WML CONSULTING

Civil, Structural and Geotechnical Engineers

# Phase 2 Geo-Environmental Investigation & Assessment

For

# Dob Brook Close, Failsworth

Undertaken on behalf of

# The Guinness Partnership

**Report No. 8948G-WML-00-XX RP-G-0002**

**October 2019**

WML CONSULTING
Civil, Structural and Geotechnical Engineers

| | |
|---|---|
| **Report Title:** | **Dob Brook Close, Failsworth**<br>**Phase 2 Geo-environmental Investigation and Assessment** |
| **Report Reference:** | **8948G-WML-00-XX RP-G-0002** |
| **Client:** | **The Guinness Partnership** |
| **Issue Date:** | **24th October 2019** |
| **Drafted By:** | **T P Booth** |
| **Reviewed By:** | **S C Seddon** |
| **Authorised By:** | **P G Davies** |

This document has been prepared for the titled project (or named part thereof) and should not be relied upon or used for any other project without an independent check being carried out as to its suitability and prior written authorization being obtained from WML Consulting. WML accepts no responsibility or liability for the consequences of the use of this document, wholly or in part, for any other purpose than that for which it was commissioned. Any persons so using or relying upon this document for such other purpose do so at their own risk.

This report was prepared for the sole use of the Client and shall not be relied upon or transferred to any other party without the express written authorisation of WML. It may contain material subject to copyright or obtained subject to license; unauthorised copying of this report will be in breach of copyright/license.

The findings and opinions provided in this document are given in good faith and are subject to the limitations imposed by employing site assessment methods and techniques, appropriate to the time of investigation and within the limitations and constraints defined within this document. The findings and opinions are relevant to the dates when the assessment was undertaken, but should not necessarily be relied upon to represent conditions at a substantially later date.

The findings and opinions conveyed in this report are based on information obtained from a variety of sources as detailed and which WML assumes to be reliable, but has not been independently confirmed. Therefore, WML cannot and does not guarantee the authenticity or reliability of third party information it has relied upon.

Where opinions expressed in this report are based on current available guidelines and legislation, no liability can be accepted by WML for the effects of any future changes to such guidelines and legislation.

The limitations of liability of WML for the contents of this document have been agreed with the Client, as set out in the terms and conditions of offer and related contract documentation.

No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information which puts into context the findings which are summarised in the executive summary.

## Revision Status / History

| Rev | Date | Issue / Purpose/ Comment | Prepared | Checked | Authorised |
|---|---|---|---|---|---|
| - | 24/10/2019 | Final | TPB | SCS | PGD |
| | | | | | |

WML Consulting Ltd
No. 8 Oak Green,
Earl Road,
Stanley Green Business Park,
Cheadle Hulme,
Cheshire
SK8 6QL

Tel: 0161 482 0600
Email:info@wmlconsulting.com
www.wmlconsulting.com

## Executive Summary

| | |
|---|---|
| **Site Location** | The site comprises land located off Dob Brook Close, Failsworth, Manchester. It is centred on approximate Ordnance Survey National Grid Reference 388340E, 400675N with an indicative postcode of M40 1DB. |
| **Development Proposals** | It is understood that the currently proposed development will comprise 30no residential apartment units within 3no low rise structures, together with external hardstanding for access and parking. The development will also include shared landscaped garden areas. |
| **Ground Conditions** | Ground conditions encountered during the intrusive investigation comprise made ground to depths of between 1.30m and 3.80mbgl, this being underlain by Glacial Till which has been proven to a maximum depth of 5.00mbgl. |
| **Site Preparation and Earthworks** | Prior to any site earthworks commencing, infestations of Japanese Knotweed (JKW) will need to be treated / eradicated by the specialist contractor.<br>The removal of trees and other vegetation may need to be undertaken in consultation with an ecological specialist.<br>Due to the previously undeveloped nature of the site, significant ground obstructions in the form of existing foundations, floor slabs and other buried obstructions are not anticipated, but cannot be fully discounted.<br>As the site is bounded to the south by the Rochdale Canal, any groundworks will need to ensure that the integrity of the canal is not compromised and will need to be undertaken in accordance with the Canal Trusts 'Code of Practice'.<br>A detailed structural dilapidation survey of the existing boundary wall will be required, in consultation with a party wall surveyor, prior to any works commencing.<br>The CCTV survey undertaken by GUN in September 2019, did not encounter any evidence for a culvert extending beneath the site from Dob Brook Close in the north-west. It is anticipated that, once the vegetation has died down and/or has been cleared, further inspection should be undertaken to ascertain whether any manholes are visible on site, with further survey work being undertaken to accurately delineate the culvert, should this be the case. |
| **Foundations and Floor Slabs** | Foundations will need to be taken down to competent glacial till where a net allowable bearing pressure of 100kN/m² would be achieved. However, the till will be encountered, in most cases, at depths of between 2.00m and 4.50mbgl, becoming deeper from the south-west to the north-east of the site. Foundation depths for each apartment block may therefore vary considerable with the deeper foundation excavations needing to be adequately supported and dewatered to maintain stability.<br>Therefore, in consideration of the issues outlined above it is anticipated that a piled foundation solution will be the most suitable option for all structures at the site. Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions.<br>Once the proposed layout has been confirmed, it is recommended that further plot specific ground investigations comprising cable percussive boreholes, are undertaken to provide geotechnical parameters for deeper soils for appropriate pile design.<br>In consideration of the thickness of made ground, new floor slabs will need to be suspended and probably of beam and block construction. |
| **Excavations and Groundwater** | Perched groundwater inflows should be anticipated within excavations. Conventional 'sump and pump' dewatering measures may not be adequate to keep excavations dry and it cannot be discounted that groundwater exclusion measures such as interlocking sheet piles may be required to prevent excessive ingress of water.<br>Such support measures will also reduce the risk of 'running sand' conditions leading to loss of ground beneath any nearby adjacent structures or infrastructure. |
| **Pavements** | New road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5%. |

| | |
|---|---|
| **Concrete Classification** | The typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively. However, further testing of sulphate and pH levels in deeper soils will be required should a piled foundation option be considered. |
| **Soakaways** | In consideration of the site being underlain by made ground and relatively impermeable glacial till, soakaways are not considered to be a feasible drainage option for the site |
| **Ground Gas** | The site classifies as Characteristic Situation (CS) 1 – Very Low Gas Risk'. However, as carbon dioxide concentrations exceed 5%, the site may need to be classified as Characteristic Situation (CS) 2 – 'Low Gas Risk' in accordance with BS8485:2015.<br>Therefore, at this stage it cannot be discounted that new structures may need to incorporate ground gas protection measures to provide a score of 3.5 in accordance with Table 4 of BS8485:2015. This would typically comprise:<br>• Passive sub-floor dispersal (minimum 100mm clear void);<br>• Sub-slab ventilation at minimum 1500mm2/m centres to at least opposite sides of the structure;<br>• Lapped, taped and sealed gas resistant membrane to reasonable levels of workmanship in line with current good practice.<br>• Membrane to be sealed around all penetrations and to damp proof course.<br>This will need to be confirmed on completion of the ground gas monitoring and risk assessment in due course and should also be confirmed with the local authority Environmental Health / Building Control Officer prior to any building design being finalised. |
| **Contamination Assessment** | The test results indicate that made ground beneath the site contains levels of certain contaminants that are slightly elevated above their respective SL's. These relate in the main to very slightly elevated and localised concentrations of lead and mercury within a single sample of made ground (TP1 0.40mbgl) and several slightly elevated PAH compounds. These are considered to be most likely due to the presence of ash and clinker within the made ground matrix.<br>Proposed shared landscaped areas should be capped by clean sub-soil and topsoil thus removing the pollution linkage. This will normally comprise a 600mm clean cover where underlain by made ground.<br>The likelihood of encountering unrecorded contamination in other areas of the site cannot be wholly discounted.<br>Very localised slightly elevated leachable concentrations of lead and copper were recorded within a single sample of made ground when compared to the stringent drinking water standards and EQS vales respectively.<br>Taking into consideration that the site is not within an EA Source Protection Zone and there are no groundwater / surface water abstractions recorded within influencing distance, the slightly elevated concentrations are not considered to pose a significant risk to controlled waters.<br>In view of this and the likelihood for the Rochdale Canal to be lined with impermeable puddle clay, recorded leachable concentrations of contaminants beneath the site are not considered to pose a significant risk to groundwater or to the canal with no specific environmental remedial measures necessary.<br>Notwithstanding this, provisions should be put in place through appropriate management of surface water run-off, to ensure that no silt or sediment enters the canal during construction. |
| **Potable Water Supplies** | The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination is not envisaged. |
| **Waste Soils** | For guidance and based on the current information, it is likely that the majority of made ground would be classified as Non-Hazardous with natural deposits classified as Inert for |

| | |
|---|---|
| | landfill disposal.<br>It will be the responsibility of the waste producer to undertake testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements. |

**CONTENTS**

**1.0 INTRODUCTION ..... 1**
Appointment ..... 1
Proposed Development ..... 1
Objective ..... 1
Scope ..... 1
**2.0 SITE LOCATION AND DESCRIPTION ..... 3**
Site Location ..... 3
Site Description ..... 3
**3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING ..... 4**
Geology and Mining ..... 4
Radon ..... 4
Environmental Setting ..... 4
Site History ..... 4
**4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT ..... 5**
**5.0 SITE INVESTIGATION ..... 6**
Rationale ..... 6
Intrusive Works ..... 6
Monitoring Standpipes ..... 6
Geotechnical and Chemical Testing ..... 7
Gas and Groundwater Monitoring ..... 7
**6.0 GROUND CONDITIONS ..... 8**
Stratigraphy ..... 8
Made Ground ..... 8
Glacial Till ..... 8
Visual/Olfactory Evidence of Contamination ..... 8
Groundwater ..... 8
General ..... 9
**7.0 GEOTECHNICAL APPRAISAL ..... 10**
Site Preparation and Earthworks ..... 10
Foundations ..... 10
Floor Slabs ..... 11
Excavations and Groundwater ..... 11
Pavement Design ..... 11
Concrete Design ..... 11
Drainage and Soakaways ..... 12
**8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA) ..... 13**
General ..... 13
Human Health ..... 13
Controlled Water ..... 14
Soil Test Results ..... 14
Leachate Test Results ..... 15
Discussion and Conclusions ..... 15
**9.0 GROUND GAS RISK ASSESSMENT ..... 17**
Methodology ..... 17
Ground Gas Conceptual Model ..... 17
Results and Recommendations ..... 18

**10.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS.....19**
Excavated Soils..... 19
Imported Fill..... 19
Water Supply Pipes..... 19

**APPENDICES**

Appendix 01 - Drawings
Appendix 02 - Exploratory Hole Records
Appendix 03 - Chemical Analytical Results
Appendix 04 - Ground Gas Monitoring
Appendix 05 - Site Specific Assessment Criteria

# 1.0 INTRODUCTION

## Appointment

1.1 WML Consulting has been commissioned by The Guinness Partnership to undertake a Phase 2 Geo-environmental Investigation and Assessment of a site referred to as Dob Brook Close, Failsworth.

## Proposed Development

1.2 It is understood that the currently proposed development will comprise 30no residential apartment units within 3no low rise structures, together with external hardstanding for access and parking. The development will also include shared landscaped garden areas.

1.3 A drawing indicating the proposed layout by Bowker Sadler Architecture, referenced 18-079-0009 Rev A, is presented in Appendix 01.

## Objective

1.4 The objective of the ground investigation and assessment was to provide geotechnical recommendations for construction design purposes together with a geo-environmental risk assessment in terms of possible ground contamination.

1.5 To achieve the objective, the following tasks were undertaken:

- Review the existing desk study report for the site and design a Phase 2 ground investigation in accordance with the Environment Agency (2004) Model Procedures for the Management of Land Contamination, CLR11.
- Characterise the ground conditions in terms of geology, soil geotechnical parameters and ground contamination from information provided by the ground investigation.
- Provide recommendations regarding suitable foundations, floor slabs and new pavement construction, together with any other geotechnical considerations that could affect possible future development.
- Determine a ground conceptual model for the site so as to undertake an appropriate Phase 2 ground contamination Generic Quantitative Risk Assessment (GQRA).

## Scope

1.6 A Phase 1 Desk Study for the site has been undertaken by WML and is presented in the following report:

- Phase 1 Desk Study and Preliminary Geoenvironmental Assessment Report, Reference 8948G-WML-00-XX-RP-G-0001, dated August 2019.

