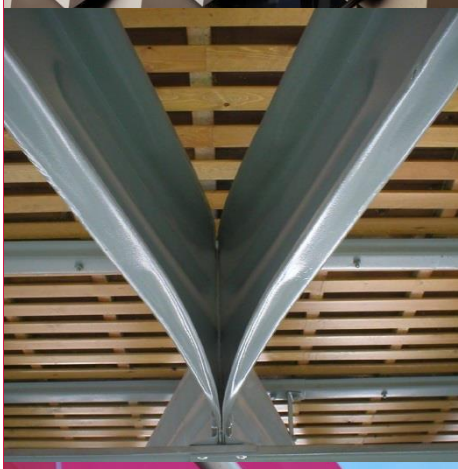

West Cumberland Hospital

Ground Investigation Report

Curtins Ref: 073983-CUR-00-XX-RP-GE-002

Revision: V01

Issue Date: 25 March 2021

Client Name: CCL Solutions

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Executive Summary

Appointment	In November 2020, Curtins were instructed by Graham Construction to undertake a Phase 2 Ground Investigation for the construction of a new hospital wing and refurbishment of existing buildings with associated car parking, communal soft landscaped, clinical and recycling waste storage in the north of the site. The site is centred on National Grid Reference NS 298950, 516040.
Current Site Status	Most of the site is currently vacant, having undertaken demolition of the previous hospital building in the west, and previous buildings in the north-east.
Summary of Phase 1	The site was vacant up until the 1960s from when the West Cumberland Hospital was constructed. The site underwent significant development in the mid to late 1960s and remained relatively the same up until the present day, where the site structures have been demolished with significant earthworks also undertaken. Based on the site's historical land use and considering the nature of present demolition and earthworks, made/reworked ground is anticipated at varying depths. Superficial deposits are indicated to comprise Till underlain by bedrock noted as the Hensingham Grit and Stainmore Formations, comprising sandstone and mudstone. Superficial deposits are not assigned an Aquifer designation. The bedrock is classified as a Secondary A aquifer. The site is not located within a source protection zone and there are no groundwater abstraction points within 1km of the site. The nearest surface water feature is located 264m south west of the site. Which appears to relate to a small drain. There are no surface water abstraction points recorded within 1km of the site. The site is located in a lower probability radon area, where less than 1% of properties are estimated to be above the radon action level. Primary potential risks to be investigated during the Phase 2, as well as establishing ground conditions for geotechnical design, included; potential for land gas and risks to human health from Made Ground soils.
Fieldworks	Fieldworks were carried out in December 2020 and comprised six cable percussion / rotary cored boreholes to a maximum depth of 17.30m bgl and seven windowless sampling boreholes up to 3.65m bgl. Additionally, further ground investigation were undertaken in March 2021 comprising three open-hole rotary boreholes to 12.00m bgl and dynamic probing within the north of the site to obtain CBR values for road/pavement design. Groundwater and gas monitoring wells installed within select borehole locations, with six return ground gas monitoring visits have been completed. Selected soil and rock samples were scheduled for chemical and geotechnical analysis.
Ground Conditions	Made Ground deposits were encountered in all of the exploratory holes (with exception of WS02), to base depths ranging from 0.45m bgl (BH01) to 2.50m bgl (WS05). The Made Ground generally comprised an upper layer of predominantly granular material with demolition material and the deeper Made Ground encountered as a cohesive material, likely reworked material. Residual soils were encountered locally within north-western to south-western area of the site within WS01 and WS02. These were encountered to underlie either Topsoil or Made Ground at shallow depths (<0.80m bgl) to depths of 3.65m bgl. Bedrock has been encountered within all of the rotary boreholes, comprising sandstone to circa 10.0m bgl with Limestone thereafter within BH01, BH02 and BH06 all within the northern portion only. The sandstone is described Medium strong light brownish grey coarse rained crystalline SANDSTONE with rare microline coal laminations. The Limestone was described as Strong light whitish grey crystalline LIMESTONE. Small pyritic inclusions noted and common quartz veins throughout.
Environmental Laboratory Testing	With respect to the proposed 'Commercial' end use, no exceedances were recorded within any samples collected from the made ground.

and Ground Gas Monitoring Results	Selected soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified in the exploratory hole logs and no asbestos fibres were positively identified during laboratory analysis of the soil samples. No flow, carbon dioxide or methane concentrations above the machine's limit of detection have been recorded.
Generic Quantitative Risk Assessment	The risk presented to site end users from made ground soils is **Low** due to no exceedances above *Commercial* thresholds were recorded in any samples recovered. The risk presented to site end users from ground gases is **Low**, with a CS-1 classification and no gas protection measures required for the site. Radon protection measures are not required.
Geotechnical Assessment	It is considered that the underlying bedrock could potentially provide a suitable bearing stratum. For foundations founded on moderately strong sandstone with discontinuity spacings >60mm, allowable bearing capacities of 1500 to 2000 kN/m2 are estimated. Where bedrock is too deep and overlaid by variable made ground (encountered across the site to depths of up to 2.50m bgl) and along with variable residual soils (locally to 3.65m bgl) it may affect the feasibility with potential mass trench fill foundations required within areas of deep made ground/residual soils. It is also considered that a piled foundation solution could be used to transfer the loads to the underlying bedrock. The carrying capacity of piles depends not only on their size and the ground conditions but also on their method installation. If a piled foundation solution is to be adopted, consideration should be given to the fractured/poor quality bedrock at from approximately 9.00 – 11.50m bgl, within the vicinity of BH02A. Based on the observations on site together with the results of laboratory tests, it is recommended that consideration is given to a suspended ground floor slab, unless founded on a suitable natural stratum with allowable bearing capacities satisfying the required pressures from the slab. Where piled foundations are anticipated, a suspended slab is recommended to bear on the pile caps by a network of beams which will minimise any differential settlement between the floor and piled structure. Laboratory test results indicate a Design Sulphate Class for concrete may be taken as DS-2 and ACEC class of AC-2 would be appropriate.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made: 1. 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. 2. Where unexpected contamination is discovered during future earthworks and/or construction, works should eb stopped and the advice of a qualified geo-environmental engineer should be sought.

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Appendices

1.0 Introduction

1.1 Project Background

Curtins have been instructed by CCL Solutions on behalf of Grahams Construction to undertake a Ground Investigation for the proposed development at the West Cumberland Hospital in Whitehaven.

The proposed development comprises the construction of a new hospital wing and refurbishment of existing buildings with associated car parking, communal soft landscaped, clinical and recycling waste storage in the north of the site.

The site is located on approximate National Grid Reference (NGR) 298950, 516040.

The current development plans can be referred to within Appendix A of this report.

1.2 Scope of Works

This report includes a review of the readily available information for the site, as presented in the Curtins 2020 Phase 1 Preliminary Risk Assessment Report (Curtins, 2020) and the recent ground investigation undertaken by Curtins. This report will provide an assessment of the geo-environmental and geotechnical conditions across the site and present an account of the ground and groundwater conditions along with any anticipated limitations or constraints caused by contamination or geohazards.

The Phase 2 report is intended to determine:

a) Likelihood of potential shallow site soils contamination, due to site's current and historic land use, adversely impacting the end-user;
b) Likelihood of potential groundwater contamination, due to site's current and historic land use, adversely impacting the end-user;
c) Likelihood of potential ground gas, adversely impacting the end-user; and
d) Likelihood of the proposed works being adversely impacted by potential geo-hazards across the site.

In addition, recommendations on foundation solutions for the proposed structures will be provided.

Detailed flood risk assessment, ecology and archaeological studies are outside of the scope of this report.

2.0 Site Setting

Information about the current site setting, history, geology and hydrogeology/hydrology, have been previously detailed within the Phase 1 Preliminary Risk Assessment, undertaken by *Curtins, Ref:73096-CUR-00-XX-RP-GE-001*. Additional sources of readily available information have also been assessed as a part of this report. A summary of these are provided in the subsequent sections.

This information will feed into the geo-environmental risk assessment (refer to Section 7.0) and geotechnical assessment (refer to Section 9.0).

2.1 Available Sources

In addition to the Phase 1 report undertaken by Curtins, other sources of relevant information reviewed for this scheme comprise:

- Envirocheck Report, included in the Curtins Phase 1
- British Geological Society (BGS) Scotland Map Sheet 30E, Scale 1:50,000 Glasgow Solid Geology (British Geological Society, 1993)
- British Geological Society (BGS) Scotland Map Sheet 30E, Scale 1:50,000 Glasgow Solid Geology (British Geological Society, 1994)
- BGS GeoIndex Online Map Viewer (British Geological Society, 2020)

2.2 Current Setting

The development site is indicated within boundary A in the figure below. Most of the site is currently vacant, having undertaken demolition of the previous hospital building in the west, and previous buildings in the north-east.

Figure 2.2 on the following page shows the approximate site boundary.

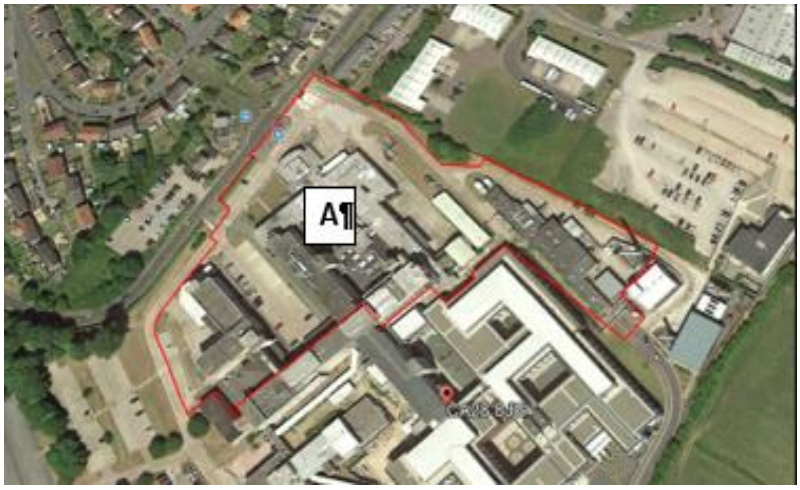

Figure 2.2 *Site Location Plan (approx. site boundary shown in pink), centred on National Grid Reference NS 298950, 516040.*

The surrounding land use is summarised in *Table 2.2*.

Table 2.2 *Surrounding Land uses*

Surrounding Area	**N**	Homewood road and mixed commercial and residential properties.
	E	Buildings associated with West Cumberland Hospital and open fields with a helipad.
	S	Residential properties and fields.
	W	Residential properties.

2.3 Previous Site Use

A summary of the review of the historical maps undertaken within the Curtins Phase 1 report is provided below:

- ***Table 2.3 –*** *Previous Site Uses and Potential Sources of Contamination*

Date	Description	Potential Sources of Contamination
1865-1957	The subject site is spread across several bounded fields. Three trees are present on the western boundary.	N/A
1961-1963	West Cumberland Hospital is first identified. The previously mentioned trees have been removed. A rectangular building is constructed in the eastern corner of the site as per present day as is a secondary rectangular building that is built parallel. A footpath provides access to these buildings from Homewood Road. A chimney is shown on the east of the site.	Uncontrolled deposition of Made Ground from construction onsite.

Date	Description	Potential Sources of Contamination
1965-1968	A large phase of development occurs between O.S. publications and West Cumberland Hospital largely resembles the same general layout as per present day. Construction of numerous buildings, many remain till present day. A row of 8No. square buildings are orientated toward NW-SE in the north west of the site. Several trees are planted along the north eastern site boundary.	Uncontrolled deposition of Made Ground from construction / demolition onsite.
1999	The site remains largely unchanged. The row of square structures previously mentioned appears to have been demolished in the north west of site and replaced by car parking.	Uncontrolled deposition of Made Ground from construction / demolition onsite.
1999-2019	Site remains largely unchanged until present day.	N/A

The contaminants, likely to be present from the historic site and surrounding area uses, include but are not limited to: asbestos within construction materials, petroleum hydrocarbons from localised fuel spillages, and inorganic compounds including heavy metals.

No significant geo-hazards have been previously recorded.

2.4 Geology and Hydrogeology

The British Geological Society (BGS) 1:50,000 maps and the BGS historic exploratory holes have been reviewed. A summary of the anticipated ground conditions is provided in *Table 2.4.*

Table 2.4 *Geological/Hydrogeological Succession*

Geology	Associated Hydrogeological Classification
Till, Devensian[1]	Secondary Undifferentiated[2]
Hensingham Grit[3]	Secondary A Aquifer[4]
Stainmore Formation[5]	Secondary A Aquifer[4]

Notes:

1. *Diamicton. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.*
2. *Assigned in cases where it has not been possible to attribute either category A or B to a rock type*

3. *Sandstone. Sedimentary Bedrock formed approximately 328 to 329 million years ago in the Carboniferous Period. Local environment previously dominated by rivers.*
4. *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.*
5. *Mudstone, Siltstone and Sandstone. Sedimentary Bedrock formed approximately 319 to 329 million years ago in the Carboniferous Period. Local environment previously dominated by swamps, estuaries and deltas.*

2.4.1 BGS Data

A review of the available online BGS borehole records did not record any historic boreholes on site, however historical boreholes were identified immediately adjacent to the site. These were summarised within the Curtins Phase 1 Preliminary Risk Assessment and are presented in *Table 2.4.1*.

Table 2.4.1 *Summary of BGS Historic Boreholes*

Reference	Location (NGR)	Details (depth to top of strata/details/thickness)
NX91NE50/52	298730, 515980	0.40m bgl, Topsoil 3.75m bgl, Broken sandstone and sandy clay. 4.50m bgl, Grey sandstone. Borehole completed at 4.50m bgl.
NX91NE/80	299061, 516308	0.00m bgl, Firm to stiff brown sandy boulder clay. 1.50m bgl, Stiff brown sandy boulder clay. 3.20m bgl, Soft brown sandy clay and grey shale. 5.00m bgl, Dark grey weathered shale. *5.00m Borehole completed*
NX91NE381	299890, 515910	0.00m bgl, Sandy gravelly cobbly clay. 6.70m bgl, Sand and gravel with cobbles and boulders. 8.35m bgl, Dark reddish-brown sandstone. 18.00m bgl, Dark red sandy clayey siltstone. *Borehole continues to 120m bgl prior to termination.*

2.5 Hydrology

The nearest surface water feature is located 264m south west of the site. Which appears to relate to a small drain.

There are 17No. discharge consents within 1km of the site. The closest is 390m north east of the site and is operated by Copeland Athletic Stadium Trust for the discharge of surface water into a freshwater stream/river.

There are no surface water abstraction points recorded within 1km of the subject site.

There are 21 pollution incidents to controlled waters within 1km of the site. The closest refers to a Category 3 – Minor incident which occurred in March 1992, 278m to the north west of the site relating to unknown oils being discharged into the Irish Sea catchment area.

2.6 Mining

There are 21No. BGS Recorded Mineral Sites within 1km of the site. The closest refers to the aforementioned Overend Quarry approximately 200m east of the site.

The site is within a known coal mining region, however, is not located within a development high risk area associated with potential zone of influence of surface or subsurface coal workings.

Based on the foregoing commentary, it is not considered there is a risk to the site from previous mining and mineral extraction activities; it is therefore not considered further.

2.7 Unexploded Ordnance

Risk mapping for UXO's has placed the site in a low-risk area. Low-risk areas are indicated as having 15 bombs per 1000 acre or less. In low risk areas, it may not be essential to undertake a detailed UXO risk assessment. Furthermore, no evidence of ruins is noted in post war mapping on site or in the surrounding area and there are no locally significant targets noted prior to or during WW2.

On this basis the risk from UXO is considered to be Low and no further assessment is required at this stage.

2.8 Ground Gas

There is a single (1No.) BGS Recorded Landfill Site entry 198m NE from the site, this refers to Overend Tip (former quarry).

There are 3No. Historic Landfill Site records within 830m of the site. The two closest refer to Overend Quarry approximately 200m north east of the site.

There are 3No. records of Potentially Infilled Land (non-water) within 1km of the site. The closest is 377m east of the site referring to unknown filled ground (pit, quarry, etc) in 1979.

There are 20 records of Potentially Infilled Land (water) within 1km of the site. A single entry is located within the site boundaries referring to unknown filled ground (pond, marsh, river, stream, dock, etc).

Two (2No.) Registered Landfill Sites are identified within the environmental database report. The closest is 195m north east of the site and also refers to Overend Quarry. The license is operated by Copeland B.C. for the disposal of gully waste and road sweepings.

The BGS Radon Mapping confirms the site is situated in a lower probability radon area where <1% of homes are at or above the radon action level. On this basis radon protection measures are not considered necessary in the construction of new dwellings or extensions.

3.0 Conceptual Site Model & Qualitative Risk Assessment

The Preliminary Conceptual Site Model (PCSM) and Qualitative Risk Assessment (QRA) are presented in the table within this section.

The PCSM details the source-pathway-receptor linkages or potential contaminant linkages (PCLs) that have been identified for the site. The QRA details the associated level of risk relating to these PCLs.

The PCSM and QRA concern the major risks to human health and the water environment with additional, more specific risk assessment protocols contained within the main body of this reporting, as detailed in Section 3.1 below.

The QRA follows the framework outlined within CIRIA C552 which is summarised within Appendix G.

The 'risk rating' within the QRA refers to the risk that the source, pathway, receptor linkage or PCL 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.

3.1 Additional Risk Assessments

The following risk assessments, listed below, are not included within the main CSM and QRA but none-the-less can be of critical importance to the onward development of the site.

- The risk presented by **Mining and Mineral Extraction** is discussed and assessed in Section 2.6.
- The risk presented by **Radon** is discussed and assessed in Section 2.8.
- The risk presented by **Unexploded Ordnance** is discussed in Section 2.7.

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 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 on site 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.

