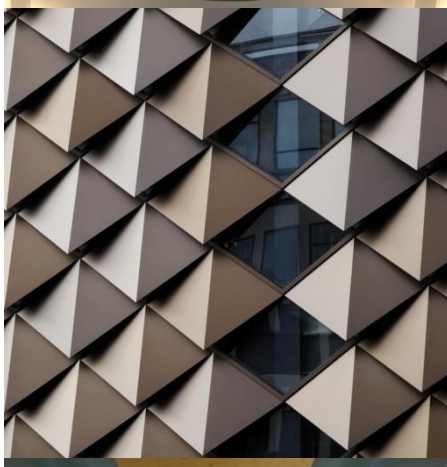
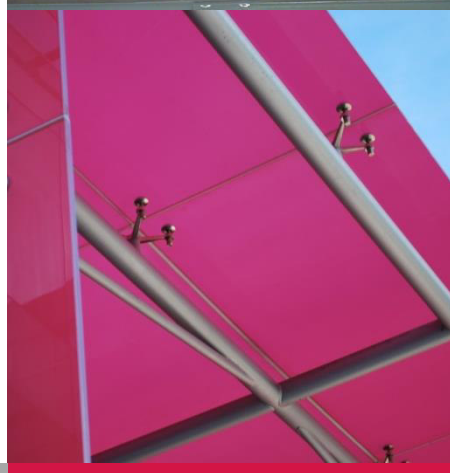








Gorton Lane, Manchester

Phase 2 Site Investigation

Curtins Ref: 068244-CUR-00-XX-RP-GE-001

Revision: V03

Issue Date: 09 September 2021

Client Name: One Manchester

Client Address: Quattro House, Redgate Lane, Longsight, Manchester, M12 4RZ

Site Address: Gorton Lane Sites, Manchester, M12 5WF

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

CIVILS & STRUCTURES • TRANSPORT PLANNING • ENVIRONMENTAL • INFRASTRUCTURE • GEOTECHNICAL • CONSERVATION & HERITAGE • PRINCIPAL DESIGNER
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • **Manchester** • Nottingham

Rev	Description	Issued by	Checked	Date
V02	Figure 2.1 and development plans enclosed updated	NF	JJ	24/04/2019
V03	Update report for Site 1 only	SH	RA	09/09/2021

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
J Bailey BSc (Hons) MSc Geo-Environmental Engineer		19 September 2018

Reviewed	Signature	Date
S Hyde BSc (Hons) MSc Senior Geo-Environmental Engineer		09 September 2021
Sam Nevitt BSc (Hons), MSc, DIC, CGeol, FGS Principal Geotechnical Engineer		19 September 2018

Authorised	Signature	Date
R Allen BSc (Hons) MSc FGS MCIWEM C.WEM CEng Principal Engineer		09 September 2021

Executive Summary

Appointment	In June 2018 Curtins were instructed by One Manchester to undertake a Phase 2 Intrusive Investigation for Site 1 and Site 2 at the Gorton Lane site in West Gorton, Manchester (approximately centred on NGR 387230, 397040). In August 2021, the report herein was updated for just one area of the development, the area north of Gorton Lane (previously known as Site 1). Development proposals comprise 12no semi-detached residential properties with private gardens and an area of soft landscaping.
Current Site Status	The site is located to the north of Wenlock Way/Gorton Lane and at the time of the investigation was vacant urban green space with a mix of low-lying shrubs, evidence of fly tipping and deciduous and evergreen trees. The site is in a predominantly residential area, bounded to the north by commercial properties, to the east by Gorton Lane followed by residential properties, to the south by Wenlock Way and a vacant area and to the west by Pottery Lane followed by residential properties.
Summary of Phase 1	Earliest records (1848) depict the site as predominantly agricultural fields with a road along the north-eastern boundary. From the late 19th Century, terraced properties occupied the site, with multiple industries such as an engineering, iron, starch and pottery works surrounding within 100m. By the mid-20th Century, buildings were demolished in the southeast which is potentially due to bombing during WWII. In the 1970s there was large scale redevelopment involving the removal of terraced properties, with the site becoming part of the neighbouring Openshaw Technical College to the west. During the late 20th Century, Pottery Lane was constructed to the west, with the site layout resembling the present day. The site is indicated to be underlain Made Ground overlying Glacial Till, further underlain by sandstone of the Halesowen Formation in the southwest and Etruria Formation in the east and north of the site. The superficial deposits are classified as an Unproductive Aquifer whilst the bedrock is classified as a Secondary A Aquifer. The nearest surface water feature is the Corn Brook located 38m from the north of site flowing in a westerly (GQA grade C). There are no water abstractions points are located within 500m. The site is classified as Low risk form Unexploded Ordnance (UXO). Primary potential risks to be investigated during the Phase 2, as well as establishing ground conditions for geotechnical design, included; potential for ground gas and risks to human health and controlled waters.
Fieldworks Undertaken	Fieldworks were carried out between 4th and 7th July 2018, comprising one cable percussive borehole, three window sample boreholes and five machine excavated trial pits. Ground gas and groundwater monitoring standpipes/piezometers were installed in all window sample boreholes and the cable percussive borehole. Selected groundwater and soil samples were subjected to laboratory analysis and six return ground gas monitoring visits have been undertaken.
Encountered Ground Conditions	Made Ground was encountered at all locations from ground level to depths of 0.40-1.3m bgl, with the base of the Made Ground not encountered in TP01 which was terminated at 2.0m bgl. Beneath a surface covering of grass, Made Ground generally comprised varying thicknesses of variable deposits comprising dark greyish-brown, sandy, silty Clay and reddish-brown to black, fine to coarse Sand and angular to sub-rounded, fine to coarse Gravel with cobbles of brick and concrete. Anthropogenic constituents include brick, coal, concrete, clay pipe, slate, clinker, glass, ceramic, sandstone, wood, cloth, asphalt, ash, plastic, metal, aggregate, tile and cables. The Made Ground was underlain by Glacial Till superficial deposits comprising cohesive soils of firm to stiff, brown with grey mottling to dark reddish-brown, gravelly, sandy Clay with rare cobbles. The base of the Glacial Till clay was not encountered upon termination of CP1 at 10.0m bgl (44,60m AOD). No groundwater strikes were recorded during the ground investigation and monitored levels during return visits were 7.58-9.30m bgl in CP1 and 2.72-3.64m bgl in WS3.
Environmental Laboratory Testing and Ground Gas Monitoring Results	With respect to the proposed end-use of the site, several exceedances were noted (when compared against *Residential with home grown produce* GAC thresholds) regarding heavy metals, TPHs and PAHs (including Naphthalene). Asbestos fibres within soils were identified during laboratory testing. A limited number of relatively minor exceedances are identified in selected groundwater samples of adopted Tier 1 thresholds (WFD EQS, EU DWS and WHO guidelines) for metals, PAHs and TPHs. During ground gas monitoring, a maximum carbon dioxide (CO_2) concentration is identified at 2.9% v/v and a maximum flow of -0.3l/hr was recorded across Site 1. Concentrations of methane (CH_4) were recorded below the instruments limit of detection. Maximum concentrations of carbon monoxide (CO) and hydrogen sulphide (H_2S) were recorded at 6ppm and 3ppm, respectively. For carbon dioxide, the adopted Gas Screening Value (GSV) for houses is 0.0029l/hr. Elevated concentrations of Toluene, Xylene, C11-C20 and C21-C40 mineral oils with respect to the protection of water supply pipes were identified within the Made Ground. Therefore, it is recommended that appropriate materials for water supply pipes would comprise Barrier Pipes (PE/AL/PE). The exact requirements are to be confirmed with the relevant utility supplier.
Ground Contamination	A **Moderate** risk rating is identified to end-users from direct contact, inhalation and ingestion of contaminants within Made Ground soils. Due to heavy metal, TPH and PAH exceedances and asbestos found within the soils underlying the soft landscaping area, an engineered capping layer and geotextile membrane will be required to break the source to receptor pathway. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the

and Ground Gas Assessment	remainder of the site. As elevated levels of Naphthalene were identified further investigation/delineation and assessment will be required due to the vapour risk posed to site end-users. A **Moderate**/**Low** risk is posed to site end-users at this stage from dust migration and inhalation from asbestos fibres within soils. The risk to the Secondary A Aquifer within the bedrock underlying the site and to surface waters in particular the Corn Brook (River Quality C), from leachable contamination in site soils through vertical and horizontal migration, has been assessed as **Low** and **Very Low**, respectively, at this stage. This assessment considers the sensitivity of the Corn Brook, and considerable depth and impermeable nature of the superficial deposits anticipated to have a very low infiltration capacity. The site is therefore not considered to be contributing significantly to reduced Corn Brook and groundwater quality, more likely impacted by historic industry in the wider area. A **Low** risk rating is identified at this stage to site end-users at this stage from ground gas migration and inhalation from soils. This corresponds with a NHBC Green gas regime and BS8485 CS1 gas regime, not requiring gas protection measures.
Preliminary Material Classification and Soils Reuse	If soil arisings are required to be disposed offsite, an initial assessment of shallow Made Ground soils was carried out using a proprietary waste characterisation assessment tool. Results of five of six samples assessed indicated an initial classification of non-hazardous. One sample were assessed as hazardous; due to the presence of Benzo(a)anthracene within CP1 at 0.30-0.40m bgl. It should also be noted that this information is for guidance only and if soil material is to be disposed offsite, further soil contaminant testing and position specific assessments, in line with WM3, is likely to be required. Where soils are being considered for offsite disposal, Waste Acceptance Criteria (WAC) testing will be required with confirmation of acceptability from the receiving landfill. The Contractors should satisfy themselves regarding the classification of any waste arisings. Confirmation of acceptability should be sought from the receiving landfill or treatment facility via the issue of laboratory chemical testing results. Excavated soils should be suitable for reuse at the site following appropriate waste management regulations and/or under a Materials Management Plan (MMP).
Geotechnical Assessment	For the residential dwellings within Site 1 and 2, it is expected that shallow strip foundations would be suitable founding in the Glacial Till comprising of firm Clay at approximately 1.00m bgl with an assumed bearing capacity of 100kN/m^2 increasing to approximately 150-175kN/m^2 in stiff Clay at depths greater than 2.00m bgl. However, further calculations should be undertaken to ensure there is an adequate factor of safety against shear failure and limit settlements to within 25mm once loadings are known. It is recommended that, outside the zone of influence of trees, consideration is given to constructing the ground floor slab on formation prepared in the Glacial Till. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 and an ACEC class of AC-1 would be appropriate for the site.
Recommendations	The following recommendations are given to ensure the site is safely developed and is 'suitable for use': 1. Due to the elevated concentrations Lead, PAHs, TPHs and the presence of asbestos fibres within the soil, an engineered capping and geotextile membrane will be required to serve as physical barrier between original site soils and site surface in areas of soft landscaping; 2. Elevated concentrations of Naphthalene will need further investigation/delineation and assessment due to the vapour risk posed to site end-users; 3. Contaminant resistant water supply pipes may be required within the development; this should first be confirmed following assessment by the utility provider; and Soils should be appropriately managed onsite during construction works to manage the risk to construction workers. Suitable PPE should be provided for all construction workers following risk assessments by employers in accordance with Construction Design Management (CDM) Regulations, 2015 and with reference to the environmental testing results presented herein and within *Appendix C*.

Copyright ©2021 Curtins Consulting Ltd

Table of Contents

1.0 Introduction....1
1.1 Project Background....1
1.2 Scope of Services....1
2.0 Phase 1 Preliminary Site Assessment Summary....2
2.1 Current Setting....2
2.2 Previous Site Use....3
2.3 Published Geology....3
2.3.1 Made Ground Deposits....3
2.3.2 Superficial Deposits....3
2.3.3 Bedrock Deposits....3
2.3.4 Mining and Quarrying....4
2.3.5 Other Pertinent Geological Existing Geological Records....4
2.4 Hydrogeology and Hydrology....4
2.5 Landfill....5
2.6 Unexploded Ordnance (UXO) Risk Assessment....5
2.7 Summary of Phase 1 PCSM....5
3.0 Phase 2 Investigation Scope of Works....7
3.1 Soil Logging and Sampling....7
3.2 Monitoring Well Installations....7
3.3 Post-Investigation Monitoring....8
3.3.1 Ground Gas Monitoring....8
3.3.2 Groundwater Sampling....8
4.0 Laboratory Analysis....9
4.1 Soil Analysis....9
4.2 Groundwater Analysis....10
4.3 Quality Assurance and Quality Control....10

Copyright ©2021 Curtins Consulting Ltd

4.4 Geotechnical Analysis 10
5.0 Encountered Ground Conditions 12
5.1 General 12
5.2 Made Ground 12
5.3 Superficial Deposits 13
5.4 Bedrock Deposits 15
5.5 Observed Potential Contamination 15
5.6 Obstructions Encountered 15
5.7 Groundwater 15
5.8 Aggressive Ground Conditions 16
6.0 Ground and Groundwater Contamination Assessment 17
6.1 Human Health GQRA 17
6.1.1 Adopted Soil Human Health GACs Screening Methodology 18
6.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results 18
6.1.3 Adopted Vapours within Groundwater Human Health GACs Screening Methodology 20
6.1.4 General Assessment Criteria Screening of Vapours from Groundwater 20
6.2 Controlled Waters GQRA 20
6.2.1 Adopted Controlled Waters Tier 1 Screening Values and Methodology 20
6.2.2 Tier 1 Screening of Groundwater Laboratory Results 21
6.3 Water Supply Pipe Assessment 21
6.4 Materials Management 22
6.4.1 Re-use of Site Soils 22
6.4.2 Material Classification 22
7.0 Ground Gas Assessment 24
7.1 Ground Gas Monitoring Results 24
7.2 Ground Gas Assessment 25
7.2.1 Ground Gas Assessment for Houses 25
8.0 Revised Conceptual Site Model 26

8.1 Summary of Significant Pollutant Linkages 29

9.0 Engineering Assessment and Recommendations 30

9.1 Introduction 30

9.2 Summary of Ground Conditions 30

9.3 Foundation Design 30

9.4 Ground Floor Slabs 31

9.5 Chemical Attack on Buried Concrete 31

9.6 Excavation and Support 31

10.0 Conclusions & Recommendations 33

10.1 Conclusions 33

10.1.1 Ground Contamination 33

10.1.2 Groundwater Contamination 33

10.1.3 Ground Gas Assessment 34

10.1.4 Geotechnical Assessment 34

10.1.5 Additional Considerations 34

10.2 Recommendations 34

11.0 References 36

Copyright ©2021 Curtins Consulting Ltd

Appendices

Appendix A **Drawings (proposed development plans and exploratory hole location plans)**

Appendix B **Exploratory Hole Logs**

Appendix C **Chemical Laboratory Testing Results**

Appendix D **Geotechnical Laboratory Testing Results**

Appendix E **Ground Gas and Groundwater Monitoring Results**

Appendix F **GAC Screening Thresholds**

Appendix G **Risk Assessment Methodology**

Copyright ©2021 Curtins Consulting Ltd

1.0 Introduction

1.1 Project Background

In June 2018 Curtins were instructed by One Manchester to undertake a Phase 2 Intrusive Investigation for two parcels of land off Gorton Lane, Manchester, known as Site 1 and Site 2. In August 2021, the report herein was updated for just one area of the development, the area north of Gorton Lane, previously known as Site 1.

The site is centred on NGR 387230, 397040, and covers an area of approximately 0.32Ha. A site location plan is presented as *Figure 2.1*.

1.2 Scope of Services

This investigation addresses recommendations as presented in the Phase 1 report (Ref.1), with the aim of the Phase 2 works to characterise geo-environmental and geotechnical conditions prior to redevelopment as 8 x 2 storey and 4 x 3 storey semi-detached residential properties with areas of car parking, private gardens and soft landscaping. The current development plans for which can be referred to within *Appendix A* of this report. This report is produced in support of an associated planning application Ref 129876/FO/2021.

Specifically, the Phase 2 report is intended to determine:

a) If there is a risk of the proposed end-user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;
c) If there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide;
d) Recommendations for the design of foundations and building ground floor slabs; and
e) Recommendations for the specification of sub-structure concrete and water supply pipes.

Consideration of detailed flood risk, ecology and archaeological issues are outside of the scope of this report.

Copyright ©2021 Curtins Consulting Ltd

2.0 Phase 1 Preliminary Site Assessment Summary

This section presents a summary of the current site setting, history, geology and hydrogeology/hydrology, as presented in the Curtins Phase 1 report (Ref.1). The Phase 1 report was undertaken for a wider site area and thus the relevant information for 'Site 1' only has been summarised below. It is not the intention of this report to duplicate the Phase 1, with the information below providing the background information to support the revised post Phase 2 siteworks Conceptual Site Model (CSM), as presented in *Section 8.0*.

2.1 Current Setting

At the time of writing the Phase 1 report (Ref. 1) the site, to the north of Wenlock Way/Gorton Lane was vacant urban green space with a mix of low lying shrubs, evidence of fly tipping and deciduous and evergreen trees.

The site is in a predominantly residential area, bounded to the north by commercial properties, to the east by Gorton Lane followed by residential properties, to the south by Wenlock Way followed by a vacant plat and to the west by Pottery Lane followed by residential properties.

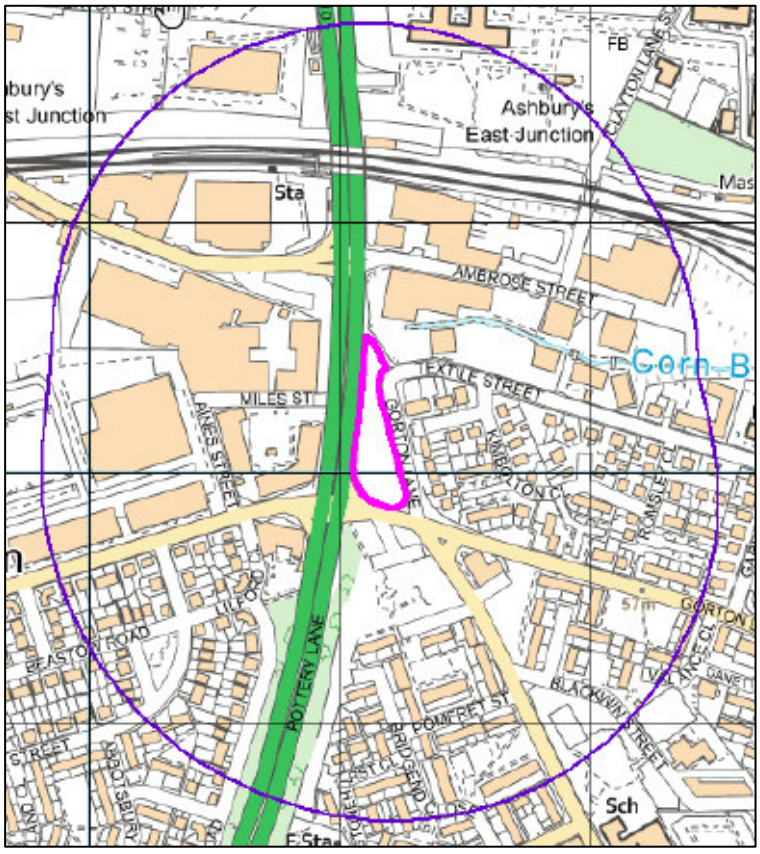


Figure 2.1 *– Site Location Plan, site boundary shown in pink and 250m buffer in purple*

2.2 Previous Site Use

A review of the available historical mapping information for the site, as presented within Curtins Phase 1 report (Ref.1), has been undertaken with specific reference to potential sources of contamination.

Earliest records (1848) depict the site as predominantly agricultural fields with a road along the northeast boundary. From the late 19th Century, terraced properties occupy the site, with multiple industries such as an engineering, iron, starch and pottery works surround within 100m. In the early 20th Century, there is a tramway on the eastern boundary.

By the mid-20th Century, buildings disappear in the southeast which is potentially due to bombing during WWII. In the 1970s there is large scale redevelopment involving the removal of terraced properties, with the site becoming part of the neighbouring Openshaw Technical College to the west. During the late 20th Century, Pottery Lane is constructed of to the west, the site layout now resembles the present day.

2.3 Published Geology

A study of the Envirocheck, BGS borehole records and BGS 1:50,000 mapping (Solid and Superficial Editions) for Manchester (Sheet 085) indicates the following geological succession underlying the site:

- Glacial Till; and
- Halesowen Formation in the southwest and Etruria Formation in the east and north of the site.

2.3.1 Made Ground Deposits

Made Ground is not indicated to be present onsite but given the previous development and the site walkover it is presumed Made Ground is present. Nearby boreholes indicate highly variable depths of Made Ground from 0.30m to 4.50m bgl.

2.3.2 Superficial Deposits

Superficial geology deposits are indicated to be Glacial Till, usually comprising sandy, gravelly, silty Clay recorded at the site.

2.3.3 Bedrock Deposits

Bedrock deposits (both of *Carboniferous Age*) are present in the southwest as the Halesowen Formation, comprising grey-green, micaceous Sandstone and grey-green Mudstone with thin coals and limestone, and in the north and east as the Etruria Formation, comprising red, purple, brown, green and grey commonly mottled Mudstone with lenticular sandstone.

Copyright ©2021 Curtins Consulting Ltd

2.3.4 Mining and Quarrying

The site is noted to be within a Coal Mining Reporting area. With reference to the Coal Authority Mining Report the property is in a surface area that could be affected by underground mining; the coal seams are recorded between 270m to 1090m bgl.

Consequently, it is considered that the risk to any development on site from coal mining is low due to the depths of the workings below the site.

2.3.5 Other Pertinent Geological Existing Geological Records

The Envirocheck report confirms there is a no hazard to very low hazard from the following ground stability hazards on and around the site; running sands, collapsible ground, landslide ground, shrinking or swelling clay, compressible ground and ground dissolution.