1.7 This report includes the findings of a Phase 2 ground investigation designed on conclusions and recommendations provided in the Phase 1 desk study. For ease of reference, the findings of the desk study are summarised in the following sections. However, the two reports are not exclusive and should be read in conjunction.

1.8 The ground investigation comprised the formation of window sample probeholes and machine excavated trial holes undertaken with reference to BS5930:2015 Code of Practice for Ground Investigation and BS10175:2011 together with A1:2013, "Investigation of Potentially Contaminated Sites - Code of Practice" except where superseded by EN ISO 22475-1 "Geotechnical Investigation and Assessment – Sampling by Drilling and Excavation and Groundwater Measurements".

1.9 Geotechnical soil testing has been undertaken in general accordance with guidelines provided in BS1377:1990 – Parts 1-9, "Method of Test for Soils for Civil Engineering Purposes". Samples for

chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175: 2011 and A1:2013).

1.10 The ground investigation has also been undertaken with reference to BS8576:2013, Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).

## 2.0 SITE LOCATION AND DESCRIPTION

### Site Location

2.1 The site comprises land located off Dob Brook Close, Failsworth, Manchester. It is centred on approximate Ordnance Survey National Grid Reference 388340E, 400675N with an indicative postcode of M40 1DB.

2.2 The proposed development site is bounded to the north and east by residential properties on Dob Brook Close, to the south by the Rochdale Canal and to the west by a scrap yard and car showroom.

### Site Description

2.3 At the time of the investigation on 11th September 2019, the site was undeveloped and fenced-off from the general public.

2.4 The north-western, western and southern area of the site was surfaced with overgrown grass and low-lying vegetation.

2.5 The central and south-eastern area was surface with dense semi-mature and mature trees of varying species. Further mature trees were located sporadically within the northern and western sections of the site.

2.6 Historically the western and south-western section of the site included large stands of Japanese Knotweed. It is understood that these have been treated by a Japanese Knotweed specialist and evidence of dead stems and the base of large stands were visible in this section of the site. However, locally small volumes of re-growth were noted during the site inspection in August 2019.

2.7 An area of localised fly tipping, located in the north-western corner of the site, mainly comprised plastic, broken windscreen glass, vegetation and metal sheeting. No obvious signs of Asbestos Containing Material (ACM) was evident within the fly-tipped material.

2.8 The brick wall which forms the western boundary with the scrap yard included a metal door which historically provided access between the adjacent site into a former structure within the site boundary (demolished in 1980).

2.9 The site reduces in elevation from approximately 89.00m Above Ordnance Datum (AOD) in the west to around 88.50mAOD in the north-east.

## 3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

3.1 The following paragraphs summarise the most relevant findings of the Phase 1 desk study report.

### Geology and Mining

3.2 The site is indicated to be underlain by Devensian Glacial Till comprising mainly clay but possibly with interbedded sand and gravel horizons. The superficial deposits are indicated to be underlain by strata of the Permian Collyhurst Sandstone which is recorded to comprise mainly red sandstone.

3.3 In consideration of the underlying geology, risks of subsidence from coal mining can been discounted.

### Radon

3.4 The property is not in a Radon Affected Area as defined by the Health Protection Agency as less than 1% of properties are above the Action Level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.

### Environmental Setting

3.5 The superficial deposits underlying the site are classified as a 'Secondary (Undifferentiated) Aquifer'. The underlying bedrock is classified as a 'Principal Aquifer'.

3.6 The site is not within an Environment Agency Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 1km.

3.7 The nearest surface water feature is the Rochdale Canal which forms the southern site boundary.

3.8 The nearest historic landfill is located over 250m to the north off Mill Lane. A vehicle scrap yard is located at the south-western site boundary.

3.9 There are 3no petrol filling stations located within 250m of the site, the closest being 105m west which is obsolete.

3.10 There are no records of sites which have been determined as Contaminated Land under Section 78R of the Environmental Protection Act 1990 within 500m of the study site.

### Site History

3.11 The earliest complete maps dated 1848 indicate the site to have been predominantly undeveloped and in rural / agricultural use. A watercourse, presumably Dob Brook, extended north-west to south-east across the central section of the site, before being culverted to the south-east. By 1892 Dob Brook had been either been culverted or diverted.

3.12 The site then remained unchanged until 1906 when it formed the south-western section of a larger football ground. With the exception of a small structure in the south-western corner of the site between 1931 and 1980 the site has never been further developed.

3.13 The area immediately surrounding the site historically comprised undeveloped rural/agricultural land before being developed for mixed industrial, commercial and residential uses. The closest historical industrial development in the wider surrounding area included a cotton mill, brewery and later a vehicle scrap yard which is still in use.

## 4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

4.1 The Phase 1 desk study report concluded that potential pollution linkages are on the whole considered unlikely with associated preliminary risks being assessed generally as very low to low.

4.2 However, the report recommended that assumptions in the conceptual model be verified by providing information on the physical and chemical ground conditions through site investigations.

4.3 The investigations were to comprise sampling and chemical analysis of the near surface soil and the installation of ground gas monitoring standpipe with subsequent monitoring of hazardous ground gas concentrations and flow.

## 5.0 SITE INVESTIGATION

### Rationale

5.1 Intrusive investigations were undertaken primarily to provide geotechnical parameters for structural design purposes but also to verify the preliminary site conceptual model and confirm the anticipated low environmental risk.

5.2 A general coverage of the site was considered appropriate although investigations could not be undertaken in the area demarcated as being affected by Japanese Knotweed on drawing 8948G-SK01 in Appendix 01, and within localised stands of knotweed within the densely overgrown areas.

5.3 It should also be noted that investigation locations were chosen where possible to align with the development layout at the time and that the layout was changed since the site investigation was undertaken as a result of planning consultation with the Canals and River Trust.

5.4 Window sample probeholes were undertaken to provide information on near surface deposits and to facilitate installation of standpipes.

5.5 This method of investigation was chosen due to the densely overgrown nature of the site and restricted access. Due to the small diameter of the probing equipment, the depth of penetration achieved is dependent on favourable ground conditions. As such, ground penetration may be restricted in circumstances where the ground is particularly strong or contains relatively large obstructions such as cobbles and/or boulders.

5.6 Also, due to the restricted nature of the site, machine excavated trial pits were undertaken, using a tracked mini-digger, to provide information on near surface deposits and to obtain samples for chemical analysis. The size of the machine was limited due to the gate size and requirement associated with the Japanese Knotweed.

5.7 TP1, TP4 and WS1 were also located within potential areas of the suspected infilled/ culverted Dob Brook.

5.8 Monitoring standpipes were installed in selected probeholes for the measurement of gas and groundwater levels.

### Intrusive Works

5.9 Ground investigation work was undertaken by LOT Geotechnics Ltd on 11th September 2019. This comprised the formation of 6no window sample probeholes to a maximum depth of 5.00 metres below ground level (mbgl).

5.10 WML also oversaw the formation of 4no machine excavated trial pits on 11th September 2019 to a maximum depth of 2.70mbgl.

5.11 The exploratory hole records are presented in Appendix 02 of this report whilst the exploratory hole locations are shown on Drawing 8948G-SK01 in Appendix 01.

### Monitoring Standpipes

5.12 Monitoring wells for groundwater were installed in 3no probeholes as indicated on the logs presented in Appendix 02.

**Geotechnical and Chemical Testing**

5.13 In-situ geotechnical testing was undertaken at regular intervals during the formation of the probeholes in the form of Standard Penetration Tests (SPTs). The results for this testing are presented on the descriptive logs in Appendix 02.

5.14 Chemical analysis was undertaken on selected soil samples for the following contaminants of concern:

- Total arsenic, boron, cadmium, chromium VI, copper, lead, mercury, nickel, selenium, vanadium, zinc.
- Total cyanide, phenols, sulphur, sulphate.
- Speciated USEPA polyaromatic hydrocarbons (PAH).
- Asbestos screen and identification.
- 2:1 water/soil sulphate extract, pH.

5.15 In order to assess the potential risk to controlled waters, selected samples of soils were submitted for leachate preparation and analyses of the following suite of contaminants:

- Total arsenic, boron, cadmium, chromium VI, copper, lead, mercury, nickel, selenium, vanadium, zinc.
- Speciated (16) hydrocarbons (PAH).
- Total phenols, sulphur, sulphate.
- Sulphate extract, pH.
- Water hardness (CaCO3).

5.16 The results of the chemical analysis are presented in Appendix 03.

**Gas and Groundwater Monitoring**

5.17 Gas and groundwater monitoring has been carried out on three occasions to date between 17th September and 21st October 2019. The monitoring results are presented in Appendix 04.

## 6.0 GROUND CONDITIONS

### Stratigraphy

6.1 Ground conditions encountered during the intrusive investigation comprise made ground to depths of between 1.30m and 3.80mbgl, this being underlain by Glacial Till which has been proven to a maximum depth of 5.00mbgl.

### Made Ground

6.2 Made ground was encountered within all exploratory holes from ground level to depths of between 1.30m and 3.80mbgl.

6.3 The upper horizon of made ground generally comprised brown and grey, interbedded clay, sand and gravel with a low to medium cobble content, to depths of between 0.90m and 1.90mbgl. Gravel sized fragments included brick, sandstone, concrete, slate, ash and locally coal, clinker, metal, wood and ceramic. Cobble sized fragments included sandstone, brick and concrete.

6.4 Within the majority of exploratory holes a lower horizon of made ground comprising dark grey to black, locally slightly silty, sandy gravel extended to depths of between 1.30m and 3.80mbgl. Gravel sized fragments included predominantly ash and clinker but also locally wood, brick and slate.

6.5 Within WS1, a basal layer of made ground comprised dark brown, slightly clayey, silty sand with occasional organic flecks from 2.30m to 3.00mbgl. Also, within WS5, a horizon of dark brown, organic, peaty clay was encountered between 2.40m and 2.90mbgl.

6.6 Deposits considered to represent possible recent deposits was encountered within WS4 between depths of 2.30m and 3.00mbgl. This comprised soft grey slightly silty, sandy clay with some decayed roots.

6.7 SPT 'N' values within the made ground ranged between 3 and 21, but generally between 3 and 8, indicating it to be soft and/or loosely compacted.

### Glacial Till

6.8 Within the all of the exploratory holes, glacial till was encountered beneath the made ground at depths of between 1.30m and 3.80mbgl.

6.9 The till generally comprised brown and grey mottled, slightly sandy, slightly gravelly, silty clay.

6.10 The upper horizons were generally described as being soft to firm, increasing in strength with increasing depth, generally to a stiff consistency.

6.11 SPT 'N' values within the glacial till ranged between 6 and 47 with an average of 18 indicating a locally soft but generally firm to stiff consistency.

### Visual/Olfactory Evidence of Contamination

6.12 No visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

### Groundwater

6.13 Groundwater seepages were encountered within the majority of exploratory holes at depths of between 1.00m and 2.40mbgl and mainly within the granular horizons of made ground.

6.14 During the initial monitoring visits, standing water was recorded at depths of between 1.25m and 2.80mbgl. This is considered to represent water perched within the made ground with true phreatic groundwater levels anticipated to be in excess of 5.00mbgl.

6.15 It should be appreciated that the groundwater monitoring described above has been undertaken during a very short period of time. Significant variations in the long-term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

**General**

6.16 It should also be appreciated that ground conditions may vary between and away from the exploratory hole positions, and that no account can be taken in this report of such variations.

## 7.0 GEOTECHNICAL APPRAISAL

### Site Preparation and Earthworks

7.1 Prior to any site earthworks commencing, infestations of Japanese Knotweed (JKW) will need to be treated / eradicated by the specialist contractor. This will likely comprise excavating and removing the JKW and the associated rhizome infested soil to a licenced landfill. However, infestations are also known to exist immediately west of the site within the vehicle scarp yard. Therefore, the JKW specialist should be consulted with regards to the prevention of spread and regrowth beneath the party wall. It is understood that this is to be managed through the use of root barriers.

7.2 A report on the effective treatment and eradication of JKW should be sought from the specialist treatment contractor on completion.

7.3 The removal of trees and other vegetation may need to be undertaken in consultation with an ecological specialist.

7.4 Due to the previously undeveloped nature of the site, significant ground obstructions in the form of existing foundations, floor slabs and other buried obstructions are not anticipated. However, in consideration of the infilled nature of the site, it cannot be wholly discounted that localised obstructions may be encountered and will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed redevelopment.