- The table below represents the first stage in the land quality risk assessment process; **the Qualitative Risk Assessment**.
- In order 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 negligible 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 in order to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Recommended Actions
Source	**Pathway(s)**	**Receptor(s)**	**Consequence**	**Likelihood of Occurrence**	**Risk Rating**	
Made Ground of unknown composition from uncontrolled deposition of construction / demolition materials on site. Localised contamination within potential chimney base on site.	**Direct contact, ingestion, inhalation (dust and vapours)**	**End-user of site & Construction Workers**	**Medium** Chronic health risk	**Low Likelihood** Minimal phases of historic development and minimal significant sources of contamination identified. Construction Workers will be protected further by appropriate PPE and Health & Safety Measures.	**Moderate / Low**	**Generic Quantitative Risk Assessment** Contamination testing is recommended as part of the ground investigation.
	Vertical migration through the superficial deposits (soils) May occur due to existing service corridors and physical processes including; capillary action and downwards into the natural deposits through infiltration.	**Controlled Waters** (groundwater) High vulnerability of superficial Principal Aquifer. Secondary A Aquifer of bedrock. No groundwater abstraction points within 1km & the site is not within a designated Source Protection Zone.	**Medium** Pollution of sensitive water resources	**Unlikely** Widespread contamination is not anticipated given the limited site history and lack of industrial land use. Superficial Till deposits anticipated to have a low infiltration capacity. The risk to the aquifer is considered low due to no SPZ or abstraction points.	**Low**	**Generic Quantitative Risk Assessment** No further action required unless visual or olfactory evidence of significant contamination is encountered on site, in this case groundwater testing is recommended.
	Horizontal migration over and through the superficial deposits (soils)	**Controlled Waters** (surface water) There are no surface water courses within 250m of the site.	**Medium** Pollution of sensitive water resources	**Unlikely** Considering the considerable distance from the site to the nearest surface water feature, it is considered unlikely that any contamination would migrate to surface water receptors.	**Low**	No further action required.
Production of ground generating gases from surrounding areas of known infilled land (water and non-water).	**Vertical and horizontal migration through existing service corridors and the underlying superficial deposits**	**End-user of site**	**Medium** Human health risk	**Low** Numerous sources of possible ground gas identified in area surrounding site. Gas migration may be limited by superficial Glacial Till deposits.	**Moderate/ Low**	**Generic Quantitative Risk Assessment** Ground gas monitoring to confirm risk following the recommended ground investigation.

4.0 Field and Laboratory Studies

4.1 Ground Investigation

Curtins Ground investigation was undertaken in December 2020 with additional drilling works undertaken in March 2021.The scope of the ground investigation was designed in general accordance with current UK guidance including:

- LCRM (Environment Agency, 2020)
- British Standard (BS) 10175 (British Standards Institute, 2017)
- BS5930:2015 (British Standards Institution, 2010)
- BSEN1997: Part 2:2007 Eurocode 7A (British Standards Institution, 2007)

The scope of the works and rationale is summarised in ***Table 4.1***.

Table 4.1 *Scope and Rationale of Fieldwork Undertaken*

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Windowless Sampling Boreholes	WS01	3.65	• Confirm shallow ground conditions. • Undertake in-situ testing. • Collect soil samples for chemical and geotechnical analysis
	WS02	3.65	
	WS03	1.90	
	WS04	2.20	
	WS05	2.50	
	WS06	1.80	
	WS07	2.20	
Cable Percussion / Rotary Cored Boreholes	BH01	11.00	• Confirm ground conditions. • Collect soil and water samples for chemical and geotechnical analysis. • Undertake in-situ testing. • Gas and groundwater level monitoring.
	BH02A	17.30	
	BH03	13.00	
	BH04	13.00	
	BH05	13.00	
	BH06	12.00	
Open Hole Rotary Boreholes	BH07	12.00	• Confirm ground conditions within vicinity of BH02A to confirm no voiding present.
	BH08	12.00	
	BH09	12.00	
Dynamic Cone Penetrometer Test	DCP01	1.00	• Obtain CBR values for proposed road/pavement design.
	DCP02	1.00	

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
	DCP03	1.00	
	DCP04	1.00	
	DCP05	1.00	
	DCP06	1.00	
	DCP07	1.00	

For the exploratory hole location plan refer to Curtins Drawing Ref: 074525-CUR-00-XX-DR-GE-001-V01, Appendix A.

The exploratory holes were logged on site by an engineer from Curtins in accordance with the requirements of BS5930:2015, including recording of any observed visual and olfactory indications of contamination.

Copies of the exploratory hole logs are provided within Appendix B.

4.1.1 In-Situ Tests

The in-situ testing undertaken during the ground investigation works is summarised in *Table 4.1.1*.

Table 4.1.1 *In-Situ Testing*

Activity	Rationale
SPT tests within window sample boreholes	To obtain in-situ density and investigate bedrock profile across the site.
Rotary coring within rotary boreholes	To obtain Rock Quality Designation (RQD) values of intact bedrock

4.2 Laboratory Analysis

Representative soil samples were obtained for laboratory geotechnical and geochemical testing, based on the field observations.

Soil samples for geochemical analysis were placed in appropriate laboratory provided containers and stored in temperature-controlled conditions prior to being transported to a UKAS accredited laboratory under chain of custody documentation.

The representative rock samples were collected and scheduled for laboratory geotechnical testing. Geotechnical samples were transported to a UKAS and MCerts accredited laboratory under chain of custody documentation for testing.

4.2.1 Geo-environmental – Soils

Soil samples were taken from shallow ground across the site, and 13 made ground samples from across the site were tested for a broad environmental suite as detailed below.

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), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite listed in *Table 4.2.1*.

Table 4.2.1 *Environmental Chemistry Analysis Suite : Soils*

Suite Ref.	Analyte	LOD
Soils Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	N/A
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	1 mg/kg
	Boron (water soluble)	0.2 mg/kg
	Cadmium	0.2 mg/kg
	Mercury	0.3 mg/kg
	Cyanide (total)	1 mg/kg
	Phenols (screen)	<0.1 – 0.3 mg/kg
	PAHs (USEPA 16)	0.05 mg/kg
	TPH (Aro/Ali Split)	0.01 to 10 mg/kg

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

4.2.2 Geo-environmental – Groundwater

Groundwater samples were taken from the wells installed in BH01, BH03 and BH06 during the second monitoring visit and were scheduled for a specific groundwater suite listed in *Table 4.2.2*.

Table 4.2.2 *– 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

Suite Ref.	Analyte	LOD
	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

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

4.2.3 Geotechnical

Soil samples for testing were prepared in accordance with BS1377 (British Standards Institution, 2016). The following geotechnical tests have been undertaken:

- 1 No. Particle Size Distribution Test;
- 29 No. Point Load (PL) Tests; and
- 13 No. Unconfined Compression Strength (UCS) Test.

Copies of the geotechnical testing certificates are presented within Appendix D.

4.3 Monitoring Well Installations

Single installations comprising 50mm diameter standpipes have been installed in BH01, BH02A, BH03, BH04, BH06, WS03 and WS05, for the purposes of gas and groundwater monitoring.

A bentonite seal was placed above the screened section of the boreholes to minimise potential for 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 installations are summarised in *Table 4.3*.

Table 4.3 *Monitoring Well Response Zones*

Borehole Ref.	Diameter (mm)	Response Zone (m bgl)	Strata Description(s)
BH01	50	2.0-11.0	Sandstone
BH02A	50	8.0-12.0	Sandstone
BH03	50	3.0-13.0	Sandstone

Borehole Ref.	Diameter (mm)	Response Zone (m bgl)	Strata Description(s)
BH04	50	4.0-13.0	Sandstone
BH06	50	2.0-12.00	Sandstone
WS03	50	1.0 – 2.0	Made Ground
WS05	50	1.0 – 2.0	Made Ground

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

4.3.1 Post-Investigation Monitoring

Six rounds of groundwater and ground gas monitoring over a three-month period have been completed, to assess the groundwater and ground gas conditions, identified in the Preliminary Conceptual Site Model within the Phase 1 Preliminary Site Assessment.

5.0 Ground Conditions

5.1 General

The ground conditions encountered during the Curtins Ground Investigation is summarised in *Table 5.1,* with detailed information presented on the exploratory hole logs, Appendix B.

Table 5.1 *Ground Conditions Summary*

Stratum	Depth to top of strata (m bgl)	Thickness (m)	
		Min	Max
Topsoil	0.0	0.40	-
Made Ground	0.0	0.45	2.5
Residual Soils	0.4 – 0.80	2.8	3.25
Bedrock: Hensingham Grit	0.45-3.65	-	

5.2 Topsoil

Topsoil was encountered within a single location (WS02) comprising a dark brown slightly silty fine and medium SAND. The material was encountered to 0.40m bgl.

5.3 Made Ground

Made Ground deposits were encountered in all of the exploratory holes (with exception of WS02), to base depths ranging from 0.45m bgl (BH01) to 2.50m bgl (WS05). The Made Ground generally comprised a predominate upper layer of granular material with demolition material and the deeper Made Ground encountered as a cohesive material, likely reworked material.

Granular Material

The granular material comprised light brown sand and gravel with gravel of sandstone, breeze block, wood, plastic, metal and cloth fragments. This unit was predominately encountered to circa 1.0m to 2.20m bgl.

Cohesive Material

The cohesive Made Ground was typically encountered to underlie the granular material and was considered to be reflective of reworked residual soils. The unit comprised a brown sandy gravelly clay with gravel of sandstone, wood, brick and nails. This material was typically encountered prior to intact bedrock.

No geotechnical laboratory testing has been undertaken on made ground, however in-situ SPTs within the made ground indicate a highly variable stratum.

5.4 Residual Soils

Residual soils were encountered locally within north-western to south-western area of the site within WS01 and WS02. These were encountered to underlie either Topsoil or Made Ground at shallow depths (<0.80m bgl) to depths of 3.65m bgl.

The residual soils were recorded as both granular and cohesive material. The cohesive material comprised a stiff brownish red sandy slightly gravelly CLAY, whilst granular material comprised a medium dense light brown slightly clayey gravelly fine to coarse SAND. The geotechnical test results recorded within the residual soils are summarised in *Table 5.4.* However, given the localised area of these deposits on-site, no geotechnical parameters have been derived for this unit.

Table 5.4 *Summary of geotechnical test results – Residual Soils*

Test	No. of tests	Minimum	Maximum	Average
In-situ				
SPT 'N' Value (cohesive)	3	20	38	30
SPT 'N' Value (granular)	1	22	-	-

5.5 Bedrock

Bedrock has been encountered within all of the rotary boreholes, comprising sandstone to circa 10.0m bgl with Limestone thereafter within BH01, BH02 and BH06 all within the northern portion only. The sandstone is described Medium strong light brownish grey coarse rained crystalline SANDSTONE with rare microline coal laminations. The Limestone was described as Strong light whitish grey crystalline LIMESTONE. Small pyritic inclusions noted and common quartz veins throughout.

It is noted that during drilling of BH02A, a significant reduction in RQD was noted at the apparent limestone interface at approximately 9m bgl. Three additional boreholes (BH07 – BH09) were advanced approximately 5m from BH02A in different directions in March 2021, to investigate whether this potentially arose due to presence of voids. Locations of additional boreholes are presented within Appendix A.

It is noted that within all three locations broken sandstone was encountered from approximately 9m bgl to and at the beginning of the limestone bedrock interface. During groundwater monitoring visits, groundwater was recorded within the bedrock at BH02A at approximately 11m bgl, at levels coinciding with the weakened/fractured bedrock.

As such, it is anticipated that this is reflective of a geological fault with noted reduction of the RQD at the interface between sandstone and limestone within this area and/or weakened/fractured bedrock coinciding with a groundwater bearing unit, rather than voiding.

The geotechnical test results recorded within the sandstone are summarised in *Table 5.5a*. The test result certificates are included within Appendix D. At this stage, no geotechnical test results or parameters have been derived for the Limestone owing to localised area on-site. ***Table 5.5a*** *Summary of geotechnical test results – Sandstone*

Test		No. of tests	Value	
In-Situ				
RQD (%)		57	Min: 0* Max: 100 Average:86	
Laboratory				
Point Load Test	Point Load Strength Index (Is_{50}) (MPa)	28	Diametral	Min: 0.48 Max: 6.94 Average: 2.19
		28	Axial	Min: 0.53 Max: 5.55 Average: 2.26
UCS (MPa)		12	Min: 26.6 Max: 50.7 Average: 37	

Notes - *At the interface between the sandstone and limestone

UCSs were determined from the Unconfined Compressive Strength (UCS) test results and Point Load test results. A factor of 20 has been used to correlate the Is_{50} determined from the Point Load tests to the UCS, Figure 5.5.

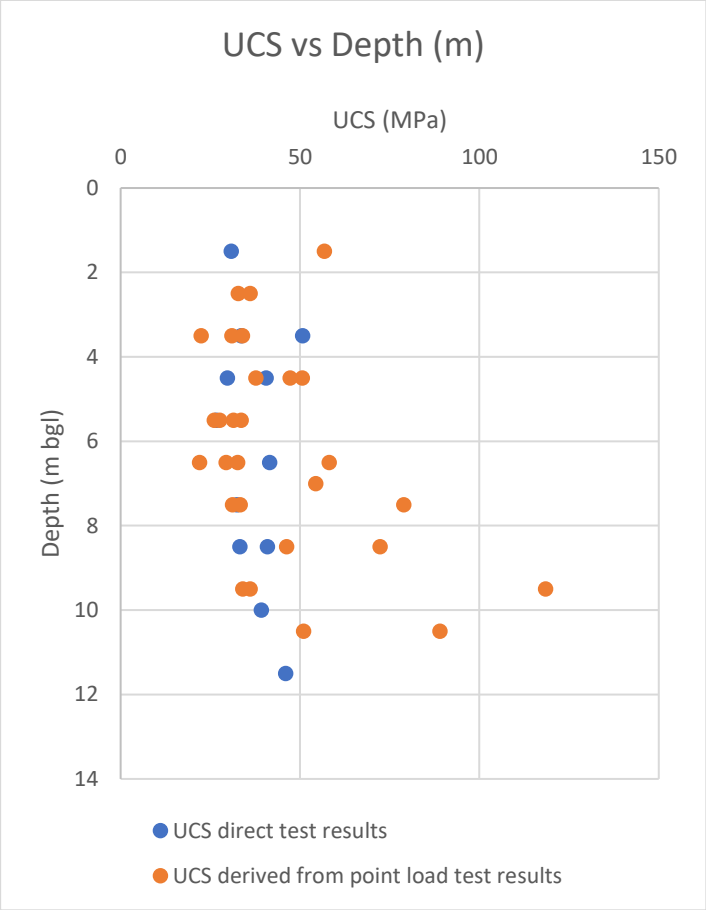

Figure 5.5 *UCS vs. Depth*

5.6 Observed Potential Contamination

No potential contamination was noted within the soils/groundwater.

5.7 Groundwater

Perched groundwater was encountered within the Made Ground during the investigation ranging from 0.50m (WS03) to 2.10m bgl (BH05). A single groundwater strike was recorded within the residual deposits of WS01 at 2.10m bgl.

Groundwater monitoring wells were installed as summarised in *Table 5.7.*

Six rounds of groundwater monitoring have been undertaken to assess the groundwater regime across the site.

Table 5.7 *Groundwater Monitoring Results*

Borehole Ref.	Installation Strata	Depth (m bgl)				
		07/01/21	20/01/21	04/02/21	17/02/21	08/03/21
BH01	Made Ground	0.77	0.00	0.0	0.65	0.99
BH02A		*	11.20	10.80	11.09	11.00
BH03		1.97	0.98	1.57	1.96	1.91
BH06		0.66	0.0	0.0	0.04	0.75
WS03		0.40	0.00	0.0	0.0	*
WS05		2.05	1.02	1.63	1.96	1.95

Notes - *Unable to be accessed

It is considered that perched water exists within the Made Ground as noted within WS03 and WS05, at depths of 0.0m to 2.05m bgl.

The installations within the sandstone (BH01, BH03 and BH06) installed within the underlying bedrock has recorded shallow groundwater, at depths of between 0.0m to 1.96m bgl, with locally deep groundwater of 10.80m to 11.20m bgl within BH02A indicating the groundwater within the bedrock aquifer is under an element of hydrostatic pressure.

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, third edition of 2017 (Building Research Establishment, 2017). *Table 5.7* details the classification.

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

Stratum	Design Sulphate Class	ACEC Class *
Made Ground	DS-2	AC-2

* ACEC assessment was based on the mobile groundwater condition for the scheme area

5.9 Dynamic Cone Penetrometer Tests

Seven dynamic cone penetrometer tests were advance to approximately 1.00m bgl to obtain CBR values within areas of proposed road/hardstanding in the new waste recycling facility.

Copies of Test results are included within Appendix D.

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 (British Standards Institution, 2013).

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 Section 3.0 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 (Environment Agency, 2014), Science Report 2 (Environment Agency, 2009) and Science Report 3 (Environment Agency, 2009).

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 (Department of Environment Food and Rural Affairs (DEFRA) , 2012) 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 proposed use to the site, as a hospital, is most analogous with a *Commercial* 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.

Soil Organic Matter (SOM) has a strong bearing on the availability of potential contaminants and therefore influences the Tier 1 Thresholds. The SOM ranged between 0.2% to 2.9%. As such, the comparison has been made against GACs developed for a sandy soil with a SOM of 1.0%.

The results of the environmental testing can be referred to in Appendix C. Copies of the Tier 1 Thresholds are contained within 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 testing undertaken on a total of thirteen made ground soil samples across the site.

With respect to the proposed 'Commercial' end use, no exceedances were recorded within any samples collected from the made ground.

Selected soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified in the exploratory hole logs and no asbestos fibres were positively identified during laboratory analysis of the soil samples.

6.2 Controlled Waters GQRA

No significant visual/olfactory evidence of contamination was identified within shallow site soils during the site investigation. This is further confirmed by laboratory testing of soils highlighted within Section 6.1.2.

Considering the conceptual site model developed within the Phase 1 Preliminary Risk Assessment, due to no surface water receptors being located within 250m of the site, and no recorded abstraction points located within 1km of the site, as well as chemical laboratory it is considered that risks to controlled waters are confirmed as Low with no further action required.

6.3 Ground Gas GQRA

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 (CIRIA, December 2007), BSI Publication (Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015 (British Standards, June 2015), BSI Publication (Guidance on Investigations for Ground Gas-Permanent gases and Volatile Organic Compounds (VOCs) (British Standards Institution, 2013) and other broadly accepted references such as the Ground Gas Handbook 2009 (S.Wilson, G.Card and S.Haines, 2009).

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 previous reporting and thereafter validating this conceptual model with the ground gas data, a semi-quantitative risk assessment.

6.3.1 Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented within Section 3.0 noted the overall moderate/low risk posed by ground gases based on the identified sources, primarily made ground from previous phases of development and gases associated with potentially infilled ground and historical development.

With respect to ground gas sources;

Made Ground

Made ground deposits were encountered in all of the exploratory holes, to a maximum depth of 3.65 m bgl.

The Made Ground generally comprised a predominate upper layer of granular material with demolition material and the deeper Made Ground encountered as a cohesive material, likely reworked material.

With respect to ground gas pathways:

Direct gassing of ground gas from the shallow soils to the near surface is considered the main pathway for ground gas migration on site.

6.3.2 Monitoring Results Discussion

In order to characterise the site's gas regime and validate the qualitative assessment of ground gas risk, standpipe installations were incorporated within six exploratory borehole locations as detailed in *Table 4.1.3* within Section 4.0.

Gas monitoring has been undertaken on the following occasions: 07/01/2021, 20/01/2021, 04/02/2021 & 17/02/21.

Gas monitoring has been undertaken during both falling and steady atmospheric pressures with barometric pressure ranging from 1014mb to 954mb.