UK Radon Mapping confirms the site is situated in an intermediate probability radon area (1% to 3% of homes are estimated to be at or above the action level). On this basis no radon protection measures are considered necessary in the construction of new dwellings or extensions. Where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

2.4 Hydrogeology and Hydrology

Environment Agency data indicates that the site, corresponding with the underlying bedrock geology, overlies a Secondary A Aquifer. These are;

> *Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.*

This is noted as being overlain by a superficial Secondary Undifferentiated Aquifer. These are;

> *Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.*

There are no recorded groundwater abstractions within 500m of the site. The site is not situated within a designated Source Protection Zone (SPZ). Groundwater vulnerability is however classified as high as given the Envirocheck classifying site soils as having 'high leaching potential.'

The nearest surface water feature is the Corn Brook water course located 38m to the north flowing west, with river quality graded at C. There is no surface water abstraction recorded within 1km of the site.

Copyright ©2021 Curtins Consulting Ltd

The site does lie within an area depicted on the EA Flood Zone maps to be at risk of flooding from rivers or the sea.

2.5 Landfill

There are no current or historic landfills located within 300m of the site.

2.6 Unexploded Ordnance (UXO) Risk Assessment

Risk mapping for UXOs has placed the site within a Moderate risk area. Moderate-risk regions are those that show a bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets.

A review of post-WWII historical mapping shows ruins located 100-200m to the northeast and 200m to the northwest. Analysis of historical mapping from the University of Manchester records bomb strikes in the vicinity during WWII; they show the area around the site was damaged during the bombings.

Due to the potential risk from UXO, a Detailed Unexploded Ordnance (UXO) Risk Assessment (Ref.2) has been obtained for the larger site. It concluded that the majority of the site was **Low** risk, but the southeast of Site 2 was **Medium** risk. The following recommendations were made:

- All Works – Site Specific UXO Awareness Briefings to all personnel conducting intrusive works;
- Medium Risk Area – UXO Specialist Onsite Support; and
- Boreholes and Piled Foundations – Intrusive Magnetometer Survey of all borehole and pile locations/clusters down to maximum bomb penetration depth.

2.7 Summary of Phase 1 PCSM

A summary of potential pollutant linkages at the development site identified in the Phase 1 report (Ref.1) presented in *Table 2.7*, were identified as requiring further investigation to enable the safe redevelopment of the site.

***Table 2.7** – Preliminary Conceptual Site Model*

Source	Pathway	Receptor	Risk
Made Ground of unknown composition from: • Uncontrolled deposition of construction/ demolition waste; and • Potential contamination associated with the Made Ground in the artificially mounded earth.	Direct contact/ ingestion and inhalation	Future site-users	**Moderate**
	Horizontal and vertical migration of contaminants	Groundwater	**Moderate/ Low**

Source	Pathway	Receptor	Risk
Production of ground generating gases from Made Ground deposits containing organic/ putrescible content.	Vertical and horizontal migration through existing service corridors and the underlying superficial deposits	Future site-users	**Moderate**

Potential contaminants of concern associated with any Made Ground present include, amongst others; broad range aliphatic and aromatic hydrocarbons present within any fuel oils; semi-volatile and volatile organic contamination; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals; and asbestos present in discarded building materials.

The qualitative risk assessment determined the above risks associated with the proposed development of the site warrant further investigation. The nearest surface water course is a non-sensitive water resource, and therefore does not warrant further investigation.

It was recommended that a ground investigation is conducted to both confirm this assessment and provide data in support of the structural and civil engineering design. The scope of the investigation undertaken in detailed in *Section 3.0*.

Copyright ©2021 Curtins Consulting Ltd

3.0 Phase 2 Investigation Scope of Works

Site investigation works were undertaken between 4th and 7th July 2018.

The scope of the ground investigation was designed in general accordance with current UK guidance including CLR11 (Ref.3), British Standard (BS) 10175 (Ref.4), BS5930:2010 (Ref.5), and BSEN1997: Part 2:2007 Eurocode 7 (Ref.6). A summary of the scope and rationale are summarised in *Table 3.0* below.

Table 3.0 – *Scope and Rationale of Fieldwork Undertaken*

Exploratory Hole Type	Exploratory Hole Ref.	Exploratory Hole Depth (m bgl)	Rationale
Window Sample holes	**WS1 – WS3**	**0.60 – 5.00**	Confirm shallow ground conditions. Collect soil samples for chemical and geotechnical analysis. Undertake in-situ testing. Gas and groundwater monitoring. Determine geotechnical parameters.
Cable Percussive holes	**CP1**	**10.00**	Confirm ground conditions. Collect soil and water samples for chemical and geotechnical analysis. Undertake in-situ testing. Gas and groundwater monitoring. Determine geotechnical parameters.
Machine Excavated Trial Pits	**TP1 – TP5**	**1.30 – 3.50**	Confirm shallow ground conditions. Collect soil samples for chemical analysis.

Curtins drawing ref. 068244-CUR-00-XX-DR-GE-001-V01 records the locations of the exploratory holes, a copy of which is contained within *Appendix A*.

3.1 Soil Logging and Sampling

Exploratory hole arisings were logged onsite by a qualified Engineer. All exploratory holes were logged in accordance with the requirements of BS5930 (Ref.5), including recording observed visual and olfactory indications of contamination. Exploratory hole logs are provided in *Appendix B*.

3.2 Monitoring Well Installations

Ground gas and groundwater monitoring installations (50 mm diameter) were installed within the three window sample boreholes and the cable percussive borehole. A bentonite seal was placed above and below the screened section of the borehole to minimise potential for downward migration of contaminants and the creation of a preferential migratory pathway. A gravel surround was installed in the annulus between the sides of the borehole and the slotted sections of pipe.

The monitoring wells within the window sample boreholes were primarily designed to assess the potential for ground gas and strata likely to have the highest permeability and as such the screened section focussed on Made Ground where sufficient depth was encountered or the underlying natural strata.

The cable percussive borehole monitoring well was primarily designed to assess the groundwater and strata likely to have the highest permeability and as such the screened section focussed on the deeper natural strata.

A summary of the response zones is presented in *Table 3.2* below.

Table 3.2 – *Monitoring Well Response Zones*

Borehole Ref.	Response Zone(s) (m bgl)	Strata Description(s) (Principal strata in capitals)
WS1	1.00 – 1.50	MADE GROUND and Clay
WS2	2.00 – 4.00	CLAY
WS3	2.00 – 4.00	CLAY
CP1	6.00 – 10.00	CLAY

Copies of borehole logs can be referred to in *Appendix B* of this report.

3.3 Post-Investigation Monitoring

3.3.1 Ground Gas Monitoring

An initial programme of six gas monitoring visits over three months was proposed to assess ground gas conditions as identified in the Preliminary Conceptual Site Model in the Phase 1 Preliminary Site Assessment (Ref.1).

3.3.2 Groundwater Sampling

A groundwater sample from cable percussive borehole CP1 was collected during the third monitoring visit.

4.0 Laboratory Analysis

Representative soil samples were selected for laboratory chemical analysis, based on the Conceptual Site Model (CSM) and field observations and to provide a characterisation of the Made Ground and natural strata encountered. Selected soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical and geotechnical analysis was Concept Life Sciences Laboratories (UKAS and MCERTS accredited).

Given the potential site wide source of contamination (Made Ground) the sampling positions (boreholes) were generally located in a non-targeted, systematic array to give adequate and representative coverage of the site accounting for the historical site use, proposed end-use and the immediate environmental setting.

4.1 Soil Analysis

The source material of contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite listed in *Table 4.1* below.

Table 4.1 – *Environmental Chemistry Analysis Suite: Soils*

Suite Ref.	Analyte	LOD
Soils Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	-
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.1 mg/kg
	Cyanide (total)	10 mg/kg
	Phenols (screen)	1 mg/kg
	PAHs (USEPA 16)	0.1 mg/kg
	TPH (Aro/Ali Split)	0.01 to 0.1 mg/kg

Six soil samples were taken from within Made Ground from the cable percussive borehole, one window sample boreholes and four trial pits and tested for Suite A.

During laboratory testing, one soil sample (CP1) positively identified asbestos fibres, subsequently the sample was sent for asbestos quantification.

Copies of the environmental chemistry testing certificates are presented in *Appendix C*.

Copyright ©2021 Curtins Consulting Ltd

4.2 Groundwater Analysis

The source material of the contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils) and heavy metals the extent of which is captured by the broad environmental testing suite listed in *Table 4.2* below.

***Table 4.2** – Environmental Chemistry Analysis Suite: Waters*

Suite Ref.	Analyte	LOD
Water Suite A	pH	-
	Total Hardness	1 mg/l
	Arsenic, Lead, Nickel, Selenium, Zinc	1 µg/l
	Boron (water soluble), Chromium, Copper, Mercury, Phenols (screen)	0.1 µg/l
	Cadmium	0.5 µg/l
	Cyanide, Sulphide	0.2 mg/l
	Sulphate	10 mg/l
	PAHs (USEPA16)	0.01 µg/l
	TPH (Aro/Ali Split)	10 µg/l

A groundwater sample was taken from cable percussive borehole CP1 and tested for the above suite.

Copies of the environmental chemistry testing certificates are presented in *Appendix C*.

4.3 Quality Assurance and Quality Control

Concept Life Sciences soil analysis report no. 743109-1, 742475-1 and 745399-1 did not record any deviations.

Concept Life Sciences soil analysis report no. 745599-1 records the soil samples were analysed outside holding time for pH. The results are comparable to the analysis report 743109-1 and 742475-1and therefore it is unlikely these deviations will affect the integrity of the results.

Concept Life Sciences water analysis report no. 751948-1 did not record any deviations.

All analysis reports are enclosed within *Appendix C*.

4.4 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref.7) and representative sub-samples were taken for testing. The following tests were carried out for samples collected from Site 1 and Site 2 during the 2018 ground investigation:

- 10 No. Moisture content;

- 10 No. Atterberg Limits;
- 2 No. Undrained Triaxial test;
- 25 No. Water soluble sulphate; and
- 25 No. pH value.

Copies of the geotechnical testing certificates are presented in *Appendix D*.

Copyright ©2021 Curtins Consulting Ltd

5.0 Encountered Ground Conditions

5.1 General

A summary of the ground conditions encountered during the site investigation works in Site 1 is presented below in *Table 5.1*, with detailed information presented in the exploratory hole logs included in *Appendix B* and a summary of each strata encountered in Site 1 and Site 2 presented in subsequent sections.

Table 5.1 – *Summary of Ground Conditions Encountered*

Stratum	Depth to top of strata, m bgl (mAOD)	Thickness (m)		Description
		Min	Max	
MADE GROUND	0.00 (51.90 – 54.60)	0.40	>2.00[1]	Dark greyish-brown, sandy, silty CLAY and reddish-brown to black, fine to coarse SAND and angular to sub-rounded, fine to coarse GRAVEL with cobbles of brick and concrete. Anthropogenic constituents include brick, coal, concrete, clay pipe, slate, clinker, glass, ceramic, sandstone, wood, cloth, asphalt, ash, plastic, metal, aggregate, tile and cables.
SUPERFICIAL DEPOSITS (Glacial Till)	0.40 – 1.30[1] (<49.90 – 53.60)	2.40*	9.00	Firm to stiff, brown with grey mottling to dark reddish-brown, gravelly, sandy CLAY with rare cobbles.
BEDROCK (Halesowen Formation & Etruria Formation)[2]	11.70 – 13.00 (42.40 – 43.30)	*	*	Weathered greyish-green, fine to medium SANDSTONE interbedded with greenish-grey siltstone *and* Weathered, red with green mottling MUDSTONE.

1 Thickness of Made Ground not proved in TP01
2 Bedrock encountered in Site 2 only
* Thickness not proved

5.2 Made Ground

Made Ground was encountered from ground level to depths of 0.40m to 5.00m bgl within all exploratory holes. It generally comprised grass over cohesive Made Ground, usually with some brick and ash fill. Asphalt was encountered within CP1 at 0.20m to 0.25m bgl.

The cohesive Made Ground was encountered within all exploratory holes from 0.00m bgl to depths of 0.40m to 5.00m bgl; generally comprised dark greyish-brown, sandy, silty Clay with frequent rootlets, rare cobbles of brick and concrete, and rare to frequent fragments of brick, coal, concrete, clay pipe,

slate, clinker, glass, ceramic, sandstone, wood, cloth, asphalt, ash, plastic, metal, aggregate, tile and cables.

Brick fill was encountered within WS3, WS5, CP1, CP3, CP4, TP2, TP4, TP10 and TP12 at 0.25m to 3.00m bgl (0.15m to 2.50m thick); generally comprised reddish-brown to dark greyish-brown, fine to coarse Sand and angular to sub-rounded, fine to coarse Gravel of concrete, brick, glass, metal, ceramic, sandstone, asphalt, coal, wires, wood, aggregate, slate, ash, plastic and clay pipe with frequent cobbles of whole and part bricks and concrete, and rare pockets of clay.

Ash fill was encountered within WS1, WS4, TP1, TP3 and TP10 at 0.30m to 2.60m bgl (0.20m to at least 1.70m thick); generally comprised black, fine to coarse Sand and angular to sub-rounded, fine to coarse Gravel of ash, clinker, coal, brick, glass, slate, sandstone, concrete, metal, tile and wood with cobbles of concrete and brick and rare pockets of clay.

A summary of the geotechnical test results recorded within the Made Ground are presented in *Table 5.2*. Full details of the geotechnical results recorded are presented on the exploratory hole logs in *Appendix B* and test result certificates in *Appendix D*.

Table 5.2 – *Summary of geotechnical test results – Made Ground*

Parameter	No. of tests	Minimum	Maximum	Average
pH	15	7.3	8.9	8.0
Water Soluble Sulphate (mg/l)	15	<50	460	100
SPT 'N' Value	9	8	40*	16*

* SPT 'N' value of >50 within CP2 at 2.00m bgl is potentially due to concrete/cobble and therefore has been excluded.

5.3 Superficial Deposits

Natural superficial deposits comprised Glacial Till from depths of 0.40m to 5.00m bgl, to proven depths of 11.70m to 13.00m bgl. It generally comprised firm to very stiff, brown with grey mottling to dark reddish-brown, gravelly, sandy Clay with rare cobbles. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including sandstone, mudstone, coal and quartzite.

A summary of the geotechnical test results recorded within the superficial deposits are presented in *Table 5.3*. Full details of the geotechnical results recorded are presented on the exploratory hole logs in *Appendix B* and test result certificates in *Appendix D*.

Table 5.3 – *Summary of geotechnical test results – superficial deposits*

Parameter	No. of tests	Minimum	Maximum	Average
Moisture Content (%)	10	7.5	21	14
Liquid Limit (%)	10	28	52	38

Copyright ©2021 Curtins Consulting Ltd

Parameter	No. of tests	Minimum	Maximum	Average
Plastic Limit (%)	10	13	23	18
Plasticity Index (%)	10	14	29	20
Modified Plasticity Index (%) (1)	10	12.7	27.0	18.7
pH	10	7.5	8.4	8.1
Water Soluble Sulphate (mg/l)	10	<50	90	59
SPT 'N' Value	50	8	>50	36
Estimated Undrained Shear Strength, Cu (kPa) (2)	50	40	>250	181
Undrained Shear Strength, Cu (kPa) (3)	2	263	411	337
Coefficient of volume compressibility, mv (m^2/MN) (4)	50	0.04	0.25	0.07
Unit Weight, γ (kN/m^3) (5)	-	18 – 21		

(1) Modified plasticity index is the plasticity of components <425µm.
(2) Cu estimated from SPT N value correlation with average Plasticity Index using a factor of 5 (Stroud and Butler, 1975).
(3) Calculated from Undrained Shear Strength in Triaxial Compression test.
(4) mv estimated from SPT N value correlation with average Plasticity Index using a factor of 0.5 (Stroud and Butler, 1975).
(5) From published sources (BS8002).

Fifty SPT 'N' values were recorded in the clay ranging from 8 to >50 which generally increased with depth (as shown in *Figure 5.3* below); indicating firm becoming very stiff cohesive soils.

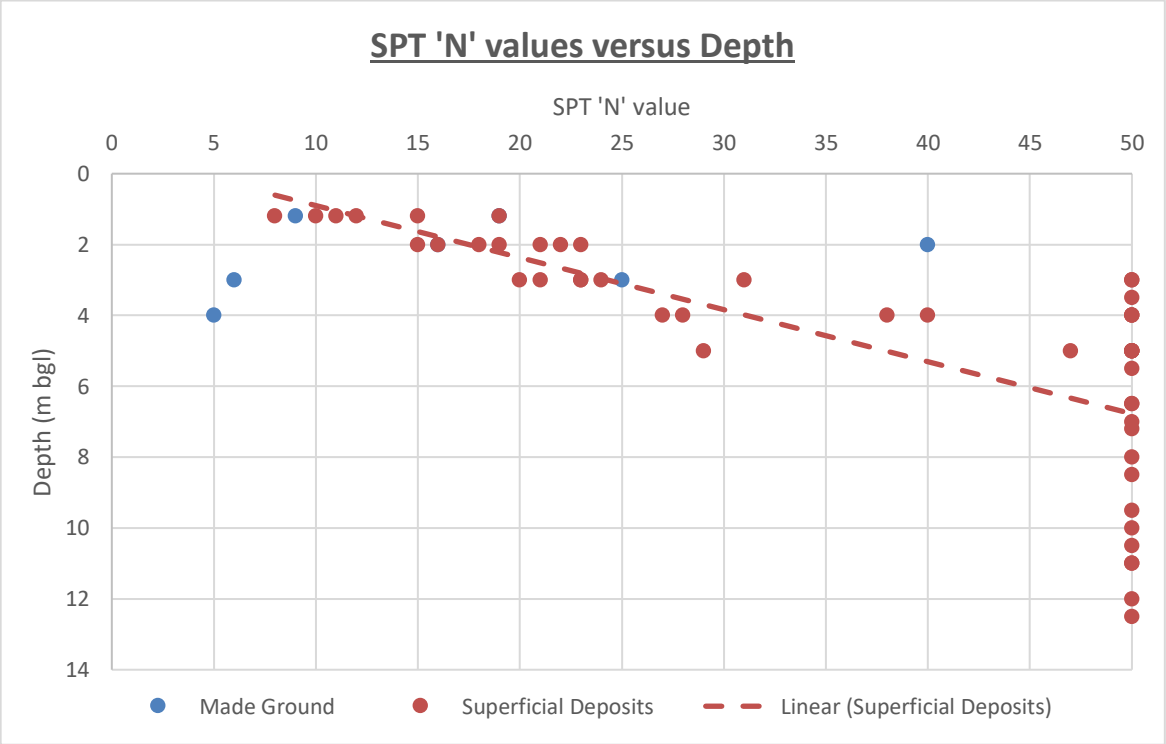


Figure 5.3 – SPT 'N' Values vs Depth (SPT 'N' values of >50 are shown as 50 on the graph).

Laboratory testing of the cohesive soils classified the soils as low to high plasticity with low to moderate volume change potential.

Two Undrained Shear Strength in Triaxial Compression tests were undertaken recording 263kPa and 411kPa, at depths of 8.00m and 9.00m respectively, indicating very high to extremely high strength clay. From published relationships, undrained shear strengths (Cu) may be estimated from SPT 'N' values. Using a factor of 5, estimated Cu values range between 40kPa to >250kPa indicating the clay to be of medium to very high strength. This confirms the description of the clay as firm to very stiff in the exploratory hole logs. The lower estimated shear strengths are from shallower soils; all estimated shear strength values are >250kPa (very high strength clay) at depths greater than 7.20m bgl.

5.4 Bedrock Deposits

The Halesowen Formation was encountered with CP2 and CP3 from 13.00m and 11.70m bgl respectively (43.00mAOD and 43.30mAOD respectively), and the Etruria Formation was encountered within CP4 from 13.00m bgl (42.40mAOD).

Within CP2 and CP3 the bedrock comprised weathered greyish-green, fine to medium Sandstone interbedded with greenish-grey siltstone, and within CP4 it comprised weathered, red with green mottling Mudstone.

The boreholes were terminated at a maximum depth of 14.00m bgl.

5.5 Observed Potential Contamination

No potential contamination or asbestos containing materials were observed during the intrusive investigation of Site 1.

5.6 Obstructions Encountered

The following obstruction was encountered during site works in Site 1.

Table 5.6 – *Encountered Obstructions*

Borehole Ref.	Observed Contamination	Depth (m bgl)
TP2	Concrete	0.40

5.7 Groundwater

A summary of the groundwater levels recorded during the siteworks, and subsequent monitoring, is presented in *Table 5.7*. Full details of the water strikes recorded during progression of the investigation positions are presented on the exploratory hole logs included in *Appendix B* and full details of the water levels recorded during the monitoring visits are presented in *Appendix E*.

Table 5.7 – *Groundwater Noted During Site Investigation*

Borehole Ref.	Water Strikes			Monitored Water Levels		
	Strike Depth (m bgl)	Strike Level (mAOD)	Strata	Installation Strata	Depth (m bgl)	Depth (mAOD)
CP1	-	-	-	CLAY	7.58 – 9.30	45.30 – 47.02
WS1	-	-	-	MADE GROUND and Clay	DRY (>1.50)	<50.40
WS2	-	-	-	CLAY	**	**
WS3	-	-	-	CLAY	2.72 – DRY (>4.00)	<49.50 – 50.78
WS4	-	-	-	CLAY	3.55 – DRY (>3.70)	<51.50 – 51.65
WS5	-	-	-	MADE GROUND and Clay	DRY (>2.00)	<53.70

* Rose to 12.00m bgl overnight.
** Unable to remove bung to monitor groundwater levels.

Groundwater was not encountered during site works within the window sample boreholes, trial pits and CP1.

