

016/3233//MJT/jej

25th April 2019

Mr A Spiers
Rouse Homes Ltd
8 Carr Crofts Drive
Armley
Leeds
LS12 3AL



Registered in England 07068066

Parkhill
Wetherby
West Yorkshire
LS22 5DZ

T 01937 545 330
www.lithos.co.uk

Dear Andrew

East Bierley – Gas risk assessment

Further to issue of our Geoenvironmental Appraisal Report (No. 3233/1a, dated February 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 3233/1a, 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 5.5km south-east of Bradford town centre at NGR SE 197 289. The site comprises a single parcel of land of approximately 1.85 hectares (4.6 acres).

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

- The site is located in an area where 1% and 3% are considered susceptible to radon emissions
- Former underground coal workings underlie the north-east of site and off-site to the north-east

Based on the above, it was considered that the site might be at risk from hazardous gas and therefore monitoring wells were installed in 6 boreholes. Details of the individual installations are provided in Report No 3233/1a.

The proposed development comprises 43 houses, as shown on Drawing 3233/2 in Report No 3233/1a. The houses will be founded on traditional strip/trench-fill foundations within Cohesive Residual soils at a minimum depth of 0.9m, over-deepened where necessary due to tree influence. Some reinforcement maybe required after consolidation of shallow workings.

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 9th January 2019 and 12th April 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)
WS01	0.4m to 1.4m (Residual soil)	0.0	0.0 to 0.4	0.0 to 0.1
WS02	0.8m to 1.8m (Residual soil)	0.0	0.1 to 0.4	
WS03	0.5m to 1.5m (Residual soil)	0.0	0.0 to 0.4	
WS04	0.5m to 1.4m (Residual soil)	0.0	0.3 to 2.1	
WS05	0.6m to 1.5m (Residual soil)	0.0	0.0 to 0.3	
WS06	1.0m to 2.0m (Residual soil)	0.0	0.0 to 2.4	0.0 to 8.8

Note: Atmospheric pressures varied between 1027mb and 983mb.

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

During one of the 6 monitoring visits, atmospheric pressure was falling (as measured on site during the visit), and two visits were undertaken when the pressure was below 1000mb.

Plots of atmospheric pressure versus time, with the monitoring visits indicated, are appended to this letter report, these show that two the visits (visits 2 and 4) were undertaken after a sustained period of falling pressure in the days prior to monitoring.

Current guidance

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

Current gas regime

The proposed 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 0.00 and 0.21 respectively. These GSVs equate to a Green gas regime (traffic light) for this site. It should be noted that the only sustained flow was recorded in WS06 in the south on one occasion (visit 2) and was 8.8ltr/hr. Significantly depleted oxygen (10.5% vol) was also detected on visit 2 in WS06. 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 carbon dioxide GSV of 0.21 classes as Characteristic Situation 2.

Although the sustained flow was only detected in one borehole in the far south, given the presence of mineworkings detected in the north and the relatively small size of the site, it is recommended that the whole site be classified as Characteristic Situation 2.

Scope of protection measures

Based on the site characterisation (Traffic Light) discussed above, the proposed foundation solution, and with reference to the gas protection “scoring” system outlined in BS8485:2015+A1:2019, Lithos consider that the following protective measures should be incorporated in all new dwellings:

Traffic light classification and “score” req’d by BS8485#	Floor slab (BS8485 “score”)	Protective measures	
		Sub-floor ventilation (BS8485 “score”)	Membrane
			Type (BS8485 “score”)
Green & CS2 (Wilson & Card) 2.5*	<i>Select one from:</i> 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) .	<i>Select one from:</i> 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 mm ² /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.

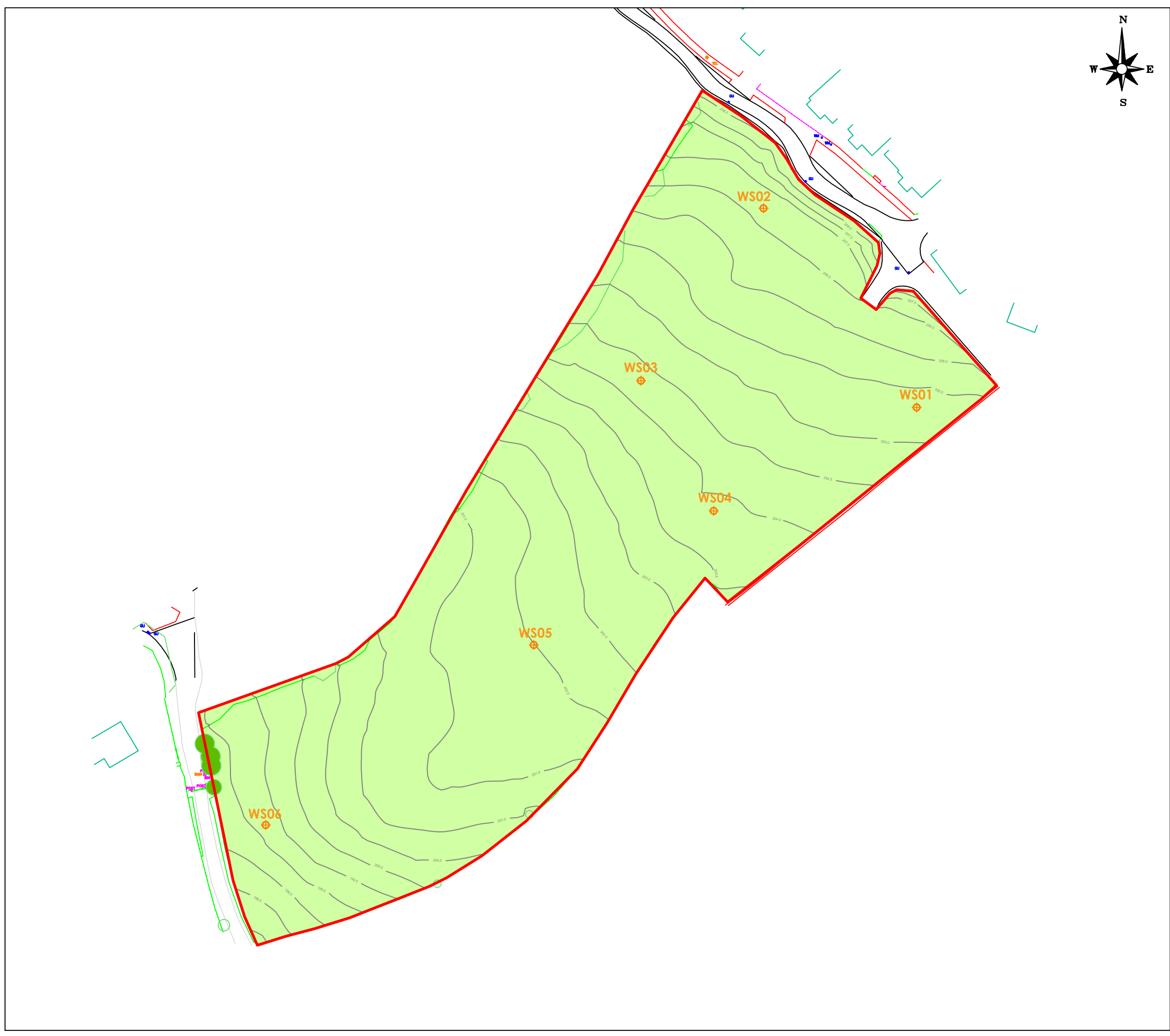
We trust the above is sufficient for your present needs, but should you have any queries please contact the undersigned.