A summary of the soil gas monitoring results to date is presented in *Table 6.3.2* and copies of the log sheets presented in Appendix E.

Table 6.3.2 *Summary of Soil Gas Monitoring Results*

Location	Flow (l/hr)		CO_2 Range of Peak Values ($\%^{vol}/_{vol}$)	CO_2 Range of Steady State ($\%^{vol}/_{vol}$)	CH_4 Range ($\%^{vol}/_{vol}$)	Strata Description (50mm well)
	Max	SS				
BH01	-23.7	-0.2	<0.1	<0.1	<0.1	Bedrock
BH02A	4.5	<0.1	1.3	1.3	<0.1	Bedrock
BH03	-63.7	<0.1	<0.1	<0.1	<0.1	Bedrock
BH06	-63.8	<0.1	<0.1	<0.1	<0.1	Bedrock
WS03	-22.7	-0.2	<0.1	<0.1	<0.1	Made Ground
WS05	0.1	0.1	<0.1	<0.1	<0.1	Made Ground

Hydrogen sulphide and carbon monoxide were recorded with maximums of 1ppm and 13ppm respectively.

6.3.3 Gas Assessment

It is noted that high negative flow rates were recorded within BH03, BH06 and WS03 on once occasion each. For the remainder of the visits, these wells were noted as being flooded. On the occasions where high flow rates were recorded, the groundwater levels recorded within the well were significantly above the screened section of the well. As such, it is considered that the cause of these peak flows is a result of pressure build up within the well, and not representative of natural site conditions. As such, these peak flows have been discounted form this assessment.

Considering both a 'worst credible scenario' (maximum 'absolute' flow rate, maximum gas concentration within a single borehole location) and 'worst possible scenario' (maximum 'absolute' flow rate, maximum gas concentration across all borehole locations) the Hazardous Gas Flow Rates (Q_{hg}) for the site are evaluated as 0.059 (carbon dioxide) and 0.001 (methane).

On the basis that encountered ground conditions have a low gassing potential and low ground gas concentrations have been recorded the site is assessed as Characteristic Situation 1 (CS-1) where gas protection measures will not be required.

6.3.4 Radon

As identified in Section 2.8, no radon protection measures are required.

However, where the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

7.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented in Section 3.0 of this report has been revised following the GQRA in *Section 6.0* above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

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 (CIRIA, 2001) 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 2.7.

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 (CITB, 2015) 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 on site 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.

- 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.
- In the absence of specific site data, a Generic Quantitative Risk Assessment is invariably recommended.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	**Pathway(s)**	**Receptor(s)**	**Consequence**	**Likelihood of Occurrence**	**Risk Rating**		
On-site sources of potential contamination: Made ground was encountered to a maximum depth of 3.65m.	**Ingestion/direct contact of soils Inhalation of vapours and soil dust/fibres**	**End users of site** Future site users, visitors and trespassers	**Mild**	**Unlikely**	**Low**	No exceedances of Commercial GACs noted within any recovered made ground soils samples.	Standard Health & Safety precautions likely to be used by workers.
	Vertical migration through the Made Ground and residual soils May occur due to processes including; capillary action.	**Controlled Waters (Groundwater)** Bedrock – Principal Aquifer No groundwater abstractions within 1km of the subject site. The site is not within a SPZ.	**Medium** Pollution of sensitive water resources	**Unlikely**	**Low**	Due to no sources of contamination identified within shallow site soils during the ground investigation and no groundwater abstractions noted within 1km of the site, this SPR linkage is not expected to be realised.	No further action required.
On-site and off-site sources of potential ground gas generation Made ground associated with historic development on-site.	**Vertical and horizontal migration through the Made Ground.**	**End users of site** Future site users, visitors and trespassers	**Mild** Human health risk	**Unlikely**	**Low**	Ground gas monitoring to date has recorded no elevated concentrations of carbon dioxide, methane. High negative flow rates have been attributed to pressure build up within monitoring wells due to high water table and are not considered representative of live site conditions. As such, the site is classified as CS-1.	No further action required.

8.0 Geotechnical Conclusions and Recommendations

The recommendations provided within this section are based on a review of the ground conditions encountered across the site, considering the geotechnical and geo-environmental limitations and hazards identified.

8.1 Foundation Recommendation

It is understood, the proposed development comprises the construction of a new two storey hospital wing and refurbishment of existing buildings with associated car parking, communal soft landscaped, clinical and recycling waste storage in the north of the site.

It is considered that the underlying bedrock could potentially provide a suitable bearing stratum. For foundations founded on moderately strong sandstone with discontinuity spacings >60mm, allowable bearing capacities of 1500 to 2000 kN/m^2 are estimated.

Where bedrock is too deep and overlaid by variable made ground (encountered across the site to depths of up to 2.50m bgl) and along with variable residual soils (locally area to 3.65m bgl) it may affect the feasibility with potential mass trench fill foundations required within areas of deep made ground/residual soils. It is also considered that a piled foundation solution could be used to transfer the loads to the underlying bedrock. It must be noted that due to high strength of the bedrock, where allowable bearing capacities cannot be achieved for a pile end bearing at rockhead, CFA piling may not be a suitable solution, and other piling techniques such as bored piles may have to be considered. In addition, obstructions within the made ground and the high strength bedrock may affect the performance of a CFA rig. Therefore, a suitably qualified and experienced piling contractor should be consulted prior to commencement of the works.

The carrying capacity of piles depends not only on their size and the ground conditions but also on their method of installation.

If a piled foundation solution is to be adopted, consideration should be given to the fractured/poor quality bedrock at from approximately 9.00 – 11.50m bgl, within the vicinity of BH02A.

8.2 Ground Floor Slabs

Based on the observations on site together with the results of laboratory tests, it is recommended that consideration is given to a suspended ground floor slab, unless founded on a suitable natural stratum with allowable bearing capacities satisfying the required pressures from the slab. Where piled foundations are anticipated, a suspended slab is recommended to bear on the pile caps by a network of beams which will minimise any differential settlement between the floor and piled structure.

8.3 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest and laboratory testing undertaken accordingly as detailed in Section 5.7.

Based on the laboratory test results it is considered that for Made Ground a Design Sulphate Class may be taken as DS-2 and an ACEC class for the site of AC-2 would be appropriate.

8.4 Excavations

It is anticipated that excavations will be required during the construction phase. These are likely to be for localised services and dig & replacement works.

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to <1.20m bgl should stand unsupported in the short term at suitable batters. However, where soft/loose deposits are present, instability is likely. 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 batters may be required. These must be designed by a suitably qualified temporary works contractor for any excavations.

Groundwater may be encountered as seepages in shallow excavations for foundations or services as perched water. It is considered that groundwater inflows, if encountered, may be controlled by pumping from sumps.

Excavation through layers of Made Ground encountered across the site 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.

All excavation temporary works shall be designed by a suitably qualified temporary works contractor for any excavations.

9.0 Geo-Environmental Conclusions and Recommendations

9.1 Geo-Environmental Conclusions

A revised tabulated Conceptual Site Model has been derived following the findings of the Generic Quantitative Risk Assessment and is presented in Section 7.0.

9.1.1 Ground Contamination

The environmental chemistry soil results have been compared with the Tier 1 criteria for soils with respect to human health against '*Commercial*' thresholds of which no exceedances were noted.

As such, the risk to site end users arising for made ground soils on-site is considered to be **Low**, with no further actions required.

9.1.2 Controlled Waters

No significant visual/olfactory evidence of contamination was identified within shallow site soils during the site investigation.

Considering the conceptual site model developed within the Phase 1 Preliminary Risk Assessment, due to no surface water receptors being located within 250m of the site, and no recorded abstraction points located within 1km of the site, as well as chemical laboratory it is considered that risks to controlled waters are confirmed as **Low** with no further action required.

9.1.3 Ground Gas Assessment

Six ground gas monitoring visits have been undertaken, with low carbon dioxide/methane concentrations recorded during the monitoring visits. The risk to the end-user of the development from soil gases is therefore considered to be **Low**.

It is noted that high negative flow rates were recorded within BH03, BH06 and WS03 on once occasion each. For the remainder of the visits, these wells were noted as being flooded. On the occasions where high flow rates were recorded, the groundwater levels recorded within the well were significantly above the screened section of the well. As such, it is considered that the cause of these peak flows is a result of pressure build up within the well, and not representative of natural site conditions. As such, these peak flows have been discounted form this assessment.

On the basis that encountered ground conditions have a low gassing potential and low ground gas concentrations have been recorded the site is assessed as Characteristic Situation 1 (CS-1) where gas protection measures will not be required.

9.2 Recommendations

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

1) 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*.

10.0 Q457Bibliography

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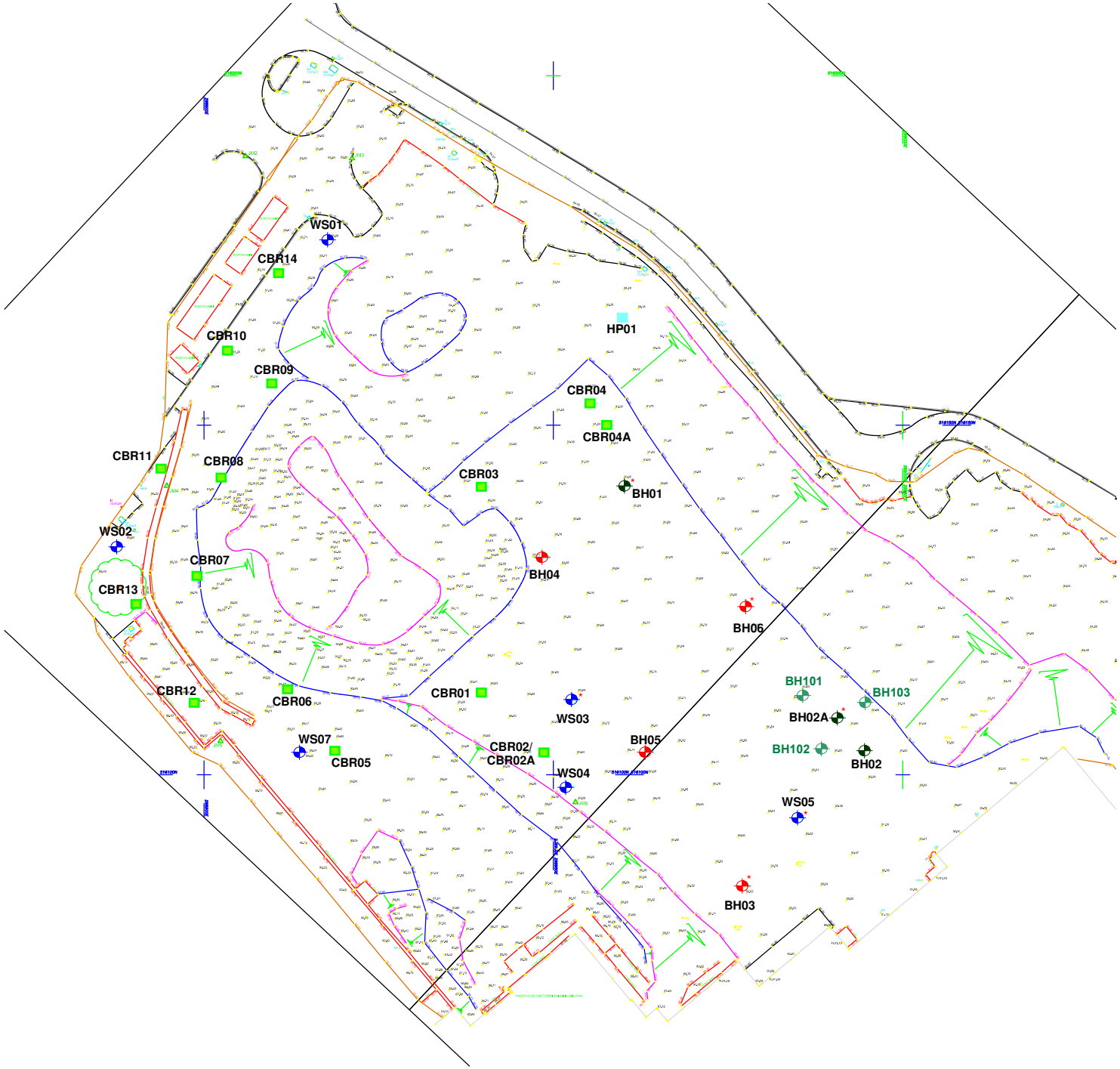
Appendix A – Drawings



CABLE PERCUSSIVE BOREHOLE LOCATIONS WITH ROTARY (CORED) FOLLOW ON

WINDOW SAMPLE BOREHOLE LOCATIONS

WINDOW SAMPLE BOREHOLE LOCATIONS WITH ROTARY (CORED) FOLLOW ON

HAND EXCAVATED TRIAL PIT LOCATION

PANDA PROBE TEST LOCATION

ROTARY OPEN HOLE BOREHOLE LOCATION

* Denotes monitoring installation

Rev:	Description:	Date:	By:	Chkd:

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Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

WEST CUMBERLAND HOSPITAL

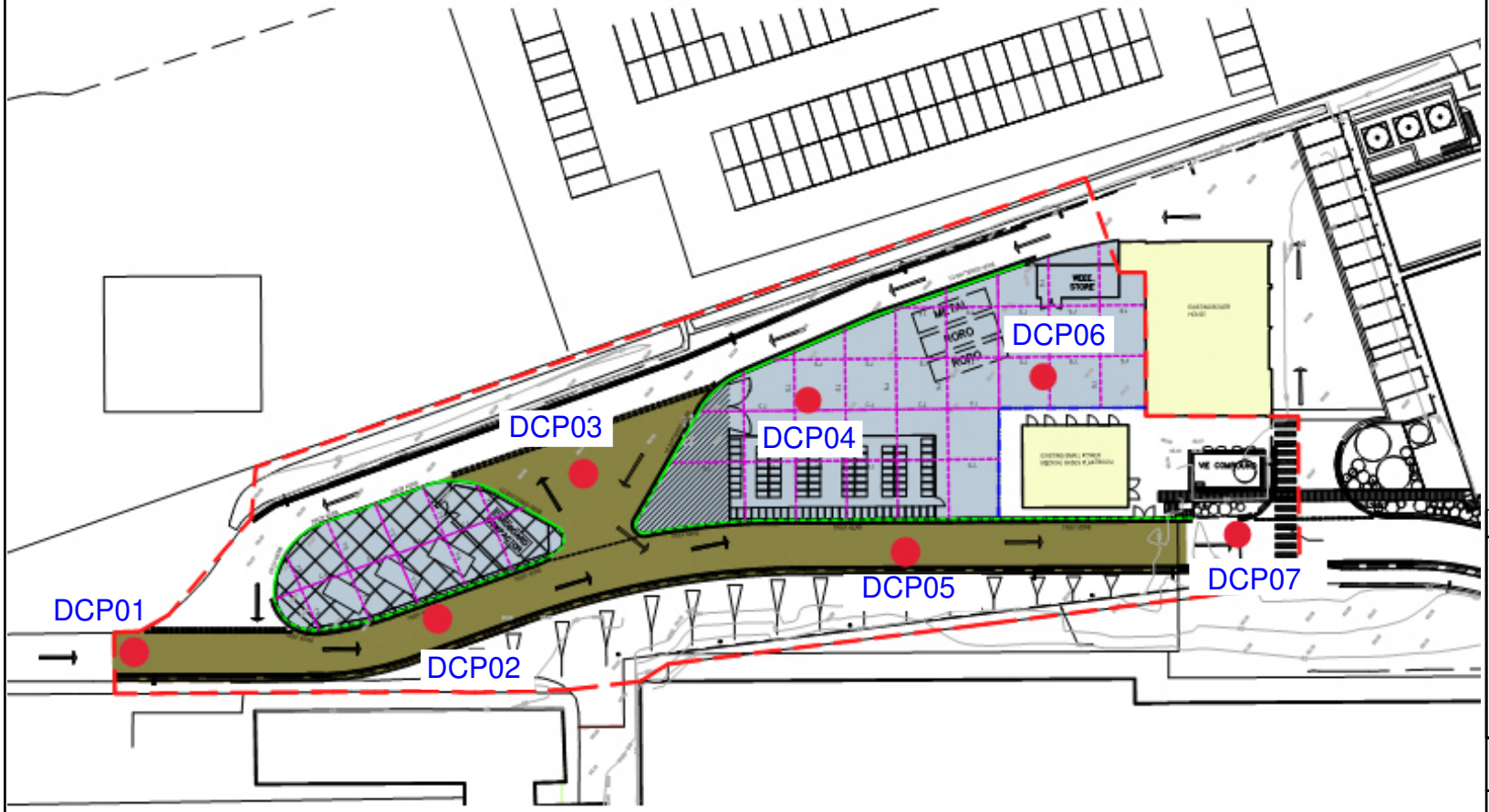
Drg Title:

EXPLORATORY HOLE LOCATION PLAN

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	22/03/2021	RT	NF

Drg No: **073096-CUR-00-XX-DR-GE-003**

Rev: **V01**



Dynamic Cone Penetration Test (DCP) Location

Rev:	Description:	Date:	By:	Chkd:

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Status:

INFORMATION

Project:

WEST CUMBERLAND HOSPITAL

Drg Title:

DCP LOCATION PLAN

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	**22/03/2021**	**RT**	**NF**

Drg No:	Rev:
073096-CUR-00-XX-DR-GE-004	**V01**

Appendix B – Exploratory Hole Logs

Trial Pit Log

Trialpit No
HP01
Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: - Level:	Date 08/12/2020
Location: Whitehaven		Dimensions (m): Depth 0.60	Scale 1:20
Client: CCL Solutions			Logged MH

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	ES		0.60			MADE GROUND: Light brown slightly silty gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded sandstone, rare brick, rare coal and wood fragments. Rare boulder of sandstone. End of pit at 0.60 m

1
2
3
4

Remarks:

Stability:

Borehole Log

Borehole No. **WS01**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 09/12/2020 - 09/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES					MADE GROUND: Gravel over orangish brown slightly sandy slightly gravelly clay. Gravel is fine to coarse angular to subrounded sandstone of mixed lithologies. Rare cobbles of sandstone.
	▼				0.80			
		1.20		N=33 (3,4/7,9,8,9)				Stiff brownish red sandy slightly gravelly CLAY. Gravel is fine and medium subangular to subrounded sandstone.
		1.70 - 3.00	Bulk		1.70			Medium dense light brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded sandstone.
	▼	2.00		N=22 (5,4/5,6,4,7)				
		3.00		0 (0 for 0mm/0 for 0mm)				
					3.60			Grey medium and coarse SANDSTONE.
					3.65			End of borehole at 3.60 m

