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Our Ref: WSH-BWB-ZZ-XX-RP-CE-0001  
Contact: Alistair Drape  
Direct Dial: 07500 731058

Date: 21<sup>st</sup> September 2021

## SUPPLEMENTARY GROUND GAS MONITORING – WITHAM ST HUGHS - AVANT

### Introduction

BWB Consulting Ltd (BWB) was instructed by Strawsons Property (the Client) to carry out a Supplementary Ground Gas Monitoring Assessment at the residential development at Witham St Hughs (the site). Details of the project brief are included in BWB proposal reference 20201207/R1/0001/NTG2115/RTR/KES.

The Client is seeking to develop a greater understanding of the ground gas risk in this area to provide information with regards to the ground gas risk and confirm whether any mitigation measures are required.

The Proposed Development is understood to comprise the redevelopment of a 70 hectare site for residential use through a large scale earthworks operation, as showed in the site plan presented as **Appendix 1**.

### Scope of Works

Intrusive ground investigation works were undertaken on the site between 1<sup>st</sup> July 2021 and 2<sup>nd</sup> July 2021, and comprised the following works:

- Eighteen exploratory holes were completed on-site to assess ground conditions;
- Installation of ground gas and water level monitoring wells within each completed exploratory hole; and

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Six post investigation ground gas and groundwater level monitoring visits.

An exploratory hole plan is presented as **Appendix 2**.

The site investigation works were carried out in accordance with BS5930:2015 'Code of Practice for Site Investigations' and BS10175:2011+A2 2017 'Investigation of Potentially Contaminated Sites'.

### Ground Conditions

Dynamic sampling logs have confirmed ground conditions typically comprised as follows: Firm, dark bluish grey sandy gravelly clay, underlain by reddish orange gravelly sand. Earthworks have been carried out across the site with fill depths ranging between a minimum of 0.5m and maximum of 1.7m. Gas monitoring wells are considered to have captured both reworked and natural ground conditions.

Dynamic sampling logs are presented within **Appendix 3**.

### Gas Monitoring Results

Supplementary ground gas monitoring across the site was conducted between 9<sup>th</sup> July 2021 and 10<sup>th</sup> September 2021, consisting of six monitoring visits. The data from this ground gas monitoring programme is presented within **Appendix 4**.

Monitoring wells were installed at shallow depths, primarily within reworked and natural superficial sand and gravel deposits on-site.

The maximum and minimum ground gas concentrations and flow rates, recorded during the recent gas monitoring visits, are summarised below in **Table 1**.

*Table 1 – Summary of Ground Gas Concentrations*

Borehole Location	Steady Flow (l/hr)		Carbon (%v/v)		Dioxide		Methane (%v/v)	
	min.	max.	min.	max.	min.	max.	min.	max.
WS01	<0.1	0.1	0.1	4.1	<0.1	<0.1	<0.1	<0.1
WS02	<0.1	<0.1	0.1	4.6	<0.1	<0.1	<0.1	<0.1
WS03	<0.1	0.1	0.7	0.7	<0.1	<0.1	<0.1	<0.1
WS04	<0.1	0.1	0.1	0.5	<0.1	<0.1	<0.1	<0.1
WS05	<0.1	0.1	1.8	2.7	<0.1	<0.1	<0.1	<0.1
WS06	<0.1	<0.1	0.6	2.4	<0.1	<0.1	<0.1	<0.1
WS07	<0.1	0.1	1.1	2.0	<0.1	<0.1	<0.1	<0.1

Borehole Location	Steady Flow (l/hr)		Carbon Dioxide (%v/v)		Methane (%v/v)	
	min.	max.	min.	max.	min.	max.
WS08	<0.1	<0.1	0.3	1.3	<0.1	<0.1
WS09	<0.1	0.1	0.5	1.5	<0.1	<0.1
WS10	<0.1	<0.1	0.6	0.8	<0.1	<0.1
WS11	<0.1	0.1	3.6	5.3	<0.1	<0.1
WS12	<0.1	<0.1	1.7	2.2	<0.1	<0.1
WS13	<0.1	0.1	0.6	1.9	<0.1	<0.1
WS14	<0.1	0.2	0.8	1.1	<0.1	<0.1
WS15	<0.1	0.1	0.5	2.7	<0.1	<0.1
WS16	<0.1	<0.1	0.8	1.0	<0.1	<0.1
WS17	<0.1	0.1	0.1	3.5	<0.1	<0.1
WS18	<0.1	0.1	1.0	3.0	<0.1	<0.1

Twelve of the eighteen boreholes completed on-site recorded positive flow rates during the monitoring period, with a maximum flow rate of 0.2l/hr recorded in borehole WS14 during the fourth monitoring visit (23<sup>rd</sup> August 2021). By the final monitoring period (10<sup>th</sup> September 2021), none of the boreholes were recording positive flow rates. None of the boreholes completed on-site recorded elevated methane concentrations.

Detectable carbon dioxide concentrations have been recorded in most of the boreholes completed on-site, with the most significant carbon dioxide readings occurring in WS11 (5.3%v/v) during the third visit (16<sup>th</sup> August 2021). In the remaining boreholes, carbon dioxide concentrations never exceeded 5%v/v.

Oxygen concentrations were generally recorded at normal levels, with lower oxygen levels typically recorded in combination with detectable carbon dioxide concentrations.