Yours sincerely

Matt Thompson
Associate Director
for and on behalf of
LITHOS CONSULTING LIMITED

Enclosures:

Drawing 3233/9 – Borehole Location Plan
Gas Monitoring Results
Plot of Atmospheric vs Time
Borehole Logs



NOTES

 WINDOW SAMPLE LOCATION

 APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



info@lithos.co.uk
www.lithos.co.uk
Tel 01937 545330

CLIENT

ROUSE HOMES

JOB TITLE

EAST BIERLEY

DRAWING TITLE

EXPLORATORY HOLE LOCATIONS
WITH GAS WELLS

DRAWN	JBR	DATE	18/04/2019	STATUS	FOR COMMENT	☐
CHECKED	MJT	DATE	18/04/2019	FOR APPROVAL	DRAFT	☐
				FINAL		☒
SCALE	1:1000	SHEET	A3	DRAWING NO.	3233/9	REVISION

Job Title:							Job No:						
East Bierley.							3233						
Client:							Sheet :						
Rouse Homes.							1 of 1						
Date:	Arrival Time:		Depart Time:		Operator:								
09/01/2019	09:00		10:45		A Taylor.								
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	1.04	ND	0.4	ND	0.4	20.3	ND	ND	ND	1.47			
WS02	1.59	ND	0.4	ND	0.4	20.2	ND	ND	ND	1.85			
WS03	0.41	ND	0.1	ND	0.1	20.4	ND	ND	ND	1.55	Bailed to 1.45m at 09:46. 3l removed. Remonitored at 10:38.		
WS04	0.48	ND	0.6	ND	0.6	20.0	ND	ND	ND	1.40	Bailed to 1.16m at 09:52. 5l removed. Remonitored at 10:40.		
WS05	ND	ND	0.6	ND	0.6	20.2	ND	ND	ND	1.56			
WS06	1.74	ND	1.3	ND	1.3	16.6	ND	ND	ND	2.07			
Notes													
Equipment Used:						Next Calibration Date		Key					
Gas Data GFM436 Infrared Gas Analyser						16/01/2019		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 (East Bierley Weather Station)									
	Temp (°C):	2 to 3.		Barometric Pressure Trend:			Steady.						
Time:	09:00	09:20	10:45	00:00	05:00	09:00	09:20	10:40	17:00	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1007	1005	1007	1002.6	1003.2	1004.4	1004.8	1004.6	1004.1	Trigger level 2	5.0	10.0	10.0
	Weather Conditions:		Cloudy.										
	Surface Ground Conditions:		Dry with frost patches.										
Remarks:													

Job Title:										Job No:					
East Bierley										3233					
Client:										Sheet :					
Rouse Homes										1 of 1					
Date:		Arrival Time:		Depart Time:		Operator:									
09/01/2019		09:00		10:45		A Taylor									
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
WS01															
WS02															
WS03	0.65	ND	0.4	ND	0.4	19.5	ND	ND	ND	1.56	Bailed to 1.45m at 09:46. 3l removed. Remonitored at 10:38.				
WS04	0.59	ND	0.3	ND	0.3	20.0	58.3	0.0	60.0	1.40	Bailed to 1.16m at 09:52. 5l removed. Remonitored at 10:40.				
WS05															
WS06															
Notes															
Equipment Used:						Next Calibration Date				Key					
Gas Data GFM436 Infrared Gas Analyser						16/01/2019				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 (East Bierley Weather Station)											
		Temp (°C):		2 to 3.		Barometric Pressure Trend:				Steady.					
Time:	09:00	09:20	10:45	00:00	05:00	09:00	09:20	10:40	17:00	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1007	1005	1007	1002.6	1003.2	1004.4	1004.8	1004.6	1004.1	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Cloudy.											
		Surface Ground Conditions:		Dry with frost patches.											
Remarks:															

