

020/5003/AG/cc

20th December 2024

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Dear Jonathan

Lower Edge Quarry – gas & groundwater monitoring results

We have undertaken the second of 12 monthly visits at Lower Edge Quarry to inform a landfill permit application, results of which are included in this letter.

This letter should be read in conjunction with the Factual Letter Report issued by Lithos on the 28th October 2024 (Ref. 017/5003/AG/cc) and the letter detailing the findings of the first monitoring visit (Ref. 019/5003/AG/cc), issued on the 12th November 2024.

Background

The site is located off Lower Edge Road, approximately 5.3km southeast of Halifax town centre and currently comprises an active quarry operated by Rand & Asquith. We understand the quarry is partially infilled with “stone, shale and pockets of fly ash”, however, in places the existing quarry void is c. 20m deep.

Lithos supervised the drilling of 5 rotary openhole boreholes between the 7th and 15th October 2024, to allow for the installation of dual gas and groundwater monitoring wells around the perimeter of the site. A total of 12 monthly visits will be undertaken to aid the application of a landfill permit. Details of the monitoring wells are listed below.

Monitoring well	Coordinates		Level	Installation	Response zone depths m bgl (m AOD)	Response zone lithology
	easting	northing				
BH01	412845.1	421374.6	160.149	19mm HDPE pipe	1.0 – 3.0 (159.15 – 157.15)	Quarry backfill
				50mm HDPE pipe	18.0 – 22.0 (142.15 – 138.15)	Quarry backfill
BH02	412729.9	421182.0	172.376	19mm HDPE pipe	1.0 – 3.0 (171.38 – 169.38)	Elland Flags
				50mm HDPE pipe	18.0 – 22.0 (154.38 – 150.38)	Elland Flags
BH03	412813.4	421106.3	177.696	19mm HDPE pipe	1.0 – 3.0 (176.70 – 174.70)	Granular Residual Soils
				50mm HDPE pipe	28.0 – 32.0 (149.70 – 145.70)	Elland Flags
BH04	412940.4	421050.0	176.317	19mm HDPE pipe	1.0 – 3.0 (175.32 – 173.32)	Quarry backfill
				50mm HDPE pipe	36.0 – 40.0 (140.32 – 136.32)	Possible Elland Flags
BH05	413013.5	421099.8	173.108	19mm HDPE pipe	1.0 – 3.0 (172.12 – 170.12)	Elland Flags
				50mm HDPE pipe	35.5 – 39.5 (137.61 – 133.61)	Elland Flags



Groundwater dip results

A total of three groundwater visits have been undertaken to determine the level of groundwater within the boreholes.

The initial visit was undertaken to assess the water level depths and allow for appropriate design of well development. Given the limited amount of water in most of the wells, 1 litre bailers were used to develop the wells on visit 1 undertaken on the 7th November 2024. The second visit was undertaken on the 4th December 2024 and only assessed groundwater levels. Results are summarised below:

Date	Visit	Well	Groundwater level m bgl	Remarks
31/10/24	Initial dip	BH01	19.23	-
07/11/24	Visit 1		20.30	Bailed 8 Litres to 21.34m bgl at 09:39. Re-dipped at 20.41m bgl at 14:45
4/12/24	Visit 2		17.93	-
31/10/24	Initial dip	BH02	20.68	-
07/11/24	Visit 1		20.82	Bailed 11 litres to 22.05m bgl at 10:00. Re-dipped at 22.05m bgl at 14:40
4/12/24	Visit 2		20.15	-
31/10/24	Initial dip	BH03	>30.00	-
07/11/24	Visit 1		32.33	Bailed 2 litres to 32.61m bgl at 10:21. Re-dipped at 32.61m bgl at 14:38
4/12/24	Visit 2		31.70	-
31/10/24	Initial dip	BH04	>30.00	-
07/11/24	Visit 1		34.85	Bailed 33 litres to 37.49m bgl at 11:05. Re-dipped at 38.01m at 14:21.
4/12/24	Visit 2		31.11	-
31/10/24	Initial dip	BH05	28.66	-
07/11/24	Visit 1		29.08	Bailed 60 litres to 35.33m bgl at 14:15
4/12/24	Visit 2		27.00	-

Groundwater samples are required monthly to aid the landfill permit application, however, it is anticipated that sample recovery will only be possible in BH04 & BH05 and perhaps BH01. Given the lack of recharge in BHs 02 & 03, it is unlikely that samples will be recovered during further monitoring visits. The first groundwater sampling visit is scheduled early January 2025.