Hydrogen sulphide and carbon monoxide concentrations were also measured during the monitoring period. Hydrogen sulphide levels were recorded between <0.1ppm (the limit of detection on the employed equipment) and 5ppm (recorded in four monitoring wells on the second visit, conducted on the 22<sup>nd</sup> July 2021). Hydrogen sulphide concentrations dropped after the second monitoring visit to 1ppm or <1ppm in the final three visits. Carbon monoxide

concentrations also peaked during the second monitoring period (4ppm in Borehole WS17), before dropping to between <1 and 2ppm in the final visit.

PID concentrations were consistently recorded as below the limits of detection during all monitoring visits.

### **Ground Gas Risk Assessment**

Sporadic, localised oxygen depletion within boreholes where increased carbon dioxide concentrations have been recorded is not considered to represent a risk to human health. Reduced oxygen levels are commonly recorded in soil gas where carbon dioxide is present.

Based on the equation below, the maximum gas screening value (GSV) recorded was 0.019, which is indicative of a 'Green' site in accordance with the NHBC Traffic Light system. However, the guidance states that consideration should be given to upgrading the gas risk to that of an 'Amber 1' site where carbon dioxide concentrations of >5% are recorded, as was the case in borehole WS11. This is discussed further below.

$$\text{Gas screening value (l/hr)} = \frac{\text{gas concentration (\%)} \times \text{measured borehole flow rate (l/h)}}{100}$$

#### Borehole WS11

Carbon dioxide readings taken from this borehole were only marginally over 5%v/v on one occasion out of six, flow rates here never exceeded 0.1l/hr, and no methane was recorded.

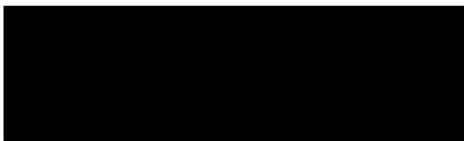
On this basis it is considered that the assessment is suitably robust and that ground gas protection measures are not required at this location.

### **Conclusions**

Based on the ground gas monitoring completed, and in line with current guidance, it is considered the site can be considered as 'Green' whereby ground gas protection measures are not required.

Should you require any further information, please don't hesitate to contact the undersigned.

Yours sincerely,



Alistair Drape  
Graduate Geotechnical Engineer

Enc.

- Appendix 1 – Site Plan
- Appendix 2 – Exploratory Hole Plan
- Appendix 3 – Dynamic Sampler Logs
- Appendix 4 – Ground Gas Monitoring Results

# Appendix 1

## Site Plan



Earthworks Strategy

Approximate site area = 586,524m² (See Table 1 for detailed break down of plateau areas and detention basins)
1) Site Strip
An average topsoil strip of 300mm has been applied across the whole site. This has been calculated by taking the average depth encountered across the 25 trial pit results undertaken during the phase 2 Geo-Environmental Assessment (See note 7). The Contractor is to determine the exact extent of required site strip, including the removal of all existing vegetation.
Assumed topsoil strip = 586,524m² x 0.3m = 175,957m³
(Area excludes any extra strip required for contractors compound)
2) Surface Build-Ups
Quads = 530mm
Plateau = 300mm
Detention basin = 150mm
Swale = 150mm
Landscaping = 150mm
\*The value of 530mm has been calculated as an average formation depth for the plateaus to allow for external construction build ups, drainage and foundation arisings to achieve a balance overall on the plateau. This depth is from the FFL to the formation level. See below for calculation.
Plateau Formation Depth Calculation
The following assumptions were made based on the masterplan in these calculations:
- Hardstanding (Roads, houses and footways) area of plateau - 50%
- Landscaping - 50%
The construction depths used to calculate the plateau formation depth were as follows:
- Road = 460mm
- House (floor slab) = 150mm
- Landscaping = 150mm
Section 38 Highway Buildups
Carrageway = 530mm
Landscaping = 150mm
Footway and footway/cycleway = 225mm
Swale = 150mm
Construction build-ups are based on a CBR of 3% as recommended by the Phase 2 Geo-Environmental Assessment.
3) Bulk Earthworks
In order to reach proposed formation levels (as shown on BWB drawing WSH-BWB-DGT-XX-DR-C-0601) the bulk earthworks are shown below:
Total Gross 191,486m³ Cut 338,463m³ Fill
NETT 191,486m³
4) Section 104 Surface Water Drainage Arisings
See Table 1 for break down of totals for Section 104 drainage arisings volumes.
Detention Basin 29,441m³ Cut 6,135m³ Fill
Swales 20,142m³ Cut 10,363m³ Fill
Total Gross 49,583m³ Cut 16,501m³ Fill
NETT 49,583m³
(Note that the detention basin arisings have been included above in the bulk earthwork volumes)
The drainage arisings have been calculated based on the following assumptions:
- An approximate underdrain cross sectional area of 0.675m² (1.5m x 0.45m)
- For the standard pipe lengths, an average pipe diameter of 375mm has been taken and a trench area of 0.494m² (0.73m x 0.625m). This is assuming that the material on site is suitable as general acceptable fill. For further details see BWB bed and surround details on BWB drawing number WSH-BWB-DDG-S104-DR-C-561\_S104 Drainage Standard Details Sheet 2.