Visit 2

Job Title:							Job No:								
East Bierley.							3233								
Client:							Sheet :								
Rouse Homes.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
07/02/2019		16:10		16:45		A Taylor									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		20.1	
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						
		CH₄	CO₂	CH₄	CO₂	O₂									
		% v/v	(%)	% v/v	(%)	(%)									
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m					
WS01	0.56	ND	ND	ND	ND	20.1	ND	ND	ND	1.45					
WS02	1.32	ND	0.1	ND	0.1	20.1	ND	ND	ND	1.84					
WS03	0.25	ND	ND	ND	ND	20.1	ND	ND	ND	1.56					
WS04	0.22	ND	0.4	ND	0.4	20.1	0.7	0.0	2.0	1.40					
WS05	1.28	ND	ND	ND	ND	20.1	ND	ND	ND	1.52					
WS06	ND	ND	2.4	ND	2.4	10.5	9.3	8.8	300.0	2.06					
Notes															
Equipment Used:						Next Calibration Date			Key						
Gas Data GFM436 Infrared Gas Analyser						16/01/2020			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 (Bierley Weather Station)											
		Temp (°C):	5	Barometric Pressure Trend:			Rising.								
Time:	16:10	16:30	16:45	00:04	06:04	16:09	16:29	16:44	21:04	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	976	975	975	993.1	983.3	993.5	993.8	993.8	995.1	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Intermittant Cloud.											
		Surface Ground Conditions:		Wet.											
Remarks:															

Visit 3

Job Title:							Job No:						
East Bierley.							3233						
Client:							Sheet :						
Rouse Homes.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
21/02/2019		14:30		17:00		A Taylor							
Gas Monitoring Results:													
Ambient Concentration (% Volume):				CH₄:	0.0	CO₂:	0.0	O₂:	20.1				
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				
		CH₄	CO₂	CH₄	CO₂	O₂							
		% v/v	(%)	% v/v	(%)	(%)							
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m			
WS01	1.20	ND	0.3	ND	0.2	20.2	ND	ND	ND	1.45	Well installed at an angle, could not insert bailer.		
WS02	1.20	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.84	Bailed to 1.80m at 15:13 -2l. Remonitored 1.79m/15:56, 1.79m/16:18, 1.79m/16:44.		
WS03	0.42	ND	ND	ND	ND	20.3	ND	ND	ND	1.54	Bailed to 1.48m at 15:20. Remonitored 0.68m/ 15:58, 0.57m/ 16:20, 0.51m/ 16:46.		
WS04	0.52	ND	0.1	ND	0.1	20.3	ND	ND	ND	1.39	Bailed to 1.22m at 15:46 -4l. Consistent 15cm coming out of bailer. Remon 0.71m/16:03, 0.62m/ 16:26, 0.58m/ 16:49.		
WS05	1.16	ND	0.2	ND	0.2	20.1	ND	ND	ND	1.51	Bailed to 1.47m at 15:25. Remonitored 1.47m/ 15:59, 1.47m/16:22, 1.46m/ 16:56.		
WS06	1.83	ND	0.8	ND	0.8	18.0	ND	ND	ND	2.07	Bailed to 2.02m at 15:28. Remonitored 2.02m/ 16:01, 2.02m/ 16:23, 2.02m/ 16:53.		
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 (Hilary Weather - Scholes Weather Station)									
		Temp (°C):		14 to 16.		Barometric Pressure Trend:		Rising.					
Time:	14:30	15:05	17:00	00:06	06:30	14:25	15:05	16:16	20:00	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	1000	1000	1000	1014.2	1016.3	1021.3	1021.7	1022.0	1026.8	Trigger level 2	5.0	10.0	10.0
		Weather Conditions:		Sunny.									
		Surface Ground Conditions:		Dry.									
Remarks:													

Visit 3 Bailed

Job Title:							Job No:						
East Bierley.							3233						
Client:							Sheet :						
Rouse Homes.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
21/02/2019		14:30		17:00		A Taylor							
Gas Monitoring Results:													
Ambient Concentration (% Volume):				CH₄:	0.0	CO₂:	0.0	O₂:	20.1				
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				
		CH₄	CO₂	CH₄	CO₂	O₂							
		(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr			secs	m
WS01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Well installed at an angle, could not insert bailer. Did not bail or remonitor.		
WS02	ND	ND	0.1	ND	0.1	20.3	ND	ND	ND	1.79	Bailed to 1.80m at 15:13 -2l. Remonitored 1.79m/15:56, 1.79m/16:18, 1.79m/16:44. All water removed- silt remaining.		
WS03	0.51	ND	0.2	ND	0.2	20.0	ND	ND	ND	1.54	Bailed to 1.48m at 15:20. Remonitored 0.68m/ 15:58, 0.57m/ 16:20, 0.51m/ 16:46.		
WS04	0.58	ND	0.3	ND	0.3	20.1	5.6	0.0	5.0	1.39	Bailed to 1.22m at 15:46 -4l. Consistent 15cm coming out of bailer. Remon 0.71m/16:03, 0.62m/ 16:26, 0.58m/ 16:49.		
WS05	1.46	ND	0.1	ND	ND	20.3	ND	ND	ND	1.51	Bailed to 1.47m at 15:25. Remonitored 1.47m/ 15:59, 1.47m/16:22, 1.46m/ 16:56.		
WS06	2.02	ND	0.1	ND	0.1	20.2	ND	ND	ND	2.07	Bailed to 2.02m at 15:28. Remonitored 2.02m/ 16:01, 2.02m/ 16:23, 2.02m/ 16:53.		
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 (Hilary Weather - Scholes Weather Station)									
		Temp (°C):		14 to 16.		Barometric Pressure Trend:		Rising.					
Time:	14:30	15:05	17:00	00:06	06:30	14:25	15:05	16:16	20:00	Trigger level 1	1.0 5.0 16.0		
Pressure (mb):	1000	1000	1000	1014.2	1016.3	1021.3	1021.7	1022.0	1026.8	Trigger level 2	5.0 10.0 10.0		
		Weather Conditions:		Sunny.									
		Surface Ground Conditions:		Dry.									
Remarks:													
Gas monitoring was repeated on the final water dip, however due to repeated removal of the bung there was little time for gas accumulation.													