7.5 Site enabling works will need to take account of the integrity of neighbouring statutory utilities.

7.6 As the site is bounded to the south by the Rochdale Canal, any groundworks will need to ensure that the integrity of the canal is not compromised and will need to be undertaken in accordance with the Canal Trusts 'Code of Practice'.

7.7 Site enabling works and particularly the removal of JKW infested soil, will also need to take account of the integrity of the existing party wall to the western boundary of the site. A detailed structural dilapidation survey of the wall may therefore be required, in consultation with a party wall surveyor, prior to any works commencing.

7.8 The CCTV survey undertaken by GUN in September 2019, did not encounter any evidence for a culvert extending beneath the site from Dob Brook Close in the north-west. However, it was noted that due to the site being overgrown, it could not be determined if any manhole covers were located within the site boundary. Therefore, although considered unlikely, it cannot be fully discounted that Dob Brook may be culverted beneath the site.

7.9 It is anticipated that, once the vegetation has died down and/or has been cleared, further inspection should be undertaken to ascertain whether any manholes are visible on site, with further survey work being undertaken to accurately delineate the culvert, should this be the case.

### Foundations

7.10 Made ground and any soft organic clays should be considered unsuitable for the direct support of structural loads as these could result in unacceptable total and differential settlements on loading.

7.11 Foundations will therefore need to be taken down to competent glacial till where a net allowable bearing pressure of 100kN/m² would be achieved. However, the till will be encountered, in most cases, at depths of between 2.00m and 4.50mbgl, becoming deeper from the south-west to the north-east of the site. Foundation depths for each apartment block may therefore vary considerable with the deeper foundation excavations needing to be adequately supported and dewatered to maintain stability.

7.12 Also, such excavations will generate significant waste soil which would probably need to be disposed to landfill.

7.13 This, together with the anticipated depth of excavation in most areas will likely render the use of deep mass concrete spread foundations impractical and uneconomical.

7.14 Therefore, in consideration of the issues outlined above it is anticipated that a piled foundation solution will be the most suitable option for all structures at the site.

7.15 Piles will need to be taken down through the made ground and any soft soils and into the underlying competent glacial till. Pile design should assume no side support (skin friction) for the pile sections surrounded by made ground or soft soils.

7.16 Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions.

7.17 For preliminary considerations, a pre-cast driven concrete pile would minimise waste soil arisings but potential noise and vibration effects may render this option unsuitable. Therefore, a bored pile solution is likely to be the most appropriate solution for the site.

7.18 Once the proposed layout has been confirmed, it is recommended that further plot specific ground investigations are undertaken in order to inform detailed foundation design. This will include the formation of cable percussive boreholes to provide geotechnical parameters for deeper soils for appropriate pile design.

**Floor Slabs**

7.19 In consideration of the thickness of made ground, new floor slabs will need to be suspended and probably of beam and block construction.

**Excavations and Groundwater**

7.20 Excavations at the site will be feasible using conventional hydraulic plant. All excavations at the site and specifically requiring man-entry, will need adequate lateral support, or will need to be battering back to a safe angle to ensure their stability.

7.21 Perched groundwater inflows should be anticipated within excavations. Conventional 'sump and pump' dewatering measures may not be adequate to keep excavations dry and it cannot be discounted that groundwater exclusion measures such as interlocking sheet piles may be required to prevent excessive ingress of water.

7.22 Such support measures will also reduce the risk of 'running sand' conditions leading to loss of ground beneath any nearby adjacent structures or infrastructure.

**Pavement Design**

7.23 In consideration of the near surface ground conditions being of made ground, it is recommended that new road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 2.5%.

7.24 The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation levels following any earthwork operations and prior to pavement construction.

7.25 In any event, all formations should be proof-rolled with any soft, loose or otherwise unsuitable material being removed and replaced with compacted granular fill.

**Concrete Design**

7.26 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive

Ground). With reference to the site history, it is deemed appropriate to classify the site as "Brownfield", with respect to BRE Special Digest.

7.27 Values of 2:1 water/soil extract for sulphate range between 10mg/l and 58mg/l. Values of pH at range from 7.2 to 7.4 indicating near neutral conditions.

7.28 On the basis of these results, the typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.

7.29 However, further testing of sulphate and pH levels in deeper soils will be required should a piled foundation option be considered.

**Drainage and Soakaways**

7.30 In consideration of the site being underlain by made ground and relatively impermeable glacial till, soakaways are not considered to be a feasible drainage option for the site.

## 8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

### General

8.1 A review of the desk study information has concluded that significant pollution linkages were unlikely with the overall preliminary risk on the whole being assessed as to low

8.2 Further to this, no visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

8.3 However, due to the presence of made ground, it has been considered prudent to adopt a precautionary principal and undertake chemical analysis of the near-surface soils to establish in more detail the human health risk status of the site.

### Human Health

8.4 Selected samples have been analysed for a general suite of contaminants of concern and compared against Screening Levels (SL's) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in CLR11, Model Procedures for the Management of Land Contamination, 2004.GQRA).

8.5 The criteria for a limited number of contaminants have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.

8.6 Within the document, Category 4 Screening Levels (C4SL's) are described as being more pragmatic than previous screening criteria and represent concentrations in soil that present an 'acceptable' level of risk within the context of Part 2A.

8.7 The National Planning Policy Framework states that 'after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990'. Therefore by inference, the C4SL's are appropriate for use in the planning context.

8.8 Although the SP1010 document states that C4SL only apply for a 'sandy loam soil with 6% soil organic matter', it is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SL's have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.

8.9 Subsequent to SP1010, LQM/CIEH have published a document entitled 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015. In brief, the document provides updated assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance. The new screening criteria, or Suitable 4 Use Levels (S4ULs), are intended to provide a complete and updated replacement to the previous LQM/CIEH GAC of 2009. As such they are considered appropriate for use in this assessment for other contaminants not covered by C4SL's and/or for organic contaminants assuming a worst-case Soil Organic Matter (SOM) of 1% as an initial conservative assessment.

8.10 For each contaminant, S4UL's and C4SL's have been calculated for six land use scenarios, namely:

- Residential with homegrown produce.
- Residential without homegrown produce.
- Allotments.
- Commercial.
- Public Open Space near residential housing.
- Public Parks (remote from residential housing).

8.11 In light of the proposed development, the SL's for a "Residential with homegrown produce" end-use are considered appropriate for a conservative assessment at this stage.

8.12 A table of relevant SL's protective of human health for both 1% and 2.5% SOM are provided in Appendix 05.

**Controlled Water**

8.13 Due to the proximity of the Rochdale Canal, it has been considered prudent to establish the leachability potential of contaminants within the made ground soils.

8.14 Generic criteria for the assessment of potential groundwater contamination have been derived from very conservative guidelines protective of drinking water and environmental quality, namely:

- UK Drinking Water Standards (DWS) as defined by The Water Supply (Water Quality) Regulations, 2016;
- UK Environmental Quality Standards (EQS) for Freshwater, based on a Hardness of 50mg/l to 100mg/l (Soft in accordance with United Utilities information for the area), 2000.

8.15 A table of relevant assessment criteria protective of controlled waters is provided in Appendix 05.

**Soil Test Results**

8.16 8no samples of made ground were analysed for a suite of Contaminants of Concern (CoC). The Organic Matter Content for the samples generally range from 2.5% to 7.6% with a single samples at 1.7%. It has therefore been considered appropriate to adopt screening levels (SL's) relating to a 2.5% SOM in the generic assessment.

8.17 The majority of the concentrations measured are below the relevant SL's for "Residential with homegrown produce" end-use assuming a 2.5% SOM with the following exceptions.

| Contaminant | Number of Exceedances | SL (mg/kg) | Recorded Concentrations (mg/kg) | Samples |
|---|---|---|---|---|
| Mercury | 1 | 1.2 | 2.1 | TP1 – 0.40m |
| Lead | 1 | 200 | 270 | TP1 – 0.40m |
| Benzo[a]anthracene | 1 | 11 | 15 | TP2 – 0.65m |
| Benzo[a]pyrene | 4 | 2.7 | 4.2 – 13 | TP1 – 0.40m<br>TP2 – 0.30m<br>TP2 – 0.65m<br>TP4 – 0.30m |
| Dibenzo[a,h]anthracene | 6 | 0.28 | 0.64 – 2.3 | WS1 – 0.40m<br>TP1 – 0.40m<br>TP2 – 0.30m<br>TP2 – 0.65m<br>TP3 – 0.20m<br>TP4 – 0.30m |
| Benzo[b]fluoranthene | 4 | 3.3 | 4.2 – 12 | TP1 – 0.40m<br>TP2 – 0.30m<br>TP2 – 0.65m<br>TP4 – 0.30m |

8.18 No asbestos was detected in any of the soil samples analysed.

**Leachate Test Results**

8.19 4no soil samples, namely TP1, TP2, TP3 and TP4, were submitted for the analysis of leachable concentrations of metals, semi-metals and PAH compounds.

8.20 The majority of the results were below the generic criteria when compared to the EQS for freshwater, and the more stringent UKDWS, with the following minor exceedances.

| Contaminant | Ref Value ug/l | | Exceedances ug/l | | Samples |
|---|---|---|---|---|---|
| | EQS | UKDWS | EQS | UKDWS | |
| Copper | 3 | 2000 | 3.3 & 5.3 | - | TP2 – 1.70m<br>TP4 – 1.70m |
| Lead | 10 | 10 | 17 | 17 | TP4 – 1.70m |

**Discussion and Conclusions**

Risks to Human Health

8.21 The test results indicate that made ground beneath the site contains levels of certain contaminants that are slightly elevated above their respective SL's. These relate in the main to very slightly elevated and localised concentrations of lead and mercury within a single sample of made ground (TP1 0.40mbgl) and several slightly elevated PAH compounds. These are considered to be most likely due to the presence of ash and clinker within the made ground matrix.

8.22 As the site is currently covered with vegetation and secured from public access, the current risk to human health from direct contact with these contaminants is considered low.

8.23 Following site development, there will be no mechanism for a direct contact pollution linkage with contaminated soil where surfaced with buildings and hardstanding. However, a direct contact pollution linkage is plausible in proposed shared landscaped areas and it is recommended that these should be capped by clean sub-soil and topsoil thus removing the pollution linkage. This will normally comprise a 600mm clean cover where underlain by made ground.

8.24 In consideration of the above, it is anticipated that a remediation strategy will be required to bring the site to a condition suitable for the intended use by removing unacceptable risks to human health. The strategy will need to be submitted to the Local Planning Authority for their approval prior to any development commencing.

8.25 The likelihood of encountering unrecorded contamination in other areas of the site cannot be wholly discounted.

Risks to Controlled Waters

8.26 Slightly elevated leachable concentrations of lead were recorded within a single sample of made ground when compared to the stringent drinking water standards. In addition, when the results were compared against the EQS values for surface water, slight exceedances of copper were recorded in 2no samples of made ground.

8.27 Taking into consideration that the site is not within an EA Source Protection Zone and there are no groundwater / surface water abstractions recorded within influencing distance, the slightly elevated concentrations are not considered to pose a significant risk to controlled waters.

8.28 Furthermore, the site will include a positive drainage system which will intercept a significant volume of surface water runoff, thus greatly reducing the potential for contaminants to leach and become mobile.

8.29 In view of this and the likelihood for the Rochdale Canal to be lined with impermeable puddle clay, recorded leachable concentrations of contaminants beneath the site are not considered to pose a significant risk to groundwater or to the canal with no specific environmental remedial measures necessary.

8.30 Notwithstanding this, provisions should be put in place through appropriate management of surface water run-off, to ensure that no silt or sediment enters the canal during construction.

## 9.0 GROUND GAS RISK ASSESSMENT

### Methodology

9.1 Current guidance for the assessment of risk associated with the presence of hazardous ground gases (principally methane and carbon dioxide) is provided in two key documents, namely:

- Code of practice for the Characterisation and remediation from Ground Gas in Affected Developments. British Standard Institution (BS 8485: 2015 & A1 2019); and
- Assessing Risks posed by Hazardous Ground Gases to Buildings CIRIA (C665, 2007).

9.2 The assessment presented herein is primarily based on the BS8485 document.

9.3 Hazardous ground gas qualitative risk assessment is based on a conceptual model similar to that used for soil and groundwater contamination sources (i.e., source-pathway-receptor pollutant linkages). A semi-quantitative estimate of risk can be assessed based on knowledge of the conceptual model and a measure of hazardous gas concentration and gas flow at the site within monitoring standpipes.

9.4 Based on the measured flow rates and hazardous gas concentrations, individual "hazardous gas flow rates" (Qhg) can be derived for each monitoring point, from which the "site characteristic hazardous gas flow rate" (Qhgs), and then the "Characteristic Situation" (CS) can be determined.