5) Section 38 Drainage Arisings (Including S104 Foul Water Drainage)
Length of highway = 2400m
Surface water underdrain arisings = 0.45m x 0.50m x 2400m = 540m³
Length of foul water sewer = 2750m
Foul water drainage arisings = 0.48m x 0.40m x 2750m = 528m³
S38 and foul sewer drainage arisings = 1068m³
Surface water drainage arisings calculations based on underdrain detail shown on BWB drawing WSH-BWB-HDG-S38-DR-D-0561. Foul water drainage arisings have been based on a 1500 pipe (in reality the pipe diameter varies). The trench width and backfill material have been based on the Class S bed and Surround detail shown on BWB drawing WSH-BWB-DDG-S104-DR-C-0561 and assuming that the material on site is suitable as general acceptable fill.
6) Potential Noise Attenuation Bund
3 noise attenuation bunds could potentially be required pending confirmation. If required, they will be constructed to the north west of the site along the boundary adjacent to the A46. It has been assumed that topsoil accumulated from the topsoil strip will be used to construct the bunds.
Noise attenuation bunds volume = 136,132m³
7) Topsoil for Development Parcels
Area A = (28,397m² x 0.5) x 0.3m = 4,260m³
Area B = (18,029m² x 0.5) x 0.3m = 2,704m³
Area C = (46,772m² x 0.5) x 0.3m = 7,016m³
Area D = (110,055m² x 0.5) x 0.3m = 1,651m³
Area E = (29,901m² x 0.5) x 0.3m = 4,485m³
Area F = (15,404m² x 0.5) x 0.3m = 2,311m³
Area G = (18,266m² x 0.5) x 0.3m = 2,740m³
Area H = (9,029m² x 0.5) x 0.3m = 1,354m³
Area I = (28,365m² x 0.5) x 0.3m = 4,255m³
Area J = (22,121m² x 0.5) x 0.3m = 3,318m³
Area K = (11,306m² x 0.5) x 0.3m = 1,696m³
Area L = (11,051m² x 0.5) x 0.3m = 1,658m³
Area M = (31,321m² x 0.5) x 0.3m = 4,709m³
Area N = (20,414m² x 0.5) x 0.3m = 3,062m³
Area O = (16,134m² x 0.5) x 0.3m = 2,420m³
Area P = (31,390m² x 0.5) x 0.3m = 4,709m³
Area Q = (14,731m² x 0.5) x 0.3m = 2,210m³
Area R = (12,952m² x 0.5) x 0.3m = 1,943m³
Total 136,132m³
These calculations are based off the parcel development plots being 50% soft landscaping and a topsoil reinstatement in these areas of 300mm.
See BWB drawing number WSH-BWB-DGT-XX-DR-C-0601\_Finished Plateau and Highway Formation Levels for further details on topsoil stockpile locations.

8) Topsoil for areas of Landscaping
Topsoil volume required = 175,957m³
Based on 300mm thick topsoil.
See drawing WSH-BWB-DGT-XX-DR-C-0601\_Finished Plateau and Highway Formation Levels for further details.
9) Topsoil for Section 104 basins and Swales
Topsoil volume required = 175,957m³
See drawing WSH-BWB-DGT-XX-DR-C-0601\_Finished Plateau and Highway Formation Levels for further details.
10) Earthworks Totals
Subsoil Cut Fill
Bulk earthworks to formation 191,486m³ 338,463m³
Including detention basin arisings 56,338m³
Swale arisings (inc. underdrain) 9,777m³
S38 drainage arisings (inc. S104 foul drainage) 1,068m³
Total 202,331m³ 338,463m³
Topsoil Cut Fill
Topsoil Strip 175,957m³ 34,929m³
Topsoil reuse for landscaping 56,338m³
Potential noise attenuation bund 21,855m³
S104 basins and swales 10,342m³
Total 175,957m³ 34,929m³
11) Conclusion
Based on the above information and strategy there is a deficit of approximately 136,132m³ subsoil over the whole site and a surplus of approximately 52,493m³ of topsoil.

BWB models used
- WSH-BWB-DGT-M3-C-625\_Highway and plateau Levels
- WSH-BWB-HGT-XX-M3-C-611\_Highway and Site Wide Formation Model
- WSH-BWB-HGT-XX-M3-C-621\_Highway and Site Wide Earthworks Model
- WSH-BWB-DGT-XX-M2-C-500\_Site Wide Drainage Layout
- WSH-BWB-VTO-XX-M3-C-001\_Phase 3 Topographical Survey

