



**BROWNFIELD
SOLUTIONS LTD**

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

DOMIS CONSTRUCTION LTD

Victoria House, Great Ancoats Street, Manchester

Geo-Environmental Assessment Report

JM/C4742/10165 Rev A

July 2021

EXECUTIVE SUMMARY	
Location and Brief Site Description	The site is located off Great Ancoats Street, Manchester, M4 7DB. It is situated within Manchester City Centre inner ring road, centred on National Grid Reference 385314, 398073 as shown on the Site Location Plan, Drawing No. C4742/01. The site currently comprises a singular three storey brick building in the east with adjoining steel framed warehouse to the west. Associated car parking is present across the southern half of the site. The brick structure is utilised to house office space and meeting rooms, the warehouse is utilised for storage of valuables with vaults as part of The Manchester Safe Deposit Centre.
Ground Conditions	Generalised ground conditions from the ground investigation comprise (top down): • Made ground encountered from ground level to between 2.40m and 2.50m bgl. • Natural strata encountered from 2.40m bgl to between 17.50m and 18.00m bgl. • Solid geology encountered from 17.50m bgl to 33.00m bgl.
Human Health - Soils Contamination	The proposed development is of residential end-use, however, the proposed basement and commercial ground floor result in commercial screening values being adopted. It is noted that the majority of the proposed development will comprise hardstanding or building footprint, with some small areas of soft landscaping around the perimeter. Elevated lead was recorded within one location of the made ground, however, the presence of hardstanding / building footprint across the majority of the development will mitigate the risk. Chrysotile and amosite fibres (loose fibres) have been detected in two samples of made ground across the site. On quantification analysis the asbestos level within the two samples was <0.001% mass and classified as being trace levels.
Controlled Waters – Surface and Groundwater Contamination	The overall risk to controlled waters is considered to be low and no further action is required.
Ground Gas	Based on the monitoring, the site is classified as Characteristic Situation 1 under the Wilson and Card classification system and no gas protection measures are required.
Outline Remedial Strategy	Subject to regulatory approval, the following outline remedial strategy is recommended: • Cover system with 450mm thick of 'clean' validated soft landscaping areas. • Verification of the above with validation reports produced.
Waste	Based on the waste classification database assessment, the majority of the made ground soils have been classified as non-hazardous. This includes the soils that will require removal for the construction of the proposed basement. A black ashy sand strata has been noted in WS04 and WS05, with highly elevated lead and a hazardous waste classification. This strata appears to be related to the historic timber yard previously located across the centre third of the site, and it is likely the soils here will be classified as hazardous due to the presence of toxic and ecotoxic lead.
Foundations and Floor Slabs	Piled foundations are considered the most suitable foundation option. Suspended floor slabs may be adopted.
Concrete Classification	Made Ground: DS3 AC-2s conditions prevail. Natural soils: DS1 AC-1s conditions prevail.
Highways Design	Made Ground CBR – 2% The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction.
Sustainable Drainage Systems (SuDS)	Drainage to soakaways is considered unsuitable for this site. Indicative soil infiltration rates range from 1.74×10^{-7} m/s to 4.65×10^{-8} m/s.
Further Work	The following further works will be required to progress to the construction phase: • Drilling of location BH3 to confirm design requirements. • Demolition Asbestos survey. • Detailed foundation design by a structural engineer.

EXECUTIVE SUMMARY

- Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.
- Implementation of the Remedial Strategy and verification of the remedial works.

This executive summary should be read in conjunction with the full report, reference JM/C4742/10165 Rev A and not as a standalone document.

PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Victoria House, Great Ancoats Street, Manchester		
Document Name:	Geo-Environmental Assessment Report		
Reference:	JM/C4742/10165 Rev A		
Status:	-	15/07/2021	Interim – awaiting completion of gas monitoring and drilling of BH3.
	A	21/07/2021	Interim – following completion of gas monitoring programme

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DRAWINGS

Drawing Number	Rev	Title
10122-A-B5D9-G200-P-00-003	-	Proposed Ground Floor Plan
10122-A-B5D9-G200-P-B1-003	-	Proposed Basement Plan
C4742/01	-	Site Location Plan
C4742/02	-	Site Features Plan
C4742/03	-	Exploratory Hole Location Plan

APPENDICES

Appendix	Title
Appendix A	BSL Methodology and Guidance
Appendix B	Exploratory Hole Logs
Appendix C	Chemical Testing Results
Appendix D	Geotechnical Testing Results
Appendix E	Monitoring Results
Appendix F	Waste Assessment Report

1.0 INTRODUCTION

1.1 Context

This report describes a Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Domis Construction Ltd on a site off Great Ancoats Street, Manchester and has been completed in general accordance with the following guidance:

-
- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
 - CLR11 - Model Procedures for the Management of Land Contamination.
 - BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
 - BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.
 - BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
 - BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.
 - NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions.
-

Definitions of terms and acronyms used within this report is presented in Section 11.0.

1.2 Proposed Development

The proposed development is for a part 25 storey, part 3 storey residential tower with ground floor commercial space above partial basement level (north-west corner) and associated hard / soft landscaping as shown on the Proposed Ground Floor Development Plan, drawing No. 10122-A-B5D9- G200-P-00-003 provided to BSL by the client.

1.3 Previous Reports

This report should be read in conjunction with BSL Desk Study Assessment Report (NS/C4742/10165) issued in June 2021.

1.4 Objectives and Scope

The objectives of this report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Following the Phase I Desk Study referenced above, an exploratory intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The exploratory investigation was undertaken using window sampling, cable percussive drilling with rotary follow on, gas and groundwater monitoring, laboratory chemical and geotechnical testing, with reporting on the findings.

1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable.

Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used reasonable skill, care and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Domis Construction Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g. to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g. due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

2.0 THE SITE

2.1 Location

The site is located off Great Ancoats Street, Manchester, M4 7DB. It is situated within Manchester City Centre inner ring road, centred on National Grid Reference 385314, 398073 as shown on the Site Location Plan, Drawing No. C4742/01.

2.2 Site Description

A site reconnaissance survey was carried out at the site on 14th April 2021. The main site features and potential issues identified during this survey are detailed below and are shown on the Site Features Plan, Drawing No. C4742/02. A selection of photographs from the site walkover are presented to the rear of this report.

Feature	Description
Site Area	The site is approximately 0.13 hectares.
Site Access	The site operates a one way system for vehicular access, access is therefore gained from Epworth Street to the south-east. Egress is onto Longacre Street to the north-west. Pedestrian access to the building is available from Great Ancoats Street to the north.
Current Land Use and Site Features	The site currently comprises a singular three storey brick building in the east with adjoining steel framed warehouse to the west. Associated car parking is present across the southern half of the site. The brick structure is utilised to house office space and meeting rooms, the warehouse is utilised for storage of valuables with vaults as part of The Manchester Safe Deposit Centre.
Potential Sources of Gross Contamination	No significant sources of contamination were identified onsite.
Vegetation	No vegetation is present within the site boundary.
Topography	The site is relatively flat, with a slight incline from Longacre Street to the west towards Epworth Street to the east.
Site Boundaries	The north-east of the site is enclosed by a brick wall with metal rails, a small metal pedestrian gate is present in the easternmost corner. The south-eastern site boundary is bound be a brick wall with metal rails, the eastern brick building gable end and a large electronic metal gate for vehicular access. The southernmost site boundary comprises the gable end of an adjacent warehouse, a gravel board fence, and a brick wall with metal fencing above. The north-western boundary is demarked by a brick wall, large electronic metal gate, the western gable end of the steel frame warehouse and a brick wall with metal railing.
Surrounding Area	The site is set within a mixed commercial and residential area, bordered by residential apartments to the west, Great Ancoats Street to the north / east with residential apartment buildings beyond. To the south-east of the site is an active construction site for a proposed hotel, and to the south is a warehouse and derelict brownfield land.

3.0 SUMMARY OF PREVIOUS REPORTS

3.1 BSL Desk Study

Brownfield Solutions Limited carried out a Phase1 Desk Top Study in June 2021 Ref NS/C4742/10165, as outlined as a requirement in Condition 8a.

Condition 8a relating to the Desk Study Assessment Report details the following:

“Before the development hereby approved commences, a report (the Preliminary Risk Assessment) to identify and evaluate all potential sources and impacts of any ground contamination, groundwater contamination and/or ground gas relevant to the site shall be submitted to and approved in writing by the City Council as local planning authority. The Preliminary Risk Assessment shall conform to City Council's current guidance document (Planning Guidance in Relation to Ground Contamination).”

Reason - To ensure that the presence of or the potential for any contaminated land and/or groundwater is detected and appropriate remedial action is taken in the interests of public safety, pursuant to policies DM1 and EN18 of the Core Strategy.”

Pertinent issues from this report are summarised below:

- The site has been developed as a timber yard with associated chimney, residential properties and as Victoria House / a Warehouse. Mapping suggests there is potential for bomb strikes in the north-east of the site due to the presence of post second world war ruins on historical mapping.
- The site is surrounded by a largely industrial heritage. The significant sources of offsite contamination includes numerous mills, grain stores, goods stations with railway sidings, factories, works, an electricity substation and more recently, warehouses.
- No significant sources of gross contamination have been identified from the current or recent use of the site. Historically, a timber yard with associated chimney has been present onsite. There is potential for some heavy metals, PAH, asbestos and petroleum hydrocarbons present in the made ground from the sites past developments.
- Developmental changes on the site, could also lead to a layer of made ground at the site and this could give rise to ground gas generation.
- Geological mapping and environmental data records indicate that the site is underlain by devensian Till, over the sandstone of the Chester Formation at depth. One BGS borehole is present within 100m of the site which comprised made ground to 2.13m bgl, over clay to 8.84m bgl over red rock to 10.06m bgl over red sandstone proven to 23.77m bgl.
- The superficial geology underlying the site has been classified as Secondary (Undifferentiated) Aquifer by the Environment Agency (EA). The Chester Formation has been classified a Principal Aquifer.
- There are currently no source protection zones (SPZ) within 500m of the site. There are no active groundwater abstraction licences within 1.4km of the site. There are no potable water abstraction licences within 2km of the site.
- The nearest surface water feature to the site is the Ashton Canal & Peak Forest Canal which is located 69m north-west of the site. The nearest watercourse to the site is the River Medlock which lies at a distance of 278m south-east of the site and flow direction is indicated to be from north-east to south-west. There are no recorded active or historical surface water abstractions within 2km of the site.
- Based on the preliminary CSM and the proposed use of the site, the overall risk from land contamination at the site is considered to be low to moderate for a redeveloped site.
- A potential on-site gas source has been identified associated with the made ground associated with previous development of the site. The preliminary CSM considers the sources to be a Moderate / Low risk to site end users and property.
- Based on the preliminary CSM, BSL believes the overall risk to controlled waters at the site is Low, as the site does not lie within 500m of an SPZ, there are no nearby surface waters and the underlying devensian Till will inhibit both lateral and vertical migration.

4.0 METHOD OF INVESTIGATION

4.1 Objectives

The objectives of the proposed site investigation and subsequent Geo-Environmental Assessment Report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Following the Phase I Desk Study referenced above, a detailed intrusive investigation is proposed to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The main investigation will be undertaken using window sampling, cable percussive boreholes, rotary coring, gas and groundwater monitoring, laboratory chemical and geotechnical testing, with reporting on the findings.

The Phase II Ground Investigation and Geo-Environmental Assessment Report will be undertaken pursuant to Condition 8a.

Condition 8a relating to the Geo-Environmental Assessment Report details the following:

“The measures for investigating the site identified in the Site Investigation Proposal shall be carried out, before the development commences and a report prepared outlining what measures, if any, are required to remediate the land (the Site Investigation Report and/or Remediation Strategy) which shall be submitted to and approved in writing by the City Council as local planning authority.

Reason - To ensure that the presence of or the potential for any contaminated land and/or groundwater is detected and appropriate remedial action is taken in the interests of public safety, pursuant to policies DM1 and EN18 of the Core Strategy.”

4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation between the dates of 14th April 2021 to 22nd May 2021.

Method	No.	Range Depths (m bgl)	Purpose
Window sample boreholes – Tracked WS rig	5	3.00 – 5.45	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination and geotechnical and testing. Installation of ground gas and water monitoring wells. WS01 to obtain samples for waste classification for basement arisings.
Cable percussive boreholes with rotary follow on	3	31.10 – 33.00	Assess deeper ground conditions, carry out SPTs and obtain samples for contamination and geotechnical testing. Installation of ground gas and water monitoring wells. Obtain rock core for geotechnical testing and parameters for foundation design. BH3 to be completed post demolition.

The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C4742/03. The exploratory hole logs are presented in Appendix B.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

- BS 5930:2015+A1:2020 Code of Practice for Site Investigations.
- BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.
- BS EN ISO 14689:2018 Geotechnical investigation and testing – Identification and classification of rock.

Full time UXO supervision was undertaken as the site was identified as having a moderate UXO risk, the cable percussive holes and window sample boreholes were progressed with stainless steel casing to allow for advanced magnetometer screening.

4.3 Sampling

During the drilling of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental and geotechnical guidance.

The distribution of samples taken across the site is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Type	Number
Environmental (ES)	14
Disturbed (D)	55
U100 (U)	4

4.4 Laboratory Testing

The potential contaminative process on site were noted to be a former timber yard in the centre of site and former residential developments therefore the following suite of determinands were chosen to screen for potential site impacts at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	5
Petroleum Hydrocarbons (TPH CWG) inc BTEX and MTBE.	2
Asbestos Screen and ID.	5
Asbestos Quantification	2
Waste Acceptance Criteria (WAC).	2

The Chemical Laboratory Testing Results are presented in Appendix C.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892- Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil'.

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
Natural Water Content.	7
Plasticity Index Analysis.	7
pH Value.	2
Water Soluble Sulphate Contents.	2
Determination of One-Dimensional Consolidation properties.	2
Point Load Testing.	5
Unconfined Compressive Strength (UCS).	5
Determination of Undrained Shear Strength in Triaxial Compression.	2

The Geotechnical Laboratory Testing Results are presented in Appendix D.

4.5 Monitoring

Ground gas and ground water monitoring standpipes were installed in seven boreholes and subsequently six monitoring visits were undertaken out of six proposed as part of the current scope, in line with the recommendations of CIRIA C665. All gas monitoring was undertaken using GA 5000 / GFM436 infrared gas meter with integral electronic flow analyser.

Flow measurements on each standpipe (l/hr) were taken. Measurements of the percentage volume in air (%v/v) of oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) were recorded in addition to the percentage Lower Explosive Limit (%LEL) of methane (Note: 100% LEL equates to 5% by volume), the atmospheric pressure (mb) and average temperature during the visit (°C).

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS01	35mm PVC	1.00 - 2.00	Made Ground	Ground Gas & GW
WS02	35mm PVC	0.50 - 2.00	Made Ground	Ground Gas & GW
WS03	35mm PVC	1.00 - 3.00	Made Ground	Ground Gas & GW
WS04	35mm PVC	1.00 - 2.00	Made Ground	Ground Gas & GW
WS05	35mm PVC	1.00 - 3.00	Made Ground	Ground Gas & GW
BH1	50mm HDPE	4.00 - 27.00	Clay and Sand	Ground Gas & GW
BH2	50mm HDPE	8.00 - 12.00	Clay and Sand	Ground Gas & GW

The gas monitoring visits recorded peak and steady state conditions. Peak results are those that occur on opening the valve on the borehole tap. Steady state conditions are those that occur a period of time afterwards when the initial (accumulated) gases have been purged from the borehole.

Final ground gas monitoring results are presented in Appendix E of this report.

5.0 GROUND CONDITIONS

5.1 Summary

A brief summary of the ground conditions encountered is presented in the table below:

Stratum	Range Depths - Top (m bgl)	Range Depths - Base (m bgl)	Range Thickness' (m)	Brief Description
Made Ground	GL	2.00 – 2.85	2.00 – 2.85	SAND and GRAVEL
Natural Superficial Strata	2.00 – 2.85	17.50 – 18.00	15.10 – 15.50	Slightly gravelly sandy CLAY over silty SAND
Solid Geology	17.50 – 18.00	31.10 – 33.00+	13.60 – 15.00+	SANDSTONE

Details are provided in the logs in Appendix B and the individual strata are described in the sections below.

5.2 Made Ground

Made Ground – General

Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 2.00m and 2.85m bgl.

Hardstanding surfacing of tarmacadam was present across the majority of the site recorded as being 0.15m thick. A concrete slab up to 0.45m thick was encountered in the west corner of the site, protruding out the ground.

The composition of the made ground beneath the hardstanding was fairly consistent across the site and represented demolition material comprising gravelly sand with varying amounts of ash as a minor constituent. Gravel and cobbles of brick and sandstone ranged from low to medium content.

5.3 Natural Superficial Strata

The natural strata underlying the site was generally a firm to stiff clay with varying amounts of sand and gravel as minor constituents. This is interpreted to represent Glacial Till. The gravel was generally subangular to angular fine to coarse of sandstone.

This was underlain by a dense clayey slightly gravelly sand with pockets of sandy clay encountered from 10.00m to 12.00m bgl down to the bedrock. SPTs regularly refused in this strata, with N values of 50.

A thin band of dense sand and gravel with a low sandstone cobble content was encountered in BH1 from 12.00m to 13.51m bgl. The sand was fine to coarse and the gravel was subrounded to angular fine to coarse of sandstone.

5.4 Solid Geology

Extremely weak brownish red fine to coarse sandstone bedrock was encountered from depths of between 17.50m and 18.00m bgl. This was proven to a maximum depth of 33.00m across the site and is interpreted to represent the Chester Formation. Discontinuities were generally very closely spaced to closely spaced, rough, undulating and sub-horizontal.

The overall percentage of Total Core Recovery (TCR) in sandstone over each core run within an individual borehole varied from 0% to 100%, although averaged at 52%. Similarly, Solid Core Recovery (SCR) ranged between 0% to 98% and averaged 37%.

Rock Quality Designation (RQD) percentages ranged between 0% up to 93%, averaged at 22%, although considerable variation in the RQD was recorded in both boreholes, and no clear trend or pattern was discernible.

5.5 Groundwater

Groundwater was not encountered during the ground investigation, although it was encountered in some of the standpipe installations during the monitoring period, and is therefore likely to be perched. The depths to groundwater and locations present are shown in the table below:

Location	Depth During Site Works (m)	Depth During Monitoring Period (range) (m)
BH1	NGW	22.01 – 22.08
BH2	NGW	9.03 – 11.44
WS01	NGW	1.49 – NGW
WS02	NGW	1.76 – NGW
WS03	NGW	1.53 – NGW
WS04	NGW	NGW
WS05	NGW	2.08 – NGW

5.6 Observations

Contamination

During the works undertaken by BSL, observations for both visual and olfactory evidence of contamination were undertaken.

With the exception of ash and clinker observed as a minor constituent in the made ground soils, no other evidence of contamination was observed at the site.

Stability of Excavations/Boreholes

The borehole sidewalls were generally stable and window sampling progressed without the need to install casing. Casing was required to prevent collapse with the granular materials during drilling of the cable percussive and rotary boreholes.

6.0 TEST RESULTS

6.1 Geotechnical Laboratory Testing

Plasticity Index Analysis

Plasticity index results ranged between 23% and 30% indicating the cohesive soils to be of moderate plasticity. Associated water contents ranged between 8.3 and 23%.

After modification of particle size in accordance with NHBC Chapter 4.2 the modified plasticity indices are in the range 23% to 29% indicating the cohesive soils to be of medium volume change potential.

Undrained Shear Strength

Undrained shear strength in triaxial compression ranged from 53 to 146kPa indicating the cohesive soils to be of medium to high strength. The results of the tests are shown in the table below:

Location	Depth (m)	Shear Strength (kPa)	Undrained Shear Strength to EC7
BH1	9.00 – 9.45	146	High
BH2	3.00 – 3.45	53	Medium

One Dimensional Consolidation Properties

The one-dimensional consolidation properties were as follows:

Location	Depth (m)	Mv Range (m ² /MN)	Cv Range (m ² /yr)	Compressibility at Approx Over-Burden Pressure
BH1	4.50 – 4.95	0.22	9.50	Medium
		0.14	3.93	Medium
		0.10	4.67	Medium
		0.06	3.94	Low
BH1	6.00 – 6.45	0.12	5.21	Medium
		0.09	3.00	Low
		0.07	3.45	Low
		0.04	3.21	Very Low

Compressibility from Tomlinson 7th Edition Page 77

Unconfined Compressive Strength (UCS) and Point Load Index

A summary of the information pertaining to the Unconfined Compressive Strength (UCS) of the intact rock material (not rock mass) related to sandstone bedrock at the site is shown in the table below. The point load index results have been used to derive the UCS using the relationship of $UCS=24 \times IS50$ for sandstone (ISRM). Two point load results were both calculated to be zero. However, these have been excluded from the results, as it is likely the samples used were extremely weathered and had been weakened by the use of water flush, and therefore are not an accurate representation of the strength of the sandstone beneath the site.

Point Load Index (MPa) (range)		UCS Range (MPa)	Method	No. of results
Is	IS50			
0.02-0.06	0.02-0.07	-	Point load (Diametral)	3
-	-	0.48 – 1.68	Point load correlation (ISRM)	3
-	-	1.10 – 4.70	UCS test	5

Permeability Test Results (Boreholes)

The results of permeability testing in boreholes using falling head methods are presented in the table below. These were carried out in general accordance with BS 5930 & BS 22282.

Location	Response Zone (m)	Stratum Type	Hydraulic Conductivity (m/sec)
BH01	4.00 – 23.00	CLAY over SAND over SANDSTONE	4.65×10^{-8}
BH02	8.00 – 12.00	CLAY over SAND	1.74×10^{-7}

6.2 Aggressive Ground Conditions – Geotechnical Chemical Testing

The test results for the assessment of aggressive ground conditions are presented in Appendix D. The results are summarised and assessed within Section 8.0 of this report.

6.3 In Situ Geotechnical Testing

In Situ Standard Penetration Tests

Standard Penetration Tests (SPTs) were carried out within the window sample and cable percussive boreholes at regular 1.0m to 1.5m intervals. The results of the individual blows and the N-values are recorded on the Exploratory Hole Logs in Appendix B.

All SPT N values are uncorrected. Density and strength descriptors are reported in accordance with the guidelines stated in BS 5930:2015+A1:2020, incorporating requirements of BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003.

6.4 Geo-Environmental Testing

Chemical Laboratory Testing

The chemical test results for soils are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

Ground Gas Monitoring

Ground gas monitoring installations have been monitored on six occasions out of six visits scheduled. The results are presented in Appendix E and are summarised and assessed within Section 8.0 of this report.

7.0 GEOTECHNICAL ASSESSMENT

7.1 Ground Model Summary

The site is currently occupied by a singular three storey brick building in the east with adjoining steel framed warehouse to the west, belonging to the Manchester Safe Deposit Centre.

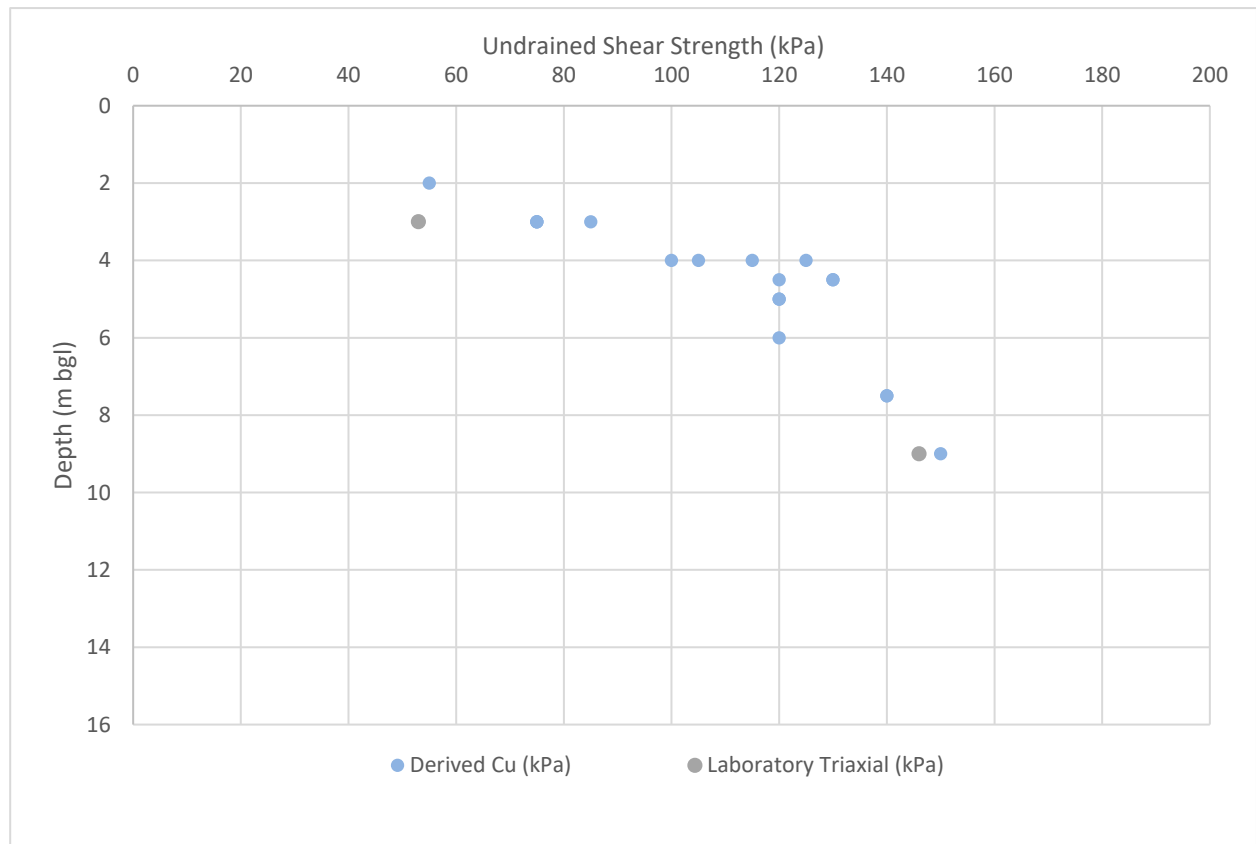
The ground conditions can be summarised as below (top down):

- Made ground generally comprising sand and gravel from ground level to between 2.00m and 2.85m bgl.
- Natural superficial deposits comprising slightly gravelly sandy CLAY over silty SAND proven to depths between 17.50m and 18.00m bgl.
- Solid geology comprising SANDSTONE proven to depths ranging between 31.10m and 33.00m bgl.
- No groundwater was detected during site works.
- Post site works monitoring levels ranging between 1.49m and 22.08m bgl.

7.2 Design Soil Parameters

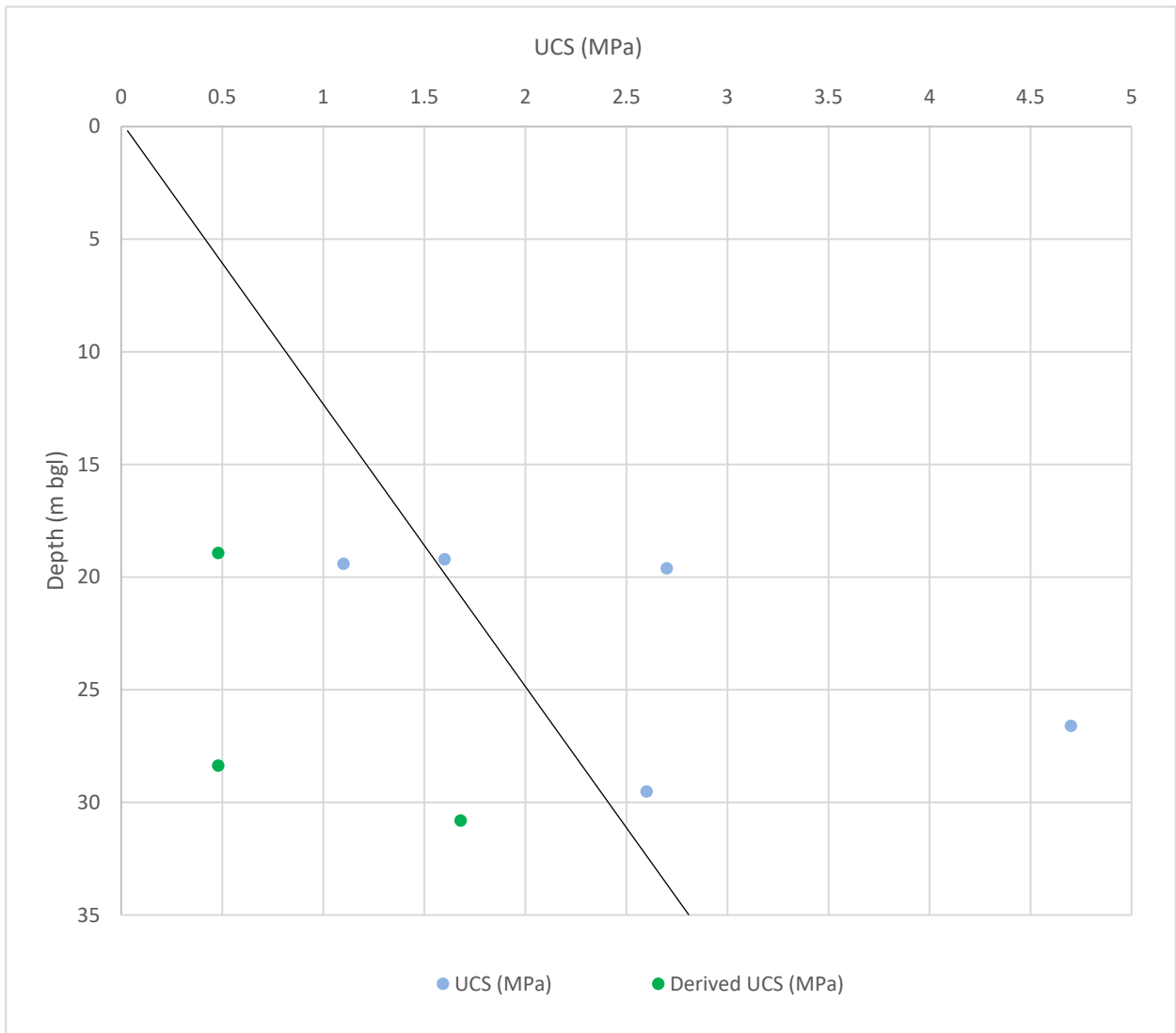
The relevant test results from the prior section have been evaluated to derive geotechnical soil parameters for the site in the following section.

A depth (m bgl) vs derived shear strength (C_u) graph is provided below to provide a profile of the soils underlying the site.



The above graph shows a general increase in soils density as depth increases within the superficial granular strata, with some slight variability between borehole locations. All SPTs undertaken in bedrock refused with an N value of 50. The majority of N values generated in made ground were less than 10.

The Unconfined Compressive Strength (UCS) was determined by laboratory testing and was also derived from laboratory point load testing using the relationship of $UCS=24 \cdot IS_{50}$ for sandstone (ISRM). A graph showing the variation in UCS and derived UCS vs depth is presented below to provide a profile of the variation in UCS of the bedrock with depth.



The variations in RQD percentages with depth in each borehole are too poor and varied to represent in a graph, with no obvious trends or patterns. The RQD of BH1 and BH2 averaged 35% and 11.9% respectively. RQD should be considered in respect to reduction factors for shaft resistance during detailed design (Rowe 2001).

Characteristic Values

A characteristic ϕ' value of 43° for the bedrock across the site has been extrapolated from the SPT 'N' value data and visual descriptions of the ground conditions within the sandstone bedrock.