Gas monitoring results

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 GFM436 infra-red gas analyser
- Standing water level using a dipmeter

To date, two monthly gas monitoring visits have been undertaken. The monitoring results from visit 2 of 12 are enclosed and summarised in the table below.

Well		Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
BH01	50mm	Quarry backfill	ND	ND	ND
	19mm	Quarry backfill	ND	0.3	ND
BH02	50mm	Elland Flags	ND	ND	0.3
	19mm	Elland Flags	ND	0.2	ND
BH03	50mm	Granular Residual Soils	ND	ND	-0.3
	19mm	Elland Flags	ND	1.7	-0.3
BH04	50mm	Quarry backfill	ND	0.1	ND
	19mm	Possible Elland Flags	ND	0.1	ND
BH05	50mm	Elland Flags	ND	ND	ND
	19mm	Elland Flags	ND	ND	0.4

Note: Atmospheric pressures varied between 1007mb and 1035mb.

During this visit, atmospheric pressure was rising from 996mb to 1027 across the day.

Should you require any further information, please contact the undersigned.

Yours sincerely



Adam Gombocz
Director

for and on behalf of
LITHOS CONSULTING LIMITED

Encl.

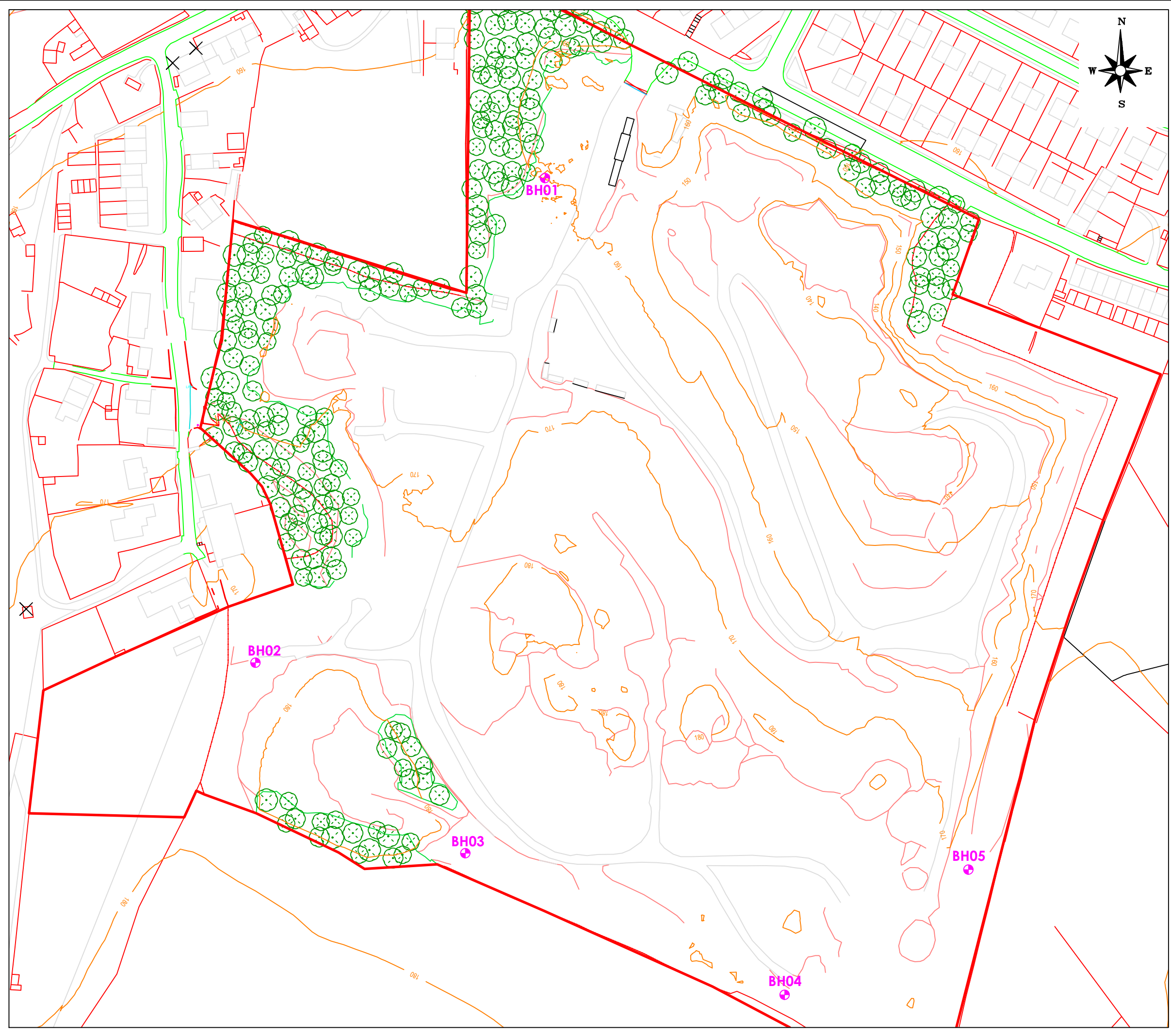
Gas & Groundwater monitoring data – visit 2
Drawing 5003/6 BH location plan
Borehole logs