Visit 4

Job Title:							Job No:								
East Bierley.							3233								
Client:							Sheet :								
Rouse Homes.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
12/03/2019		13:55		15:20		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									
		% v/v	(%)	% v/v	(%)	(%)									
	(m) bgl						litre/hr	litre/hr	secs	m					
WS01	0.10	ND	0.1	ND	0.1	20.0	ND	ND	ND	1.44					
WS02	1.38	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.80					
WS03	0.20	ND	0.3	ND	0.2	20.1	ND	ND	ND	1.53	Negative flow: -1 to 0 over 5 sec. Bailed to 1.44 at 14:26 -3l. Remonitored 15:07				
WS04	0.00	ND	0.8	ND	0.8	19.1	0.4	0.0	4.0	1.38	Water at surface. Standing water around well. Bailed to 1.05m at 14:51. Remonitored at 14:57 0.24m.				
WS05	1.24	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.48					
WS06	0.11	ND	0.4	ND	0.2	19.8	ND	ND	ND	2.06	Negative flow: -0.3 to 0 over 5 sec. Bailed but very fast recharge. -10l with recharge to 0.20m in <30secs.				
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 (Bierley Weather Station)											
		Temp (°C):		4 to 5.		Barometric Pressure Trend:		Falling.							
Time:	13:55	14:30	15:20	00:04	06:04	13:54	14:29	15:19	18:00	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	973	970	969	1000.6	988	987.7	987.4	987.4	986	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Overcast.											
		Surface Ground Conditions:		Wet.											
Remarks:															

Visit 4 Bailed

Job Title:							Job No:						
East Bierley.							3233						
Client:							Sheet :						
Rouse Homes.							1 of 1						
Date:		Arrival Time:		Depart Time:		Operator:							
12/03/2019		13:55		15:20		A Taylor							
Gas Monitoring Results:													
Ambient Concentration (% Volume):				CH₄:	0.0	CO₂:	0.0	O₂:	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				
		CH₄	CO₂	CH₄	CO₂	O₂							
		% v/v	(%)	% v/v	(%)	(%)							
	(m) bgl	% v/v	(%)	% v/v	(%)	(%)	litre/hr	litre/hr	secs	m			
WS01	0.10	ND	0.1	ND	0.1	20.0	ND	ND	ND	1.44			
WS02	1.38	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.80			
WS03	0.39	ND	0.4	ND	0.4	19.6	13.9	0.0	10.0	1.53	Negative flow: -1 to 0 over 5 sec. Bailed to 1.44 at 14:26 -3l. Remonitored 15:07		
WS04	0.00	ND	0.8	ND	0.8	19.1	0.4	0.0	4.0	1.38	Water at surface. Standing water around well. Bailed to 1.05m at 14:51. Remonitored at 14:57 0.24m.		
WS05	1.24	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.48			
WS06	0.11	ND	0.4	ND	0.2	19.8	ND	ND	ND	2.06	Negative flow: -0.3 to 0 over 5 sec. Bailed but very fast recharge. -10l with recharge to 0.20m in <30secs.		
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 (Bierley Weather Station)									
		Temp (°C):		Barometric Pressure Trend:		Falling.							
		4 to 5.											
Time:	13:55	14:30	15:20	00:04	06:04	13:54	14:29	15:19	18:00	Trigger level 1	1.0	5.0	16.0
Pressure (mb):	973	970	969	1000.6	988	987.7	987.4	987.4	986	Trigger level 2	5.0	10.0	10.0
		Weather Conditions:		Overcast.									
		Surface Ground Conditions:		Wet.									
Remarks:													

