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CONSULTING

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Prepared for:	Holchem Laboratories Limited
Date:	October 2022

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CLIENT	HOLCHEM LABORATORIES LTD
CLIENT CONTACT	-
For and Behalf of Groundtech Consulting	
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Introduction

We are pleased to present our findings following the completion of the gas monitoring programme undertaken at the above site for the proposed commercial development.

A Geo-Environmental Appraisal was carried out by Groundtech Consulting referenced *GRO-22216-3751*, dated 08 September 2022.

Previous Investigation Summary

Brian Clancy Higby Partnership produced a Ground Investigation Report (*Ref: 1401-4246, dated May 2014*) and a summary of the relevant information is summarised below.

Superficial Deposits

The site is indicated to be underlain by superficial Hummocky (Moundy) Glacial Deposits which characteristically comprises clayey sand and gravel.

Solid Geology

The solid geology is the Pennine Lower Coal Measures Formation consisting of mudstone, siltstone and sandstone. The site is not underlain at shallow depth by any coal seams.

Scope and Ground Conditions

Three cable percussive boreholes were drilled to depths of between 8.0m and 12.0m bgl.

Made Ground was encountered in all locations beneath the site to a maximum depth of 9.5m bgl and comprised cohesive clay fill with variable granular content of sand and subangular gravel. Slightly clayey fine to coarse sand was encountered between depths of 1.2m and 1.65m bgl within BH02, clayey fine to medium grained sand and gravel was present between depths of 1.98m and 4.8m bgl within BH03.

Alluvial deposits consisting of soft to firm dark brown slightly sandy Clay with occasional gravel was encountered between depths of 3.2m to 5.2m bgl in BH02 and loose to medium dense dark brown fine to medium Sand was observed between 4.9m to 10.45m bgl in all exploratory holes.

Glacial deposits comprising firm to stiff brown sandy silty Clay with thin bands of wet fine to medium sand was encountered between 7.0m to 12.0m bgl.

Bedrock was not encountered during the investigation.

Groundwater was observed in BH01 at 9.0m bgl.

Ground Model

Groundtech Consulting carried out Ground Investigation works in June 2022 and the following ground model was determined.

Made Ground

Made Ground was encountered in all three cable percussive boreholes to depths of between 2.5m and 6.5m bgl. The deepest Made Ground was present in the eastern part of the proposed development area.

The surfacing of the site comprised the following:

- Sandy cobbles of sandstone were encountered in BH04 to a depth of 0.5m bgl.
- Dark brown slightly sandy clayey topsoil was present in BH05 and BH07 to a maximum depth of 0.3m bgl.

Four main populations of Made Ground were encountered during the investigation and are described below:

- Firm dark brown sandy gravelly clay with gravel of mixed lithologies including sandstone, siltstone and brick was present in BH07 from depths 0.25m to 4.9m bgl in BH07.
- Brown clayey gravelly Sand with a low cobble content and gravel of mixed lithologies including sandstone and brick was present in BH05 between depths 0.3m and 0.7m bgl.
- Firm brown silty sandy Clay was found in BH04 between depths 0.5m to 0.7m bgl.
- Dark brown clayey slightly gravelly Sand with gravel of mixed lithologies including mudstone was present in BH04 between depths of 0.7m and 2.5m bgl.

Natural Ground

The natural strata encountered generally confirmed the published geological records.

Two main natural stratification were encountered during the investigation are described below:

- Firm to stiff brown sandy gravelly Clay was encountered between depths of 3.1m to 20.0m bgl in all the borehole locations across the site.
- Loose to medium dense clayey gravelly Sand was encountered between depths of 2.5m to 15.7m bgl in BH4, BH5 and BH7.

Bedrock

Bedrock was not encountered during the investigation.

Groundwater

Groundwater strikes were observed in all four boreholes beneath the site as detailed below:

Location	Water Strike Depth (m bgl)
BH4	7.00
BH5	8.00
BH6	9.00
BH7	10.00

The exploratory hole positions are shown on the Exploratory Hole Location Plan GRO-22216-P02 and the logs are appended.