Earthworks Notes and Assumptions

- 1. The topographical survey model is used to obtain the existing ground levels, the contractor is to satisfy themselves with the existing levels prior to taking occupation of the site. The levels are taken from the following drawing:
- Oakes Surveys, drawing number 2663 FINAL (Sheets 1 to 7), dated 07.06.07.
2. Soft spots or any other material deemed to be unsuitable for formation shall be removed and replaced with acceptable fill material or as directed by the engineer.
3. During the formation of this strategy all topsoil and vegetation will be stripped. Clean topsoil stockpiles of a maximum height of 2m for re-use within soft landscaped area to be placed across the site as shown on this strategy. All topsoil to remain is subject to satisfactory chemical analysis and approval by a Geotechnical Engineer.
4. The formation strata should be proof rolled prior to placement of the first layer and any soft spots identified during proof rolling should be removed and replaced with Engineered Fill. Any Made Ground or soft strata (Cu <75 kN/m²) identified should be inspected by a geotechnical engineer before filling commences and may require to be excavated and replaced with Engineered Fill.
5. Prior to commencement of works, trials should take place to ensure the proposed plan for compacting the fill is suitable to achieve the required compaction. Trial should be undertaken on each of the material types to be used in the uplling process.
6. All materials and workmanship shall be in accordance with the BWB Earthworks Specification, and the Specification for Highway Works, Volume 1 of the Manual of Contract Documents for Highway Works published by HMSO.
7. All work shall follow the guidelines and recommendation contained within BS6031: 2009, Code of Practice for Earthworks.
8. The general filling work shall be undertaken in accordance with Clause 612 of the SHW to an End Product compaction with layers not exceeding 250mm thickness.
9. The Earthworks Contractor shall allow for carrying out any investigation or testing that he considers necessary to ensure the suitability of the material to be used within the works.
10. Before starting the site clearance works, the Earthworks Contractor shall verify with the Client which existing fences, gates, walls, roads, paved areas, trees, shrubs, etc. are to be removed. Existing water features that are to be redundant and are to be filled must be cleared of all vegetation and soft organic deposits before filling. Any existing watercourses which have previously been filled should be re-excavated and treated likewise.
11. It is a requirement that any imported fill that may be required shall be first authorised for use by the Engineer prior to importation to site.
12. On completion of the earthworks, the Earthworks Contractor shall carry out CBR tests on the final formation, the number and locations of which shall be agreed with the Engineer.
13. An 'As-Built' topographical survey of the finished plateau shall be completed and provided to BWB in PDF and 3D CAD format following completion of the plateau formations as shown in this drawing.

Notes

- 1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. The masterplan shown in this drawing is FPCR Indicative Masterplan, drawing number 58011-0-06, revision B, dated 29.08.17.
6. This drawing is based on topographical survey undertaken by Oakes Surveys; drains reference R663 Final, dated 07.06.07, sheets 1 to 7.
7. The existing ground information has been based off BWB Phase 2 Geo-Environmental Assessment, document number WSH-BWB-ZZ-YE-RP-0001 Complete.
8. The earthworks drawing should be read in conjunction with the levels strategy, drawing number: WSH-BWB-DGT-XX-DR-C-0601

Earthworks Notes and Assumptions

- 1. No bulking factors have been allowed for in the volume calculations.
2. It is assumed ground is topped by 300mm topsoil.
3. All excavated material is suitable for reuse.
4. All earthworks to be completed in accordance with BWB's earthworks end product specification.
5. Stockpiled materials often deteriorate due to water infiltration and they may become unsuitable for incorporation in the works; further testing and re-assessment should be made prior to the finalisation and implementation of the earthworks design.
6. The construction depths assumed are as shown within the Earthworks Strategy calculation. These thicknesses may vary based on the ground conditions encountered and should be verified by means of CBR tests at formation level.
7. The earthworks quantities have been provided by BWB for guidance only. The contractor shall be responsible for, and take the risk for, estimating the bulk earthworks on which his tender is based. The contractor's estimated volumes shall be confirmed with his tender.
8. It should be noted that the earthwork volumes provided by BWB are accurate to ±5%. This margin takes account of the variations that may result through the use of modelling software.
9. On completion, the contractor shall confirm to BWB the actual volume of earthworks materials left in any temporary stockpiles required by the contract.
10. The contractor shall be responsible for disposing of any unacceptable earthworks materials encountered during or generated by the works in licensed tips off site unless otherwise agreed with BWB.
11. The contractor shall be responsible for all material sampling, testing and earthworks validation reporting in order to comply with the requirements of the project-specific BWB earthworks specification (and the BWB technical specification for earthworks strategies).



Legend

- Major Cut Contour, 1000mm intervals
Minor Cut Contour, 200mm intervals
No Cut/Fill
Major Fill Contour, 1000mm
Minor Fill Contour, 200mm intervals
Future plot plateau/S104 swale/S104 detention basin boundary
Site Boundary
Detention basin reference to read with Table 1
Potential noise attenuation bund area

Table with 4 columns: Rev, Date, Details of issue / revision, and Rev. Row 1: P1, 06.06.18, Preliminary, HW, AL. Row 2: Rev, Date, Details of issue / revision, and Rev.

Issues & Revisions

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Manchester | 0161 233 4260
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Client

Strawsons Property

Project Title

Phase 3, Witham Saint Hughs

Drawing Title

Earthworks Strategy

Drawn: H. Woolley, Reviewed: A. Lodge

BWB Ref: NTM 2082, Date: 04.06.18, Scale @A1: 1:2000

Drawing Status

PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number

WSH-BWB-DGT-XX-DR-C-0630 S1 P1

Table 1 - Break Down of Cut Fill for Plateaus and Section 104 Drainage. Columns: Plateau, Cut (m³), Fill (m³), Nett (m³). Rows include Plateaus A-R and Section 104 Detention Basins 1-9 and Swales.