1 2 3 4

Remarks

AGS

Borehole Log

Borehole No. **WS02**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 09/12/2020 - 09/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Grass over TOPSOIL: Dark brown slightly silty fine and medium sand.
					0.40			Light brown and yellowish brown with rare grey mottling sandy CLAY.
					0.70			Stiff reddish brown sandy slightly gravelly CLAY. Gravel is fine and medium angular to subrounded sandstone.
		1.20		N=20 (2,3/4,5,5,6)				
		2.00		N=38 (5,6/11,8,7,12)				
		3.00		0 (0 for 0mm/0 for 0mm)				
					3.65			End of borehole at 3.65 m

1 2 3 4

Remarks

AGS

Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 07/12/2020 - 07/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
	▼	0.40	ES					MADE GROUND: Light brown silty gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded sandstone, brick, wood fragments, metal fragments and rare nails. Occasional cobbles of sandstone. Rare boulders of sandstone.
		1.20		N=24 (5,6/7,7,5,5)	1.20			MADE GROUND: Yellowish/greyish brown and brown slightly clayey gravelly medium and coarse sand. Gravel is fine to coarse angular to subrounded sandstone. Rail nails.
		1.80		0 (0 for 0mm/0 for 0mm)	1.80			Yellowish/greyish brown medium and coarse SANDSTONE.
					1.90			End of borehole at 1.90 m

Remarks

AGS

Borehole Log

Borehole No. **WS04**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 07/12/2020 - 07/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES					MADE GROUND: Light brown silty gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded sandstone, brick, wood fragments, metal fragments and rare nails. Occasional cobbles of sandstone. Rare boulders of sandstone.
		1.20		N=20 (4,3/2,5,7,6)	1.20			MADE GROUND: Brown sandy gravelly clay and clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded sandstone, brick, wood fragments, metal fragments and rare nails.
		1.90		50 (25 for 113mm/50 for 85mm)	1.90			Brown and yellowish brown fine to coarse SANDSTONE.
					2.20			End of borehole at 2.20 m

Remarks

AGS

Borehole Log

Borehole No. **WS05**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 08/12/2020 - 08/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	ES					MADE GROUND: Light brown sand and gravel. Gravel is fine to coarse angular to subrounded sandstone, breeze block fragments, wood, plastic, rare metal and rare cloth fragments. Occasional cobbles of sandstone.
		1.20		N=15 (3,5/5,3,3,4)				
		2.20		50 (1,2/50 for 160mm)				
					2.50			Grey medium and coarse SANDSTONE.
					2.51			End of borehole at 2.51 m

Remarks

AGS

Borehole Log

Borehole No. **WS07**

Sheet 1 of 1

Project Name: West Cumberland Hospital	Project No. 073096	Co-ords: -	Hole Type WS
Location: Whitehaven		Level:	Scale 1:20
Client: CCL Solutions		Dates: 09/12/2020 - 09/12/2020	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	ES					MADE GROUND: Light brown sand and gravel. Gravel is fine to coarse angular to subrounded concrete, brick, rare clinker, sandstone, rare breeze block fragments, rare wood and rare metal.
					1.40			MADE GROUND: Brown sandy gravelly clay. Gravel is fine to coarse angular to subrounded concrete, brick, rare clinker, sandstone, rare breeze block fragments, rare wood and rare metal.
					1.80			MADE GROUND: Red brick,
					2.00			MADE GROUD: Grey gravelly clay. Gravel is fine to coarse angular to subangular mudstone.
					2.20			End of borehole at 2.20 m

1 2 3 4

Remarks

AGS

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 14/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH01	RC		CG	1:50	Sheet 1 of 2

Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
						0.50			# Drilling carried out by Cable Percussion.
						1.00			# SANDSTONE.
1.00 - 2.00	4	100	100	90					Medium strong light brownish grey coarse grained crystalline SANDSTONE. Closely spaced horizontal fractures, stepped rough. Rare rust orange oxidised banding noted.
2.00 - 3.00	4	90	100	100					
3.00 - 4.00	3	100	100	90					
4.00 - 5.00	2	100	100	95					
5.00 - 6.00	5	100	100	80					
6.00 - 7.00	4	100	100	90					
7.00 - 8.00	3	100	100	100					
8.00 - 9.00	2	100	100	95					
9.00 - 10.00	3	100	100	90					*Closely spaced microline coal laminations.*
	Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
1.00	139	1.00	139									0.00	1.00	Air			100
11.00	115											1.00	11.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 14/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH01	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.00 - 10.70	3	100	100	90		10.70			Medium strong light brownish grey coarse grained crystalline SANDSTONE. Closely spaced horizontal fractures, stepped rough. Rare rust orange oxidised banding noted.
		10.70 - 10.80		100	50	0		10.80			Weak locally very weak dark blackish grey very fine grained pyritic MUDSTONE. Recovered non intact.
		10.80 - 11.00	0	100	100	100		11.00			Strong light whitish grey crystalline LIMESTONE. Small pyritic inclusions noted and common quartz veins.
											End of Borehole at 11.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

11 12 13 14 15 16 17 18 19 20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
1.00	139	1.00	139									0.00	1.00	Air			100
11.00	115											1.00	11.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 10/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH02A	RC		CG	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								0.50			# Drilling carried out by Cable Percussion.
								1.00			# SANDSTONE.
		1.00 - 2.00	5	100	100	80					Medium strong light brownish grey coarse grained crystalline SANDSTONE with rare microline coal laminations. Closely spaced horizontal fractures, stepped rough, preferential along coal laminations. Rare rust orange oxidised banding noted throughout.
		2.00 - 3.00	3	100	100	100					
		3.00 - 4.00	5	100	100	95					
		4.00 - 5.00	2	100	100	100					
		5.00 - 6.00	2	100	100	90					
		6.00 - 7.00	4	100	100	90					
		7.00 - 8.00	5	40	100	40					*Becomes very coarse.*
		8.00 - 9.00	0	40	100	100					
		9.00 - 10.00		40	100	0					
			Type/FI	TCR	SCR	RQD	D/R/(SPT)	10.00			

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
13.00	139	13.00	139									0.00	1.00	Air			100
17.30	115											1.00	7.80	Water			100
												7.80	13.00	Water			0
												13.00	17.30	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 10/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH02A	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.00 - 11.00		70	80	20					Strong light whitish grey crystalline LIMESTONE. Small pyritic inclusions noted and common quartz veins throughout. Widely spaced sub-horizontal fractures, stepped rough.
		11.00 - 12.00	4	80	80	80					
		12.00 - 13.00	3	70	100	100					
		13.00 - 14.00	5	100	100	80					
		14.00 - 15.00	4	100	100	90					
		15.00 - 16.00	5	100	95	85					
		16.00 - 17.00		70	80	30					
		17.00 - 17.30	5	60	70	40		17.30			End of Borehole at 17.300m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

11 12 13 14 15 16 17 18 19 20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
13.00	139	13.00	139									0.00	1.00	Air			100
17.30	115											1.00	7.80	Water			100
												7.80	13.00	Water			0
												13.00	17.30	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 09/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH03	RC		CG	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											# Backfill.
								1.80			# Weathered SANDSTONE.
								2.40			# SANDSTONE.
								3.00			Medium strong light brownish grey coarse grained crystalline SANDSTONE. Closely spaced horizontal fractures, stepped rough. Rare rust orange oxidised banding noted.
		3.00 - 4.00	3	100	100	100					
		4.00 - 5.00	6	100	100	95					
		5.00 - 6.00	7	100	100	80					
		6.00 - 7.00	1	100	100	100					
		7.00 - 8.00	3	100	100	95					
		8.00 - 9.00	5	100	100	100					
		9.00 - 10.00	3	100	100	100					
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 09/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH03	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.00 - 11.00	5	100	100	85					Medium strong light brownish grey coarse grained crystalline SANDSTONE. Closely spaced horizontal fractures, stepped rough. Rare rust orange oxidised banding noted.
		11.00 - 12.00	3	100	100	100					
		12.00 - 13.00	3	100	100	100		13.00			End of Borehole at 13.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

11 12 13 14 15 16 17 18 19 20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 14/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH04	RC		CG	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											# MADE GROUND: Collapsed borehole.
								1.60			# MADE GROUND: Sandstone boulder.
	▼							2.00			# MADE GROUND: Crushed broken sandstone. (Possible fill).
	▼							2.60			# Hard SANDSTONE with fractures.
								3.00			
		3.00 - 4.00	6	100	100	50					Medium strong light brownish grey coarse grained crystalline SANDSTONE with rare microline coal laminations. Closely spaced horizontal fractures, stepped rough, preferential along coal laminations. Rare rust orange oxidised banding noted throughout.
		4.00 - 5.00	7	100	100	60					
		5.00 - 6.00	8	100	100	30					
		6.00 - 7.00	6	100	95	70					
		7.00 - 8.00	7	100	100	70					
		8.00 - 9.00	10	100	95	40					
		9.00 - 10.00	3	100	95	95					
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 14/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH04	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.00 - 11.00	3	100	100	100					Medium strong light brownish grey coarse grained crystalline SANDSTONE with rare microline coal laminations. Closely spaced horizontal fractures, stepped rough, preferential along coal laminations. Rare rust orange oxidised banding noted throughout.
		11.00 - 12.00	3	100	100	90					
		12.00 - 13.00	3	100	95	80		13.00			End of Borehole at 13.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

11 12 13 14 15 16 17 18 19 20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 11/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH05	RC		CG	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
	▼							2.10			# MADE GROUND: Collapsed borehole.
								2.50			# Broken SANDSTONE.
								3.00			# SANDSTONE.
		3.00 - 4.00	4	100	100	90					Medium strong light brownish grey coarse grained crystalline SANDSTONE with rare microline coal laminations. Closely spaced horizontal fractures, stepped rough, preferential along coal laminations. Rare rust orange oxidised banding noted throughout.
		4.00 - 5.00	3	100	100	100					
		5.00 - 6.00	3	100	100	85					
		6.00 - 7.00	2	100	100	95					
		7.00 - 8.00	2	100	100	100					
		8.00 - 9.00	3	100	100	100					
		9.00 - 10.00	2	100	100	100					
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 11/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Fraste XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH05	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.00 - 11.00	4	100	100	90					Medium strong light brownish grey coarse grained crystalline SANDSTONE with rare microline coal laminations. Closely spaced horizontal fractures, stepped rough, preferential along coal laminations. Rare rust orange oxidised banding noted throughout.
		11.00 - 12.00	5	100	100	80					*Closely spaced microline coal laminations.*
		12.00 - 13.00	2	100	100	90					
								13.00			End of Borehole at 13.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

11 12 13 14 15 16 17 18 19 20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	3.00	Air			100
13.00	115											3.00	13.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 11/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Frast XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH06	RC		CG	1:50	Sheet 1 of 2

Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
						1.20			# MADE GROUND: Collapsed borehole.
						1.80			# MADE GROUND: Clay bound sandstone. (Possible fill).
						2.00			# SANDSTONE.
2.00 - 3.00	6	100	100	80					Medium strong light brownish grey coarse grained crystalline SANDSTONE. Closely spaced horizontal fractures, stepped rough. Rare rust orange oxidised banding noted.
3.00 - 4.00	4	100	100	95					
4.00 - 5.00	6	100	100	70					
5.00 - 6.00	5	100	100	90					
6.00 - 7.00	2	100	100	100					
7.00 - 8.00	3	100	100	100					
8.00 - 9.00	3	100	100	100					
9.00 - 10.00	3	100	100	100					
	Type/FI	TCR	SCR	RQD	D/R/(SPT)	10.00			

1 2 3 4 5 6 7 8 9 10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
2.00	139	2.00	139									0.00	2.00	Air			100
12.00	115											2.00	12.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 11/12/2020
Location: Whitehaven	Contractor:	
Project No. : 3670	Crew Name: JH	Drilling Equipment: Frast XL

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH06	RC		CG	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		~~10.00 - 10.10~~		~~100~~	~~0~~	~~0~~		10.10			Weak locally very weak orangish brown heavily weathered and oxidised fine to medium grained SANDSTONE. Recovered non intact and clay bound.
		10.10 - 11.10	5	100	100	60					Strong light whitish grey crystalline LIMESTONE. Small pyritic inclusions noted and common quartz veins throughout. Closely spaced sub-horizontal fractures, stepped rough.
		11.10 - 12.00	2	100	100	80		12.00			End of Borehole at 12.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
2.00	139	2.00	139									0.00	2.00	Air			100
12.00	115											2.00	12.00	Water			100

Remarks

Description based on drillers records.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 08/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH101	RO		JM	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								0.60			# MADE GROUND.
								2.10			# Fine grained SANDSTONE.
								3.20			# Fine grained yellow SANDSTONE.
								4.90			# Fine grained grey SANDSTONE.
								5.90			# Fine grain yellow SANDSTONE.
								6.50			# Fine grained SANDSTONE.
								8.60			# Fine grained yellow SANDSTONE.
											# Badly broken SANDSTONE.
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	8.60	Air/Mist			100
12.00	115											8.60	10.70	Air/Mist			60
												10.70	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 08/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH101	RO		JM	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											# Badly broken SANDSTONE.
								10.70			# Fine grain SANDSTONE.
								11.10			# LIMESTONE.
								12.00			End of Borehole at 12.000m

10 11 12 13 14 15 16 17 18 19

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	8.60	Air/Mist			100
12.00	115											8.60	10.70	Air/Mist			60
												10.70	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 08/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH102	RO		JM	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											# MADE GROUND.
								0.90			# Fine grained yellow SANDSTONE.
								1.50			# Fine grained grey SANDSTONE.
								4.70			# Fine grained SANDSTONE.
								6.20			# Fine grained yellow SANDSTONE.
								8.30			# Fine grained SANDSTONE.
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	9.90	Air/Mist			100
12.00	115											9.90	11.00	Air/Mist			60
												11.00	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 08/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH102	RO		JM	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								9.90			# Fine grained SANDSTONE.
								11.00			# Broken SANDSTONE.
								12.00			# LIMESTONE.
											End of Borehole at 12.000m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

10 11 12 13 14 15 16 17 18 19

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	9.90	Air/Mist			100
12.00	115											9.90	11.00	Air/Mist			60
												11.00	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 09/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH103	RO		JM	1:50	Sheet 1 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								0.80			# MADE GROUND.
								3.10			# Fine grain yellow SANDSTONE.
								4.20			# Fine grained grey SANDSTONE.
								6.10			# Fine grained SANDSTONE.
								7.30			# Fine grained yellow SANDSTONE.
								8.60			# Fine grained grey SANDSTONE.
											# Broken SANDSTONE.
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

1 2 3 4 5 6 7 8 9

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	8.60	Air/Mist			100
12.00	115											8.60	9.90	Air/Mist			60
												9.90	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Rotary Core Log

Phoenix Drilling Ltd

Project Name: West Cumberland Hospital	Client: Curtins	Date: 09/03/2021
Location: Whitehaven	Contractor:	
Project No. : 3775	Crew Name: JS	Drilling Equipment: Fraste ML

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH103	RO		JM	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								9.90			# Broken SANDSTONE.
								11.20			# SANDSTONE.
								12.00			# LIMESTONE.
											End of Borehole at 12.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)
3.00	139	3.00	139									0.00	8.60	Air/Mist			100
12.00	115											8.60	9.90	Air/Mist			60
												9.90	12.00	Air/Mist			100

Remarks

Description based on drillers records.
Inspection pit pre dug to 1.20m and CAT scanned.

Appendix C – Chemical Laboratory Testing Results

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 20/10811
Issue Number: 1 **Date:** 18 January, 2021

Client:
Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Joe James/Matthew Holroyd
Project Name: WC. Hospital
Project Ref: B073096
Order No: EBED60
Date Samples Received: 14/12/20
Date Instructions Received: 14/12/20
Date Analysis Completed: 18/01/21

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Sophie France
Client Service Manager

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/1	20/10811/2	20/10811/3	20/10811/4	20/10811/5	20/10811/6	20/10811/7	Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	BH01	WS05	WS01	WS07	BH04	BH02A	BH03			
Depth to Top	0.35	0.50	0.40	0.50	0.40	0.40	0.70			
Depth To Bottom										
Date Sampled	08-Dec-20	08-Dec-20	09-Dec-20	09-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	6A	5A	4A	4A	4AE	4AE			
% Stones >10mm$_A$	15.9	23.1	1.3	38.6	21.4	20.8	13.6	% w/w	0.1	A-T-044
pH$_D$[M#]	10.43	9.72	8.32	10.77	10.40	9.19	9.42	pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D$[M#]	0.57	0.55	0.19	1.04	0.64	0.27	0.48	g/l	0.01	A-T-026s
Cyanide (total)$_A$[M#]	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC$_A$	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic matter$_D$[M#]	1.0	0.8	2.6	2.9	1.2	2.5	0.9	% w/w	0.1	A-T-032 OM
Arsenic$_D$[M#]	5	6	8	2	5	7	10	mg/kg	1	A-T-024s
Boron (water soluble)$_D$	2.3	1.8	<1.0	1.4	1.7	<1.0	1.0	mg/kg	1	A-T-027s
Cadmium$_D$[M#]	0.6	0.5	1.2	0.6	<0.5	<0.5	0.6	mg/kg	0.5	A-T-024s
Copper$_D$[M#]	16	18	16	14	14	11	15	mg/kg	1	A-T-024s
Chromium$_D$[M#]	18	12	20	17	13	10	10	mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead$_D$[M#]	43	47	21	64	39	21	27	mg/kg	1	A-T-024s
Mercury$_D$	0.98	0.68	<0.17	1.34	0.62	0.23	0.22	mg/kg	0.17	A-T-024s
Nickel$_D$[M#]	12	9	12	12	12	8	15	mg/kg	1	A-T-024s
Selenium$_D$[M#]	<1	<1	2	1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc$_D$[M#]	52	46	22	64	41	17	21	mg/kg	5	A-T-024s

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/1	20/10811/2	20/10811/3	20/10811/4	20/10811/5	20/10811/6	20/10811/7	Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	BH01	WS05	WS01	WS07	BH04	BH02A	BH03			
Depth to Top	0.35	0.50	0.40	0.50	0.40	0.40	0.70			
Depth To Bottom										
Date Sampled	08-Dec-20	08-Dec-20	09-Dec-20	09-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	6A	5A	4A	4A	4AE	4AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_D^{\#}$	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_D$	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/1	20/10811/2	20/10811/3	20/10811/4	20/10811/5	20/10811/6	20/10811/7	Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	BH01	WS05	WS01	WS07	BH04	BH02A	BH03			
Depth to Top	0.35	0.50	0.40	0.50	0.40	0.40	0.70			
Depth To Bottom										
Date Sampled	08-Dec-20	08-Dec-20	09-Dec-20	09-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	6A	5A	4A	4A	4AE	4AE			
PAH-16MS (MSD order)										
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Phenanthrene$_A^{M\#}$	<0.03	<0.03	<0.03	0.03	0.08	0.20	<0.03	mg/kg	0.03	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	mg/kg	0.02	A-T-019s
Fluoranthene$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	<0.08	0.16	<0.08	mg/kg	0.08	A-T-019s
Pyrene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	0.11	<0.07	mg/kg	0.07	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Chrysene$_A^{M\#}$	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order)$_A^{M\#}$	<0.08	<0.08	<0.08	<0.08	0.08	0.50	<0.08	mg/kg	0.03	A-T-019s