9.5 BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation and the proposed development based on building type as outlined in Table 3.

**Table 3 - Building Types**

| | Type A | Type B | Type C | Type D |
|---|---|---|---|---|
| **Ownership** | Private | Private or commercial/ Public, possible multiple | Commercial / Public | Commercial / Industrial |
| **Control (Change of use)** | None | Some but not all | Full | Full |
| **Room Sizes** | Small | Small/ medium | Small to Large | Large Industrial/ Retail Park |

9.6 The proposed development therefore is indicated to comprise the construction of Type B buildings which include:

- *Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium size rooms with passive ventilation of rooms and other internal spaces throughout the ground floor.*

### Ground Gas Conceptual Model

9.7 The site is not located in an area where radon protection measures are required.

9.8 There are no current or historic landfills within influencing distance of the site.

9.9 Made ground from historical in-filling has been encountered beneath the site up to 3.80m in thickness. This was not found to contain any significant volumes of organic materials which could be considered a significant source of ground gas. However, a relatively thin horizon of peaty clay was encountered

within WS5 between 2.40m and 2.90mbgl. Notwithstanding this, due to the age of infilling, the potential for the made ground to generate ground gas in significant volumes is considered low.

9.10 With the exception of localised recent deposits (WS4 2.30m to 3.00mbgl) which included some decayed roots, no evidence a significant thickness of natural organic material was encountered in the exploratory holes within the area of the infilled brook.

9.11 The presence of ground gas resulting from shallow unrecorded mine workings can be discounted.

9.12 In consideration of the above, the preliminary risk to the development from ground gas has been assessed low. However, it has been considered prudent to undertake ground gas monitoring, primarily for methane and carbon dioxide, with associated flow rates, on 3no occasions to date between 17th September and 21st October 2019.

**Results and Recommendations**

9.13 The results indicate concentrations of peak and steady methane below detection limits with peak and steady carbon dioxide concentrations generally ranging from 0.1% to 8.1% by volume in air.

9.14 No detectable ground gas flows have been recorded during the initial monitoring visits.

9.15 The results give a maximum composite Qhg value of 0.0081l/hr and indicate the site to classify as Characteristic Situation (CS) 1 – Very Low Gas Risk'. However, as carbon dioxide concentrations exceed 5%, the site may need to be classified as Characteristic Situation (CS) 2 – 'Low Gas Risk' in accordance with BS8485:2015.

9.16 Therefore, at this stage it cannot be discounted that new structures may need to incorporate ground gas protection measures to provide a score of 3.5 in accordance with Table 4 of BS8485:2015. This would typically comprise:

- Passive sub-floor dispersal (minimum 100mm clear void);
- Sub-slab ventilation at minimum 1500mm$^2$/m centres to at least opposite sides of the structure;
- Lapped, taped and sealed gas resistant membrane to reasonable levels of workmanship in line with current good practice.
- Membrane to be sealed around all penetrations and to damp proof course.

9.17 This will need to be confirmed on completion of the ground gas monitoring and risk assessment in due course and should also be confirmed with the local authority Environmental Health / Building Control Officer prior to any building design being finalised.

## 10.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

### Excavated Soils

10.1 Groundworks undertaken during the development will produce excavated soil which will require appropriate site management. Principally, and in line with the sustainable development agenda, any soils arising from site excavations should firstly be considered for re-use where possible by incorporation into the development.

10.2 However, due to the restricted nature of the site and the inhomogeneous nature of the underlying made ground, sorting and segregation of excavated soils to render them suitable for re-use is not considered feasible.

10.3 Where soils are surplus to requirements, they will need to be removed from site through appropriate waste management.

10.4 It should be noted that the chemical analysis results for disposal classification are assessed against different assessment criteria to those relating to contamination risk assessment. Soils that are deemed suitable for use in terms of risk to human health and the environment may not necessary be un-contaminated and could be classified as 'Non-Hazardous' or even Hazardous' for disposal purposes.

10.5 For guidance and based on the current information, it is likely that the majority of made ground would be classified as Non-Hazardous with natural deposits classified as Inert for landfill disposal.

10.6 It will be the responsibility of the waste producer to undertake testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

### Imported Fill

10.7 Imported fill will be subject to specific quality requirements and should be accompanied by appropriate certification to confirm its suitability. Allowance should also be made for testing imported fill materials prior to placement to ensure suitability.

### Water Supply Pipes

10.8 The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination is not envisaged.

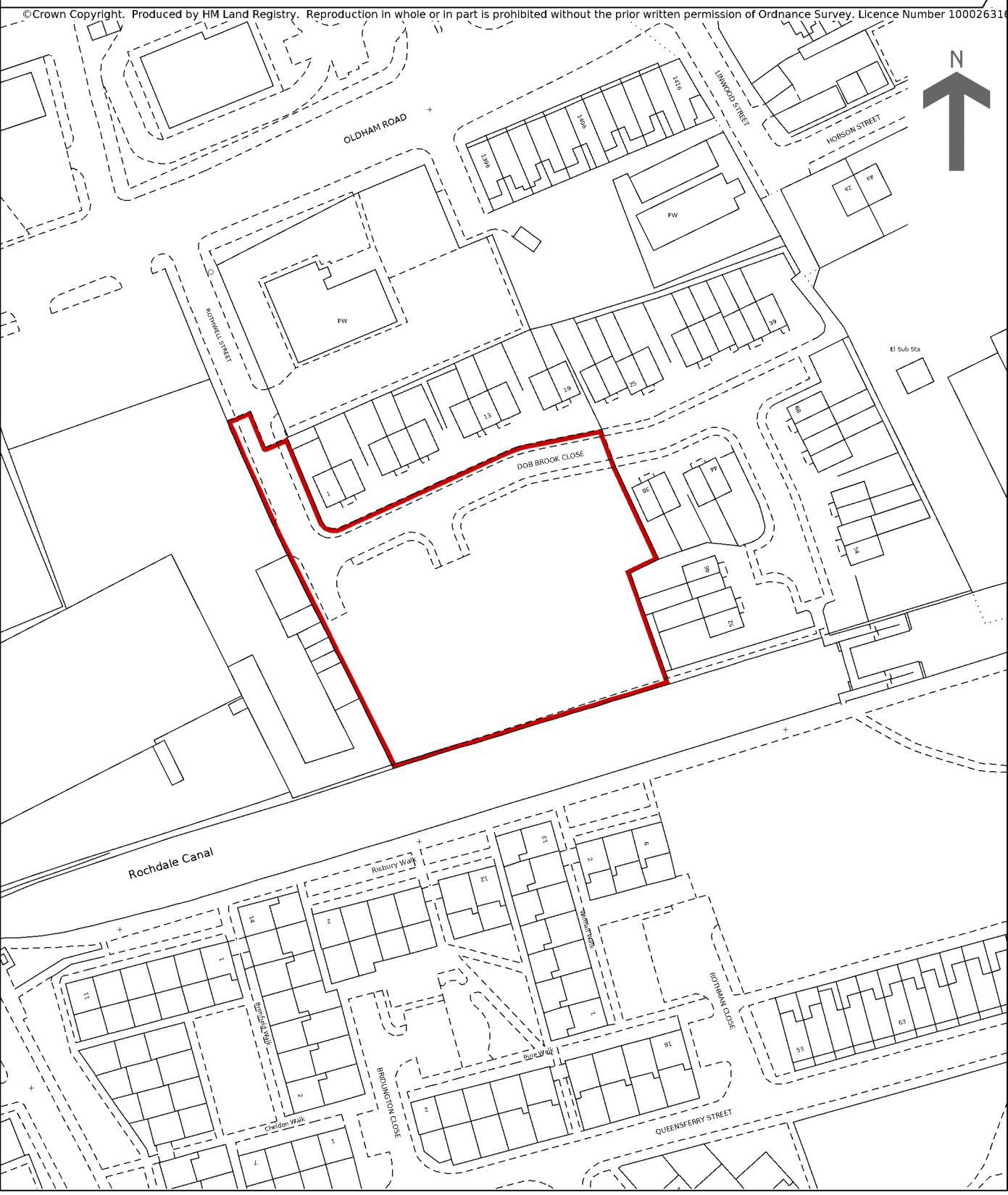
# APPENDIX 01

## Drawings

# HM Land Registry
## Current title plan

Title number **GM575031**
Ordnance Survey map reference **SD8800NW**
Scale **1:1250**
Administrative area **Greater Manchester : Manchester**

©Crown Copyright. Produced by HM Land Registry. Reproduction in whole or in part is prohibited without the prior written permission of Ordnance Survey. Licence Number 100026316




**This is a print of the view of the title plan obtained from HM Land Registry showing the state of the title plan on 05 July 2019 at 11:10:07. This title plan shows the general position, not the exact line, of the boundaries. It may be subject to distortions in scale. Measurements scaled from this plan may not match measurements between the same points on the ground.**

**This title is dealt with by HM Land Registry, Fylde Office.**

BOWKER SADLER PARTNERSHIP LIMITED
THIS DRAWING IS THE SUBJECT OF COPYRIGHT WHICH VESTS IN BOWKER SADLER PARTNERSHIP LIMITED. IT IS AN INFRINGEMENT OF COPYRIGHT TO REPRODUCE THIS DRAWING, BY WHATEVER MEANS, INCLUDING ELECTRONIC, WITHOUT THE EXPRESS WRITTEN CONSENT OF BOWKER SADLER PARTNERSHIP LIMITED WHICH RESERVES ALL ITS RIGHTS

BOWKER SADLER PARTNERSHIP LIMITED ASSERTS ITS RIGHTS TO BE IDENTIFIED AS THE AUTHOR OF THIS DESIGN

- DRAWING NOT TO BE SCALED.
- REPORT ERRORS & OMISSIONS TO ARCHITECT.
- CHECK ALL DIMENSIONS ON SITE
- DRAWING TO BE READ IN CONJUNCTION WITH THE HEALTH AND SAFETY PLAN AND ALL RELEVANT RISK ASSESSMENTS

## Proposed Site Plan

1 : 200

## Schedule of Accommodation

| Apartment Type | Gross Internal Floor Area (GIA) |
|---|---|
| 2 Nº Type 1 - 1B2P Apartments (Ground Floor) | 50.8 m² |
| 2 Nº Type 2 - 1B2P Apartment (First Floor) | 54.5 m² |
| 2 Nº Type 3 - 1B2P Apartments (Ground Floor) | 50.8 m² |
| 2 Nº Type 4 - 1B2P Apartments (First Floor) | 54.5 m² |
| 2 Nº Type 5 - 1B2P Apartments (Ground Floor) | 50.8 m² |
| 2 Nº Type 6 - 1B2P Apartments (First Floor) | 54.5 m² |
| 8 Nº Type 7 - 2B3P Apartments (Ground Floor) | 61.0 m² |
| 8 Nº Type 8 - 2B4P Duplex Apartments (First Floor / Second Floor) | 87.7 m² |
| 1 Nº Type 9 - 1B2P Apartment (Ground Floor) | 50.8 m² |
| 1 Nº Type 10 - 1B2P Apartment (First Floor) | 54.5 m² |

Total: 30 Nº Apartments

100% Parking

14 Nº 1B2P Apartments

8 Nº 2B3P Apartments

8 Nº 2B4P Apartments

| REV. | DATE | DRN. | | CHKD. |
|---|---|---|---|---|
| A | 30.09.19 | ADS | Apartment Gross Internal Floor Areas added | MD |

PROJECT
Dob Brook Close

CLIENT
The Guinness Partnership

DRAWING
Proposed Site Plan

| SCALE | SHEET SIZE | DRAWN | CHECKED | DATE |
|---|---|---|---|---|
| As indicated | @ A1 | ADS | MD | 13/09/2019 |

BOWKER SADLER **ARCHITECTURE**
A: Hatherlow House, Hatherlow, Romiley, Stockport SK6 3DY
T: 0161 406 7333
E: office@bowker-sadler.co.uk
W: www.bowker-sadler.co.uk

| JOB No | DRAWING No | REVISION |
|---|---|---|
| 18-079 | 0009 | A |

STATUS
FEASIBILITY

1:5 1:50 1m 2 3 4 5 6 7m

1:1 1:100 1m 2 3 4 5 6 7 8 9 10 11 12 13 14 15

P:\2018\18-079\Drawings\feasibility\refs\x - site_opt c4.rvt

| Station | Easting | Northing | Level |
|---|---|---|---|
| 1 | 388361.508 | 400715.560 | 88.568 |
| 2 | 388307.208 | 400695.132 | 88.311 |