Gas Monitoring

During the Ground Investigation works, monitoring standpipes were installed in the following holes and a summary of the installations is provided in the table below.

Location	Depth (m)	Response Zone (m bgl)	Targeted Strata	Reason
BH4	3.0	1.0 – 3.0	Made Ground/Sand	Ground Gas
BH5	7.0	3.0 – 7.0	Clay	Ground Gas
BH7	3.0	1.0 – 3.0	Made Ground	Ground Gas

The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe.

Four ground gas monitoring visits have been completed between 28th July and 22nd September 2022. Monitoring of the weather conditions and predicted atmospheric pressures (Met Office Surface Pressure Charts) was carried out up to 72 hours in advance of proposed monitoring visits in order that a reasonable period of data was obtained to determine atmospheric trends, and also to target the 'worst case' scenario.

Permanent gas and flow rate monitoring was carried out using a GFM436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) as the percentage volume in air (%v/v).
- Hydrogen sulphide (H₂S) and carbon monoxide (CO) as the percentage volume in air (%v/v).
- Lower Explosive Limit (% LEL) of methane.
- Atmospheric and borehole pressure, including pressure trend.
- Flow measurements (l/hr).

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes.

Permanent gas and groundwater monitoring results are appended.

Gas Monitoring Results

Concentrations of methane (CH₄) have been recorded in BH4 and BH7 in the central and eastern parts of the site at peak concentrations of between 17.5% v/v and 46.4% v/v. No methane was detected in BH5 in the western area.

Detectable levels of carbon dioxide (CO₂) were recorded in all three standpipes at peak concentrations of 3.1% v/v up to a maximum level of 7.9% v/v. Carbon dioxide was recorded above 5.0% v/v in BH5 and BH7.

Associated depleted oxygen (O₂) was recorded with a minimum concentration of 0.0% v/v being detected in BH7 during the 2nd and 3rd visits.

Generally, no positive gas flow rates were recorded in the standpipes except for one occurrence. A positive gas flow rate of 1.8 l/hr was recorded during the 3rd monitoring visit in BH7.

The atmospheric pressure ranged between 995mb and 1007mb and the monitoring was carried out during periods of steady and falling barometric pressure.

Groundwater was only encountered once during the monitoring period and was present in BH5 on the second visit at 4.79m bgl which is within the response zone of the standpipe.

Characterisation of the Gas Screening Value (GSV)

In accordance with CIRIA Report C665, November 2007 it is felt that an adequate risk assessment can be undertaken based on the following limiting factors:

- *The proposed development has been considered as **low sensitivity** based on the site being developed with a commercial end use comprising a warehouse extension to the main laboratory (Table 5.5 – Typical/Idealised frequency and period of monitoring, after Wilson et al, 2005).*
- *The risk associated with the generation potential of a source is considered as **moderate** as 9.5m of Made Ground has been encountered beneath the site (assessment based on the environmental setting as well as observations noted during the fieldworks).*

Based on the results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to gas screening values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates. In addition, individual “hazardous gas flow rates” (Q_{hg}) have been derived for each monitoring point.

$$GSV \text{ (l/hr)} = \text{max borehole flow rate (l/hr)} \times \text{max gas concentration (\%)}$$

For this assessment, the maximum recorded concentrations of carbon dioxide of 7.9% v/v and methane of 46.4% v/v have been used to calculate the GSVs, along with a positive gas flow rate of 1.8 l/hr.

$$\text{Carbon Dioxide GSV} = 0.079 \text{ (7.9\%)} \times 1.8 = 0.1422 \text{ l/hr}$$

$$\text{Methane GSV} = 0.464 \text{ (46.4\%)} \times 1.8 = 0.8352 \text{ l/hr}$$

Assessment

Peak carbon dioxide concentrations recorded typically range from 3.1% v/v to 7.9% v/v, with concentrations in excess of 5.0% v/v being recorded in BH5 and BH7. In addition, high concentrations of methane have been detected in BH4 and BH7 ranging from 17.3% v/v to 46.4% v/v, which targeted the Made Ground.