During monitoring visits, groundwater was recorded at 2.72m to 9.30m bgl. However, it should be noted this was during dry summer months, therefore groundwater may be encountered at shallower depths during winter or wetter periods.

5.8 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, 3rd edition of 2005 (Ref.8). *Table 5.8* details the classification.

Table 5.8 – *Aggressive Chemical Environment for Concrete (ACEC) Site Classification*

Stratum	Design Sulphate Class	ACEC Class (1)
Made Ground	DS-1	AC-1
Superficial deposits	DS-1	AC-1

(1) ACEC assessment was based on the *static* groundwater condition in a *brownfield* scheme area.

6.0 Ground and Groundwater Contamination Assessment

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end-users, associated utilities and the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end-users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (Ref.9).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 Desk Study in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in *Section 8.0* of this report.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

6.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model (Ref.10), Science Report 2 (Ref.11) and Science Report 3 (Ref.12).

A generic quantitative risk assessment (GQRA) has been carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria (GAC) where available, including:

i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and

dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;

ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds;

iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (Ref.13) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

6.1.1 Adopted Soil Human Health GACs Screening Methodology

The use of the site, noted as 12no semi-detached residential properties with areas of car parking, private gardens and soft landscaping; is most analogous with a *Residential with home grown produce* end-use scenario and so assessment has been undertaken against the following GACs, in order of preference:

1. Environment Agency Soil Guideline Values,
2. CL:AIRE, AGS, EIC. Soil Generic Assessment Criteria for Human Health Risk Assessments,
3. LQM/CIEH 2015 S4ULs for Human Health Risk Assessment, and
4. DEFRA Category 4 Screening Levels.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the site soils ranged significantly from <0.1% to 11%. The high organic content encountered in several soils is representative of the Made Ground features.

With consideration for a calculated geometric average, the soils determine an SOM of 0.25%. As such, a comparison against Generic Assessment Criteria (GAC) thresholds for a conservative SOM of 1.0% for *Residential with home grown produce* end-use has been adopted. The adopted GAC's are listed in *Appendix F*.

6.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*.

With respect to the proposed end-use of the site, several exceedances are noted within recovered soil samples as detailed below.

Table 6.1.2 – *Soil GAC exceedances for a residential with home grown produce end-use*

Borehole Ref.	Depth (m bgl)	Determinant	Concentration (mg/kg)	GAC (mg/kg)
CP1	0.30 – 0.40	Lead	230	200
		TPH aromatic C12-C16	210	140
		TPH aromatic C16-C35	2050	1100
		Naphthalene	15	2.3
		Benzo(a)Anthracene	30	7.2
		Chrysene	29	15
		Benzo(b)fluoranthene	28	2.6
		Benzo(a)Pyrene	25	2.2
		Dibenzo(ah)Anthracene	5.9	0.24
WS1	0.40 – 0.50	Lead	230	200
		TPH aromatic C16-C35	1260	1100
		Benzo(b)fluoranthene	5.3	2.6
		Benzo(a)Pyrene	6.0	2.2
		Dibenzo(ah)Anthracene	1.4	0.24
TP2	0.70 – 0.80	Benzo(a)Pyrene	2.5	2.2
		Dibenzo(ah)Anthracene	0.6	0.24
TP3	0.70 – 0.90	Lead	230	200
TP4	0.60 – 0.80	Lead	620	200
TP5	0.40 – 0.50	Benzo(a)Anthracene	13	7.2
		Benzo(b)fluoranthene	13	2.6
		Benzo(a)Pyrene	10	2.2
		Dibenzo(ah)Anthracene	2.2	0.24

During site works, no suspected asbestos containing materials (ACMs) were noted within site soils in Site 1.

Chrysotile asbestos fibres were identified within CP1 0.30-0.40m bgl at 0.001%.

The above results table indicates that in the soils there are elevated metals, primarily lead.

The distribution of these elevated species is relatively uniform across the site. pH results indicated relatively alkaline conditions. The elevated PAHs recorded generally correlate with the identification of ash constituents within Made Ground deposits; it is thought to be responsible for the exceedances and is indicative of the historical uses of the site and the wider area.

6.1.3 Adopted Vapours within Groundwater Human Health GACs Screening Methodology

The use of the site, noted as residential development comprising houses with private gardens and associated roadways, car parking and areas of soft landscaping, is most analogous with a *residential* end-use scenario; assessment has been undertaken in accordance with this against the GACs outlined in the SoBRA guidance (Ref.14).

6.1.4 General Assessment Criteria Screening of Vapours from Groundwater

The results of the environmental (groundwater) testing can be referred to in *Appendix C*.

With respect to the proposed end-use of the site, no exceedances are noted within recovered water samples.

6.2 Controlled Waters GQRA

A model for assessing the potential for pollution of controlled waters and for deriving a safe concentration in ground and groundwater is the Environment Agency's publication "Remedial Targets Methodology - Hydrogeological Risk Assessment for Land Contamination' (Ref.15).

In relation to the standards for controlled waters, there are currently no generic groundwater standards or surface water standards that are necessarily applicable to all sites.

However, dependant on the receptor identified as being at risk, see *Section 6.2.1*, the EU Drinking Water Standards (Ref.16) and/or Water Framework Directive Ecology Quality Standards (WFD EQS) (Ref.17) can be utilised as primary screening values in a Tier 1 assessment. These can also be supplemented by World Health Organisation (WHO) guidelines (Ref.18), where WFD or DWS do not exist.

6.2.1 Adopted Controlled Waters Tier 1 Screening Values and Methodology

The results of laboratory analysis of groundwater have been assessed against EU Drinking Water Standards (EU DWS), as the site is underlain by Secondary A Aquifer within the bedrock, and WFD freshwater ecology quality standards (EQS), due to the proximity of the Corn Brook. In the absence of EU DWS & WFD EQS, WHO guidelines have been utilised.

The adopted Tier 1 Screening Values are listed in *Appendix F*.

Copyright ©2021 Curtins Consulting Ltd

6.2.2 Tier 1 Screening of Groundwater Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*.

With respect to the aforementioned GACs, several exceedances are noted within recovered water samples as detailed below.

Table 6.2.2 – *Groundwater Exceedances*

Determinand	*WFD EQS Value (µg/l)*	DWS WQS Value (µg/l)	Samples > Tier 1 Values
Chromium	*4.7*	**50**	*CP1 – 7µg/l*
Copper	*2000*	**1***	**CP1 – 2.8µg/l**
Benzo(a)Pyrene	*0.00017*	**0.01**	***CP1 – 0.1µg/l***
PAHs (sum of four)**	-	**0.1**	**CP1 – 0.4µg/l**
TPH (C21-C35 aromatic)	***	***	CP1 – 130µg/l

* Bioavailable

** The sum of concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(123-cd)pyrene.

*** As there are no EU DWS & WFD EQS thresholds, WHO guidelines have been utilised (TPH [C21-C35 aromatic] threshold is 90µg/l).

There have been relatively minor exceedances against Tier 1 values for metals, sulphate, PAHs and TPHs which are indicative of wider sources contamination from the long industrial history of the surrounding area.

6.3 Water Supply Pipe Assessment

With reference to the UKWIR Report no. 10/WM/03/21 (Ref.19) advice is given on the appropriate materials for these ground conditions. The exact requirements are to be confirmed with the relevant utility supplier.

PE and PVC pipes are not suitable for use for water supply pipes at this site due to concentrations of Toluene, Xylene, C11-C20 and C21-C40 mineral oils exceeding UKWIR guidelines. Barrier pipe (PE-Al-PE) is considered to be appropriate for this site, however the exact requirements are to be confirmed with the relevant utility supplier.

6.4 Materials Management

6.4.1 Re-use of Site Soils

Based on the geochemical testing results presented as part of this investigation it is considered that there is no specific requirement to remove soils from site because of them presenting an unacceptable risk to human health or the environment.

The re-use of site-won soils may therefore be undertaken if the following principles are met:

i) the geotechnical suitability of the material needs to be confirmed;
ii) the re-use of the material needs to be covered as part of the planning approval, e.g. site levels maintained within agreed limits;
iii) the volume of the material being re-used needs to be confirmed and traceable; and
iv) regulatory approval from the relevant authorities has been sought.

These principles are outlined within the CL;AIRE Definition of Waste Code of Practice (v2) (Ref.20) and if and where the re-use of site-won soils is proposed as part of the development works it is recommended that a Materials Management Plan is produced in line with the Definition of Waste Code of Practice to detail and document the process.

6.4.2 Material Classification

Where any site soils are to be disposed of off-site guidance on the disposal of contaminated soils is provided within the following document published by the Environment Agency, the Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (1st Edition 2015) (Ref.21).

Guidance states that the principal contractor (or any other sub-contractor undertaking excavations) should, in conjunction with the proposed disposal facility, use where possible the relevant environmental chemistry analyses results to classify any surplus material identified for offsite disposal. However, it should be noted that this information is for guidance only and material identified for disposal should be tested and assessed in accordance with WM3 to enable classification during the works.

An initial assessment for the waste classification of the shallow and deeper Made Ground soils encountered onsite has been carried out through a comparison of the soil testing results against the Tier 1 Thresholds and using the Waste Soils Characterisation Assessment Tool, Cat-WasteSoil, developed by McArdle and Atkins. This online tool gives a rapid assessment of contaminated soils and their classification as either hazardous or non-hazardous (stable non-reactive hazardous waste) waste, it should be noted that this tool does not classify inert waste. Persistent Organic Pollutants (POP's) were not tested for as part of the investigation, however

based on the Conceptual Site Model the risk of these being present on the site is considered Low.

The initial assessment revealed that of the six Made Ground soils tested, five samples have been identified as 'non-hazardous' with respect to Environment Agency waste classes, using the guidance given in WM3.

However, one sample has been identified as 'hazardous' classification for offsite disposal owing to the concentration of Benzo(a)anthracene in CP1 at 0.30-0.40m bgl. The elevated concentrations of PAHs may be caused by ashy material within the sub-base material as noted in the borehole logs.

However, where soils are being considered for offsite disposal, Waste Acceptance Criteria (WAC) testing will be required with confirmation of acceptability from the receiving landfill.

As discussed, preliminary waste classification is undertaken to offer indicative advice with respect to disposal requirements. Landfill operators are not obliged to accept waste and, if they were to do so, may have specific requirements beyond those outlined above prior to acceptance. Landfill operators should be contacted to confirm the above classifications or otherwise.

Copyright ©2021 Curtins Consulting Ltd

7.0 Ground Gas Assessment

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA (Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (Ref.22), BSI Publication (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015 (Ref.23), NHBC Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Report No. 04 (Ref.24) and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref.25).

The gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within the Phase 1 Preliminary Site Assessment (desk study) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

7.1 Ground Gas Monitoring Results

To characterise the site's ground gas regime and validate the qualitative assessment of ground gas risk, standpipe installations were incorporated within the three window sample boreholes and the cable percussive borehole as detailed in *Section 3.2*.

An initial programme of six gas monitoring visits over three months was proposed. Six gas monitoring visits have been undertaken between 18th June and 3rd September 2018, with barometric pressure recorded between 999 and 1016mb. The monitoring period included one monitoring visit during falling barometric pressure The results log sheets are contained within *Appendix E* and summarised in *Table 7.1* below.

Table 7.1 – *Summary of Ground Gas Monitoring Results*

Borehole Ref.	Maximum CH_4 Concentration (%)	Maximum CO_2 Concentration (%)	Minimum Steady O_2 Concentration (%)	Maximum gas flow (l/hr)
CP1	<0.1	1.2	18.7	-0.1
WS1	<0.1	0.9	19.8	-0.3
WS2	<0.1	2.9	18.8	-0.2
WS3	<0.1	1.5	19.5	-0.2

Concentrations of methane (CH_4) were recorded below the instrument's detection limit within all the monitoring wells throughout the monitoring period. Maximum concentrations of carbon monoxide (CO) and hydrogen sulphide (H_2S) were recorded at 6ppm and 3ppm, respectively. Carbon Dioxide was recorded in peak concentrations between 0.6% and 4.1%. Maximum gas flow was recorded between -0.2 and 0.3 litres/hour.

Concentrations of carbon dioxide for Site 1 were recorded between 0.6% and 2.9%.

7.2 Ground Gas Assessment

The Conceptual Site Model presented within the Phase 1 Preliminary Site Assessment identified possible Made Ground deposits as a potential source of ground gas generation both onsite and offsite resulting from historical development and land use. The report suggests no records of organic rich drift deposits (e.g. peat) being present. Additionally, shallow coal deposits are noted to not underlie the site. Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane and hydrogen sulphide. The consequence was evaluated as Moderate risk.

Made Ground soils were encountered to depths of between 0.40m to 5.00m bgl but with limited putrescible content generally. The ground investigation revealed a ground model generally consistent with the preliminary conceptual site model. Natural deposits were generally Clay with no significant putrescible/organic content.

As the proposed development plans include low rise residential housing the ground gas assessment has been undertaken in accordance with NHBC Report 04 (Ref.24).

Negative flow values have been included as positive flow values in the below calculations as, in the correct meteorological conditions, it is considered that the reverse flow conditions are possible and therefore are representative of ground conditions.

The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction. Appropriate ground gas monitoring and safety measures should be in place during the works, as the potential presence of ground gases could pose a risk in any confined spaces of deep excavations.

7.2.1 Ground Gas Assessment for Houses

Consideration of the recorded soil gas flow rates, presented above, enables hazardous gas flow rates (Q_{hg}) to be evaluated in accordance with NHBC Report 04. Q_{hg} for methane can be derived for a temporal 'worst case' scenario from the peak gas flow and peak gas concentration from a single borehole on a single visit. Q_{hg} for carbon dioxide can be derived for a temporal 'representative' scenario from the steady state gas flow and steady state gas concentration from a single borehole on a single visit.

Evaluation of the maximum Q_{hg} for carbon dioxide is 0.0029 l/hr. No methane was recorded during monitoring visits.

The sites Gas Screening Value (GSV), in accordance with an assessment by NHBC classification for low rise housing with a ventilated underfloor void (minimum 150mm), indicates a Green gas regime for carbon dioxide, not requiring gas protection measures.

Copyright ©2021 Curtins Consulting Ltd

8.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented in the Phase 1 report (Ref.1) and discussed in *Section 3.0* of this report has been revised following the GQRA in *Section 6.0* and *7.0* above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf and graphically presented as *Appendix A*.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

The CSM follows the framework outlined within CIRIA C552 (Ref.26) which is summarised within *Appendix G*.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Risks presented by Unexploded Ordnance is discussed and assessed in *Section 2.6*.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (Ref.27) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works onsite will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model. Reference should be given to the environmental testing results discussed within *Section 6.0* and presented within *Appendix C*.

Copyright ©2021 Curtins Consulting Ltd



- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	**Pathway(s)**	**Receptor(s)**	**Consequence**	**Likelihood of Occurrence**	**Risk Rating**		
Made Ground including fragments of brick, coal, concrete, clay pipe, slate, clinker, glass, ceramic, sandstone, wood, cloth, asphalt, ash, plastic, metal, aggregate, tile and cables [containing, elevated concentrations of heavy metals and TPHs].	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Site end-users	Medium	Likely	**Moderate**	Elevated concentrations of Lead and TPHs are likely caused by inclusions of ash within Made Ground soils.	Engineered capping and geotextile membrane to serve as physical barrier between original site soils and site surface in areas of soft landscaping. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site. Standard health & safety precautions and suitable environmental controls/ construction management to put in place by construction contractors to protect adjacent residents and staff.
	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Construction and maintenance workers	Mild (Standard Health & Safety precautions likely to be used by workers)	Low	**Low**		
	Soil dust ingestion/inhalation produced during construction	Adjacent residents	Medium	Unlikely (suitable environmental controls likely to be employed by construction contractors)	**Low**		
Made Ground including fragments of brick, coal, concrete, clay pipe, slate, clinker, glass, ceramic, sandstone, wood, cloth, asphalt, ash, plastic, metal, aggregate, tile and cables [containing, elevated concentrations of PAHs, including Naphthalene].	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Site end-users	Medium	Likely	**Moderate**	PAHs (including Naphthalene) are likely caused by inclusions of ash within Made Ground soils.	Elevated concentrations of Naphthalene will need further investigation/delineation and assessment due to the vapour risk posed to site end-users.
	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation	Construction and maintenance workers	Mild (Standard Health & Safety precautions likely to be used by workers)	Low	**Low**		Standard Health & Safety precautions likely to be used by workers.
	Soil dust ingestion/inhalation produced during construction	Adjacent residents	Medium	Unlikely (suitable environmental controls likely to be employed by construction contractors)	**Low**		Suitable environmental controls likely to be employed by construction contractors.
Asbestos fibres within a Made Ground soil samples from CP01 at 0.001% w/w.	Dust and migration inhalation	Site end-users	Medium	Low	**Moderate/ Low**	Chrysotile asbestos fibres identified in CP01 at 0.30-0.40m bgl.	Engineered capping and geotextile membrane to serve as physical barrier between original site soils and site surface in areas of soft landscaping. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site. Handpicking and careful removal of any asbestos containing materials (ACMs) encountered.
		Construction and maintenance workers	Mild (Standard Health & Safety precautions likely to be used by workers)	Likely	**Moderate/ Low**		Standard health & safety precautions and suitable environmental controls/ construction management to put in place by construction contractors to protect adjacent residents and staff.
		Adjacent residents	Medium	Low	**Moderate/ Low**		

Conceptual Site Model			Qualitative Risk Assessment			Comments	Action
Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Relatively minor exceedances against Tier 1 values for metals, PAHs and TPHs within groundwater	Horizontal migration over and through the superficial deposits	Controlled Waters (Corn Brook 38m north)	Mild	Unlikely	**Very Low**	Considering the poor quality of the Corn Brook (River Quality C) and the impermeable nature of the superficial deposits, it is considered unlikely that any minor contamination within waters onsite would migrate to the Corn Brook.	No further action required.
	Vertical migration through the superficial deposits	Controlled Waters (Secondary A Aquifer)	Medium	Unlikely	**Low**	Considering the considerable depth and impermeable nature of the superficial deposits, it is considered unlikely that any minor contamination within perched waters onsite would migrate downwards to the Secondary A Aquifer within the bedrock.	No further action required.
Organic matter and/or contamination as source material for the generation of ground gas.	Ground gas & vapour migration and inhalation	Site end-users	Medium	Unlikely	**Low**	For the houses on Site 1, the ground gas assessment records a GSV of 0.0029l/hr indicating the site to be classified as NHBC Green gas regime, not requiring gas protection measures.	No further action required.
		Construction and maintenance workers	Mild (Standard Health & Safety precautions likely to be used by workers)	Unlikely	**Very Low**		

Copyright ©2021 Curtins Consulting Ltd

8.1 Summary of Significant Pollutant Linkages

A **Moderate** risk rating is identified to end-users at this stage from direct contact, inhalation and ingestion of contaminants within Made Ground soils. Due to heavy metals, TPHs and PAHs exceedances and asbestos found within the soils underlying the soft landscaping area, an engineered capping layer and geotextile membrane will be required to break the source to receptor pathway. As elevated levels of Naphthalene were identified further investigation/delineation and assessment will be required due to the vapour risk posed to site end-users. The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site.

A **Moderate/Low** risk is posed to site end-users at this stage from dust migration and inhalation from asbestos fibres within soils. As a result, an engineered capping and geotextile membrane to serve as physical barrier between original site soils and site surface in areas of soft landscaping is recommended. Handpicking and careful removal of ACMs should be undertaken if encountered on Site 1.

A **Moderate/Low** to **Low** risk rating is identified to construction workers and adjacent residents at this stage from Made Ground soils. Suitable environmental controls likely to be employed by construction contractors to protect adjacent residents and Health & Safety precautions to protect construction workers should be employed.

The risk to the Secondary A Aquifer within the bedrock underlying the site and to surface waters in particular the Corn Brook, from leachable contamination in site soils through vertical and horizontal migration, has been assessed as **Low** and **Very Low**, respectively, at this stage. This assessment considers the sensitivity of the Corn Brook, and considerable depth and impermeable nature of the superficial deposits anticipated to have a very low infiltration capacity. The site is therefore not considered to be contributing significantly to reduced Corn Brook and groundwater quality, more likely impacted by historic industry in the wider area.

A **Low** risk rating is identified at this stage to site end-users at this stage from ground gas migration and inhalation from soils. This corresponds with a NHBC Green gas regime and BS8485 CS1 gas regime, not requiring gas protection measures.

Copyright ©2021 Curtins Consulting Ltd

9.0 Engineering Assessment and Recommendations

9.1 Introduction

This section will assess the relevant geotechnical issues for the proposed development as mix of 2 and 3 storey houses with areas of car parking, private gardens and soft landscaping. The proposed development plan is contained within *Appendix A*.

The engineering assessment considers foundation design, bearing capacity, settlement, excavations and earthworks for the site. Structural details and loadings have not yet been provided. It should be noted that details may change in the development of designs beyond the issue of this Phase 2 Report and the Construction Designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the site investigation information and their own examination of the site.

9.2 Summary of Ground Conditions

The ground conditions at the site generally comprised variable depth of Made Ground (0.40-5.00m bgl) underlain by firm to very stiff Glacial Till, overlying the Halesowen Formation (weathered greyish-green, fine to medium Sandstone interbedded with greenish-grey siltstone) and the Etruria Formation (weathered, red with green mottling Mudstone) from 11.70-13.00m bgl.

During site works, groundwater was encountered within the bedrock at 13.00m bgl with CP2.

The geotechnical parameters recommended for use in the design based on the ground conditions encountered are summarised in *Table 9.2* below.