## GENERAL NOTES

1. DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.
2. NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
3. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
4. THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

## KEY

- SITE BOUNDARY
- WS1 — WINDOW SAMPLE PROBEHOLES
- TP1 — WINDOW SAMPLE PROBEHOLES
- AREA OF KNOWN JAPANESE KNOTWEED

| Rev. | Amendment | Date | By | Chkd |
|---|---|---|---|---|
| P1 | FIRST PRELIMINARY ISSUE. | AUG '19 | SCS | PGD |

Project
DOB BROOK CLOSE

Client
THE GUINNESS PARTNERSHIP

Title
EXPLORATORY HOLE
LOCATION PLAN

| Drawn | Checked | Date | Scale |
|---|---|---|---|
| SCS | PGD | 2210-19 | 1:200 |

WML CONSULTING
Chartered Civil and Structural Engineers
No.8 Oak Green
Earl Road
Stanley Green Business Park
Cheadle Hulme
Cheshire SK8 6QL
Tel 0161 482 0600
Fax 0161 486 9210
e-mail info@wmlconsulting.com
www.wmlconsulting.com

Job No. 8949G
Drawing No. SK-01 -

# APPENDIX 02

## Exploratory Hole Records

| | | | |
|---|---|---|---|
| WML CONSULTING | Project Title: Dob Brook Close | | TP1 |
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Tracked Excavator | Logged By: TPB | Scale: 1:40 |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water |
|---|---|---|---|---|---|---|---|
| 0.10 | E | | | | 0.15 | Dark brown, slightly silty SAND with roots. (MADE GROUND) | |
| 0.40 | E | | | | 1.00 | Brownish grey, slightly clayey, gravelly SAND. Gravel is angular to subangular, fine to coarse, including brick, sandstone, slate and concrete. Medium cobble content. Cobbles are subangular, including brick and concrete. (MADE GROUND) | |
| | | | | | 1.70 | | |
| 1.90 | E | | | | 2.00 | Dark grey, slightly silty, slightly sandy, angular to subangular, fine to coarse GRAVEL including ash and clinker. (MADE GROUND) | ▼ |
| | | | | | 2.50 | | |
| 2.60 | J | | | | 2.70 | Firm, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone. (GLACIAL TILL) | |
| | | | | | 3.00 | End Of Trial Pit At 2.70 m | |

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | TP2 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Tracked Excavator | Logged By: TPB | Scale: 1:40 |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water |
|---|---|---|---|---|---|---|---|
| 0.30 | E | | | | | Dark brown, slightly silty, slightly gravelly SAND with roots. Gravel subangular, fine to coarse, including brick, sandstone and ash. (MADE GROUND) | |
| 0.65 | E | | | | 0.60 | Brownish grey, slightly clayey, sandy, angular to subangular, fine to coarse GRAVEL including brick, sandstone, slate, concrete, ash and wood. Medium cobble content. Cobbles are subangular, including sandstone, brick and concrete. (MADE GROUND) | |
| | | | | | 1.00 | | |
| | | | | | 1.60 | | |
| 1.70 | E | | | | 1.80 | Dark grey, slightly silty, sandy, angular to subangular, fine to coarse GRAVEL including ash and clinker. (MADE GROUND) | |
| 1.90 | J | | | | | | |
| 2.00 | D | | | | 2.00 | Firm, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone. (GLACIAL TILL) | |
| | | | | | | End Of Trial Pit At 2.00 m | |
| | | | | | 3.00 | | |

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | TP3 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Tracked Excavator | Logged By: TPB | Scale: 1:40 |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water |
|---|---|---|---|---|---|---|---|
| 0.20 | E | | | | | Turf over brownish grey, slightly clayey, gravelly SAND. Gravel is angular to subangular, fine to coarse, including brick, sandstone, wood and concrete. Low cobble content. Cobbles are subangular, including brick and concrete. (MADE GROUND) | |
| 1.00 | E | | | | 1.00 | | |
| | | | | | 1.80 | | |
| | | | | | 2.00 | Dark grey, slightly silty, sandy, angular to subangular, fine to coarse GRAVEL including ash, clinker, brick, wood and slate. (MADE GROUND) | |
| | | | | | 2.50 | | |
| 2.60 | J | | | | 2.65 | Firm, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone. (GLACIAL TILL) | |
| | | | | | 3.00 | End Of Trial Pit At 2.65 m | |

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Printed By GeoLogs (www.GeoLogs.com)

| | | | |
|---|---|---|---|
| WML CONSULTING | Project Title: Dob Brook Close | | TP4 |
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Tracked Excavator | Logged By: TPB | Scale: 1:40 |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water |
|---|---|---|---|---|---|---|---|
| 0.30 | E | | | | 1.00 | Turf over brownish grey, slightly clayey, sandy, angular to subangular, fine to coarse GRAVEL including brick, sandstone, slate, concrete, wood, metal and ash. Medium cobble content. Cobbles are subangular, including brick and concrete. (MADE GROUND) | |
| 1.70 | E | | | | 1.60 | Dark grey, slightly silty, slightly sandy, angular to subangular, fine to coarse GRAVEL including ash, clinker and brick. (MADE GROUND) | |
| | | | | | 2.00 | | |
| | | | | | 2.20 | | ▼ |
| | | | | | 2.40 | Firm, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone. (GLACIAL TILL) | |
| | | | | | 3.00 | End Of Trial Pit At 2.40 m | |

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | WS1 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: TPB |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| 0.40 | E | | | | 1.00 | Dark brown, slightly clayey, gravelly SAND with rootlets. Gravel is angular to subangular, fine to coarse, including brick, concrete, ash, clinker and coal. Low cobble content. Cobbles are subangular, including brick. (MADE GROUND) | | |
| | | N=21 | | | 1.20 | | | |
| 1.40 | D | | | | | Brown, slightly gravelly, sandy CLAY. Gravel subangular, fine to coarse, including brick, ash and sandstone. (MADE GROUND) | | |
| | | N=3 | | | 1.90 | | | |
| | | | | | 2.00 | Dark grey, slightly silty, sandy, angular to subangular, fine to coarse GRAVEL including ash and clinker. (MADE GROUND) | | |
| | | | | | 2.30 | Dark brown, slightly clayey, silty SAND with occasional organic flecks (MADE GROUND) | | |
| | | N=15 | | | 3.00 | Stiff, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and siltstone. (GLACIAL TILL) | | |
| | | N=15 | | | 4.00 | | | |
| | | N=32 | | | 5.00 | End Of Borehole At 5.00 m | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| 12/09/2019 | 1 | | | | |
| | | | | | |
| | | | | | |

| Daily Log Of Depths | | | Chiselling | | |
|---|---|---|---|---|---|
| Date | Casing | Water | From | To | Hours |
| | | | | | |
| | | | | | |

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | WS2 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: TPB |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| 0.40 | E | | | | 0.30 | Turf over brown and grey, slightly sandy, subangular, fine to coarse GRAVEL including sandstone and brick. (MADE GROUND) | | |
| | | | | | 0.70 | Brownish grey, slightly clayey, gravelly SAND with occasional organic flecks. Gravel is subangular, fine to coarse, including brick, ash, wood, sandstone, ceramic. (MADE GROUND) | | |
| | | N=5 | | | 1.00 | | | |
| 1.70 | D | | | | 1.70 | Brown, slightly gravelly, sandy CLAY. Gravel is subangular, fine to coarse, including brick and sandstone. (MADE GROUND) | | |
| | | N=10 | | | 2.00 | Firm, becoming stiff, brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and siltstone. (GLACIAL TILL) | | |
| | | N=18 | | | 3.00 | | | |
| | | N=32 | | | 4.00 | | | |
| | | N=26 | | | 4.60 | End Of Borehole At 4.60 m | | |
| | | | | | 5.00 | | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS
No Groundwater Encountered
Sampler refused at 4.60mbgl.

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

| Daily Log Of Depths | | | Chiselling | | |
|---|---|---|---|---|---|
| Date | Casing | Water | From | To | Hours |
| | | | | | |
| | | | | | |

| WML CONSULTING | Project Title: Dob Brook Close | | WS3 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: KE |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.10 | Soft black organic sandy clay with some roots and many rootlets. (MADE GROUND) | | |
| | | | | | 0.50 | Brown fine to coarse sand with medium cobble content. Cobbles are large brick and concrete. (MADE GROUND) | | |
| | | | | | 0.90 | | | |
| | | | | | 1.00 | Dark brown slightly clayey slightly organic gravelly fine to coarse sand. Gravel includes clinker. (MADE GROUND) | | |
| | | N=10 | | | 1.30 | Black sand and gravel of ash and clinker. (MADE GROUND) | | |
| | | N=14 | | | 2.00 | Firm becoming very stiff mid brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone and coal. (GLACIAL TILL) | | |
| | | N=19 | | | 3.00 | | | |
| | | N=47 | | | 4.00 | | | |
| | | | | | 4.10 | End Of Borehole At 4.10 m | | |
| | | | | | 5.00 | | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

REMARKS
No Groundwater Encountered

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Daily Log Of Depths / Chiselling

| Date | Casing | Water | From | To | Hours |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | WS4 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: KE |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.15 | Dark brown clayey organic sand with many roots. (MADE GROUND) | | |
| | | | | | 0.40 | Bricks and flagstones. (MADE GROUND) | | |
| | | | | | 1.00 | Brown clayey sandy gravel with low cobble content. Gravel is sandstone brick and concrete. Cobbles are concrete. (MADE GROUND) | | |
| | | N=8 | | | | | | |
| | | N=7 | | | 1.90 2.00 | Black sand and gravel of ash and clinker. (MADE GROUND) | ▼ | |
| | | | | | 2.30 | Soft grey slightly sandy CLAY with some decayed roots. (GLACIAL TILL) | | |
| | | N=6 | | | 3.00 3.10 | Soft becoming firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone. (GLACIAL TILL) | | |
| | | N=19 | | | 4.00 | | | |
| | | N=16 | | | 5.00 | End Of Borehole At 5.00 m | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

REMARKS

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| 13/09/2019 | 2 | | | | |

Daily Log Of Depths

| Date | Casing | Water |
|---|---|---|
| | | |

Chiselling

| From | To | Hours |
|---|---|---|
| | | |

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | WS5 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: KE |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.15 | Black clayey organic sand with many roots. (MADE GROUND) | | |
| | | | | | | Soft black and brown sandy gravelly clay with low cobble content. Gravel is fine to coarse brick and concrete and clinker. Cobbles are brick. (MADE GROUND) | | |
| | | | | | 1.00 | | | |
| | | N=18 | | | | | | |
| | | | | | 1.90 | | | |
| | | N=6 | | | 2.00 | Black sand and gravel of ash and clinker. (MADE GROUND) | ▼ | |
| | | | | | 2.40 | Soft dark brown organic peaty clay. (MADE GROUND) | | |
| | | | | | 2.90 | | | |
| | | N=5 | | | 3.00 | Black sand and gravel of ash and clinker. (MADE GROUND) | | |
| | | | | | 3.80 | | | |
| | | N=10 | | | 4.00 | Soft becoming firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone. (GLACIAL TILL) | | |
| | | N=23 | | | 5.00 | End Of Borehole At 5.00 m | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| 13/09/2019 | 2.1 | | | | |
| | | | | | |
| | | | | | |

Daily Log Of Depths / Chiselling

| Date | Casing | Water | From | To | Hours |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |

Printed By GeoLogs (www.GeoLogs.com)

| WML CONSULTING | Project Title: Dob Brook Close | | WS6 |
|---|---|---|---|
| | Project Number: 8948G | Client: Guinness Partnership | Sheet 1 Of 1 |
| | GL (mAOD): | N Coord: 0 | E Coord: 0 |
| Date: 11/09/2019 | Method: Window Sample | Driller: LOT Geotechnics | Logged By: KE |

| Depth (m) | Type | Test Result | Level | Legend | Depth (m) | Description | Water | Standpipe |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.15 | Black clayey organic sand with many roots. (MADE GROUND) | | |
| | | | | | | Black clayey sandy fine to coarse gravel with medium cobble content. Gravel is concrete clinker and brick. Cobbles are brick. (MADE GROUND) | | |
| | | N=5 | | | 1.00 | | | |
| | | | | | 1.50 | Soft brown sandy clay. (MADE GROUND) | | |
| | | | | | 1.80 | Black ash and clinker. (MADE GROUND) | | |
| | | N=3 | | | 2.00 | | | |
| | | | | | 2.40 | Soft to firm locally very soft brown mottled grey sandy slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded sandstone and mudstone and quartz. (GLACIAL TILL) | | |
| | | N=12 | | | 3.00 | | | |
| | | N=13 | | | 4.00 | Firm brown slightly sandy slightly gravelly CLAY. (GLACIAL TILL) | | |
| | | N=10 | | | 5.00 | End Of Borehole At 5.00 m | | |
| | | | | | 6.00 | | | |