The carbon dioxide and methane concentrations are likely to be associated with the Made Ground that is present beneath the site to depths of up to 9.5m bgl or the Alluvial clay and sand deposits which are present to depths of up to 10.45m bgl.

When considering the gas monitoring results in accordance with CIRIA C665 (Section A Development and Table 8.5 – Modified Wilson and Card Classification), it can be seen that the GSV for carbon dioxide corresponds with CS2 criteria (GSV of less than 0.7 l/hr) however, the GSV for methane falls within CS3 (GSV less than 3.5 l/hr).

Significantly high concentrations of methane have consistently been recorded during all four monitoring visits in BH4 and BH7 and carbon dioxide levels greater than 5% v/v were recorded in BH5 and BH7 on all four occasions. Based on the recorded gas monitoring results and the calculated GSVs, the site is considered to be placed in CS3.

Characteristic Situation 3

An extract of the table is presented below.

Characteristic Situation	Wilson and Card		Wilson and Card	
	Methane		Carbon Dioxide	
	Gas Screening Value (l/hr)	Typical Maximum Concentration (% v/v)	Gas Screening Value (l/hr)	Typical Maximum Concentration (% v/v)
1	<0.07	<1	<0.07	<5
2	<0.7	Borehole flow rate not greater than 70l/hr	<0.7	Borehole flow rate not greater than 70l/hr
3	<3.5	-	<3.5	-
4	<15	Quantitative Risk Assessment Required	<15	Quantitative Risk Assessment Required
5	<70	-	<70	-
6	>70	-	>70	-

Gas protection measures as outlined in CIRIA C665 for CS3 are as follows:

- Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft).*
- Beam and block or precast concrete slab.*
- Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.*
- All types of floor slab as listed above.*
- All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.*

The proposed commercial development is classified as a Building Type C in accordance with BS8485:2015 and as the site has been classified as CS3, in accordance with Table 2 of the above guidance, 3 points of protection are required for the proposed commercial development and gas protection measures are necessary.

Gas precautionary measures outlined in BS8485:2015 include the following to reach the required number of protection points and should consist of at least two different elements:

Structural Barrier / Floor Slab

- Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations – 1.5 points.*

Ventilation Protection Measures

- Passive sub floor dispersal layer of good performance – 1.5 points.*



- Gas resistant membrane (including methane) meeting the criteria outlined in Table 7 of BS 8485:2015 – 2 points.

Radon Gas

The site is not located in an area where basic radon precautions are required within the proposed development.

Conclusions

The site has been classified as being in CS3 in accordance with CIRIA C665 and gas protection measures are required within the proposed development at the site.