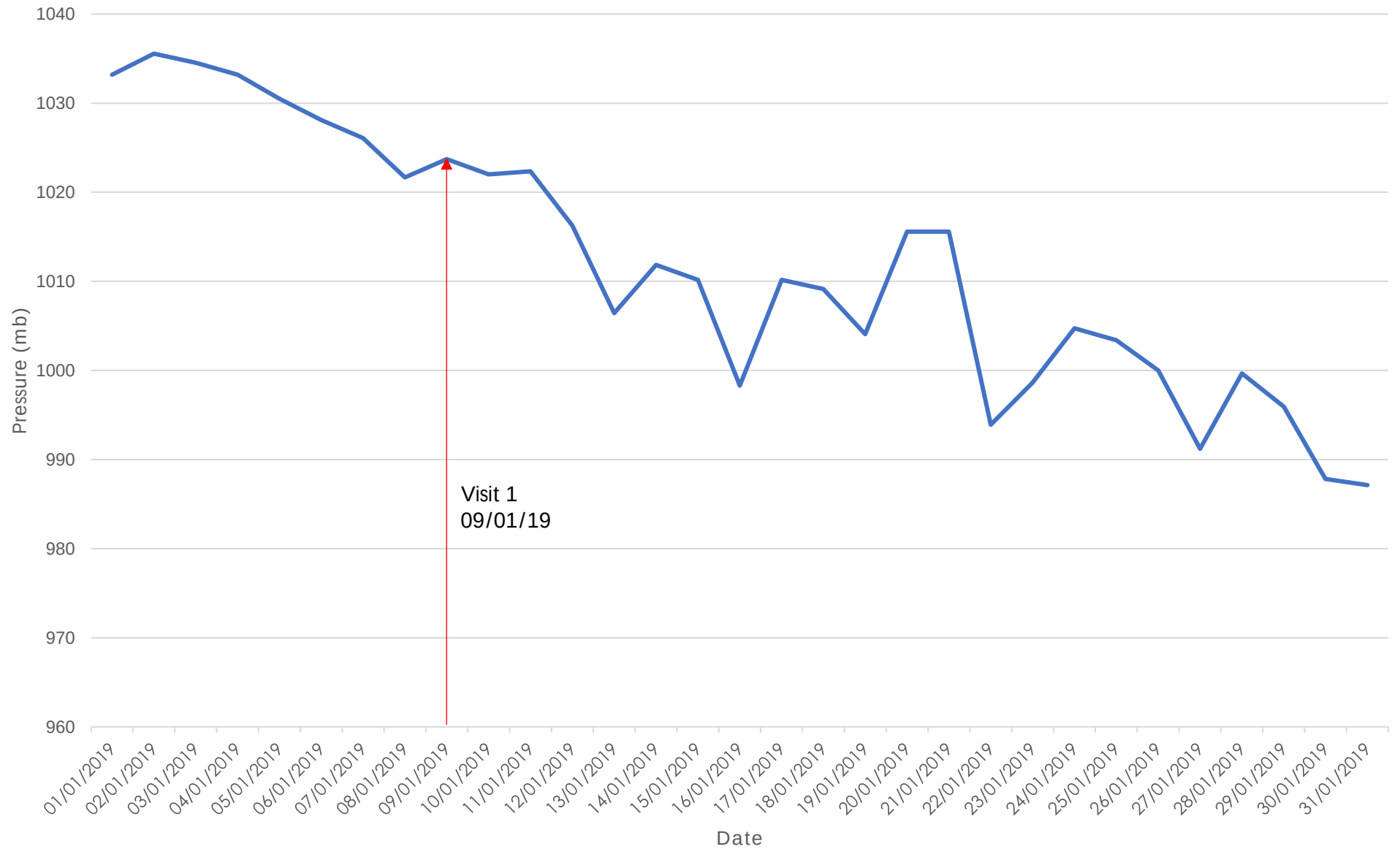
Visit 5

Job Title:							Job No:								
East Bierley.							3233								
Client:							Sheet :								
Rouse Homes.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
27/03/2019		14:05		15:30		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
WS01	1.29	ND	0.4	ND	0.2	19.9	0.8	0.0	8.0	1.46					
WS02	1.03	ND	0.3	ND	0.3	19.9	ND	ND	ND	1.83					
WS03	0.52	ND	0.2	ND	0.2	20.1	ND	ND	ND	1.54					
WS04	0.51	ND	0.3	ND	0.3	19.9	0.3	0.0	5.0	1.39					
WS05	1.04	ND	0.3	ND	0.2	20.0	ND	ND	ND	1.49					
WS06	1.26	ND	0.5	ND	0.5	19.5	0.4	0.0	5.0	2.06					
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 (East Bierley Weather Station)											
		Temp (°C):		11		Barometric Pressure Trend:				Rising					
Time:	14:05	14:55	15:30	00:00	05:00	14:00	14:50	15:30	21:00	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1010	1009	1009	1006	1006	1007	1007	1007	1008	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Sunny with intermittant cloud.											
		Surface Ground Conditions:		Dry.											
Remarks:															