## Appendix 2

### Exploratory Hole Plan





- NOTES**
1. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS MUST BE CHECKED/ VERIFIED ON SITE. IF IN DOUBT ASK.
  2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
  3. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE.
  4. ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

- LEGEND**
- Proposed DS Location

**BWB**  
**Building, Infrastructure and Environmental Consultancy**  
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 Nottingham, NG2 3DQ  
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Client:  
 Strawsons

Project Title:  
 Witham St Hughes - Avant

Drawing Title:  
 Figure 1 - Site Proposed EHL

Scale: Not to Scale	Date:	Drawn: K.Sinclair	Authorised:
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Drawing Status:  
**DRAFT**

Drawing No: 001	Revision: R1
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## Appendix 3

### Dynamic Sampling Logs



Well

Well



Well

Well



Well

Well

Well



Well

Well

Well



Well

Well

Well

Well



Well

Well

Well

Well



## Appendix 4

### Ground Gas Monitoring Results



**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

09/07/2021

**Background Readings:**

O <sub>2</sub> % v/v :	20.4	CO <sub>2</sub> % v/v :	0.0	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Dry			Equipment Used:	Technician:
H <sub>2</sub> S ppm :	0	CO ppm :	0	Pressure Trend :	Falling	Ground Conditions :	Dry			GA5000	MD

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL (mbgl)	Water Depth (mbgl)	Depth to DNAPL (mbgl)	Total Depth (mbgl)
				Low	Steady	High	Steady	High	Steady			Peak	Steady					
WS01	-	1021	-0.09	20.7	20.7	0.1	0.1	0.0	0.0	0	0	0.0	0.0	NR	-	1.50	-	1.96
WS02	-	1021	-0.03	20.4	20.4	0.1	0.1	0.0	0.0	0	1	0.0	0.0	NR	-	1.28	-	1.83
WS03	-	1021	-0.02	20.1	20.1	0.1	0.1	0.0	0.0	0	0	0.0	0.0	NR	-	1.44	-	1.84
WS04	-	1021	0.05	20.1	20.1	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.87
WS05	-	1021	-0.10	20	20	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	1.56	-	1.73
WS06	-	1021	0.07	20.1	20.1	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.80
WS07	-	1021	0.05	20	20	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	1.66	-	1.89
WS08	-	1021	0.14	20.1	20.1	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	1.66	-	1.79
WS09	-	1021	0.05	20.2	20.2	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.91
WS10	-	1021	-0.03	20.2	20.2	0	0	0.0	0.0	1	0	0.0	0.0	NR	-	1.76	-	1.84
WS11	-	1021	0.14	20.2	20.2	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	1.75	-	1.89
WS12	-	1021	0.00	20.3	20.3	0	0	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.83
WS13	-	1021	0.10	20.4	20.4	0	0	0.0	0.0	0	1	0.0	0.0	NR	-	1.72	-	1.84
WS14	-	1021	0.00	20.5	20.5	0	0	0.0	0.0	2	1	0.0	0.0	NR	-	DRY	-	1.80
WS15	-	1021	0.17	20.6	20.6	0	0	0.0	0.0	2	1	0.0	0.0	NR	-	DRY	-	1.80
WS16	-	1021	0.10	20.7	20.7	0	0	0.0	0.0	2	1	0.0	0.0	NR	-	1.53	-	1.88
WS17	-	1021	-0.13	20.8	20.8	0	0	0.0	0.0	2	1	0.0	0.0	NR	-	1.87	-	1.89
WS18	-	1021	0.47	20.8	20.8	0	0	0.0	0.0	2	0	0.0	0.0	NR	-	DRY	-	1.93

**Remarks :**

NR -Not recorded



**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

22/07/2021

**Background Readings:**

O <sub>2</sub> % v/v :	20.3	CO <sub>2</sub> % v/v :	0.0	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Sunny + Cloudy			Equipment Used:	Technician:
H <sub>2</sub> S ppm :	1	CO ppm :	1	Pressure Trend :	Falling	Ground Conditions :	Dry, no moisture			GA5000	DP

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL (mbgl)	Water Depth (mbgl)	Depth to DNAPL (mbgl)	Total Depth (mbgl)
				Low	Steady	High	Steady	High	Steady			Peak	Steady					
WS01	-	1023	0.48	16.9	16.9	0.6	0.6	0.0	0.0	5	2	0.0	0.0	NR	-	1.71	-	1.97
WS02	-	1023	0.35	6.9	20.6	1.7	0.1	0.0	0.0	5	2	0.0	0.0	NR	-	1.75	-	1.89
WS03	-	1023	0.17	17.9	17.9	0.8	0.0	0.0	0.0	2	1	0.0	-0.1	NR	-	1.68	-	1.84
WS04	-	1023	0.22	4.9	4.9	0.6	0.5	0.0	0.0	2	3	-0.1	-0.1	NR	-	1.79	-	1.87
WS05	-	1023	0.41	5.4	5.4	1.8	1.8	0.0	0.0	5	1	0.0	0.0	NR	-	1.71	-	1.73
WS06	-	1023	0.45	15.7	16.9	0.8	0.6	0.0	0.0	4	2	0.0	0.0	NR	-	DRY	-	1.81
WS07	-	1023	0.26	5.9	5.9	1.1	1.1	0.0	0.0	3	1	0.0	0.0	NR	-	1.65	-	1.90
WS08	-	1023	0.28	7.6	11.1	1.0	0.8	0.0	0.0	3	2	0.0	0.0	NR	-	1.71	-	1.87
WS09	-	1023	0.41	4.4	4.5	0.7	0.5	0.0	0.0	4	2	0.0	0.0	NR	-	DRY	-	1.92
WS10	-	1023	0.38	11.6	19.8	3.2	0.6	0.0	0.0	4	2	-0.1	-0.1	NR	-	1.77	-	1.87
WS11	-	1023	0.35	5.7	12.2	3.6	3.6	0.0	0.0	4	2	0.0	0.0	NR	-	1.83	-	1.89
WS12	-	1023	0.40	6.4	13.0	1.7	1.7	0.0	0.0	5	2	0.0	0.0	NR	-	DRY	-	1.83
WS13	-	1023	0.28	11.0	11.6	1.9	1.9	0.0	0.0	3	2	0.0	0.0	NR	-	1.71	-	1.83
WS14	-	1023	0.29	11.6	19.6	1.7	0.9	0.0	0.0	3	2	0.0	0.0	NR	-	DRY	-	1.80
WS15	-	1023	0.36	14.7	16.6	2.7	2.7	0.0	0.0	4	1	0.0	0.0	NR	-	DRY	-	1.82
WS16	-	1023	0.33	15.0	15.0	0.9	0.9	0.0	0.0	3	2	0.0	-0.1	NR	-	1.80	-	1.89
WS17	-	1023	0.33	6.8	6.8	2.4	1.2	0.0	0.0	4	4	0.0	0.0	NR	-	1.73	-	1.90
WS18	-	1023	0.35	4.3	4.3	1.9	1.9	0.0	0.0	4	2	0.0	0.0	NR	-	1.84	-	1.94