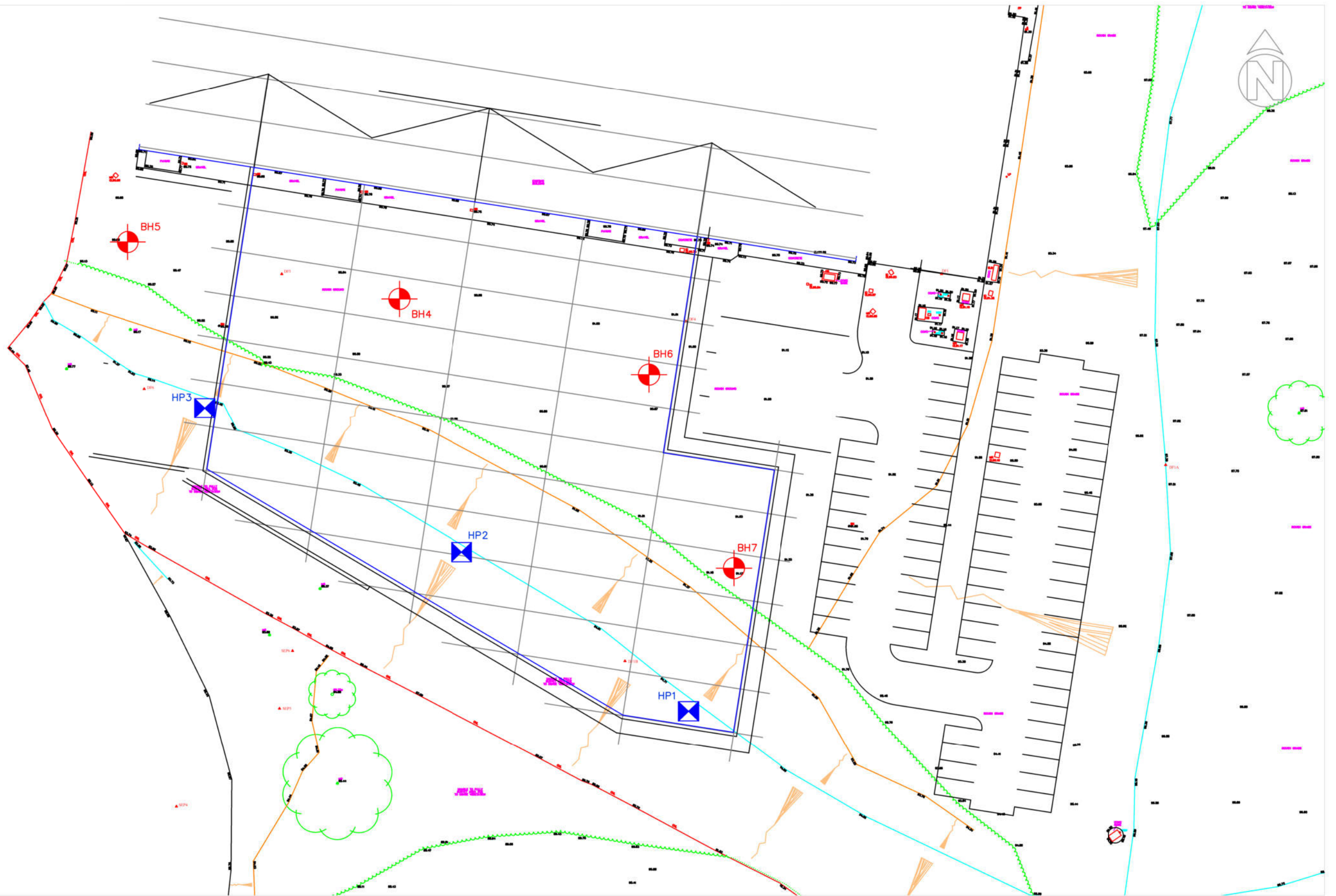
Radon precautions not required.

The installation and verification of the gas protection measures should be carried out in accordance with CIRIA C735.

It is recommended that confirmation of these findings is made with the Local Authority prior to any irrevocable action being taken.



PLANS





EXPLORATORY HOLE LOGS



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Borehole Log

Borehole No.

BH4

Sheet 1 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 15/06/2022 - 16/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		0.50			MADE GROUND: Sandy cobbles of sandstone. Sand is fine to coarse.	
		0.50	ES		0.70			MADE GROUND: Firm brown sandy silty clay. Sand is fine to coarse.	
		1.00	D					MADE GROUND: Dark brown clayey slightly gravelly coarse sand. Gravel is rounded to subrounded coarse of mudstone.	1
		1.20		N=23 (1,2/5,7,4,7)					
		1.50	ES						
		2.00		N=11 (1,2/2,3,2,4)					2
		2.60	D		2.50			Medium dense brown clayey gravelly fine to coarse SAND. Gravel is subrounded to rounded fine of mudstone.	
		3.00	ES						3
		3.00	B	N=11 (1,1/2,2,3,4)					
		3.00 - 3.45							
		4.00		N=13 (1,2/3,3,3,4)					4
		5.00							
		5.00 - 5.45	B	N=17 (2,3/4,4,4,5)	5.10			Firm to medium strength grey brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is rounded to subrounded fine of mudstone.	5
		6.00 - 6.45	U						6
		6.50	D		6.40			Medium dense grey silty gravelly fine to coarse SAND. Sand is fine to coarse. Gravel is rounded to subrounded fine of mudstone and siltstone.	7
		7.00	B	N=18 (1,3/4,4,4,6)				Firm high strength dark brown gravelly sandy CLAY. Sand is fine. Gravel is subrounded to rounded fine mudstone and siltstone.	8
		7.00 - 7.45			7.80				
		8.50 - 8.95	U						
		9.00	D		9.00			Firm dark brown sandy slightly gravelly silty CLAY. Sand is fine. Gravel is subrounded to rounded fine of mudstone.	9
		10.00 - 10.45	B		10.00				10