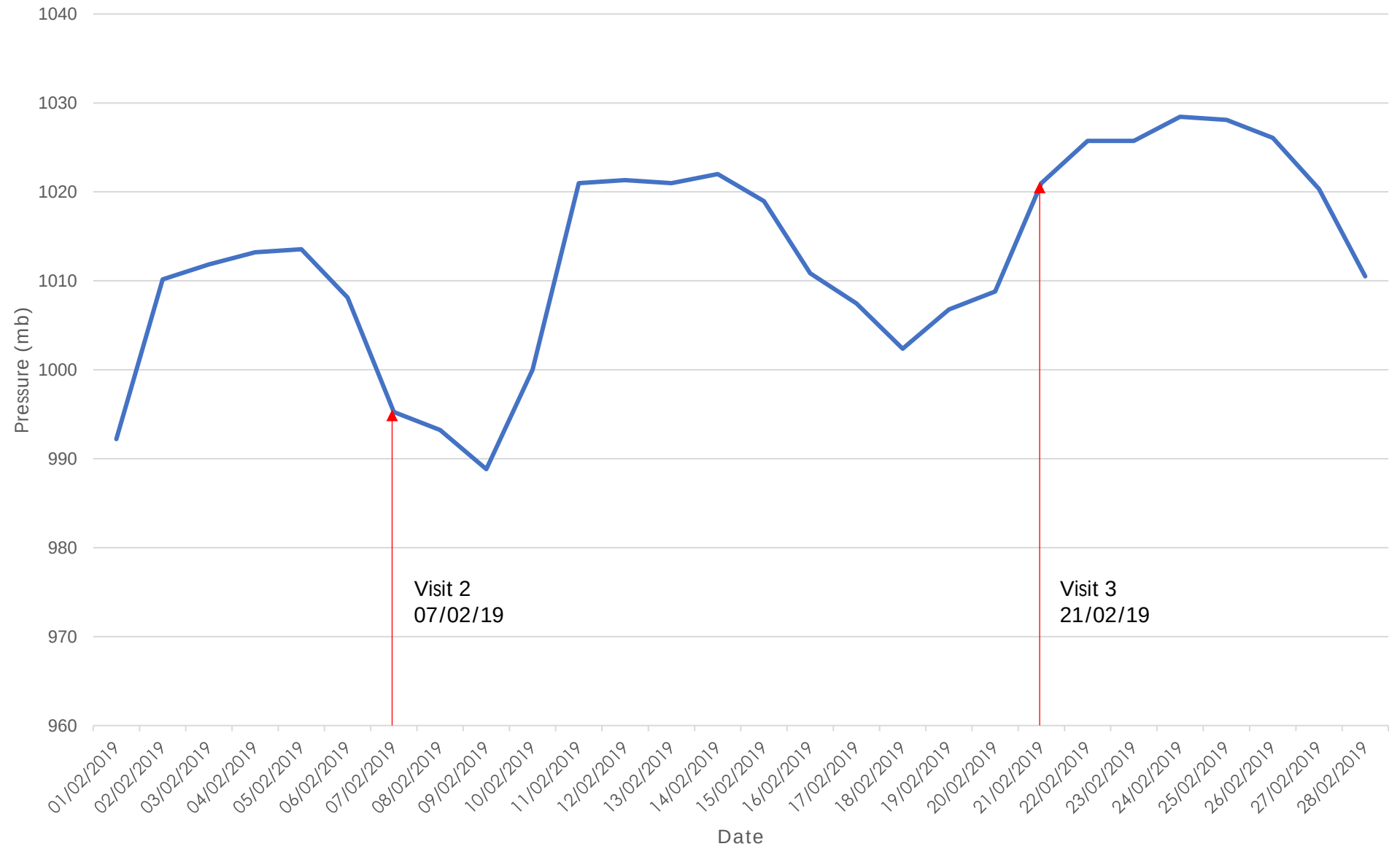
Visit 6

Job Title:							Job No:								
East Bierley.							3233								
Client:							Sheet :								
Rouse Homes.							1 of 1								
Date:		Arrival Time:		Depart Time:		Operator:									
12/04/2019		15:02		16:10		A Taylor									
Gas Monitoring Results:															
Ambient Concentration (% Volume):				CH ₄ :		0.0		CO ₂ :		0.0		O ₂ :		19.9	
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
WS01	ND	ND	0.5	ND	0.4	19.6	ND	ND	ND	1.45					
WS02	1.04	ND	0.4	ND	0.4	19.8	ND	ND	ND	1.83					
WS03	0.87	ND	0.5	ND	0.3	19.7	ND	ND	ND	1.55					
WS04	0.84	ND	2.1	ND	2.1	16.3	3.9	ND	20.0	1.38					
WS05	0.98	ND	0.3	ND	0.3	19.8	ND	ND	ND	1.52					
WS06	ND	ND	1.5	ND	1.5	18.2	ND	ND	ND	2.07					
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 (East Bierley Weather Station)											
		Temp (°C):		9 to 10.		Barometric Pressure Trend:		Steady							
Time:	15:02	15:38	16:10	00:00	09:00	15:00	15:40	16:10	21:00	Trigger level 1	1.0	5.0	16.0		
Pressure (mb):	1..3	1002	1002	1000	1001	1001	1001	1000	1001	Trigger level 2	5.0	10.0	10.0		
		Weather Conditions:		Overcast.											
		Surface Ground Conditions:		Dry.											
Remarks:															