Based on a correlation developed by Broch and Franklin (1972), who proposed that $UCS=24(Is_{50})$, the results of the point load testing completed correlate to a UCS of between 0.48MPa and 1.68MPa. Compressive strength testing of bedrock core samples determined the UCS to be between 1.1MPa and 4.7MPa. There is a weak, positive correlation between an increase in depth and an increase in UCS. There is also a weak correlation between the UCS testing and point load testing results.

Based on field strength descriptions and the laboratory testing, the characteristic UCS for the bedrock underlying the site has been derived and summarised in the table below.

Bedrock Strata	Depth (m)	Characteristic UCS (MPa)
Sandstone	20	1.6
	22.5	1.8
	25	2.0
	27.5	2.2
	30	2.4
	32.5	2.6

7.3 Foundations

The development will comprise the demolition of the existing building and the construction of a part 25 storey, part 3 storey residential tower with ground floor commercial space above partial basement level and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7.

Preliminary design by calculation has been undertaken to determine the design resistance of the bearing strata in the following section. No proposed structural loads were available at the time of writing, therefore the following recommendations are provisional and should be reviewed at the detailed design stage.

Piles

Due to the likely magnitude of the column loads expected to be imposed by the proposed multi-storey structure, the use of shallow foundations is not considered feasible for the proposed development. Therefore, the most suitable foundations are considered to be piles extending through the made ground and superficial deposits and bearing on sandstone bedrock which was observed to depths of between 17.50m and 33.00m bgl. Selection of a pile type and detailed design of pile foundation is typically completed by specialist piling contractors; the following general information is provided for guidance only. Based on the information from the site investigation, the most suitable foundation type is considered to be continuous flight auger (CFA) or displacement piles socketed into the sandstone bedrock.

Bored piles are also considered suitable; however, they may need to be cased due to the presence of granular material that could result in caving of the walls of the bored shaft and/or seepage from perched groundwater layers.

Driven piles including small displacement, large displacement, and driven cast in-place while considered technically and economically feasible are not recommended for this site as noise from their installation may impact surrounding businesses and ground vibrations caused by piling operations may cause damage to nearby structures. Augured displacement piles may be suitable as these have the advantage of minimising the generation of waste soils.

Piles should be extended through the made ground and the superficial deposits. Depending on the structural loadings and design requirements, piles will likely utilise a combination of skin friction and end-bearing resistance, transferring the majority of the load to the underlying competent sandstone.

Trial piles are recommended to verify design assumptions including confirmation that a reasonable socket length into bedrock can be achieved using a CFA piling rig. Load testing can also be completed on trial piles to confirm a final design and verify that the design resistance can be achieved.

As the loads and piling details were unavailable at the time of writing this report, it is suggested that an allowable end bearing capacity of 7MPa is assumed at this stage and this can be reassessed once more

details are available. Design guidance for piled foundations socketed into bedrock is provided in BS 8004:2015 – Code of practice for foundations.

For piles socketed in bedrock, the ultimate shaft resistance for the portion of the pile embedded in the bedrock may be determined through the following equation:

$$q_s = k_1 p_{ref} \left(\frac{q_u}{p_{ref}} \right)^{k_2}$$

In this equation, q_s is the ultimate shaft resistance in kN/m^2 , q_u is the UCS value of the bedrock, p_{ref} is a reference pressure of 100kPa and k_1 and k_2 are coefficients selected from the range presented in BS 8004 as 1.0 and 0.6 respectively.

The ultimate shaft resistance for the portion of the pile embedded in granular soil may be determined through the following equation:

$$q_s = K_s \tan \delta \sigma'_v$$

In this equation, q_s is the ultimate shaft resistance in kN/m^2 , K_s is an earth pressure coefficient conservatively assumed as 0.7 for preliminary design purposes, δ is the angle of interface friction 35° , and σ'_v is effective overburden pressure over the embedded length of the pile.

The frictional contribution of the made ground has been omitted from these calculations due to the variability and generally loose nature. Additionally, pile designs should be based on the final ground level, if any excavation is proposed, rather than the current ground elevations.

The ultimate end bearing resistance of the competent bedrock has been determined using the following equation:

$$q_b = k_3 p_{ref} \left(\frac{q_u}{p_{ref}} \right)^{k_4}$$

In this equation, q_b is the ultimate base resistance in kN/m^2 , q_u is the UCS value of the bedrock, p_{ref} is a reference pressure of 100kPa and k_3 and k_4 are coefficients identified in BS 8004 as 15 and 0.5 respectively for cemented materials. The design base resistance may be limited by the compressive strength of the concrete used to construct the pile or the structural capacity of the pile itself.

Following guidance provided in Rowe (2001), the ultimate bedrock shaft resistances should be reduced by a suitable factor to account for discontinuities in the rock mass. Adopting a conservative characteristic RQD of between 11.9% and 30%, consistent with that observed within the more successful core recoveries at depths which piles are anticipated to be founded and based on the close spacing of discontinuities in the rock mass, BSL recommends a reduction factor of 0.2 for the ultimate shaft resistance.

Due to occasional poor core recovery within the boreholes, 2 SPTs were taken at relevant intervals between the core runs to provide necessary data to aid in the preliminary foundation design. Both SPTs conducted within the sandstone bedrock produced an N value of 50 and refused within the first incremental blow. These results therefore justify the reduction factor.

Based on the available information and methodology outlined above, preliminary calculations were undertaken to provide estimated factored allowable loads for a singular circular concrete pile, to be socketed into sandstone bedrock of variable lengths and a variety of diameters (based on standard rotary pile boring equipment). A global factor of safety of 3 has been used in this assessment. The preliminary

allowable loads are shown in the table below. Note these recommendations are provisional and subject to review at the detailed design stage.

Pile Length (m)	Embedment into Rock (m)	Allowable Loads (MN) for Specified Pile Diameters		
		350mm	600mm	750mm
20	2.25	0.8	1.8 ^[1]	2.5 ^[1]
25	7.25	2.1	3.9	5.1
30	12.25	3.3	6.0	7.7

[1] Not in compliance with EC7 as <5 pile diameters into bearing stratum.

Higher loads can be achieved through using larger pile diameters or pile groups. or by using pile groups. These calculations have been based on a single pile, it is likely that piles will be installed in groups and the group action of the piles should be considered.

If any increase to existing ground elevations is proposed (i.e. fill placement) or if any dewatering operations are proposed in the vicinity of the site, the piles should be designed to resist potential downdrag forces (negative skin friction) based on the results of the consolidation testing presented in the previous section.

If the ground conditions encountered during the construction phase differ significantly to the conditions encountered during construction, work should cease and BSL contacted for further advice.

During the construction phase supervision should be on a continuous basis to check the design assumptions are correct and construction conforms to design. Supervision should include inspections, Control Ground Investigations and monitoring.

As stated above, these calculations are preliminary, should be used only as a guide and reviewed at the detailed design stage. Information gained from this ground investigation should be assessed by experienced piling contractors and suitably qualified structural engineers such that appropriate piles are selected and designed given the site conditions that have been encountered.

Information gained from this ground investigation should be assessed by an experienced piling contractor such that appropriate piles are selected and designed given the site conditions that have been encountered.

Whilst detailed design is beyond the scope of this report, the following should be taken into consideration during the detailed design stage by a suitably competent contractor/engineer:

- Piles should extend a minimum of five pile diameters into the bearing stratum to fully mobilise end-bearing resistance and shaft resistance.
- Higher allowable loads than those listed in the table above could be achieved by increasing the diameter of the piles or by using pile groups.
- Obstructions in the ground (e.g. relict foundations) could cause piles to stop shallower than their anticipated design depth, or deviate from the vertical, therefore reducing their capacity.
- Bored piles through coarse soils will likely result in loosening, with resultant reduced shaft friction.
- Discussions should be made with the piling contractor regarding the suitability of driven piles due to the levels of disruption to the adjacent residential and commercial properties.
- CFA piles are likely to be a suitable alternative to driven piles to reduce noise levels, although there will be additional costs associated with disposal of excess soils.
- The construction of a basement structure should also be taken into account for foundation and pile design.
- The piling work should be undertaken in accordance with BS EN 12699:2015 'Execution of Special Geotechnical Work - Displacement piles', and also relevant standards associated with manufacturing the piles.
- In accordance with Eurocode 7 it would be prudent to verify the compressive resistance of the strata and the pile design should be by static load testing on working piles 1.5 times the characteristic load on more than 1% of working piles. This will provide an accurate strength of the end bearing stratum.

Working Platform

Prior to the commencement of piling works, a working platform will be required for tracked plant. This should be designed and installed in accordance with BR470 (BRE 2004) based on the plant requirements, data and rig loadings.

UXO

Based on the available information to date, specialist UXO advice and/or supervision will be required for all groundworks, including piling.

7.4 Building Near Trees

Due to the location of the site and its surrounding land use, BSL has assumed that there are no trees within an influencing distance of the site and no evidence of current or former trees was observed during the site investigation.

Where foundations are constructed on clay soils within the influencing distance of trees including proposed planting, the upper section of the pile (to the recommended minimum founding depth) should be sleeved or overbored to allow for clay volume change. Bored, cast-in-place piles are well suited to counteracting heave. Driven piles are less well suited to counteracting heave and are difficult to install in stiff desiccated clay without excessive noise and vibration.

7.5 Floor Slabs

Given the thickness of made ground present (generally >600mm), suspended floor slabs should be adopted at the site in accordance with NHBC standards.

A suspended floor slab should be adopted at the site, supported by piles. As the cohesive material beneath site has only been encountered outside an influencing distance of the floor slabs, a minimum void space of 150mm can be adopted.

Ground bearing slabs may be adopted providing the following criteria are satisfied:

-
- Any other compressible or unsuitable materials (topsoil containing vegetation and organic matter, including tree roots, are excavated and either improved or removed and replaced with suitable materials.
 - It is demonstrated that desiccation in cohesive soils is not present.
 - Any fill beneath the slab is suitable, well-compacted granular material placed in an appropriate thickness in accordance with a suitable specification (e.g. SHW Series 600) designed and supervised by an appropriately qualified engineer, with the end performance validated.
 - The slab is adequately reinforced.
 - Regular construction joints and ties are provided to allow for differential settlement.
-

The final floor slab design should be of sufficient thickness and sufficiently reinforced to accept the envisaged applied loads, without unacceptable total or differential movement.

Vertical elements within the structure, such as columns and walls will need to be isolated from the ground bearing slab in order to allow for the slab to expand against them without resulting in cracking.

Prior to the placement of the founding materials and the construction of a ground bearing floor slab, the sub-formation and formation will need to be inspected and checked by a geotechnical engineer to ensure the ground conditions are as expected. If soft spots or hard spots are identified at the formation level, they should be reported to the Geotechnical Engineer immediately and remedial actions agreed.

Incorporation of geogrid reinforcement at formation level, before granular material is placed and compacted, will likely minimise required excavation depths and help provide a suitable foundation for the ground bearing slab.

Ground floor slabs should also be designed to incorporate any ground gas protections measures, although results to date do not indicate these will be required at present, subject to ongoing monitoring and regulatory confirmation.

7.6 Site Preparation and Construction

Topsoil and subsoil should be removed from beneath all buildings and hardstanding areas.

There are a number of services crossing the site. To allow construction, all services will need to be disconnected and any suspected dead services are confirmed as dead by testing.

Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) is recommended to maintain the build programme. Breaking equipment may also be required locally to penetrate old foundations associated with former construction.

The presence of substantial depths of made ground across the site may result in settlement of newly installed drainage. This should be taken into consideration during the design of drainage, which may include flexible joints to allow for some differential settlement.

To protect against the effects of heave, new drainage should be designed to take account of potential ground movement, including where pipes and services which pass through substructure walls or foundations. The volume change potential on this site is medium and the potential ground movements that need to be considered for design are 100mm

Recorded post site works groundwater levels ranged between 1.54m and 24.31m bgl (47.47m and 24.29m AOD) and therefore will be encountered within likely excavation depths. Based on the exploratory holes logs and monitoring, it is considered that methods such as sump pumping are likely to be sufficient to deal with anticipated flows. Further guidance is provided in CIRIA C750 "Groundwater Control: Design and Practice". It should be noted that groundwater levels will vary seasonally and the timing of construction may influence requirements.

7.7 Basement Construction

A basement structure is proposed beneath the northern third of the proposed building. Depths of to the base of the structure are no currently known to BSL.

Based on the proposed development layout, the excavations for the basement will likely encounter made ground down to approximately 2.00m bgl, overlying clays to a maximum depth of 2.80m to 5.00m bgl, overlying medium dense clayey sand.

The following points need to be considered in the design and construction of the basement:

-
- The method of excavation of materials within the basement.
 - Temporary and permanent support of the excavation.
-

- Groundwater levels, control and water proofing of basement sidewalls/base.
- Active pressures from groundwater and the surrounding earth acting on the sidewalls/base.
- Potential settlement of adjacent structures or infrastructure due to ground deformation or dewatering.
- Differential settlement between the basement structure and other foundations or floor slab elements.
- Cut and fill requirements across the wider site.
- Floor heave/settlement.

Embedded retaining walls could be utilised for the construction of the basement using temporary support, where one advantage is that they could be incorporated into the foundation design for the proposed structure. This could include either a contiguous or secant piled wall or a diaphragm wall.

The selection of the type of embedded retaining wall, will depend on a range of factors such as environmental constraints, including noise and vibration, as well as cost.

Alternatively, sheet piled walls could be utilised or the basement retaining walls could be constructed within an open excavation. However, the sides of the excavation would need to be sufficiently battered and supported for safety, and the available space on site may preclude this option.

Methods of water proofing basements and below ground structures are detailed in BS 8102 (2009), "Code of practice for protection of below ground structures against water from the ground".

Temporary support (if adopted) should be designed in accordance with BS 5975 "Code of practice for temporary works procedures and the permissible stress design of falsework".

The design of the basement should also take into account ground gas protection measures, although ventilation within the basement may negate the requirement of these measures. A full assessment will be made upon completion of the ground gas monitoring programme.

If the materials excavated from the basement are to be re-used elsewhere on site, then an earthworks specification will be required to ensure the appropriate management and reuse of the existing soils. This may also need to be undertaken in accordance with a Materials Management Plan (MMP) under the CL:AIRE Code of Practice.

7.8 Concrete Classification

The soluble sulphate and Ph test results have been assessed in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in the table below.

For the purposes of this assessment, the groundwater has been classified as static given the site is underlain by low permeability deposits.

Stratum	No. Samples	Characteristic SO ₄ (g/l)	Characteristic pH	DS Class	ACEC Class
Made Ground	5	1780	7.3	DS3	AC-2s
Natural Superficial Strata	4	160	7	DS1	AC-1s

The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

7.9 Highways

Made ground is likely to be present at formation levels. Equilibrium CBR values are likely to be 2% within the made ground unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer.

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 450mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

7.10 Sustainable Drainage Systems (SuDS)

The use of sustainable drainage systems, such as traditional soakaways within the natural ground, is not likely to be feasible due to the low infiltration rates obtained (on the order of 10^{-7} to 10^{-9} m/s), the presence of variable and potentially contaminated made ground near the surface, and the respective underlying low permeability cohesive strata.

8.0 GEO-ENVIRONMENTAL RISK ASSESSMENT

8.1 Introduction

The samples were tested for an assessment of the chemical contamination that may pose a risk to human health. The results were examined with reference to a selection of guidance documents as detailed in Appendix A. In this case the LQM/CIEH S4ULs and DEFRA C4SLs for a commercial end use have been adopted as Tier 1 generic screening values, due to the currently proposed commercial space occupying the ground floor of the structure.

The apparent exceedance of the relevant screening value is taken as indicating further detailed assessment or remedial action is required.

A summary assessment sheet is presented in Appendix C alongside the chemical test results. Results are discussed in detail in the sections below.

8.2 Soils Test Results and Risk Assessment – Human Health

Metals

The following elevated metals were detected:

Exploratory Hole	Depth (m)	Metal	Concentration (mg/kg)	Adopted Screening Value (mg/kg)
WS04	0.25-0.60	Lead	4100	2300

Asbestos

The locations where asbestos has been detected, alongside the results of quantification (where carried out) are summarised in the table below:

Exploratory Hole	Depth (m)	Asbestos ID	Concentration by Weight (%)
WS01	0.50 – 1.10	Chrysotile loose fibres	<0.001
WS03	0.30 – 0.80	Amosite loose fibres	<0.001

Both samples containing asbestos are noted to be in the north-west of the site, likely associated with the former residential properties noted in this area of the site on historical mapping.

No visual evidence of asbestos contamination was noted during the investigation, which was undertaken by an engineer with asbestos awareness and NNLW qualifications.

Poly Aromatic Hydrocarbons (PAHs)

No PAHs have been detected above the adopted screening criteria.

Total Petroleum Hydrocarbons (TPH CWG)

No petroleum hydrocarbons have been identified above the adopted screening criteria.

BTEX and MTBE

No BTEX or MTBE compounds have been identified above the adopted screening criteria.

8.3 Summary – Human Health Risk Assessment

Based on the testing and assessment undertaken it would appear that there is localised contamination within the made ground in the form of metals attributed to ash within the made ground strata.

Chrysotile and amosite asbestos fibres have been detected in two samples to date at trace levels.

The above pose a risk to human health and will require further consideration.

8.4 Controlled Waters Risk Assessment

Whilst there are elevated concentrations of contaminants, based on the investigation works undertaken to date and subject to agreement with the Environment Agency, the site is not considered to pose a significant risk to controlled water for the following reasons:

- The EQS for lead are also based on bioavailability and so this risk assessment is conservative as it assumes 100% bioavailability.
- There is no indication under present conditions of pollution of controlled waters and conditions following development of the site will not be any worse, indeed they may improve with increased hard cover and water retaining imported garden soils.
- The concentrations of leachable substances that could emanate from the site will be subject to dilution and dispersal during transport and so the risks will reduce with distance from the site and into the identified surrounding water bodies.
- It would be technically challenging and probably disproportionately costly to remove the contaminants from the water to the pre-input stage.
- No significant contamination has been identified on site in soils based on the results obtained as a potential indicator of groundwater contamination.
- The nearest watercourse is over 250m away, which provides considerable distance for attenuation and contaminant degradation.
- The site is underlain by low permeability clays which will inhibit lateral and vertical contaminant migration.
- The site does not lie within 500m of an SPZ.
- There are no groundwater abstractions within 1500m.
- There are no potable (sensitive) water abstractions within 2000m.

8.5 Permanent Ground Gas and Vapours Results

Four ground gas monitoring visits have been carried out between the dates of 19th April 2021 and 18th June 2021. A further two visits are scheduled. Results are summarised in the table below:

	CH ₄ (%)		CO ₂ (%)		O ₂ (%)		CO (ppm)		H ₂ S (ppm)		Flow	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Peak	0.0	0.1	0.1	5.0	11.7	21.4	0.0	0.0	0.0	0.0	-0.1	1.0
Steady	0.0	0.1	0.1	5.1	13.6	21.3	0.0	0.0			0.1	0.7

Notes: CH₄ = Methane; CO₂ = Carbon dioxide; O₂ = Oxygen; CO = Carbon Monoxide; H₂S = Hydrogen Sulphide; TVOC (PID) = Total Volatile Organic Compounds (as measured with Photo Ionisation Detector); ppm = Parts Per Million.

The highest carbon dioxide concentrations were recorded in WS04 (5.1% v/v) on the sixth monitoring visit during a period of rising pressure. No methane concentrations were detected above ambient levels. The maximum flow of 1.0 l/hr was recorded in all monitoring locations on the fifth and sixth visit.

The atmospheric pressure ranged between 999mb and 1014mb over the monitoring period, of which visits were conducted over a range of falling, steady and rising pressure trends.

8.6 Ground Gas Risk Assessment

In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to

buildings’ and BS8485:2015+A1:2019 ‘Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings’.

As the proposed end-use is a high rise development, guidance dictates that the gas monitoring results should be assessed in accordance with the Wilson and Card methodology.

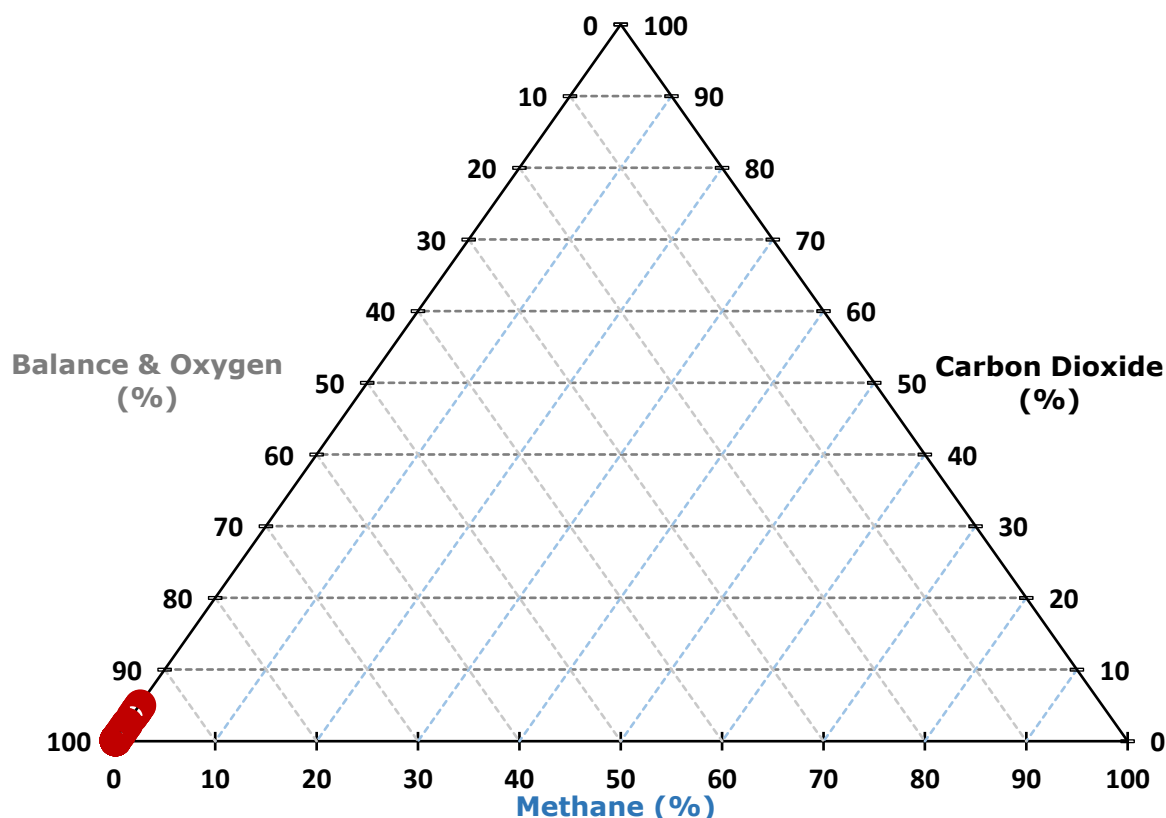
The Wilson and Card methodology uses the concept of a Gas Screening Value (GSV) which is derived using the following equation: $(\text{max gas concentration} / 100) \times \text{maximum flow}$.

A maximum positive flow of 0.7l/hr has been used to derive the GSVs. The GSV’s for the site are presented below.

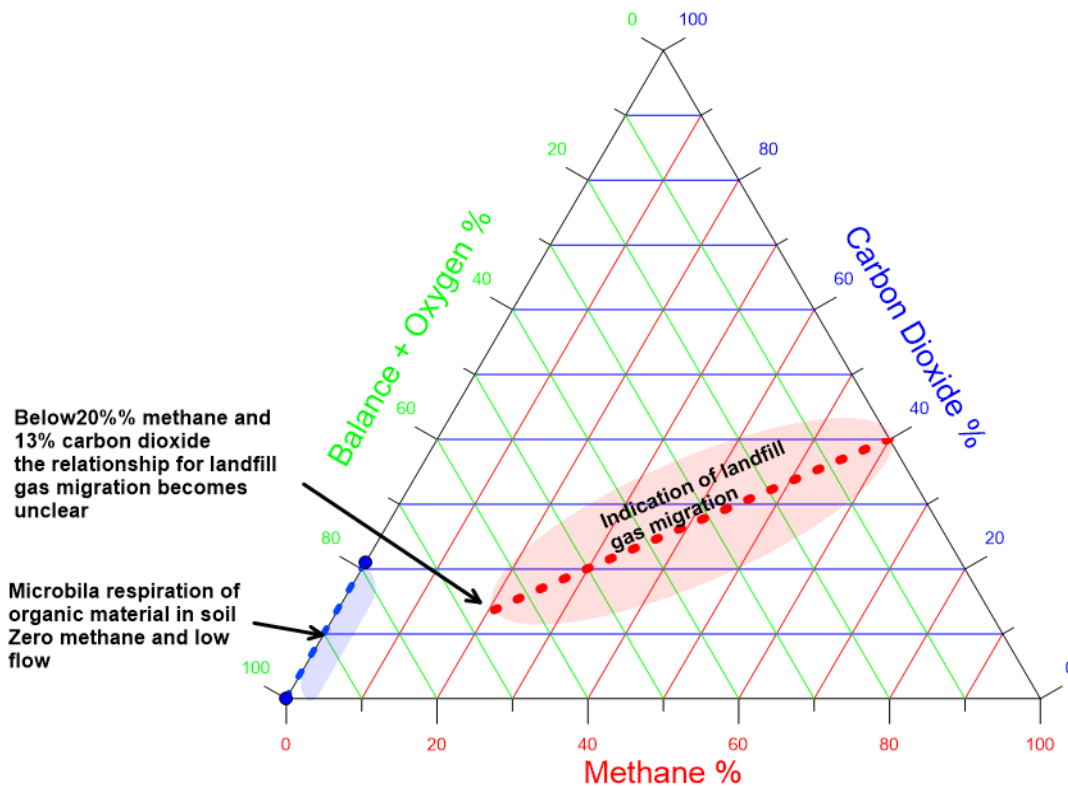
Gas	GSV (l/h)	Typical Threshold Concentration Exceeded	Classification
Methane	0.001	No	CS1
Carbon Dioxide	0.051	Yes	CS2

The GSV for carbon dioxide place the site the site into Characteristic Situation 1 (CS1), however due to concentrations of carbon dioxide greater than 5% v/v being recorded at the site then the site will be classified as Characteristic Situation 2 (CS2).

Guidance states that where results plot in the zone typical for microbial respiration there is no need to increase the characteristic situation. In order to increase confidence in this assessment and adopting a lines of evidence approach, reference has been made to the recent 2018 paper by Wilson et al (Ambisence and EPG Ltd) “Using ternary plots for interpretation of ground gas monitoring results”. The data has been presented on the ternary plot displayed below, which aims to determine the likely source of the ground gas.



The dataset falls within the zone attributed to microbial respiration of organic material in soils, and the hypothesis is supported by the low gas flow rates and very low methane concentrations which characterise the gas monitoring data as shown below (extract from Wilson et al 2018).



The rates of gas generation via microbial respiration are typically very low and subsequently high flow rates would not be expected from this source.

Based on this rationale, in this instance the classification of CS2 is not considered to be applicable and the site is considered to be characteristic of a CS1 site.

Furthermore, the structure is likely to have an inherent level of ground gas protection, with floor slabs likely to comprise a significant thickness of reinforced concrete which would further resist ground gas ingress. Whilst piles are being utilised at the site, it is not considered that these would create a significant pathway for ground gas migration based on the latest industry research (Piled foundations and pathways for ground gas migration in the UK, Wilson and Mortimer, 2017).

8.7 Potable Water Supply

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

As the site is brownfield, there is the assumption that barrier pipe would be utilised, although requirements should be confirmed by risk assessment and with the water supply company.

8.8 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf. Unless stated otherwise, in respect to off-site sources, only risks that are assessed as moderate and above within the preliminary CSM have been carried forward to this section, or

where a previously unidentified potential source, pathway and / or receptor has been identified from the recent site works.

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Made ground / Timber Yard / Warehouse Metals, asbestos.	Root uptake, ingestion, direct contact, inhalation of dusts / vapours	End-users	Unlikely	Medium	Moderate / Low	Elevated concentrations of lead were encountered within the made ground. Trace levels of asbestos were located in two samples to date. Proposed development plans indicate that the site is to be present with either hardstanding or building footprint across the majority of the site. In addition, the soils where asbestos was identified in WS05 are to be removed for the construction of a new basement. The creation of a circa 600mm piling mat will also prevent the upward migration of any potential contaminants. Any small residual areas of soft landscaping, currently indicated around the perimeter, will require a cover layer system. Given this, the risk to the end-user is considered to be moderate to low and further remediation may be required.
On site Made Ground Metals and organic contamination	Migration into/chemical attack of water supply pipelines	Water Pipelines / End users	Unlikely	Mild/Minor	Very low	Contaminants within the soil/groundwater could potentially attack the clean potable water supply pipe, contaminants should be assessed in accordance with the relevant guidance to determine the correct pipe material and level of precautions required.
On site Made ground Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/explosion	End-users / property / structures	Unlikely	Severe	Moderate / Low	Slightly elevated concentrations of carbon dioxide were encountered during the gas monitoring, this is considered to be attributed to microbial activity and the site is therefore classified as Characteristic Situation 1 and no gas protection measures are required.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Made ground / Timber Yard / Warehouse PAH's, Metals	Overland flow, / migration through saturated zone	River Medlock 278m away (Surface waters)	Unlikely	Medium	Low	It is considered contaminants associated with the made ground and other past industrial uses are unlikely to impact the River Medlock. This is due to the low permeability of the clays underlying the area, which will inhibit lateral migration, and the potential for contaminants to attenuate and degrade over this distance. In addition, the significant highway drainage in such an urban area makes it unlikely any overland flow can reach the receptor. Therefore, a low risk is posed to the river from the made ground.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary Undifferentiated Aquifer (Groundwater)	Low Likelihood	Mild	Low	The site is currently surfaced in hardstanding and will remain so, with a new surface water drainage system installed which will further reduce the risk to controlled waters. A pollution incident was recorded 19m north-east of the site but this was noted to have a Category 3 (minor) impact on water. The presence of significant mobile contamination onsite was not encountered during the site investigation. The risk is considered to be Low.
	Migration through saturated zone	Principal Aquifer (Groundwater)	Unlikely	Medium	Low	There are no potable water abstraction licences or Source Protection Zones near the site. As stated above, the site is currently surfaced in hardstanding and will remain so, with a new surface water drainage system installed which will further reduce the risk to controlled waters. Further to this, a thickness of low permeability deposits underlies the made ground which will inhibit vertical migration. The risk to the principal aquifer is considered to be low.

8.9 Outline Remedial Measures

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

Generally elevated concentrations of heavy metals and asbestos are not considered to be a viable source of contamination and no relevant pathways have been identified onsite due to the presence of hardstanding and building footprint proposed for the extents of the site, therefore no specific remedial measures are required for heavy metal contaminated soils in respect to human health risk via dermal contact and ingestion for the proposed end use, except for any small areas of soft landscaping as proposed around the perimeter.

Where gardens or soft landscaping are present a cover of “clean” subsoil and topsoil should be provided to break the pathway to site end users. This should be 450mm in soft landscaping areas (Public Open Space – POS) in accordance with BRE 465. This will allow plants to be grown and prevent undesirable soils being brought to the surface. The inclusion of a geotextile marker layer at the base or a coarse granular, ‘hard dig’ layer are recommended.

Prior to import or re-use of clean cover soils, they should be tested to confirm chemical suitability. After installation of the clean cover, soil depths should be verified by a suitably qualified independent geo-environmental engineer, such as BSL.