Table 9.2 – *Geotechnical Parameters*

Parameter	Glacial Till (Firm Clay at 1.00m bgl)	Bedrock
Undrained Shear Strength, Cu (kPa) (1)	55	-
Coefficient of volume compressibility, mv (m^2/MN) (2)	0.18	-
Unit Weight, γ (kN/m^3) (3)	18	22

(1) Calculated from Undrained Shear Strength in Triaxial Compression test.
(2) mv estimated from SPT N value correlation with average Plasticity Index using a factor of 0.5 (Stroud and Butler, 1975).
(3) From published sources (BS8002).

9.3 Foundation Design

It is understood that the proposed development of Site 1 is to consist of as mix of 2 and 3 storey houses. Loadings are currently unknown and are likely to pre-determine the suitability of the foundations to be adopted at the site.

The shallow ground conditions onsite generally comprise Made Ground (to proven depths of 50.6m to 55.8m AOD), underlain by Glacial Till, overlying bedrock (Sandstone and Mudstone) from 42.40m to 43.30m AOD. Made Ground deposits are not considered suitable as founding strata due to the, generally, loose and variable nature of the deposits, therefore foundations should be taken through the Made Ground and founded in the Glacial Till.

For the residential dwellings, it is expected that shallow strip foundations would be suitable founding in the Glacial Till comprising of firm Clay at approximately 1.00m bgl with an assumed bearing capacity of 100kN/m^2, increasing to approximately 150-175kN/m^2 in stiff Clay at depths greater than 2.00m bgl. However, further calculations should be undertaken to ensure there is an adequate factor of safety against shear failure and limit settlements to within 25mm once loadings are known.

The foundations should be placed beneath the Made Ground and outside the zone of influence of trees in accordance with the NHBC guidance. Where Made Ground is encountered at founding depth, it should be removed and replaced with properly compacted granular fill or foundations should be taken deeper locally. Where strip solutions are utilised, the effects of tree heave should be considered, and foundations should be capable of accommodating the effects of trees, shrubs and hedgerows on shrinkable soils, of medium volume change potential, without excessive movement.

9.4 Ground Floor Slabs

The design of the ground floor slabs will be dependent on the foundation method adopted.

For the residential dwellings within in Site 1, based on observations onsite together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing the ground floor slab on formation prepared in the Glacial Till. Any soft or deleterious material should be removed and replaced with properly compacted granular fill. Where the final levels dictate that the depth of sub floor fill exceeds 600mm, ground floor slabs should be suspended in accordance with NHBC requirements.

9.5 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1 (Ref.8) and laboratory testing undertaken accordingly in *Section 5.8*. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 for all strata. An ACEC class of AC-1 would be appropriate for the site.

9.6 Excavation and Support

Based on observations onsite, together with the results of in-situ and laboratory tests, it is considered that excavations to <1.00m bgl within the Glacial Till should stand unsupported in the short term (1-14

days). Excavations within the Made Ground may not stand unsupported in the short term. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those >1.20m deep, in accordance with Health and Safety Regulations.

Suitable side slope angles excavated in firm to very stiff Clay are likely to be in the region of 20-35 degrees when wet, increasing to 35-45 degrees when dry, based on guidance provided by CIRIA report 97 Trenching Practice (Ref.28).

Excavation through layers of Made Ground and superficial deposits should be feasible using conventional site plant. Following periods of heavy rainfall, the use of a tracked excavator may be required to prevent plant subsidence. Groundwater is not likely to be encountered, however encountering perched water cannot be discounted. It is considered that groundwater inflows, if encountered, may be controlled by pumping from sumps.

Copyright ©2021 Curtins Consulting Ltd

10.0 Conclusions & Recommendations

10.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in *Section 8.0*.

10.1.1 Ground Contamination

The environmental chemistry soil results have been compared with the Generic Assessment Criteria (GAC) for soils with respect to human health against '*Residential with home grown produce*' thresholds.

With respect to the proposed end-use of the site GAC thresholds have been exceeded with respect to heavy metals, TPHs and PAHs (including Naphthalene); these concentrations are likely to be associated with ash within the Made Ground. Asbestos fibres within soils were also identified.

It is considered that the risk presented to site end-users, primarily in landscaped areas, from Made Ground soils onsite is **Moderate**; consequently, an engineered capping layer and geotextile membrane will be required to break the source to receptor pathway.

The building footprint and areas of hard standing will break the source-pathway-receptor linkage across the remainder of the site.

As elevated levels of Naphthalene were identified, further investigation/delineation and assessment will be required due to the vapour risk posed to site end-users.

10.1.2 Groundwater Contamination

The environmental chemistry water results have been compared with the Tier 1 criteria for water; with respect to groundwater against EU Drinking Water Standards (DWS) and with respect to surface water against WFD EQS thresholds (WHO guidelines used where no EU DWS & WFD EQS thresholds).

The Tier 1 thresholds have been minorly exceeded with respect to metals, sulphate, PAHs and TPHs. The risk to the Secondary A Aquifer within the bedrock underlying the site and to surface waters in particular the Corn Brook, from leachable contamination in site soils through vertical and horizontal migration, has been assessed as Low and Very Low, respectively, at this stage.

This assessment considers the sensitivity of the Corn Brook, and considerable depth and impermeable nature of the superficial deposits anticipated to have a very low infiltration

capacity. The site is therefore not considered to be contributing significantly to reduced Corn Brook and groundwater quality, more likely impacted by historic industry in the wider area.

10.1.3 Ground Gas Assessment

Six gas monitoring visits have been undertaken, with maximum carbon dioxide concentration of 2.9% v/v and a maximum flow of -0.3 l/hr recorded for Site 1. The risk to the end-user the development site from soil gases is therefore considered to be **Low**. The gas regime for the site is NHBC Green for the houses, requiring no gas protection measures.

The BGS Radon Mapping confirms the site is situated in an area where 1% to 3% of homes are above the radon action level. On this basis no radon protection measures are considered necessary in the construction of new dwellings or extensions. Where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

10.1.4 Geotechnical Assessment

For the residential dwellings within Site 1 and 2, it is expected that shallow strip foundations would be suitable founding in the Glacial Till comprising of firm Clay at approximately 1.00m bgl with an assumed bearing capacity of 100kN/m^2 increasing to approximately 150-175kN/m^2 in stiff Clay at depths greater than 2.00m bgl. However, further calculations should be undertaken to ensure there is an adequate factor of safety against shear failure and limit settlements to within 25mm once loadings are known. It is recommended that, outside the zone of influence of trees, consideration is given to constructing the ground floor slab on formation prepared in the Glacial Till.

Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 and an ACEC class of AC-1 would be appropriate for the site.

10.1.5 Additional Considerations

Risk mapping for UXOs has placed the site within a Moderate risk area. A review of post-WWII historical mapping shows ruins located 100-200m to the northeast and 200m to the northwest. Analysis of historical mapping from the University of Manchester records bomb strikes in the vicinity during WWII; they show the area around the site was damaged during the bombings. A Detailed Unexploded Ordnance (UXO) Risk Assessment has concluded that the majority of the site was **Low** risk, but the southeast of Site 2 was **Medium** risk; the recommendations are summarised within *Section 2.6*.

10.2 Recommendations

Based on the findings of the ground investigation, the following recommendations are made:

1) Due to the elevated concentrations Lead, PAHs, TPHs and the presence of asbestos fibres within the soil, an engineered capping and geotextile membrane will be required to serve as physical barrier between original site soils and site surface in areas of soft landscaping.
2) Elevated concentrations of Naphthalene will need further investigation/delineation and assessment due to the vapour risk posed to site end-users.
3) Contaminant resistant water supply pipes may be required within the development; this should first be confirmed following assessment by the utility provider.

It is recommended that construction workers are provided with appropriate PPE and sanitary facilities with reference to the environmental testing results presented herein and within *Appendix C*.

Copyright ©2021 Curtins Consulting Ltd

11.0 References

1. Curtins (2018) Phase 1 Preliminary Risk Assessment, Gorton Lane Sites, Gorton (ref. 067694-CUR-XX-RP-GE-001-V02).
2. 1st Line Defence (2018) Detailed Unexploded Ordnance (UXO) Threat & Risk Assessment (ref. DA6611-00).
3. Environment Agency (2004) Model Procedures for the management of land Contamination Contaminated Land Report 11 (report no. CLR11).
4. British Standards Institution (2011) Investigation of Potentially Contaminated Sites (report no. BS10175).
5. British Standards Institution BSI (2010) Code of Practice for Site Investigations (report no. BS5930).
6. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
7. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
8. Building Research Establishment (2005) Concrete in Aggressive Ground (Special Digest 1).
9. British Standards Institution (2013) Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs) (report no.BS8576:2013).
10. Environment Agency (2014) Contaminated Land Exposure (CLEA) Tool (version 1.071).
11. Environment Agency (2009) Human Health Toxicological Assessment of Contaminants in Soil (report no. SC050021/SR2).
12. Environment Agency (2009) Updated Technical Background to the CLEA Model (report no. SC050021/SR3).
13. Department of Environment Food and Rural Affairs (DEFRA) (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
14. SoBRA (2017) Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater – Version 1.0.
15. Environment Agency (2006) Remedial Targets Methodology - Hydrogeological Risk Assessment for Land Contamination (report no.ea/br/e/std/vr10thanni).
16. European Union (1998) Drinking Water Directive (Council Directive 98/83/EC).
17. The Water Framework Directive, (Standards and Classification) Directions (England and Wales).
18. World Health Organisation (2017) Guidelines for Drinking Water Quality (4th edition).
19. UK Water Industry Research (2010) Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (report no. 10/WM/03/21).
20. Contaminated Land: Applications in Real Environments (CL:AIRE) (2011) Definition of Waste Code of Practice (version 2).
21. Environment Agency (2015) Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (1st edition).

Copyright ©2021 Curtins Consulting Ltd

22. CIRIA (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (report no. C665).
23. British Standards Institution (2015) Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (report no.BS8485).
24. NHBC (2007) Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present (report no. 04).
25. S Wilson, G Card, S Haines (2009) Ground Gas Handbook Cathness, Scotland, Whittles Publishing.
26. CIRIA (2001) Contaminated Land Risk Assessment. A guide to good practice (report no. C552).
27. CITB (2015) Construction (Design and Management) Regulations.
28. CIRIA (2001) Trenching Practice, 2nd Edition (report no. 97).

Copyright ©2021 Curtins Consulting Ltd

Appendix A Drawings

- OMi Architects, Site Layout Plan – Second, drawing ref. L0152 Rev A (dated July 2021).
- Curtins, Site 1 Exploratory Hole Location Plan, drawing ref. 068244-CUR-00-XX-DR-GE-001-V01 (dated June 2018).
- Curtins, Diagrammatic Conceptual Site Model, drawing no. 068244-CUR-00-XX-DR-GE-003-V01 (dated July 2018).

Copyright ©2021 Curtins Consulting Ltd

POTTERY LANE

GORTON LANE

GORTON LANE

KEY

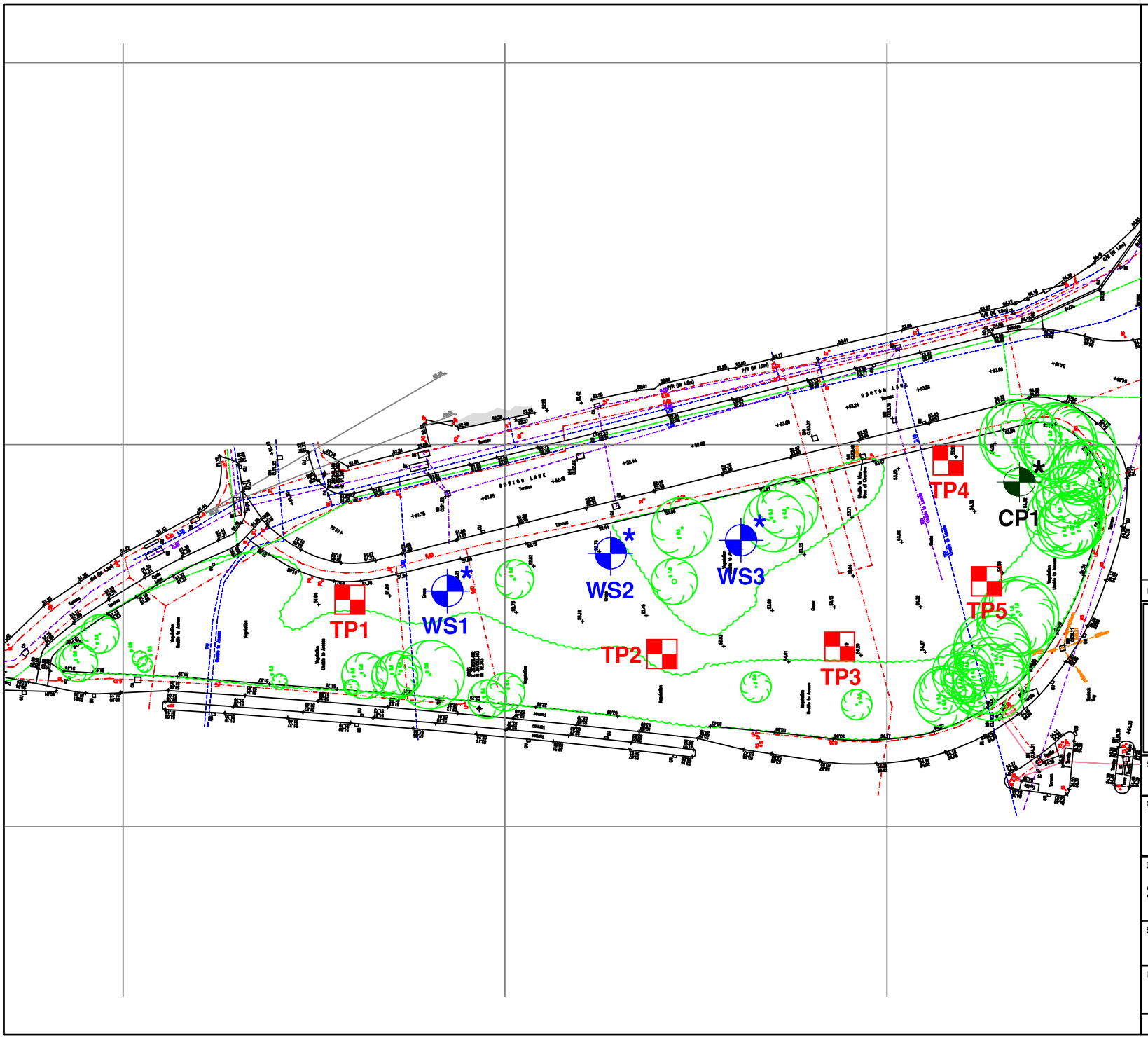
- 3 BED 4 PERSON HOUSE
- 4 BED 6 PERSON HOUSE
- PAVING TO PRIVATE EXTERNAL AREAS
- RESIDENTS' PARKING COURT
- DENSE PLANTING
- PRIVATE GARDEN
- SITE BOUNDARY
- NEW TREE
- EXISTING TREE

One Manchester
Gorton Lane, Manchester

Site Layout Plan - Second

1:200 @ A1 JUL 2021
1405 DWG: L0152 A

OMI Architects



Machine Excavated Trial Pit

Window Sample Borehole Location

Cable Percussive Borehole Location

* Denotes borehole is installed

Rev:	Description:	Date:	By:	Chkd:

curtins

Curtins Consulting Ltd,
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status: INFORMATION

Project: Gorton Lane

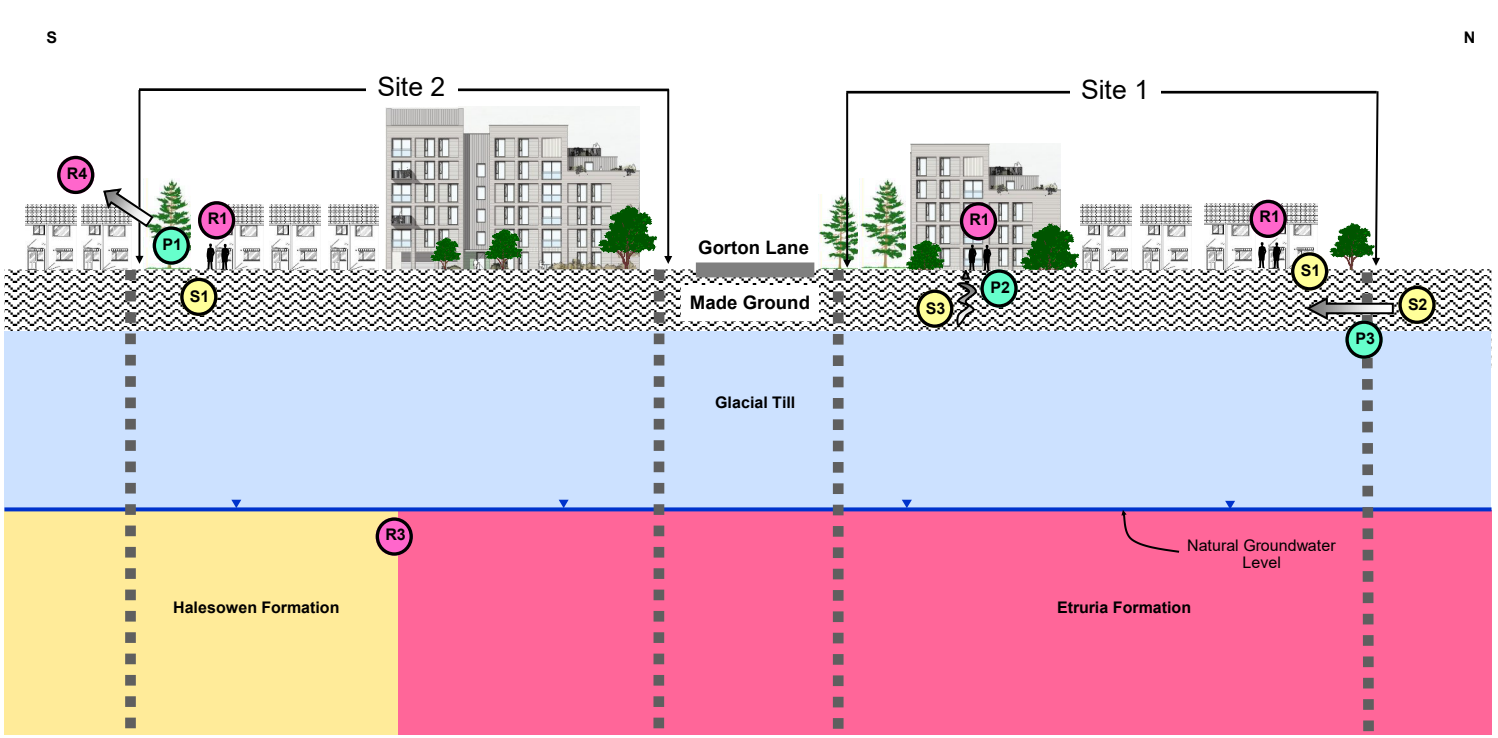
Drg Title: Site 1 Exploratory Hole Location Plan

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	20/06/18	JB	JJ

Drg No: 068244-CUR-00-XX-DR-GE-001-V01 Rev: /

© This drawing is the copyright of Curtins Consulting Ltd

Gorton Lane, Manchester



Sources

- S1 Made Ground (onsite)
- S2 Made Ground (offsite)
- S3 Ground gas sources

Pathways

- P1 Direct contact, ingestion and or inhalation
- P2 Vertical migration
- P3 Horizontal migration

Receptors

- R1 End users (Residential)
- R2 Construction worker
- R3 Groundwater
- R4 Nearby residents

curtins
Merchant Exchange,
17-19 Whitworth Street West,
Manchester, M1 5WG
Tel: 0161 236 2394

Project	Drawing No.	Author	Client
Gorton Lane	068244-CUR-00-XX-DR-GE-003-V01	JB	One Manchester
Drawing Title	**Date**	**Checked**	**Scale**
Diagrammatic Conceptual Model	09/07/2018	SH	Not to scale

Appendix B Exploratory Hole Logs

- Cable Percussive Borehole Log, CP1
- Window Sample Borehole Logs, WS01 to WS03.
- Machine Excavated Pit Logs, TP01 to TP05.

Copyright ©2021 Curtins Consulting Ltd

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Borehole Log

Borehole No. **CP1**
Sheet 1 of 2

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: -	Hole Type CP
Location: Manchester		Level: 54.60	Scale 1:40
Client: One Manchester		Dates: 04/06/2018 - 04/06/2018	Logged By JB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30 - 0.40	ES		0.20 0.25 0.40	54.40 54.35 54.20		Grass over MADE GROUND of dark brown, very gravelly, sandy CLAY. Gravel is angular to sub-rounded, fine to medium of coal, brick, concrete, asphalt and various lithologies. ASPHALT. MADE GROUND of dark brown, very gravelly, fine to coarse SAND. Gravel is angular to sub-angular, fine to coarse of brick, asphalt, concrete, coal, glass and various lithologies.
		1.20		N=19 (3,3/4,5,5,5)	1.00	53.60		MADE GROUND of brown with grey mottling, gravelly, sandy CLAY. Gravel is sub-angular to sub-rounded of various lithologies, brick, concrete and coal.
		2.00		N=23 (7,6/4,6,6,7)				Stiff, brown with grey, gravelly, slightly sandy CLAY. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone and mudstone.
		3.00		N=20 (2,2/4,5,5,6)				
		3.40 - 3.60	D					
		4.00		N=38 (4,4/7,8,11,12)	4.00	50.60		Very stiff, brown, very sandy, very gravelly CLAY with rare cobbles. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including coal, mudstone, sandstone, quartzite.
		5.00		N=29 (3,5/6,7,8,8)				
		6.00 - 6.45	U					
		7.20		N=50 (5,6/50 for 245mm)				

Continued on next sheet

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater not encountered. Elevations are estimated from topographic survey.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Borehole Log

Borehole No.
CP1
Sheet 2 of 2

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: -	Hole Type CP
Location: Manchester		Level: 54.60	Scale 1:40
Client: One Manchester		Dates: 04/06/2018 - 04/06/2018	Logged By JB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		8.50		N=50 (5,11/50 for 270mm)				
		10.00		50 (25 for 70mm/50 for 35mm)	10.00	44.60		End of borehole at 10.00 m

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater not encountered. Elevations are estimated from topographic survey.