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/1	20/10811/2	20/10811/3	20/10811/4	20/10811/5	20/10811/6	20/10811/7	Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1	1			
Client Sample ID	BH01	WS05	WS01	WS07	BH04	BH02A	BH03			
Depth to Top	0.35	0.50	0.40	0.50	0.40	0.40	0.70			
Depth To Bottom										
Date Sampled	08-Dec-20	08-Dec-20	09-Dec-20	09-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5A	6A	5A	4A	4A	4AE	4AE			
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	2	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	4	<1	<1	2	2	<1	<1	mg/kg	1	A-T-055s
Ali >C21-C35$_A^{M\#}$	36	11	<1	39	35	6	4	mg/kg	1	A-T-055s
Total Aliphatics$_A$	42	12	<1	42	38	6	4	mg/kg	1	A-T-055s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	3	<1	<1	15	7	<1	<1	mg/kg	1	A-T-055s
Aro >C10-C12$_A$	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Aro >C12-C16$_A$	2	<1	<1	1	2	<1	<1	mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	4	2	<1	6	5	<1	<1	mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	18	7	<1	21	24	6	2	mg/kg	1	A-T-055s
Total Aromatics$_A$	27	9	<1	44	40	7	2	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35)$_A$	69	21	<1	86	78	13	6	mg/kg	1	A-T-055s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/8	20/10811/9	20/10811/10	20/10811/11	20/10811/12	20/10811/13		Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	WS03	WS06	HP01	WS04	BH05	WS01				
Depth to Top	0.40	0.45	0.50	0.40	1.20	1.70				
Depth To Bottom					1.40	3.00				
Date Sampled	07-Dec-20	08-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20	09-Dec-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Solid				
Sample Matrix Code	4AE	4A	4AE	4A	4A	7				
% Stones >10mm$_A$	21.6	10.6	18.8	18.7	16.5	<0.1		% w/w	0.1	A-T-044
pH$_D^{M\#}$	10.84	11.22	10.68	10.04	10.73	8.63		pH	0.01	A-T-031s
Sulphate (water sol 2:1)$_D^{M\#}$	0.86	0.57	0.75	0.63	0.28	0.03		g/l	0.01	A-T-026s
Cyanide (total)$_A^{M\#}$	<1	<1	<1	<1	<1	-		mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC$_A$	<0.2	<0.2	<0.2	<0.2	<0.2	-		mg/kg	0.2	A-T-050s
Organic matter$_D^{M\#}$	1.2	1.8	0.9	1.1	0.2	-		% w/w	0.1	A-T-032 OM
Arsenic$_D^{M\#}$	3	5	4	9	6	-		mg/kg	1	A-T-024s
Boron (water soluble)$_D$	2.4	2.8	2.7	2.2	1.4	-		mg/kg	1	A-T-027s
Cadmium$_D^{M\#}$	0.8	0.7	0.7	0.7	<0.5	-		mg/kg	0.5	A-T-024s
Copper$_D^{M\#}$	17	22	19	24	8	-		mg/kg	1	A-T-024s
Chromium$_D^{M\#}$	17	21	17	15	7	-		mg/kg	1	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	<1	<1	-		mg/kg	1	A-T-040s
Lead$_D^{M\#}$	71	106	54	50	19	-		mg/kg	1	A-T-024s
Mercury$_D$	1.73	1.98	1.76	0.75	0.33	-		mg/kg	0.17	A-T-024s
Nickel$_D^{M\#}$	14	14	11	11	4	-		mg/kg	1	A-T-024s
Selenium$_D^{M\#}$	<1	<1	<1	<1	<1	-		mg/kg	1	A-T-024s
Zinc$_D^{M\#}$	77	272	169	37	15	-		mg/kg	5	A-T-024s
1.10a PSD (Grading/63um/sand fraction/wet sieve) BS1377 pt 2 1990 cl 9.2$_A^{\#}$	-	-	-	-	-	Appended		%	0.1	Subcon SS

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/8	20/10811/9	20/10811/10	20/10811/11	20/10811/12	20/10811/13		Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	WS03	WS06	HP01	WS04	BH05	WS01				
Depth to Top	0.40	0.45	0.50	0.40	1.20	1.70				
Depth To Bottom					1.40	3.00				
Date Sampled	07-Dec-20	08-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20	09-Dec-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Solid				
Sample Matrix Code	4AE	4A	4AE	4A	4A	7				
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_D^{\#}$	NAD	NAD	NAD	NAD	NAD	-				A-T-045
Asbestos ACM - Suitable for Water Absorption Test?$_D$	N/A	N/A	N/A	N/A	N/A	-				A-T-045

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/8	20/10811/9	20/10811/10	20/10811/11	20/10811/12	20/10811/13		Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	WS03	WS06	HP01	WS04	BH05	WS01				
Depth to Top	0.40	0.45	0.50	0.40	1.20	1.70				
Depth To Bottom					1.40	3.00				
Date Sampled	07-Dec-20	08-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20	09-Dec-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Solid				
Sample Matrix Code	4AE	4A	4AE	4A	4A	7				
PAH-16MS (MSD order)										
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	-		mg/kg	0.03	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-019s
Acenaphthene$_A^{M\#}$	<0.01	0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-019s
Fluorene$_A^{M\#}$	0.02	0.01	0.02	<0.01	<0.01	-		mg/kg	0.01	A-T-019s
Phenanthrene$_A^{M\#}$	0.08	0.14	0.19	0.06	<0.03	-		mg/kg	0.03	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	0.03	<0.02	<0.02	-		mg/kg	0.02	A-T-019s
Fluoranthene$_A^{M\#}$	0.08	0.16	0.32	<0.08	<0.08	-		mg/kg	0.08	A-T-019s
Pyrene$_A^{M\#}$	0.08	0.14	0.28	<0.07	<0.07	-		mg/kg	0.07	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	<0.04	0.06	0.14	<0.04	<0.04	-		mg/kg	0.04	A-T-019s
Chrysene$_A^{M\#}$	0.07	0.11	0.18	<0.06	<0.06	-		mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	<0.05	0.05	0.10	<0.05	<0.05	-		mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	-		mg/kg	0.07	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	<0.04	<0.04	0.06	<0.04	<0.04	-		mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	<0.03	<0.03	0.04	<0.03	<0.03	-		mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	-		mg/kg	0.04	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	<0.05	<0.05	<0.05	-		mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order)$_A^{M\#}$	0.33	0.68	1.36	<0.08	<0.08	-		mg/kg	0.03	A-T-019s

Envirolab Job Number: 20/10811

Client Project Name: WC. Hospital

Client Project Ref: B073096

Lab Sample ID	20/10811/8	20/10811/9	20/10811/10	20/10811/11	20/10811/12	20/10811/13		Units	Limit of Detection	Method ref
Client Sample No	1	1	1	1	1	1				
Client Sample ID	WS03	WS06	HP01	WS04	BH05	WS01				
Depth to Top	0.40	0.45	0.50	0.40	1.20	1.70				
Depth To Bottom					1.40	3.00				
Date Sampled	07-Dec-20	08-Dec-20	08-Dec-20	07-Dec-20	08-Dec-20	09-Dec-20				
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Solid				
Sample Matrix Code	4AE	4A	4AE	4A	4A	7				
TPH CWG										
Ali >C5-C6$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
Ali >C6-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
Ali >C8-C10$_A$	<1	<1	<1	<1	<1	-		mg/kg	1	A-T-055s
Ali >C10-C12$_A^{M\#}$	3	<1	<1	<1	<1	-		mg/kg	1	A-T-055s
Ali >C12-C16$_A^{M\#}$	13	2	5	2	<1	-		mg/kg	1	A-T-055s
Ali >C16-C21$_A^{M\#}$	15	4	10	2	<1	-		mg/kg	1	A-T-055s
Ali >C21-C35$_A^{M\#}$	67	48	117	11	2	-		mg/kg	1	A-T-055s
Total Aliphatics$_A$	99	54	131	15	2	-		mg/kg	1	A-T-055s
Aro >C5-C7$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
Aro >C7-C8$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
Aro >C8-C10$_A$	14	15	6	3	<1	-		mg/kg	1	A-T-055s
Aro >C10-C12$_A$	2	<1	<1	<1	<1	-		mg/kg	1	A-T-055s
Aro >C12-C16$_A$	8	2	4	2	<1	-		mg/kg	1	A-T-055s
Aro >C16-C21$_A^{M\#}$	8	5	8	3	<1	-		mg/kg	1	A-T-055s
Aro >C21-C35$_A^{M\#}$	30	25	34	9	<1	-		mg/kg	1	A-T-055s
Total Aromatics$_A$	62	47	51	16	<1	-		mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35)$_A$	161	101	183	31	3	-		mg/kg	1	A-T-055s
BTEX - Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
BTEX - Toluene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
BTEX - o Xylene$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s
MTBE$_A^{\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	-		mg/kg	0.01	A-T-022s

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. email

Client: Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG

Project: WC. Hospital

Clients Project No: B073096

Project No: 20/10811

Date Received: 14/12/2020 (am)

Cool Box Temperatures (°C): 7.9

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/00605
Issue Number: 1 **Date:** 28 January, 2021

Client:
Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Joe James
Project Name: West Cumberland Hospital
Project Ref: 73096
Order No: EBMA2667
Date Samples Received: 21/01/21
Date Instructions Received: 21/01/21
Date Analysis Completed: 28/01/21

Prepared by:

Melanie Marshall
Laboratory Coordinator

Approved by:

Danielle Brierley
Client Manager

UKAS TESTING
1247

Envirolab Job Number: 21/00605

Client Project Name: West Cumberland Hospital

Client Project Ref: 73096

Lab Sample ID	21/00605/1	21/00605/2	21/00605/3					Units	Limit of Detection	Method ref
Client Sample No	1	2	3							
Client Sample ID	BH01	BH06	BH03							
Depth to Top	0.50	0.50	1.50							
Depth To Bottom										
Date Sampled	20-Jan-21	20-Jan-21	20-Jan-21							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
pH (w)$_A^\#$	11.65	11.37	11.25					pH	0.01	A-T-031w
Hardness Total$_A^\#$	276	137	250					mg/l Ca CO3	2	A-T-049w
Sulphate (w)$_A^\#$	52	124	250					mg/l	1	A-T-026w
Cyanide (total) (w)$_A^\#$	<0.005	<0.005	<0.005					mg/l	0.005	A-T-042wTCN
Phenols - Total by HPLC (w)$_A$	<0.01	0.17	<0.01					mg/l	0.01	A-T-050w
Sulphide (w)$_A$	<0.1	5.8	<0.1					mg/l	0.1	A-T-S2-w
DOC (w)$_A^\#$	4.5	17.0	8.3					mg/l	0.2	A-T-032w
Arsenic (dissolved)$_A^\#$	4	31	5					µg/l	1	A-T-025w
Boron (dissolved)$_A^\#$	17	17	16					µg/l	10	A-T-025w
Cadmium (dissolved)$_A^\#$	<0.2	<0.2	<0.2					µg/l	0.2	A-T-025w
Calcium (dissolved)$_A^\#$	110	54	100					mg/l	1	A-T-049w
Copper (dissolved)$_A^\#$	11	3	15					µg/l	1	A-T-025w
Chromium (dissolved)$_A^\#$	11	9	13					µg/l	1	A-T-025w
Lead (dissolved)$_A^\#$	<1	<1	<1					µg/l	1	A-T-025w
Mercury (dissolved)$_A^\#$	<0.1	<0.1	<0.1					µg/l	0.1	A-T-025w
Nickel (dissolved)$_A^\#$	2	14	3					µg/l	1	A-T-025w
Selenium (dissolved)$_A^\#$	1	1	2					µg/l	1	A-T-025w
Zinc (dissolved)$_A^\#$	<1	2	20					µg/l	1	A-T-025w

Envirolab Job Number: 21/00605

Client Project Name: West Cumberland Hospital

Client Project Ref: 73096

Lab Sample ID	21/00605/1	21/00605/2	21/00605/3					Units	Limit of Detection	Method ref
Client Sample No	1	2	3							
Client Sample ID	BH01	BH06	BH03							
Depth to Top	0.50	0.50	1.50							
Depth To Bottom										
Date Sampled	20-Jan-21	20-Jan-21	20-Jan-21							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
PAH 16MS (w)										
Acenaphthene (w)$_A^{\#}$	0.02	0.02	0.02					µg/l	0.01	A-T-019w
Acenaphthylene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Anthracene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Benzo(a)anthracene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Benzo(a)pyrene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Benzo(b)fluoranthene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Benzo(ghi)perylene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Benzo(k)fluoranthene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Chrysene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Dibenzo(ah)anthracene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Fluoranthene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Fluorene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Indeno(123-cd)pyrene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Naphthalene (w)$_A^{\#}$	0.04	0.03	0.06					µg/l	0.01	A-T-019w
Phenanthrene (w)$_A^{\#}$	0.04	0.02	0.03					µg/l	0.01	A-T-019w
Pyrene (w)$_A^{\#}$	<0.01	<0.01	<0.01					µg/l	0.01	A-T-019w
Total PAH 16MS (w)$_A^{\#}$	0.10	0.07	0.11					µg/l	0.01	A-T-019w

Envirolab Job Number: 21/00605

Client Project Name: West Cumberland Hospital

Client Project Ref: 73096

Lab Sample ID	21/00605/1	21/00605/2	21/00605/3					Units	Limit of Detection	Method ref
Client Sample No	1	2	3							
Client Sample ID	BH01	BH06	BH03							
Depth to Top	0.50	0.50	1.50							
Depth To Bottom										
Date Sampled	20-Jan-21	20-Jan-21	20-Jan-21							
Sample Type	Water - EW	Water - EW	Water - EW							
Sample Matrix Code	N/A	N/A	N/A							
TPH CWG (w)										
Ali >C5-C6 (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
Ali >C6-C8 (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
Ali >C8-C10 (w)$_A^{\#}$	<5	<5	<5					µg/l	5	A-T-055w
Ali >C10-C12 (w)$_A^{\#}$	<5	<5	<5					µg/l	5	A-T-055w
Ali >C12-C16 (w)$_A^{\#}$	<5	<5	<5					µg/l	5	A-T-055w
Ali >C16-C21 (w)$_A^{\#}$	<5	<5	<5					µg/l	5	A-T-055w
Ali >C21-C35 (w)$_A^{\#}$	<5	8	<5					µg/l	5	A-T-055w
Total Aliphatics (w)$_A^{\#}$	<5	8	<5					µg/l	5	A-T-055w
Aro >C5-C7 (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
Aro >C7-C8 (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
Aro >C8-C10 (w)$_A$	<5	6	<5					µg/l	5	A-T-055w
Aro >C10-C12 (w)$_A^{\#}$	<5	18	8					µg/l	5	A-T-055w
Aro >C12-C16 (w)$_A^{\#}$	<5	15	11					µg/l	5	A-T-055w
Aro >C16-C21 (w)$_A^{\#}$	<5	18	13					µg/l	5	A-T-055w
Aro >C21-C35 (w)$_A^{\#}$	<10	15	12					µg/l	10	A-T-055w
Total Aromatics (w)$_A$	<10	72	44					µg/l	10	A-T-055w
TPH (Ali & Aro >C5-C35) (w)$_A$	<10	80	44					µg/l	10	A-T-055w
BTEX - Benzene (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
BTEX - Toluene (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
BTEX - m & p Xylene (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
BTEX - o Xylene (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w
MTBE (w)$_A^{\#}$	<1	<1	<1					µg/l	1	A-T-022w

REPORT NOTES

General
This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:
All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:
Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel email

Client: Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG

Project: West Cumberland Hospital

Clients Project No: 73096

Project No: 21/00605

Date Received: 21/01/2021 (am)

Cool Box Temperatures (°C): 4.2

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Appendix D – Geotechnical Laboratory Testing Results

STRUCTURAL SOILS LTD

TEST REPORT

Report No. 584418-01 (00) 1774

Date 18-January-2021 Contract B073906

Client Envirolab
Address Units 7-8
Sandpits Business Park
Mottram Road
Hyde
SK14 3AR
For the Attention of Michael Knight

Samples submitted by client	18-December-2020	Client Reference	20/10811
Testing Started	05-January-2021	Client Order No.	P0745381
Testing Completed	18-January-2021	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests

1.10 Particle Size Distribution wet sieve method BS1377:Part 2:1990,clause 9.2 (superseded)*

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of .
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd 18 Frogmore Rd Hemel Hempstead HP3 9RT Tel.01442 416661 e-mail dimitris.xirouchakis@soils.co.uk

TESTING VERIFICATION CERTIFICATE

UKAS TESTING
1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **18/01/2021 14:47:37**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Sharon Cairns (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