Ground Gas Protection Systems

Based on the ground gas monitoring results, no mitigation measures are required, subject to agreement with the local authority and no radon protection is required for new buildings at this location.

General

It is recommended that the approval of the Regulators (Local Authority /NHBC / Environment Agency) is obtained in regard to the above prior to any irrevocable action is taken at the site.

Once the above bodies have approved the above outline remedial proposals, a Verification Plan will need to be produced to meet planning requirements and submitted to the regulatory authorities for approval.

In addition, the writing and approval of a Materials Management Plan (MMP) or suitable exemptions/permits will be required to allow re-use of suitable material at the site.

A watching brief is recommended during groundworks for any unidentified sources of contamination. If any gross contaminated material is encountered works should cease in that area and BSL consulted.

Once remediation is complete, verification reports will need to be produced by a suitably qualified independent geo-environmental engineer, such as BSL, in order to achieve regulatory sign off.

8.10 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals)	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Likely	Mild	Moderate / Low
Asbestos	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Low likelihood	Medium	Moderate/ Low
Ground gas	Inhalation in confined spaces/trenches	Construction Workers	Unlikely	Severe	Moderate / Low

Trace levels of chrysotile and amosite asbestos have been identified in two samples to date and trace levels of asbestos are assumed across the north-western part of the site associated with former residential developments. The risk from asbestos should be highlighted in the method statements and site induction. If further evidence of asbestos is encountered in the soils, work should cease until asbestos control measures have been agreed and put in place. Asbestos is further discussed in Section 8.11 below.

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and/or 0.5% for long term exposure. Furthermore, soil concentrations of oxygen were encountered below the HSE recommendations of 18%.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, all contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

8.11 Asbestos

The investigation of asbestos issues within structures was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

Any asbestos within structures will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

Asbestos fibres have been identified in two samples at the site with quantification analysis identifying these to be trace amounts. At these concentrations the liberation of fibres is considered to be unlikely and no specific precautionary measures with regards to asbestos are likely to be required at the site. The level of precautions required are at the discretion of the principal contactor on site however good site practices including minimising the generation of dusts should be adhered to and sufficient to mitigate against the risk from asbestos. In addition site personnel should have the risk communicated at the induction stage. It is recommended that the asbestos in construction materials assessment tool is used at the site to inform asbestos licensing and control measures.

Excavations in soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CARSOIL) and CAR 2012. All such works will need to be agreed with the regulatory bodies (HSE and/or LA).

Additional guidance is provided within the BSL methodology Guidance Note in Appendix A.

9.0 WASTE SOIL CLASSIFICATION & ASSESSMENT

9.1 Summary

BSL have undertaken a preliminary assessment of potential excavation waste to arise from the site during redevelopment to:

- Classify the excavation waste to arise as either hazardous or non-hazardous.
- Identify the most sustainable options for the wastes to arise in accordance with the waste hierarchy.
- Provide a written description of the waste required as part of the Duty of Care.
- Provide details of “hazardous properties” to complete hazardous waste consignment note (where applicable).
- Be able to provide a basic classification report to a landfill operator (where waste is destined for landfill disposal).

9.2 Waste Classification Procedure

As described in the ‘Waste Duty of Care Code of Practice (2016)’ any substance or object that the holder discards, intends to discard or is required to discard is a waste. It is the responsibility of the waste producer to classify this waste. The classification process is described in the ‘Guidance on the classification and assessment of waste’ WM3 and aims to determine whether the waste is Hazardous or Non-Hazardous to human health and the environment.

Hazardous wastes are signified by entries where the code is followed by an asterisk, where some wastes are deemed hazardous without further assessment, which are termed “Absolute Entries” e.g. most waste oils. Alternatively, waste entries are termed “Mirror” entries that require further assessment of hazardous properties, in order to determine whether they are hazardous waste or not (e.g. soil and stones). The EWC codes relevant to excavation wastes are:

- 17 05 03* - soil and stones containing dangerous substances.
- 17 05 04 – soil and stones other than those mentioned in 17 05 03.

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste, Decision 2003/33/EC and Landfill Regulations 2005) led to the establishment of a methodology for classifying wastes.

Wastes first need to be classified based on their total concentrations and classified as either hazardous or non-hazardous waste. WAC testing is only required if the end disposal route is a landfill and WAC analysis must not be used for waste classification.

Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. A waste must comply with the WAC limits for the relevant landfill, otherwise the soil will need to be pre-treated. There are three different WAC criteria, these are:

- Inert waste.
- Stable Non-Reactive Hazardous Waste (SNRHW).
- Hazardous waste.

There are no standard set of WAC limits for non-hazardous landfill sites and each non-hazardous landfill will have its own set of criteria under which it is licenced to accept non-hazardous waste. These will need to be determined through the selected waste receiver prior to disposal.

A non-hazardous waste should not be compared with WAC limits for hazardous or SNRHW waste sites and the WAC test should only be used to determine if the waste is suitable for disposal at an inert waste landfill site. Likewise, wastes classified as hazardous based on their total concentrations should not be compared with WAC limits for inert waste landfill sites, as these will not be accepted.

Details of how material should be classified for waste disposal are presented in the BSL Methodology and Guidance in Appendix A and are summarised in the table below:

Classification based on Total Concentrations ¹	PRIOR TO LEAVING SITE			
	Non-Hazardous Waste		Hazardous Waste	
	IF SOILS CANNOT BE RE-USED ELSEWHERE AND MUST GO TO LANDFILL			
WAC testing	Below inert WAC limit values	Above inert WAC limit values	Below hazardous WAC limit values ⁴	> WAC limit values
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

2 Individual sites may have certain limit values pre-determined in their licence.

3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

4 Possibility that wastes could be classified as stable Nonreactive HAZARDOUS waste in non-hazardous Landfill (e.g. soils containing low concentrations of asbestos, gypsum or sulphate bearing soils).

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC.

Soils above hazardous WAC limit values require pre-treatment prior to disposal. The effective pre-treatment, typically involving separation, sorting and screening, can offer cost savings through reducing the hazardous nature and volumes of soil. Costs for disposal of non-hazardous/hazardous soils are significant compared to the disposal of inert material.

Inert Waste

The possibility of automatic inert classification of the naturally occurring “clean” soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing. This is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other classes of landfill.

9.3 Waste Classification and Waste Acceptance Criteria (WAC)

We have reviewed the testing results and assessed them through a waste classification database which allows users to code and classify waste as defined in the EWC (European Waste Catalogue) based on EC Regulation 1272/2008 on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste - Technical Guidance”).

Five samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3 using the HazWasteOnline tool.

The Waste Classification Report and WAC testing results are presented in Appendix F. The results of the waste assessment based on total concentrations are presented in the table below, alongside the WAC analysis test results.

Location	Depth (m)	Stratum	Waste Classification	WAC Analysis	Landfill	Comments
WS01	0.30 – 0.50	MADE GROUND		Inert	INERT landfill	-
WS03	0.30 – 0.80	MADE GROUND	Non – Hazardous	Inert	INERT landfill	-
WS01	0.50 – 1.10	MADE GROUND	Non – Hazardous	-	-	-
WS02	0.30 – 0.50	MADE GROUND	Non – Hazardous	-	-	-
WS04	0.25 – 0.60	MADE GROUND	Hazardous	-	-	HP10, 14
HB2	0.30 – 1.00	MADE GROUND	Non – Hazardous	-	-	-

Based on the waste classification database assessment, the majority of the made ground soils have been classified as **non-hazardous**. This includes the soils that will require removal for the construction of the proposed basement.

A black ashy sand strata has been noted in WS04 and WS05, with highly elevated lead and a hazardous waste classification. This strata appears to be related to the historic timber yard previously located across the centre third of the site, and it is likely the soils here will be classified as hazardous due to the presence of toxic and ecotoxic lead.

Note that further testing of the soils (WAC testing) may be required on the actual arisings in order to satisfactorily categorise the soil for its suitability for disposal to landfill.

Waste Containing Asbestos

Should soils contain asbestos, the concentration and type of asbestos identified, in addition to the chemical composition (i.e. hazardous or non-hazardous detailed above), will determine which waste code is applicable to the soils and which landfill will accept it.

Waste	Conc. by Weight (%)	EWG 2002 Catalogue Entry Code	Waste Disposal Route
Non-hazardous containing asbestos fibres	<0.001 - <0.1%	17 05 04 (soil and stones other than those mentioned in 17 05 03*)	Non-hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a stable non-reactive hazardous landfill site.
Hazardous containing asbestos fibres	<0.001 - <0.1%	17 05 03* (soil and stones containing dangerous substances)	Hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a hazardous landfill site.
Non-hazardous soils containing asbestos fibres	>0.1%	17 05 03* (soil and stones containing dangerous substances)	Hazardous landfill authorised to receive asbestos, or in a stable non-reactive hazardous waste cell at a non-hazardous landfill authorised to receive asbestos.
Non-hazardous Soils containing ACM (Mechanically separable)	>0.1%	17 06 05 (construction material containing asbestos) 17 05 04 (soil and stones other than those mentioned in 17 05 03*)	ACMs disposed of at a hazardous landfill authorised to receive asbestos, or in a stable non-reactive hazardous waste cell at a non-hazardous landfill authorised to receive asbestos. Soils should be disposed of at a non-hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a stable non-reactive hazardous landfill site.
Hazardous soils containing ACM	>0.1%	17 05 03* (soil and stones containing dangerous substances)	Hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a hazardous landfill site.

The concentrations of fibres in the samples tested were all at trace levels which indicates the soils will potentially be accepted as stable non-reactive hazardous waste.

A watching brief should be maintained for evidence of Asbestos Containing Materials (ACMs), any ACMs observed should be handpicked and disposed of in accordance with current asbestos disposal regulations.

Testing for total contaminant concentrations on natural soils was not undertaken and they are assumed to be non-hazardous.

9.4 Options Assessment

Following the classification of waste materials, the options available for the waste can be considered in the context of the waste hierarchy as below:

- Onsite re-use (with or without prior treatment) under suitable exceptions/permits.
- Offsite processing for recycling or recovery e.g. screening.
- Offsite disposal (with or without prior treatment) i.e. landfill.

Where feasible, efforts should be made to retain soils for onsite re-use to minimise costs and maximise the sustainability of projects.

Based on the above, the possible options for the generation of waste soils at the site are described in the table below:

Waste Generation Source	Comments
Crush	The crushed concrete is site derived from structures which had not been used for potentially contaminative activities. These should be subject to an asbestos survey and removal of asbestos as required, prior to demolition and crushing of structures. Assuming the above criteria are met, with materials containing no asbestos or ACM, crushed concrete is considered to be inert without testing. Where samples of crushed concrete have been subject to totals testing this is likely to be hazardous due to pH, and where subject to WAC testing, the sulphate and TDS limits are breached, this is to be expected due to the presence of concrete.
Made Ground from site levelling/foundations excavations/services excavations	Samples of made ground from across the site have been classified as non-hazardous and hazardous for off-site disposal purposes, although should be suitable for re-use on site if required under suitable exemptions/permits.
Natural ground from site levelling/foundations excavations/services excavations	The Till may be considered suitable for re-use onsite as fill where the criteria of the WFD exception for re-use of naturally occurring soils can be met. Naturally occurring clean materials could also be exported to another site under the direct transfer scenario of the DoWCoP.

General

If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Where it is necessary to dispose material off site it is recommended that materials are segregated and sufficient time is allowed to further classify the actual soil arisings that constitute the waste, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is illegal to dilute and mix soils without a suitable permit.

9.5 Re-use of Soils

By definition in law, any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a “waste”) is then placed on another part of the development site (or used on another development site) without an appropriate materials management plan, permit or exemption being in place, by law this material is defined as “illegally deposited waste”.

Landfill tax rules allow HM Revenue & Customs (HMRC) to recover landfill tax on illegally deposited waste on construction sites. This could lead to excessive costs without the correct documentation in place. In addition, a person who makes, knowingly causes or knowingly facilitates a disposal to be made at an unauthorised site is also liable to pay Landfill Tax.

In order to comply with UK legislation and avoid excessive costs, if the re-use of soils is proposed on site, this should be done in accordance with the relevant exemptions or permits in place.

Soils Re-use Under DoWCoP

One of the main industry mechanisms for allowing the re-use of soils in construction is the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP) also known as a Materials Management Plan (MMP). Further guidance is provided in the BSL Methodology and Guidance in Appendix A.

To implement the DoWCoP (for Route A), there is a requirement to notify the Environment Agency and Local Authority of the intention to use the code of practice in principal, after which there is a 21-day notice period for their response.

In order to re-use soils under the DoWCoP, there are four key criteria that need to be met:

-
- The aims and objectives of the project meet the requirements of the Waste Framework Directive (does not harm human health or the environment).
 - The soils can be demonstrated to be suitable for use (backed up by chemical/geotechnical testing and assessment).
 - There is certainty of use (planning consents are in place alongside materials tracking, which should be in place as part of good site practice in any case).
 - Quantity (the quantity of materials used should be known).
-

Information on existing site levels, proposed levels, volumes generated (e.g. foundation / drainage excavation arisings) would need to be known in order to complete the MMP.

If the DoWCoP is the chosen route, the MMP should be in place and declared by a Qualified Persons (QP) before works commence, otherwise excavated soils could constitute an illegal deposit of waste and enforcement action could be taken by the EA and HMRC.

The declared MMP should be amended as new import sources are added.

Once the project is complete, a verification report detailing soils re-use/import will need to be produced and submitted to CL:AIRE, which may be subject to a random audit process. Sites found to be non-compliant with the CoP can be referred to the EA for further investigation.

Regardless of implementing re-use under the code of practice or not, all sites should have some form of materials tracking in place in compliance with current legislation. Any re-use scheme should also be designed to minimise disposal costs.

Re-use of soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CAR-SOIL™) and CAR 2012.

In terms of the re-use of brick/concrete crush materials, the DoWCoP does cover aggregates, but only on the site of origin, and the EA WRAP aggregate Quality Protocol might best apply to ensure quality standards, which are discussed further below.

Soils Re-use under Exemptions and Permits

Suitable options to allow the re-use and/or import of soils and aggregates on site are provided in the table below:

Re-use Mechanism	Description
U1 Exemption	Can be applied to re-use/import of soils and stones, but only up to 1000 tonnes or for brick and concrete up to 5000 tonnes. This is usually an efficient way to re-use small volumes of waste materials. However, only one U1 can be filled in per site in any 3-year period. Quick and free via online registration.
WRAP Quality Protocols	Describes how processed demolition arisings can be removed from regulatory waste regime. Requires a demonstration of appropriateness by: • Factory Production Control Manual. • Facility Permit (or Exemption). • Grading Analysis.
Waste Framework Directive (WFD) exclusion	In regard to "clean" naturally occurring soils only that are to be re-used on their site of origin, these are covered by a Waste Framework Directive (WFD) exclusion which is an EA regulatory position statement. So long as the project can prove the four criteria listed above for the DoWCoP, then permits or the DoWCoP are not required. However, many projects still use the CoP to ensure compliance.
T5 Screening and blending of waste	The T5 exemption allows you to temporarily treat waste on a small scale to produce aggregate or soil at a particular location, such as a construction or demolition site. The limit is 5,000 tonnes. This applies to: • Screening soil on a demolition site to remove wood and rubble. • Blending soil and compost that has been produced under an exemption on a construction site to produce better soil for landscaping on that site (e.g. peaty deposits). • Crushing waste (except bricks, tiles and concrete) before screening or blending • Grading waste concrete after it has been crushed to produce a certain type of aggregate.
T7 Exemption	The T7 allows treatment of waste bricks, tiles and concrete by crushing, grinding or reducing in size. This needs to be registered with the Local Authority.
Other Permitting Routes	Other options include use under an Environmental Permit (Standard or Bespoke Rules), however these may be a time consuming and costly route, where use of the other above options (if applicable) are likely to be more feasible in construction.

10.0 CONCLUSIONS

10.1 Geo-Environmental

Geo-Environmental – Human Health

The proposed development is of residential end-use, however, the proposed basement and commercial ground floor result in commercial screening values being adopted. It is noted that the majority of the proposed development will comprise hardstanding or building footprint, with some small areas of soft landscaping around the perimeter.

Elevated lead was recorded within one location of the made ground, however, the presence of hardstanding / building footprint across the majority of the development will mitigate the majority of the risk. If any residual areas of soft landscaping remain, then a cover system will need to be implemented to mitigate the risk.

Chrysotile and amosite fibres (loose fibres) have been detected in two samples of made ground across the site. On quantification analysis the asbestos level within the two samples was <0.001% mass and classified as being trace levels.

Ground gas monitoring has revealed a maximum carbon dioxide concentration of 5.1%v/v and methane concentrations of 0.1%v/v. Based on the gas monitoring the site is classified as Characteristic Situation 1 under the Wilson and Card system and ground gas protection measures will not be required.

Geo-Environmental – Controlled Waters

The overall risk to controlled waters is considered to be low and no further action is required.

Waste

Based on the waste classification database assessment, the majority of the made ground soils have been classified as **non-hazardous**. This includes the soils that will require removal for the construction of the proposed basement.

A black ashy sand strata has been noted in WS04 and WS05, with highly elevated lead and a hazardous waste classification. This stratum appears to be related to the historic timber yard previously located across the centre third of the site, and it is likely the soils here will be classified as hazardous due to the presence of toxic and ecotoxic lead.

Note that further testing of the soils (WAC testing) may be required on the actual arisings in order to satisfactorily categorise the soil for its suitability for disposal to landfill.

10.2 Geotechnical

Foundations

Based on the proposed development, the recommended foundation type is CFA piles founded in competent sandstone bedrock, based on a 20-30m pile length. Detailed foundation design should be completed by a suitably qualified specialist.

Floor slabs

Suspended floor slabs are recommended for the proposed structure.

Concrete classification

The results of laboratory pH and sulphate content, indicate that sulphate class DS-3 and ACEC class AC-2s conditions prevail for the made ground soils, and sulphate class DS-1 and ACEC class AC-1s for natural soils, in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

Highways

Made ground is likely to be present at formation levels. Equilibrium CBR values are likely to be 2% within the made ground unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer.

Drainage (SUDS)

The use of soakaways within the natural ground is not considered to be feasible at the site due to the low infiltration rates obtained (on the order of 10^{-8} m/s) and due to the presence of variable and potentially contaminated made ground near the surface, with respective underlying low permeability cohesive strata.

10.3 Further Work

The following further work is considered necessary to progress the site to construction phase:

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- Drilling of location BH3 to confirm design requirements.
 - Demolition Asbestos survey.
 - Detailed foundation design by a structural engineer.
 - Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.
 - Implementation of the Remedial Strategy and verification of the remedial works.
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11.0 ABBREVIATIONS AND DEFINITIONS

GLOSSARY	
Term / Abbreviation	Definition
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater or ground gas.
Controlled Waters	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.

GLOSSARY	
Term / Abbreviation	Definition
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
pH	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).

GLOSSARY	
Term / Abbreviation	Definition
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	Definition
°	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m ²)
KN/m ² /mm	Kilo Newton per metered squared per millimeter
kN/m ²	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m ²)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M ² /MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
µg/l	Micrograms per Litre (parts per billion)
µm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m ³	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million

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NOTE:

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Rev	Date	Description
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Project Title
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Status
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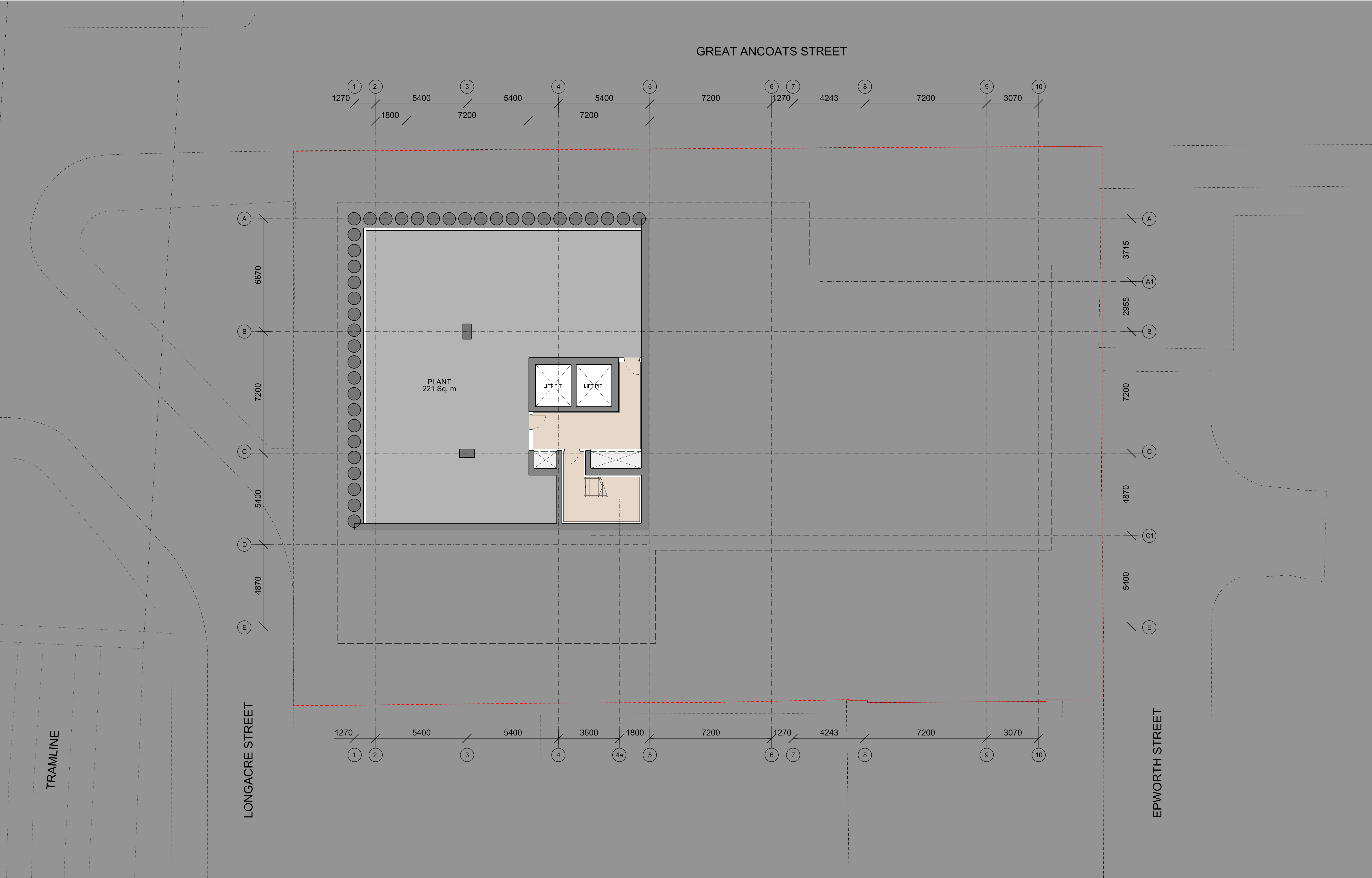
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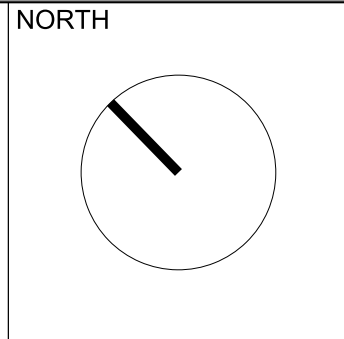
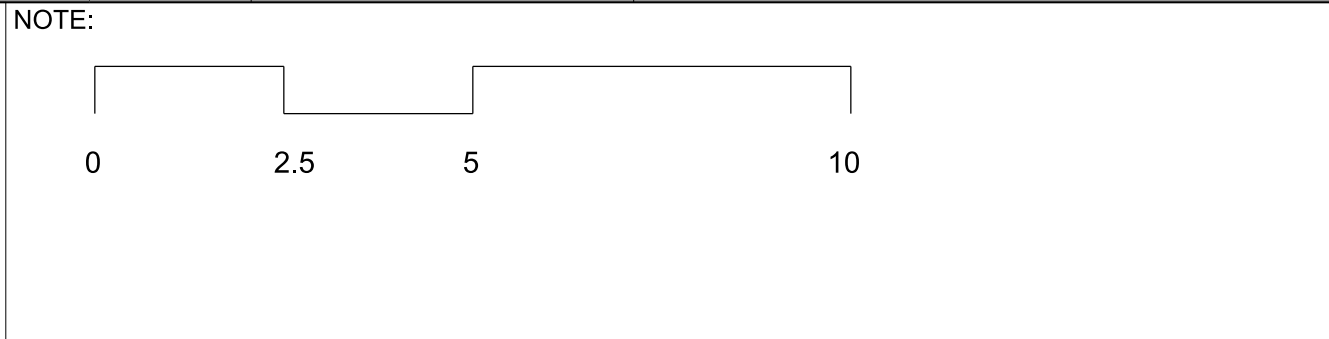
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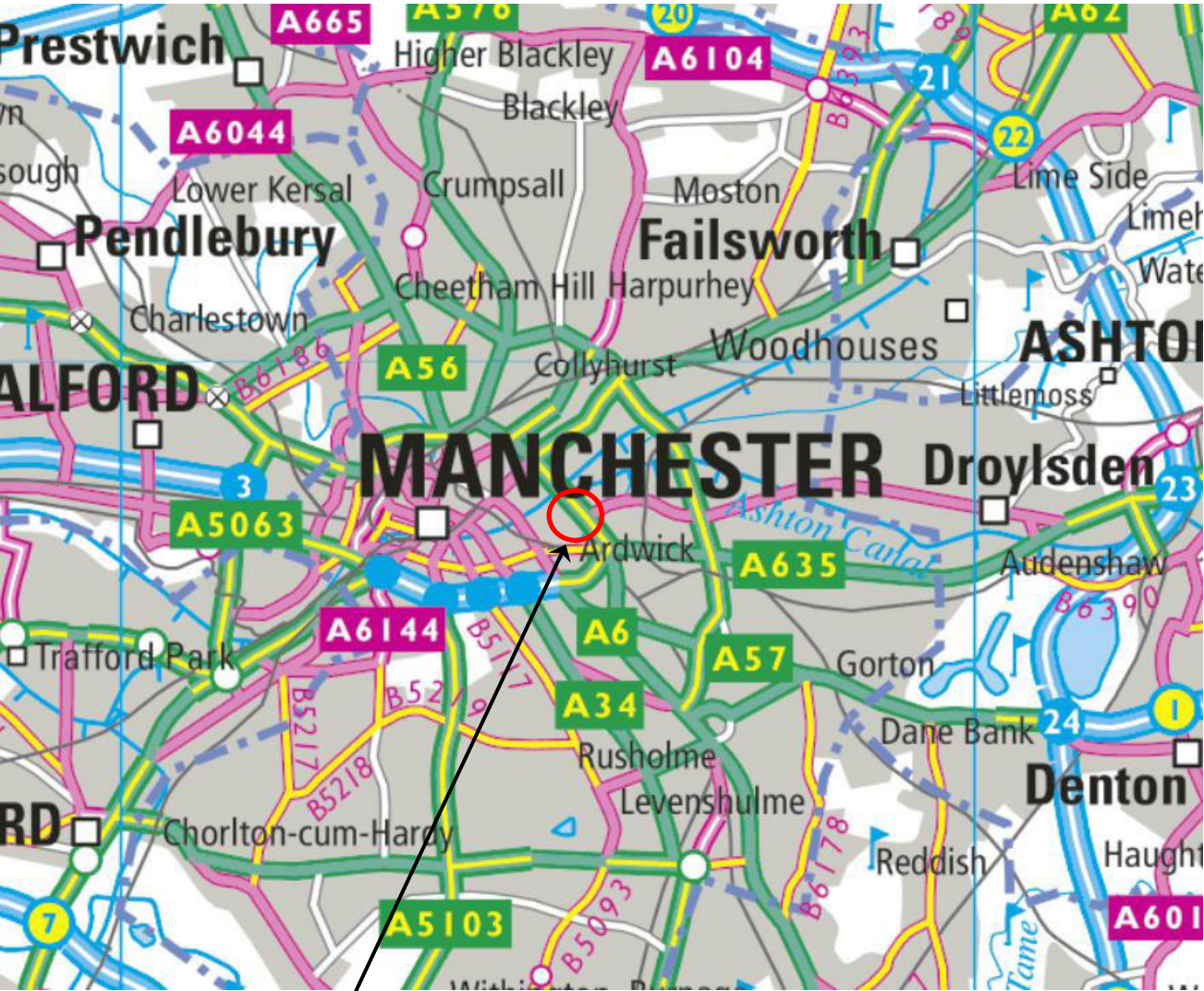
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00	18-02-2020	Planning Issue

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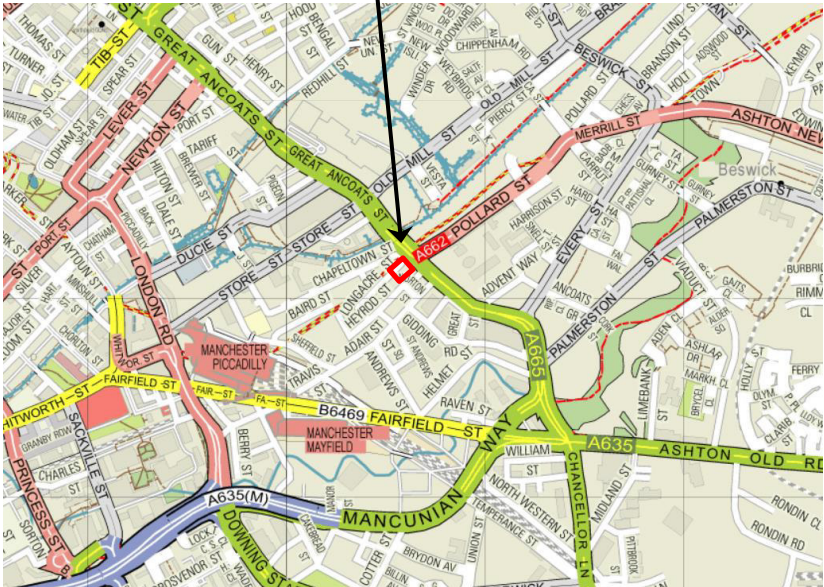
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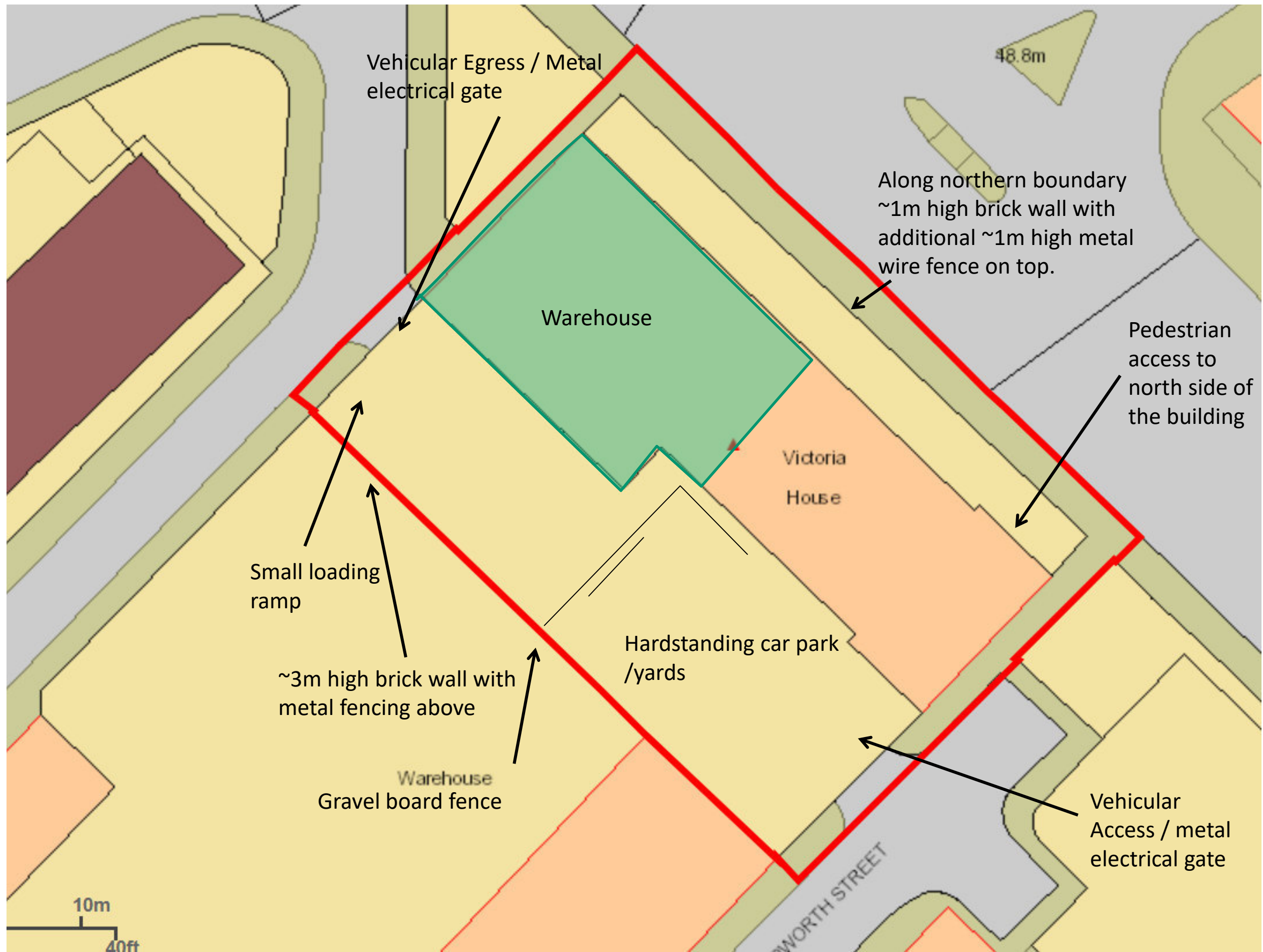


