords: 446729.00 - 404131.00		Hole Type WS
Location: Goldthorpe				Level:		Scale 1:20		
Client: Countryside Properties				Dates: 10/04/2019 - 10/04/2019		Logged By CC		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark grey slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone and coal. (MADE GROUND TOPSOIL)	
		0.50 0.50	K T					MADE GROUND: Dark brown, blue and black slightly clayey ashy GRAVEL of mixed lithologies including burnt shale, glass, coal, mudstone, dark blue material, and friable pale blue platy mineral. (COLLIERY SPOIL)	
		1.00		N=12 (2,2/3,2,3,4) HVP=68	0.90			Firm light orange and grey mottled slightly sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of mixed lithologies including sandstone and mudstone. (COHESIVE RESIDUAL SOIL)	1
					1.45		End of borehole at 1.45 m		4

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.								
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					Borehole Log			Borehole No. WS10 Sheet 1 of 1	
Project Name: Goldthorpe Colliery					Project No. 1750		Co-ords: 446735.00 - 404171.00		Hole Type WS
Location: Goldthorpe					Level:		Scale 1:20		Logged By CC
Client: Countryside Properties					Dates: 10/04/2019 - 10/04/2019				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Dark grey gravelly SAND. Gravel is subangular to subrounded fine to coarse of mixed lithologies including mudstone, burnt shale and coal. (GRANULAR MADE GROUND)	
					0.80			MADE GROUND: Black and orange ashy subangular to subrounded fine to medium GRAVEL of mixed lithologies including clinker, coal and burnt shale. (ASH & CLINKER)	
					1.00			MADE GROUND: Dark orangish red clayey slightly sandy GRAVEL of mixed lithologies including mudstone, coal and burnt shale. (BURNT RED SHALE)	1
								Firm light orange and grey mottled slightly gravelly CLAY. Gravel is angular to subangular fine to coarse of mudstone. (COHESIVE RESIDUAL SOIL)	
	2.00		N=43 (7,8/8,9,12,14)	2.00			Moderately strong light grey SILTSTONE recovered as angular to subangular fine to coarse gravel. (WEATHERED COAL MEASURES)	2	
					2.45			End of borehole at 2.45 m	
									3
									4

Remarks
 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Co-ordinates from hand held GPS, hole not surveyed in.