Visit 2

Job Title:				Job No:	
Quarry at Rastrick, Brighouse				5003	
Client:				Sheet :	
Britology				2 of 2	
Date:	Arrival Time:	Depart Time:	Operator:		
04/12/2024	08:00	09:30	George Costley & Charlotte Copley		



Gas Monitoring Results:											
Ambient Concentration (% Volume):			CH ₄ :	ND	CO ₂ :	ND	O ₂ :	17.0			
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		
BH01 (50mm)	17.93	ND	ND	ND	ND	16.9	ND	ND	120.0	21.46	
BH02 (50mm)	20.15	ND	ND	ND	ND	17.0	-0.3	0.3	120.0	22.79	
BH03 (50mm)	31.70	ND	ND	ND	ND	17.0	-0.3	-0.3	120.0	37.77	
BH04 (50mm)	31.11	ND	0.1	ND	0.1	16.5	ND	ND	120.0	41.55	
BH05 (50mm)	27.00	ND	ND	ND	ND	17.0	ND	ND	120.0	40.83	
BH01 (19mm)	ND	ND	0.3	ND	0.3	17.0	ND	ND	120.0	2.82	
BH02 (19mm)	ND	ND	0.2	ND	0.2	17.0	ND	ND	120.0	2.74	
BH03 (19mm)	ND	ND	1.7	ND	1.7	15.3	-0.3	-0.3	120.0	2.83	
BH04 (19mm)	ND	ND	0.1	ND	0.1	17.0	-0.4	ND	120.0	2.82	
BH05 (19mm)	ND	ND	ND	ND	ND	17.1	1.8	0.4	120.0	2.90	
Equipment Used:						Next Calibration Date			Key		
Gas Data GFM436 Infrared Gas Analyser						27/03/2025			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 (Ganton Weather Station)							
	Temp (°C):	3.4 > 5.5		Barometric Pressure Trend:			Rising				
Time:	08:00	09:15	09:30	00:00	06:00	08:00	09:15	09:30	11:30	Trigger level 1	
Pressure (mb):	996	1000	1000	1024	1026	1026	1027	1027	1027	Trigger level 2	
	Weather Conditions:		Clear skies, Cold								
	Surface Ground Conditions:		Wet								
Remarks:											
	Ganton Weather station is located approximately 2 miles south from the site (Quarry at Rastrick, Brighouse)										