SITE LOCATION

NEAREST POSTCODE: M4 7DB



REV	DATE	DESCRIPTION	BY	CKD
 BROWNFIELD SOLUTIONS LTD CEO ENVIRONMENTAL ENGINEERING EXCELLENCE				
CLIENT				
DOMIS CONSTRUCTION				
PROJECT TITLE				
VICTORIA HOUSE, GREAT ANCOAT STREET				
DRAWING TITLE				
SITE LOCATION PLAN				
DRAWING No.	REVISION	SCALE	DATE	
C4742/01	-	NTS	22/04/21	
DRAWN BY		CHECKED BY		
SD		DMG		



KEY

— APPROXIMATE SITE BOUNDARY

REV	DATE	DESCRIPTION	BY	CKD

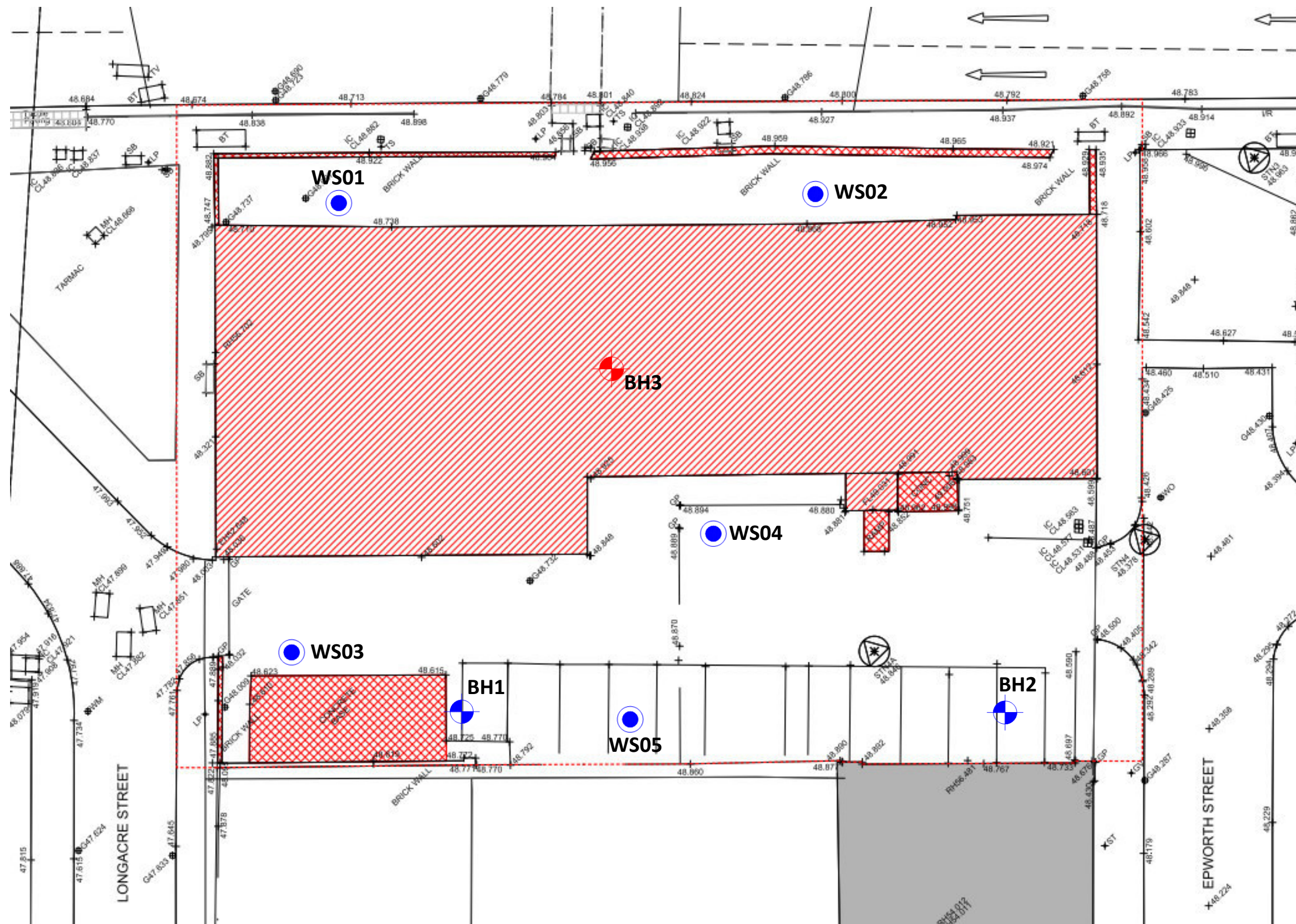


CLIENT
DOMIS CONSTRUCTION LTD

PROJECT TITLE
VICTORIA HOUSE, GREAT ANCOATS STREET, MANCHESTER

DRAWING TITLE
SITE FEATURES PLAN

DRAWING No. C4742/02	REVISION -	SCALE NTS	DATE 24/05/21
DRAWN BY NS		CHECKED BY DMG	



KEY

-  WINDOW SAMPLE BOREHOLE
-  CABLE PERCUSSIVE BOREHOLE (WITH ROTARY FOLLOW ON TO BE UNDERTAKEN)
-  CABLE PERCUSSIVE BOREHOLE TO BE UNDERTAKEN

REV	DATE	DESCRIPTION	BY	CKD



CLIENT	DOMIS CONSTRUCTION
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PROJECT TITLE	VICTORIA HOUSE, GREAT ANCOATS STREET, MANCHESTER
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DRAWING TITLE	EXPLORATORY HOLE LOCATION PLAN
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DRAWING No. C4742/03	REVISION -	SCALE NTS	DATE 20/04/21
DRAWN BY JMJ		CHECKED BY NS	

APPENDIX A

BSL Methodology and Guidance

BSL Methodology and Guidance – Geo-Environmental Assessment Reports

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report.

Desk Studies are written in broad agreement with BS 10175:2011+A2:2017. The first stage of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011+A2:2017), often referred to as a Phase 1 Desk Study Assessment, comprising a desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed. From this are identified any geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them.

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include the exploratory, main and supplementary Investigations described in BS 10175:2011+A2:2017.

Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act;
- The Contaminated Land (England) Regulations 2000;
- The DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused;
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- **Source** - substances that are potential contaminants or pollutants that may cause harm;
- **Pathway** - a potential route by which contaminants can move from the source to the receptor;
- **Receptor** - a receptor that may be harmed, for example the water environment, humans and water.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the SPR approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below however the list is not exhaustive:

- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990.
- CLR11 – Model Procedures.
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002.
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002.
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003).
- BS 10175:2011+A2:2017.

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
 - The Environment Protection Act (1990).
 - The Water Resources Act (1991).
 - The Environment Act (1995).
 - The Contaminated Land (England) Act (2000).
 - The Pollution Prevention and Control (England and Wales) Regulations (2000).
 - The Landfill Regulations (England and Wales) Regulations (2002).
 - The Landfill (England and Wales) (Amendment) Regulations (2004).
 - Contaminated Land (England) Regulations (2012).
 - Health and Safety at Work Act.
-

Contaminated Land Risk Assessment

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification ➡ Hazard Assessment ➡ Risk Estimation ➡ Risk Evaluation

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under CLR11, three tiers of risk assessment exist - Preliminary, Generic Quantitative and Detailed Quantitative.

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552:

- **High likelihood:** There is a pollution linkage and an event 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 it is probable that an event will occur. Circumstances are such that the 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 even over a longer period such event would take place, and is less likely in the short term;
- **Unlikely:** There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

The severity is also classified using a system based on CIRIA C552. The terms and definitions are:

- **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 resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse;
 - **Medium:** Chronic damage to human health ('significant harm' as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve;
 - **Mild:** Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment;
Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.
 - **Minor:** harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.
-

Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low
	No Linkage	No risk			

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

- **Very high:** There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required;
- **High:** Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term;
- **Moderate:** It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term;
- **Low:** It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild;
- **Very Low:** There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled 'no linkage' in the summary table and no further action is required.

Ground Gas Guidance

Redevelopment on brownfield sites is an ever increasing occurrence, including those sites where a potential ground gas issue is present.

BS8485:2015+A1:2019 and CIRIA C665 is the current guidance which gives up-to-date advice on all aspects of ground gas. It outlines good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to gas contaminated land. Two semi-quantitative methods are set out for the assessment of risk:

- 1 For low rise housing with a ventilated under floor void at minimum 150 mm (Boyle and Witherington);
- 2 For all other development types (Wilson and Card).

Both methods use the concept of Gas Screening Values (GSVs) to identify levels of risk. The mitigation and management of potentially unacceptable risk is described with reference to both passive and active systems of gas. Source removal is also discussed as an option.

CIRIA C665 and the advice it contains has been prepared to be generally consistent with CLR11 *Model Procedures for the management of land contamination* (Defra and Environment Agency, 2004a). The aim of CIRIA C665 is a consistent approach to decision making, particularly relating to the scope of protective design measures on a site specific basis.

Legislative Framework

CIRIA C665 provides technical guidance however also recognises the context into which the guidance has to be employed. Government policy is based upon a “suitable for use approach”, which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the “source” in a “pollutant linkage” which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be “contaminated land” under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land* (DETR, 2000a).

Frequency and Duration of Monitoring

The monitoring period for a specific site covers the “worst case” scenario. A “worst case” scenario will occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of the additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with soil gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

Typical/idealised periods of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (Flats)	2 months	3 months	6 months	12 months	24 months
	High (Residential with Gardens)	3 months	6 months	6 months	12 months	24 months

Typical/idealised frequency of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4	6	6	12	12
	Moderate (Flats)	6	6	9	12	24
	High (Residential with Gardens)	6	9	12	24	24

Note

- 1 NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).
- 2 There is no industry consent over “high”, “medium” or “low” generation potential of source.
- 3 At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

It is recommended that newly installed monitoring wells are left for 24 hours to allow the soil gas to reach equilibrium. It should be recognised, however, that some soil gas regimes could take considerably longer (up to seven days). Interpretation of any initial readings should take this equilibrium process into account.

Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

General

The current recommended method for assessing contamination is on the basis of:

Source-Pathway-Receptor

Where any one of these “pollution linkages” is absent there is deemed to be no risk.

Fundamentally receptors can be considered as humans and controlled waters (surface and ground waters).

The purpose of using Tier 1 screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

Human Health

Current UK guidance is provided by DEFRA and the Environment Agency (EA). Publications forming part of the guidance include; CLEA Model, toxicological reports and soil guideline values (SGV), collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions, all of the original SGV's that were published have been withdrawn and publication of new SGV's commenced in 2009.

For determinands where no SGVs are available, S4UL values have been published using the CLEA 1.06 Model. These are the third set of generic assessment criteria generated by CIEH, and replace the previous two sets of GACs. The revised S4UL values are based on greater knowledge of relevant toxicology and further consideration of exposure frequencies.

No SGV or S4UL is available for lead as this is derived based on blood lead levels. C4SL values for six determinands including lead was published by DEFRA/CL:AIRE in December 2014 and they represent a low risk as opposed to minimal risk. The C4SL values are based on a sandy loam with 6% Soil Organic Matter. These screening values were published by DEFRA for Part 2A use, although with the dual purpose for use under planning. However these have not been officially accepted by Local Government for use under planning. S4ULs remain the first reference due to the broader range of end uses and soil organic content.

The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances the following data sources are used in the order of preference given below:

- CIEH S4UL values (derived by CIEH/LQM)
- DEFRA/CL:AIRE C4SL's
- CL:AIRE GAC values
- Current UK SGV's
- Guidance from other European countries
- Guidance from the outside Europe

Controlled Waters

The European Water Framework Directive (WFD) became UK law in December 2003. It was created to ensure that European countries manage their rivers, groundwater and lakes so that they stay healthy for people and for wildlife.

This is achieved by the use of chemical standards for surface waters and groundwater. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental regimes, and for different protection objectives.

Statutory Standards are set in legislation and if exceeded, this constitutes non-compliance with statutory obligations. European Directives are implemented in England and Wales by corresponding statutory instruments (i.e. regulations). The statutory instruments can be the exact same standards as they appear in the Directive or be more stringent.

A number of non-statutory standards also exist, these are set by various organisations (including the EA) for chemicals that are considered to be of concern, but are not covered by any specific legislation.

The chemical standards used in the UK to control impact of contamination on controlled waters are Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.

Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

Further Assessment

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further more detailed investigation, including the deriving of site specific values to better define the risk and to design appropriate remedial measures.

Source	Contaminant	Unit SOM (%)	Proposed End Use														
			Residential with Homegrown Produce			Residential without Homegrown Produce			Commercial			Public Open Space (POS) resi			Public Open Space (POS) park		
			1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
LQM S4UL	Arsenic	mg/kg	37	37	37	40	40	40	640	640	640	79	79	79	170	170	170
LQM S4UL	Cadmium	mg/kg	11	11	11	85	85	85	190	190	190	120	120	120	532	532	532
LQM S4UL	Chromium (III)	mg/kg	910	910	910	910	910	910	8600	8600	8600	1500	1500	1500	33000	33000	33000
LQM S4UL	Chromium (VI)	mg/kg	6	6	6	6	6	6	33	33	33	7.7	7.7	7.7	220	220	220
LQM S4UL	Copper	mg/kg	2400	2400	2400	7100	7100	7100	68000	68000	68000	12000	12000	12000	44000	44000	44000
C4SL	Lead	mg/kg	200	200	200	330	330	330	2300	2300	2300	760	760	760	1400	1400	1400
LQM S4UL	Mercury, Elemental	mg/kg	1.2	1.2	1.2	1.2	1.2	1.2	58	58	58	16	16	16	30	30	30
LQM S4UL	Nickel	mg/kg	180	180	180	180	180	180	980	980	980	230	230	230	3400	3400	3400
LQM S4UL	Selenium	mg/kg	250	250	250	430	430	430	12000	12000	12000	1100	1100	1100	1800	1800	1800
LQM S4UL	Zinc	mg/kg	3700	3700	3700	40000	40000	40000	730000	730000	730000	81000	81000	81000	170000	170000	170000
LQM S4UL	Phenol (total)	mg/kg	280	550	1100	750	1300	2300	760	1500	3200	760	1500	3200	760	1500	3200
LQM S4UL	Acenaphthene	mg/kg	210	510	1100	3000	4700	6000	84000	97000	100000	15000	15000	15000	29000	30000	30000
LQM S4UL	Acenaphthylene	mg/kg	170	420	920	2900	4600	6000	83000	97000	100000	15000	15000	15000	29000	30000	30000
LQM S4UL	Anthracene	mg/kg	2400	5400	11000	31000	35000	37000	520000	540000	540000	74000	74000	74000	150000	150000	150000
LQM S4UL	Benzo(a)anthracene	mg/kg	7.2	11	13	11	14	15	170	170	180	29	29	29	49	56	62
LQM S4UL	Benzo(a)pyrene	mg/kg	2.2	2.7	3.0	3.2	3.2	3.2	35	35	36	5.7	5.7	5.7	11	12	13
LQM S4UL	Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	3.9	4	4	44	44	45	7.1	7.2	7.2	13	15	16
LQM S4UL	Benzo(ghi)perylene	mg/kg	320	340	350	360	360	360	3900	4000	4000	640	640	640	1400	1500	1600
LQM S4UL	Benzo(k)fluoranthene	mg/kg	77	93	100	110	110	110	1200	1200	1200	190	190	190	370	410	440
LQM S4UL	Chrysene	mg/kg	15	22	27	30	31	32	350	350	350	57	57	57	93	110	120
LQM S4UL	Dibenz(a,h)anthracene	mg/kg	0.24	0.28	0.30	0.31	0.32	0.32	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4
LQM S4UL	Fluoranthene	mg/kg	280	560	890	1500	1600	1600	23000	23000	23000	3100	3100	3100	6300	6300	6400
LQM S4UL	Fluorene	mg/kg	170	400	860	2800	3800	4500	63000	68000	71000	9900	9900	9900	20000	20000	20000
LQM S4UL	Indeno(1,2,3,cd)pyrene	mg/kg	27	36	41	45	46	46	500	510	510	82	82	82	150	170	180
LQM S4UL	Naphthalene	mg/kg	2.3	5.6	13	2.3	5.6	13	190	460	1100	4900	4900	4900	1200	1900	3000
LQM S4UL	Phenanthrene	mg/kg	95	220	440	1300	1500	1500	22000	22000	23000	3100	3100	3100	6200	62000	6300
LQM S4UL	Pyrene	mg/kg	620	1200	2000	3700	3800	3800	54000	54000	54000	7400	7400	7400	15000	15000	15000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 5 - 6	mg/kg	42	78	160	42	78	160	3200	5900	12000	570000	590000	600000	95000	130000	180000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 6 - 8	mg/kg	100	230	530	100	230	530	7800	17000	40000	600000	610000	620000	150000	220000	320000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 8 - 10	mg/kg	27	65	150	27	65	150	2000	4800	11000	13000	13000	13000	14000	18000	21000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 10 - 12	mg/kg	130	330	760	130	330	770	9700	23000	47000	13000	13000	13000	21000	23000	24000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 12 - 16	mg/kg	1100	2400	4300	1100	2400	4400	59000	82000	90000	13000	13000	13000	25000	25000	26000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 16 - 35	mg/kg	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000
LQM S4UL	Petroleum Hydrocarbons Aliphatic EC 35 - 44	mg/kg	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 5 - 7	mg/kg	70	140	300	370	690	1400	26000	46000	86000	56000	56000	56000	76000	84000	92000
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 7 - 8	mg/kg	130	290	660	860	1800	3900	56000	110000	180000	56000	56000	56000	87000	95000	100000
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 8 - 10	mg/kg	34	83	190	47	110	270	3500	8100	17000	5000	5000	5000	7200	8500	9300
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 10 - 12	mg/kg	74	180	380	250	590	1200	16000	28000	34000	5000	5000	5000	9200	9700	10000
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 12 - 16	mg/kg	140	330	660	1800	2300	2500	36000	37000	38000	5100	5100	5000	10000	10000	10000
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 16 - 21	mg/kg	260	540	930	1900	1900	1900	28000	28000	28000	3800	3800	3800	7600	7700	7800
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 21 - 35	mg/kg	1100	1500	1700	1900	1900	1900	28000	28000	28000	3800	3800	3800	7800	7800	7900
LQM S4UL	Petroleum Hydrocarbons Aromatic EC 35 - 44	mg/kg	1100	1500	1700	1900	1900	1900	28200	28200	28200	3800	3800	3800	7800	7800	7900
LQM S4UL	Benzene	mg/kg	0.087	0.17	0.37	0.38	0.7	1.4	27	47	90	72	72	73	90	100	110
LQM S4UL	Toluene	mg/kg	130	290	660	880	1900	3900	56000	110000	180000	56000	56000	56000	87000	95000	100000
LQM S4UL	Ethyl Benzene	mg/kg	47	110	260	83	190	440	5700	13000	27000	24000	24000	25000	17000	22000	27000
LQM S4UL	Xylene - o	mg/kg	60	140	330	88	210	480	6600	15000	33000	41000	42000	43000	17000	24000	33000
LQM S4UL	Xylene - m	mg/kg	59	140	320	82	190	450	6200	14000	31000	41000	42000	43000	17000	24000	32000
LQM S4UL	Xylene - p	mg/kg	56	130	310	79	180	430	5900	14000	30000	41000	42000	43000	17000	23000	31000
CL-AIRE 2010	MTBE (methyl tert-butyl ether)	mg/kg	49	84	160	49	84	160	7900	13000	24000	49	84	160	49	84	160
LQM S4UL	Chloroethene (Vinyl Chloride)	mg/kg	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4
LQM S4UL	1,2-Dichloroethane (1,2-DCA)	mg/kg	0.0071	0.011	0.019	0.0092	0.013	0.023	0.67	0.97	1.7	29	29	29	21	24	28
LQM S4UL	1,1,1-Trichloroethane	mg/kg	8.8	1.8	39	9	18	40	660	1300	3000	14000	14000	14000	57000	76000	100000
LQM S4UL	1,1,2,2-Tetrachloroethane	mg/kg	1.6	3.4	7.5	3.9	8	17	270	550	11000	1400	1400	1400	1800	2100	2300
LQM S4UL	1,1,1,2-Tetrachloroethane	mg/kg	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	1400	1400	1400	1500	1800	2100
LQM S4UL	Tetrachloroethene (PCE)	mg/kg	0.18	0.39	0.9	0.18	0.4	0.92	19	42	95	1400	1400	1400	810	1100	1500
LQM S4UL	Tetrachloromethane (carbon tetrachloride)	mg/kg	0.026	0.056	0.13	0.026	0.056	0.13	2.9	6.3	14	890	920	950	190	270	400

Source	Contaminant	Unit SOM (%)	Proposed End Use														
			Residential <u>with</u> Homegrown Produce			Residential <u>without</u> Homegrown Produce			Commercial			Public Open Space (POS) resi			Public Open Space (POS) park		
			1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
LQM S4UL	Trichloroethene (TCE)	mg/kg	0.016	0.034	0.075	0.017	0.036	0.08	1.2	2.6	5.7	120	120	120	70	91	120
LQM S4UL	Trichloromethane (chloroform)	mg/kg	0.91	1.7	3.4	1.2	2.1	4.2	99	170	350	2500	2500	2500	2600	2800	3100
LQM S4UL	Chlorobenzene	mg/kg	0.45	1	2.4	0.46	1	2.4	56	130	290	11000	13000	14000	1300	2000	2900
LQM S4UL	1, 2 Dichlorobenzene	mg/kg	23	55	130	24	57	130	2000	4800	11000	90000	95000	98000	24000	26000	51000
LQM S4UL	1, 3 Dichlorobenzene	mg/kg	0.4	1	2.3	0.44	1.1	2.5	30	73	170	300	300	300	390	440	470
LQM S4UL	1, 4 Dichlorobenzene	mg/kg	61	150	350	61	150	340	4400	10000	25000	17000	17000	17000	26000	36000	36000
LQM S4UL	1, 2, 3 Trichlorobenzene	mg/kg	1.5	3.6	8.6	1.5	3.7	8.8	102	250	590	1800	1800	1800	770	1100	1600
LQM S4UL	1, 2, 4 Trichlorobenzene	mg/kg	2.6	6.4	15	2.6	6.4	15	220	530	1300	15000	17000	19000	1700	2600	4000
LQM S4UL	1, 2, 3, 4 Trichlorobenzene	mg/kg	0.33	0.81	1.9	0.33	0.81	1.9	23	55	130	1700	1700	1800	280	580	860
LQM S4UL	1, 2, 3, 4 Tetrachlorobenzene	mg/kg	15	36	78	24	56	120	1700	3080	4400	830	830	830	1500	1600	1600
LQM S4UL	1, 2, 3, 5 Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	0.75	1.9	4.3	49	120	240	78	79	79	110	120	130
LQM S4UL	1, 2, 4, 5 Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	0.73	1.7	3.5	42	72	96	13	13	13	25	26	26
LQM S4UL	Pentachlorobenzene	mg/kg	5.8	12	22	19	30	38	640	770	830	100	100	100	190	190	190
LQM S4UL	Hexachlorobenze	mg/kg	1.8	3.3	4.9	4.1	5.7	6.7	110	120	120	16	16	16	30	30	30

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See LQM/CIEH S4ULs for Human Health Risk Assessment document for notes regarding derivation.

Re-Use Of Waste - Guidance Note

Definition of Waste

The Environment Agency considers waste to be “...any material that is discarded, or intended to be discarded...” This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

CL:AIRE: Code of Practice

Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE DoWCoP), also commonly referred to as a “Materials Management Plan”.

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

1. Protection of human health and protection of the environment.
2. Suitability of use, without further treatment.
3. Certainty of use.
4. Quantity of material.

In order to satisfy these requirements the following are required:

- i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
- ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
- iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
- iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
- v) Volume calculations.
- vi) Planning permission for the development.
- vii) Contractual details to be clear, regarding who steps in if a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.

Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use.

Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

Waste Classification For Soils

Introduction

Waste producers have a duty of care to classify the waste they are producing:

- before it is collected, disposed of or recovered.
- to identify the controls that apply to the movement of the waste.
- to complete waste documents and records.
- to identify suitably authorised waste management options.
- to prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

Background for Landfill Disposal

In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept **hazardous, non-hazardous** or **inert** wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

Classification

Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

17 05	soil (including excavated soil from contaminated sites), stones and dredging spoil
17 05 03*	soil and stones containing dangerous substances
17 05 04	soil and stones other than those mentioned in 17 05 03

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific "hazardous properties" which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

Waste Definitions

Inert	- Will not undergo any significant physical, chemical or biological transformations. - Will not dissolve. - Will not burn. - Will not physically or chemically react. - Will not biodegrade. - Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. - Has insignificant total leachability and pollutant content. - Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate).
Non-Hazardous	Is not inert (see above) Is not hazardous (see below)
Hazardous	Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance)
Stable Non-reactive hazardous waste#	Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas).

This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

WAC Testing

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the **WAC is not relevant**. Furthermore the WAC limits **cannot be used to make an assessment of whether a waste is hazardous**. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

Classification based on Total Concentrations ¹	Non-Hazardous Waste		Hazardous Waste	
	Below inert WAC limit values:	Above inert WAC limit values:	Below hazardous WAC limit values	Above hazardous WAC limit values
WAC testing				
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).

2 Individual sites may have certain limit values pre-determined in their licence.

3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

Hydrocarbons in Soils

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

Known Oils

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs

to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

Unknown Oils

Where hydrocarbons are contaminating soils it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

- For contaminated land specific consideration must be given to the following before proceeding;
- The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
 - The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of **marker compounds** is optional; however it is recommended that where possible the marker compounds should be used. WM3 states:

- If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:
- The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
 - This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
 - The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

TPH Concentration (mg/kg)	Petrol or Diesel	BaP (mg/kg)	Classification
10,000	No	0.9	Non- Hazardous
1,000	No	Not available	Hazardous
1,000	Yes	Not relevant	Hazardous

References

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

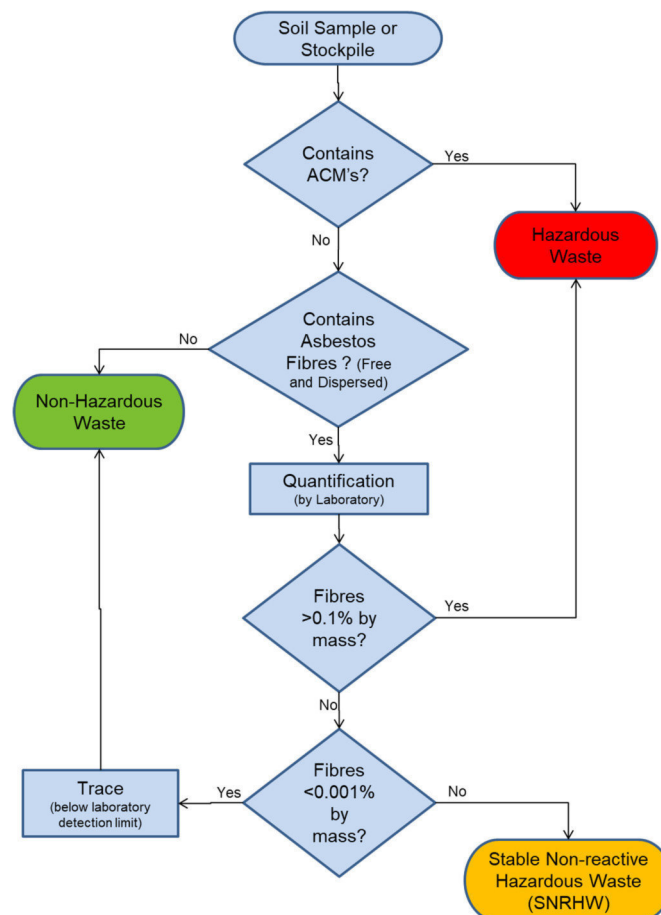
Additional Asbestos Guidance Notes

Disposal

The 1st Edition of WM3 “Guidance on the classification and assessment of waste”, details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)



Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.

Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site¹. These levels are often termed “trace” by laboratories.

Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)¹. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.