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Borehole Log

Borehole No.
WS1
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: -	Hole Type WS
Location: Manchester		Level: 51.90	Scale 1:40
Client: One Manchester		Dates: 05/06/2018 - 05/06/2018	Logged By JB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	51.70		Grass over MADE GROUND of dark brown, sandy, silty CLAY with frequent rootlets and rare gravel of sandstone, brick and coal.
		0.40 - 0.50	ES		0.40	51.50		MADE GROUND of dark brown, slightly clayey, fine to coarse SAND and angular to sub-angular, fine to coarse GRAVEL of brick, concrete, clay pipe, coal, slate and clinker.
		1.20		N=12 (2,2/3,3,3,3)	1.30	50.60		MADE GROUND of black, fine to coarse SAND and angular to sub-angular, fine to coarse GRAVEL of ash, clinker, coal, brick, glass, slate, sandstone and concrete (ASH FILL).
		2.00		N=22 (3,3/5,5,6,6)				Stiff, greyish-brown with grey mottling, sandy, slightly gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone and mudstone.
		3.00		N=31 (6,6/6,8,8,9)				*Becomes very stiff.*
		3.50 - 4.00	D					
		4.00		N=40 (10,10/10,10,10,10)	4.20	47.70		Very stiff, brown, very sandy, slightly gravelly CLAY with rare cobbles. Gravel is sub-angular to rounded, fine to medium of various lithologies including sandstone, quartzite, mudstone and coal.
		5.00		N=47 (10,10/11,11,12,13)	5.00	46.90		End of borehole at 5.00 m

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater not encountered. Elevations are estimated from topographic survey.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Borehole Log

Borehole No. **WS2**

Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: -	Hole Type WS
Location: Manchester		Level: 52.70	Scale 1:40
Client: One Manchester		Dates: 05/06/2018 - 05/06/2018	Logged By JB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	52.30		Grass over MADE GROUND of dark brown, sandy, silty CLAY with frequent rootlets. Gravel is angular to sub-rounded, fine to coarse of brick, slate, glass and ceramic.
					1.00	51.70		Firm, brownish-grey with orange mottling, very sandy, silty CLAY with rare gravel of various lithologies including sandstone, quartzite, mudstone and coal.
		1.20		N=10 (2,2/3,3,2,2)				Firm, brown with grey, slightly gravelly, sandy CLAY. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone, quartzite and mudstone.
		2.00		N=19 (4,4/4,5,5,5)				*Becomes stiff.*
		3.00		N=21 (5,5/5,5,5,6)				*Becomes very stiff.*
		4.00		N=50 (7,9/50 for 275mm)				*Sandstone cobbles.*
		4.50 - 5.00	D		4.30	48.40		Very stiff, brown, very sandy, slightly gravelly CLAY with rare cobbles of sandstone. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including sandstone, mudstone, coal and quartzite.
		5.00		50 (17,17/50 for 225mm)	5.00	47.70		End of borehole at 5.00 m

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater not encountered. Elevations are estimated from topographic survey.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Borehole Log

Borehole No. **WS3**
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: -	Hole Type WS
Location: Manchester		Level: 53.50	Scale 1:40
Client: One Manchester		Dates: 05/06/2018 - 05/06/2018	Logged By JB

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	53.10		Grass over MADE GROUND of dark brown, sandy, silty CLAY with frequent rootlets and fragments of slate, glass, brick, concrete and ceramic.
					0.60	52.90		MADE GROUND of reddish-brown, sandy, angular to sub-angular, fine to coarse GRAVEL and COBBLES of brick.
		1.20		N=15 (3,3/3,4,4,4)				Firm, brownish-grey with orange mottling, very sandy, silty CLAY with rare gravel of various lithologies including sandstone, quartzite, mudstone and coal.
								Becomes stiff and vertical blueish-grey silt lenses (desiccation cracks).
		1.80 - 2.00	D					
		2.00		N=16 (4,4/4,4,4,4)				
		3.00		N=24 (5,5/6,6,6,6)				
								Rare cobbles.
		4.00		N=28 (6,7/7,7,7,7)				
					4.20	49.30		Very stiff, dark brown, very sandy, gravelly CLAY. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including sandstone, mudstone, coal and quartzite.
		5.00		N=50 (10,15/15,15,15,5)	5.00	48.50		End of borehole at 5.00 m

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater not encountered. Elevations are estimated from topographic survey.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Trial Pit Log

Trialpit No
TP1
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: - Level: 51.90	Date 07/06/2018
Location: Manchester		Dimensions (m): Depth 2.00	Scale 1:25
Client: One Manchester			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	51.60		Grass over MADE GROUND of dark brown, slightly gravelly, sandy CLAY with frequent rootlets and cobbles of brick and concrete. Gravel is angular to sub-rounded, fine to coarse of sandstone, brick, coal and concrete.
				2.00	49.90		MADE GROUND of dark greyish-brown, slightly clayey, fine to coarse SAND and angular to sub-rounded, fine to coarse GRAVEL of concrete, brick, metal, ash, clinker, coal, slate, glass and wood with cobbles of whole and part brick, concrete and tile and rare pockets of clay. End of pit at 2.00 m

1
2
3
4
5

Remarks: Groundwater not encountered. Trial pit terminated at 2.00m bgl due to side walls collapsing. Elevations are estimated from topographic survey.

Stability: Unstable - side wall collapse.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Trial Pit Log

Trialpit No
TP2
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: - Level: 53.50	Date 07/06/2018
Location: Manchester		Dimensions (m): Depth 3.50	Scale 1:25
Client: One Manchester			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.50	53.00		Grass over MADE GROUND of dark brown, very gravelly, sandy CLAY with frequent rootlets and cobbles of brick and concrete. Gravel is angular to sub-rounded, fine to coarse of aggregate, slate, concrete, brick, metal, clinker, coal and plastic. *Concrete obstruction.*
	0.70 - 0.80	ES		1.10	52.40		MADE GROUND of light brown, slightly clayey, fine to coarse SAND and angular to sub-rounded, fine to coarse GRAVEL of aggregate, concrete, brick and slate.
				1.70	51.80		Firm, orangish-brown with grey mottling, very sandy, gravelly CLAY with grey fine sand lenses. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone, mudstone and chert.
				3.50	50.00		Stiff, brown with grey mottling, sandy, slightly gravelly CLAY with rare rounded cobbles and vertical grey silt lenses. Gravel is sub-angular to rounded, fine of various lithologies including sandstone, coal and quartzite.
							End of pit at 3.50 m

1 2 3 4 5

Remarks: Groundwater not encountered. Elevations are estimated from topographic survey.

Stability: Stable.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Trial Pit Log

Trialpit No
TP3
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: - Level: 54.20	Date 07/06/2018
Location: Manchester		Dimensions (m): Depth 3.50	Scale 1:25
Client: One Manchester			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Grass over MADE GROUND of dark brown, very gravelly, sandy CLAY with frequent rootlets and cobbles of brick and concrete. Gravel is angular to sub-rounded, fine to coarse of aggregate, slate, concrete, brick, metal, clinker, coal and plastic.
	0.70 - 0.90	ES		0.70	53.50		MADE GROUND of black, fine to coarse SAND and angular to sub-angular, fine to coarse GRAVEL of ash, clinker, coal, brick and concrete (ASH FILL).
				0.90	53.30		Firm, orangish-brown with grey mottling, very sandy, gravelly CLAY with grey fine sand lenses. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone, mudstone and chert.
				1.40	52.80		Stiff, brown with grey mottling, sandy, slightly gravelly CLAY with rare rounded cobbles and vertical grey silt lenses. Gravel is sub-angular to rounded, fine of various lithologies including sandstone, coal and quartzite.
				3.50	50.70		End of pit at 3.50 m

1
2
3
4
5

Remarks: Groundwater not encountered. Elevations are estimated from topographic survey.

Stability: Stable.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Trial Pit Log

Trialpit No
TP4
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: - Level: 53.90	Date 07/06/2018
Location: Manchester		Dimensions (m): Depth 3.50	Scale 1:25
Client: One Manchester			Logged JB

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							Grass over MADE GROUND of dark brown, very gravelly, sandy CLAY with frequent rootlets and cobbles of brick and concrete. Gravel is angular to sub-rounded, fine to coarse of aggregate, slate, concrete, brick, metal, clinker, coal and plastic.
				0.40	53.50		
	0.60 - 0.80	ES					MADE GROUND of reddish-grey, fine to coarse SAND and angular to sub-rounded, fine to coarse GRAVEL of brick, cables, concrete, clinker, ash, coal, sandstone with whole and part brick cobbles (ASH & BRICK FILL).
				0.90	53.00		
							Stiff, brown with grey mottling, sandy, slightly gravelly CLAY with rare rounded cobbles and vertical grey silt lenses. Gravel is sub-angular to rounded, fine of various lithologies including sandstone, coal and quartzite.
				3.50	50.40		End of pit at 3.50 m

1
2
3
4
5

Remarks: Groundwater not encountered. Elevations are estimated from topographic survey.

Stability: Stable.

AGS

Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Trial Pit Log

Trialpit No
TP5
Sheet 1 of 1

Project Name: Gorton Lane	Project No. B068244.000	Co-ords: - Level: 54.60	Date 07/06/2018
Location: Manchester		Dimensions (m): Depth 3.50	Scale 1:25
Client: One Manchester			Logged JB

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.40 - 0.50	ES					Grass over MADE GROUND of dark brown, very gravelly, sandy CLAY with frequent rootlets and cobbles of brick and concrete. Gravel is angular to sub-rounded, fine to coarse of aggregate, slate, concrete, brick, metal, clinker, coal and plastic.
				1.00	53.60		Firm, orangish-brown with grey mottling, very sandy, gravelly CLAY with grey fine sand lenses. Gravel is sub-angular to sub-rounded, fine to medium of various lithologies including coal, sandstone, mudstone and chert.
				1.20	53.40		Stiff, brown with grey mottling, sandy, slightly gravelly CLAY with rare rounded cobbles and vertical grey silt lenses. Gravel is sub-angular to rounded, fine of various lithologies including sandstone, coal and quartzite.
				3.50	51.10		End of pit at 3.50 m

1 2 3 4 5

Remarks: Groundwater not encountered. Elevations are estimated from topographic survey.

Stability: Stable.

AGS

Appendix C Chemical Laboratory Testing Results

- Concept Life Sciences, Environmental Chemistry Analysis Results (Soil):
  - Certificate No. 743109-1
  - Certificate No. 742475-1
  - Certificate No. 745399-1 (asbestos quantification)
- Concept Life Sciences, Environmental Chemistry Analysis Results (Water):
  - Certificate No. 751948-1

Copyright ©2021 Curtins Consulting Ltd

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 743109-1

Date of Report: 18-Jun-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Siobhan Hyde

Customer Job Reference: B068244
Customer Purchase Order: EBMA1255
Customer Site Reference: Gorton Lane
Date Job Received at Concept: 08-Jun-2018
Date Analysis Started: 11-Jun-2018
Date Analysis Completed: 18-Jun-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service Advisor

This document has been printed from a digitally signed master copy

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Curtins Suite A

				Concept Reference	**743109 003**	**743109 009**	**743109 010**	**743109 011**	**743109 012**
				Customer Sample Reference	**WS6**	**TP7**	**TP10**	**TP12**	**TP9**
				Bottom Depth	**0.5**	**0.4**	**1.0**	**0.8**	**0.5**
				Top Depth	**0.4**	**0.3**	**0.8**	**0.6**	**0.3**
				Date Sampled	**06-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Topsoil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**20**	**18**	**54**	**18**	**19**
Cadmium	T6	M40	1	mg/kg	<1	<1	**1**	<1	<1
Chromium	T6	M40	1	mg/kg	**24**	**29**	**45**	**17**	**24**
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	**59**	**130**	**1200**	**74**	**91**
Lead	T6	M40	1	mg/kg	**220**	**260**	**740**	**610**	**250**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**28**	**29**	**130**	**15**	**28**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**200**	**190**	**330**	**310**	**180**
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Asbestos ID	T27	A40			N.D.	N.D.	Chrysotile Detected	N.D.	N.D.
pH	T7	A40			**7.7**	**8.0**	**7.9**	**7.9**	**7.9**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	**0.06**	<0.05	**0.35**	**0.08**	<0.05
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	**1**	<1	<1
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
Soil Organic Matter	T287	A40	0.1	%	<0.1	<0.1	**0.2**	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Curtins Suite A

				Concept Reference	**743109 013**	**743109 014**	**743109 015**	**743109 016**	**743109 017**
				Customer Sample Reference	**TP8**	**TP2**	**TP3**	**TP5**	**TP4**
				Bottom Depth	**1.6**	**0.8**	**0.9**	**0.5**	**0.8**
				Top Depth	**1.4**	**0.7**	**0.7**	**0.4**	**0.6**
				Date Sampled	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**17**	**12**	**24**	**22**	**13**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**14**	**16**	**23**	**20**	**12**
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	**120**	**45**	**96**	**69**	**49**
Lead	T6	M40	1	mg/kg	**1200**	**150**	**230**	**180**	**620**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**12**	**17**	**27**	**21**	**10**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**580**	**130**	**82**	**150**	**460**
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Asbestos ID	T27	A40			N.D.	N.D.	N.D.	N.D.	N.D.
pH	T7	A40			**8.4**	**8.9**	**7.3**	**8.3**	**8.3**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	<0.05	**0.05**	**0.46**	<0.05	<0.05
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1	<1	<1
Soil Organic Matter	T287	A40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Curtins Suite A

Concept Reference	**743109 018**	**743109 021**
Customer Sample Reference	**TP11**	**TP6**
Bottom Depth	**0.7**	**0.4**
Top Depth	**0.5**	**0.3**
Date Sampled	**07-JUN-2018**	**07-JUN-2018**
Matrix Class	**Sandy Soil**	**Sandy Soil**

Determinand	Method	Test Sample	LOD	Units		
Arsenic	T6	M40	2	mg/kg	**9**	**22**
Cadmium	T6	M40	1	mg/kg	<1	**1**
Chromium	T6	M40	1	mg/kg	**23**	**29**
Chromium VI	T6	A40	1	mg/kg	<1	<1
Copper	T6	M40	1	mg/kg	**36**	**210**
Lead	T6	M40	1	mg/kg	**140**	**460**
Mercury	T6	M40	1	mg/kg	<1	<1
Nickel	T6	M40	1	mg/kg	**10**	**28**
Selenium	T6	M40	3	mg/kg	<3	<3
Zinc	T6	M40	1	mg/kg	**81**	**290**
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1
Asbestos ID	T27	A40			N.D.	N.D.
pH	T7	A40			**7.9**	**8.1**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	<0.05	<0.05
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1
Soil Organic Matter	T287	A40	0.1	%	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
TPH (CWG) with MTBE, BTEX

Concept Reference	**743109 003**	**743109 009**	**743109 010**	**743109 011**	**743109 012**
Customer Sample Reference	**WS6**	**TP7**	**TP10**	**TP12**	**TP9**
Bottom Depth	**0.5**	**0.4**	**1.0**	**0.8**	**0.5**
Top Depth	**0.4**	**0.3**	**0.8**	**0.6**	**0.3**
Date Sampled	**06-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
Matrix Class	**Topsoil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**

Determinand	Method	Test Sample	LOD	Units					
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1	(13,110) <2	(13) <1	(13,110) <2
Toluene	T54	AR	1	µg/kg	**(13) 7**	**(13) 21**	(110,13) <2	(13) <1	**(13) 14**
EthylBenzene	T54	AR	1	µg/kg	<1	<1	(110) <2	<1	(110) <2
M/P Xylene	T54	AR	1	µg/kg	<1	<1	(110) <2	<1	(110) <2
O Xylene	T54	AR	1	µg/kg	**1**	<1	(110) <2	<1	(110) <2
Xylene (Total)	T54	AR	1	µg/kg	<1	<1	(110) <2	<1	(110) <2
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	(110) <2	<1	(110) <2
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.020	<0.010	(110) <0.020
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.020	<0.010	(110) <0.020
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.020	<0.010	(110) <0.020
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	(13) <1	(13) <1	(13,9) <10	(13) <1	(13) <1
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	**(13) 1**	**(13) 2**	(9,13) <10	(13) <1	**(13) 1**
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	**(13) 2**	**(13) 5**	(9,13) <10	**(13) 1**	**(13) 2**
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	**(13) 8**	**(13) 19**	**(13,9) 61**	**(13) 6**	**(13) 12**
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	**10**	**24**	**61**	**7**	**14**
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.020	<0.010	(110) <0.020
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	**0.021**	(110) <0.020	<0.010	**0.014**
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.020	<0.010	(110) <0.020
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	(13) <2	(13) <2	(13,9) <10	(13) <2	(13) <2
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	**(13) 2**	**(13) 15**	**(13,9) 15**	**(13) 3**	**(13) 5**
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	**(13) 11**	**(13) 83**	**(13,9) 110**	**(13) 23**	**(13) 34**
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	**(13) 24**	**(13) 200**	**(13,9) 300**	**(13) 58**	**(13) 96**

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
TPH (CWG) with MTBE, BTEX

				Concept Reference	**743109 013**	**743109 014**	**743109 015**	**743109 016**	**743109 017**
				Customer Sample Reference	**TP8**	**TP2**	**TP3**	**TP5**	**TP4**
				Bottom Depth	**1.6**	**0.8**	**0.9**	**0.5**	**0.8**
				Top Depth	**1.4**	**0.7**	**0.7**	**0.4**	**0.6**
				Date Sampled	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1	(13) <1	(13,110) <2	(13) <1
Toluene	T54	AR	1	µg/kg	**(13) 21**	**(13) 2**	**(13) 39**	**(13) 7**	**(13) 3**
EthylBenzene	T54	AR	1	µg/kg	<1	<1	<1	(110) <2	<1
M/P Xylene	T54	AR	1	µg/kg	<1	<1	**2**	(110) <2	<1
O Xylene	T54	AR	1	µg/kg	<1	<1	**2**	(110) <2	<1
Xylene (Total)	T54	AR	1	µg/kg	<1	<1	(110) <2	(110) <2	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	<1	(110) <2	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.010	(110) <0.020	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.010	(110) <0.020	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.010	(110) <0.020	<0.010
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	(13) <1	(13) <1	**(13) 16**	(13,9) <10	(13) <1
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	(13) <1	(13) <1	**(13) 270**	(13,9) <10	(13) <1
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	**(13) 1**	**(13) 1**	**(13) 430**	(13,9) <10	**(13) 2**
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	**(13) 6**	**(13) 11**	**(13) 210**	**(13,9) 40**	**(13) 9**
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	**7**	**12**	**640**	**40**	**11**
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.010	(110) <0.020	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	**0.021**	<0.010	**0.039**	(110) <0.020	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	(110) <0.010	(110) <0.020	<0.010
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	(13) <2	(13) <2	**(13) 11**	(9,13) <10	(13) <2
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	**(13) 1**	(13) <1	**(13) 82**	**(13,9) 21**	**(13) 3**
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	**(13) 8**	**(13) 10**	**(13) 150**	**(13,9) 190**	**(13) 11**
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	**(13) 37**	**(13) 29**	**(13) 49**	**(13,9) 570**	**(13) 22**

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
TPH (CWG) with MTBE, BTEX

Concept Reference	**743109 018**	**743109 021**
Customer Sample Reference	**TP11**	**TP6**
Bottom Depth	**0.7**	**0.4**
Top Depth	**0.5**	**0.3**
Date Sampled	**07-JUN-2018**	**07-JUN-2018**
Matrix Class	**Sandy Soil**	**Sandy Soil**

Determinand	Method	Test Sample	LOD	Units		
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1
Toluene	T54	AR	1	µg/kg	**(13) 2**	(13) <1
EthylBenzene	T54	AR	1	µg/kg	<1	<1
M/P Xylene	T54	AR	1	µg/kg	<1	<1
O Xylene	T54	AR	1	µg/kg	<1	<1
Xylene (Total)	T54	AR	1	µg/kg	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	(13) <1	(13) <1
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	**(13) 2**	**(13) 2**
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	**(13) 5**	**(13) 3**
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	**(13) 28**	**(13) 10**
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	**33**	**13**
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	(13) <2	(13) <2
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	**(13) 13**	**(13) 3**
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	**(13) 84**	**(13) 21**
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	**(13) 190**	**(13) 63**

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Miscellaneous

Concept Reference					**743109 002**	**743109 003**	**743109 009**	**743109 010**	**743109 011**
Customer Sample Reference					**WS6**	**WS6**	**TP7**	**TP10**	**TP12**
Bottom Depth						**0.5**	**0.4**	**1.0**	**0.8**
Top Depth					**0.6**	**0.4**	**0.3**	**0.8**	**0.6**
Date Sampled					**06-JUN-2018**	**06-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
Matrix Class						**Topsoil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Asbestos ID	T27	A40			Amosite Detected Chrysotile Detected	N.D.	N.D.	Chrysotile Detected	N.D.
Moisture @105C	T162	AR	0.1	%	-	**15**	**10**	**11**	**7.8**
Retained on 10mm sieve	T2	M40	0.1	%	-	<0.1	<0.1	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Miscellaneous

Concept Reference					**743109 012**	**743109 013**	**743109 014**	**743109 015**	**743109 016**
Customer Sample Reference					**TP9**	**TP8**	**TP2**	**TP3**	**TP5**
Bottom Depth					**0.5**	**1.6**	**0.8**	**0.9**	**0.5**
Top Depth					**0.3**	**1.4**	**0.7**	**0.7**	**0.4**
Date Sampled					**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
Matrix Class					**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Asbestos ID	T27	A40			N.D.	N.D.	N.D.	N.D.	N.D.
Moisture @105C	T162	AR	0.1	%	**15**	**13**	**5.1**	**16**	**7.2**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Miscellaneous