KEY
D - Disturbed Sample
B - Bulk Sample
U - Undisturbed
W - Water Sample
S - Standard Penetration Test
C - Cone Penetration Test
N - Penetration Test 'N' Value
V - Hand Shear Vane kPa
▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Scale: 1:40

Water Strikes

| Date | Strike | Level | Minutes | Casing | Sealed |
|---|---|---|---|---|---|
| 13/09/2019 | 1.9 | | | | |

Daily Log Of Depths

| Date | Casing | Water |
|---|---|---|
| | | |

Chiselling

| From | To | Hours |
|---|---|---|
| | | |

# APPENDIX 03

# Chemical Analytical Results

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

# Final Report

| | | | |
|---|---|---|---|
| **Report No.:** | 19-30759-1 | | |
| **Initial Date of Issue:** | 19-Sep-2019 | | |
| **Client** | WML Consulting Ltd | | |
| **Client Address:** | No. 8 Oak Green<br>Stanley Green Business Park<br>Earl Rd<br>Cheadle<br>SK8 6QL | | |
| **Contact(s):** | Sam Seddon | | |
| **Project** | 8948G Dob Brook Close | | |
| **Quotation No.:** | | **Date Received:** | 13-Sep-2019 |
| **Order No.:** | 8948G | **Date Instructed:** | 13-Sep-2019 |
| **No. of Samples:** | 15 | | |
| **Turnaround (Wkdays):** | 5 | **Results Due:** | 19-Sep-2019 |
| **Date Approved:** | 19-Sep-2019 | | |
| **Approved By:** | | | |
| **Details:** | Amy Parekh-Pross, Technical Projects Manager | | |

# Results - Leachate

**Project: 8948G Dob Brook Close**

| **Client: WML Consulting Ltd** | | | | | **Chemtest Job No.:** | 19-30759 | 19-30759 | 19-30759 | 19-30759 |
|---|---|---|---|---|---|---|---|---|---|
| Quotation No.: | | | | | **Chemtest Sample ID.:** | 887992 | 887996 | 887999 | 888003 |
| Order No.: 8948G | | | | | Client Sample Ref.: | E | E | E | E |
| | | | | | Client Sample ID.: | 4 | 8 | 11 | 15 |
| | | | | | Sample Location: | TP1 | TP2 | TP3 | TP4 |
| | | | | | Sample Type: | SOIL | SOIL | SOIL | SOIL |
| | | | | | Top Depth (m): | 1.9 | 1.7 | 1 | 1.7 |
| | | | | | Date Sampled ($): | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 |
| **Determinand** | **Accred.** | **SOP** | **Type** | **Units** | **LOD** | | | | |
| pH | U | 1010 | | | N/A | 8.3 | 8.2 | 8.2 | 8.1 |
| Sulphur | N | 1220 | | mg/l | 1.0 | 21 | 10 | 13 | 23 |
| Sulphate | U | 1220 | | mg/l | 1.0 | 62 | 31 | 39 | 68 |
| Hardness | U | 1415 | | mg/l | 15 | 160 | 59 | 78 | 96 |
| Arsenic (Dissolved) | U | 1450 | | µg/l | 1.0 | 4.0 | 5.4 | 3.3 | 4.5 |
| Boron (Dissolved) | U | 1450 | | µg/l | 20 | 130 | 63 | 73 | 86 |
| Cadmium (Dissolved) | U | 1450 | | µg/l | 0.080 | 0.093 | < 0.080 | < 0.080 | 0.13 |
| Copper (Dissolved) | U | 1450 | | µg/l | 1.0 | < 1.0 | 3.3 | 2.0 | 5.3 |
| Mercury (Dissolved) | U | 1450 | | µg/l | 0.50 | < 0.50 | < 0.50 | < 0.50 | < 0.50 |
| Nickel (Dissolved) | U | 1450 | | µg/l | 1.0 | 1.5 | < 1.0 | < 1.0 | < 1.0 |
| Lead (Dissolved) | U | 1450 | | µg/l | 1.0 | 1.6 | 4.7 | < 1.0 | 17 |
| Selenium (Dissolved) | U | 1450 | | µg/l | 1.0 | 1.8 | 3.7 | < 1.0 | 2.7 |
| Vanadium (Dissolved) | U | 1450 | | µg/l | 1.0 | 1.2 | 2.1 | 1.4 | 3.1 |
| Zinc (Dissolved) | U | 1450 | | µg/l | 1.0 | 7.6 | 2.5 | 1.4 | 12 |
| Chromium (Hexavalent) | U | 1490 | | µg/l | 20 | < 20 | < 20 | < 20 | < 20 |
| Naphthalene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Acenaphthylene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Acenaphthene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Fluorene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Phenanthrene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Anthracene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Fluoranthene | U | 1700 | | µg/l | 0.10 | < 0.10 | 4.4 | < 0.10 | < 0.10 |
| Pyrene | U | 1700 | | µg/l | 0.10 | < 0.10 | 4.2 | < 0.10 | < 0.10 |
| Benzo[a]anthracene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Chrysene | N | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Benzo[b]fluoranthene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Benzo[k]fluoranthene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Benzo[a]pyrene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Indeno(1,2,3-c,d)Pyrene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Dibenz(a,h)Anthracene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Benzo[g,h,i]perylene | U | 1700 | | µg/l | 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Total Of 16 PAH's | N | 1700 | | µg/l | 2.0 | < 2.0 | 8.6 | < 2.0 | < 2.0 |
| Total Phenols | U | 1920 | | mg/l | 0.030 | < 0.030 | < 0.030 | < 0.030 | < 0.030 |

Chemtest
The right chemistry to deliver results

# Results - Soil

**Project: 8948G Dob Brook Close**

| **Client: WML Consulting Ltd** | | | | **Chemtest Job No.:** | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quotation No.: | | | | **Chemtest Sample ID.:** | 887989 | 887990 | 887991 | 887993 | 887994 | 887995 | 887997 | 887998 | 888000 |
| Order No.: 8948G | | | | Client Sample Ref.: | E | E | E | J | E | E | J | E | J |
| | | | | Client Sample ID.: | 1 | 2 | 3 | 5 | 6 | 7 | 9 | 10 | 12 |
| | | | | Sample Location: | WS1 | TP1 | TP1 | TP1 | TP2 | TP2 | TP2 | TP3 | TP3 |
| | | | | Sample Type: | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | | Top Depth (m): | 0.4 | 0.1 | 0.4 | 2.6 | 0.3 | 0.65 | 1.9 | 0.2 | 2.6 |
| | | | | Date Sampled ($): | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 |
| | | | | Asbestos Lab: | COVENTRY | COVENTRY | COVENTRY | | COVENTRY | COVENTRY | | COVENTRY | |
| **Determinand** | **Accred.** | **SOP** | **Units** | **LOD** | | | | | | | | | |
| ACM Type | U | 2192 | | N/A | - | - | - | | - | - | | - | |
| Asbestos Identification | U | 2192 | % | 0.001 | No Asbestos Detected | No Asbestos Detected | No Asbestos Detected | | No Asbestos Detected | No Asbestos Detected | | No Asbestos Detected | |
| ACM Detection Stage | U | 2192 | | N/A | - | - | - | | - | - | | - | |
| Moisture | N | 2030 | % | 0.020 | 19 | 27 | 14 | 20 | 17 | 22 | 18 | 18 | 20 |
| pH | U | 2010 | | N/A | 8.1 | 7.4 | 8.2 | 7.2 | 8.0 | 8.2 | 7.4 | 8.2 | 7.4 |
| Boron (Hot Water Soluble) | U | 2120 | mg/kg | 0.40 | 0.77 | < 0.40 | 0.42 | | 0.50 | < 0.40 | | < 0.40 | |
| Sulphate (2:1 Water Soluble) as SO4 | U | 2120 | g/l | 0.010 | 0.063 | < 0.010 | < 0.010 | 0.031 | < 0.010 | 0.025 | 0.058 | < 0.010 | 0.010 |
| Total Sulphur | U | 2175 | % | 0.010 | 0.092 | 0.086 | 0.070 | 0.050 | 0.094 | 0.11 | 0.031 | 0.041 | 0.035 |
| Cyanide (Total) | U | 2300 | mg/kg | 0.50 | < 0.50 | < 0.50 | < 0.50 | | < 0.50 | < 0.50 | | < 0.50 | |
| Sulphate (Total) | U | 2430 | mg/kg | 100 | 1400 | 1200 | 800 | | 1200 | 2300 | | 620 | |
| Arsenic | U | 2450 | mg/kg | 1.0 | 27 | 18 | 16 | | 18 | 12 | | 15 | |
| Cadmium | U | 2450 | mg/kg | 0.10 | 0.50 | 0.34 | 0.31 | | 0.32 | 0.32 | | 0.45 | |
| Copper | U | 2450 | mg/kg | 0.50 | 80 | 34 | 55 | | 42 | 45 | | 36 | |
| Mercury | U | 2450 | mg/kg | 0.10 | 0.77 | 0.35 | 2.1 | | 0.24 | 0.97 | | 0.25 | |
| Nickel | U | 2450 | mg/kg | 0.50 | 34 | 18 | 31 | | 19 | 24 | | 27 | |
| Lead | U | 2450 | mg/kg | 0.50 | 180 | 91 | 270 | | 93 | 150 | | 140 | |
| Selenium | U | 2450 | mg/kg | 0.20 | 0.48 | 0.60 | 0.32 | | 0.66 | 0.50 | | 0.31 | |
| Vanadium | U | 2450 | mg/kg | 5.0 | 38 | 29 | 38 | | 28 | 28 | | 34 | |
| Zinc | U | 2450 | mg/kg | 0.50 | 170 | 78 | 120 | | 64 | 92 | | 66 | |
| Chromium (Hexavalent) | N | 2490 | mg/kg | 0.50 | < 0.50 | < 0.50 | < 0.50 | | < 0.50 | < 0.50 | | < 0.50 | |
| Organic Matter | U | 2625 | % | 0.40 | 5.5 | 13 | 5.3 | | 7.6 | 2.5 | | 3.3 | |
| Naphthalene | U | 2700 | mg/kg | 0.10 | 0.59 | < 0.10 | 1.1 | | 0.97 | 4.9 | | 0.84 | |
| Acenaphthylene | U | 2700 | mg/kg | 0.10 | < 0.10 | < 0.10 | 0.38 | | 0.19 | 0.63 | | 0.13 | |
| Acenaphthene | U | 2700 | mg/kg | 0.10 | < 0.10 | < 0.10 | 2.0 | | 0.50 | 5.1 | | 0.98 | |
| Fluorene | U | 2700 | mg/kg | 0.10 | 0.37 | < 0.10 | 1.9 | | 0.61 | 5.0 | | 0.70 | |
| Phenanthrene | U | 2700 | mg/kg | 0.10 | 2.6 | < 0.10 | 13 | | 4.7 | 29 | | 3.6 | |
| Anthracene | U | 2700 | mg/kg | 0.10 | 0.66 | < 0.10 | 3.6 | | 1.2 | 9.3 | | 1.4 | |
| Fluoranthene | U | 2700 | mg/kg | 0.10 | 4.1 | 1.1 | 14 | | 6.9 | 31 | | 6.5 | |
| Pyrene | U | 2700 | mg/kg | 0.10 | 4.6 | 1.2 | 15 | | 7.6 | 32 | | 6.6 | |
| Benzo[a]anthracene | U | 2700 | mg/kg | 0.10 | 3.3 | 2.3 | 6.3 | | 4.9 | 15 | | 2.9 | |
| Chrysene | U | 2700 | mg/kg | 0.10 | 3.3 | 1.7 | 5.8 | | 3.8 | 13 | | 2.6 | |
| Benzo[b]fluoranthene | U | 2700 | mg/kg | 0.10 | 2.4 | < 0.10 | 5.3 | | 4.2 | 12 | | 3.3 | |
| Benzo[k]fluoranthene | U | 2700 | mg/kg | 0.10 | 1.4 | < 0.10 | 2.9 | | 2.2 | 6.1 | | 1.5 | |
| Benzo[a]pyrene | U | 2700 | mg/kg | 0.10 | 2.3 | < 0.10 | 5.6 | | 4.2 | 13 | | 2.6 | |
| Indeno(1,2,3-c,d)Pyrene | U | 2700 | mg/kg | 0.10 | 1.4 | < 0.10 | 3.3 | | 2.6 | 7.3 | | 1.5 | |
| Dibenz(a,h)Anthracene | U | 2700 | mg/kg | 0.10 | 0.64 | < 0.10 | 1.1 | | 0.89 | 2.3 | | 0.72 | |