The following codes should be assigned to the asbestos waste as appropriate:

17 06	Insulation materials and asbestos-containing construction materials
17 06 01	Insulation materials containing asbestos
17 06 03	Other insulation materials consisting of or containing hazardous substances
17 06 04	Insulation materials other than those mentioned in 17 06 01 and 17 06 03
17 06 05	Construction material containing asbestos

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and “*other suitable materials*” may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

Construction

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four hour period. The control limit is not a ‘safe’ level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 “the release of dispersed asbestos fibres from soil” 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m³.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (eg by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

End Use

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction. These are at a “Beta” test stage and further publications will be provided in due course.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk. There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

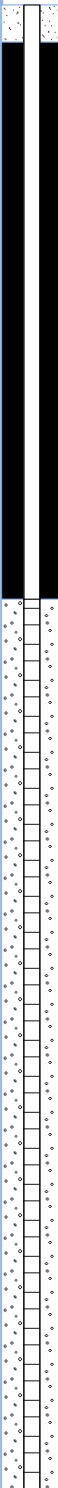
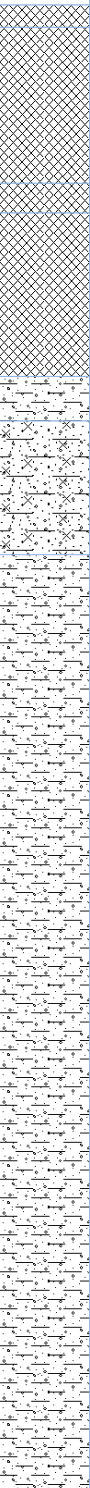
Asbestos in Soil as Free Fibres

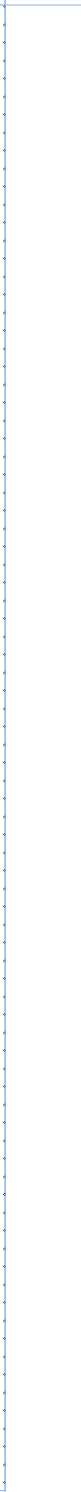
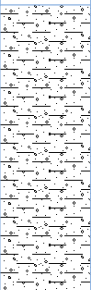
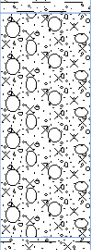
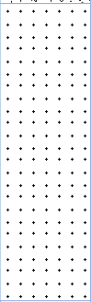
Concentration (by weight)	Waste Disposal			Construction Issues		End Use	
	Recycle	Inert	SNR Hazardous	Hazardous		Suitable for re-use on site	Precautions
Not detected	✓	✓			No precautions necessary, however on a brownfield site asbestos not previously identified may be found during works and a statement within the contractors method statement for how they will deal with this unforeseen asbestos would be good practice to ensure compliance with CAR2012.	Yes	None
Trace (<0.001%)		✓ ²			Precautions are unlikely to be required, however a detailed method statement may be required to ensure compliance with CAR2012. Basic asbestos management good practice will be required. Typically precautions would include: - Ensuring soils do not dry out to become dusty. - Site personnel have the risk communicated at induction stage.	Yes	Generally clean cover or hardstanding cover required.
0.001% – 0.099%			✓		Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes.	Possibly	Clean cover or hardstanding cover required.
0.1+%				✓	Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement. Typical precautions would include: - Site personnel have the risk communicated at induction stage. - Ensuring personnel have suitable training. - Task monitoring to inform PPE requirements. - Site wide and or perimeter monitoring. - Ensuring soils do not dry out to become dusty and that misting is available during groundworks. - Separate stockpiling. - Clean haulage routes. - Decontamination unit	Unlikely ³ Re-use of soils containing asbestos within an earthworks scheme will involve significant engineering and the risk for generating dusts will be significantly increased with repeated handling and compaction.	Clean cover and a hard dig layer. A plan should be in place for future excavations as part of the Health and Safety File.

- The standard laboratory detection limit is normally 0.001%. Below 0.001% is trace and currently regarded as not containing asbestos for the purposes of disposal off site. However the waste producer has a duty to fully classify the waste and the presence of trace asbestos should be declared. Consequently it is unlikely that a waste treatment site will take this soil and an inert landfill may make a commercial decision to only take it under some circumstances.
- The re-use of soils containing asbestos at concentrations above hazardous waste is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be warranted where there a long program for implementation.

APPENDIX B

Exploratory Hole Logs

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Cable Percussion with Rotary Core No.	
							BH1			
							Sheet 1 of 4			
PROJECT NO: C4742							CO-ORDS: 385296E, 398073N		Hole Type	
									CP+RC	
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							LEVEL: 48.60m OD		Scale	
									1:51	
CLIENT: DOMIS CONSTRUCTION							DATES: 14/04/21 - 16/04/21		Logged	Checked
									JMJ	NS
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.15	48.45		MADE GROUND: Tarmacadam.	1.0	
		0.50	D					MADE GROUND: Dark brown sand and gravel with low cobble content. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of sandstone and brick. Cobbles are angular up to 150mm of brick.		
		1.20-1.65	D		1.20	47.40		MADE GROUND: Sandstone cobbles boulders (drillers description) recovered as sandy gravel and cobbles.	2.0	
		1.20	SPT	N≥50 (8,12/50 for 230mm)	1.40	47.20		MADE GROUND: Dark brown sand and gravel with low cobble content and occasional pockets of soft to firm sandy clay. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of sandstone and brick. Cobbles are angular up to 150mm of brick.		
		1.50	D						3.0	
		2.50	D		2.50	46.10		Stiff dark brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of sandstone.		
		3.00-3.45	D		2.80	45.80		Medium dense red brown silty clayey SAND. Sand is fine to coarse.	4.0	
		3.00	SPT	N=17 (3,3/4,4,4,5)						
		3.50	D		3.70	44.90		Firm to stiff brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone.	5.0	
		4.50-4.95	U							
		5.00	D						6.0	
		6.00-6.45	D							
		6.00	SPT	N=24 (4,4/5,6,6,7)					7.0	
		6.50	D							
		7.50-7.95	D						8.0	
		7.50	SPT	N=28 (5,5/6,7,7,8)						
		8.00	D						9.0	
		9.00-9.45	U							
		9.50	D						10.0	
Remarks		1. Hand dug inspection pit excavated to 1.20m bgl. 2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 13.00m bgl. 3. Chiselling with no progress at 13.50m BGL (2hrs). 4. No groundwater encountered. 5. Borehole progressed by rotary coring from 18.00m bgl to base. 6. Borehole installed to 27.00m bgl; 4.00m plain, 23.00m slotted.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Cable Percussion with Rotary Core No.			
PROJECT NO: C4742						CO-ORDS: 385296E, 398073N		BH1			
								Sheet 2 of 4			
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS						LEVEL: 48.60m OD		Hole Type			
								CP+RC			
CLIENT: DOMIS CONSTRUCTION						DATES: 14/04/21 - 16/04/21		Scale			
								1:51			
								Logged	Checked		
								JMJ	NS		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description			
Depth (m)	Type	Results									
		10.50-10.95 10.50	D SPT	N≥50 (16 for 125mm/50 for 260mm)		12.00	36.60		Very dense red brown silty clayey SAND and GRAVEL with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded of sandstone. Cobbles are subangular to subrounded of sandstone.	11.0	
		11.00	D								
		12.00-12.45 12.00	D SPT	N≥50 (10,13/50 for 225mm)							
		13.00	D								
		13.50 13.50-13.95 13.50	D D SPT	N≥50 (25 for 5mm/50 for 5mm)		13.51	35.09		Obstruction of cobbles and boulders of Sandstone. Very dense reddish brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of sandstone.	12.0	
		13.51	SPT	N≥50 (25 for 0mm/50 for 0mm)							
		14.50	SPT	N≥50 (25 for 6.5mm/50 for 4mm)							
		16.00	SPT	N≥50 (25 for 3.5mm/50 for 6mm)							
											13.0
											14.0
									15.0		
									16.0		
									17.0		
									18.0		
			1	100	73	36	18.00	30.60		Extremely weak brownish red fine to coarse grained SANDSTONE unweathered. 18.00 - 19.00m bgl; Discontinuities are very closely to closely spaced rough undulating horizontal to 30 degrees sub-horizontal. 18.20 - 18.55m bgl; Recovered as reddish grey sandy angular to sub-angular GRAVEL of sandstone and mudstone. Sand is fine to coarse.	
		18.00 - 21.00	5							19.00 - 20.00m bgl; Discontinuities are very closely to closely spaced rough undulating horizontal to 40 degrees sub-horizontal.	
		19.21 - 19.38	D								
		19.41 - 19.57	D								
		20.00 - 20.12	11								
			D						19.0		
				TCR	SCR	RQD				20.0	
Remarks		1. Hand dug inspection pit excavated to 1.20m bgl. 2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 13.00m bgl. 3. Chiselling with no progress at 13.50m BGL (2hrs). 4. No groundwater encountered. 5. Borehole progressed by rotary coring from 18.00m bgl to base. 6. Borehole installed to 27.00m bgl; 4.00m plain, 23.00m slotted.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane		



Cable Percussion with Rotary Core No.

Sheet 3 of 4

CO-ORDS: 385296E, 398073N

LEVEL: 48.60m OD

DATES: 14/04/2021 - 16/04/2021

JMJ

NS

[illegible]

1. Hand dug inspection pit excavated to 1.20m bgl.
2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 13.00m bgl.
3. Chiselling with no progress at 13.50m BGL (2hrs).
4. No groundwater encountered.
5. Borehole progressed by rotary coring from 18.00m bgl to base.
6. Borehole installed to 27.00m bgl; 4.00m plain, 23.00m slotted.

ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane



BROWNFIELD
SOLUTIONS LTD

Borehole Log

Cable Percussion with Rotary Core No.

BH1

Sheet 4 of 4

PROJECT NO: C4742

CO-ORDS: 385296E, 398073N

PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS

LEVEL: 48.60m OD

CLIENT: DOMIS CONSTRUCTION

DATES: 14/04/2021 - 16/04/2021

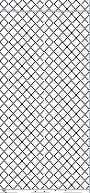
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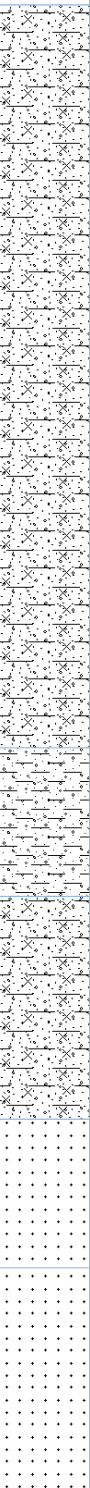
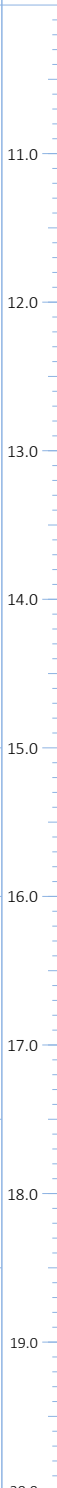
JMJ

NS

Well	Water Strike	Depth (m)	Type / FI	Coring			Depth (m)	Level (m OD)	Legend	Stratum Description	
				TCR (%)	SCR (%)	RQD (%)					
		30.00 - 33.00	NR				33.00	15.60		30.00 to 31.00m bgl; Discontinuities are widely spaced rough undulating horizontal to 20 degrees sub-horizontal.	
			NI							31.00 - 32.47m bgl; No recovery.	31.0
										32.47 - 33.00m bgl; Recovered as sandy angular to sub-angular fine to coarse GRAVEL of sandstone. Sand is fine to coarse.	32.0
										End of Borehole at 33.00m	33.0
											34.0
											35.0
											36.0
											37.0
											38.0
											39.0
											40.0

Remarks	- Hand dug inspection pit excavated to 1.20m bgl. - Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 13.00m bgl. - Chiselling with no progress at 13.50m BGL (2hrs). - No groundwater encountered. - Borehole progressed by rotary coring from 18.00m bgl to base. - Borehole installed to 27.00m bgl; 4.00m plain, 23.00m slotted.	ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane
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 BROWNFIELD SOLUTIONS LTD							Borehole Log		Cable Percussion with Rotary Core No.			
									BH2			
									Sheet 1 of 4			
PROJECT NO: C4742							CO-ORDS: 385316E, 398054N		Hole Type			
									CP+RC			
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							LEVEL: 49.24m OD		Scale			
									1:51			
CLIENT: DOMIS CONSTRUCTION							DATES: 14/04/21 - 22/05/21		Logged	Checked		
									JMJ	NS		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description				
		Depth (m)	Type	Results								
					0.15	49.08		MADE GROUND: Tarmacadam over hardcore.		1.0		
					0.30	48.94		MADE GROUND: Concrete.				
		0.40	D					MADE GROUND: Dark brown sand and gravel with low cobble content. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of sandstone and brick. Cobbles are angular up to 150mm of brick.				
		1.00	D				1.20	48.04		MADE GROUND: Dark brown sand and gravel with low cobble content and occasional pockets of soft to firm sandy clay. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of sandstone and brick. Cobbles are angular up to 150mm of brick.		2.0
		1.20	D									
		1.50-1.95	D									
		1.50	SPT	N=7 (2,2/1,2,2,2)			2.40	46.84		Firm to stiff brown slightly gravelly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone.		3.0
		2.50	D									
		3.00-3.45	U									
		3.50	D							4.0		
		4.50-4.95	D									
		4.50	SPT	N=26 (4,5/6,6,7,7)								
		5.00	D							5.0		
		6.00-6.45	U									
		6.50	D									
		7.50-7.95	D							6.0		
		7.50	SPT	N=28 (4,5/6,7,7,8)								
		8.00	D									
		9.00-9.45	D							7.0		
		9.00	SPT	N=30 (5,6/7,7,8,8)								
		10.00	D									
10.00		D				10.00	39.24				10.0	
Remarks												
1. Hand dug inspection pit excavated to 1.20m bgl. 2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 15.00m bgl. 3. Chiselling with slow progress from 16.50m to 16.80m (3/4hr) and 18.20m to 18.50m (1/2hr). 4. No groundwater encountered. 5. Borehole progressed by rotary coring from 18.50m bgl to base. 6. Borehole installed to 12.00m bgl; 8.00m plain, 4.00m slotted.								ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane				

 BROWNFIELD SOLUTIONS LTD						Borehole Log		Cable Percussion with Rotary Core No.					
PROJECT NO: C4742						CO-ORDS: 385316E, 398054N		BH2					
								Sheet 2 of 4					
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS						LEVEL: 49.24m OD		Hole Type					
								CP+RC					
CLIENT: DOMIS CONSTRUCTION						DATES: 14/04/21 - 22/05/21		Scale					
								1:51					
								Logged	Checked				
								JMJ	NS				
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description					
		Depth (m)	Type	Results									
		10.50-10.95 10.50	D SPT	N≥50 (25 for 50mm/50 for 210mm)				Very dense red brown silty SAND with pockets of sandy clay. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone.					
		11.00	D										
		12.00-12.45 12.00	D SPT	N≥50 (7,11/50 for 232mm)									
		13.00	D										
		13.50-13.95 13.50	D SPT	N≥50 (8,11/50 for 210mm)									
		14.50	D										
		15.00-15.45 15.00	D SPT	N≥50 (8,12/50 for 270mm)									
		15.50	D										
		16.50-16.95 16.50	D SPT	N≥50 (25 for 10mm/50 for 10mm)									
		17.50	D										
		18.00	D SPT	N≥50 (25 for 70mm/50 for 40mm)									
		18.50	SPT TN	100 N≥50 33 (25 for 30mm/50 for 25mm)									
		18.50 - 20.00	9										
			4										
			1										
			7										
				40 7 0 TCR SCR RQD									
Remarks		1. Hand dug inspection pit excavated to 1.20m bgl. 2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 15.00m bgl. 3. Chiselling with slow progress from 16.50m to 16.80m (3/4hr) and 18.20m to 18.50m (1/2hr). 4. No groundwater encountered. 5. Borehole progressed by rotary coring from 18.50m bgl to base. 6. Borehole installed to 12.00m bgl; 8.00m plain, 4.00m slotted.						ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane					

 BROWNFIELD SOLUTIONS LTD									Borehole Log			Cable Percussion with Rotary Core No.	
PROJECT NO: C4742				CO-ORDS: 385316E, 398054N				BH2					
								Sheet 3 of 4					
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS				LEVEL: 49.24m OD				Hole Type					
								CP+RC					
CLIENT: DOMIS CONSTRUCTION				DATES: 14/04/2021 - 22/05/2021				Scale					
								1:51					
								Logged	Checked				
								JMJ	NS				
Well	Water Strike	Depth (m)	Type / FI	Coring			Depth (m)	Level (m OD)	Legend	Stratum Description			
		20.00 - 21.50	NR	0	0	0				19.50 - 20.00m bgl; Discontinuities are very closely to closely spaced rough undulating 5 - 30 degrees sub-horizontal.	21.0		
			NI							20.90 - 21.40m bgl; Recovered as gravelly SAND. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium of sandstone.			
			2							21.40 - 21.50m bgl; Discontinuities are very closely spaced rough undulating horizontal to 5 degrees sub-horizontal.			
		21.50 - 23.00	NR	0	0	0				21.50 - 23.00m bgl; No recovery.	22.0		
			NR							23.10 - 24.60m bgl; No recovery.			
			NR							24.60 - 25.00m bgl; No recovery.			
		23.10 - 24.60	NR	73	72	37				25.00 - 26.10m bgl; Discontinuities are very closely to closely spaced rough undulating 5 to 30 degrees sub-horizontal.	25.0		
			NR							26.10 - 28.20m bgl; No recovery.			
			15							28.31 - 29.10m bgl; Discontinuities are very closely to closely spaced rough undulating horizontal to 10 degrees sub-horizontal.			
		24.60 - 26.10	NR	30	24	8				29.01 - 29.04m bgl; MUDSTONE.	29.0		
			NR							29.10 - 30.40m bgl; No recovery.			
			NR										
		26.10 - 29.10	NR	35	20	5					30.0		
			NR										
			NR										
NR													
NR													

Remarks	1. Hand dug inspection pit excavated to 1.20m bgl. 2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 15.00m bgl. 3. Chiselling with slow progress from 16.50m to 16.80m (3/4hr) and 18.20m to 18.50m (1/2hr). 4. No groundwater encountered. 5. Borehole progressed by rotary coring from 18.50m bgl to base. 6. Borehole installed to 12.00m bgl; 8.00m plain, 4.00m slotted.	ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane
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Cable Percussion with Rotary Core No.

BH2

Sheet 4 of 4

CO-ORDS: 385316E, 398054N

LEVEL: 49.24m OD

DATES: 14/04/2021 - 22/05/2021

Logged	Checked
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JMJ

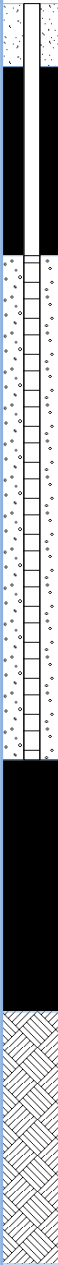
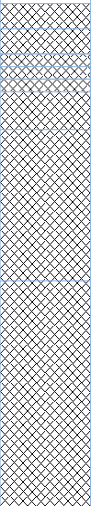
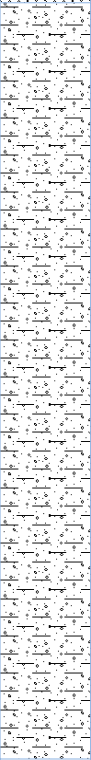
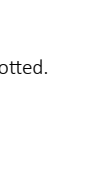
NS

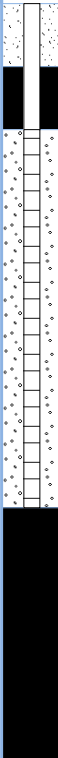
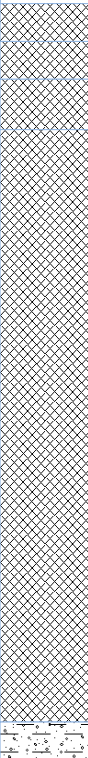
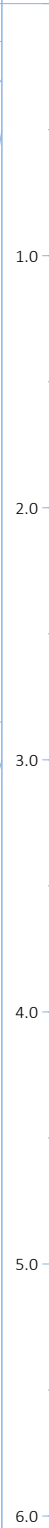
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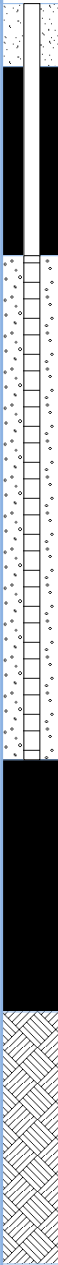
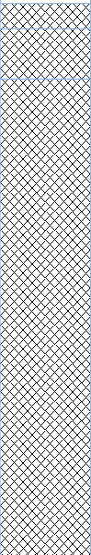
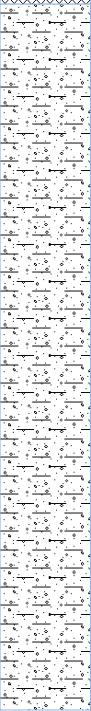
Remarks

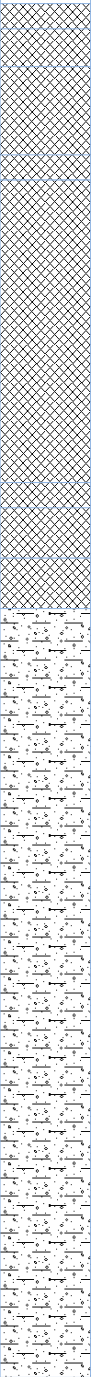
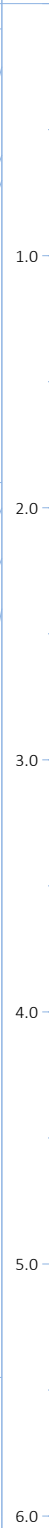
1. Hand dug inspection pit excavated to 1.20m bgl.
2. Started in 200mm diameter casing and tools and reduced to 150mm casing and tools at 15.00m bgl.
3. Chiselling with slow progress from 16.50m to 16.80m (3/4hr) and 18.20m to 18.50m (1/2hr).
4. No groundwater encountered.
5. Borehole progressed by rotary coring from 18.50m bgl to base.
6. Borehole installed to 12.00m bgl; 8.00m plain, 4.00m slotted.

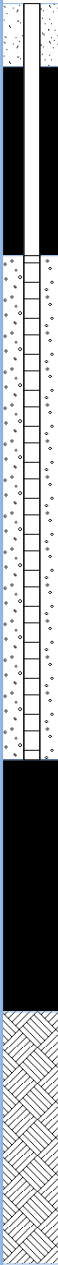
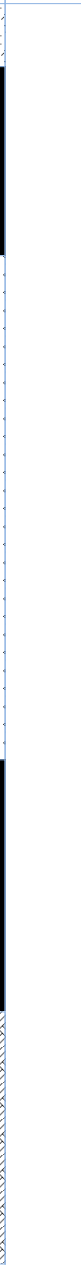
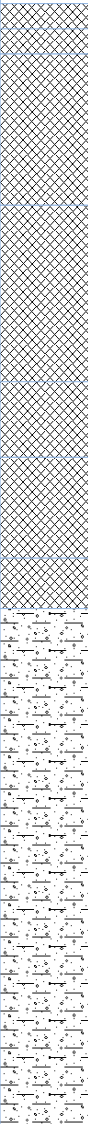
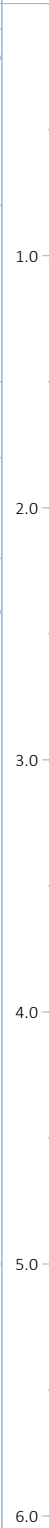
ES = Environmental Sample
D = Disturbed Sample
B = Bulk Sample
LB = Large Bulk Sample
U = Undisturbed Sample
UT = Undisturbed Thin Wall Sample
SPT = Standard Penetration Test
PID = Photoionization Detector (ppm)
PPM = Part Per Million
HSV = Hand Shear Vane

BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS01	
PROJECT NO: C4742							CO-ORDS: 385313E, 398093N		Sheet 1 of 1	
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							LEVEL: 48.79m OD		Hole Type	
									WS	
CLIENT: DOMIS CONSTRUCTION							DATES: 15/04/21		Scale	
									1:30	
									Logged	Checked
									NS	JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.50-1.10	ES		0.10	48.69		MADE GROUND: Tarmacadam.	1.0	
					0.20	48.59		MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.		
					0.25	48.54		MADE GROUND: Light brown fine to medium sand.		
					0.30	48.49		MADE GROUND: Tarmacadam.		
					0.35	48.44		MADE GROUND: Concrete.		
					0.50	48.29		MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.		
		1.10-2.00	ES	N=6 (1,1/1,2,1,2)	1.10	47.69		MADE GROUND: Brown gravelly sand. Sand is fine to coarse with ash. Gravel is subangular fine to medium of sandstone, coal, brick, limestone and rare clinker.		
			SPT					MADE GROUND: Firm brown slightly gravelly slightly sandy clay. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone, sandstone, coal and brick.		
		2.00	SPT	N=11 (2,3/2,3,3,3)	2.00	46.79		Stiff to very stiff brown mottled grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone and coal.	2.0	
		2.50	D							
		3.00	SPT	N=15 (3,3/4,3,4,4)					3.0	
		4.00	SPT	N=21 (4,4/5,5,6,5)					4.0	
		4.50	SPT	N=24 (6,5/5,6,6,7)						
					5.00	43.79		End of Borehole at 5.00m	5.0	
									6.0	
Remarks		1. Hand dug trial pit excavated to 1.20m bgl. 2. No groundwater encountered. 3. Borehole installed to 3.00m bgl; 1.00m plain and 2.00m slotted. 4. Borehole backfilled with arisings to the base.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

Borehole Log							Window Sampler No.						
							WS02						
							Sheet 1 of 1						
PROJECT NO: C4742							CO-ORDS: 385335E, 398072N						
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							Hole Type						
							WS						
							Scale						
							1:30						
CLIENT: DOMIS CONSTRUCTION							DATES: 15/04/21						
							Logged	Checked					
							NS	JM					
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description					
		Depth (m)	Type	Results									
		0.30-0.50	ES		0.15	48.86		MADE GROUND: Tarmacadam.					
					0.30	48.71		MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.					
					0.50	48.51		MADE GROUND: Reddish brown gravelly sand with low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, slate, limestone and sandstone. Cobbles are angular up to 150mm of brick.					
		1.20	SPT	N=6 (1,1/1,2,2,1)				MADE GROUND: Reddish brown slightly gravelly slightly sandy cobbles. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, mortar, slate and glass. Cobbles are angular up to 150mm of brick.					
		2.00	SPT	N=10 (2,2/2,3,2,3)									
		2.90	D		2.85	46.16		Stiff brown mottled grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone and coal. End of Borehole at 3.00m					
					3.00	46.01							

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS03	
									Sheet 1 of 1	
PROJECT NO: C4742							CO-ORDS: 385294E, 398078N		Hole Type	
									WS	
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							LEVEL: 48.30m OD		Scale	
									1:30	
CLIENT: DOMIS CONSTRUCTION							DATES: 15/04/21		Logged	Checked
									NS	JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.10	48.20		MADE GROUND: Tarmacadam.		1.0
		0.30-0.80	ES		0.30	48.00		MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone.		
								MADE GROUND: Brown gravelly sand. Sand is fine to coarse with ash. Gravel is subangular fine to medium of sandstone, concrete, coal, brick, limestone and rare clinker and rare glass.		
								Stiff brown mottled grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone and coal.		
		1.20	SPT	N=7 (1,1/1,2,2,2)						
		2.00	SPT	N=11 (2,2/3,3,2,3)	2.20	46.10				
		2.50	D							
		3.00	SPT	N=15 (3,3/4,3,4,4)						
		4.00	SPT	N=20 (4,5/4,5,5,6)						
		4.50	SPT	N=26 (5,6/6,7,6,7)						
					5.00	43.30		End of Borehole at 5.00m		
Remarks		1. Hand dug trial pit excavated to 1.20m bgl. 2. No groundwater encountered. 3. Borehole installed to 3.00m bgl; 1.00m plain and 2.00m slotted.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

Borehole Log							Window Sampler No.		
							WS04		
							Sheet 1 of 1		
PROJECT NO: C4742							CO-ORDS: 385312E, 398070N		
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							Hole Type		
							WS		
CLIENT: DOMIS CONSTRUCTION							Scale		
							1:30		
DATES: 15/04/21							Logged	Checked	
							NS	JM	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10-1.00	ES		0.10	48.83		MADE GROUND: Tarmacadam.	
					0.25	48.68		MADE GROUND: Reddish brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick and sandstone.	
					0.60	48.33		MADE GROUND: Black gravelly sand. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of slag, clinker, brick, tarmac, flint, sandstone and coal.	
					0.70	48.23		MADE GROUND: Tarmacadam.	
		1.00-1.90	ES					MADE GROUND: Black gravelly sand with low cobble content. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of slag, clinker, brick, tarmac, flint, sandstone and coal. Cobbles are angular up to 150mm of brick.	
		1.20	SPT	N=4 (1,1/1,1,1,1)					
					1.90	47.03			
		2.00	SPT	N=23 (2,10/10,5,4,4)	2.00	46.93		MADE GROUND: Orangish brown slightly sandy gravel. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone.	
					2.20	46.73		MADE GROUND: Red sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to medium of brick.	
					2.40	46.53		MADE GROUND: Blackish brown slightly gravelly slightly sandy clay. Sand is fine to medium. Gravel is angular to subangular fine to medium of brick and coal.	
								Stiff brown mottled grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone and coal.	
		3.00-3.45	D						
		3.00	SPT	N=17 (2,3/4,4,4,5)					
		4.00	D SPT	N=25 (6,5/6,6,6,7)					
		5.00	SPT	N=24 (4,5/5,6,6,7)					
					5.45	43.48		End of Borehole at 5.45m	
Remarks		1. Hand dug trial pit excavated to 1.20m bgl. 2. No groundwater encountered. 3. Borehole installed to 2.00m bgl; 1.00m plain and 1.00m slotted.							
		ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane							

 BROWNFIELD SOLUTIONS LTD							Borehole Log		Window Sampler No.	
									WS05	
									Sheet 1 of 1	
PROJECT NO: C4742							CO-ORDS: 385307E, 398062N		Hole Type	
									WS	
PROJECT NAME: VICTORIA HOUSE, GREAT ANCOATS							LEVEL: 48.87m OD		Scale	
									1:30	
CLIENT: DOMIS CONSTRUCTION							DATES: 15/04/21		Logged	Checked
									NS	JM
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.20-0.80	ES		0.10 0.20	48.77 48.67		MADE GROUND: Tarmacadam. MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of limestone. MADE GROUND: Brown gravelly sand. Sand is fine to coarse with ash. Gravel is angular to subangular fine to coarse of brick, coal, limestone, concrete and clinker.		
		0.80-1.50	ES		0.80	48.07		MADE GROUND: Black gravelly sand. Sand is fine to coarse of ash. Gravel is angular to subangular fine to coarse of clinker, brick, coal and rare slag.		
		1.20	SPT	N=6 (1,1/1,2,1,2)	1.50	47.37		MADE GROUND: Brown gravelly sand. Sand is fine to coarse. Gravel is angular to subangular fine to medium of brick and rare slate.		
		2.00	SPT	N=7 (2,2/1,2,2,2)	1.80	47.07		MADE GROUND: Brown gravelly clayey sand. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick and coal.		
		2.50	D		2.20	46.67		MADE GROUND: Blackish brown slightly gravelly slightly sandy clay. Sand is fine to medium. Gravel is angular to subangular fine to medium of brick and coal.		
		3.00	SPT	N=15 (2,3/3,3,4,5)	2.40	46.47		Stiff brown mottled grey slightly gravelly slightly sandy CLAY. Sand is fine to medium. Gravel is subangular to subrounded fine to medium of sandstone and coal.		
		3.50	D							
		4.00	SPT	N=23 (4,5/6,6,5,6)						
		4.50	SPT	N=24 (6,5/5,6,6,7)	4.45	44.42				
								End of Borehole at 5.00m		
Remarks		1. Hand dug trial pit excavated to 1.20m bgl. 2. No groundwater encountered. 3. Borehole collapsed to 2.50m bgl when at 4.00m bgl, borehole progressed with continuous CPT. 4. Borehole installed to 3.00m bgl; 1.00m plain and 2.00m slotted.							ES = Environmental Sample D = Disturbed Sample B = Bulk Sample LB = Large Bulk Sample U = Undisturbed Sample UT = Undisturbed Thin Wall Sample SPT = Standard Penetration Test PID = Photoionization Detector (ppm) PPM = Part Per Million HSV = Hand Shear Vane	

APPENDIX C

Chemical Testing Results

Nicola Swallow
Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

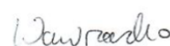
t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: n.swallow@brownfield-solutions.co.uk

Analytical Report Number : 21-76580

Replaces Analytical Report Number: 21-76580, issue no. 1
Additional analysis undertaken.