Concept Reference					**743109 017**	**743109 018**	**743109 021**
Customer Sample Reference					**TP4**	**TP11**	**TP6**
Bottom Depth					**0.8**	**0.7**	**0.4**
Top Depth					**0.6**	**0.5**	**0.3**
Date Sampled					**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
Matrix Class					**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Asbestos ID	T27	A40			N.D.	N.D.	N.D.
Moisture @105C	T162	AR	0.1	%	**12**	**10**	**12**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
PAH USEPA16

Concept Reference					**743109 003**	**743109 009**	**743109 010**	**743109 011**	**743109 012**
Customer Sample Reference					**WS6**	**TP7**	**TP10**	**TP12**	**TP9**
Bottom Depth					**0.5**	**0.4**	**1.0**	**0.8**	**0.5**
Top Depth					**0.4**	**0.3**	**0.8**	**0.6**	**0.3**
Date Sampled					**06-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
Matrix Class					**Topsoil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	(9) <1.0	**0.4**	**0.1**
Acenaphthylene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	(9) <1.0	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	(9) <1.0	**0.5**	**0.1**
Fluorene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	(9) <1.0	**0.3**	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	(9) <1.0	**2.0**	**5.3**	**2.8**	**1.0**
Anthracene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	**1.4**	**0.7**	**0.2**
Fluoranthene	T207	M105	0.1	mg/kg	(9) <1.0	**6.3**	**11**	**4.4**	**1.7**
Pyrene	T207	M105	0.1	mg/kg	(9) <1.0	**6.4**	**9.6**	**3.8**	**1.6**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	(9) <1.0	**3.1**	**6.6**	**1.8**	**0.8**
Chrysene	T207	M105	0.1	mg/kg	(9) <1.0	**3.5**	**6.7**	**1.9**	**0.8**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	(9) <1.0	**3.7**	**6.8**	**1.7**	**0.7**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	(9) <1.0	**3.8**	**6.2**	**1.1**	**0.6**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	(9) <1.0	**4.3**	**7.7**	**1.6**	**0.8**
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	(9) <1.0	**2.0**	**4.0**	**0.9**	**0.4**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	(9) <1.0	(9) <1.0	**1.8**	**0.4**	**0.1**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	(9) <1.0	**2.5**	**4.4**	**1.0**	**0.5**
PAH(total)	T207	M105	0.1	mg/kg	(9) <1.0	**40**	**73**	**23**	**9.5**

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
PAH USEPA16

				Concept Reference	**743109 013**	**743109 014**	**743109 015**	**743109 016**	**743109 017**
				Customer Sample Reference	**TP8**	**TP2**	**TP3**	**TP5**	**TP4**
				Bottom Depth	**1.6**	**0.8**	**0.9**	**0.5**	**0.8**
				Top Depth	**1.4**	**0.7**	**0.7**	**0.4**	**0.6**
				Date Sampled	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T207	M105	0.1	mg/kg	<0.1	**0.1**	<0.1	**1.6**	**0.1**
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	**0.2**	**0.1**	**3.0**	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	**0.2**	**0.4**	**2.2**	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**0.5**	**2.5**	**0.9**	**24**	**0.8**
Anthracene	T207	M105	0.1	mg/kg	<0.1	**0.7**	<0.1	**6.2**	**0.1**
Fluoranthene	T207	M105	0.1	mg/kg	**1.1**	**6.2**	**0.7**	**31**	**1.1**
Pyrene	T207	M105	0.1	mg/kg	**1.0**	**6.0**	**0.8**	**25**	**1.1**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**0.6**	**3.3**	**0.4**	**13**	**0.5**
Chrysene	T207	M105	0.1	mg/kg	**0.6**	**3.1**	**0.4**	**13**	**0.6**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**0.7**	**2.2**	**0.4**	**13**	**0.5**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	**0.4**	**1.9**	**0.2**	**7.0**	**0.3**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**0.6**	**2.5**	**0.4**	**10**	**0.5**
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**0.5**	**1.0**	**0.2**	**5.2**	**0.3**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**0.2**	**0.6**	**0.1**	**2.2**	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**0.8**	**1.6**	**0.3**	**6.1**	**0.3**
PAH(total)	T207	M105	0.1	mg/kg	**7.2**	**32**	**5.3**	**160**	**6.3**

Concept Reference: 743109
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
PAH USEPA16

				Concept Reference	**743109 018**	**743109 021**
				Customer Sample Reference	**TP11**	**TP6**
				Bottom Depth	**0.7**	**0.4**
				Top Depth	**0.5**	**0.3**
				Date Sampled	**07-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Naphthalene	T207	M105	0.1	mg/kg	**6.6**	**0.1**
Acenaphthylene	T207	M105	0.1	mg/kg	(9) <1.0	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	**9.1**	<0.1
Fluorene	T207	M105	0.1	mg/kg	**7.6**	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	**57**	**0.9**
Anthracene	T207	M105	0.1	mg/kg	**14**	**0.2**
Fluoranthene	T207	M105	0.1	mg/kg	**54**	**1.8**
Pyrene	T207	M105	0.1	mg/kg	**47**	**1.8**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**18**	**1.0**
Chrysene	T207	M105	0.1	mg/kg	**19**	**1.0**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**18**	**1.2**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	**9.9**	**0.7**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**16**	**1.1**
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**7.8**	**0.6**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**3.7**	**0.2**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**9.3**	**0.7**
PAH(total)	T207	M105	0.1	mg/kg	**300**	**11**

Index to symbols used in 743109-1

Value	Description
A40	Assisted dried < 40C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
N.D.	Not Detected
13	Results have been blank corrected.
110	LOD raised due to low internal standard recovery.
9	LOD raised due to dilution of sample
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.

Method Index

Value	Description
T2	Grav
T207	GC/MS (MCERTS)
T287	Calc TOC/0.58
T6	ICP/OES
T54	GC/MS (Headspace)
T546	Colorimetry (CF)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T7	Probe
T162	Grav (1 Dec) (105 C)
T27	PLM
T909	GCxGC

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T6	M40	2	mg/kg	M	003,009-018,021
Cadmium	T6	M40	1	mg/kg	M	003,009-018,021
Chromium	T6	M40	1	mg/kg	M	003,009-018,021
Chromium VI	T6	A40	1	mg/kg	N	003,009-018,021
Copper	T6	M40	1	mg/kg	M	003,009-018,021
Lead	T6	M40	1	mg/kg	M	003,009-018,021
Mercury	T6	M40	1	mg/kg	M	003,009-018,021
Nickel	T6	M40	1	mg/kg	M	003,009-018,021
Selenium	T6	M40	3	mg/kg	M	003,009-018,021
Zinc	T6	M40	1	mg/kg	M	003,009-018,021
Boron (water-soluble)	T6	A40	1	mg/kg	N	003,009-018,021
pH	T7	A40			M	003,009-018,021
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	M	003,009-018,021
Cyanide(Total)	T546	AR	1	mg/kg	M	003,009-018,021
Phenols(Mono)	T546	AR	1	mg/kg	M	003,009-018,021
Soil Organic Matter	T287	A40	0.1	%	N	003,009-018,021
Benzene	T54	AR	1	µg/kg	U	003,009-018,021
Toluene	T54	AR	1	µg/kg	U	003,009-018,021
EthylBenzene	T54	AR	1	µg/kg	U	003,009-018,021
M/P Xylene	T54	AR	1	µg/kg	U	003,009-018,021
O Xylene	T54	AR	1	µg/kg	U	003,009-018,021
Xylene (Total)	T54	AR	1	µg/kg	U	003,009-018,021
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	003,009-018,021
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	U	003,009-018,021
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	U	003,009-018,021
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	U	003,009-018,021

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	U	003,009-018,021
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	N	003,009-018,021
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	003,009-018,021
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	U	003,009-018,021
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	U	003,009-018,021
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	U	003,009-018,021
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	U	003,009-018,021
Asbestos ID	T27	A40			SU	002-003,009-018,021
Moisture @105C	T162	AR	0.1	%	N	003,009-018,021
Retained on 10mm sieve	T2	M40	0.1	%	N	003,009-018,021
Naphthalene	T207	M105	0.1	mg/kg	M	003,009-018,021
Acenaphthylene	T207	M105	0.1	mg/kg	U	003,009-018,021
Acenaphthene	T207	M105	0.1	mg/kg	M	003,009-018,021
Fluorene	T207	M105	0.1	mg/kg	M	003,009-018,021
Phenanthrene	T207	M105	0.1	mg/kg	M	003,009-018,021
Anthracene	T207	M105	0.1	mg/kg	U	003,009-018,021
Fluoranthene	T207	M105	0.1	mg/kg	M	003,009-018,021
Pyrene	T207	M105	0.1	mg/kg	M	003,009-018,021
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	003,009-018,021
Chrysene	T207	M105	0.1	mg/kg	M	003,009-018,021
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	003,009-018,021
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	003,009-018,021
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	003,009-018,021
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	003,009-018,021
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	003,009-018,021
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	003,009-018,021
PAH(total)	T207	M105	0.1	mg/kg	U	003,009-018,021

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: Supplemental 742475-1

Date of Report: 21-Jun-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Jess Bailey

Customer Job Reference: BO68244
Customer Purchase Order: EBMA1252
Customer Site Reference: Gorton Lane
Date Job Received at Concept: 06-Jun-2018
Date Analysis Started: 07-Jun-2018
Date Analysis Completed: 14-Jun-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
David Catterall
Laboratory Manager

This document has been printed from a digitally signed master copy

Concept Reference: 742475
Project Site: Gorton Lane
Customer Reference: BO68244

Soil Analysed as Soil
Curtins Suite A

				Concept Reference	**742475 001**	**742475 004**	**742475 007**
				Customer Sample Reference	**CP1**	**WS1**	**CP2**
				Bottom Depth	**0.4**	**0.5**	**0.8**
				Top Depth	**0.3**	**0.4**	**0.5**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Arsenic	T6	M40	2	mg/kg	**12**	**23**	**19**
Cadmium	T6	M40	1	mg/kg	<1	<1	**3**
Chromium	T6	M40	1	mg/kg	**19**	**22**	**570**
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1
Copper	T6	M40	1	mg/kg	**71**	**130**	**160**
Lead	T6	M40	1	mg/kg	**230**	**230**	**420**
Mercury	T6	M40	1	mg/kg	<1	<1	**1**
Nickel	T6	M40	1	mg/kg	**21**	**36**	**33**
Selenium	T6	M40	3	mg/kg	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**180**	**150**	**290**
Boron (water-soluble)	T6	A40	1	mg/kg	<1	<1	<1
Asbestos ID	T27	A40			Chrysotile Fibres Detected	N.D.	N.D.
pH	T7	A40			**8.1**	**8.0**	**7.6**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	<0.05	<0.05	<0.05
Cyanide(Total)	T546	AR	1	mg/kg	<1	<1	<1
Phenols(Mono)	T546	AR	1	mg/kg	<1	<1	<1
Soil Organic Matter	T287	A40	0.1	%	**5.9**	**11**	**7.4**

Concept Reference: 742475
Project Site: Gorton Lane
Customer Reference: BO68244

Soil Analysed as Soil
TPH (CWG) with MTBE, BTEX

				Concept Reference	**742475 001**	**742475 004**	**742475 007**
				Customer Sample Reference	**CP1**	**WS1**	**CP2**
				Bottom Depth	**0.4**	**0.5**	**0.8**
				Top Depth	**0.3**	**0.4**	**0.5**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Benzene	T54	AR	1	µg/kg	(13) <1	(13,110) <2	(13,110) <2
Toluene	T54	AR	1	µg/kg	**4**	(110) <2	(110) <2
EthylBenzene	T54	AR	1	µg/kg	**7**	(110) <2	(110) <2
M/P Xylene	T54	AR	1	µg/kg	**19**	(110) <2	(110) <2
O Xylene	T54	AR	1	µg/kg	**19**	(110) <2	(110) <2
Xylene (Total)	T54	AR	1	µg/kg	**38**	(110) <2	(110) <2
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	(110) <2	(110) <2
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(110) <0.020
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(110) <0.020
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(110) <0.020
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	(13) **5**	(13) **3**	(13) <1
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	(13) **32**	(13) **15**	(13) **9**
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	(13) **98**	(13) **54**	(13) **51**
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	(13) **89**	(13) **68**	(13) **51**
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	**190**	**120**	**100**
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(110) <0.020
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	(110) <0.020	(110) <0.020
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	**0.26**	(110) <0.020	(110) <0.020
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	(13) **51**	(13) **4**	(13) **9**
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	(13) **210**	(13) **93**	(13) **81**
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	(13) **750**	(13) **440**	(13) **450**
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	(13) **1300**	(13) **820**	(13) **770**

Concept Reference: 742475
Project Site: Gorton Lane
Customer Reference: BO68244

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**742475 001**	**742475 004**	**742475 007**
				Customer Sample Reference	**CP1**	**WS1**	**CP2**
				Bottom Depth	**0.4**	**0.5**	**0.8**
				Top Depth	**0.3**	**0.4**	**0.5**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Moisture @105C	T162	AR	0.1	%	**8.4**	**7.5**	**18**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1

Concept Reference: 742475
Project Site: Gorton Lane
Customer Reference: BO68244

Soil Analysed as Soil
PAH USEPA16

				Concept Reference	**742475 001**	**742475 004**	**742475 007**
				Customer Sample Reference	**CP1**	**WS1**	**CP2**
				Bottom Depth	**0.4**	**0.5**	**0.8**
				Top Depth	**0.3**	**0.4**	**0.5**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Naphthalene	T207	M105	0.1	mg/kg	**15**	**0.4**	**28**
Acenaphthylene	T207	M105	0.1	mg/kg	**0.2**	**0.6**	**0.4**
Acenaphthene	T207	M105	0.1	mg/kg	**14**	**4.2**	**32**
Fluorene	T207	M105	0.1	mg/kg	**9.0**	**2.2**	**19**
Phenanthrene	T207	M105	0.1	mg/kg	**65**	**9.0**	**130**
Anthracene	T207	M105	0.1	mg/kg	**17**	**2.1**	**35**
Fluoranthene	T207	M105	0.1	mg/kg	**91**	**14**	**140**
Pyrene	T207	M105	0.1	mg/kg	**76**	**14**	**120**
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	**30**	**5.4**	**51**
Chrysene	T207	M105	0.1	mg/kg	**29**	**5.9**	**51**
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	**28**	**5.3**	**50**
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	**23**	**6.2**	**32**
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	**25**	**6.0**	**39**
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	**13**	**3.6**	**21**
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	**5.9**	**1.4**	**11**
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	**15**	**4.4**	**23**
PAH(total)	T207	M105	0.1	mg/kg	**460**	**84**	**780**

Index to symbols used in Supplemental 742475-1

Value	Description
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
A40	Assisted dried < 40C
N.D.	Not Detected
13	Results have been blank corrected.
110	LOD raised due to low internal standard recovery.
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Supplemental report to include revised PAH results.
Asbestos was subcontracted to REC Asbestos.

Method Index

Value	Description
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T546	Colorimetry (CF)
T287	Calc TOC/0.58
T27	PLM
T162	Grav (1 Dec) (105 C)
T54	GC/MS (Headspace)
T909	GCxGC
T6	ICP/OES
T2	Grav
T7	Probe
T207	GC/MS (MCERTS)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T6	M40	2	mg/kg	M	001,004,007
Cadmium	T6	M40	1	mg/kg	M	001,004,007
Chromium	T6	M40	1	mg/kg	M	001,004,007
Chromium VI	T6	A40	1	mg/kg	N	001,004,007
Copper	T6	M40	1	mg/kg	M	001,004,007
Lead	T6	M40	1	mg/kg	M	001,004,007
Mercury	T6	M40	1	mg/kg	M	001,004,007
Nickel	T6	M40	1	mg/kg	M	001,004,007
Selenium	T6	M40	3	mg/kg	M	001,004,007
Zinc	T6	M40	1	mg/kg	M	001,004,007
Boron (water-soluble)	T6	A40	1	mg/kg	N	001,004,007
Asbestos ID	T27	A40			SU	001,004,007
pH	T7	A40			M	001,004,007
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	M	001,004,007
Cyanide(Total)	T546	AR	1	mg/kg	M	001,004,007
Phenols(Mono)	T546	AR	1	mg/kg	M	001,004,007
Soil Organic Matter	T287	A40	0.1	%	N	001,004,007
Benzene	T54	AR	1	µg/kg	U	001,004,007
Toluene	T54	AR	1	µg/kg	U	001,004,007
EthylBenzene	T54	AR	1	µg/kg	U	001,004,007
M/P Xylene	T54	AR	1	µg/kg	U	001,004,007
O Xylene	T54	AR	1	µg/kg	U	001,004,007
Xylene (Total)	T54	AR	1	µg/kg	U	001,004,007
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	001,004,007
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	U	001,004,007
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	U	001,004,007
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	U	001,004,007
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	U	001,004,007
TPH (C16-C35 aliphatic)	T909	AR	1	mg/kg	N	001,004,007
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	001,004,007
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	U	001,004,007
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	U	001,004,007
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	U	001,004,007
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	U	001,004,007
Moisture @105C	T162	AR	0.1	%	N	001,004,007
Retained on 10mm sieve	T2	M40	0.1	%	N	001,004,007
Naphthalene	T207	M105	0.1	mg/kg	M	001,004,007
Acenaphthylene	T207	M105	0.1	mg/kg	U	001,004,007
Acenaphthene	T207	M105	0.1	mg/kg	M	001,004,007
Fluorene	T207	M105	0.1	mg/kg	M	001,004,007

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Phenanthrene	T207	M105	0.1	mg/kg	M	001,004,007
Anthracene	T207	M105	0.1	mg/kg	U	001,004,007
Fluoranthene	T207	M105	0.1	mg/kg	M	001,004,007
Pyrene	T207	M105	0.1	mg/kg	M	001,004,007
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001,004,007
Chrysene	T207	M105	0.1	mg/kg	M	001,004,007
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001,004,007
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001,004,007
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001,004,007
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001,004,007
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001,004,007
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001,004,007
PAH(total)	T207	M105	0.1	mg/kg	U	001,004,007

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 745399-1

Date of Report: 21-Jun-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Siobhan Hyde

Customer Job Reference: BO68244
Customer Purchase Order: EBMA1270
Customer Site Reference: Gorton Lane
Date Job Received at Concept: 06-Jun-2018
Date Analysis Started: 19-Jun-2018
Date Analysis Completed: 21-Jun-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

Report checked
and authorised by :
Aleksandra Pacula
Senior Customer Service
Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service
Advisor



This document has been printed from a digitally signed master copy

Concept Reference: 745399
Project Site: Gorton Lane
Customer Reference: BO68244

Soil Analysed as Soil
Miscellaneous

Concept Reference	**745399 001**	**745399 002**
Customer Sample Reference	**CP1 (742475/001)**	**WS6 (743109/002)**
Bottom Depth	**0.4**	
Top Depth	**0.3**	**0.6**
Date Sampled	**04-JUN-2018**	**06-JUN-2018**

Determinand	Method	Test Sample	LOD	Units		
Asbestos Quantification	T27	AR	0.001	%	Chrysotile Loose Fibres Detected <0.001	Amosite Fibres Detected Chrysotile Fibres Detected **0.89**

Index to symbols used in 745399-1

Value	Description
AR	As Received
S	Analysis was subcontracted
U	Analysis is UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.