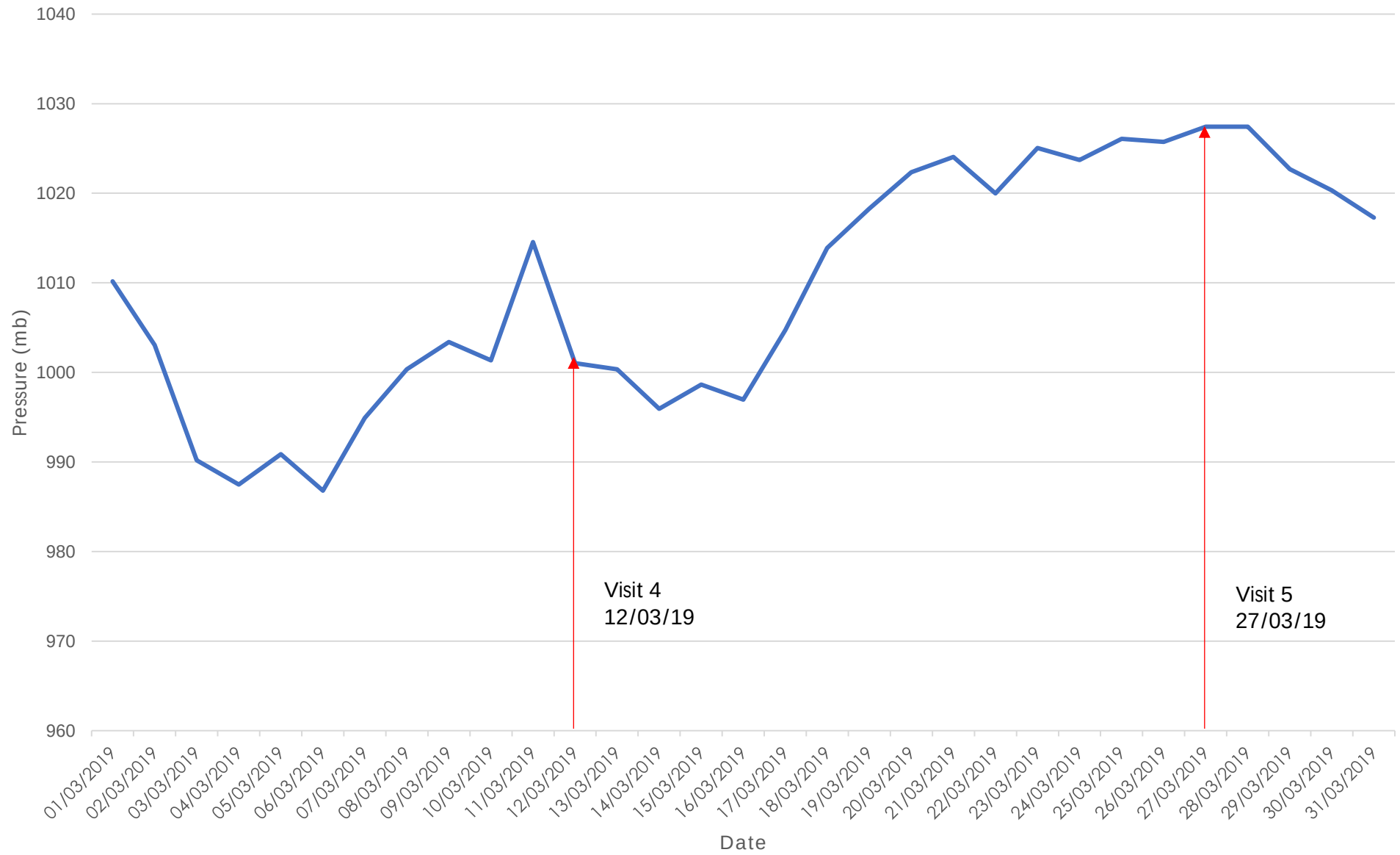
January 2019 Atmospheric Pressure Graph



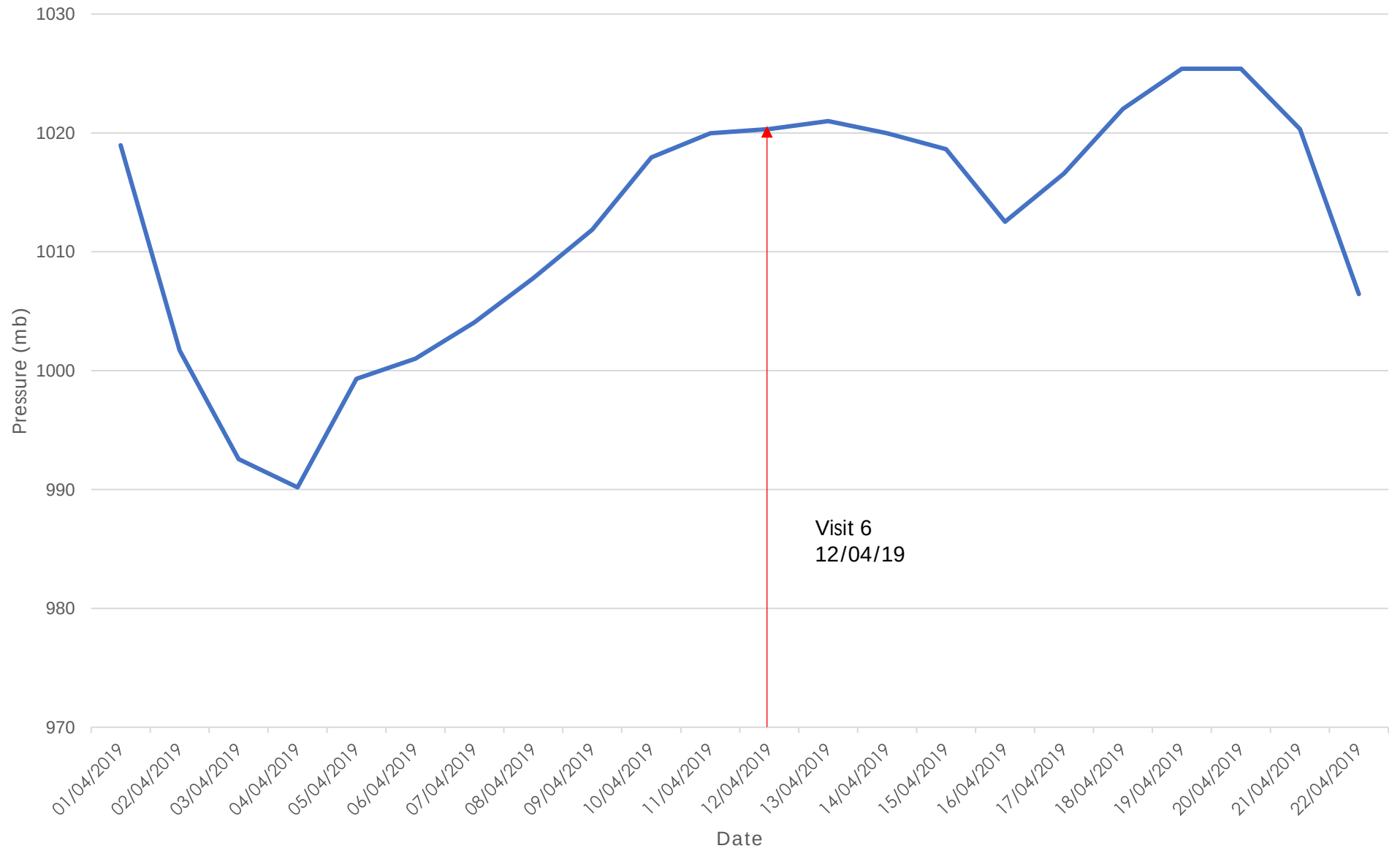
February 2019 Atmospheric Pressure Graph



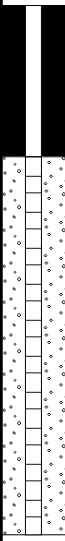
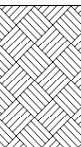
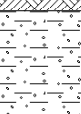
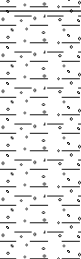
March 2019 Atmospheric Pressure Graph



April 2019 Atmospheric Pressure Graph

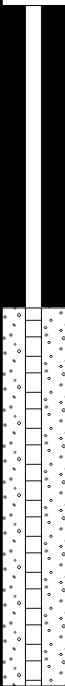
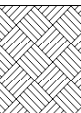
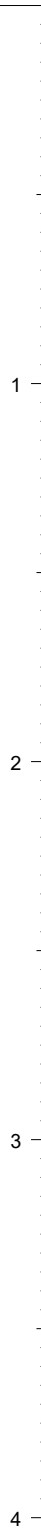


					Borehole Log			Borehole No. WS01 Sheet 1 of 1	
Project Name: East Bierley					Project No. 3233		Co-ords: 419838.00 - 428962.00		Hole Type WS
Location: East Bierley					Level:		Scale 1:20		Logged By JBR
Client: Rouse Homes					Dates: 04/12/2018 - 04/12/2018				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40		 Soft dark brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine and medium sandstone. (TOPSOIL)		
					0.70		 Firm light grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
							 Stiff light brown mottled orangish brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL) <i>0.75m: Too gravelly for vanes.</i>	1	
					1.40		 1.35-1.40m: Refusal on sandstone obstruction (bedrock or subangular lithorelict cobble). End of borehole at 1.40 m	2	
									3
									4

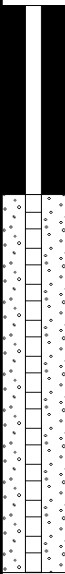
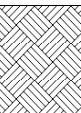
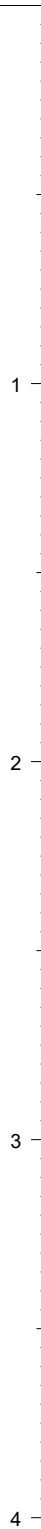
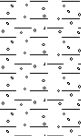
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Coordinates from handheld GPS (c.3m).								
--	--	--	--	--	--	--	--	---

				Borehole Log				Borehole No. WS02 Sheet 1 of 1	
Project Name: East Bierley				Project No. 3233		Co-ords: 419798.00 - 429014.00		Hole Type WS	
Location: East Bierley				Level:		Scale 1:20			
Client: Rouse Homes				Dates: 04/12/2018 - 04/12/2018		Logged By JBR			