**Remarks :**

0777 91 33 250

NR -Not recorded



**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

16/08/2021

**Background Readings:**

O <sub>2</sub> % v/v :	21.1	CO <sub>2</sub> % v/v :	0.1	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Overcast, Cloudy and Light rain		Equipment Used:	Technician:
H <sub>2</sub> S ppm :	0	CO ppm :	0	Pressure Trend :	Rising	Ground Conditions :	Dry, no moisture		GA5000	DP

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL (mbgl)	Water Depth (mbgl)	Depth to DNAPL (mbgl)	Total Depth (mbgl)
				Low	Steady	High	Steady	High	Steady			Peak	Steady					
WS01	-	1017	0.02	12.6	12.6	2.3	2.2	0.0	0.0	1	0	0.0	0.0	NR	-	1.65	-	1.97
WS02	-	1019	0.07	14.1	20.1	1.9	0.6	0.0	0.0	1	0	0.1	0.0	NR	-	1.62	-	1.89
WS03	-	1019	0.02	19.4	19.5	0.8	0.8	0.0	0.0	1	0	0.1	0.1	NR	-	1.63	-	1.84
WS04	-	1019	0.02	19.4	20.8	0.7	0.2	0.0	0.0	2	1	0.1	0.1	NR	-	DRY	-	1.87
WS05	-	1019	0.03	7.2	7.2	2.7	2.7	0.0	0.0	1	1	0.1	0.1	NR	-	1.65	-	1.73
WS06	-	1019	0.07	9.1	12.0	1.2	2.4	0.0	0.0	1	0	0.1	0.0	NR	-	1.75	-	1.81
WS07	-	1019	0.03	7.8	7.8	1.4	1.4	0.0	0.0	1	0	0.1	0.1	NR	-	1.79	-	1.90
WS08	-	1019	0.00	8.8	13.2	1.3	1.3	0.0	0.0	1	1	0.1	0.0	NR	-	1.79	-	1.87
WS09	-	1019	0.02	13.3	17.4	1.2	0.5	0.0	0.0	1	1	0.1	0.1	NR	-	DRY	-	1.92
WS10	-	1019	0.09	16.2	19.9	0.8	0.8	0.0	0.0	1	1	0.1	0.0	NR	-	1.78	-	1.87
WS11	-	1019	0.09	11.5	11.5	5.3	5.3	0.0	0.0	1	1	0.1	0.1	NR	-	1.80	-	1.89
WS12	-	1019	0.02	12.2	14.0	4.8	2.1	0.0	0.0	1	1	0.1	0.0	NR	-	DRY	-	1.83
WS13	-	1019	0.05	14.2	19.1	2.0	1.0	0.0	0.0	2	1	0.1	0.1	NR	-	1.76	-	1.83
WS14	-	1019	0.02	18.4	18.4	1.1	0.8	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.80
WS15	-	1019	0.05	17.7	17.8	1.9	1.9	0.0	0.0	2	1	0.1	0.1	NR	-	DRY	-	1.82
WS16	-	1019	0.10	16.4	16.4	1.8	1.0	0.0	0.0	0	1	0.0	0.0	NR	-	1.80	-	1.89
WS17	-	1019	0.07	16.4	19.4	1.0	0.6	0.0	0.0	2	1	0.1	0.1	NR	-	1.89	-	1.90
WS18	-	1019	0.14	8.5	8.5	2.5	2.5	0.0	0.0	2	1	0.1	0.1	NR	-	1.86	-	1.94

**Remarks :** NR -Not recorded



**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

23/08/2021

**Background Readings:**

O <sub>2</sub> % v/v :	21.1	CO <sub>2</sub> % v/v :	0.1	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Overcast, Cloudy and Light rain			Equipment Used:	Technician:
H <sub>2</sub> S ppm :	0	CO ppm :	0	Pressure Trend :	Rising	Ground Conditions :	Dry, no moisture			GA5000	DP