Method Index

Value	Description
T27	PLM

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Asbestos Quantification	T27	AR	0.001	%	SU	001-002

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 751948-1

Date of Report: 20-Jul-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Jess Bailey

Customer Job Reference: B068244
Customer Purchase Order: EBMA1295
Customer Site Reference: Gorton Lane
Date Job Received at Concept: 13-Jul-2018
Date Analysis Started: 17-Jul-2018
Date Analysis Completed: 20-Jul-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Aneta Dybek-Echtermeyer
Customer Service Advisor

Issued by :
Aneta Dybek-Echtermeyer
Customer Service Advisor

This document has been printed from a digitally signed master copy

Concept Reference: 751948
Project Site: Gorton Lane
Customer Reference: B068244

Water Analysed as Water
Curtins Water Suite 1

				Concept Reference	**751948 001**	**751948 002**	**751948 003**
				Customer Sample Reference	**CP1**	**CP2**	**CP4**
				Top Depth	**9.50**	**12.50**	**5.00**
				Depth	**9.50**	**12.50**	**5.00**
				Date Sampled	**13-JUL-2018**	**13-JUL-2018**	**13-JUL-2018**
				Sample Received (ml)	**580**	**2080**	**2080**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
As (Dissolved)	T281	F	0.2	µg/l	**0.7**	**0.8**	**0.8**
Cd (Dissolved)	T281	F	0.02	µg/l	<0.02	**0.03**	<0.02
Cr (Dissolved)	T281	F	1	µg/l	**7**	<1	<1
Cu (Dissolved)	T281	F	0.5	µg/l	**2.8**	**1.8**	**1.0**
Pb (Dissolved)	T281	F	0.3	µg/l	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	F	0.05	µg/l	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	F	1	µg/l	**2**	**2**	**2**
Se (Dissolved)	T281	F	0.5	µg/l	**1.3**	**0.9**	**0.6**
Zn (Dissolved)	T281	F	2	µg/l	**4**	**7**	**8**
B (Dissolved)	T373	AR	0.01	mg/l	**0.12**	**0.11**	**0.13**
Cyanide(Total)	T4	AR	0.05	mg/l	<0.05	<0.05	<0.05
Hardness expressed as CaCO3	T6	AR	10	mg/l	**570**	**600**	**720**
pH	T7	AR			**7.40**	**7.16**	**7.34**
Sulphate	T686	F	0.5	mg/l	**120**	**170**	**270**
Sulphide	T4	AR	0.05	mg/l	<0.05	<0.05	<0.05

Concept Reference: 751948
Project Site: Gorton Lane
Customer Reference: B068244

Water Analysed as Water
PAH USEPA16

				Concept Reference	**751948 001**	**751948 002**	**751948 003**
				Customer Sample Reference	**CP1**	**CP2**	**CP4**
				Top Depth	**9.50**	**12.50**	**5.00**
				Depth	**9.50**	**12.50**	**5.00**
				Date Sampled	**13-JUL-2018**	**13-JUL-2018**	**13-JUL-2018**
				Sample Received (ml)	**580**	**2080**	**2080**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Naphthalene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) **0.03**
Acenaphthylene	T149	AR	0.01	µg/l	(100,13) <0.10	(13) **0.01**	(13) <0.01
Acenaphthene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) **0.01**
Fluorene	T149	AR	0.01	µg/l	(100,13) <0.10	(13) <0.01	(13) **0.01**
Phenanthrene	T149	AR	0.01	µg/l	(13) **0.20**	(13) **0.03**	(13) **0.01**
Anthracene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.01**	(13) <0.01
Fluoranthene	T149	AR	0.01	µg/l	(13) **0.20**	(13) **0.07**	(13) **0.01**
Pyrene	T149	AR	0.01	µg/l	(13) **0.20**	(13) **0.06**	(13) **0.01**
Benzo(a)Anthracene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) <0.01
Chrysene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.03**	(13) <0.01
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.03**	(13) <0.01
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.01**	(13) <0.01
Benzo(a)Pyrene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) <0.01
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) <0.01
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	(13,100) <0.10	(13) <0.01	(13) <0.01
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	(13) **0.10**	(13) **0.02**	(13) <0.01
PAH(total)	T149	AR	0.01	µg/l	**1.6**	**0.37**	**0.08**

Concept Reference: 751948
Project Site: Gorton Lane
Customer Reference: B068244

Water Analysed as Water
TPH (CWG) with MTBE, BTEX

				Concept Reference	**751948 001**	**751948 002**	**751948 003**
				Customer Sample Reference	**CP1**	**CP2**	**CP4**
				Top Depth	**9.50**	**12.50**	**5.00**
				Depth	**9.50**	**12.50**	**5.00**
				Date Sampled	**13-JUL-2018**	**13-JUL-2018**	**13-JUL-2018**
				Sample Received (ml)	**580**	**2080**	**2080**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Benzene	T54	AR	1	µg/l	(13) <1	(13) <1	(13) <1
Toluene	T54	AR	1	µg/l	<1	<1	<1
EthylBenzene	T54	AR	1	µg/l	<1	<1	<1
M/P Xylene	T54	AR	1	µg/l	<1	<1	<1
O Xylene	T54	AR	1	µg/l	<1	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/l	<1	<1	<1
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C10-C12 aliphatic)	T910	AR	0.01	mg/l	(100,13) <0.10	(13) <0.01	(13) <0.01
TPH (C12-C16 aliphatic)	T910	AR	0.01	mg/l	(13,100) <0.10	(13) <0.01	(13) <0.01
TPH (C16-C21 aliphatic)	T910	AR	0.01	mg/l	(100,13) <0.10	(13) <0.01	(13) <0.01
TPH (C21-C35 aliphatic)	T910	AR	0.01	mg/l	(13,100) <0.10	**(13) 0.02**	(13) <0.01
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	<0.010	<0.010	<0.010
TPH (C10-C12 aromatic)	T910	AR	0.01	mg/l	(13,100) <0.10	(13) <0.01	(13) <0.01
TPH (C12-C16 aromatic)	T910	AR	0.01	mg/l	(13,100) <0.10	**(13) 0.02**	(13) <0.01
TPH (C16-C21 aromatic)	T910	AR	0.01	mg/l	(100,13) <0.10	**(13) 0.05**	**(13) 0.02**
TPH (C21-C35 aromatic)	T910	AR	0.01	mg/l	**(13) 0.13**	**(13) 0.18**	**(13) 0.03**

Index to symbols used in 751948-1

Value	Description
F	Filtered
AR	As Received
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T149	GC/MS (SIR)
T215	GC/MS (Headspace)(LV)
T4	Colorimetry
T54	GC/MS (Headspace)
T373	ICP/OES (Filtered)
T910	GCxGC (LV)
T6	ICP/OES
T281	ICP/MS (Filtered)
T7	Probe
T686	Discrete Analyser

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
As (Dissolved)	T281	F	0.2	µg/l	U	001-003
Cd (Dissolved)	T281	F	0.02	µg/l	U	001-003
Cr (Dissolved)	T281	F	1	µg/l	U	001-003
Cu (Dissolved)	T281	F	0.5	µg/l	U	001-003
Pb (Dissolved)	T281	F	0.3	µg/l	U	001-003

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Hg (Dissolved)	T281	F	0.05	µg/l	U	001-003
Ni (Dissolved)	T281	F	1	µg/l	U	001-003
Se (Dissolved)	T281	F	0.5	µg/l	U	001-003
Zn (Dissolved)	T281	F	2	µg/l	U	001-003
B (Dissolved)	T373	AR	0.01	mg/l	N	001-003
Cyanide(Total)	T4	AR	0.05	mg/l	U	001-003
Hardness expressed as CaCO3	T6	AR	10	mg/l	N	001-003
pH	T7	AR			U	001-003
Sulphate	T686	F	0.5	mg/l	U	001-003
Sulphide	T4	AR	0.05	mg/l	N	001-003
Naphthalene	T149	AR	0.01	µg/l	U	001-003
Acenaphthylene	T149	AR	0.01	µg/l	U	001-003
Acenaphthene	T149	AR	0.01	µg/l	U	001-003
Fluorene	T149	AR	0.01	µg/l	U	001-003
Phenanthrene	T149	AR	0.01	µg/l	U	001-003
Anthracene	T149	AR	0.01	µg/l	U	001-003
Fluoranthene	T149	AR	0.01	µg/l	U	001-003
Pyrene	T149	AR	0.01	µg/l	U	001-003
Benzo(a)Anthracene	T149	AR	0.01	µg/l	U	001-003
Chrysene	T149	AR	0.01	µg/l	U	001-003
Benzo(b)fluoranthene	T149	AR	0.01	µg/l	U	001-003
Benzo(k)fluoranthene	T149	AR	0.01	µg/l	U	001-003
Benzo(a)Pyrene	T149	AR	0.01	µg/l	U	001-003
Indeno(123-cd)Pyrene	T149	AR	0.01	µg/l	U	001-003
Dibenzo(ah)Anthracene	T149	AR	0.01	µg/l	U	001-003
Benzo(ghi)Perylene	T149	AR	0.01	µg/l	U	001-003
PAH(total)	T149	AR	0.01	µg/l	U	001-003
Benzene	T54	AR	1	µg/l	U	001-003
Toluene	T54	AR	1	µg/l	U	001-003
EthylBenzene	T54	AR	1	µg/l	U	001-003
M/P Xylene	T54	AR	1	µg/l	U	001-003
O Xylene	T54	AR	1	µg/l	U	001-003
Methyl tert-Butyl Ether	T54	AR	1	µg/l	U	001-003
TPH (C5-C6 aliphatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C6-C8 aliphatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C8-C10 aliphatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C10-C12 aliphatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C12-C16 aliphatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C16-C21 aliphatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C21-C35 aliphatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C6-C7 aromatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C7-C8 aromatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C8-C10 aromatic)	T215	AR	0.010	mg/l	N	001-003
TPH (C10-C12 aromatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C12-C16 aromatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C16-C21 aromatic)	T910	AR	0.01	mg/l	N	001-003
TPH (C21-C35 aromatic)	T910	AR	0.01	mg/l	N	001-003

Appendix D Geotechnical Laboratory Testing Results

- Geotechnical Analysis Results:
  - Concept Life Sciences, Report No. 745599-1
  - Professional Soils Laboratory, Report No. PSL18/3091

Copyright ©2021 Curtins Consulting Ltd

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: Supplemental 745599-1

Date of Report: 10-Jul-2018

Customer: Curtins Consulting Ltd.
17-19 Whitworth Street West
Manchester
M1 5WG

Customer Contact: Ms Siobhan Hyde

Customer Job Reference: B068244
Customer Purchase Order: EBMA1268
Customer Site Reference: Gorton Lane
Date Job Received at Concept: 08-Jun-2018
Date Analysis Started: 19-Jun-2018
Date Analysis Completed: 06-Jul-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service Advisor

This document has been printed from a digitally signed master copy

Concept Reference: 745599
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**745599 001**	**745599 003**	**745599 004**	**745599 005**	**745599 007**
				Customer Sample Reference	**CP1 (742475-002)**	**WS1 (742475-005)**	**WS2 (742475-006)**	**CP2 (742475-008)**	**WS3 (742475-010)**
				Bottom Depth	**3.6**	**4.0**	**5.0**	**5.2**	**2.0**
				Top Depth	**3.4**	**3.5**	**4.5**	**5.0**	**1.8**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**18**	**9.1**	**7.4**	**7.3**	**19**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 745599
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**745599 008**	**745599 009**	**745599 011**	**745599 012**	**745599 014**
				Customer Sample Reference	**WS6 (743109-004)**	**WS5 (743109-005)**	**CP4 (743109-007)**	**WS4 (743109-008)**	**CP3 (743109-020)**
				Bottom Depth	**3.0**	**2.2**	**10.0**	**3.4**	**10.7**
				Top Depth	**2.5**	**2.0**	**9.5**	**3.2**	**10.3**
				Date Sampled	**06-JUN-2018**	**06-JUN-2018**	**06-JUN-2018**	**06-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**14**	**13**	**12**	**11**	**8.8**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 745599
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Undrained Shear Strength / Triaxial Compression

				Concept Reference	**745599 002**	**745599 006**	**745599 010**	**745599 013**
				Customer Sample Reference	**CP1 (742475-003)**	**CP2 (742475-009)**	**CP4 (743109-006)**	**CP3 (743109-019)**
				Bottom Depth	**6.45**	**9.95**	**8.45**	**9.45**
				Top Depth	**6.0**	**9.5**	**8.0**	**9.0**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**06-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**				
Shear Strength	T961	AR			No Result - See Notes	No Result - See Notes	Attached	Attached

Concept Reference: 745599
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**745599 001**	**745599 003**	**745599 004**	**745599 005**	**745599 007**
				Customer Sample Reference	**CP1 (742475-002)**	**WS1 (742475-005)**	**WS2 (742475-006)**	**CP2 (742475-008)**	**WS3 (742475-010)**
				Bottom Depth	**3.6**	**4.0**	**5.0**	**5.2**	**2.0**
				Top Depth	**3.4**	**3.5**	**4.5**	**5.0**	**1.8**
				Date Sampled	**04-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**	**05-JUN-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**8.2**	**8.1**	**8.2**	**8.4**	**7.5**
Plasticity Index	T31	AR		%	Attached	Attached	Attached	Attached	Attached
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	**0.09**	<0.05	<0.05	<0.05	<0.05
Moisture	T2	AR	0.1	%	**18**	**9.1**	**7.4**	**7.3**	**19**

Concept Reference: 745599
Project Site: Gorton Lane
Customer Reference: B068244

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**745599 008**	**745599 009**	**745599 011**	**745599 012**	**745599 014**
				Customer Sample Reference	**WS6 (743109-004)**	**WS5 (743109-005)**	**CP4 (743109-007)**	**WS4 (743109-008)**	**CP3 (743109-020)**
				Bottom Depth	**3.0**	**2.2**	**10.0**	**3.4**	**10.7**
				Top Depth	**2.5**	**2.0**	**9.5**	**3.2**	**10.3**
				Date Sampled	**06-JUN-2018**	**06-JUN-2018**	**06-JUN-2018**	**06-JUN-2018**	**07-JUN-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**7.9**	**8.3**	**8.1**	**8.4**	**8.1**
Plasticity Index	T31	AR		%	Attached	Attached	Attached	Attached	Attached
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	**0.08**	**0.06**	**0.05**	**0.06**	<0.05
Moisture	T2	AR	0.1	%	**14**	**13**	**12**	**11**	**8.8**

Index to symbols used in Supplemental 745599-1

Value	Description
AR	As Received
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
A40	Assisted dried < 40C
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

These samples have been analysed exceeding recommended holding times for pH. It is possible therefore that the results provided may be compromised.
Plasticity Index was subcontracted to PSL, Triaxial Compression to James Fisher testing.
Note - there was insufficient sample to complete analysis on samples 002 and 006.
Supplemental report to include updated subcontracted reports.

Method Index

Value	Description
T162	Grav (1 Dec) (105 C)
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T7	Probe
T961	Quick undrained triaxial on re-compacted samples
T31	Physical (Subcontracted)

T2	Grav

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Moisture @105C	T162	AR	0.1	%	N	001,003-005,007-009,011-012,014
Retained on 10mm sieve	T2	M40	0.1	%	N	001,003-005,007-009,011-012,014
Shear Strength	T961	AR			SU	002,006,010,013
pH	T7	A40			M	001,003-005,007-009,011-012,014
Plasticity Index	T31	AR		%	SU	001,003-005,007-009,011-012,014
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	M	001,003-005,007-009,011-012,014
Moisture	T2	AR	0.1	%	N	001,003-005,007-009,011-012,014

James Fisher Testing Services Ltd
Ruby House,
40A Hardwick Grange
Warrington, WA1 4RF

UKAS TESTING 0955

LABORATORY TEST REPORT
UNDRAINED TRIAXIAL COMPRESSION
BS 1377 : Part 7 : 1990 Clause 7

Project:	745599	**Job No:**	
Client:	Concept Life Sciences	**Lab Ref No:**	SA32772
		Date Received:	26/06/2018
		Date Tested:	04/07/2018
		Date Reported:	04/07/2018
Originator:	Manpm	**Sample Ref:**	010 -CP4 -8.00-8.45

Sample Details

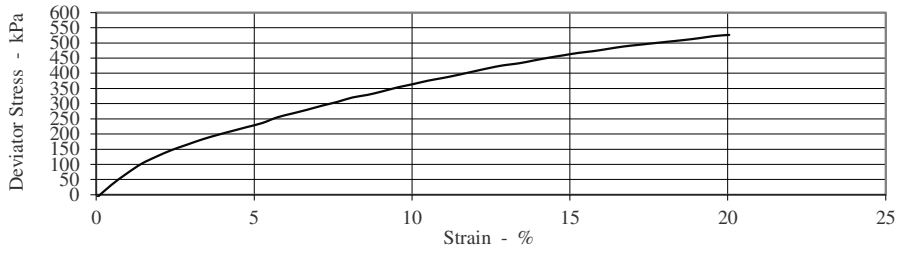
Description		Very Stiff Slightly Laminated Sandy CLAY
Sample Condition		Undisturbed
Height	mm	209.5
Diameter	mm	102.2
Moisture Content	%	13
Bulk Density	Mg/m³	2.27
Dry Density	Mg/m³	2.00

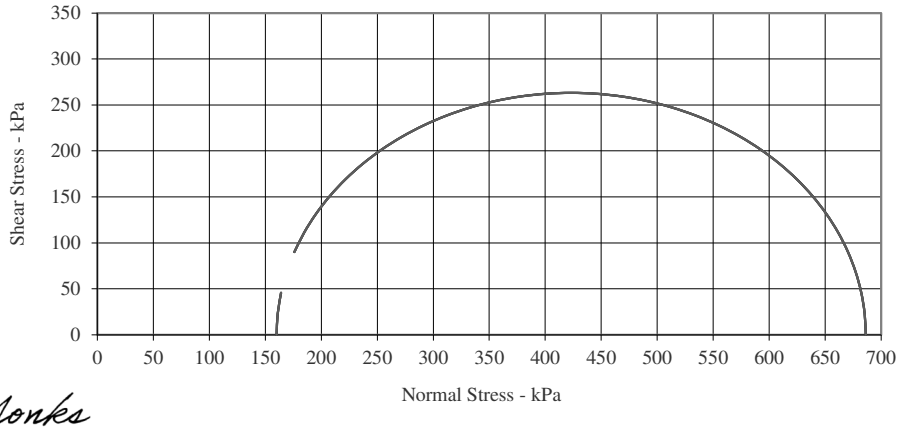
Test Details

Membrane Thickness	mm	0.31
Membrane Correction	kPa	1.15
Rate of Axial Displacement	%/min	1.91
Cell Pressure	kPa	160
Strain at Failure	%	20.0
Maximum Deviator Stress	kPa	526
Shear Strength	kPa	**263**
Mode of Failure		Plastic

Shear Strength Parameters

C	**263 kPa**
Phi	**0.0 °**





K.Monks

R99 R1 WTN

Approved Signature
James Fisher Testing Services Ltd
❑ Karl Monks, Lab Team Leader

A part of James Fisher and Sons plc Marine Services Worldwide

James Fisher Testing Services Ltd
Ruby House,
40A Hardwick Grange
Warrington, WA1 4RF

UKAS TESTING 0955

LABORATORY TEST REPORT
UNDRAINED TRIAXIAL COMPRESSION
BS 1377 : Part 7 : 1990 Clause 7

Project:	745599	**Job No:**	
Client:	Concept Life Sciences	**Lab Ref No:**	SA32772
		Date Received:	26/06/2018
		Date Tested:	04/07/2018
		Date Reported:	04/07/2018
Originator:	Manpm	**Sample Ref:**	013-CP3-9.00-9.45

Sample Details

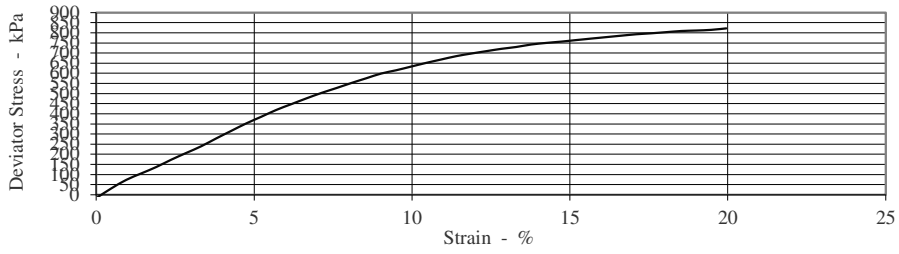
Description		Very Stiff Brown Sandy Slightly Gravelly CLAY
Sample Condition		Undisturbed
Height	mm	210.5
Diameter	mm	101.7
Moisture Content	%	9.5
Bulk Density	Mg/m³	2.29
Dry Density	Mg/m³	2.09

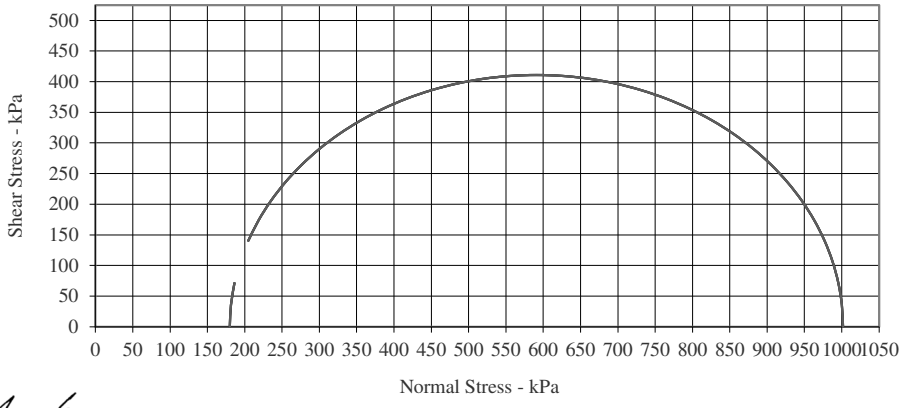
Test Details

Membrane Thickness	mm	0.26
Membrane Correction	kPa	0.97
Rate of Axial Displacement	%/min	1.90
Cell Pressure	kPa	180
Strain at Failure	%	20.0
Maximum Deviator Stress	kPa	822
Shear Strength	kPa	**411**
Mode of Failure		Plastic

Shear Strength Parameters

C	**411 kPa**
Phi	**0.0** °





R99 R1 WTN

K.Monks
Approved Signature
James Fisher Testing Services Ltd
❑ Karl Monks, Lab Team Leader

A part of James Fisher and Sons plc
Marine Services Worldwide

A trading division of James Fisher Testing Services Ltd. Registered Number 01182561. Registered in UK at Fisher House, PO Box 4, Barrow-in-Furness, Cumbria, LA14 1HR.
This document is produced from a digitally signed master. Supplemental745599-1

LABORATORY REPORT

4043

Contract Number: PSL18/3091

Report Date: 10 July 2018

Client's Reference:

Client Name: Concept Life Sciences
Hadfield House
9 Hadfield Street
Old Trafford
Manchester
M16 9FE

For the attention of: ManPM

Contract Title: 745599

Date Received: 22/6/2018
Date Commenced: 22/6/2018
Date Completed: 5/7/2018

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
R Berriman (Quality Manager)

L Knight (Senior Technician)
S Eyre (Senior Technician)
A Fry (Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
CP1	1		3.40	3.60	Brown slightly gravelly sandy CLAY.
WS1	3		3.50	4.00	Brown slightly gravelly very sandy CLAY.
WS2	4		4.50	5.00	Brown slightly gravelly very sandy CLAY.
CP2	5		5.00	5.20	Brown slightly gravelly very sandy CLAY.
WS3	7		1.80	2.00	Brown mottled grey slightly gravelly slightly sandy CLAY.
WS6	8		2.50	3.00	Brown mottled grey slightly gravelly sandy CLAY.
WS5	9		2.00	2.20	Brown mottled grey slightly gravelly sandy CLAY.
CP4	11		9.50	10.00	Brown slightly gravelly very sandy CLAY.
WS4	12		3.20	3.40	Brown slightly gravelly sandy CLAY.
CP3	14		10.30	10.70	Brown slightly gravelly very sandy CLAY.