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Soft dark brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine and medium sandstone. (TOPSOIL)		
					0.50		 Firm brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine to medium mudstone and sandstone. (COHESIVE RESIDUAL SOIL)		
				HVP=81			 Firm light grey mottled orangish brown CLAY. (COHESIVE RESIDUAL SOIL)		
					1.10		 0.80m: <i>Becoming stiff.</i>		
					1.80		 Stiff light grey mottled orangish brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
							1.75-1.80m: <i>Refusal on weak siltstone bedrock.</i> End of borehole at 1.80 m		

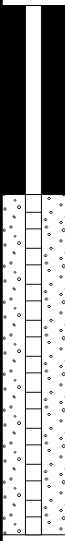
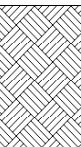
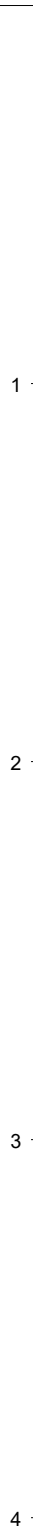
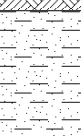
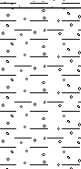
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Coordinates from handheld GPS (c.3m).		
--	--	---

				Borehole Log				Borehole No. WS03 Sheet 1 of 1	
Project Name: East Bierley				Project No. 3233		Co-ords: 419766.00 - 428969.00		Hole Type WS	
Location: East Bierley				Level:		Scale 1:20		Logged By JBR	
Client: Rouse Homes				Dates: 04/12/2018 - 04/12/2018					

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		 Soft dark brown slightly sandy CLAY. (TOPSOIL)		
							 Firm light grey mottled orangish brown CLAY. (COHESIVE RESIDUAL SOIL)		
				HVP=58	1.10		 Stiff light grey mottled orangish brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
					1.50		1.45-1.50m: Refusal on weak siltstone bedrock. End of borehole at 1.50 m		

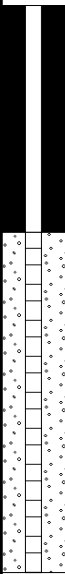
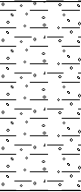
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Coordinates from handheld GPS (c.3m).								
--	--	--	--	--	--	--	--	---

				Borehole Log				Borehole No. WS04 Sheet 1 of 1	
Project Name: East Bierley				Project No. 3233		Co-ords: 419785.00 - 428935.00		Hole Type WS	
Location: East Bierley				Level:		Scale 1:20		Logged By JBR	
Client: Rouse Homes				Dates: 04/12/2018 - 04/12/2018					

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40		 Soft dark brown slightly sandy slightly gravelly CLAY. Gravel is angular and subangular fine and medium mudstone. (TOPSOIL)		
				HVP=56	0.75		 Firm light brown mottled orangish brown sandy CLAY. (COHESIVE RESIDUAL SOIL)		
					1.20		 Stiff light grey mottled orangish brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
					1.40		 Light grey angular and subangular fine to coarse lithorelict GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL) <i>1.35-1.40m Refusal on weak siltstone bedrock.</i> End of borehole at 1.40 m		

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Coordinates from handheld GPS (c.3m).								
--	--	--	--	--	--	--	--	---

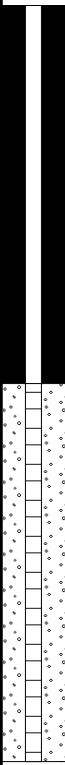
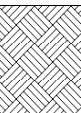
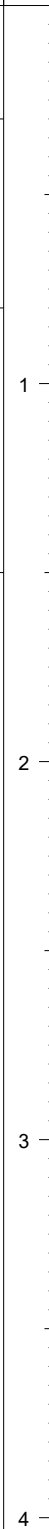
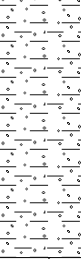
				Borehole Log				Borehole No. WS05 Sheet 1 of 1	
Project Name: East Bierley				Project No. 3233		Co-ords: 419738.00 - 428900.00		Hole Type WS	
Location: East Bierley				Level:		Scale 1:20			
Client: Rouse Homes				Dates: 04/12/2018 - 04/12/2018		Logged By JBR			

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20		 Soft dark brown slightly sandy CLAY. (TOPSOIL)		
							 Firm light grey mottled orangish brown CLAY. (COHESIVE RESIDUAL SOIL)		
				HVP=56			 0.80m: Thin bed of weak brown siltstone.		
				HVP=57			 Stiff light grey mottled light brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL) 1.00m: Too gravelly for vanes.	1	
					1.00		 1.45-1.50m: Refusal on weak siltstone bedrock. End of borehole at 1.50 m		
					1.50				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. Coordinates from handheld GPS (c.3m).



				Borehole Log			Borehole No. WS06 Sheet 1 of 1	
Project Name: East Bierley				Project No. 3233		Co-ords: 419668.00 - 428852.00		Hole Type WS
Location: East Bierley				Level:		Scale 1:20		
Client: Rouse Homes				Dates: 04/12/2018 - 04/12/2018		Logged By JBR		

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
				HVP=65	0.30		 Soft dark brown slightly sandy CLAY. (TOPSOIL)		
					0.80		 Firm light grey mottled orangish brown CLAY. (COHESIVE RESIDUAL SOIL)		
					1.50		 Stiff light grey mottled orangish brown gravelly CLAY. Gravel is angular and subangular fine and medium lithorelicts of siltstone. (COHESIVE RESIDUAL SOIL)		
					2.00		 Light grey and grey angular and subangular fine to coarse lithorelict GRAVEL of siltstone. (GRANULAR RESIDUAL SOIL)		
							1.95-2.00m: Refusal on weak siltstone bedrock. End of borehole at 2.00 m		

Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not apparent during drilling. 3. Coordinates from handheld GPS (c.3m).		
--	--	---