Project / Site name:	Victoria House Great Ancoals Street Manchester	Samples received on:	21/05/2021
Your job number:	C4742	Samples instructed on/ Analysis started on:	21/05/2021
Your order number:		Analysis completed by:	09/06/2021
Report Issue Number:	2	Report issued on:	09/06/2021
Samples Analysed:	7 soil samples		



Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Lab Sample Number				1879507	1879508	1879509	1879510	1879511
Sample Reference				WS01	WS02	WS03	WS04	BH2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50-1.10	0.30-0.50	0.30-0.80	0.25-0.60	0.30-1.00
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.1	13	8.6	9.0	9.9
Total mass of sample received	kg	0.001	NONE	1.2	1.0	1.0	1.0	1.0

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile	-	Amosite	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001	-	< 0.001	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001	-	< 0.001	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.4	8.8	10.1	7.3	11.1
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	460	150	1100	3500	3600
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.23	0.076	0.54	1.8	1.8
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	228	76.4	537	1760	1800
Organic Matter	%	0.1	MCERTS	1.9	3.2	1.8	5.2	2.4

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.65	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	1.1	< 0.05	0.86	< 0.05	0.39
Fluorene	mg/kg	0.05	MCERTS	0.92	< 0.05	0.58	0.25	0.32
Phenanthrene	mg/kg	0.05	MCERTS	5.7	2.0	5.4	2.6	3.7
Anthracene	mg/kg	0.05	MCERTS	1.5	1.1	1.6	0.66	1.1
Fluoranthene	mg/kg	0.05	MCERTS	4.9	7.9	9.5	4.4	7.3
Pyrene	mg/kg	0.05	MCERTS	5.0	8.2	9.6	4.8	7.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.1	3.9	3.8	2.8	3.3
Chrysene	mg/kg	0.05	MCERTS	1.8	2.9	4.0	2.7	2.9
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.9	4.8	4.5	3.5	4.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.81	1.3	2.0	0.91	1.3
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.9	4.3	4.3	2.9	3.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.91	2.3	2.1	1.4	2.0
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.66	0.61	0.54	0.58
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.2	3.1	2.6	1.8	2.5

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	30.4	42.4	51.4	29.1	40.7
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.2	17	18	95	28
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	9.4	83	26	83	28
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	9.4	83	26	83	28
Copper (aqua regia extractable)	mg/kg	1	MCERTS	71	59	140	380	69
Lead (aqua regia extractable)	mg/kg	1	MCERTS	54	500	380	4100	350
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.6	< 0.3	< 0.3	0.8
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	8.2	23	18	94	22
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	130	150	700	310

Analytical Report Number: 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Lab Sample Number				1879507	1879508	1879509	1879510	1879511
Sample Reference				WS01	WS02	WS03	WS04	BH2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50-1.10	0.30-0.50	0.30-0.80	0.25-0.60	0.30-1.00
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Monoaromatics & Oxygenates

Benzene	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
Toluene	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
p & m-xylene	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
o-xylene	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	2.3	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	4.0	14	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	10	26	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	62	83	-	-
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	MCERTS	-	72	110	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	76	130	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	< 0.001	< 0.001	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	< 1.0	4.8	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	< 2.0	16	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	20	56	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	78	160	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	98	240	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Lab Sample Number				1879512	1879513
Sample Reference				BH1	BH2
Sample Number				None Supplied	None Supplied
Depth (m)				5.00	9.00
Date Sampled				Deviating	Deviating
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	11	10
Total mass of sample received	kg	0.001	NONE	0.50	0.50

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	8.6
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.13	0.094
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-
Organic Matter	%	0.1	MCERTS	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-
Chromium (III)	mg/kg	1	NONE	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-

Analytical Report Number: 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Lab Sample Number				1879512	1879513
Sample Reference				BH1	BH2
Sample Number				None Supplied	None Supplied
Depth (m)				5.00	9.00
Date Sampled				Deviating	Deviating
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Monoaromatics & Oxygenates					
Benzene	mg/kg	0.001	MCERTS	-	-
Toluene	mg/kg	0.001	MCERTS	-	-
Ethylbenzene	mg/kg	0.001	MCERTS	-	-
p & m-xylene	mg/kg	0.001	MCERTS	-	-
o-xylene	mg/kg	0.001	MCERTS	-	-
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	0.001	MCERTS	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	MCERTS	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 21-76580
Project / Site name: Victoria House Great Ancoals Street Manchester
Your Order No:

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
1879507	WS01	0.50-1.10	205	Loose Fibres	Chrysotile	< 0.001	< 0.001
1879509	WS03	0.30-0.80	185	Loose Fibres	Amosite	< 0.001	< 0.001

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

Analytical Report Number : 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1879507	WS01	None Supplied	0.50-1.10	Brown loam with gravel.
1879508	WS02	None Supplied	0.30-0.50	Brown loam with gravel.
1879509	WS03	None Supplied	0.30-0.80	Brown loam with gravel.
1879510	WS04	None Supplied	0.25-0.60	Brown loam with gravel and vegetation.
1879511	BH2	None Supplied	0.30-1.00	Brown loam with gravel.
1879512	BH1	None Supplied	5	Brown clay and sand with gravel.
1879513	BH2	None Supplied	9	Brown clay and sand with gravel.

Analytical Report Number : 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.



Analytical Report Number : 21-76580
Project / Site name: Victoria House Great Ancoals Street Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Sample Deviation Report



Analytical Report Number : 21-76580

Project / Site name: Victoria House Great Ancoals Street Manchester

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH1	None Supplied	S	1879512	a	None Supplied	None Supplied	None Supplied
BH2	None Supplied	S	1879511	a	None Supplied	None Supplied	None Supplied
BH2	None Supplied	S	1879513	a	None Supplied	None Supplied	None Supplied
WS01	None Supplied	S	1879507	a	None Supplied	None Supplied	None Supplied
WS02	None Supplied	S	1879508	a	None Supplied	None Supplied	None Supplied
WS03	None Supplied	S	1879509	a	None Supplied	None Supplied	None Supplied
WS04	None Supplied	S	1879510	a	None Supplied	None Supplied	None Supplied

APPENDIX D

Geotechnical Testing Results



TEST REPORT

Client Brownfield Solution Ltd

Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Contract C4742
Victoria House, Manchester

Job Number MRN 4242/5
Date of Issue 11 June 2021
Page 1 of 2

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

Murray Rix is the trading name of Murray Rix (Northern) Limited. Registered in England 2878361

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK
METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/5

SAMPLE LABEL	BH02	DATE SAMPLED	04-Jun-21
LAB SAMPLE No	99946-99950	DATE RECEIVED	08-Jun-21
DATE TESTED	09-Jun-21	SAMPLED BY	Client

MATERIAL	Sandstone
ADVISED SOURCE	Site Investigation Sample

[illegible]

*W Entry required if test type is not Diametrical

REMARKS

SIGNED 

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21



TEST REPORT

Client Brownfield Solution Ltd

Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Contract C4742
Victoria House, Manchester

Job Number MRN 4242/4
Date of Issue 11 June 2021
Page 1 of 6

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
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- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

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MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE
DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE
SPECIMENS
ASTM D7012 – 14 Method C

Client
Address

Brownfield Solutions
William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Site C4742 Victoria House, Manchester

Job No. MRN 4242/4

Laboratory Sample Number 99313

Site Reference Number BH02 19.61-19.77

Date of Receipt 26 May 2021

Date of Test 02 June 2021

Dimensions

Tested by	SC	Diameter	70.5 mm
Length after preparation	136 mm	Length/diameter ratio	1.92

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH02 19.61-19.77
Sample Location	Not advised	Tested By	SC

Date of Drilling 22 May 2021

Drilled by Others

Description of core after test	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

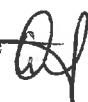
Compressive Strength

Load at Failure	kN	10.4	Measured Compressive Strength	N/mm ²	2.7
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Compressive Strength 2.7MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection.
Sample length/diameter ratio below the required ratio as detailed in the Standard

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE
DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE
SPECIMENS
ASTM D7012 – 14 Method C

Client Brownfield Solutions
Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Site C4742 Victoria House, Manchester

Job No. MRN 4242/4

Laboratory Sample Number 99314

Site Reference Number BH01 19.21-19.38

Date of Receipt 26 May 2021

Date of Test 02 June 2021

Dimensions

Tested by	SC	Diameter	70.0 mm
Length after preparation	138 mm	Length/diameter ratio	1.97

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH01 19.21-19.38
Sample Location	Not advised	Tested By	SC

Date of Drilling 20 May 2021

Drilled by Others

Description of core after test	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	6.2	Measured Compressive Strength	N/mm ²	1.6
-----------------	----	-----	-------------------------------	-------------------	-----

Compressive Strength 1.6MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection.
Sample length/diameter ratio below the required ratio as detailed in the Standard

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE
DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE
SPECIMENS
ASTM D7012 – 14 Method C

Client Brownfield Solutions
Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Site C4742 Victoria House, Manchester

Job No. MRN 4242/4

Laboratory Sample Number 99315

Site Reference Number BH01 26.60-26.78

Date of Receipt 26 May 2021

Date of Test 02 June 2021

Dimensions

Tested by	SC	Diameter	70.0 mm
Length after preparation	125 mm	Length/diameter ratio	1.79

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH01 26.60-26.78
Sample Location	Not advised	Tested By	SC

Date of Drilling 20 May 2021

Drilled by Others

Description of core after test	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	18.2	Measured Compressive Strength	N/mm ²	4.7
-----------------	----	------	-------------------------------	-------------------	-----

Compressive Strength 4.7MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection.
Sample length/diameter ratio below the required ratio as detailed in the Standard

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE
DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE
SPECIMENS
ASTM D7012 – 14 Method C

Client
Address

Brownfield Solutions
William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Site C4742 Victoria House, Manchester

Job No. MRN 4242/4

Laboratory Sample Number 99316

Site Reference Number BH01 29.52-29.67

Date of Receipt 26 May 2021

Date of Test 02 June 2021

Dimensions

Tested by	SC	Diameter	70.0 mm
Length after preparation	131 mm	Length/diameter ratio	1.87

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH01 29.52-29.67
Sample Location	Not advised	Tested By	SC

Date of Drilling 20 May 2021

Drilled by Others

Description of core after test	Split vertically from top to bottom, with no visible end effects
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Compressive Strength

Load at Failure	kN	10.1	Measured Compressive Strength	N/mm ²	2.6
-----------------	----	------	-------------------------------	-------------------	-----

Compressive Strength 2.6MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection.
Sample length/diameter ratio below the required ratio as detailed in the Standard

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE DETERMINATION OF THE COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

ASTM D7012 – 14 Method C

Client Brownfield Solutions
Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Site C4742 Victoria House, Manchester

Job No. MRN 4242/4

Laboratory Sample Number 99317

Site Reference Number BH01 19.41-19.57

Date of Receipt 26 May 2021

Date of Test 02 June 2021

Dimensions

Tested by	SC	Diameter	70.0 mm
Length after preparation	90.5 mm	Length/diameter ratio	1.29

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH01 19.41-19.57
Sample Location	Not advised	Tested By	SC

Date of Drilling 20 May 2021

Drilled by Others

Description of core after test	Split vertically from top to bottom, with no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	4.3	Measured Compressive Strength	N/mm ²	1.1
-----------------	----	-----	-------------------------------	-------------------	-----

Compressive Strength 1.1MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection.
Sample length/diameter ratio below the required ratio as detailed in the Standard

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 11 June 2021



TEST REPORT

Client Brownfield Solution Ltd

Address William Smith House
173-183 Witton Street
Northwich
Cheshire
CW9 5LP

Contract C4742
Victoria House, Manchester

Job Number MRN 4242/6
Date of Issue 11 June 2021
Page 1 of 14

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

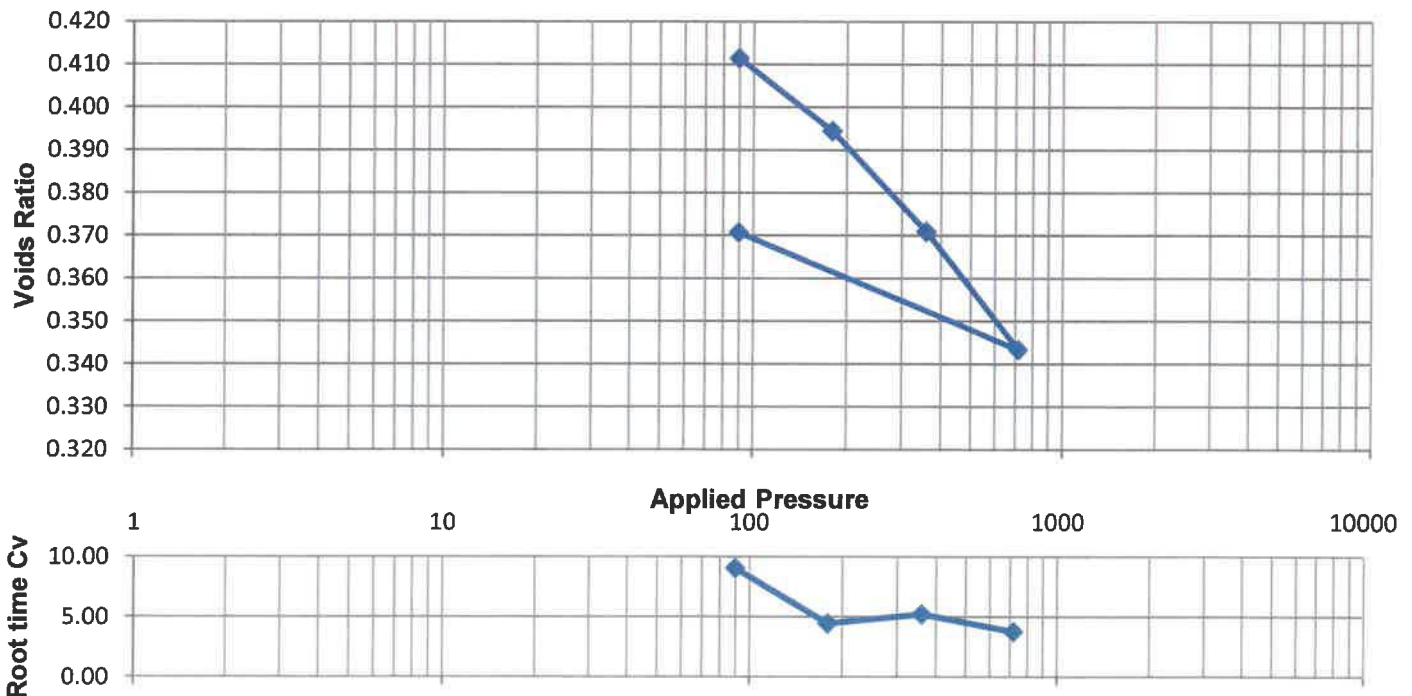
BS 1377 : PART 5 : Clause 3 : 1990

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	BH1 4.50-4.95	DATE SAMPLED	Not advised
LAB SAMPLE No.	99302	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client
MATERIAL	Stiff brown silty sandy CLAY with rare gravel		
ADVISED SOURCE	Site Investigation Sample		

Specimen Location		Sample Length (mm)	420	Specimen depth from top of Sample (mm)	60
		Sample Orientation	Vertical	Specimen Condition	Undisturbed

INITIAL CONDITIONS					Load No.	Applied Pressure kPa	Sample Height mm	Void Ratio	Mv m2/MN	Temp °C	Cv t90 root m2/yr	Cv t50 log m2/yr
Height	20.0 mm	Particle density	2.65	Ass	1	90	19.61	0.411	0.22	20	9.04	9.50
Diameter	75.0 mm	Initial void ratio	0.44		2	180	19.37	0.394	0.14	20	4.45	3.93
Weight wet	189.5 g	Deg. of sat.	99 %		3	360	19.04	0.371	0.10	20	5.20	4.67
Moist. cont.	17 %	Swell. press.	5 kN/m2		4	720	18.66	0.343	0.06	20	3.76	3.94
Bulk Density	2.14 Mg/m3	Dry density	1.84	Mg/m3	5	90	19.04	0.371	0.03	20		
					6							
					7							



Remarks/Abnormalities

Name O.P Davies BA (Hons)
(Laboratory Manager)

Signed 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

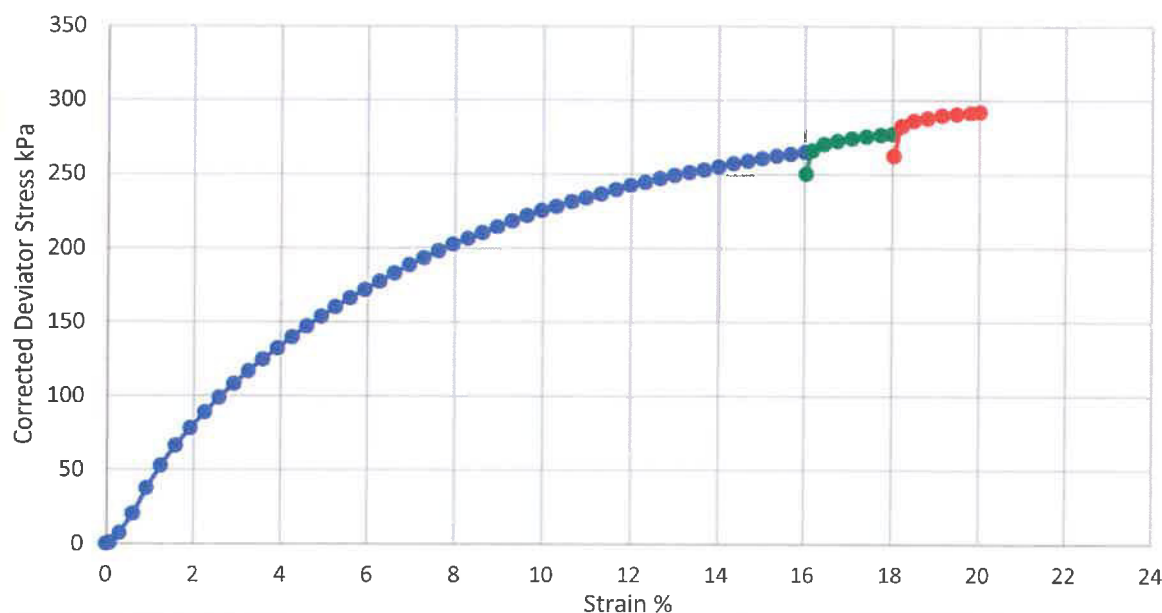
BS 1377 : PART 7: Clause 9 Multi Stage

CLIENT	Brownfield Solutions
SITE	C4742 - Victoria House Manchester
JOB NUMBER	MRN 4742/6

SAMPLE LABEL	BH1 9.00-9.45m	DATE SAMPLED	Not advised
LAB SAMPLE No.	99303	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client
MATERIAL	Stiff brown silty sandy CLAY with rare gravel		
ADVISED SOURCE	Site Investigation Sample		

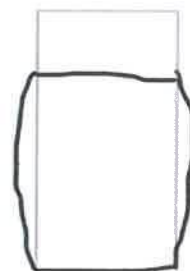
INITIAL CONDITIONS

Specimen Location	Sample Length (mm)	380	Specimen depth from top of Sample (mm)	150
	Sample Orientation	Vertical	Specimen Condition	Undisturbed
	Specimen Length (mm)	203	Specimen Moisture Content (%)	15
	Specimen Diameter (mm)	103	Specimen Bulk Density (Mg/m ³)	2.17
	Membrane Thickness (mm)	0.40	Specimen Dry Density (Mg/m ³)	1.89
	Membrane Correction	1.25	1.36	1.47

CORRECTED DEVIATOR STRESS vs AXIAL STRAIN

TEST TYPE
MULTI STAGE

SKETCH OF SPECIMEN AT FAILURE



PLASTIC

Cell Pressure (kPa)	Failure Strain (%)	Rate of Strain (%/min)	Corrected Deviator Stress (kPa)	Shear Strength Cu (kPa)
90	16	2	265.0	133
180	18	2	277.3	139
360	20	2	292.4	146

Remarks/Abnormalities

Name O.P Davies BA (Hons)
(Laboratory Manager)

Signed

Date 28 May 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

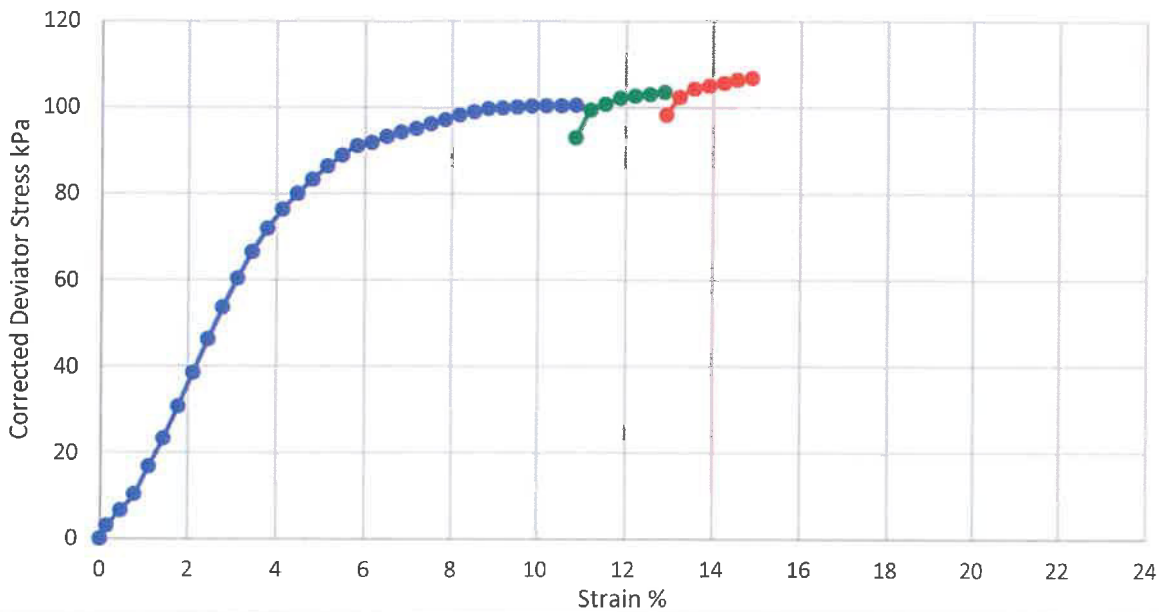
UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION
BS 1377 : PART 7: Clause 9 Multi Stage

CLIENT	Brownfield Solutions
SITE	C4742 - Victoria House Manchester
JOB NUMBER	MRN 4742/6

SAMPLE LABEL	BH2 3.00-3.45m	DATE SAMPLED	Not advised
LAB SAMPLE No.	99304	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client
MATERIAL	Stiff brown silty sandy CLAY with rare gravel		
ADVISED SOURCE	Site Investigation Sample		

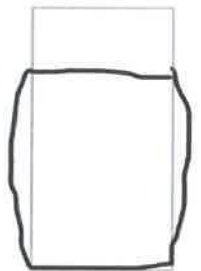
INITIAL CONDITIONS

Specimen Location		Sample Length (mm)	430	Specimen depth from top of Sample (mm)	105
		Sample Orientation	Vertical	Specimen Condition	Undisturbed
		Specimen Length (mm)	198	Specimen Moisture Content (%)	16
		Specimen Diameter (mm)	102	Specimen Bulk Density (Mg/m3)	2.1
		Membrane Thickness (mm)	0.40	Specimen Dry Density (Mg/m3)	1.80
		Membrane Correction	1.26	1.37	1.49

CORRECTED DEVIATOR STRESS vs AXIAL STRAIN

TEST TYPE
MULTI STAGE

SKETCH OF SPECIMEN AT FAILURE



PLASTIC

Cell Pressure (kPa)	Failure Strain (%)	Rate of Strain (%/min)	Corrected Deviator Stress (kPa)	Shear Strength c_u (kPa)
30	11	2	100.5	50
60	13	2	103.5	52
120	15	2	106.9	53

Remarks/Abnormalities

Name O.P Davies BA (Hons)
(Laboratory Manager)

Signed 

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF THE ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

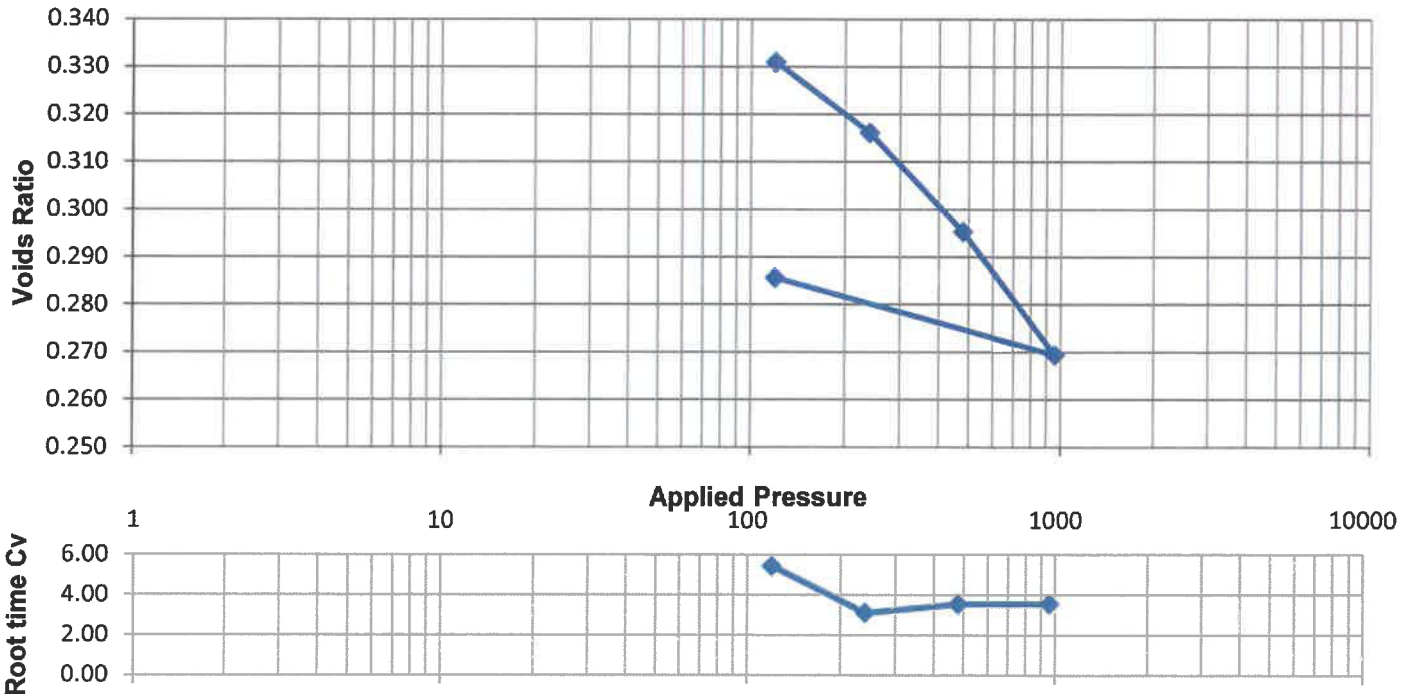
BS 1377 : PART 5 : Clause 3 : 1990

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	BH1 6.00-6.45	DATE SAMPLED	Not advised
LAB SAMPLE No.	99305	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client
MATERIAL	Stiff brown silty sandy CLAY with rare gravel		
ADVISED SOURCE	Site Investigation Sample		

Specimen Location	Sample Length (mm)	450	Specimen depth from top of Sample (mm)	80
	Sample Orientation	Vertical	Specimen Condition	Undisturbed

INITIAL CONDITIONS					Load No.	Applied Pressure kPa	Sample Height mm	Void Ratio	Mv m2/MN	Temp °C	Cv t90 root m2/yr	Cv t50 log m2/yr
Height	20.0 mm	Particle density	2.65	Ass	1	120	19.72	0.331	0.12	20	5.41	5.21
Diameter	75.0 mm	Initial void ratio	0.35		2	240	19.50	0.316	0.09	20	3.08	3.00
Weight wet	197.9 g	Deg. of sat.	107	%	3	480	19.19	0.295	0.07	20	3.51	3.45
Moist. cont.	14 %	Swell. press.	5	kN/m2	4	960	18.81	0.269	0.04	20	3.53	3.21
Bulk Density	2.24 Mg/m3	Dry density	1.96	Mg/m3	5	120	19.05	0.286	0.02	20		
					6							
					7							



Remarks/Abnormalities

Name O.P Davies BA (Hons)
(Laboratory Manager)

Signed

Date 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

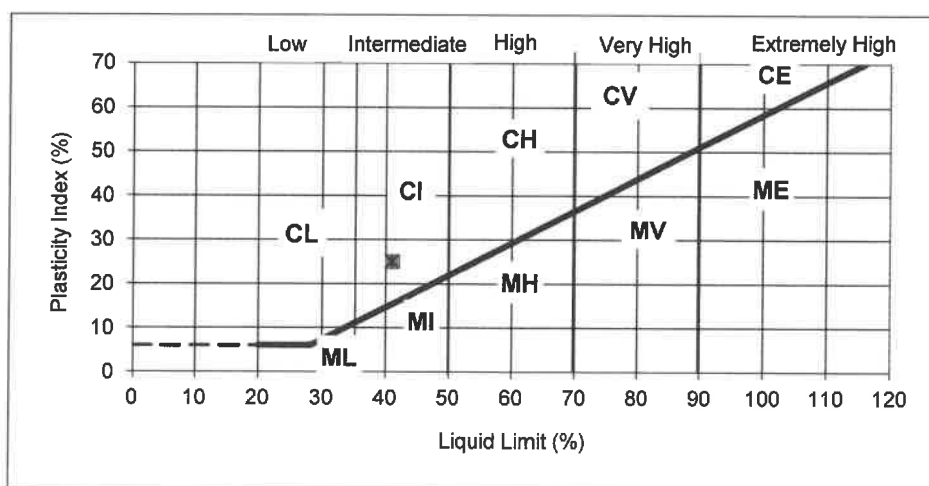
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS01 2.50	DATE SAMPLED	Not advised
SAMPLE No.	99306	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
13	41	16	25	97



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

pH and Sulphate as SO₄
BS 1377: PART 3: 1990

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS01 2.50	DATE SAMPLED	Not advised
LAB SAMPLE No	99306	DATE RECEIVED	26 May 2021
DATE TESTED	02 June 2021	SAMPLED BY	Client

ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried

PH Value	7.0	g/l
Sulphate as SO ₄ (2:1 Water Extract)	0.11	

REMARKS

SIGNED



NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

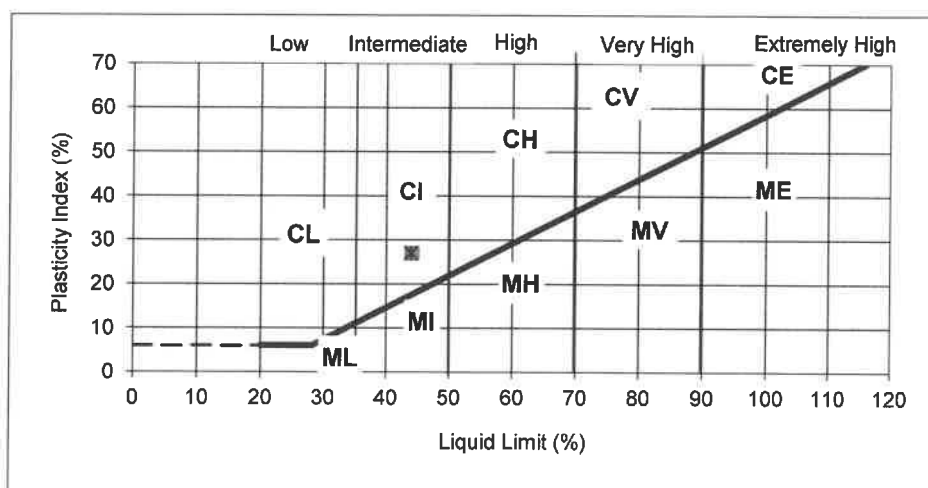
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS02 2.90	DATE SAMPLED	Not advised
SAMPLE No.	99307	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	44	17	27	99



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

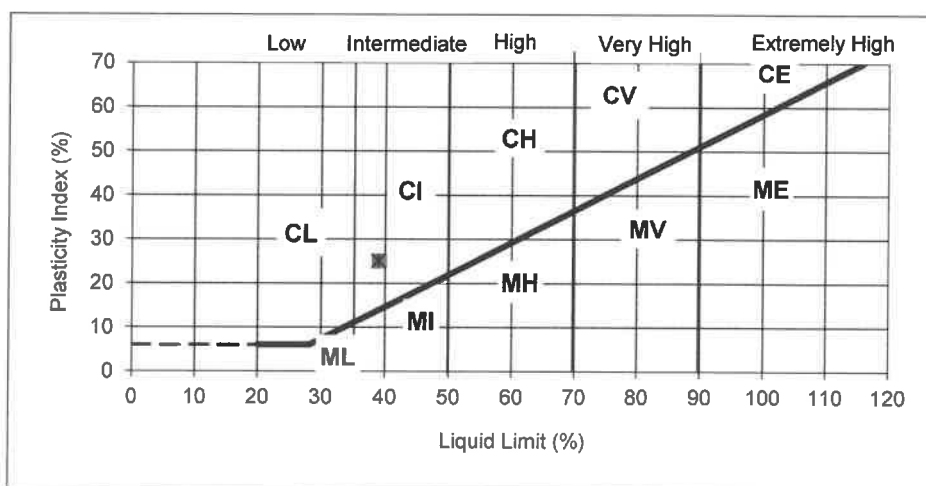
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS03 2.50	DATE SAMPLED	Not advised
SAMPLE No.	99308	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
8.3	39	14	25	97



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

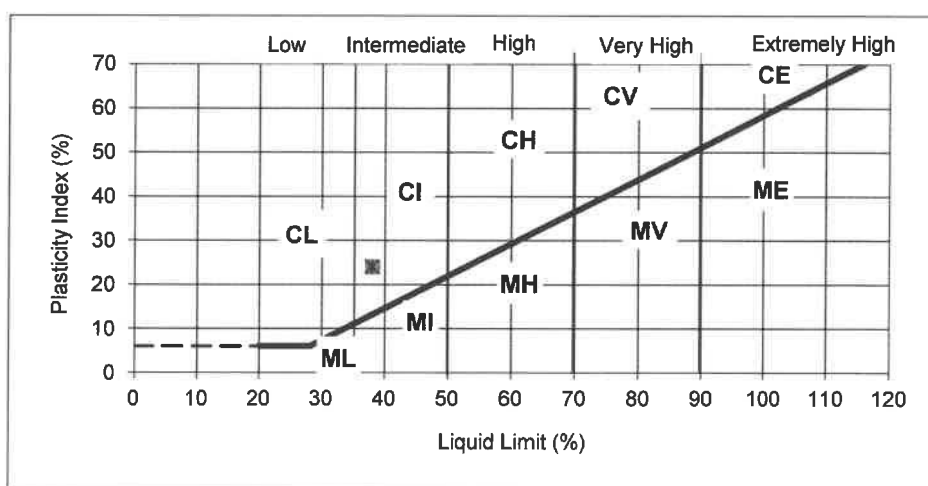
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS04 3.0-3.45	DATE SAMPLED	Not advised
SAMPLE No.	99309	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	38	14	24	95



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

TEST CERTIFICATE

pH and Sulphate as SO₄
BS 1377: PART 3: 1990

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS04 3.00-3.45	DATE SAMPLED	Not advised
LAB SAMPLE No	99307	DATE RECEIVED	26 May 2021
DATE TESTED	02 June 2021	SAMPLED BY	Client

ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried

PH Value	7.0	g/l
Sulphate as SO ₄ (2:1 Water Extract)	0.16	

REMARKS

SIGNED 

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11 June 2021

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

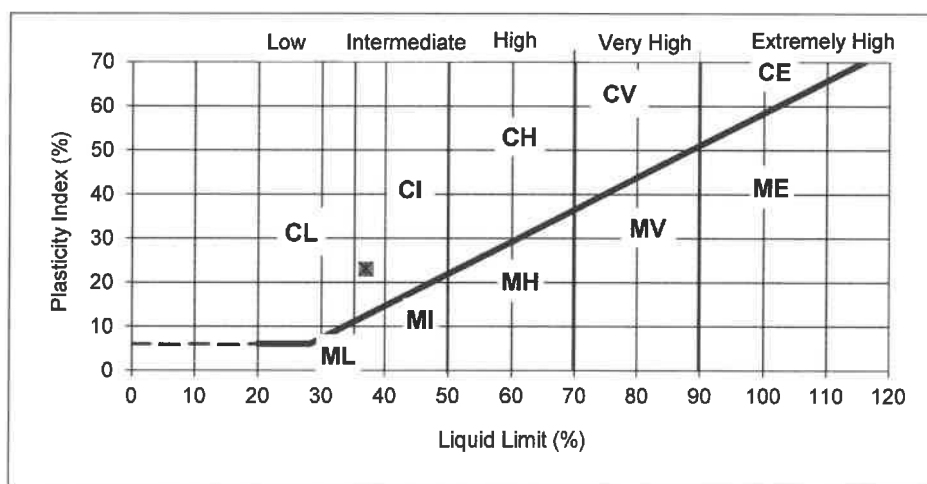
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	WS05 2.50	DATE SAMPLED	Not advised
SAMPLE No.	99310	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
13	37	14	23	98



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

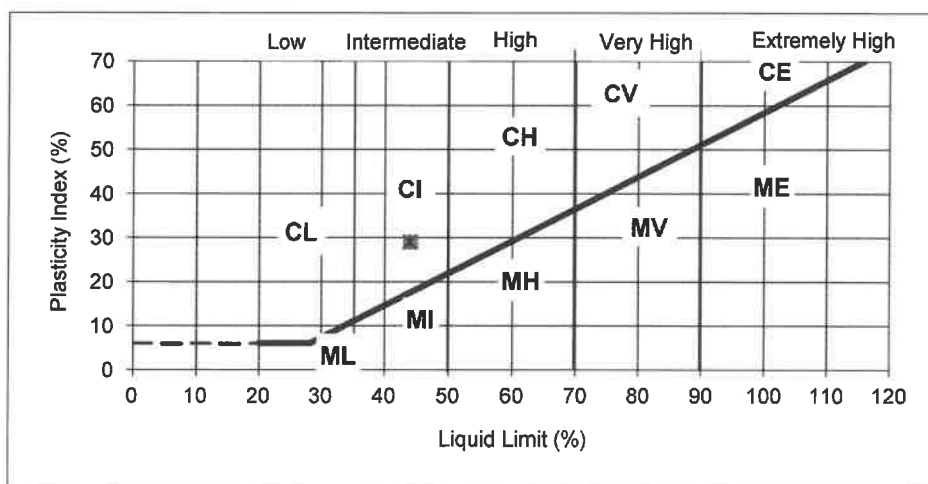
BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	BH1 2.50	DATE SAMPLED	Not advised
SAMPLE No.	99311	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
17	44	15	29	98



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

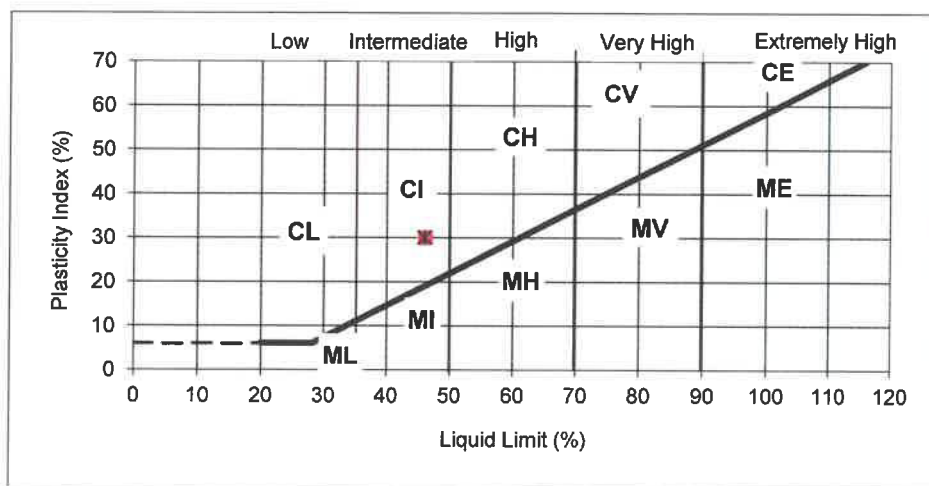
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	Brownfield Solutions
SITE	C4742 Victoria House, Manchester
JOB NUMBER	MRN 4242/6

SAMPLE LABEL	BH2 2.50	DATE SAMPLED	Not advised
SAMPLE No.	99312	DATE RECEIVED	26-May-21
DATE TESTED	05-Jun-21	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with rare gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
23	46	16	30	95



REMARKS

Sample tested in natural condition

SIGNED

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 11-Jun-21

BH01
Test 1

DOMIS CONSTRUCTION

VICTORIA HOUSE

C4742



**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Falling Head Permeability Test

(a) bottom of borehole:	23.85	m
(b) bottom of casing:		m
(c) top of filter material:	4.00	m
(d) initial groundwater level or base of hole:	22.08	m
(e) centre of piezometer tip:		m
Height of casing/standpipe above surface	0.00	m
Diameter of casing/standpipe	150	mm
Length of filter (above GW table or base of hole)	18.08	m

Date of Test:

08/05/2001

Logged By:

PG

Checked By:

NS

Site Recorded Data

Time (secs)	Depth to water (m)	Head of water (m)	Head Ratio H/H_0	Time (secs)	Depth to water (mm)	Head of water (m)	Head Ratio H/H_0
0	0.00	22.08	1.000	870	4.95	17.13	0.776
11	0.64	21.44	0.971	900	5.07	17.01	0.770
25	0.73	21.35	0.967	930	5.40	16.68	0.755
35	0.78	21.30	0.965	960	5.77	16.31	0.739
45	0.82	21.26	0.963	990	6.16	15.92	0.721
55	0.85	21.23	0.962	1020	6.41	15.67	0.710
60	0.86	21.22	0.961	1050	6.66	15.42	0.698
80	0.90	21.18	0.959	1080	6.70	15.38	0.697
90	0.92	21.16	0.958	1110	6.73	15.35	0.695
105	0.95	21.13	0.957	1140	6.75	15.33	0.694
120	0.97	21.11	0.956	1170	6.77	15.31	0.693
330	1.82	20.26	0.918	1200	6.80	15.28	0.692
375	2.10	19.98	0.905	1500	7.06	15.02	0.680
390	2.20	19.88	0.900	1800	7.25	14.83	0.672
405	2.80	19.28	0.873	2490	8.44	13.64	0.618
420	2.34	19.74	0.894	3060	8.70	13.38	0.606
460	2.48	19.60	0.888	3600	8.94	13.14	0.595
480	2.51	19.57	0.886	4200	9.19	12.89	0.584
495	2.55	19.53	0.885	4800	9.44	12.64	0.572
510	2.60	19.48	0.882	5520	9.38	12.70	0.575
525	2.65	19.43	0.880	6000	9.85	12.23	0.554
540	2.68	19.40	0.879	6600	10.12	11.96	0.542
555	2.72	19.36	0.877	7200	10.38	11.70	0.530
570	2.78	19.30	0.874	7800	10.53	11.55	0.523
585	2.84	19.24	0.871	8400	10.67	11.41	0.517
600	2.98	19.10	0.865	9000	10.84	11.24	0.509
615	2.95	19.13	0.866	9780	11.03	11.05	0.500
630	2.99	19.09	0.865	10500	11.08	11.00	0.498
645	3.05	19.03	0.862	10980	11.14	10.94	0.495
660	3.12	18.96	0.859	11520	11.68	10.40	0.471
675	3.15	18.93	0.857	12120	12.55	9.53	0.432
690	3.21	18.87	0.855	12720	12.71	9.37	0.424
705	3.24	18.84	0.853	13500	12.90	9.18	0.416
720	3.28	18.80	0.851	13800	13.00	9.08	0.411
735	3.34	18.74	0.849	14400	13.13	8.95	0.405
750	3.39	18.69	0.846	15060	13.24	8.84	0.400
765	3.46	18.62	0.843	15600	13.34	8.74	0.396
780	3.49	18.59	0.842	16320	13.47	8.61	0.390
795	3.56	18.52	0.839	16920	13.59	8.49	0.385
810	3.69	18.39	0.833	17400	13.69	8.39	0.380
825	3.97	18.11	0.820	18000	13.80	8.28	0.375
840	4.26	17.82	0.807				
855	4.56	17.52	0.793				
880	4.79	17.29	0.783				

BH01
Test 1

DOMIS CONSTRUCTION

VICTORIA HOUSE

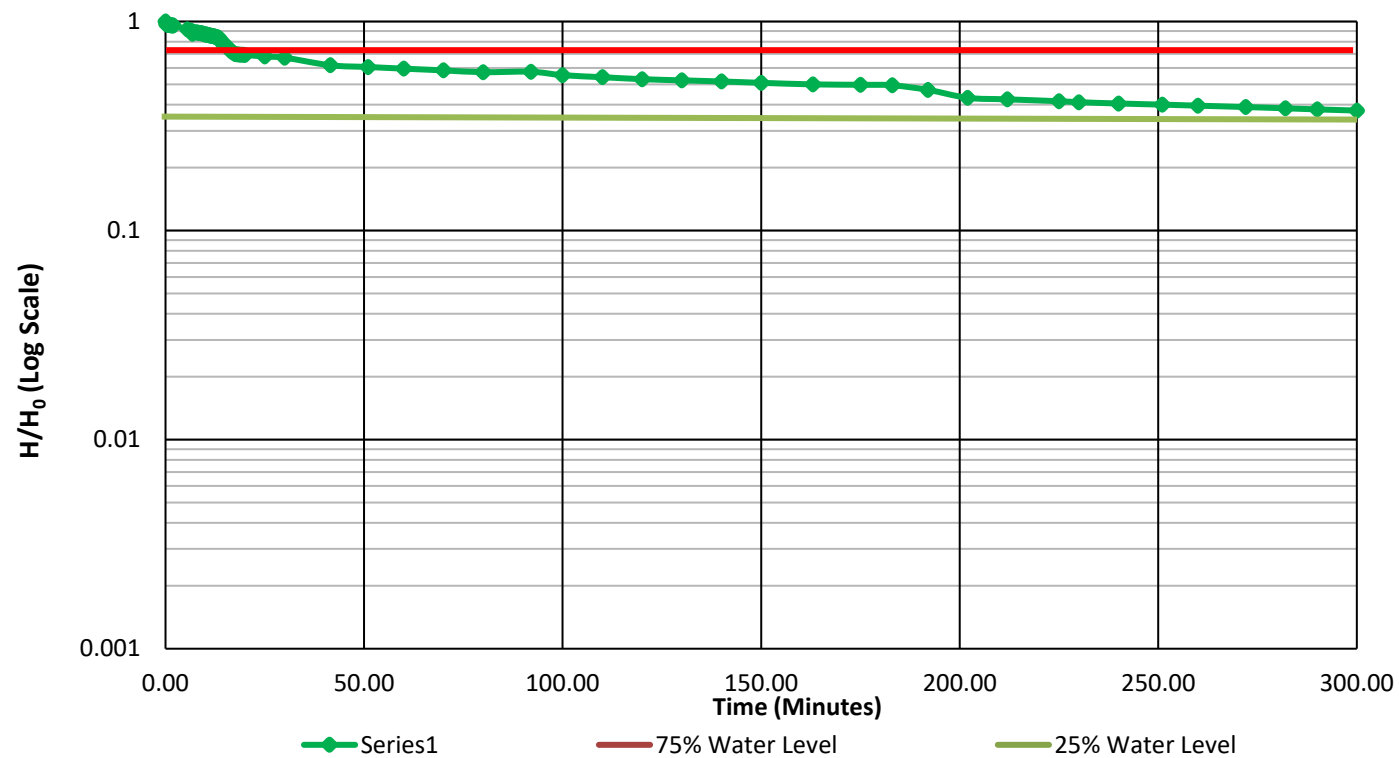
C4742



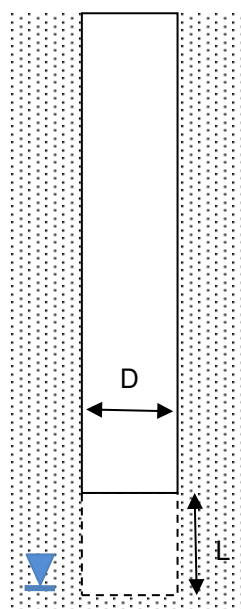
**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Head Ratio Vs Time



Calculation of Intake Factor (F)



X-sectional area of base

$$A = 0.017671459 \text{ m}^2$$

Diameter

$$D = 0.15 \text{ m}$$

Length

$$L = 18.08 \text{ m}$$

Cylindrical Cavity with $\frac{L}{D} > 10$

$$F = \frac{2\pi L}{\ln\left(2\frac{L}{D}\right)}$$

$$F = \frac{113.600}{5.485}$$

$$F = 20.711$$

Calculation

	Head (m)	Depth (m bgl)	Time (s)
75% effective level	16.560	5.520	960.000
25% effective level	5.520	16.560	NA

At time (t_1) Depth to water = 0.000 $t_1 = 0.0$ sec

Initial groundwater level = 22.08

Depth of Water (H_1) = 22.080

At time (t_2) Depth to water = 13.800 $t_2 = 18000.0$ sec

Initial groundwater level = 22.08

Depth of Water (H_2) = 8.280

$$\text{Permeability} = k = \frac{A}{F(t_2 - t_1)} \log_e \frac{H_1}{H_2}$$

$$k = \frac{0.0177}{372793.51} \ln \frac{22.080}{8.280}$$

$$k = 4.65\text{E-}08 \text{ m/s}$$

BH02
Test 1

DOMIS CONSTRUCTION

VICTORIA HOUSE

C4742



**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Falling Head Permeability Test

(a) bottom of borehole:	11.77	m
(b) bottom of casing:		m
(c) top of filter material:	8.00	m
(d) initial groundwater level or base of hole:	11.38	m
(e) centre of piezometer tip:		m
Height of casing/standpipe above surface	0.00	m
Diameter of casing/standpipe	150	mm
Length of filter	3.77	m

Date of Test:

08/05/2001

Logged By:

PG

Checked By:

NS

Site Recorded Data

Time (mm:ss.0)	Depth to water (m)	Head of water (m)	Head Ratio H/H ₀	Time (mm:ss.0)	Depth to water (mm)	Head of water (m)	Head Ratio H/H ₀
:15	0.00	10.98	1.000	10:00	3.69	9.67	0.881
:27	0.64	10.91	0.994	10:18	3.97	9.62	0.876
:35	0.73	10.88	0.991	11:00	4.26	9.59	0.873
:47	0.78	10.83	0.986	11:18	4.56	9.55	0.870
1:00	0.82	10.78	0.982	12:00	4.79	9.52	0.867
1:10	0.85	10.74	0.978	12:18	4.95	9.48	0.863
1:24	0.86	10.67	0.972	13:00	5.07	9.45	0.861
1:30	0.90	10.64	0.969	13:18	5.40	9.41	0.857
2:00	0.92	10.61	0.966	14:00	5.77	9.38	0.854
2:09	0.95	10.57	0.963	15:00	6.16	9.33	0.850
2:15	0.97	10.55	0.961	20:00	6.41	9.03	0.822
2:18	1.82	10.54	0.960	25:18	6.66	8.78	0.800
2:24	2.10	10.52	0.958	30:00	6.70	8.61	0.784
2:30	2.20	10.49	0.955	43:00	6.73	8.15	0.742
3:09	2.80	10.42	0.949	01:00:12	6.75	7.45	0.679
3:18	2.34	10.39	0.946	01:02:00	6.77	6.93	0.631
3:27	2.48	10.37	0.944	01:03:00	6.80	6.77	0.617
4:00	2.51	10.32	0.940	01:23:00	7.06	6.38	0.581
4:09	2.55	10.29	0.937	01:32:00	7.25	6.18	0.563
4:18	2.60	10.25	0.934	02:00:00	8.44	5.98	0.545
4:27	2.65	10.22	0.931	02:13:00	8.70	5.77	0.526
5:00	2.68	10.18	0.927	02:25:00	8.94	5.37	0.489
5:09	2.72	10.15	0.924	02:35:00	9.19	5.23	0.476
5:18	2.78	10.11	0.921	03:03:00	9.44	4.98	0.454
5:27	2.84	10.08	0.918	03:15:00	9.38	4.83	0.440
6:00	2.98	10.05	0.915	03:25:00	9.85	4.70	0.428
6:09	2.95	10.02	0.913	03:35:00	10.12	4.56	0.415
6:18	2.99	9.98	0.909	03:45:00	10.38	4.36	0.397
6:27	3.05	9.96	0.907	04:05:00	10.53	4.25	0.387
7:00	3.12	9.94	0.905	04:15:00	10.67	4.17	0.380
7:09	3.15	9.91	0.903	04:27:00	10.84	4.06	0.370
7:18	3.21	9.89	0.901	04:41:00	11.03	3.90	0.355
7:27	3.24	9.87	0.899	04:47:00	11.08	3.85	0.351
8:00	3.28	9.83	0.895	04:51:00	11.14	3.77	0.343
8:09	3.34	9.81	0.893	05:05:00	11.68	3.67	0.334
8:18	3.39	9.79	0.892	05:13:00	12.55	3.53	0.321
8:27	3.46	9.77	0.890	05:24:00	12.71	3.45	0.314
9:00	3.49	9.75	0.888	05:35:00	12.90	3.41	0.311
9:18	3.56	9.71	0.884	06:00:00	13.00	3.33	0.303

BH02
Test 1

DOMIS CONSTRUCTION

VICTORIA HOUSE

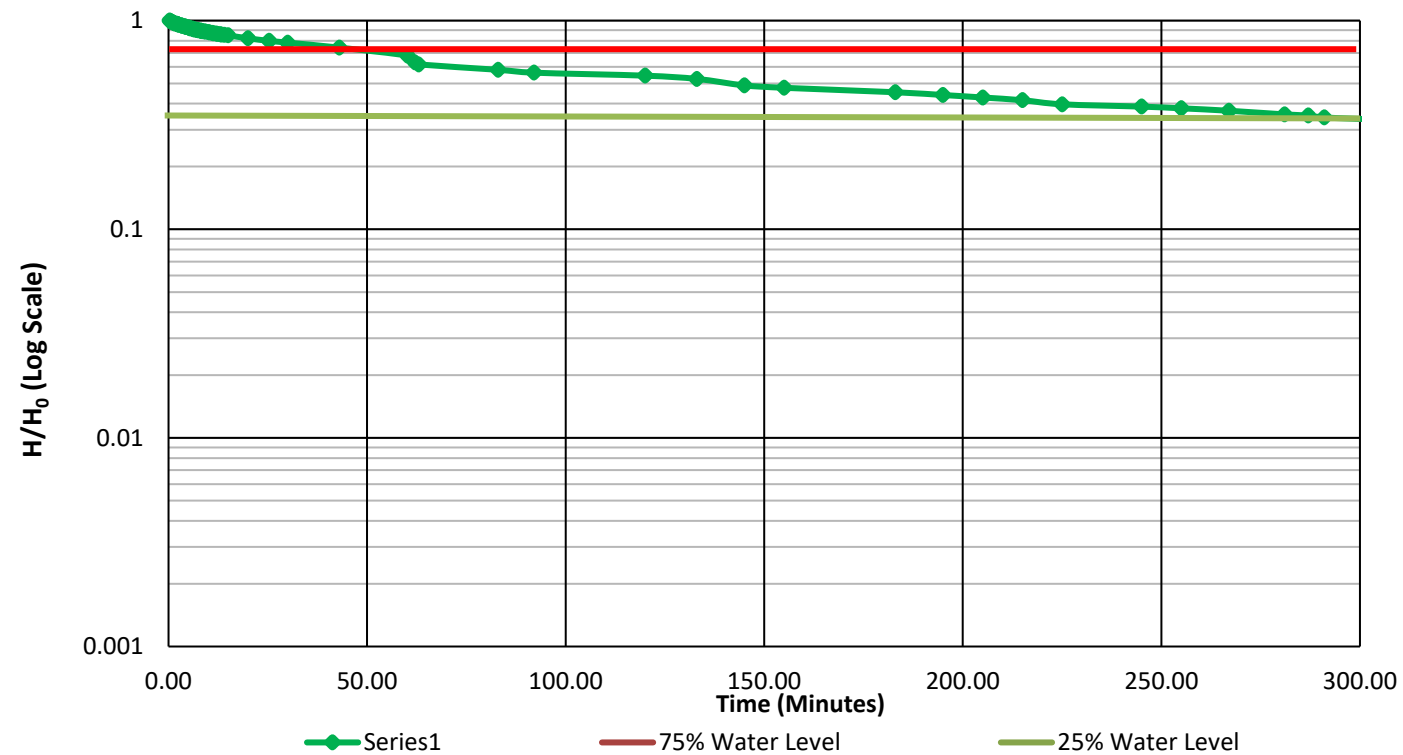
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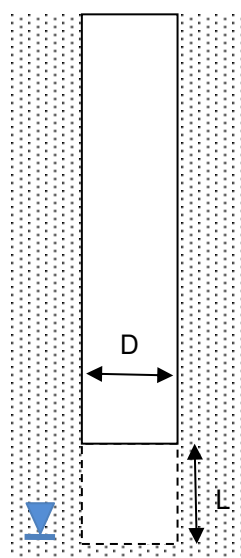
**BROWNFIELD
SOLUTIONS LTD**
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

Data Analysis

Head Ratio Vs Time



Calculation of Intake Factor (F)



X-sectional area of base

$$A = 0.017671459 \text{ m}^2$$

Diameter

$$D = 0.15 \text{ m}$$

Length

$$L = 3.77 \text{ m}$$

$$\text{Cylindrical Cavity with } \frac{L}{D} > 10 \quad F = \frac{2\pi L}{\ln\left(2\frac{L}{D}\right)}$$

$$F = \frac{23.688}{3.917}$$

$$F = 6.047$$

Calculation

	Head (m)	Depth (m bgl)	Time (s)
75% effective level	8.235	2.745	1800
25% effective level	2.745	8.235	NA

$$\text{At time } (t_1) \text{ Depth to water} = 0.000 \quad t_1 = 0.0 \text{ sec}$$

$$\text{Initial groundwater level} = 11.38$$

$$\text{Depth of Water } (H_1) = 11.380$$

$$\text{At time } (t_2) \text{ Depth to water} = 8.235 \quad t_2 = 21600.0 \text{ sec}$$

$$\text{Initial groundwater level} = 11.38$$

$$\text{Depth of Water } (H_2) = 3.145$$

$$\text{Permeability} = k = \frac{A}{F(t_2 - t_1)} \text{Log}_e \frac{H_1}{H_2}$$

$$k = \frac{0.0177}{130612.12} \ln \frac{11.380}{3.145}$$

$$k = 1.74\text{E-}07 \text{ m/s}$$

APPENDIX E

Monitoring Results

Ground Gas Monitoring Results



CLIENT:				Date	Operator	Analysr	Weather Observations				Temp (°C)		Pressure Trend		Min Barometric Pressure (mb)				Notes				
DOMIS CONSTRUCTION LTD				19/04/2021	PG	GA5000	Sunny		No wind		Warm		16		Steady		1014						
JOB NO.				20/05/2021	PG	GFM436	Overcast		Light breeze		Warm		16		Falling		1002						
C4742				08/06/2021	PG	GFM436	Sunny		Windy		Cool		6		Rising		1012						
SITE:				18/06/2021	ML	GFM436	Overcast		No wind		Warm		13		Falling		999						
VICTORIA HOUSE, GREAT ANCOATS STREET				28/06/2021	PG	GFM436	Intermittent cloud		Windy		Cool		16		Steady		1006						
				21/07/2021	PG	GFM436	Sunny		No wind		Hot		18		Rising		1011						
Notes: mb = milibars; CH ₄ = methane; LEL = lower explosive limit = 5%v/v; CO ₂ = carbon dioxide; O ₂ = oxygen; CO=carbon monoxide; H ₂ S = hydrogen sulphide; TVOC= Total volatile organic compounds; PPM = parts per million. Where the flow is less than the limit of detection of the instrument, the detection limit is reported (Highlighted in green). Gas Screening Values (GSVs) are rounded to 3 decimal places. Calibration Records for analysers used available on request.																							
Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)					
				Summary Statistics																			
Max. values:				1014	3.0	1.0	0.7	0.1	0.1	2.0	2.0	5.0	5.1	21.4	21.3	0.0	0.0	0.0	22.1	26.0	0.001	0.005	
Min. values:				999	0.0	-0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	11.7	13.6	0.0	0.0	0.0	1.5	1.5	0.000	0.000	
				Worst-case GSVs based on maximum recorded steady flow and maximum individual peak concentrations:																		0.001	
19/04/2021	PM	Ambient		1014	-	-	-	0.1	-	2.0	-	0.1	-	21.4	-	N.A.	0.0	-	-	-	-	-	Not yet completed
		WS01	1.00 - 2.00	-	1.29	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	21.0	21.2	N.A.	0.0	NA	NGW	3.35	0.000	0.000	
		WS02	0.50 - 1.50	-	0.45	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.1	21.2	21.3	N.A.	0.0	NA	NGW	1.54	0.000	0.000	
		WS03	1.00 - 2.00	-	0.47	0.1	0.1	0.1	0.1	2.0	2.0	0.8	0.9	20.3	20.1	N.A.	0.0	NA	1.93	3.01	0.000	0.001	
		WS04	1.00 - 2.00	-	0.90	0.1	0.1	0.1	0.1	2.0	2.0	1.7	3.1	18.2	17.6	N.A.	0.0	NA	NGW	1.60	0.000	0.002	
		WS05	1.00 - 2.00	-	0.31	0.1	0.1	0.1	0.1	2.0	2.0	2.4	3.0	18.3	17.2	N.A.	0.0	NA	NGW	3.00	0.000	0.002	
		BH1	4.00 - 27.00	-	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A.	0.0	NA	N.A	N.A	N.A	N.A	
		BH2	8.00 - 12.00	-	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A.	0.0	NA	N.A	N.A	N.A	N.A	
19/04/2021	PM	Ambient		1014	-	-	-	0.1	-	2.0	-	0.1	-	21.4	-	N.A.	0.0	-	-	-	-	-	
20/05/2021	AM	Ambient		1002	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	Covered by vehicle
		WS01	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.1	19.6	20.0	0.0	0.0	NA	1.49	3.10	0.000	0.000	
		WS02	0.50 - 1.50	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.2	0.3	20.0	20.0	0.0	0.0	NA	NGW	1.56	0.000	0.000	
		WS03	1.00 - 2.00	-	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	NA	N.A	N.A	N.A	N.A	
		WS04	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	3.4	4.9	16.4	15.0	0.0	0.0	NA	NGW	1.61	0.000	0.003	
		WS05	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	0.8	0.9	18.7	18.7	0.0	0.0	NA	1.90	3.02	0.000	0.001	
		BH1	4.00 - 27.00	-	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	NA	N.A	N.A	N.A	N.A	
		BH2	8.00 - 12.00	-	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	NA	N.A	N.A	N.A	N.A	
20/05/2021	AM	Ambient		1002	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	
08/06/2021	AM	Ambient		1012	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	Not yet completed
		WS01	1.00 - 2.00	-	0	0.1	0.1	0.1	0.1	2.0	2.0	0.3	0.1	19.6	19.9	0.0	0.0	NA	NGW	1.55	0.000	0.000	
		WS02	0.50 - 1.50	-	3	0.6	0.7	0.1	0.1	2.0	2.0	0.4	0.3	19.0	19.5	0.0	0.0	NA	1.76	3.06	0.001	0.003	
		WS03	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.1	1.4	18.2	17.7	0.0	0.0	NA	NGW	3.00	0.000	0.001	
		WS04	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.1	0.1	19.9	20.0	0.0	0.0	NA	NGW	1.60	0.000	0.001	
		WS05	1.00 - 2.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	4.2	0.2	15.5	19.7	0.0	0.0	NA	2.07	3.02	0.000	0.004	
		BH1	4.00 - 27.00	-	0.0	0.1	0.1	0.1	0.1	2.0	2.0	1.1	0.1	18.7	19.9	0.0	0.0	NA	22.08	23.85	0.000	0.001	
		BH2	8.00 - 12.00	-	0.0	0.2	0.1	0.1	0.1	2.0	2.0	0.9	0.2	16.7	19.6	0.0	0.0	NA	11.38	11.77	0.000	0.001	
08/06/2021	AM	Ambient		1012	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	
18/06/2021	AM	Ambient		999	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	Not yet completed
		WS01	1.00 - 2.00	-	0.3	0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	21.1	21.1	0.0	0.0	NA	1.93	2.10	0.000	0.000	
		WS02	0.50 - 1.50	-	0.3	-0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	20.9	21.0	0.0	0.0	NA	NGW	1.57	0.000	0.000	
		WS03	1.00 - 2.00	-	0.2	-0.1	0.1	0.1	0.1	2.0	2.0	0.3	0.2	20.8	20.9	0.0	0.0	NA	1.53	2.53	0.000	0.000	
		WS04	1.00 - 2.00	-	0.1	0.1	0.1	0.1	0.1	2.0	2.0	2.3	2.0	18.6	19.9	0.0	0.0	NA	NGW	1.62	0.000	0.002	
		WS05	1.00 - 2.00	-	0.1	0.1	0.1	0.1	0.1	2.0	2.0	4.9	4.0	15.5	16.8	0.0	0.0	NA	2.14	2.93	0.000	0.005	
		BH1	4.00 - 27.00	-	0.3	-0.1	0.1	0.1	0.1	2.0	2.0	4.2	4.1	15.6	17.2	0.0	0.0	NA	22.01	24.33	0.000	0.004	
		BH2	8.00 - 12.00	-	0.3	-0.1	0.1	0.1	0.1	2.0	2.0	0.1	0.1	21.2	21.2	0.0	0.0	NA	9.03	11.65	0.000	0.000	
18/06/2021	AM	Ambient		999	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	