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL	Water Depth	Depth to DNAPL	Total Depth
				Low	Steady	High	Steady	High	Steady	Peak	Peak	Peak	Steady	Peak	(mbgl)	(mbgl)	(mbgl)	(mbgl)
WS01	-	1033	-0.12	15.9	15.9	1.5	1.5	0.0	0.0	0	0	0.1	0.1	NR	-	1.69	-	1.97
WS02	-	1033	-0.05	16.4	17.9	1.3	0.9	0.0	0.0	0	0	0.0	-0.1	NR	-	1.61	-	1.80
WS03	-	1033	-0.07	18.0	19.2	0.8	0.8	0.0	0.0	0	0	0.0	0.0	NR	-	1.70	-	1.84
WS04	-	1033	-0.05	19.1	20.4	0.7	0.1	0.0	0.0	0	0	0.0	0.0	NR	-	DRY	-	1.88
WS05	-	1033	-0.05	10.2	10.2	2.5	2.5	0.0	0.0	0	1	0.0	0.0	NR	-	1.65	-	1.73
WS06	-	1033	-0.02	12.1	13.6	2.1	0.9	0.0	0.0	0	1	0.0	0.0	NR	-	1.75	-	1.83
WS07	-	1033	-0.07	6.9	6.9	1.6	1.6	0.0	0.0	0	0	0.1	0.1	NR	-	1.81	-	1.89
WS08	-	1033	0.02	8.4	18.7	1.5	0.3	0.0	0.0	1	1	-0.1	-0.1	NR	-	1.74	-	1.83
WS09	-	1033	0.02	13.4	13.4	0.6	0.5	0.0	0.0	1	1	-0.1	-0.1	NR	-	DRY	-	1.93
WS10	-	1033	0.07	13.6	19.6	0.8	0.8	0.0	0.0	1	1	0.0	0.0	NR	-	1.77	-	1.86
WS11	-	1033	0.05	12.6	12.6	4.7	4.7	0.0	0.0	1	1	0.0	-0.1	NR	-	1.81	-	1.88
WS12	-	1033	0.12	13.2	16.2	4.3	1.7	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.83
WS13	-	1033	0.10	16.2	20.5	1.7	0.6	0.0	0.0	1	1	0.0	0.0	NR	-	1.76	-	1.85
WS14	-	1033	0.02	18.4	18.4	0.8	0.8	0.0	0.0	1	0	0.2	0.2	NR	-	DRY	-	1.91
WS15	-	1033	0.03	18.2	21.0	0.9	0.5	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.85
WS16	-	1033	0.03	17.0	17.0	0.8	0.8	0.0	0.0	1	1	0.0	0.0	NR	-	1.80	-	1.89
WS17	-	1033	0.12	17.2	21.3	0.9	0.1	0.0	0.0	1	1	0.0	0.0	NR	-	1.88	-	1.90
WS18	-	1033	0.02	10.0	10.0	2.4	2.4	0.0	0.0	1	1	-0.1	-0.1	NR	-	1.86	-	1.94

**Remarks :** NR -Not recorded





**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

02/09/2021

**Background Readings:**

O <sub>2</sub> % v/v :	15.5	CO <sub>2</sub> % v/v :	1.5	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Dry and cloudy			Equipment Used:	Technician:
H <sub>2</sub> S ppm :	0	CO ppm :	0	Pressure Trend :	Falling	Ground Conditions :	Dry			GA5000	TY

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL (mbgl)	Water Depth (mbgl)	Depth to DNAPL (mbgl)	Total Depth (mbgl)
				Low	Steady	High	Steady	High	Steady			Peak	Steady					
WS01	-	1031	-0.07	6.2	6.2	3.5	3.5	0.0	0.0	1	0	0.1	0.1	NR	-	1.62	-	1.91
WS02	-	1031	-0.03	7.3	7.0	4.6	4.6	0.0	0.0	0	0	0.0	0.0	NR	-	1.54	-	1.97
WS03	-	1031	0.00	19.3	19.2	0.8	0.8	0.0	0.0	0	0	0.0	0.0	NR	-	1.67	-	1.79
WS04	-	1031	-0.02	18.6	18.6	0.3	0.3	0.0	0.0	0	0	-0.1	0.0	NR	-	DRY	-	1.83
WS05	-	1031	0.00	10.7	10.7	2.5	2.5	0.0	0.0	0	0	0.0	0.0	NR	-	1.62	-	1.70
WS06	-	1031	0.02	9.8	9.8	1.3	1.3	0.0	0.0	0	0	0.0	0.0	NR	-	1.69	-	1.78
WS07	-	1031	0.00	6.9	6.9	1.8	1.8	0.0	0.0	1	1	0.0	0.0	NR	-	1.78	-	1.84
WS08	-	1031	-0.02	16.8	16.8	0.5	0.5	0.0	0.0	1	1	-0.1	0.0	NR	-	1.67	-	1.75
WS09	-	1031	0.02	1.7	1.7	1.5	1.5	0.0	0.0	1	0	0.0	0.0	NR	-	DRY	-	1.83
WS10	-	1031	0.05	19.9	19.9	0.7	0.7	0.0	0.0	0	1	0.0	0.0	NR	-	1.72	-	1.79
WS11	-	1031	0.03	13.6	13.6	4.4	4.3	0.0	0.0	1	2	-0.1	0.0	NR	-	1.75	-	1.84
WS12	-	1031	0.03	15.2	15.2	1.8	1.8	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.80
WS13	-	1031	0.09	19.9	19.9	0.7	0.7	0.0	0.0	1	1	0.0	0.0	NR	-	1.71	-	1.79
WS14	-	1031	0.07	13.1	13.1	1.2	1.1	0.0	0.0	0	1	0.0	0.0	NR	-	DRY	-	1.84
WS15	-	1031	0.10	20.9	20.9	0.5	0.5	0.0	0.0	1	1	0.0	0.0	NR	-	DRY	-	1.80
WS16	-	1031	0.05	17.2	17.2	0.9	0.9	0.0	0.0	0	1	0.0	0.0	NR	-	1.75	-	1.85
WS17	-	1031	0.03	15.5	15.5	0.3	0.3	0.0	0.0	1	1	0.0	0.0	NR	-	1.81	-	1.82
WS18	-	1031	0.03	6.2	6.2	3.0	3.0	0.0	0.0	1	1	0.0	0.0	NR	-	1.79	-	1.87