# Results - Soil

**Project: 8948G Dob Brook Close**

| **Client: WML Consulting Ltd** | | | | **Chemtest Job No.:** | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 | 19-30759 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quotation No.: | | | | **Chemtest Sample ID.:** | 887989 | 887990 | 887991 | 887993 | 887994 | 887995 | 887997 | 887998 | 888000 |
| Order No.: 8948G | | | | Client Sample Ref.: | E | E | E | J | E | E | J | E | J |
| | | | | Client Sample ID.: | 1 | 2 | 3 | 5 | 6 | 7 | 9 | 10 | 12 |
| | | | | Sample Location: | WS1 | TP1 | TP1 | TP1 | TP2 | TP2 | TP2 | TP3 | TP3 |
| | | | | Sample Type: | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL | SOIL |
| | | | | Top Depth (m): | 0.4 | 0.1 | 0.4 | 2.6 | 0.3 | 0.65 | 1.9 | 0.2 | 2.6 |
| | | | | Date Sampled ($): | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 | 11-Sep-2019 |
| | | | | Asbestos Lab: | COVENTRY | COVENTRY | COVENTRY | | COVENTRY | COVENTRY | | COVENTRY | |
| **Determinand** | **Accred.** | **SOP** | **Units** | **LOD** | | | | | | | | | |
| Benzo[g,h,i]perylene | U | 2700 | mg/kg | 0.10 | 1.4 | < 0.10 | 3.0 | | 3.3 | 6.5 | | 1.6 | |
| Total Of 16 PAH's | U | 2700 | mg/kg | 2.0 | 29 | 6.3 | 84 | | 49 | 190 | | 38 | |
| Total Phenols | U | 2920 | mg/kg | 0.30 | < 0.30 | < 0.30 | < 0.30 | | < 0.30 | < 0.30 | | < 0.30 | |

Chemtest
The right chemistry to deliver results

# Results - Soil

**Project: 8948G Dob Brook Close**

| **Client: WML Consulting Ltd** | | | **Chemtest Job No.:** | | 19-30759 | 19-30759 |
|---|---|---|---|---|---|---|
| Quotation No.: | | | **Chemtest Sample ID.:** | | 888001 | 888002 |
| Order No.: 8948G | | | Client Sample Ref.: | | E | E |
| | | | Client Sample ID.: | | 13 | 14 |
| | | | Sample Location: | | WS2 | TP4 |
| | | | Sample Type: | | SOIL | SOIL |
| | | | Top Depth (m): | | 0.4 | 0.3 |
| | | | Date Sampled ($): | | 11-Sep-2019 | 11-Sep-2019 |
| | | | Asbestos Lab: | | COVENTRY | COVENTRY |
| **Determinand** | **Accred.** | **SOP** | **Units** | **LOD** | | |
| ACM Type | U | 2192 | | N/A | - | - |
| Asbestos Identification | U | 2192 | % | 0.001 | No Asbestos Detected | No Asbestos Detected |
| ACM Detection Stage | U | 2192 | | N/A | - | - |
| Moisture | N | 2030 | % | 0.020 | 16 | 16 |
| pH | U | 2010 | | N/A | 8.2 | 8.2 |
| Boron (Hot Water Soluble) | U | 2120 | mg/kg | 0.40 | 1.5 | 1.9 |
| Sulphate (2:1 Water Soluble) as SO4 | U | 2120 | g/l | 0.010 | 0.12 | 0.015 |
| Total Sulphur | U | 2175 | % | 0.010 | 0.11 | 0.064 |
| Cyanide (Total) | U | 2300 | mg/kg | 0.50 | < 0.50 | < 0.50 |
| Sulphate (Total) | U | 2430 | mg/kg | 100 | 3700 | 680 |
| Arsenic | U | 2450 | mg/kg | 1.0 | 13 | 24 |
| Cadmium | U | 2450 | mg/kg | 0.10 | 0.32 | 0.38 |
| Copper | U | 2450 | mg/kg | 0.50 | 30 | 51 |
| Mercury | U | 2450 | mg/kg | 0.10 | < 0.10 | 0.40 |
| Nickel | U | 2450 | mg/kg | 0.50 | 39 | 25 |
| Lead | U | 2450 | mg/kg | 0.50 | 51 | 150 |
| Selenium | U | 2450 | mg/kg | 0.20 | 0.22 | < 0.20 |
| Vanadium | U | 2450 | mg/kg | 5.0 | 35 | 31 |
| Zinc | U | 2450 | mg/kg | 0.50 | 72 | 110 |
| Chromium (Hexavalent) | N | 2490 | mg/kg | 0.50 | < 0.50 | < 0.50 |
| Organic Matter | U | 2625 | % | 0.40 | 1.7 | 6.2 |
| Naphthalene | U | 2700 | mg/kg | 0.10 | 0.67 | 0.93 |
| Acenaphthylene | U | 2700 | mg/kg | 0.10 | < 0.10 | 0.45 |
| Acenaphthene | U | 2700 | mg/kg | 0.10 | 0.19 | 1.7 |
| Fluorene | U | 2700 | mg/kg | 0.10 | 0.14 | 1.9 |
| Phenanthrene | U | 2700 | mg/kg | 0.10 | 0.68 | 15 |
| Anthracene | U | 2700 | mg/kg | 0.10 | 0.16 | 4.1 |
| Fluoranthene | U | 2700 | mg/kg | 0.10 | 0.99 | 18 |
| Pyrene | U | 2700 | mg/kg | 0.10 | 1.1 | 18 |
| Benzo[a]anthracene | U | 2700 | mg/kg | 0.10 | 0.30 | 7.7 |
| Chrysene | U | 2700 | mg/kg | 0.10 | 0.36 | 6.9 |
| Benzo[b]fluoranthene | U | 2700 | mg/kg | 0.10 | 0.43 | 6.2 |
| Benzo[k]fluoranthene | U | 2700 | mg/kg | 0.10 | 0.30 | 3.4 |
| Benzo[a]pyrene | U | 2700 | mg/kg | 0.10 | 0.53 | 6.6 |
| Indeno(1,2,3-c,d)Pyrene | U | 2700 | mg/kg | 0.10 | < 0.10 | 3.9 |
| Dibenz(a,h)Anthracene | U | 2700 | mg/kg | 0.10 | < 0.10 | 1.2 |

# Results - Soil

**Project: 8948G Dob Brook Close**

| **Client: WML Consulting Ltd** | | | **Chemtest Job No.:** | | 19-30759 | 19-30759 |
|---|---|---|---|---|---|---|
| Quotation No.: | | | **Chemtest Sample ID.:** | | 888001 | 888002 |
| Order No.: 8948G | | | Client Sample Ref.: | | E | E |
| | | | Client Sample ID.: | | 13 | 14 |
| | | | Sample Location: | | WS2 | TP4 |
| | | | Sample Type: | | SOIL | SOIL |
| | | | Top Depth (m): | | 0.4 | 0.3 |
| | | | Date Sampled ($): | | 11-Sep-2019 | 11-Sep-2019 |
| | | | Asbestos Lab: | | COVENTRY | COVENTRY |
| **Determinand** | **Accred.** | **SOP** | **Units** | **LOD** | | |
| Benzo[g,h,i]perylene | U | 2700 | mg/kg | 0.10 | < 0.10 | 3.7 |
| Total Of 16 PAH's | U | 2700 | mg/kg | 2.0 | 5.9 | 100 |
| Total Phenols | U | 2920 | mg/kg | 0.30 | < 0.30 | < 0.30 |

Chemtest
The right chemistry to deliver results

# Test Methods

| SOP | Title | Parameters included | Method summary |
|---|---|---|---|
| 1010 | pH Value of Waters | pH | pH Meter |
| 1220 | Anions, Alkalinity & Ammonium in Waters | Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium | Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser. |
| 1415 | Cations in Waters by ICP-MS | Sodium; Potassium; Calcium; Magnesium | Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS). |
| 1450 | Metals in Waters by ICP-MS | Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc | Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS). |
| 1490 | Hexavalent Chromium in Waters | Chromium [VI] | Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide. |
| 1700 | Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID | Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene | Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds) |
| 1920 | Phenols in Waters by HPLC | Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded. | Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection. |
| 2010 | pH Value of Soils | pH | pH Meter |
| 2030 | Moisture and Stone Content of Soils(Requirement of MCERTS) | Moisture content | Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C. |
| 2120 | Water Soluble Boron, Sulphate, Magnesium & Chromium | Boron; Sulphate; Magnesium; Chromium | Aqueous extraction / ICP-OES |
| 2175 | Total Sulphur in Soils | Total Sulphur | Determined by high temperature combustion under oxygen, using an Eltra elemental analyser. |
| 2192 | Asbestos | Asbestos | Polarised light microscopy / Gravimetry |
| 2300 | Cyanides & Thiocyanate in Soils | Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate | Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser. |
| 2430 | Total Sulphate in soils | Total Sulphate | Acid digestion followed by determination of sulphate in extract by ICP-OES. |
| 2450 | Acid Soluble Metals in Soils | Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc | Acid digestion followed by determination of metals in extract by ICP-MS. |
| 2490 | Hexavalent Chromium in Soils | Chromium [VI] | Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide. |
| 2625 | Total Organic Carbon in Soils | Total organic Carbon (TOC) | Determined by high temperature combustion under oxygen, using an Eltra elemental analyser. |
| 2700 | Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID | Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene | Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds) |

# Test Methods

| SOP | Title | Parameters included | Method summary |
|---|---|---|---|
| 2920 | Phenols in Soils by HPLC | Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded. | 60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection. |

Chemtest
The right chemistry to deliver results

## Report Information

### Key

| | |
|---|---|
| U | UKAS accredited |
| M | MCERTS and UKAS accredited |
| N | Unaccredited |
| S | This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis |
| SN | This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis |
| T | This analysis has been subcontracted to an unaccredited laboratory |
| I/S | Insufficient Sample |
| U/S | Unsuitable Sample |
| N/E | not evaluated |
| < | "less than" |
| > | "greater than" |
| $ | This information has been supplied by the client and can affect the integrity of test data. |

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

### Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

### Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

# APPENDIX 04

## Gas Monitoring Results

## GAS MONITORING METHODOLOGY

1. The following are recorded upon arrival or at each location as the monitoring progresses:-

   - Operator name;
   - Instrumentation name i.e. Gas Data - GFM436;
   - Atmospheric pressure;
   - Time of commencement of the monitoring visit;
   - Ground conditions e.g. wet, dry waterlogged etc.;
   - General weather conditions, as the prevailing conditions may affect the results; and
   - Condition of the monitoring point e.g. damaged, covered etc.

2. The background oxygen concentration in the vicinity of the monitoring point is recorded to ensure that the instrument is zeroed.

3. Where appropriate, both the flow and pressure differential are recorded at each monitoring point prior to obtaining the gas concentrations.

4. Concentrations of light hydrocarbon gas, comprising methane (%v/v), carbon dioxide (%v/v), oxygen (%v/v), hydrogen sulphide (ppm), carbon monoxide (ppm) and hexane % are monitored continuously over a 90 seconds period. The highest concentrations of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest concentration of oxygen are then recorded.

5. If/where concentrations stabilise after 90 seconds, the steady-state concentrations are recorded. If concentrations are still varying, monitoring is continued until steady-state conditions are attained and concentrations then recorded. The accuracy for light hydrocarbon gases is :-

   - Methane - +/-0.2% at 5%.
   - Carbon dioxide - +/-0.1% at 10%.

6. Depth to water level and base of installation are recorded as the movement of groundwater can affect gas migration and migration pathways to monitoring points.

7. The above steps are to be repeated at each monitoring point.

8. The following are then recorded upon completion of the monitoring process:-

   - Atmospheric pressure;
   - Time of completion of the monitoring visit.