Ground Gas Monitoring Results



Date	Time	Location	Response zone (m)	Pressures (mb)		Gas flows (l/hr)		CH ₄ (%v/v)		CH ₄ (%LEL)		CO ₂ (%v/v)		O ₂ (%v/v)		Other Gases (PPM)			Depth to Water (m)	Well Base (m)	Gas Screening Value (CH ₄) (l/hr)	Gas Screening Value (CO ₂) (l/hr)	Notes
				Atmospheric Pressure	Relative Well Pressure	Initial	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	CO	H ₂ S	TVOC (PID)					
28/06/2021	AM	Ambient		1006	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	
		WS01	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	0.1	0.1	20.1	20.1	0.0	0.0	NA	1.96	3.10	0.000	0.000	
		WS02	0.50 - 1.50	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	0.2	0.1	20.0	20.1	0.0	0.0	NA	NGW	1.53	0.000	0.000	
		WS03	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	1.6	1.7	17.4	17.2	0.0	0.0	NA	1.88	2.98	0.000	0.002	
		WS04	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	4.4	4.7	14.3	13.6	0.0	0.0	NA	NGW	1.58	0.000	0.004	
		WS05	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	4.2	1.7	14.5	17.5	0.0	0.0	NA	2.12	2.99	0.000	0.004	
		BH1	4.00 - 27.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	3.5	0.6	16.3	19.4	0.0	0.0	NA	22.05	25.99	0.000	0.004	
		BH2	8.00 - 12.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	2.4	0.8	11.7	18.1	0.0	0.0	NA	11.44	11.76	0.000	0.002	
28/06/2021	AM	Ambient		1005	-	-	-	0.1	-	2.0	-	0.1	-	20.1	-	0.0	0.0	-	-	-	-	-	
21/07/2021	AM	Ambient		1006	-	-	-	0.1	-	2.0	-	0.1	-	20.3	-	0.0	0.0	-	-	-	-	-	
		WS01	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	0.1	0.1	20.0	20.1	0.0	0.0	NA	1.71	3.11	0.000	0.000	
		WS02	0.50 - 1.50	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	0.4	0.4	20.0	20.0	0.0	0.0	NA	NGW	1.54	0.000	0.000	
		WS03	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	2.2	0.3	15.2	19.6	0.0	0.0	NA	1.87	2.96	0.000	0.002	
		WS04	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	3.9	5.1	15.2	14.0	0.0	0.0	NA	NGW	1.59	0.000	0.004	
		WS05	1.00 - 2.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	4.6	0.4	13.0	19.4	0.0	0.0	NA	2.08	3.00	0.000	0.005	
		BH1	4.00 - 27.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	5.0	0.3	14.0	20.1	0.0	0.0	NA	22.05	25.65	0.000	0.005	
		BH2	8.00 - 12.00	-	0.0	1.0	0.1	0.1	0.1	2.0	2.0	1.8	0.8	12.7	17.4	0.0	0.0	NA	11.43	11.73	0.000	0.002	
21/07/2021	AM	Ambient		1005	-	-	-	0.1	-	2.0	-	0.1	-	20.3	-	0.0	0.0	-	-	-	-	-	

APPENDIX F

Waste Assessment Report

**Nicola Swallow**

Brownfield Solutions Ltd
William Smith House
173 - 183 Witton Street
Northwich
Cheshire
CW9 5LP

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Croxley Green
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WD18 8YS

t: 01923 225404

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e: reception@i2analytical.com

e: n.swallow@brownfield-solutions.co.uk

Analytical Report Number : 21-76586

Project / Site name:	Victoria House Great Ancoals Street Manchester	Samples received on:	21/05/2021
Your job number:	C4742	Samples instructed on/ Analysis started on:	21/05/2021
Your order number:		Analysis completed by:	02/06/2021
Report Issue Number:	1	Report issued on:	02/06/2021
Samples Analysed:	2 10:1 WAC samples		

Signed: *A. Czerwińska*

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

i2 Analytical

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Waste Acceptance Criteria Analytical Results							
Report No:	21-76586						
					Client: BSL		
Location	Victoria House Great Ancoals Street Manchester						
Lab Reference (Sample Number)	1879619 / 1879620				Landfill Waste Acceptance Criteria		
Sampling Date					Limits		
Sample ID	WS01				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.30-0.50						
Solid Waste Analysis							
TOC (%)**	1.4				3%	5%	6%
Loss on Ignition (%) **	3.3				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	0.047				1	--	--
Mineral Oil (mg/kg)	450				500	--	--
Total PAH (WAC-17) (mg/kg)	50.7				100	--	--
pH (units)**	8.2				--	>6	--
Acid Neutralisation Capacity (mol / kg)	11				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:1	Limit values for compliance leaching test		
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0111			0.106	0.5	2	25
Barium *	0.0446			0.424	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0029			0.027	0.5	10	70
Copper *	0.0057			0.054	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	< 0.0004			< 0.0040	0.5	10	30
Nickel *	0.0021			0.020	0.4	10	40
Lead *	0.0067			0.064	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0040			0.038	4	50	200
Chloride *	1.8			17	800	15000	25000
Fluoride	0.42			4.0	10	150	500
Sulphate *	9.2			87	1000	20000	50000
TDS*	44			420	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.70			44.7	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.2						
Dry Matter (%)	95						
Moisture (%)	5.1						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.					** = UKAS accredited (liquid eluate analysis only)		
Stated limits are for guidance only and I2 cannot be held responsible for any discrepancies with current legislation					** = MCFRTS accredited		

Results are expressed on a dry weight basis, after correction for moisture content where applicable.

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

i2 Analytical

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email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	21-76586						
					Client: BSL		
Location	Victoria House Great Ancoals Street Manchester						
Lab Reference (Sample Number)	1879621 / 1879622				Landfill Waste Acceptance Criteria		
Sampling Date					Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS03						
Depth (m)	0.30-0.80						
Solid Waste Analysis							
TOC (%)**	1.1				3%	5%	6%
Loss on Ignition (%) **	3.1				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	110				500	--	--
Total PAH (WAC-17) (mg/kg)	41.5				100	--	--
pH (units)**	9.2				--	>6	--
Acid Neutralisation Capacity (mol / kg)	26				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:1	Limit values for compliance leaching test		
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0116			0.0918	0.5	2	25
Barium *	0.0213			0.169	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0059			0.047	0.5	10	70
Copper *	0.017			0.13	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0032			0.0251	0.5	10	30
Nickel *	0.0030			0.024	0.4	10	40
Lead *	0.0011			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0036			0.029	4	50	200
Chloride *	4.1			33	800	15000	25000
Fluoride	0.42			3.4	10	150	500
Sulphate *	43			340	1000	20000	50000
TDS*	120			980	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.40			58.6	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.0						
Dry Matter (%)	91						
Moisture (%)	8.6						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.					* = UKAS accredited (liquid eluate analysis only)		
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation					** = MCERTS accredited		

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



Analytical Report Number : 21-76586

Project / Site name: Victoria House Great Ancoals Street Manchester

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1879619	WS01	None Supplied	0.30-0.50	Brown loam with gravel.
1879621	WS03	None Supplied	0.30-0.80	Brown loam with gravel.

Analytical Report Number : 21-76586

Project / Site name: Victoria House Great Ancoals Street Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025

Analytical Report Number : 21-76586

Project / Site name: Victoria House Great Ancoals Street Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Sample Deviation Report



Analytical Report Number : 21-76586

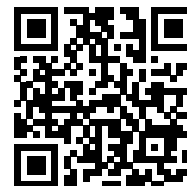
Project / Site name: Victoria House Great Ancoals Street Manchester

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS01	None Supplied	L	1879620	a	None Supplied	None Supplied	None Supplied
WS01	None Supplied	S	1879619	a	None Supplied	None Supplied	None Supplied
WS03	None Supplied	L	1879622	a	None Supplied	None Supplied	None Supplied
WS03	None Supplied	S	1879621	a	None Supplied	None Supplied	None Supplied

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



SMBTQ-AFYCYC-L4QFB

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in **pale yellow**.

Job name

Victoria House, Great Ancoats Street, Manchester

Description/Comments

Project

C4742

Site

Victoria House, Great Ancoats Street, Manchester

Classified by

Name: **Nicola Swallow**
Date: **14 Jul 2021 10:55 GMT**
Telephone: **01606 334 844**
Company: **Brownfield Solutions Limited**
William Smith House
173-183 Witton Street
Northwich
CW9 5LP

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

Course
Hazardous Waste Classification

Date

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01	0.50-1.10	Non Hazardous		2
2	WS02	0.30-0.50	Non Hazardous		4
3	WS03	0.30-0.80	Non Hazardous		7
4	WS04	0.25-0.60	Hazardous	HP 10, HP 14	10
5	BH2	0.30-1.00	Non Hazardous		12

Related documents

#	Name	Description
1	BSL Suite	waste stream template used to create this Job

Report

Created by: Nicola Swallow

Created date: 14 Jul 2021 10:55 GMT

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	14
Appendix B: Rationale for selection of metal species	15
Appendix C: Version	16



Classification of sample: WS01

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS01	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.50-1.10 m	
Moisture content:	
5.1%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 5.1% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				9.4	pH		9.4	pH	9.4 pH		
2	arsenic { arsenic trioxide }				5.2	mg/kg	1.32	6.516	mg/kg	0.000652 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	0.6	mg/kg	1.285	0.732	mg/kg	0.0000569 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				9.4	mg/kg	1.462	13.038	mg/kg	0.0013 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				71	mg/kg	1.126	75.861	mg/kg	0.00759 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	54	mg/kg		51.246	mg/kg	0.00512 %	✓	
	082-001-00-6											
8	mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
9	nickel { nickel dihydroxide }				8.2	mg/kg	1.579	12.291	mg/kg	0.00123 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8											
11	zinc { zinc oxide }				110	mg/kg	1.245	129.936	mg/kg	0.013 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
12	naphthalene				1	mg/kg		0.949	mg/kg	0.0000949 %	✓	
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				1.1	mg/kg		1.044	mg/kg	0.000104 %	✓	
		201-469-6	83-32-9									
15	fluorene				0.92	mg/kg		0.873	mg/kg	0.0000873 %	✓	
		201-695-5	86-73-7									



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		5.7 mg/kg		5.409 mg/kg	0.000541 %	✓	
17	anthracene	204-371-1	120-12-7		1.5 mg/kg		1.424 mg/kg	0.000142 %	✓	
18	fluoranthene	205-912-4	206-44-0		4.9 mg/kg		4.65 mg/kg	0.000465 %	✓	
19	pyrene	204-927-3	129-00-0		5 mg/kg		4.745 mg/kg	0.000475 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		2.1 mg/kg		1.993 mg/kg	0.000199 %	✓	
21	chrysene	601-048-00-0	205-923-4		1.8 mg/kg		1.708 mg/kg	0.000171 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1.9 mg/kg		1.803 mg/kg	0.00018 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.81 mg/kg		0.769 mg/kg	0.0000769 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		1.9 mg/kg		1.803 mg/kg	0.00018 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.91 mg/kg		0.864 mg/kg	0.0000864 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.05 mg/kg		<0.05 mg/kg	<0.000005 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		1.2 mg/kg		1.139 mg/kg	0.000114 %	✓	
28	asbestos	650-013-00-6	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<		<	<		ND
Total:								0.0323 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Classification of sample: WS02

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.30-0.50 m	
Moisture content:	
13%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 13% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				8.8	pH		8.8	pH	8.8 pH		
2	arsenic { arsenic trioxide }				17	mg/kg	1.32	19.528	mg/kg	0.00195 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				83	mg/kg	1.462	105.539	mg/kg	0.0106 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				59	mg/kg	1.126	57.792	mg/kg	0.00578 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	500	mg/kg		435	mg/kg	0.0435 %	✓	
	082-001-00-6											
8	mercury { mercury dichloride }				0.6	mg/kg	1.353	0.707	mg/kg	0.0000707 %	✓	
	080-010-00-X	231-299-8	7487-94-7									
9	nickel { nickel dihydroxide }				23	mg/kg	1.579	31.606	mg/kg	0.00316 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8											
11	zinc { zinc oxide }				130	mg/kg	1.245	140.777	mg/kg	0.0141 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-469-6	83-32-9									
15	fluorene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		201-695-5	86-73-7									



#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number								
16	phenanthrene		201-581-5	85-01-8		2 mg/kg		1.74 mg/kg	0.000174 %	✓		
17	anthracene		204-371-1	120-12-7		1.1 mg/kg		0.957 mg/kg	0.0000957 %	✓		
18	fluoranthene		205-912-4	206-44-0		7.9 mg/kg		6.873 mg/kg	0.000687 %	✓		
19	pyrene		204-927-3	129-00-0		8.2 mg/kg		7.134 mg/kg	0.000713 %	✓		
20	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		3.9 mg/kg		3.393 mg/kg	0.000339 %	✓		
21	chrysene	601-048-00-0	205-923-4	218-01-9		2.9 mg/kg		2.523 mg/kg	0.000252 %	✓		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		4.8 mg/kg		4.176 mg/kg	0.000418 %	✓		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		1.3 mg/kg		1.131 mg/kg	0.000113 %	✓		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		4.3 mg/kg		3.741 mg/kg	0.000374 %	✓		
25	indeno[123-cd]pyrene		205-893-2	193-39-5		2.3 mg/kg		2.001 mg/kg	0.0002 %	✓		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.66 mg/kg		0.574 mg/kg	0.0000574 %	✓		
27	benzo[ghi]perylene		205-883-8	191-24-2		3.1 mg/kg		2.697 mg/kg	0.00027 %	✓		
28	TPH (C6 to C40) petroleum group			TPH		174 mg/kg		151.38 mg/kg	0.0151 %	✓		
29	benzene	601-020-00-8	200-753-7	71-43-2		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
30	toluene	601-021-00-3	203-625-9	108-88-3		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
31	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
32	xylene	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
33	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.001 mg/kg		<0.001 mg/kg	<0.0000001 %		<LOD	
34	asbestos	650-013-00-6	-----	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<		<	<		ND	
Total:									0.0983 %			

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- ND Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous property to non hazardous because The absence of a free draining liquid and the relatively low concentrations of short-chain hydrocarbons reported indicates that this hazard property is not applicable to this waste.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0151%)



Classification of sample: WS03

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:	
WS03	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.30-0.80 m		
Moisture content:		
8.6%		
(wet weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 8.6% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	■ pH		PH		10.1	pH		10.1	pH	10.1 pH		
2	arsenic { arsenic trioxide }				18	mg/kg	1.32	21.722	mg/kg	0.00217 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				26	mg/kg	1.462	34.732	mg/kg	0.00347 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				140	mg/kg	1.126	144.069	mg/kg	0.0144 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	380	mg/kg		347.32	mg/kg	0.0347 %	✓	
	082-001-00-6											
8	mercury { mercury dichloride }				<0.3	mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
9	nickel { nickel dihydroxide }				18	mg/kg	1.579	25.986	mg/kg	0.0026 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8											
11	zinc { zinc oxide }				150	mg/kg	1.245	170.65	mg/kg	0.0171 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.86	mg/kg		0.786	mg/kg	0.0000786 %	✓	
		201-469-6	83-32-9									
15	fluorene				0.58	mg/kg		0.53	mg/kg	0.000053 %	✓	
		201-695-5	86-73-7									



#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value		MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number										
16	phenanthrene					5.4	mg/kg		4.936	mg/kg	0.000494 %	✓		
		201-581-5		85-01-8										
17	anthracene					1.6	mg/kg		1.462	mg/kg	0.000146 %	✓		
		204-371-1		120-12-7										
18	fluoranthene					9.5	mg/kg		8.683	mg/kg	0.000868 %	✓		
		205-912-4		206-44-0										
19	pyrene					9.6	mg/kg		8.774	mg/kg	0.000877 %	✓		
		204-927-3		129-00-0										
20	benzo[a]anthracene					3.8	mg/kg		3.473	mg/kg	0.000347 %	✓		
		601-033-00-9	200-280-6	56-55-3										
21	chrysene					4	mg/kg		3.656	mg/kg	0.000366 %	✓		
		601-048-00-0	205-923-4	218-01-9										
22	benzo[b]fluoranthene					4.5	mg/kg		4.113	mg/kg	0.000411 %	✓		
		601-034-00-4	205-911-9	205-99-2										
23	benzo[k]fluoranthene					2	mg/kg		1.828	mg/kg	0.000183 %	✓		
		601-036-00-5	205-916-6	207-08-9										
24	benzo[a]pyrene; benzo[def]chrysene					4.3	mg/kg		3.93	mg/kg	0.000393 %	✓		
		601-032-00-3	200-028-5	50-32-8										
25	indeno[123-cd]pyrene					2.1	mg/kg		1.919	mg/kg	0.000192 %	✓		
		205-893-2		193-39-5										
26	dibenz[a,h]anthracene					0.61	mg/kg		0.558	mg/kg	0.0000558 %	✓		
		601-041-00-2	200-181-8	53-70-3										
27	benzo[ghi]perylene					2.6	mg/kg		2.376	mg/kg	0.000238 %	✓		
		205-883-8		191-24-2										
28	TPH (C6 to C40) petroleum group					363.1	mg/kg		331.873	mg/kg	0.0332 %	✓		
				TPH										
29	benzene					<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD	
		601-020-00-8	200-753-7	71-43-2										
30	toluene					<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD	
		601-021-00-3	203-625-9	108-88-3										
31	ethylbenzene					<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD	
		601-023-00-4	202-849-4	100-41-4										
32	xylene					<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD	
		601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]										
33	polychlorobiphenyls; PCB					<0.001	mg/kg		<0.001	mg/kg	<0.0000001 %		<LOD	
		602-039-00-4	215-648-1	1336-36-3										
34	asbestos					<			<		<		ND	
		650-013-00-6	-----	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5										
Total:												0.113 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification



Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and ≤ 75°C"

Force this Hazardous property to non hazardous because The absence of a free draining liquid and the relatively low concentrations of short-chain hydrocarbons reported indicates that this hazard property is not applicable to this waste.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0332%)



Classification of sample: WS04

 **Hazardous Waste**
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample name:	LoW Code:
WS04	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 03 * (Soil and stones containing hazardous substances)
0.25-0.60 m	
Moisture content:	
9%	
(wet weight correction)	

Hazard properties

HP 10: Toxic for reproduction "waste which has adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring"

Hazard Statements hit:

Repr. 1A; H360Df "May damage the unborn child. Suspected of damaging fertility."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex: (Note 1 conc.: 0.373%)

HP 14: Ecotoxic "waste which presents or may present immediate or delayed risks for one or more sectors of the environment"

Hazard Statements hit:

Aquatic Chronic 1; H410 "Very toxic to aquatic life with long lasting effects."

Because of determinand:

lead compounds with the exception of those specified elsewhere in this Annex: (Note 1 conc.: 0.373%)

Determinands

Moisture content: 9% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	pH				7.3 pH		7.3	pH	7.3 pH		
2	arsenic { arsenic trioxide }				95 mg/kg	1.32	114.142	mg/kg	0.0114 %	✓	
	033-003-00-0	215-481-4	1327-53-3								
3	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6								
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2 mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0								
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				83 mg/kg	1.462	110.391	mg/kg	0.011 %	✓	
		215-160-9	1308-38-9								
6	copper { dicopper oxide; copper (I) oxide }				380 mg/kg	1.126	389.332	mg/kg	0.0389 %	✓	
	029-002-00-X	215-270-7	1317-39-1								
7	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	4100 mg/kg		3731	mg/kg	0.373 %	✓	
	082-001-00-6										
8	mercury { mercury dichloride }				<0.3 mg/kg	1.353	<0.406	mg/kg	<0.0000406 %		<LOD
	080-010-00-X	231-299-8	7487-94-7								



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
9	nickel { nickel dihydroxide }				94 mg/kg	1.579	135.11 mg/kg	0.0135 %		✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1 mg/kg	1.405	<1.405 mg/kg	<0.000141 %			<LOD
	034-002-00-8										
11	zinc { zinc oxide }				700 mg/kg	1.245	792.883 mg/kg	0.0793 %		✓	
	030-013-00-7	215-222-5	1314-13-2								
12	naphthalene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
13	acenaphthylene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
		205-917-1	208-96-8								
14	acenaphthene				<0.05 mg/kg		<0.05 mg/kg	<0.000005 %			<LOD
		201-469-6	83-32-9								
15	fluorene				0.25 mg/kg		0.228 mg/kg	0.0000228 %		✓	
		201-695-5	86-73-7								
16	phenanthrene				2.6 mg/kg		2.366 mg/kg	0.000237 %		✓	
		201-581-5	85-01-8								
17	anthracene				0.66 mg/kg		0.601 mg/kg	0.0000601 %		✓	
		204-371-1	120-12-7								
18	fluoranthene				4.4 mg/kg		4.004 mg/kg	0.0004 %		✓	
		205-912-4	206-44-0								
19	pyrene				4.8 mg/kg		4.368 mg/kg	0.000437 %		✓	
		204-927-3	129-00-0								
20	benzo[a]anthracene				2.8 mg/kg		2.548 mg/kg	0.000255 %		✓	
	601-033-00-9	200-280-6	56-55-3								
21	chrysene				2.7 mg/kg		2.457 mg/kg	0.000246 %		✓	
	601-048-00-0	205-923-4	218-01-9								
22	benzo[b]fluoranthene				3.5 mg/kg		3.185 mg/kg	0.000319 %		✓	
	601-034-00-4	205-911-9	205-99-2								
23	benzo[k]fluoranthene				0.91 mg/kg		0.828 mg/kg	0.0000828 %		✓	
	601-036-00-5	205-916-6	207-08-9								
24	benzo[a]pyrene; benzo[def]chrysene				2.9 mg/kg		2.639 mg/kg	0.000264 %		✓	
	601-032-00-3	200-028-5	50-32-8								
25	indeno[123-cd]pyrene				1.4 mg/kg		1.274 mg/kg	0.000127 %		✓	
		205-893-2	193-39-5								
26	dibenz[a,h]anthracene				0.54 mg/kg		0.491 mg/kg	0.0000491 %		✓	
	601-041-00-2	200-181-8	53-70-3								
27	benzo[ghi]perylene				1.8 mg/kg		1.638 mg/kg	0.000164 %		✓	
		205-883-8	191-24-2								
28	asbestos				<		<	<			ND
	650-013-00-6	-----	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5								
Total:									0.53 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: BH2

 **Non Hazardous Waste**
 Classified as **17 05 04**
 in the List of Waste

Sample details

Sample name:	LoW Code:
BH2	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.30-1.00 m	
Moisture content:	
9.9%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 9.9% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	pH				11.1	pH		11.1	pH	11.1 pH		
2	arsenic { arsenic trioxide }				28	mg/kg	1.32	33.309	mg/kg	0.00333 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
3	cadmium { cadmium sulfide }			1	<0.2	mg/kg	1.285	<0.257	mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6									
4	chromium in chromium(VI) compounds { chromium(VI) oxide }				<1.2	mg/kg	1.923	<2.308	mg/kg	<0.000231 %		<LOD
	024-001-00-0	215-607-8	1333-82-0									
5	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				28	mg/kg	1.462	36.872	mg/kg	0.00369 %	✓	
		215-160-9	1308-38-9									
6	copper { dicopper oxide; copper (I) oxide }				69	mg/kg	1.126	69.995	mg/kg	0.007 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
7	lead { lead compounds with the exception of those specified elsewhere in this Annex }			1	350	mg/kg		315.35	mg/kg	0.0315 %	✓	
	082-001-00-6											
8	mercury { mercury dichloride }				0.8	mg/kg	1.353	0.976	mg/kg	0.0000976 %	✓	
	080-010-00-X	231-299-8	7487-94-7									
9	nickel { nickel dihydroxide }				22	mg/kg	1.579	31.309	mg/kg	0.00313 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
10	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<1	mg/kg	1.405	<1.405	mg/kg	<0.000141 %		<LOD
	034-002-00-8											
11	zinc { zinc oxide }				310	mg/kg	1.245	347.661	mg/kg	0.0348 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.39	mg/kg		0.351	mg/kg	0.0000351 %	✓	
		201-469-6	83-32-9									
15	fluorene				0.32	mg/kg		0.288	mg/kg	0.0000288 %	✓	
		201-695-5	86-73-7									



#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
16	phenanthrene	201-581-5	85-01-8		3.7 mg/kg		3.334 mg/kg	0.000333 %	✓	
17	anthracene	204-371-1	120-12-7		1.1 mg/kg		0.991 mg/kg	0.0000991 %	✓	
18	fluoranthene	205-912-4	206-44-0		7.3 mg/kg		6.577 mg/kg	0.000658 %	✓	
19	pyrene	204-927-3	129-00-0		7.1 mg/kg		6.397 mg/kg	0.00064 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		3.3 mg/kg		2.973 mg/kg	0.000297 %	✓	
21	chrysene	601-048-00-0	205-923-4		2.9 mg/kg		2.613 mg/kg	0.000261 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		4.4 mg/kg		3.964 mg/kg	0.000396 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		1.3 mg/kg		1.171 mg/kg	0.000117 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		3.8 mg/kg		3.424 mg/kg	0.000342 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		2 mg/kg		1.802 mg/kg	0.00018 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.58 mg/kg		0.523 mg/kg	0.0000523 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		2.5 mg/kg		2.253 mg/kg	0.000225 %	✓	
28	asbestos	650-013-00-6	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<		<	<		ND
Total:								0.0876 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- ND** Not detected
- CLP: Note 1 Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

■ pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

■ chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4 H332 , Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Resp. Sens. 1 H334 , Skin Sens. 1 H317 , Repr. 1B H360FD , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ lead compounds with the exception of those specified elsewhere in this Annex

CLP index number: 082-001-00-6
Description/Comments: Least-worst case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following CLP protocols, considers many simple lead compounds to be Carcinogenic category 2
Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)
Additional Hazard Statement(s): Carc. 2 H351
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium
www.reach-lead.eu/substanceinformation.html. Review date 29/09/2015

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4 H302 , Acute Tox. 1 H330 , Acute Tox. 1 H310 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Aquatic Chronic 2 H411

■ fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Carc. 2 H351 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Skin Irrit. 2 H315

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4 H302 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2 H315 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

▪ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2 H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

▪ **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: Flam. Liq. 3 H226 , Asp. Tox. 1 H304 , STOT RE 2 H373 , Muta. 1B H340 , Carc. 1B H350 , Repr. 2 H361d , Aquatic Chronic 2 H411

▪ **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

CLP index number: 601-023-00-4

Description/Comments:

Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)

Additional Hazard Statement(s): Carc. 2 H351

Reason for additional Hazards Statement(s):

03 Jun 2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

▪ **polychlorobiphenyls; PCB** (EC Number: 215-648-1, CAS Number: 1336-36-3)

CLP index number: 602-039-00-4

Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans; POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.

Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)

Additional Hazard Statement(s): Carc. 1A H350

Reason for additional Hazards Statement(s):

29 Sep 2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on hazard statements

cadmium {cadmium sulfide}

Worst case species based on hazard statements

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case species based on hazard statements

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Worst case species based on hazard statements

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead compounds with the exception of those specified elsewhere in this Annex}

The absence of chromium VI within the soil samples indicates that lead chromate could not be present within the site soils. The sample was collected from an area overlain with hardstanding suggesting that soluble lead form may still remain. Given this the next most conservative lead species has been selected.

mercury {mercury dichloride}

Worst case species based on hazard statements

nickel {nickel dihydroxide}

Worst case species based on hazard statements

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on hazard statements



zinc {zinc oxide}

The absence of chromium VI within the soil samples indicates that zinc chromate could not be present within the site soils. The sample was collected from an area overlain with hardstanding suggesting that soluble zinc form may still remain. Given this the next most conservative zinc species has been selected.

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.1, May 2018**

HazWasteOnline Classification Engine Version: 2021.187.4816.9162 (06 Jul 2021)

HazWasteOnline Database: 2021.187.4816.9162 (06 Jul 2021)

This classification utilises the following guidance and legislation:

WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2019 - UK: 2019 No. 720 of 27th March 2019

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020

POPs Regulation 2019 - Regulation (EU) 2019/1021 of 20 June 2019

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