Continued on next sheet

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 7.0m bgl. 4. Standpipe installed to 3.0m bgl: 1.0m plain, 2.0m slotted.





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Borehole Log

Borehole No.

BH4

Sheet 2 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 15/06/2022 - 16/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.50 - 11.95	U					Firm brown silty CLAY.	11
								<u>High strength at 11.5m bgl</u>	12
		13.00 13.00 - 13.45	B	N=17 (2,3/3,4,4,6)	13.00			Medium dense fine brown clayey silty SAND.	13
		14.50		N=26 (3,3/4,5,7,10)					14
		15.50 - 15.95	B		15.70				15
		17.00 17.00 - 17.45	B	N=36 (4,5/5,7,10,14)	17.00			Firm brown sandy gravelly CLAY. Sand is fine. Gravel is rounded to subrounded fine of mixed lithologies including siltstone and sandstone.	16
		18.50		N=50 (4,5/10,14,16,10)	18.50			Firm to stiff brown sandy gravelly CLAY. Sand is fine. Gravel is rounded to subrounded fine to coarse of mixed lithologies including siltstone and sandstone.	17
		19.50		N=43 (5,4/6,10,10,17)				Firm to stiff brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to rounded coarse of mixed lithologies including siltstone and sandstone.	18
					20.00			End of borehole at 20.00 m	19
									20

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 7.0m bgl. 4. Standpipe installed to 3.0m bgl: 1.0m plain, 2.0m slotted.



Borehole Log

Borehole No.

BH5

Sheet 1 of 2

Project Name: HOLCHEM, PILSWORTH IND ESTATE

 Project No.
GRO-22216

Co-ords: -

 Hole Type
CP

Location: BURY

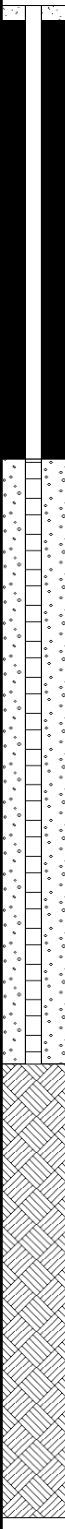
Level:

 Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 14/06/2022 - 15/06/2022

 Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.70	B		0.30			MADE GROUND: Brown clayey sandy topsoil. Sand is fine.	
		0.50	ES		0.70			MADE GROUND: Brown clayey gravelly fine to coarse sand with low cobble content. Gravel is rounded to subrounded fine to coarse of mixed lithologies including sandstone and brick.	
		1.20	D					MADE GROUND: Firm brown silty sandy clay. Sand is fine.	1
		1.20		N=12 (2,1/3,2,3,4)					
		1.20 - 1.65	B						
		2.00	ES						2
		2.00		N=6 (1,1/2,1,2,1)					
		2.00 - 2.45	B						
		3.00	ES		3.10				3
		3.00		N=15 (2,2/3,4,4,4)					
		3.00 - 3.45	B					Firm to stiff high strength brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of siltstone.	
		4.00	ES						4
		4.00 - 4.45	U						
		4.50	D						
		5.00		N=14 (2,3/3,3,4,4)					5
		5.00 - 5.45	B						
		6.00		N=10 (1,2/2,2,3,3)	5.70			Firm brown silty CLAY.	6
		6.00 - 6.45	B						
		7.00		N=10 (1,1/1,2,3,4)					7
		7.50 - 7.95	B		7.50			Firm brown silty slightly gravelly CLAY. Gravel is angular to subangular coarse of mixed lithologies including siltstone and sandstone.	8
		9.00		N=17 (3,3/3,4,4,6)	8.70			Firm to stiff brown sandy CLAY. Sand is fine.	9
		9.00 - 9.45	B		9.45			Firm brown gravelly CLAY with sand bands. Sand is fine. Gravel is rounded to subrounded fine to coarse of mixed lithologies including	10