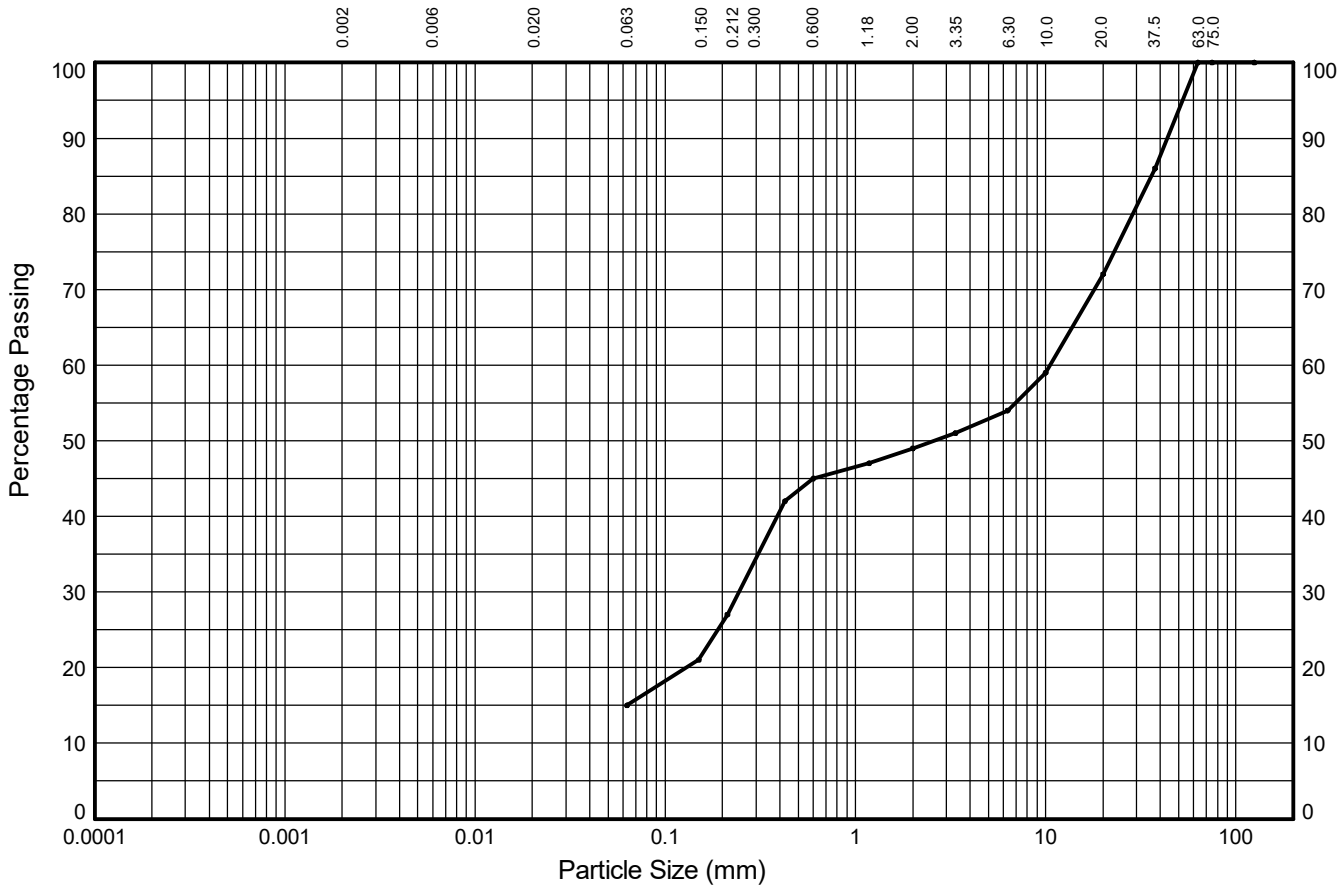
	Contract:	Job No:
STRUCTURAL SOILS LTD	**B073096**	**584418**

AGS

PARTICLE SIZE DISTRIBUTION TEST

In accordance with clauses 9.2 of BS1377:Part 2:1990

Window Sample: **WS01** Sample Ref: **13** Sample Type: **B** Depth (m): **1.70**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	-	-	-	11%	19%	4%	5%	18%	28%	
	SILT			SAND			GRAVEL			
15%				34%			51%			0%

Test Sieve (mm)	Percent Passing (%)
125.0	**100**
75.0	**100**
63.0	**100**
37.5	**86**
20.0	**72**
10.0	**59**
6.30	**54**
3.35	**51**
2.00	**49**
1.18	**47**
0.600	**45**
0.425	**42**
0.212	**27**
0.150	**21**
0.063	**15**

Particle Diameter (mm)	Percent Passing (%)

Sedimentation sample was not pre-treated

Coefficients	
D_{10} (mm)	**NA**
D_{15} (mm)	**0.063**
D_{30} (mm)	**0.244**
D_{50} (mm)	**2.588**
D_{60} (mm)	**10.548**
D_{85} (mm)	**35.853**
D_{90} (mm)	**43.492**
C_U	**NA**
C_C	**NA**

Soil Description:

Brown very sandy clayey GRAVEL

Key: C_U = Uniformity coefficient. C_C = Coefficient of curvature as defined in BS EN ISO 14688-2

STRUCTURAL SOILS
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Compiled By	Date
SHARON CAIRNS	**18/01/21**

Contract	Contract Ref:
B073096	**584418**

AGS

LABORATORY TEST CERTIFICATE

MATtest Limited
materials testing & consultancy

10 Queenslie Point
Queenslie Industrial Estate
120 Stepps Road
Glasgow
G33 3NQ

Certificate No : **21/073 - 01**

To : **Jillian Lafferty**

Client : **Phoenix Drilling Limited**
2 Nairn Road
Deans Industrial Estate
Livingston
EH54 8AY

Dear Sirs,

LABORATORY TESTING OF ROCK

Introduction

We refer to samples taken from West Cumberland Hospital and delivered to our laboratory on 27th January 2021.

Material & Source

Sample Reference	:	See Report Plates
Sampled By	:	Client
Sampling Certificate	:	Not Supplied
Location	:	See Report Plates
Description	:	Rock Cores
Date Sampled	:	Not Supplied
Date Tested	:	27th January 2021 Onwards
Source	:	3670 - West Cumberland Hospital

Test Results;

As Detailed On Page 2 to Page 11 inclusive

Comments;

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
All remaining samples for this project will be disposed of 28 days after issue of this test certificate

Remarks;

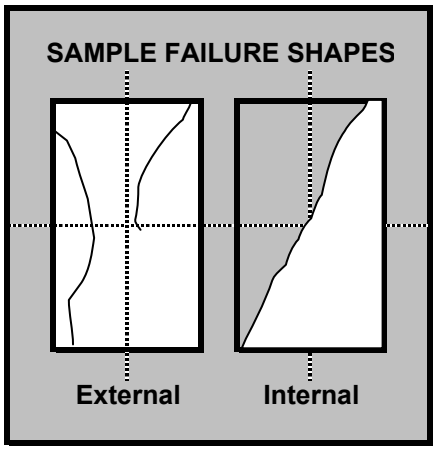
Approved for Issue

T McLelland (Director)

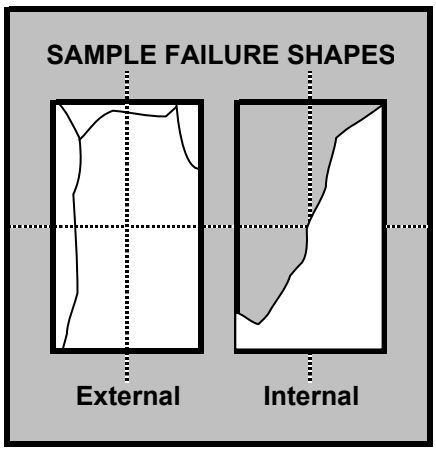
Date 03/02/2021

UKAS TESTING
2643

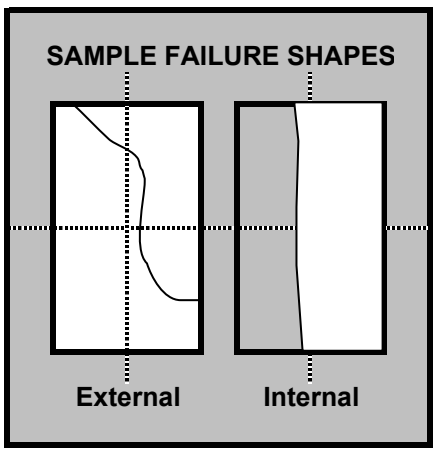
BOREHOLE		**BH01**
SAMPLE		**C**
DEPTH	m	**3.50**
SAMPLE DIAMETER	mm	**72.34**
SAMPLE HEIGHT	mm	**167.45**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**4.55**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**138.0**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**33.6**
WATER CONTENT (ISRM Suggested Methods)	%	**4.7**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.39**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.28**



BOREHOLE		**BH01**
SAMPLE		**C**
DEPTH	m	**6.50**
SAMPLE DIAMETER	mm	**72.50**
SAMPLE HEIGHT	mm	**160.31**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**6.09**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**171.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**41.5**
WATER CONTENT (ISRM Suggested Methods)	%	**4.5**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.31**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.21**



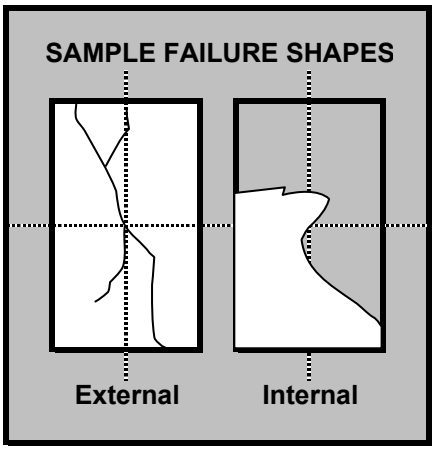
BOREHOLE		**BH01**
SAMPLE		**C**
DEPTH	m	**10.00**
SAMPLE DIAMETER	mm	**72.12**
SAMPLE HEIGHT	mm	**162.12**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**5.43**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**160.2**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**39.2**
WATER CONTENT (ISRM Suggested Methods)	%	**4.3**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.44**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.34**



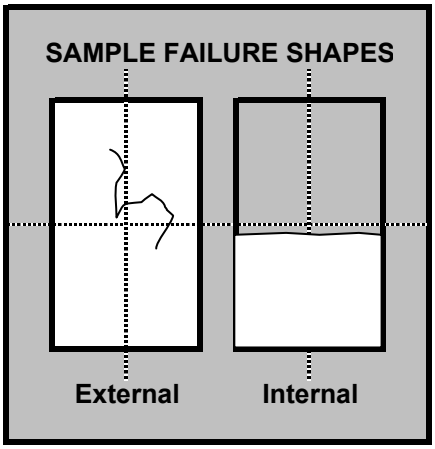
Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

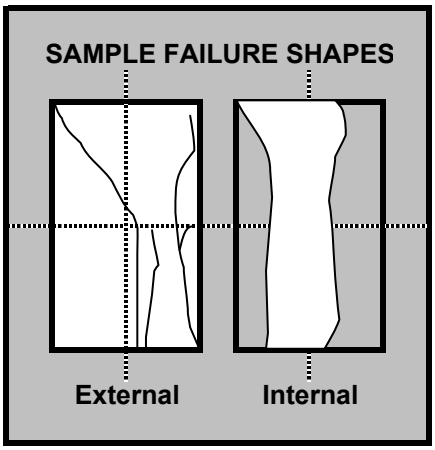
BOREHOLE		**BH02**
SAMPLE		**C**
DEPTH	m	**1.50**
SAMPLE DIAMETER	mm	**72.55**
SAMPLE HEIGHT	mm	**161.50**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**4.39**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**127.3**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**30.8**
WATER CONTENT (ISRM Suggested Methods)	%	**4.4**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.31**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.21**



BOREHOLE		**BH02**
SAMPLE		**C**
DEPTH	m	**5.50**
SAMPLE DIAMETER	mm	**72.36**
SAMPLE HEIGHT	mm	**161.13**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**3.55**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**109.3**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**26.6**
WATER CONTENT (ISRM Suggested Methods)	%	**3.9**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.34**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.26**



BOREHOLE		**BH02**
SAMPLE		**C**
DEPTH	m	**13.00**
SAMPLE DIAMETER	mm	**72.33**
SAMPLE HEIGHT	mm	**158.23**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**4.41**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**135.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**33.0**
WATER CONTENT (ISRM Suggested Methods)	%	**0.3**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.67**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.66**

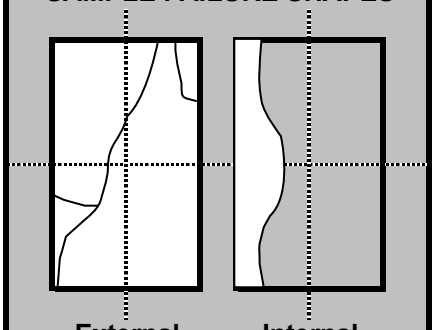


Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

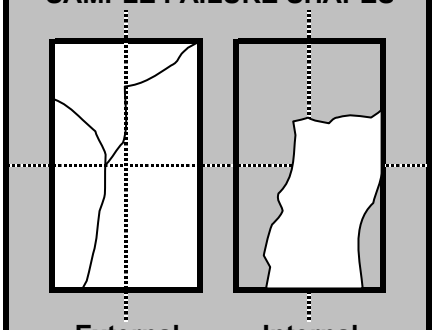
BOREHOLE		**BH03**
SAMPLE		**C**
DEPTH	m	**4.50**
SAMPLE DIAMETER	mm	**72.73**
SAMPLE HEIGHT	mm	**171.70**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**5.59**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**168.3**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**40.5**
WATER CONTENT (ISRM Suggested Methods)	%	**4.5**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.31**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.21**

SAMPLE FAILURE SHAPES



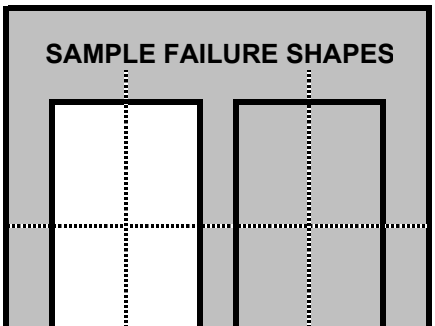
BOREHOLE		**BH03**
SAMPLE		**C**
DEPTH	m	**8.50**
SAMPLE DIAMETER	mm	**72.39**
SAMPLE HEIGHT	mm	**161.76**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**4.54**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**136.6**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**33.2**
WATER CONTENT (ISRM Suggested Methods)	%	**6.0**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.37**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.24**

SAMPLE FAILURE SHAPES



BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

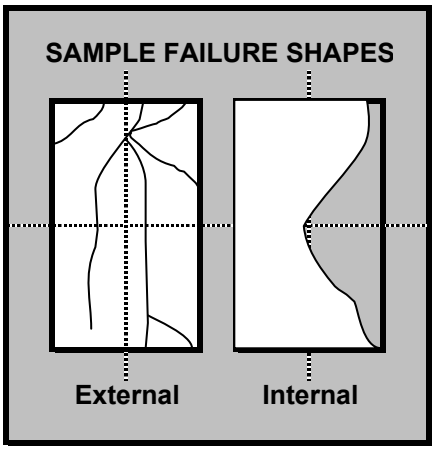
SAMPLE FAILURE SHAPES



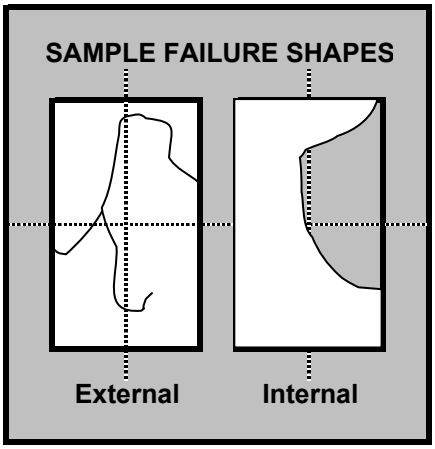
Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

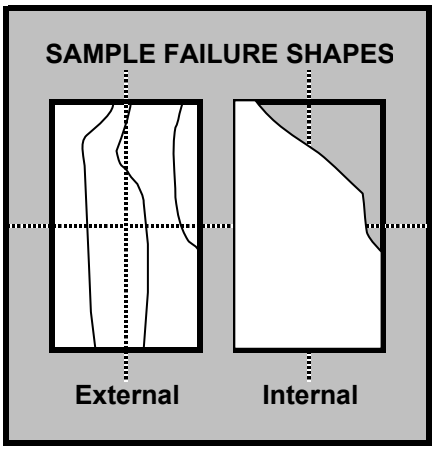
BOREHOLE		**BH04**
SAMPLE		**C**
DEPTH	m	**3.50**
SAMPLE DIAMETER	mm	**72.44**
SAMPLE HEIGHT	mm	**164.58**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**7.21**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**209.0**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**50.7**
WATER CONTENT (ISRM Suggested Methods)	%	**3.9**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.47**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.38**



BOREHOLE		**BH04**
SAMPLE		**C**
DEPTH	m	**7.50**
SAMPLE DIAMETER	mm	**72.28**
SAMPLE HEIGHT	mm	**161.69**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.4**
TEST DURATION	min.sec	**5.01**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**132.9**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**32.4**
WATER CONTENT (ISRM Suggested Methods)	%	**3.1**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.48**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.41**



BOREHOLE		**BH04**
SAMPLE		**C**
DEPTH	m	**11.50**
SAMPLE DIAMETER	mm	**72.44**
SAMPLE HEIGHT	mm	**165.35**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**6.41**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**189.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**46.0**
WATER CONTENT (ISRM Suggested Methods)	%	**0.6**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.40**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.39**

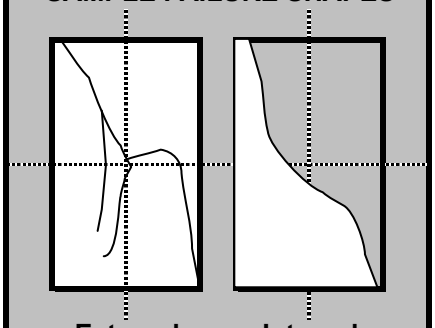


Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

BOREHOLE		**BH05**
SAMPLE		**C**
DEPTH	m	**4.50**
SAMPLE DIAMETER	mm	**72.43**
SAMPLE HEIGHT	mm	**164.23**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**4.16**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Unknown**
FAILURE LOAD	kN	**122.4**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**29.7**
WATER CONTENT (ISRM Suggested Methods)	%	**2.4**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.26**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.21**

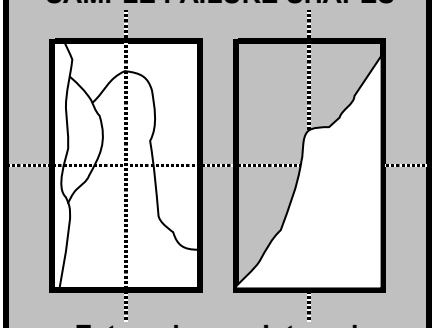
SAMPLE FAILURE SHAPES



External **Internal**

BOREHOLE		**BH05**
SAMPLE		**C**
DEPTH	m	**8.50**
SAMPLE DIAMETER	mm	**72.67**
SAMPLE HEIGHT	mm	**167.69**
TEST CONDITION		**As Received**
RATE OF LOADING	kN/s	**0.5**
TEST DURATION	min.sec	**6.09**
DATE OF TESTING		**02/02/2021**
LOAD FRAME USED		**2000kN**
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		**Perpendicular**
FAILURE LOAD	kN	**169.6**
UNCONFINED COMPRESSIVE STRENGTH	MPa	**40.9**
WATER CONTENT (ISRM Suggested Methods)	%	**3.3**
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.32**
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	**2.24**

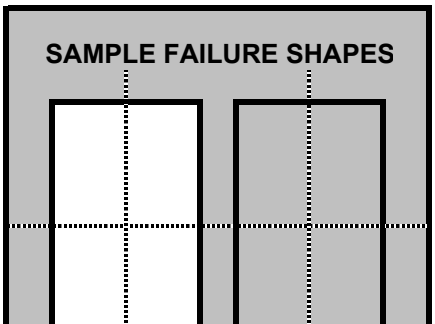
SAMPLE FAILURE SHAPES



External **Internal**

BOREHOLE		
SAMPLE		
DEPTH	m	
SAMPLE DIAMETER	mm	
SAMPLE HEIGHT	mm	
TEST CONDITION		
RATE OF LOADING	kN/s	
TEST DURATION	min.sec	
DATE OF TESTING		
LOAD FRAME USED		
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		
FAILURE LOAD	kN	
UNCONFINED COMPRESSIVE STRENGTH	MPa	
WATER CONTENT (ISRM Suggested Methods)	%	
BULK DENSITY (ISRM Suggested Methods)	Mg/m^3	
DRY DENSITY (ISRM Suggested Methods)	Mg/m^3	