### Key For Gas Monitoring Records

| | |
|---|---|
| BH/WS | - Readings taken from gas valve within borehole or window sample probehole. |
| Flow | - Gas flow measured in litres per hour |
| <0.1 | - Where flows are less than 0.1l/hr are recorded |
| $Co_2$ | - Carbon Dioxide |
| $O_2$ | - Oxygen |
| $H_2S$ | - Hydrogen Sulphide |
| CO | - Carbon Monoxide |
| PD | - Pressure differential measured in millibars |
| % | - Percentage |
| ppm | - Parts Per Million |
| l/hr | - Litres per hour |
| $CH_4$ | - Methane |
| mbgl | - Metres below ground level |
| GSV | - Gas Screening Value |

| TEST DATE AND CONDITIONS | | |
|---|---|---|
| Date | 14/08/19 | |
| Atmospheric Pressure | 993 | mB |
| Ambient Temperature | 21.9 | °C |
| Environics Serial No. | 5089 | |


**GAS DATA LTD**
Unit 4, Fairfield Court
Seven Stars Estate
Wheler Rd
Coventry
CV3 4LJ
Tel 02476303311 Fax 02476307711


***GFM436 Final Inspection & Calibration Check Certificate***

| | |
|---|---|
| Customer | WML Consulting Ltd |
| Certificate Number | 121220 |
| Order Number | 323564 |

| | |
|---|---|
| Serial Number | 12969 |
| Software Version | G436-00.0027/0010 |

| Recalibration DUE Date |
|---|
| 14/08/20 |

| Instrument Checks | | | | | |
|---|---|---|---|---|---|
| Keyboard | ✓ | | Display Contrast | ✓ | |
| Pump Flow In | 500 | *Accept > 200 cc/min* | Pump Flow @ -200mB | 300 | *Accept > 200 cc/min* |
| Clock Set / Running | ✓ | | Labels Fitted | ✓ | |

| Gas Checks | | | | | | |
|---|---|---|---|---|---|---|
| | $CH_4$ | | $CO_2$ | | $O_2$ | |
| | Instrument Gas Readings % | True Gas Value % | Instrument Gas Readings % | True Gas Value % | Instrument Gas Readings % | True Gas Value % |
| Sensor | 60 | 60 | 40 | 40 | 20.9 | 20.9 |
| | *Accept ±3.0* | | *Accept ±3.0* | | *Accept ±0.5* | |
| | 5 | 5 | 5 | 5 | 6 | 6 |
| | *Accept ±0.3* | | *Accept ±0.3* | | *Accept ±0.3* | |
| Zero Reading 100% N2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | *Accept ±0.0* | | *Accept ±0.0* | | *Accept ±0.1* | |

| Optional Gas Checks | | | | | | |
|---|---|---|---|---|---|---|
| Applied Gas & Range | | Concentration Tested @ (ppm) | Instrument Readings *(ppm)* | | | |
| Gas Type | Range *(ppm)* | | Zero Reading | | Instrument Gas Reading | |
| H2S | 5000 | *1500* | 0 | *Accept ±0.0* | 1500 | *Accept ±5.0* |
| CO | 2000 | *1000* | 0 | *Accept ±0.0* | 1000 | *Accept ±5.0* |
| Hexane | *2.0%* | 2.0% | 0 | *Accept ±0.0* | 1.99 | *Accept ±10.0* |

| Cross Gas Effects | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Applied Gas *(ppm)* | | Instrument Readings *(ppm)* | | | | | | | |
| Gas Type | Concentration | Toxic 1: | H2S | Toxic 2: | CO | Toxic 3: | HEX | | |
| H2S | *1500* | 1500 | | 0 | | 0 | | | |
| CO | *1000* | 40 | | 1000 | | 0 | | | |
| Hexane | *2.0%* | 0 | | 0 | | 1.99 | | | |

| Pressure Checks | | | |
|---|---|---|---|
| Atmospheric Pressure [AP] *(mB)* | | | |
| Current Atmospheric Pressure (mB) | | Instrument Atmospheric Pressure Reading (mB) | |
| *AP Open Ports* | | 993 | *Accept ±2.0* |
| AP Port (Internal) | *+800 mB* | 800 | *Accept ±5.0* |
| | *+1200mb* | 1200 | *Accept ±5.0* |

| Flow Checks | | | | | |
|---|---|---|---|---|---|
| Borehole Flow | | | Differential Pressure | | |
| Applied Reading *(l/h)* | Instrument Reading *(l/h)* | | Applied Pressure *(Pa)* | Instrument Reading *(Pa)* | |
| *-30* | -30.3 | *Accept ±3.0* | -556 | -570 | *Accept ±50* |
| *-3* | -3 | *Accept ±1.0* | -23 | -22 | *Accept ±6.0* |
| *0* | 0 | *Accept ±0.0* | 0 | 0 | *Accept ±0.5* |
| *3* | 3 | *Accept ±0.5* | 17 | 17 | *Accept ±3.0* |
| *30* | 30 | *Accept ±3.0* | 385 | 384 | *Accept ±50* |
| *60* | 60 | *Accept ±6.0* | 1192 | 1193 | *Accept ±130* |
| *90* | 90.4 | *Accept ±9.0* | 2362 | >>>>> | *Accept ±250* |

| Temperature Checks | | |
|---|---|---|
| Calibration Temperature | Instrument Temperature Reading °C | |
| Applied Temperature °C | | |
| *-10* | -10 | *Accept ±2.0* |
| *0* | 0 | *Accept ±1.0* |
| *30* | 30 | *Accept ±1.0* |
| *60* | 60 | *Accept ±1.0* |
| *100* | 100 | *Accept ±1.0* |

| Technician: | Date Tested: |
|---|---|
| *Jack Rutland* | *15/08/19* |

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2015. Certificate NQA 8374. Valid until 21/03/2022

# APPENDIX 05

## Site Specific Acceptance Criteria

The GAC's for the assessment of potential groundwater contamination have been derived from very conservative guidelines protective of drinking water and environmental quality, namely:

- UK Drinking Water Standards (DWS) as defined by The Water Supply (Water Quality) Regulations, 2016;
- UK Environmental Quality Standards (EQS) for Freshwater, based on a Hardness of 0-100mg/l (soft), 2000;
- Petroleum Products in Drinking-water, Background document for development of WHO Guidelines for Drinking-water Quality, 2011.

**Table 1: Inorganic Tier 1 Water Environment Screening Criteria**

| Contaminant | Units | Hardness Banding (CaCO3 mg/l) | EQS /WFD (Freshwater) | UK DWS |
|---|---|---|---|---|
| Arsenic | µg/l | - | 50 | 10 |
| Ammonia | mg/l | - | 0.2 | 0.5 |
| Boron | µg/l | - | 2000 | 1000 |
| Cadmium | µg/l | - | 5 | 5 |
| Chromium | µg/l | 0-50 | 2 | 50 |
| | | 50-100 | 10 | |
| | | 100-150 | 10 | |
| | | 150-200 | 20 | |
| | | 200-250 | 20 | |
| Copper | µg/l | 0-10 | 0.5 | 2000 |
| | | 10-50 | 0.5 | |
| | | 50-200 | 3 | |
| | | 200-250 | 8 | |
| | | >250 | 12 | |
| Cyanide (Free) | µg/l | - | 1 | - |
| Cyanide | | - | - | 50 |
| Iron | µg/l | - | 1000 | 200 |
| Lead | µg/l | 0-50 | 4 | 10 |
| | | 50-150 | 10 | |
| | | 150-250 | 20 | |
| | | >250 | 20 | |
| Mercury | µg/l | - | 1 | 1 |
| Nickel | µg/l | 0-50 | 8 | 20 |
| | | 50-100 | 20 | |
| | | 100-150 | 20 | |
| | | 150-250 | 40 | |
| | | >250 | 40 | |
| Selenium | µg/l | - | - | 10 |
| Sulphate (SO4) | mg/l | - | 400 | 250 |
| Zinc | µg/l | 0-50 | 8 | 5000 |
| | | 50-150 | 15 | |
| | | 150-250 | 50 | |
| | | >250 | 50 | |
| pH | - | - | 6-9 | - |

**Table 2: Organic Tier 1 Water Environment Screening Criteria**

| Contaminant | Units | UK DWS | WHO |
|---|---|---|---|
| PAHs - The sum of<br>• Benzo(b)fluoranthene,<br>• Benzo(ghi)perylene,<br>• Benzo(k)fluoranthene,<br>• indeno(1,2,3-c,d)pyrene) | µg/l | 0.1 | - |
| Phenol (total) | µg/l | 0.5 | - |
| MTBE | µg/l | - | 15 |
| Aliphatic C5-C6 | µg/l | - | 15,000 |
| Aliphatic C6-C8 | µg/l | - | 15,000 |
| Aliphatic C8-C10 | µg/l | - | 300 |
| Aliphatic C10-C12 | µg/l | - | 300 |
| Aliphatic C12-C16 | µg/l | - | 300 |
| Aliphatic C16-21 | µg/l | - | (300) * |
| Aliphatic C21-35 | µg/l | - | (300)* |
| Aromatic C6-C7 | µg/l | 1 (benzene) | 10 (benzene) |
| Aromatic C7-C8 | µg/l | - | 700 (toluene) |
| Aromatic C8-C10 | µg/l | - | 300 (ethylbenzene) |
| Aromatic C10-12 | µg/l | - | 100 |
| Aromatic C12-C16 | µg/l | - | 100 |
| Aromatic C16-C21 | µg/l | - | 90 |
| Aromatic C21-C35 | µg/l | - | 90 |

## Site Specific Assessment Criteria for Residential (with homegrown produce) assuming a 2.5% SOM for Hydrocarbons

| Contaminant | Assessment Criteria for Residential (mg/kg) |
|---|---|
| **Metals** | |
| Arsenic | 37 |
| Boron | 290 |
| Cadmium | 26 |
| Chromium III | 910 |
| Chromium VI | 6 |
| Copper | 2,400 |
| Lead* | 200 |
| Mercury | 1.2 |
| Nickel | 130 |
| Selenium | 250 |
| Vanadium | 410 |
| Zinc | 3,700 |
| **Non – Metals** | |
| Phenol | 200 |
| **Polyaromatic Hydrocarbons (PAH)** | |
| Benz[a]anthracene | 11 |
| Benzo[a]pyrene | 2.7 |
| Benzo[b]fluoranthene | 3.3 |
| Benzo[ghi]perylene | 340 |
| Benzo[k]fluoranthene | 93 |
| Chrysene | 22 |
| Dibenz[ah]anthracene | 0.28 |
| Fluoranthene | 560 |
| Indeno[123-cd]pyrene | 26 |
| Naphthalene | 5.6 |
| Pyrene | 1,200 |

**Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3240. All rights reserved.**

* Where not included in the S4UL's criteria for a limited number of contaminants, namely lead, have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.

| Contaminant | Criteria for Residential End Use (mg/kg) |
|---|---|
| **Volatile Organic Compounds (VOCs)** | |
| Benzene | 0.17 |
| Ethylbenzene | 110 |
| Toluene | 290 |
| Xylene | 130 |
| 1,2-Dichloroethane | 0.011 |
| 1,1,1-Trichloroethane | 18 |
| Tetrachloroethane | 3.4 |
| Tetrachloroethene (PCE) | 0.39 |
| Tetrachloromethane | 0.056 |
| Trichloroethene (TCE) | 0.034 |
| Trichloromethane | 1.7 |
| Vinyl Chloride | 0.00087 |
| **Semi-Volatile Organic Compounds (SVOCs)** | |
| 1,2-Dichlorobenzene | 55 |
| 1,4-Dichlorobenzene | 150[f] |
| 1,2,4-Trichlorobenzene | 6.4 |
| Hexachlorobenzene | 3.3 (0.5)[vap] |
| **Total Petroleum Hydrocarbons (TPH)** | |
| Aliphatic C5-6 | 78 |
| Aliphatic C6-8 | 230 |
| Aliphatic C8-10 | 65 |
| Aliphatic C10-12 | 330(118)[vap] |
| Aliphatic C12-16 | 2,400(59)[sol] |
| Aliphatic C16-35 | 92,000(21)[f, sol] |
| Aliphatic C35 - 44 | 92,000(21)[f,sol] |
| Aromatic C5 – 7 (benzene) | 140 |
| Aromatic C7 – 8 (toluene) | 290 |
| Aromatic C8-10 | 83 |
| Aromatic C10-12 | 180 |
| Aromatic C12-16 | 330 |
| Aromatic C16-21 | 540[f] |
| Aromatic C21-35 | 1,500[f] |
| Aromatic C35 - 44 | 1,500[f] |

**Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3240. All rights reserved.**

* Where not included in the S4UL's criteria for a limited number of contaminants, namely lead, have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.