Continued on next sheet

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 8.0m bgl. 4. Standpipe installed to 7.0m bgl: 3.0m plain, 4.0m slotted.





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Borehole Log

Borehole No.

BH5

Sheet 2 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 14/06/2022 - 15/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50 - 10.95	B	N=17 (3,3/4,4,4,5)	10.20			siltstone and sandstone.	
								Medium dense grey silty gravelly fine to coarse SAND. Sand is fine to coarse. Gravel is rounded to subrounded fine of mudstone and siltstone.	11
		12.00 12.00 - 12.45	B	N=22 (2,2/3,4,5,10)					12
		13.50 13.50 - 13.95	B	N=25 (4,4/5,5,7,8)					13
		15.00		N=28 (4,4/5,7,8,8)	15.00			End of borehole at 15.00 m	14
									15
									16
									17
									18
									19
									20

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 8.0m bgl. 4. Standpipe installed to 7.0m bgl: 3.0m plain, 4.0m slotted.





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Borehole Log

Borehole No.

BH6

Sheet 1 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 17/06/2022 - 20/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		0.50			MADE GROUND: Dark brown slightly sandy topsoil. Sand is fine.	
		0.50	ES					MADE GROUND: Brown clayey gravelly fine to coarse sand with low cobble content. Gravel is rounded to subrounded fine to coarse of mixed lithologies including sandstone and brick.	1
		1.00	D						
		1.20		N=10 (1,2/3,2,2,3)					
		1.50	ES						
		2.00		N=9 (1,1/2,1,3,3)					2
		2.20	ES						
		3.00		N=15 (2,2/2,4,4,5)					3
		3.00 - 3.45	B		3.30				
		4.00		N=13 (2,3/2,3,4,4)				MADE GROUND: Firm dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is subrounded to subangular fine to coarse of sandstone, siltstone and brick.	4
		4.00 - 4.45	B						
		5.00		N=16 (2,2/3,4,4,5)					5
		5.00 - 5.45	B						
		6.50		N=13 (2,3/2,4,3,4)	6.50				6
		8.00		N=9 (1,2/1,3,2,3)					7
		8.00 - 8.45	B						
		8.50 - 8.70	B		8.50				
					8.70			Firm dark brown sandy gravelly CLAY. Sand is coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies including sandstone and siltstone.	8
								Brown plastic pseudo-fibrous PEAT.	
		9.00 - 9.45	U					Firm to stiff high strength brown sandy CLAY. Sand is fine.	9
		9.50	D		9.50			Stiff brown mottled grey CLAY.	
									10

Continued on next sheet

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 9.0m bgl. 4. Backfilled with arisings.





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Borehole Log

Borehole No.

BH6

Sheet 2 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

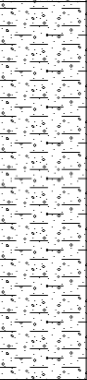
Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 17/06/2022 - 20/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50 - 10.95	B	N=21 (3,5/4,4,5,8)	10.50				
		12.00 - 12.45	U					Stiff brown gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is rounded to subrounded fine to coarse of siltstone and sandstone.	11
		12.50	D		12.50			<u>Medium strength at 12.0m bgl.</u>	12
		13.50 13.50 - 13.95	B	N=17 (3,4/4,4,4,5)				Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to subangular and coarse of mixed lithologies including siltstone and sandstone.	13
		14.50		N=21 (3,4/4,5,6,6)					14
					15.00			End of borehole at 15.00 m	15
									16
									17
									18
									19
									20

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 9.0m bgl. 4. Backfilled with arisings.