NOTES

 BOREHOLE LOCATION

 APPROXIMATE SITE BOUNDARY

EXPLORATORY HOLE LOCATIONS HAVE BEEN SURVEYED
IN (COORDINATES & GROUND LEVEL) ON COMPLETION

REV.	DESCRIPTION	DATE



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

CLIENT

BRITOLOGY

JOB TITLE

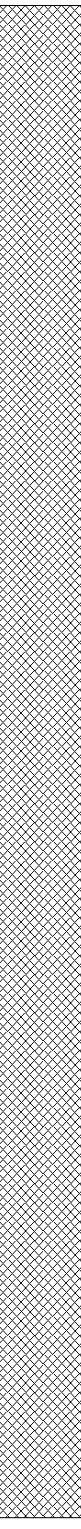
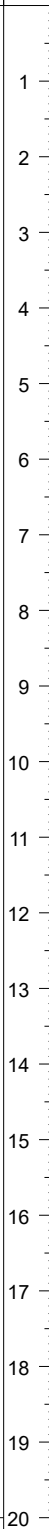
QUARRY NEAR
RASTRICK,
BRIGHOUSE

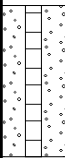
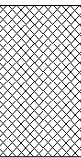
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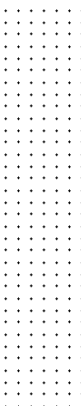
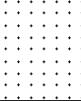
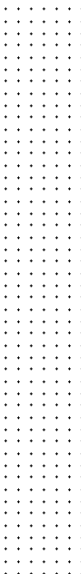
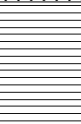
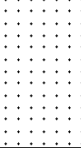
EXPLORATORY HOLE LOCATIONS

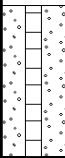
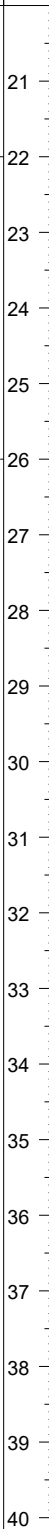
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CHECKED	AG	DATE	16 10 2025	FOR APPROVAL	☐
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				FINAL	☒

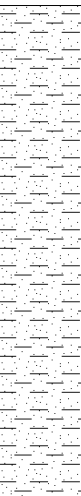
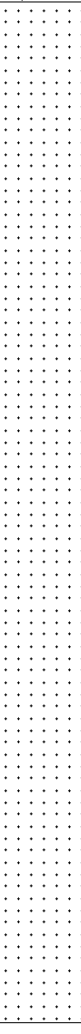
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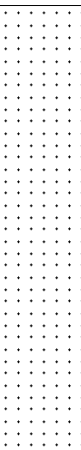
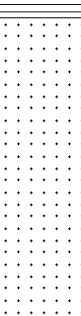
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Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412845.06 - 421374.61		Hole Type PH				
Location: Rastrick					Level: 160.15		Scale 1:100		Logged By CC				
Client: Britology					Dates: 15/10/2024 - 15/10/2024								
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description					
		Depth (m)	Type	Results									
								MADE GROUND: Light brown QUARRY BACKFILL. Recovered as sandstone with occasional flecks of mudstone. (QUARRY BACKFILL)					
		Continued on next sheet											
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.													

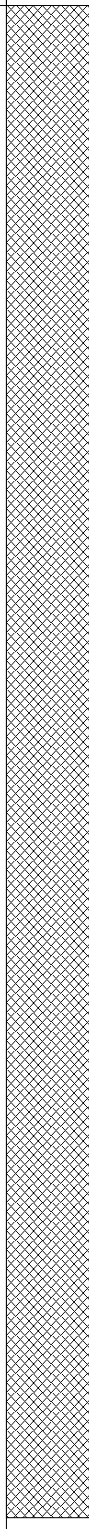
					Borehole Log			Borehole No. BH01 Sheet 2 of 2			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412845.06 - 421374.61		Hole Type PH		
Location: Rastrick					Level: 160.15		Scale 1:100		Logged By CC		
Client: Britology					Dates: 15/10/2024 - 15/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					22.00	138.15		End of borehole at 22.00 m	21		
									22		
									23		
									24		
									25		
									26		
									27		
									28		
									29		
									30		
									31		
									32		
									33		
									34		
									35		
									36		
									37		
									38		
									39		
									40		
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.											