UKAS TESTING
4043

PSL
Professional Soils Laboratory

745599

Contract No:
PSL18/3091
Client Ref:

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
CP1	1		3.40	3.60	21			42	21	21	93	Intermediate plasticity CI.
WS1	3		3.50	4.00	7.5			28	14	14	91	Low plasticity CL.
WS2	4		4.50	5.00	8.7			32	15	17	93	Low plasticity CL.
CP2	5		5.00	5.20	12			34	16	18	93	Low plasticity CL.
WS3	7		1.80	2.00	20			52	23	29	93	High plasticity CH.
WS6	8		2.50	3.00	16			47	22	25	94	Intermediate plasticity CI.
WS5	9		2.00	2.20	16			44	20	24	93	Intermediate plasticity CI.
CP4	11		9.50	10.00	13			28	13	15	93	Low plasticity CL.
WS4	12		3.20	3.40	14			40	19	21	95	Intermediate plasticity CI.
CP3	14		10.30	10.70	8.9			31	14	17	93	Low plasticity CL.

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL Professional Soils Laboratory

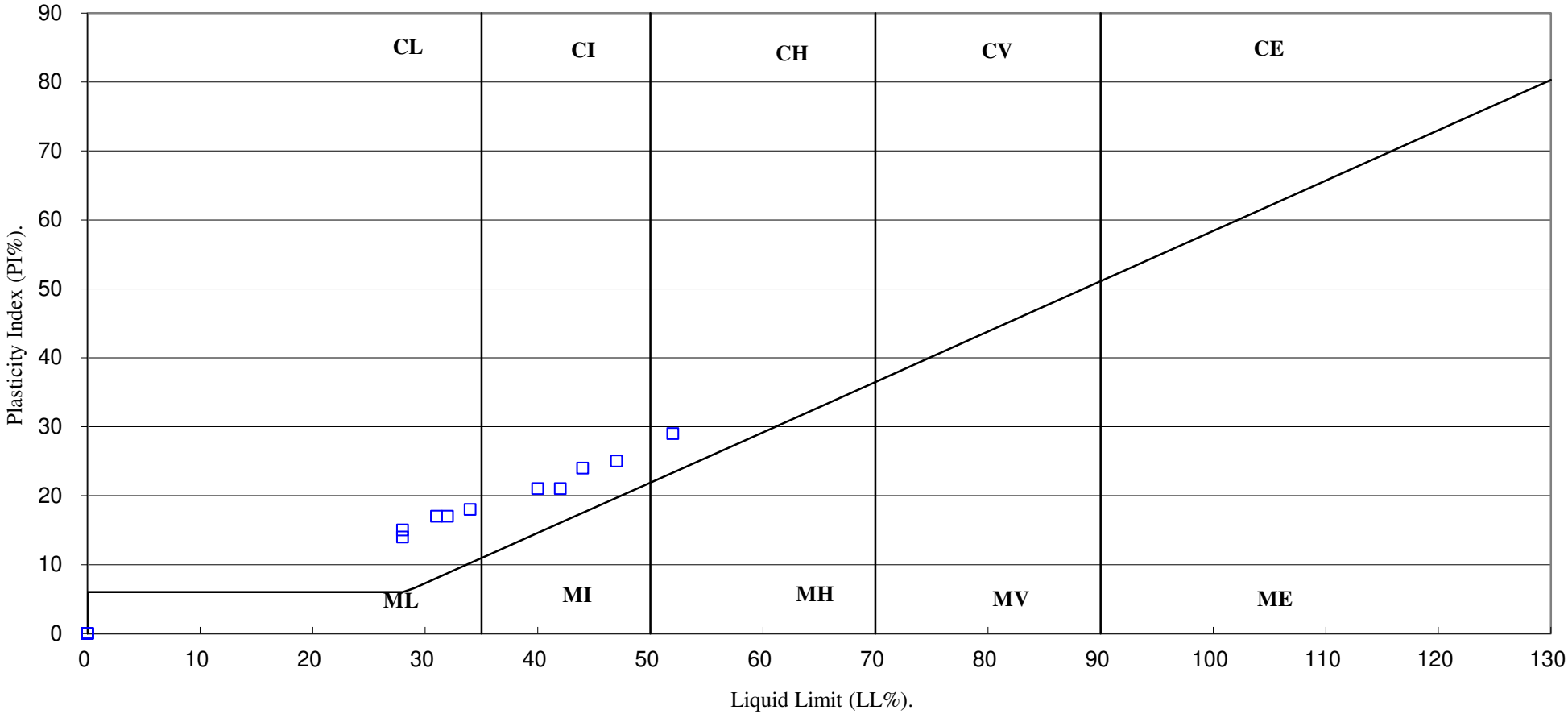
745599

Contract No:

PSL18/3091

Client Ref:

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	745599	**Contract No:** PSL18/3091 **Client Ref:** 0

Appendix E Ground Gas and Groundwater Monitoring Results

Copyright ©2021 Curtins Consulting Ltd

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	18/06/2018
Job Number:	B068244.000	**Visit:**	1
Client:	One Manchester	**Weather:**	Cloudy
Barometric State:	Steady	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1008	0.0	0.0	0.0	0.0	0.8	0.8	19.0	1	1	9.30	10.85	
WS1	1008	0.0	0.0	0.0	0.0	0.9	0.9	19.8	2	3	DRY	1.50	
WS2	1008	0.0	0.0	0.0	0.0	1.7	1.7	18.9	1	3	-	-	**1**
WS3	1008	0.0	0.0	0.0	0.0	1.1	1.1	19.5	2	3	DRY	4.30	

Notes

1 Unable to remove bung

Logged by

JB

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	02/07/2018
Job Number:	B068244.000	**Visit:**	2
Client:	One Manchester	**Weather:**	Sunny
Barometric State:	Rising	**Ground Conditions:**	Very dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1013	0.0	0.0	0.0	0.0	0.8	0.8	19.4	2	1	8.52	9.92	
WS1	-	-	-	-	-	-	-	-	-	-	DRY	1.50	**1**
WS2	1012	0.0	0.0	0.0	0.0	2.1	2.1	19.1	2	3	-	-	**2**
WS3	1012	0.0	0.0	0.0	0.0	1.1	1.0	19.9	2	3	DRY	4.20	

Notes

1	Borehole disturbed - gas valve open
2	Unable to remove bung

Logged by

JB

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	13/07/2018
Job Number:	B068244.000	**Visit:**	3
Client:	One Manchester	**Weather:**	Raining
Barometric State:	Steady	**Ground Conditions:**	Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1016	-0.1	-0.1	0.0	0.0	0.3	0.3	20.4	1	6	8.90	9.90	
WS1	1016	-0.3	-0.1	0.0	0.0	0.6	0.6	20.3	0	3	DRY	1.50	
WS2	1016	-0.2	-0.1	0.0	0.0	2.4	2.4	19.0	0	3	-	-	**1**
WS3	1016	-0.2	0.0	0.0	0.0	1.5	1.5	19.5	0	3	3.64	4.00	

Notes

1 Unable to remove bung

Logged by

JB

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	13/08/2018
Job Number:	B068244.000	**Visit:**	4
Client:	One Manchester	**Weather:**	Overcast and rain
Barometric State:	Rising	**Ground Conditions:**	Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1001	0.0	0.0	0.0	0.0	1.2	1.2	19.0	1	3	7.58	9.95	
WS1	1001	-0.1	0.0	0.0	0.0	0.7	0.7	20.2	1	3	Dry	1.50	
WS2	1001	0.0	0.0	0.0	0.0	2.9	2.9	18.8	1	3	-	-	**1**
WS3	1001	0.0	0.0	0.0	0.0	1.1	1.1	19.9	1	5	2.88	4.08	

Notes

1 Unable to remove bung

Logged by

MH

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	22/08/2018
Job Number:	B068244.000	**Visit:**	5
Client:	One Manchester	**Weather:**	Drizzly
Barometric State:	Falling	**Ground Conditions:**	Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1006	0.0	0.0	0.0	0.0	1.0	1.0	18.7	1	3	7.58	10.00	
WS1	1007	0.0	0.0	0.0	0.0	0.6	0.6	20.6	1	1	Dry	1.52	
WS2	1007	0.0	0.0	0.0	0.0	2.1	2.1	19.4	2	1	-	-	**1**
WS3	1006	0.0	0.0	0.0	0.0	0.8	0.8	20.5	1	1	2.80	4.00	

Notes

1 Unable to remove bung

Logged by

ST

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Gorton Lane	**Date:**	03/09/2018
Job Number:	B068244.000	**Visit:**	6
Client:	One Manchester	**Weather:**	Overcast
Barometric State:	Steady	**Ground Conditions:**	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
CP1	1013	0.0	0.0	0.0	0.0	0.9	0.9	18.8	1	3	7.75	10.00	
WS1	1015	0.0	0.0	0.0	0.0	0.7	0.7	20.3	2	1	Dry	1.50	
WS2	1014	0.0	0.0	0.0	0.0	2.5	2.5	18.9	1	1	-	-	**1**
WS3	1015	0.0	0.0	0.0	0.0	0.9	0.9	20.2	2	3	2.72	4.00	

Notes

1 Unable to remove bung

Logged by

ST

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Appendix F GAC Screening Thresholds

- Curtins GAC Thresholds for 1.0% SOM.
- Curtins Tier 1 Thresholds for Water Contaminants.

Copyright ©2021 Curtins Consulting Ltd

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM

curtins

Contaminants	Residential with home grown produce	Residential without home grown produce	Allotments	Commercial	Public open space near residential housing POS_{resi}	Public park POS_{park}
Metals						
Beryllium	*1.7*	*1.7*	*35*	*12*	*2.2*	*63*
Boron	*290*	*11,000*	*45*	*240,000*	*21,000*	*46,000*
Cadmium	**10**[13] 22	**85**[13] 150	**1.8** 3.9	**230** 410	*120* 220	*560* 880
Chromium III	*910*	*910*	*18,000*	*8,600*	*1,500*	*33,000*
Chromium VI	*6* 21	*6* 21	*1.8* 170	*33* 49	*7.7* 21	*220* 250
Lead	200	310	80	2,300	630	1,300
Mercury *(elemental)*	**1**	**1**	**26**	**26**	*16*	**26**[8] *[30]*
Mercury (inorganic)	**170**	**240**	**80**	**3600**	*120*	*240*
Nickel	*130*[10]	*180*[10]	*53*[11]	*980*[10]	*230*	*800*
Vanadium	*410*	*1200*	*91*	*9000*	*2000*	*5000*
Copper	*2400*	*7100*	*520*	*68000*	*12000*	*44000*
Zinc	*3700*	*40000*	*620*	*730000*	*81000*	*170000*
Semi-Metals and non-metals						
Arsenic	**32**[12] 37	**35**[12] 40	**43**[12] 49	**640**[12] 640	*79* 79	*170* 170
Antimony		***550***		***7500***	***1500***	***3300***
Selenium	**350**	**600**	**120**	**13000**	*1100*	*1800*
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
$EC_{>5}$ - EC_6	*42*	*42*	*730*	*3200*	*570000*	*95000*
$EC_{>6}$ - EC_8	*100*	*100*	*2300*	*7800*	*600000*	*150000*
$EC_{>8}$ - EC_{10}	*27*	*27*	*320*	*2000*	*13000*	*14000*
EC_{10}-EC_{12}	*130*	*130*	*2200*	*9700*	*13000*	*21000*
EC_{12}-EC_{16}	*1100*	*1100*	*11000*	*59000*	*13000*	*25000*
$EC_{>16}$ - EC_{35}	*65000*	*65000*	*260000*	*1600000*	*250000*	*450000*
$EC_{>35}$ - EC_{44}	*65000*	*65000*	*260000*	*1600000*	*250000*	*450000*
Aromatic risk banded hydrocarbons - TPHCWG method						
$EC_{>5}$ - EC_7	*70*	*370*	*13*	*26000*	*56000*	*76000*
$EC_{>7}$ - EC_8	*130*	*860*	*22*	*56000*	*56000*	*87000*
$EC_{>8}$ - EC_{10}	*34*	*47*	*8.6*	*3500*	*5000*	*7200*
EC_{10} - EC_{12}	*74*	*250*	*13*	*16000*	*5000*	*9200*
EC_{12} - EC_{16}	*140*	*1800*	*23*	*36000*	*5100*	*10000*
$EC_{>16}$ - EC_{21}	*260*	*1900*	*46*	*28000*	*3800*	*7600*
$EC_{>21}$ - EC_{35}	*1100*	*1900*	*370*	*28000*	*3800*	*7800*
$EC_{>35}$ - EC_{44}	*1100*	*1900*	*370*	*28000*	*3800*	*7800*
Aliph + Arom EC >44-70	*1600*	*1900*	*1200*	*28000*	3800	7800
Aromatic						
Benzene	**0.08**	**0.3**	**0.017**	**28**	*72*	*90*
Ethyl benzene	**65**	**170**	**16**	**520**[8] [17000]	**520**[8] *[24000]*	**520**[8] *[17000]*
Toluene	**120**	**610**	**22**	**860**[8] [59000]	**860**[8] *[56000]*	**860**[8] *[87000]*
Xylene[9]	**41**	**53**	**28**	**480**[8] [69000]	**480**[8] *[41000]*	**480**[8] *[17000]*
Phenol	**180**	**310**	**66**	**760**[14] (31000)	**760**[14] *(10000)*	**760**[14] *(7600)*
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	*2.3*	*2.3*	*4.1*	*190*	*4900*	*1200*
Acenaphthylene	*170*	*2900*	*28*	*83000*	*15000*	*29000*
Acenaphthene	*210*	*3000*	*34*	*84000*	*15000*	*29000*
Fluorene	*170*	*2800*	*27*	*63000*	*9900*	*20000*
Phenanthrene	*95*	*1300*	*15*	*22000*	*3100*	*6200*
Anthracene	*2400*	*31000*	*380*	*520000*	*74000*	*150000*
Fluoranthene	*280*	*1500*	*52*	*23000*	*3100*	*6300*
Pyrene	*620*	*3700*	*110*	*54000*	*7400*	*15000*
Benz(a)anthracene	*7.2*	*11*	*2.9*	*170*	*29*	*49*
Chrysene	*15*	*30*	*4.1*	*350*	*57*	*93*
Benzo(b)fluoranthene	*2.6*	*3.9*	*0.99*	*44*	*7.1*	*13*
Benzo(k)fluoranthene	*77*	*110*	*37*	*1200*	*190*	*370*
Benzo(a)pyrene	*2.2*	*3.2*	*0.97*	*35*	*5.7*	*11*
Indeno(123cd)pyrene	*27*	*45*	*9.5*	*500*	*82*	*150*
Dibenzo(ah)anthracene	*0.24*	*0.31*	*0.14*	*3.5*	*0.57*	*1.1*
Benzo(ghi)perylene	*320*	*360*	*290*	*3900*	*640*	*1400*
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	*0.00064*	*0.00077*	*0.00055*	*0.059*	*3.5*	*4.8*
Trichloroethene (TCE)	*0.016*	*0.017*	*0.041*	*1.2*	*120*	*70*
1,1,1,2 Tetrachlorethane	*1.2*	*1.5*	*0.79*	*110*	*1400*	*1500*
Tetrachlorethene (PCE)	*0.18*	*0.18*	*0.65*	*19*	*1400*	*810*
1,1,1 Trichlorethane	*8.8*	*9*	*48*	*660*	*140000*	*57000*

Notes

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m^{-3}
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

Tier 1 Thresholds

Water Contaminants: Initial Assessment of Risk

Introduction

The Generic Assessment Criteria (GAC) employed as Tier 1 Controlled Water Screening criteria are given in Tables 1 and 2. The more conservative available Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) (Freshwater and Saltwater), applicable in England and Wales have been included in the tables.

The list of determinands is non-industry specific and it should be recognised that additional site specific determinands may need to be taken into account. The applicability of these criteria, with regard to the developed Conceptual Site Model, is discussed within the relevant section of the preceding report. Further details on individual GAC can be obtained in the referenced source legislation.

Generic Assessment Criteria

Table 1 – Inorganic Contaminant Controlled Waters Generic Assessment Criteria

Contaminant	Units	Hardness Banding (mg/l CaCO3)	EQS (Freshwater)	EQS (Saltwater)	EU DWS	WHO
Arsenic	µg/l	-	50	25	10	10
Boron	µg/l	-	2000	7000	1000	0.3
Cadmium	µg/l	<40	0.08	0.2	5	3
		40- <50	0.08			
		50- <100	0.09			
		100- <200	0.15			
		>200	0.25			
Chromium III	µg/l	-	4.7	-	50	50
Chromium VI	µg/l	-	3.4	0.6		
Copper	µg/l	-	1 bioavailable[i]	3.76 Where DOC[ii] ≤ 1mg	2000	2000
				3.76 + (2.677 x ((DOC/2)-0.5)) Where DOC[ii] >1mg/l		
Cyanide (Free)	µg/l	-	1	1		
Cyanide (Total)	µg/l	-	1	1	50	70
Iron	µg/l	-	1000	1000	200	300
Lead	µg/l		1.2	1.3	10	10
Mercury	µg/l	-	0.07[iii]	0.07 [iii]	1	1
Nickel	µg/l	-	4 bioavailable[i]	8.6	20	70

Rev - | Copyright © 2016 Curtins Consulting Ltd

Contaminant	Units	Hardness Banding (mg/l CaCO3)	EQS (Freshwater)	EQS (Saltwater)	EU DWS	WHO
Selenium	µg/l	-	-	-	10	10
Sulphate	mg/l	-	400	-	250	-
Sulphide	µg/l	-	0.25	-	-	-
Zinc	µg/l	-	10.9 bioavailable[ii] + ABC[v]	6.8 dissolved[iV] + ABC	5000	3000

i - fraction likely to have toxic effect as determined using the UKTAG Metal Bioavailability Assessment Tool
ii - concentration of dissolved organic carbon in mg/l of the receiving water (as identified in the Conceptual Site Model)
iii - in absence on Annual Average the Maximum Allowable Concentration Used
iv - total dissolved as reported
V - Average Background Concentration (ABC) as listed in Part 2 Table 2 in Ref. 1.

Table 2 – Organic Contaminant Controlled Waters Generic Assessment Criteria

Contaminant	Units	EQS (Freshwater)	EQS (Saltwater)	EU DWS	WHO
Organics					
Phenol (total)	µg/l	7.7	7.7	0.5	-
MTBE	µg/l	-	-	-	15
Total Petroleum Hydrocarbons (TPH)					
Aliphatic C5-C6	µg/l	-	-	-	15000
Aliphatic C6-C8	µg/l	-	-	-	15000
Aliphatic C8-C10	µg/l	-	-	-	300
Aliphatic C10-C12	µg/l	-	-	-	300
Aliphatic C12-C16	µg/l	-	-	-	300
Aliphatic C16-C21	µg/l	-	-	-	300
Aliphatic C21-C35	µg/l	-	-	-	300
Aromatic C6-C7 (benzene)	µg/l	10	8	1	10
Aromatic C7-C8 (toluene)	µg/l	74	74	-	700
Aromatic C8-C10 (ethylbenzene)	µg/l	20	20	-	300
Aromatic C10-C12	µg/l	-	-	-	100
Aromatic C12-C16	µg/l	-	-	-	100
Aromatic C16-C21	µg/l	-	-	-	90
Aromatic C21-C35	µg/l	-	-	-	90
Total Hydrocarbons (Dissolved / Emulsion)	µg/l	-	-	10 (revoked)	300

Rev - | Copyright © 2016 Curtins Consulting Ltd

Contaminant	Units	EQS (Freshwater)	EQS (Saltwater)	EU DWS	WHO
BTEX Compounds					
Benzene	µg/l	10	8	1	10
Toluene	µg/l	74	74	-	700
Ethyl-benzene	µg/l	20	20	-	300
Xylene (o+p+m)	µg/l	30	30	-	-
Polycyclic Aromatic Hydrocarbons (PAH)					
Anthracene	µg/l	0.1	0.1	-	-
Benzo(a)pyrene	µg/l	0.00017	0.00017	0.01	0.01
Napthalene	µg/l	2	2	-	-
PAHs Sum of four- benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene	µg/l	-	-	0.1	-

References

1 The Water Framework Directive, (Standards and Classification) Directions (England and Wales) [2015]
2 Council Directive 76/464/EEC, Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) [1976]
3 Council Directive 98/83/EC on the quality of water intented for human consumption [1998]
4 World Health Organisation (WHO), Guidelines for Drinking Water Quality. Third edition [2004]

Rev - | Copyright © 2016 Curtins Consulting Ltd

Appendix G Risk Assessment Methodology

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment, the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability (Likelihood)	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Copyright ©2021 Curtins Consulting Ltd

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Copyright ©2021 Curtins Consulting Ltd

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	*Harm* is *likely to arise* to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	*It is possible* that without appropriate further action *harm could arise* to a designated receptor. It is relatively *unlikely* that any such harm would be *severe,* and if any harm were to occur it is *more likely* that such harm would be *relatively mild.*
Low Risk	*It is possible* that *harm could arise* to a designated receptor from an identified hazard. It is *likely* that, at worst, if any harm was realised any effects would be *mild.*
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term ‘risk’ in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

Copyright ©2021 Curtins Consulting Ltd

Our Locations

Birmingham
2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol
Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge
50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff
3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas
Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin
39 Fitzwilliam Square
Dublin 2
Ireland
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh
1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow
Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal
28 Lowther Street
Kendal
Cumbria
LA9 4DH
T. 01539 724 823
kendal@curtins.com

Leeds
Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool
51-55 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London
40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham
56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com

Curtins Consulting Ltd registered in England and Wales No: 2054159
Registered office: 51-55 Tithebarn Street, Liverpool, L2 2SB