GROUNDTECH
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Borehole Log

Borehole No.

BH7

Sheet 2 of 2

Project Name: HOLCHEM, PILSWORTH IND
ESTATE

Project No.
GRO-22216

Co-ords: -

Hole Type
CP

Location: BURY

Level:

Scale
1:50

Client: BRIAN CLANCY HIGBY PARTNERSHIP

Dates: 13/06/2022 - 14/06/2022

Logged By
JOD

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00		N=15 (2,2/4,3,3,5)	10.50			Firm to stiff brown sandy gravelly CLAY. Sand is fine. Gravel is subrounded to subangular fine to coarse of mixed lithologies including siltstone and sandstone.	11
		12.50 - 12.95	U		12.50				12
		13.00	D					Firm to stiff grey mottled brown silty CLAY.	13
		14.00		N=16 (2,3/3,4,4,5)					14
		14.50		N=18 (2,3/4,4,5,5)	15.00				15
								End of borehole at 15.00 m	15
									16
									17
									18
									19
									20

Remarks

1. Location scanned for utilities. 2. Hand dug inspection pit to 1.2m bgl. 3. Groundwater encountered at 10m bgl. 4. Standpipe installed to 3.0m bgl: 1.0m plain, 2.0m slotted.





GROUND GAS MONITORING RESULTS

SITE NAME:		HOLCHEM, PILSWORTH INDUSTRIAL ESTATE				ENGINEER:		William Sandiford Mitchell				
CLIENT:		HOLCHEM LABRATORIES				DATE:		28/07/2022				
JOB NO:		GRO-22216										
Pressure Trend:		Steady	Weather:	Overcast			Equipment:		GFM 436			
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)					
Start		20.8	0.0	0.0	0.0	0.0	0.0					
Finish		20.8	0.0	0.0	0.0	0.0	0.0					

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH04	0.0	0.0	0.00	17.5	17.3	350.0	3.1	3.1	6.4	6.5	0.0	0.0	0.0	0.0	0.0031	0.0175	1007	-	N	N/A	N/A	NGW
BH05	0.0	0.0	0.00	0.0	0.0	0.0	4.4	4.4	12.8	13.1	0.0	0.0	0.0	0.0	0.0044	0.0000	1007	-	N	N/A	N/A	NGW
BH07	0.0	0.0	0.00	41.2	41.0	824.0	5.3	5.3	1.4	1.5	0.0	0.0	0.0	0.0	0.0053	0.0412	1007	-	N	N/A	N/A	NGW
Notes:																						

GROUNDTECH
CONSULTING

SITE NAME:		HOLCHEM, PILSWORTH INDUSTRIAL ESTATE				ENGINEER:		William Sandiford Mitchell				
CLIENT:		HOLCHEM LABRATORIES				DATE:		18/08/2022				
JOB NO:		GRO-22216										
Pressure Trend:		Steady	Weather:	Overcast			Equipment:		GFM 436			
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)					
Start		20.8	0.0	0.0	0.0	0.0	0.0					
Finish		20.8	0.0	0.0	0.0	0.0	0.0					

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH04	0.0	0.0	0.00	20.3	19.7	406.0	3.6	3.6	3.7	4.1	0.0	0.0	0.0	0.0	0.0036	0.0203	1003	-	N	N/A	N/A	NGW
BH05	0.0	0.0	0.00	0.0	0.0	0.0	5.8	5.7	12.0	12.1	0.0	0.0	0.0	0.0	0.0058	0.0000	1004	-	N	N/A	N/A	4.79
BH07	0.0	0.0	0.00	46.4	46.0	928.0	6.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0063	0.0464	1002	-	N	N/A	N/A	NGW

Notes:

SITE NAME:		HOLCHEM, PILSWORTH INDUSTRIAL ESTATE				ENGINEER:		William Sandiford Mitchell				
CLIENT:		HOLCHEM LABRATORIES				DATE:		07/09/2022				
JOB NO:		GRO-22216										
Pressure Trend:		Falling	Weather:	Overcast			Equipment:		GFM 436			
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)					
Start		20.9	0.0	0.0	0.0	0.0	0.0					
Finish		20.9	0.0	0.0	0.0	0.0	0.0					

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH04	0.0	0.0	0.00	29.2	28.7	584.0	3.9	3.6	0.1	1.0	0.0	0.0	0.0	0.0	0.0039	0.0292	996	-	N	N/A	N/A	NGW
BH05	0.0	0.0	0.00	0.0	0.0	0.0	7.1	7.0	8.6	8.7	0.0	0.0	0.0	0.0	0.0071	0.0000	997	-	N	N/A	N/A	NGW
BH07	1.8	1.8	0.11	46.3	45.9	926.0	6.2	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1116	0.8334	995	-	N	N/A	N/A	NGW

Notes:

SITE NAME:		HOLCHEM, PILSWORTH INDUSTRIAL ESTATE				ENGINEER:		William Sandiford Mitchell				
CLIENT:		HOLCHEM LABRATORIES				DATE:		22/09/2022				
JOB NO:		GRO-22216										
Pressure Trend:		Falling	Weather:	Overcast			Equipment:		GFM 436			
Ambient:		O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)					
Start		20.8	0.0	0.0	0.0	0.0	0.0					
Finish		20.8	0.0	0.0	0.0	0.0	0.0					

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	LNAPL (Y/N)	DNAPL (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady								
BH04	0.0	0.0	0.00	29.3	28.4	586.0	3.9	3.9	0.0	0.1	0.0	0.0	0.0	0.0	0.0039	0.0293	1006	-	N	N/A	N/A	NGW
BH05	0.0	0.0	0.00	0.0	0.0	0.0	7.9	7.8	5.8	6.0	0.0	0.0	0.0	0.0	0.0079	0.0000	1007	-	N	N/A	N/A	NGW
BH07	0.0	0.0	0.00	46.1	46.1	922.0	6.1	6.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0061	0.0461	1005	-	N	N/A	N/A	NGW
Notes:																						

LIMITATIONS

Limitations

This report (Report) forms part of the Services and if applicable Additional Services undertaken by Groundtech Consulting Ltd pursuant to a written contract (Agreement) which contains detailed provisions including express limitations of the liability of Groundtech Consulting Ltd.

This Report was prepared using reasonable skill and care as stated in the Agreement for the purpose including intended end use stated by the Client (Purpose) and the liability of Groundtech Consulting Ltd in respect of the form and content of this Report is no greater than its liability under the Agreement. All records, measurements notes, or any other data (Data) obtained by or for the benefit of the Consultant were obtained at a specific point in time and it may not be assumed by the Client or any person relying on this Report that the Data will remain unaffected by the passage of time, the seasons, weather conditions, changes in the water table or the carrying out and completion of works at the Site.

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The observations and conclusions outlined in this Report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting Ltd.

Groundtech Consulting Ltd is not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The Report is based upon Groundtech Consulting Ltd's observations of existing physical conditions at the Site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the Client on the history and usage of the Site. The findings and recommendations contained in this Report are based in part upon information provided by third parties, and Groundtech Consulting Ltd have relied upon such information assuming it to be correct.

Groundtech Consulting Ltd accepts no responsibility for errors or inaccuracies in third party information presented in this Report. Groundtech Consulting Ltd was not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services or Additional Services. Groundtech Consulting Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting Ltd and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions may also vary due to the ground's heterogeneous properties and because investigation exploratory locations only allow examination of the ground at discrete

locations. The potential exists for ground conditions to be encountered which are different to those considered in this Report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. If so stipulated in the Agreement, geo-environmental testing was carried out for a limited number of parameters based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

Any groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and groundwater levels may occur at other times of the year which are higher than were recorded during this investigation.

Any site drawings provided in this Report are preliminary and used to present the general relative locations of features on, and surrounding, the Site.