**Remarks :** NR -Not recorded



**GAS AND GROUNDWATER MONITORING RESULTS**

**Contract Name :**

Witham St Hughes

**Contract No :**

N10018

**Date :**

10/09/2021

**Background Readings:**

O <sub>2</sub> % v/v :	20.8	CO <sub>2</sub> % v/v :	0.0	CH <sub>4</sub> % v/v :	0.0	Weather Conditions :	Dry and warm 23°c				Equipment Used:	Technician:
H <sub>2</sub> S ppm :	0	CO ppm :	0	Pressure Trend :	-	Ground Conditions :	Dry				GA5000	TY

Location	Time	Atmospheric Pressure (mb)	Differential Pressure (mb)	O <sub>2</sub> (% v/v)		CO <sub>2</sub> (% v/v)		CH <sub>4</sub> (% v/v)		H <sub>2</sub> S (ppm)	CO (ppm)	Gas Flow Rate (l/hr)		VOC (ppm)	Depth to LNAPL (mbgl)	Water Depth (mbgl)	Depth to DNAPL (mbgl)	Total Depth (mbgl)
				Low	Steady	High	Steady	High	Steady			Peak	Steady					
WS01	-	1009	-0.07	7.4	7.4	4.1	4.1	0.0	0.0	0	1	0.0	0.0	NR	-	1.51	-	1.91
WS02	-	1009	-0.09	12.4	12.4	3.3	3.3	0.0	0.0	0	1	0.0	0.0	NR	-	1.47	-	1.97
WS03	-	1009	-0.03	0.7	0.7	19.3	19.3	0.0	0.0	1	0	0.0	0.0	NR	-	1.65	-	1.79
WS04	-	1009	-0.03	20.4	20.6	0.2	0.2	0.0	0.0	0	0	-0.1	0.0	NR	-	DRY	-	1.83
WS05	-	1009	-0.07	12.2	12.2	2.5	2.5	0.0	0.0	1	0	0.0	0.0	NR	-	1.02	-	1.70
WS06	-	1009	-0.02	8.6	8.6	1.6	1.6	0.0	0.0	1	0	0.0	0.0	NR	-	1.72	-	1.78
WS07	-	1009	0.00	8.0	8.0	2.0	2.0	0.0	0.0	1	0	0.0	0.0	NR	-	1.75	-	1.84
WS08	-	1009	-0.02	16.8	16.8	0.9	0.8	0.0	0.0	1	0	0.0	0.0	NR	-	1.66	-	1.75
WS09	-	1009	0.03	13.2	13.2	1.1	1.1	0.0	0.0	0	2	-0.1	0.0	NR	-	DRY	-	1.83
WS10	-	1009	0.07	18.7	18.7	0.8	0.8	0.0	0.0	0	1	0.0	0.0	NR	-	1.71	-	1.79
WS11	-	1009	0.09	12.6	12.6	4.9	4.7	0.0	0.0	0	1	0.0	0.0	NR	-	1.75	-	1.84
WS12	-	1009	0.05	13.1	13.1	2.2	2.2	0.0	0.0	1	1	-0.1	0.0	NR	-	DRY	-	1.80
WS13	-	1009	0.00	15.8	15.8	1.4	1.4	0.0	0.0	0	0	0.0	0.0	NR	-	1.72	-	1.79
WS14	-	1009	0.10	17.8	17.8	0.8	0.8	0.0	0.0	1	0	0.0	0.0	NR	-	DRY	-	1.84
WS15	-	1009	0.04	15.2	15.2	1.8	1.8	0.0	0.0	0	0	0.0	0.0	NR	-	DRY	-	1.80
WS16	-	1009	0.16	16.7	16.7	1.0	1.0	0.0	0.0	0	1	-0.1	0.0	NR	-	1.74	-	1.85
WS17	-	1009	0.14	4.6	4.6	3.5	3.5	0.0	0.0	1	0	0.0	0.0	NR	-	1.79	-	1.82
WS18	-	1009	0.10	18.8	18.8	1.0	1.0	0.0	0.0	0	1	-0.1	0.0	NR	-	1.80	-	1.87

**Remarks :** NR -Not recorded