SAMPLE FAILURE SHAPES



External **Internal**

Tested in accordance with ASTM D7012 - 14

SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH

MATtest Limited
materials testing & consultancy

BOREHOLE	SAMPLE	DEPTH (m)	MOISTURE CONTENT (%)	TYPE OF TEST * (see below)	CORE DIAMETER (mm)	EQUIVALENT DIAMETER (mm)	PLATEN SEPARATION (mm)	FAILURE LOAD (kN)	Is (MPa)	Is(50) (MPa)
BH01	C	1.50	As Received	D	72.73	72.73	72.73	14.20	2.68	3.18
				A	72.22	72.84	57.70	12.45	2.35	2.78
				A	72.61	71.93	55.97	11.19	2.16	2.55
	C	2.50	As Received	D	72.85	72.85	72.85	9.44	1.78	2.11
				A	72.98	74.59	59.88	6.89	1.24	1.48
				A	72.83	75.11	60.84	8.56	1.52	1.82
	C	4.50	As Received	D	72.41	72.41	72.41	10.33	1.97	2.33
				A	72.13	73.07	58.13	12.55	2.35	2.79
				A	72.50	71.14	54.83	10.67	2.11	2.47
	C	5.50	As Received	D	72.42	72.42	72.42	6.66	1.27	1.50
				A	72.30	68.13	50.42	6.69	1.44	1.66
				A	72.40	73.32	58.31	7.01	1.30	1.55
	C	7.50	As Received	D	72.40	72.40	72.40	4.21	0.80	0.95
				A	72.51	86.37	80.80	21.46	2.88	3.68
				A	72.30	81.89	72.84	10.71	1.60	1.99
	C	8.50	As Received	D	72.37	72.37	72.37	11.00	2.10	2.48
				A	72.40	73.15	58.04	11.41	2.13	2.53
				A	72.35	62.34	42.19	6.78	1.74	1.93

NOTE: N/M - Not measured
NOTE: A dash (-) signifies that scale did not register a reading

* I = IRREGULAR TEST
D = DIAMETRAL TEST
A = AXIAL TEST

Mean Is(50) - Axial tests	2.27
Mean Is(50) - Diametrical tests	2.09
Ia(50)	1.09

Tested in accordance with ISRM (2007)

SUMMARY OF POINT LOAD TEST RESULTS

MATtest Limited
materials testing & consultancy

BOREHOLE	SAMPLE	DEPTH (m)	MOISTURE CONTENT (%)	TYPE OF TEST * (see below)	CORE DIAMETER (mm)	EQUIVALENT DIAMETER (mm)	PLATEN SEPARATION (mm)	FAILURE LOAD (kN)	Is (MPa)	Is(50) (MPa)
BH02	C	2.50	As Received	D	72.22	72.22	72.22	5.09	0.98	1.15
				A	72.10	77.39	65.24	8.50	1.42	1.73
				A	72.09	72.17	56.75	8.96	1.72	2.03
	C	3.50	As Received	D	72.48	72.48	72.48	7.01	1.33	1.58
				A	72.50	86.06	80.23	10.26	1.39	1.77
				A	72.41	84.33	77.14	9.79	1.38	1.74
	C	4.50	As Received	D	72.47	72.47	72.47	5.76	1.10	1.29
				A	72.30	80.55	70.49	10.20	1.57	1.95
				A	72.40	67.86	49.96	9.67	2.10	2.41
	C	6.50	As Received	D	72.39	72.39	72.39	8.00	1.53	1.80
				A	72.41	84.68	77.78	2.98	0.42	0.53
				A	72.58	71.82	55.81	11.24	2.18	2.56
	C	7.50	As Received	D	72.90	72.90	72.90	16.57	3.12	3.69
				A	72.50	69.90	52.93	16.58	3.39	3.95
				A	72.52	65.54	46.52	15.92	3.71	4.19
	C	10.50	As Received	D	72.36	72.36	72.36	23.83	4.55	5.37
				A	72.28	75.09	61.26	18.46	3.27	3.93
				A	72.21	73.28	58.41	19.01	3.54	4.20

NOTE: N/M - Not measured
NOTE: A dash (-) signifies that scale did not register a reading

* I = IRREGULAR TEST
D = DIAMETRAL TEST
A = AXIAL TEST

Mean Is(50) - Axial tests	2.58
Mean Is(50) - Diametrical tests	2.48
Ia(50)	1.04

Tested in accordance with ISRM (2007)

SUMMARY OF POINT LOAD TEST RESULTS

MATtest Limited
materials testing & consultancy

BOREHOLE	SAMPLE	DEPTH (m)	MOISTURE CONTENT (%)	TYPE OF TEST * (see below)	CORE DIAMETER (mm)	EQUIVALENT DIAMETER (mm)	PLATEN SEPARATION (mm)	FAILURE LOAD (kN)	Is (MPa)	Is(50) (MPa)
BH03	C	3.50	As Received	D	71.99	71.99	71.99	4.40	0.85	1.00
				A	72.14	71.96	56.37	7.71	1.49	1.76
				A	72.06	67.55	49.73	7.52	1.65	1.89
	C	5.50	As Received	D	71.78	71.78	71.38	4.54	0.88	1.04
				A	71.90	83.84	76.79	9.06	1.29	1.63
				A	71.80	84.17	77.49	6.97	0.98	1.24
	C	6.50	As Received	D	72.39	72.39	72.39	3.18	0.61	0.72
				A	72.51	78.95	67.51	8.14	1.31	1.60
				A	72.21	80.73	70.88	10.98	1.69	2.09
	C	7.50	As Received	D	72.65	72.65	72.65	5.94	1.13	1.33
				A	72.31	72.97	57.84	7.60	1.43	1.69
				A	72.78	68.39	50.47	6.71	1.44	1.65
	C	9.50	As Received	D	72.72	72.72	72.72	12.19	2.30	2.73
				A	72.10	79.66	69.12	5.03	0.79	0.98
				A	72.28	75.84	62.49	6.63	1.15	1.39

NOTE: N/M - Not measured
NOTE: A dash (-) signifies that scale did not register a reading

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A = AXIAL TEST

Mean Is(50) - Axial tests	1.59
Mean Is(50) - Diametrical tests	1.36
Ia(50)	1.17

Tested in accordance with ISRM (2007)

SUMMARY OF POINT LOAD TEST RESULTS

MATtest Limited
materials testing & consultancy

BOREHOLE	SAMPLE	DEPTH (m)	MOISTURE CONTENT (%)	TYPE OF TEST * (see below)	CORE DIAMETER (mm)	EQUIVALENT DIAMETER (mm)	PLATEN SEPARATION (mm)	FAILURE LOAD (kN)	Is (MPa)	Is(50) (MPa)
BH04	C	4.50	As Received	D	72.36	72.36	72.36	12.80	2.44	2.89
				A	72.41	75.06	61.11	9.66	1.71	2.06
				A	72.30	66.63	48.23	8.31	1.87	2.13
	C	5.50	As Received	D	72.39	72.39	72.39	5.72	1.09	1.29
				A	72.11	61.49	41.18	6.90	1.82	2.00
				A	72.40	64.86	45.63	6.51	1.55	1.74
	C	6.50	As Received	D	72.21	72.21	72.21	16.74	3.21	3.79
				A	72.39	90.48	88.81	17.87	2.18	2.85
				A	72.19	86.48	81.37	12.18	1.63	2.08
	C	8.50	As Received	D	72.73	72.73	72.73	12.64	2.39	2.83
				A	72.50	68.14	50.30	13.08	2.82	3.24
				A	72.10	64.31	45.05	17.66	4.27	4.78
	C	9.50	As Received	D	72.30	72.30	72.30	30.74	5.88	6.94
				A	72.48	82.33	73.45	28.84	4.26	5.33
				A	72.25	80.56	70.54	28.79	4.44	5.50
	C	10.50	As Received	D	72.32	72.32	72.32	25.54	4.88	5.77
				A	72.15	79.15	68.19	16.22	2.59	3.18
				A	72.23	72.81	57.65	19.69	3.71	4.40

NOTE: N/M - Not measured
NOTE: A dash (-) signifies that scale did not register a reading

* I = IRREGULAR TEST
D = DIAMETRAL TEST
A = AXIAL TEST

Mean Is(50) - Axial tests	3.27
Mean Is(50) - Diametrical tests	3.92
Ia(50)	0.84

Tested in accordance with ISRM (2007)

SUMMARY OF POINT LOAD TEST RESULTS

MATtest Limited
materials testing & consultancy

BOREHOLE	SAMPLE	DEPTH (m)	MOISTURE CONTENT (%)	TYPE OF TEST * (see below)	CORE DIAMETER (mm)	EQUIVALENT DIAMETER (mm)	PLATEN SEPARATION (mm)	FAILURE LOAD (kN)	Is (MPa)	Is(50) (MPa)
BH05	C	3.50	As Received	D	72.49	72.49	72.49	2.18	0.42	0.49
				A	72.30	84.92	78.33	8.49	1.18	1.49
				A	72.51	73.45	58.44	6.26	1.16	1.38
	C	5.50	As Received	D	72.09	72.09	72.09	2.11	0.41	0.48
				A	72.40	80.56	70.40	9.46	1.46	1.81
				A	72.41	79.69	68.88	9.55	1.50	1.85
	C	6.50	As Received	D	72.17	72.17	72.17	3.89	0.75	0.88
				A	72.10	73.10	58.20	5.65	1.06	1.25
				A	72.20	71.08	54.96	5.01	0.99	1.16
	C	7.50	As Received	D	72.16	72.16	72.16	5.73	1.10	1.30
				A	72.30	81.32	71.83	11.00	1.66	2.07
				A	72.81	69.68	52.38	6.84	1.41	1.63
	C	9.50	As Received	D	72.26	72.26	72.26	5.49	1.05	1.24
				A	72.11	68.09	50.50	7.11	1.53	1.76
				A	72.51	60.22	39.28	8.02	2.21	2.41
	C	10.50	As Received	D	72.50	72.50	72.50	8.75	1.66	1.97
				A	72.31	71.08	54.87	13.30	2.63	3.08
				A	72.69	70.82	54.19	11.09	2.21	2.59

NOTE: N/M - Not measured
NOTE: A dash (-) signifies that scale did not register a reading

* I = IRREGULAR TEST
D = DIAMETRAL TEST
A = AXIAL TEST

Mean Is(50) - Axial tests	1.87
Mean Is(50) - Diametrical tests	1.06
Ia(50)	1.77

Tested in accordance with ISRM (2007)

SUMMARY OF POINT LOAD TEST RESULTS

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SOCOTEC

UKAS TESTING

0001

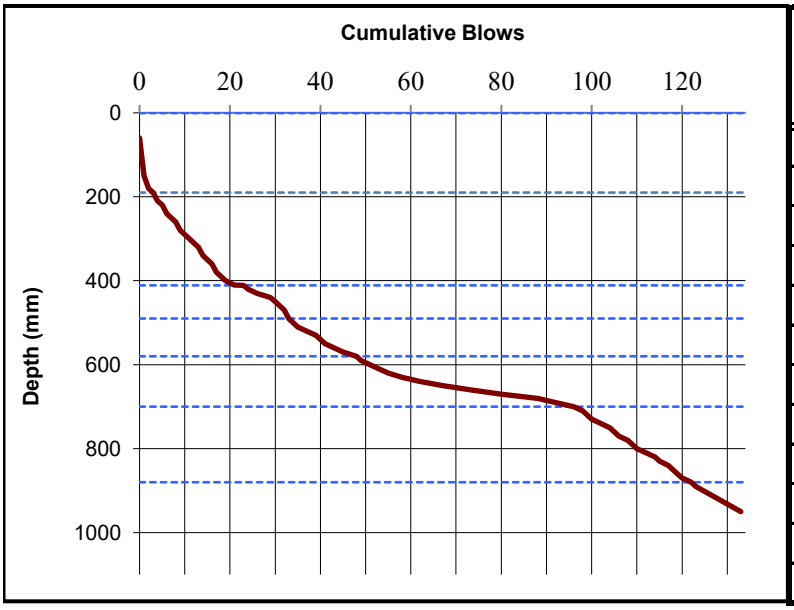
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/02**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 2**
		Start Depth(mm) :	60

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	3	3	5.6	130	190
2	20	23	23.8	221	411
3	10	33	34.0	79	490
4	15	48	45.4	90	580
5	48	96	>100	120	700
6	26	122	39.1	180	880

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

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SOCOTEC

UKAS TESTING

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TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/03**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 3**
		Start Depth(mm) :	80

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)

Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	1	1	4.0	60	140
2	4	5	8.3	120	260
3	3	8	4.8	150	410
4	4	12	14.7	70	480
5	5	17	6.5	190	670
6	5	22	4.8	250	920

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

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UKAS TESTING

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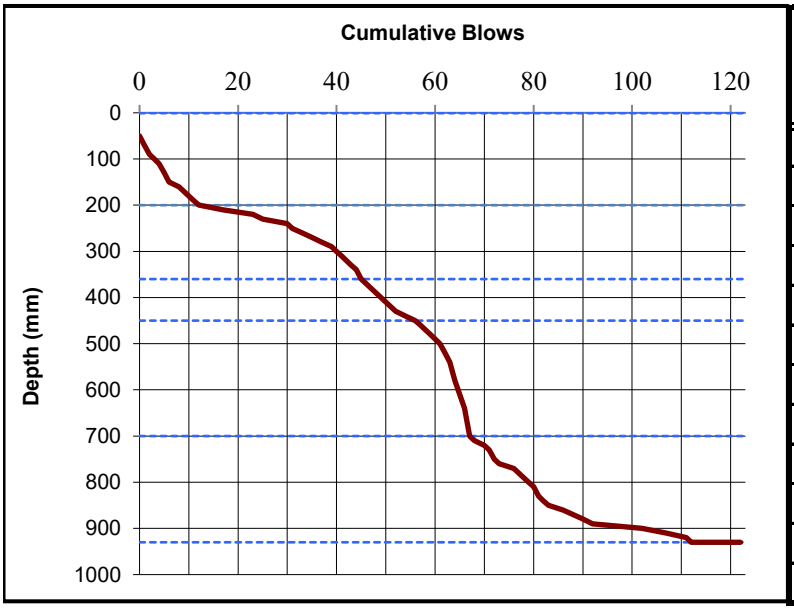
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/04**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 4**
		Start Depth(mm) :	50

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	12	12	20.9	150	200
2	33	45	56.9	160	360
3	11	56	32.7	90	450
4	11	67	11.1	250	700
5	45	112	53.8	230	930

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

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UKAS TESTING

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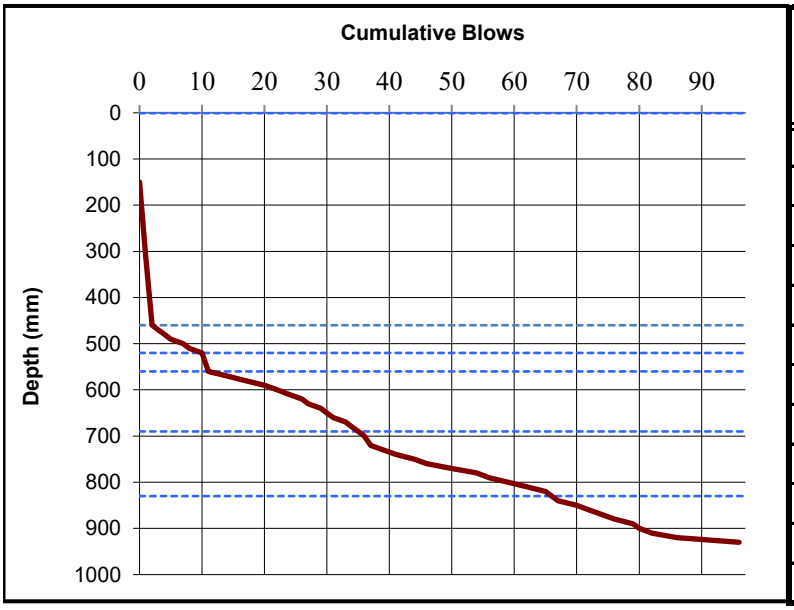
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/05**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 5**
		Start Depth(mm) :	150

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	2	2	1.5	310	460
2	8	10	35.9	60	520
3	1	11	6.1	40	560
4	24	35	50.6	130	690
5	31	66	61.4	140	830

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

SOCOTEC UK Limited
29 Rufford Court
Hardwick Grange
Warrington
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WA1 4RF
Telephone: +44 (0) 1925 286220

SOCOTEC

UKAS TESTING

0001

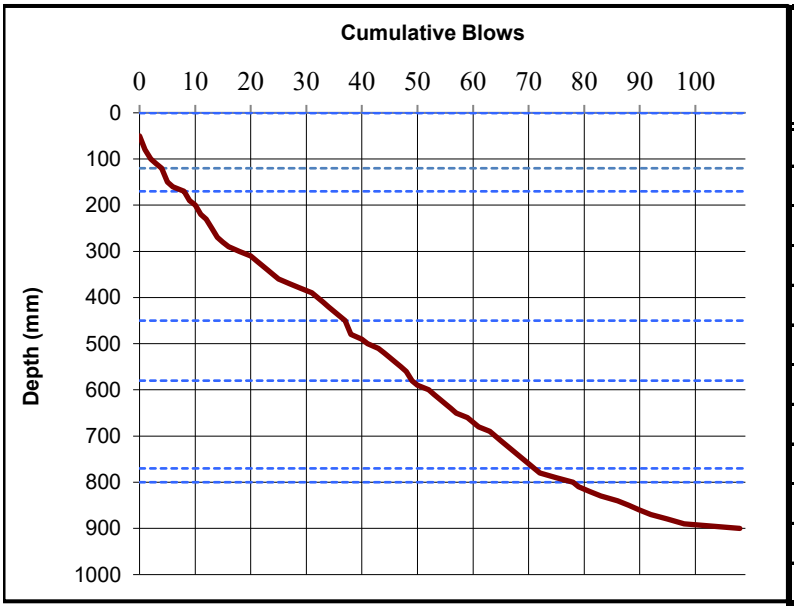
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/06**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 6**
		Start Depth(mm) :	50

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	4	4	14.7	70	120
2	4	8	20.9	50	170
3	29	37	27.5	280	450
4	12	49	24.3	130	580
5	22	71	30.9	190	770
6	7	78	64.9	30	800