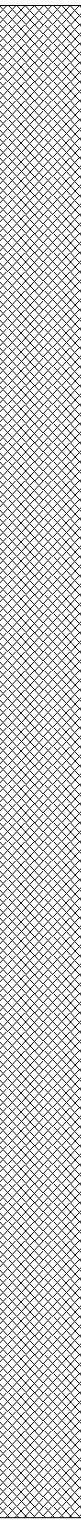
					Borehole Log			Borehole No. BH02 Sheet 1 of 2			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412729.92 - 421181.99		Hole Type PH		
Location: Rastrick					Level: 172.40		Scale 1:100		Logged By CC		
Client: Britology					Dates: 07/10/2024 - 07/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					1.50	170.90		Overburden. (GRANULAR RESIDUAL SOIL)	1		
									Light brown SANDSTONE. (ELLAND FLAGS)	2	
										3	
										4	
										5	
										6	
						7.00	165.40		Interbedded SANDSTONE and MUDSTONE. (ELLAND FLAGS)	7	
						8.40	164.00		Light brown SANDSTONE. (ELLAND FLAGS)	8	
										9	
										10	
								11			
								12			
								13			
								14			
								15			
								16			
				16.30	156.10		Dark grey MUDSTONE. (ELLAND FLAGS)	17			
								18			
								19			
				18.00	154.40		Light brown SANDSTONE with fine bands of dark grey MUDSTONE. (ELLAND FLAGS)	20			
Continued on next sheet											
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered between 17.3m and 20.3m depth. 3. Flush returns were lost from 12.4m and 15.4m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.											

					Borehole Log			Borehole No. BH02 Sheet 2 of 2			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412729.92 - 421181.99		Hole Type PH		
Location: Rastrick					Level: 172.40		Scale 1:100		Logged By CC		
Client: Britology					Dates: 07/10/2024 - 07/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					22.00	150.40		Dark grey MUDSTONE. (ELLAND FLAGS)			
					26.00	146.40					
								End of borehole at 26.00 m			
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater encountered between 17.3m and 20.3m depth. 3. Flush returns were lost from 12.4m and 15.4m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.											

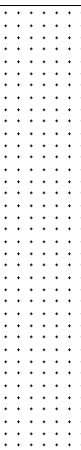
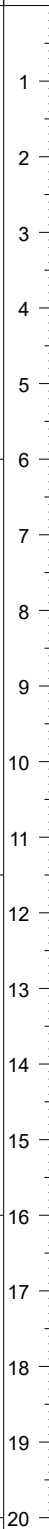
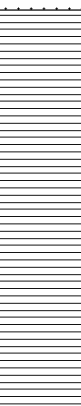
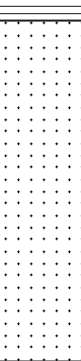
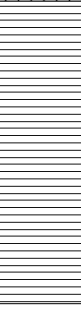
					Borehole Log			Borehole No. BH03 Sheet 1 of 2			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412813.40 - 421106.28		Hole Type PH		
Location: Rastrick					Level: 177.70		Scale 1:100		Logged By CC		
Client: Britology					Dates: 08/10/2024 - 09/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					6.50	171.20		Overbuden. (GRANULAR RESIDUAL SOIL)	1		
									2		
									3		
									4		
									5		
									6		
								Light brown SANDSTONE with occasional bands of dark grey MUDSTONE. (ELLAND FLAGS)	7		
									8		
									9		
									10		
									11		
									12		
									13		
									14		
									15		
									16		
									17		
									18		
									19		
									20		
Continued on next sheet											
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.											

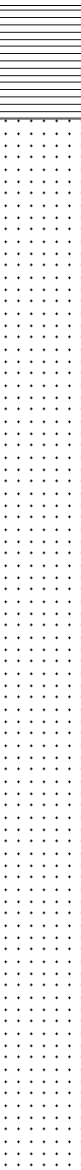
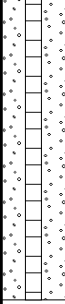
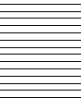
					Borehole Log			Borehole No. BH03 Sheet 2 of 2	
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412813.40 - 421106.28		Hole Type PH
Location: Rastrick					Level: 177.70		Scale 1:100		
Client: Britology					Dates: 08/10/2024 - 09/10/2024		Logged By CC		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									21
									22
									23
									24
									25
					26.00	151.70		Dark grey MUDSTONE. (ELLAND FLAGS)	26
					27.00	150.70		Interbedded SANDSTONE and MUDSTONE. (ELLAND FLAGS)	27
									28
									29
									30
					31.00	146.70		Dark grey MUDSTONE. (ELLAND FLAGS)	31
									32
					32.40	145.30		End of borehole at 32.40 m	33
									34
									35
									36
									37
									38
									39
									40
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									