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

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SOCOTEC

UKAS TESTING

0001

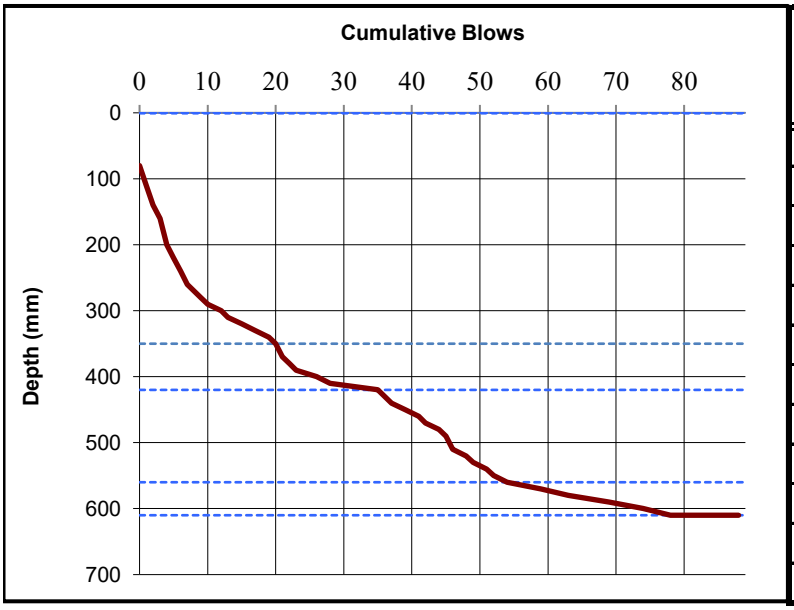
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/07**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay/ Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 7**
		Start Depth(mm) :	80

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	20	20	19.3	270	350
2	15	35	59.3	70	420
3	19	54	36.6	140	560
4	24	78	>100	50	610

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

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SOCOTEC

UKAS TESTING

0001

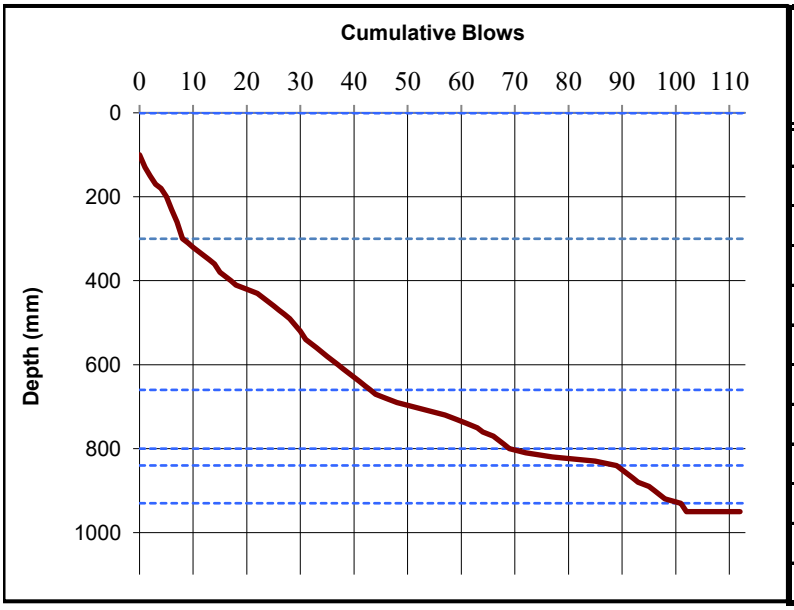
TEST REPORT

Dynamic Cone Penetrometer

Documented In House Method No DIHM 302

Client:	CURTINS CONSULTING ENGINEERS	Report No:	**51061689/21/01**
	Edinburgh	Job No:	51061689
	United Kingdom		
	EH4 3BL	Date Tested:	09/03/2021
		Date Reported:	17/03/2021
Contact:	1a Belford Road		
Site:	**West Cumberland Hospital, Whitehaven**		
Material:	Clay & Stone		
Location:	**Proposed Waste Compound**	Reference:	**No 1**
		Start Depth(mm) :	100

Interpretative Method : TRL Equation : Log10(CBR) = 2.480 - 1.057 x Log10(mm/blow)



Layer	No. of Blows	Cum. No of Blows	CBR (%)	Layer Thickness (mm)	Total Depth (mm)
1	8	8	10.1	200	300
2	35	43	25.7	360	660
3	26	69	51.0	140	800
4	20	89	>100	40	840
5	12	101	35.9	90	930

Comments :

☐ Mark R. Dawkins - Laboratory Manager

Signed: ☑ Paul Thomas - Section Manager

For and on behalf of SOCOTEC UK Limited

Appendix E – Ground Gas and Groundwater Monitoring Results

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

GAS MONITORING LOG SHEET

Project:	West Cumberland Hospital	**Date:**	07/01/2021
Job Number:	B073096.302	**Visit:**	1
Client:	CCL Solutions	**Weather:**	cold, cloudy
Barometric State:	Falling	**Ground Conditions:**	wet / frozen

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						
WS03	986	-22.7	-0.2	0.0	0.0		0.0	112.1	0	0	0.40	1.80	
WS05	988	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0	0	2.05	2.16	
BH01	986	-0.6	0.0	0.0	0.0	0.0	0.0	19.8	0	0	0.77	11.22	
BH02A													**1**
BH03	987	-63.7	0.0	0.0	0.0	0.0	0.0	18.5	0	0	1.97	13.14	**2**
BH06	986	-63.8	0.0	0.0	0.0	0.0	0.0	20.0	0	0	0.66	11.55	**2**

Notes

1 Top of borehole frozen / flooded, could not open
2 Flow monitored for 5mins as it slowly reduced to 0.0

Logged by

SH

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:	West Cumberland Hospital	**Date:**	20/01/2021
Job Number:	B073096.302	**Visit:**	2
Client:	CCL Solutions	**Weather:**	Rain
Barometric State:	Falling	**Ground Conditions:**	Water-logged

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						
WS03	953										0.00	1.76	**1**
WS05	954	0.1	0.1	0.0	0.0	0.1	0.0	18.60	0	0	1.02	1.15	
BH01	959										0.00	11.27	**1, 2, 3**
BH02A	956	4.5	1.8	0.0	0.0	1.3	1.3	14.80	0	0	11.20	11.58	
BH03	956	1.8	1.8	0.0	0.0	0.0	0.0	18.20	0	0	0.98	13.12	**3**
BH06	959										0.00	11.63	**1, 3**

Notes

1 Borehole flooded
2 Groundwater was orignally measured at 0.33m bgl, but rose to ground level when being purged for sampling
3 Borehole purged and groundwater sample collected

Logged by

SH

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:	West Cumberland Hospital	**Date:**	04/02/2021
Job Number:	B073096.302	**Visit:**	3
Client:	CCL Solutions	**Weather:**	Rain
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						
WS03											0.00	1.77	1
WS05	993	0.0	0.0	0.0	0.0	0.0	0.0	19.3	0	2	1.63	2.10	
BH01											0.00	11.10	1
BH02A	992	0.0	0.0	0.0	0.0	1.0	1.0	17.8	1	2	10.80	11.45	2
BH03	992	-58.1	0.0	0.0	0.0	0.0	0.0	20.6	1	2	1.57	12.85	3
BH06											0.00	11.40	1

Notes

1 - Monitoring well flooded.
2 - Monitoring stopped after 30 seconds due to inflow of water into monitoring pipe.
3 - Steady state air flow rate recorded after 6 minutes.

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:	West Cumberland Hospital	**Date:**	17/02/2021
Job Number:	B073096.302	**Visit:**	4
Client:	CCL Solutions	**Weather:**	Sunny
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						
WS03											0.00	1.76	**1**
WS05	1014	0.0	0.0	0.0	0.0	0.0	0.0	18.9	0	13	1.96	2.14	
BH01											0.65	11.25	**1**
BH02A	1014	0.0	0.0	0.0	0.0	0.0	0.0	20.8	0	13	11.09	11.33	
BH03	1014	-43.0	0.0	0.0	0.0	0.0	0.0	20.2	1	10	1.96	12.83	
BH06											0.04	10.50	**1**

Notes

1 - Not gas mointored due to historic high water levels. Bung removed to check water levels on arrival, releasing any gas within the well. Monitoring would provide non-representative results.
2 - Steady state air flow rate achieved after 4 minutes.

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:	West Cumberland Hospital	**Date:**	08/03/2021
Job Number:	B073096.302	**Visit:**	5
Client:	CCL Solutions	**Weather:**	Overcast, showers
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						
WS03													1
WS05	1013	0.4	0.4	0.0	0.0	0.0	0.0	17.0	0	2	1.95	2.17	
BH01	1012	-23.7	-0.1	0.0	0.0	0.0	0.0	20.8	1	6	0.99	11.32	2
BH02A	1013	-0.4	0.0	0.0	0.0	0.0	0.0	21.9	0	0	11.00	11.40	
BH03	1013	0.7	0.4	0.0	0.0	0.0	0.0	19.5	0	8	1.91	13.00	
BH06	1014	-55.6	0.0	0.0	0.0	0.0	0.0	19.3	1	6	0.75	10.60	3

Notes

1	Could not locate
2	Fell to steady state flow rate after circa 4mins.
3	Fell to steady state flow rate after circa 3 mins.

Logged by

NF

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:	West Cumberland Hospital	**Date:**	18/03/2021
Job Number:	B073096.302	**Visit:**	6
Client:	CCL Solutions	**Weather:**	Sunny
Barometric State:	Falling	**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						
WS03											0.00	1.76	1
WS05	1018	0.0	0.0	0.0	0.0	0.0	0.0	20.4	0	0	1.80	2.15	
BH01											0.36	11.30	1
BH02A													2
BH03	1019	17.3	0.0	0.0	0.0	0.0	0.0	20.8	0	0	1.74	13.10	
BH06											0.10	10.65	1

Notes

1 Borehole flooded and not gas monitored
2 Could not locate

Logged by

SH

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

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% 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	*160*	*160*	*3900*	*12000*	*600000*	*180000*
$EC_{>6}$ - EC_8	*530*	*530*	*13000*	*40000*	*620000*	*320000*
$EC_{>8}$ - EC_{10}	*150*	*150*	*1700*	*11000*	*13000*	*21000*
EC_{10}-EC_{12}	*760*	*770*	*7300*	*47000*	*13000*	*24000*
EC_{12}-EC_{16}	*4300*	*4400*	*13000*	*90000*	*13000*	*26000*
$EC_{>16}$ - EC_{35}	*110000*	*110000*	*270000*	*1800000*	*250000*	*490000*
$EC>_{35}$ - EC_{44}	*110000*	*110000*	*270000*	*1800000*	*250000*	*490000*
Aromatic risk banded hydrocarbons - TPHCWG method						
$EC>_5$ - EC_7	*300*	*1400*	*57*	*86000*	*56000*	*92000*
$EC>_7$ - EC_8	*660*	*3900*	*120*	*180000*	*56000*	*100000*
$EC_{>8}$ - EC_{10}	*190*	*270*	*51*	*17000*	*5000*	*9300*
EC_{10} - EC_{12}	*380*	*1200*	*74*	*34000*	*5000*	*10000*
EC_{12} - EC_{16}	*660*	*2500*	*130*	*38000*	*5000*	*10000*
$EC_{>16}$ - EC_{21}	*930*	*1900*	*260*	*28000*	*3800*	*7800*
$EC_{>21}$ - EC_{35}	*1700*	*1900*	*1600*	*28000*	*3800*	*7900*
$EC>_{35}$ - EC_{44}	*1700*	*1900*	*1600*	*28000*	*3800*	*7900*
Aliph + Arom EC >44-70	*1900*	*1900*	*3000*	*28000*	3800	7900
Aromatic						
Benzene	**0.33** 0.87	**1.0** 3.3	**0.07** 0.18	**95** 98	*73* 140	*110* 230
Ethyl benzene	**350**	**840**	**90**	**2800**[8] [66000]	**2800**[8] [*25000*]	**2800**[8] [*27000*]
Toluene	**610**	**2700**	**120**	**4400**[8] [190000]	**4400**[8] [*56000*]	**4400**[8] [*100000*]
Xylene[9]	**230**	**290**	**160**	**2600**[8] [32000]	**2600**[8] [*43000*]	**2600**[8] [*31000*]
Phenol	**420**	**520**	**280**	**3200**[14] (38000)	**3200**[14] (*10000*)	**3200**[14] (*9300*)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	*13*	*13*	*24*	*1100*	*4900*	*3000*
Acenaphthylene	*920*	*6000*	*160*	*100000*	*15000*	*30000*
Acenaphthene	*1100*	*6000*	*200*	*100000*	*15000*	*30000*
Fluorene	*860*	*4500*	*160*	*71000*	*9900*	*20000*
Phenanthrene	*440*	*1500*	*90*	*23000*	*3100*	*6300*
Anthracene	*11000*	*37000*	*2200*	*540000*	*74000*	*150000*
Fluoranthene	*890*	*1600*	*290*	*23000*	*3100*	*6400*
Pyrene	*2000*	*3800*	*620*	*54000*	*7400*	*15000*
Benz(a)anthracene	*13*	*15*	*13*	*180*	*29*	*62*
Chrysene	*27*	*32*	*19*	*350*	*57*	*120*
Benzo(b)fluoranthene	*3.7*	*4.0*	*3.9*	*45*	*7.2*	*16.0*
Benzo(k)fluoranthene	*100*	*110*	*130*	*1200*	*190*	*440*
Benzo(a)pyrene	*3.0* 5.0	*3.2* 5.3	*3.5* 5.7	*36* 77	*5.7* 10	*13* 21
Indeno(123cd)pyrene	*41*	*46*	*39*	*510*	*82*	*180*
Dibenzo(ah)anthracene	*0.3*	*0.32*	*0.43*	*3.6*	*0.58*	*1.4*
Benzo(ghi)perylene	*350*	*360*	*640*	*4000*	*640*	*1600*
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	*0.0014*	*0.0015*	*0.0018*	*0.12*	*3.5*	*5.4*
Trichloroethene (TCE)	*0.075*	*0.08*	*0.21*	*5.7*	*120*	*120*
1,1,1,2 Tetrachlorethane	*6.4*	*8.2*	*4.4*	*560*	*1400*	*2100*
Tetrachlorethene (PCE)	*0.90*	*0.92*	*3.6*	*95*	*1400*	*1500*
1,1,1 Trichlorethane	*39*	*40*	*240*	*3000*	*140000*	*100000*

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 6% - 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

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% 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	*78*	*78*	*1700*	*5900*	*590000*	*130000*
$EC_{>6}$ - EC_8	*230*	*230*	*5600*	*17000*	*610000*	*220000*
$EC_{>8}$ - EC_{10}	*65*	*65*	*770*	*4800*	*13000*	*18000*
EC_{10}-EC_{12}	*330*	*330*	*4400*	*23000*	*13000*	*23000*
EC_{12}-EC_{16}	*2400*	*2400*	*13000*	*82000*	*13000*	*25000*
$EC_{>16}$ - EC_{35}	*92000*	*92000*	*270000*	*1700000*	*250000*	*480000*
$EC>_{35}$ - EC_{44}	*92000*	*92000*	*270000*	*1700000*	*250000*	*480000*
Aromatic risk banded hydrocarbons - TPHCWG method						
$EC>_5$ - EC_7	*140*	*690*	*27*	*46000*	*56000*	*84000*
$EC>_7$ - EC_8	*290*	*1800*	*51*	*110000*	*56000*	*95000*
$EC_{>8}$ - EC_{10}	*83*	*110*	*21*	*8100*	*5000*	*8500*
EC_{10} - EC_{12}	*180*	*590*	*31*	*28000*	*5000*	*9700*
EC_{12} - EC_{16}	*330*	*2300*	*57*	*37000*	*5100*	*10000*
$EC_{>16}$ - EC_{21}	*540*	*1900*	*110*	*28000*	*3800*	*7700*
$EC_{>21}$ - EC_{35}	*1500*	*1900*	*820*	*28000*	*3800*	*7800*
$EC>_{35}$ - EC_{44}	*1500*	*1900*	*820*	*28000*	*3800*	*7800*
Aliph + Arom EC >44-70	*1800*	*1900*	*2100*	*28000*	3800	7800
Aromatic						
Benzene	**0.16**	**0.49**	**0.035**	**50**	*72*	*100*
Ethyl benzene	**150**	**380**	**39**	**1200**[8] [35000]	**1200**[8] [*24000*]	**1200**[8] [*22000*]
Toluene	**270**	**1300**	**51**	**1900**[8] [110000]	**1900**[8] [*56000*]	**1900**[8] [*95000*]
Xylene[9]	**98**	**120**	**70**	**1200**[8] [14000]	**1200**[8] [*42000*]	**1200**[8] [*23000*]
Phenol	**290**	**420**	**140**	**1500**[14] (35000)	**1500**[14] (*10000*)	**1500**[14] (*8300*)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	*5.6*	*5.6*	*10*	*460*	*4900*	*1900*
Acenaphthylene	*420*	*4600*	*69*	*97000*	*15000*	*30000*
Acenaphthene	*510*	*4700*	*85*	*97000*	*15000*	*30000*
Fluorene	*400*	*3800*	*67*	*68000*	*9900*	*20000*
Phenanthrene	*220*	*1500*	*38*	*22000*	*3100*	*6200*
Anthracene	*5400*	*35000*	*950*	*540000*	*74000*	*150000*
Fluoranthene	*560*	*1600*	*130*	*23000*	*3100*	*6300*
Pyrene	*1200*	*3800*	*270*	*54000*	*7400*	*15000*
Benz(a)anthracene	*11*	*14*	*6.5*	*170*	*29*	*56*
Chrysene	*22*	*31*	*9.4*	*350*	*57*	*110*
Benzo(b)fluoranthene	*3.3*	*4.0*	*2.1*	*44*	*7.2*	*15*
Benzo(k)fluoranthene	*93*	*110*	*75*	*1200*	*190*	*410*
Benzo(a)pyrene	*2.7*	*3.2*	*2*	*35*	*5.7*	*12*
Indeno(123cd)pyrene	*36*	*46*	*21*	*510*	*82*	*170*
Dibenzo(ah)anthracene	*0.28*	*0.32*	*0.27*	*3.6*	*0.57*	*1.3*
Benzo(ghi)perylene	*340*	*360*	*470*	*4000*	*640*	*1500*
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	*0.00087*	*0.001*	*0.001*	*0.077*	*3.5*	*5*
Trichloroethene (TCE)	*0.034*	*0.036*	*0.091*	*2.6*	*120*	*91*
1,1,1,2 Tetrachlorethane	*2.8*	*3.5*	*1.9*	*250*	*1400*	*1800*
Tetrachlorethene (PCE)	*0.39*	*0.4*	*1.5*	*42*	*1400*	*1100*
1,1,1 Trichlorethane	*18*	*18*	*110*	*1300*	*140000*	*76000*

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 2.5% - 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

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
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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

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

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.

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.

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