					Borehole Log			Borehole No. BH04 Sheet 1 of 3			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412940.37 - 421050.00		Hole Type PH		
Location: Rastrick					Level: 176.30		Scale 1:100		Logged By CC		
Client: Britology					Dates: 10/10/2024 - 10/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
								MADE GROUND: Light brown QUARRY BACKFILL. Recovered as a light brown sandstone with occasional bands of dark grey mudstone. (QUARRY BACKFILL)	1		
									2		
										3	
										4	
										5	
										6	
										7	
										8	
										9	
										10	
										11	
										12	
										13	
										14	
										15	
										16	
										17	
										18	
										19	
										20	
Continued on next sheet											
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Flush returns were lost from 40.0m and 44.5m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.											

					Borehole Log			Borehole No. BH04 Sheet 2 of 3			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412940.37 - 421050.00		Hole Type PH		
Location: Rastrick					Level: 176.30		Scale 1:100		Logged By CC		
Client: Britology					Dates: 10/10/2024 - 10/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
								)	21		
									22		
									23		
									24		
									25		
									26		
									27		
									28		
									29		
									30		
									31		
									32		
									33		
									34		
									35		
									36		
									37		
									38		
									39		
									40		
					40.00	136.30	Continued on next sheet				
Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Flush returns were lost from 40.0m and 44.5m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.											

					Borehole Log			Borehole No. BH04 Sheet 3 of 3			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 412940.37 - 421050.00		Hole Type PH		
Location: Rastrick					Level: 176.30		Scale 1:100		Logged By CC		
Client: Britology					Dates: 10/10/2024 - 10/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					44.50	131.80		Soft drilling, limited flush returns. Possible mudstone?			
								End of borehole at 44.50 m			
Remarks											
1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Flush returns were lost from 40.0m and 44.5m depth. 4. Exploratory hole surveyed in (level and co-ordinates) on completion.											
											

					Borehole Log			Borehole No. BH05 Sheet 1 of 2			
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 413013.46 - 421099.76		Hole Type PH		
Location: Rastrick					Level: 173.10		Scale 1:100		Logged By CC		
Client: Britology					Dates: 14/10/2024 - 14/10/2024						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					6.00	167.10		Light brown SANDSTONE. (ELLAND FLAGS)			
					11.50	161.60		Dark grey MUDSTONE. (ELLAND FLAGS)			
					16.00	157.10		Light brown SANDSTONE. (ELLAND FLAGS)			
								Dark grey MUDSTONE. (ELLAND FLAGS)			
		Continued on next sheet									
		Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.									
											

					Borehole Log			Borehole No. BH05 Sheet 2 of 2									
Project Name: Quarry at Rastrick					Project No. 5003		Co-ords: 413013.46 - 421099.76		Hole Type PH								
Location: Rastrick					Level: 173.10		Scale 1:100		Logged By CC								
Client: Britology					Dates: 14/10/2024 - 14/10/2024												
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description									
		Depth (m)	Type	Results													
					21.50	151.60		Light brown SANDSTONE. (ELLAND FLAGS)	21								
									22								
									23								
									24								
									25								
									26								
									27								
									28								
									29								
									30								
					35.50	137.60		Dark grey MUDSTONE. (ELLAND FLAGS)	35								
									36								
									37								
									38								
									39								
									40								
									End of borehole at 39.50 m								
									Remarks 1. Prior to drilling a Cable Avoidance Tool (CAT) survey was carried out. 2. Groundwater was not encountered. 3. Exploratory hole surveyed in (level and co-ordinates) on completion.								
																	