BROWNFIELD SOLUTIONS LTD

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

# FG VIVERE MANCHESTER LTD

## Cornbrook Residential, Manchester

Phase II Geo-Environmental Assessment Report

AH/C5540/13714 Rev A

February 2025

| EXECUTIVE SUMMARY | |
|---|---|
| **Location and Brief Site Description** | The site is located off Cornbrook Road, Manchester, M15 4WB, centred on National Grid Reference 382409, 397044. |
| **Ground Conditions** | Generalised ground conditions from the ground investigation comprise (top down):<br>• Made ground encountered from ground level to between 0.40m and 2.30m bgl.<br>• Natural strata encountered from 0.40m bgl to between 6.80m and 7.30m bgl.<br>• Solid geology encountered from 6.80m bgl to 26.00m bgl.<br>• Groundwater recorded between 0.87m and 7.00m bgl. |
| **Human Health - Soils Contamination** | • Minor elevations of heavy metals within one order of magnitude of the screening value of the general made ground was identified.<br>• Elevations within two orders of magnitude of the screening values were identified within the made ground of SA04. |
| **Controlled Waters – Surface and Groundwater Contamination** | • The risk is considered low and no further assessment is required. |
| **Ground Gas** | Based on the monitoring, the site is classified as CS1 – No protection is required. |
| **Outline Remedial Strategy** | Subject to regulatory approval, the following outline remedial strategy is recommended:<br>• Source removal of elevated naphthalene local to ashy made ground associated with SA04;<br>• Cover system with 450mm thick of 'clean' validated topsoil/subsoil in soft landscaping areas.<br>• Verification of the above with validation reports produced. |
| **Waste** | Made ground –is classified as non-hazardous. |
| **Foundations and Floor Slabs** | Piled foundations are considered the most suitable foundation option socketed into the competent sandstone bedrock<br><br>As a preliminary guide, allowable axial loads for a circular pile range between 3.7MN for a 600mm diameter pile with 5m embedment up to 12.7MN for a 900mm diameter pile with 15m embedment.<br><br>Detailed foundation design will need to be completed by a suitably qualified specialist. |
| **Concrete Classification** | Made Ground: DS3 AC-3 conditions prevail.<br>Natural superficial strata: DS1 AC-1 conditions prevail.<br>Bedrock: DS1 AC-1 conditions prevail. |
| **Highways Design** | Made Ground CBR – 2%<br>Superficial Strata CBR – cohesive/fine soils– 5%<br>Superficial Strata CBR – granular/coarse soils– 40%<br>The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction. |
| **Site Drainage** | Indicative soil infiltration rates range from $10^{-3}$m/s to $10^{-7}$m/s. Drainage to soakaways is considered potentially suitable or this site. |
| **Further Work** | The following further works will be required to progress to the construction phase:<br>• Detailed foundation design by a structural engineer.<br>• Design of Remedial Strategy and confirmation with the Local Authority /EA / warranty provider.<br>• Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.<br>• Implementation of the Remedial Strategy and verification of the remedial works. |

This executive summary should be read in conjunction with the full report, reference AH/C5540/13714 Rev A and not as a standalone document. Report template version 4.5.

## PROJECT QUALITY CONTROL DATA SHEET

| | | | |
|---|---|---|---|
| **Site Name:** | Cornbrook Residential, Manchester | | |
| **Document Name:** | Phase II Geo-Environmental Assessment Report | | |
| **Reference:** | AH/C5540/13714 Rev A | | |
| **Status:** | - | 25/11/2024 | Interim. |
| | A | 03/02/2025 | Updated with the Completion of the Gas Monitoring Programme. |
| | | | |

| **Issued By:** | **Client:** | **Engineer** |
|---|---|---|
| Brownfield Solutions Ltd<br>William Smith House<br>173 – 183 Witton Street<br>Northwich<br>Cheshire<br>CW9 5LP<br><br>Tel: 01606 334 844<br>brownfield-solutions.com | FG Vivere Manchester Ltd<br>14 Wood Street,<br>Bolton,<br>England,<br>BL1 1DY | Renaissance Associates Ltd<br>Carvers Warehouse<br>77 Dale Street<br>Manchester<br>M1 2HG |
| | Contact: Lyndon Forshaw | Contact: Aria Shino |

| Written by: | Checked by: | Approved by: |
|---|---|---|
| A Hunt | N Swallow | J Mather |
| BSc (Hons) FGS | BSc (Hons) MSc MIEnvSc | BSc (Hons) MIEnvSc FGS |
| Graduate Project Engineer | Principal Project Engineer | Senior Project Engineer |

## CONTENTS

**1.0 INTRODUCTION ..... 1**

1.1 Context ..... 1
1.2 Proposed Development ..... 1
1.3 Previous Reports ..... 1
1.4 Objectives and Scope ..... 1
1.5 Limitations ..... 1

**2.0 THE SITE ..... 4**

2.1 Location ..... 4
2.2 Site Description ..... 4

**3.0 SUMMARY OF PREVIOUS REPORTS ..... 5**

**4.0 METHOD OF INVESTIGATION ..... 6**

4.1 Objectives ..... 6
4.2 Site Works ..... 6
4.3 Sampling Strategy ..... 7
4.4 Laboratory Testing ..... 7
4.5 Monitoring ..... 8

**5.0 GROUND CONDITIONS ..... 9**

5.1 Summary ..... 9
5.2 Made Ground ..... 9
5.3 Natural Superficial Strata ..... 9
5.4 Solid Geology ..... 9
5.5 Groundwater ..... 10
5.6 Observations ..... 10

**6.0 TEST RESULTS ..... 12**

6.1 Geotechnical Laboratory Testing ..... 12
6.2 Aggressive Ground Conditions – Geotechnical Chemical Testing ..... 12
6.3 In Situ Geotechnical Testing ..... 12
6.4 Geo-Environmental Testing ..... 13

**7.0 GEOTECHNICAL ASSESSMENT ..... 14**

7.1 Ground Model ..... 14
7.2 Design Soil Parameters ..... 14
7.3 Foundations ..... 17
7.4 Floor Slabs ..... 19
7.5 Site Preparation and Construction ..... 20
7.6 Concrete Classification ..... 20
7.7 Highways ..... 21
7.8 Site Drainage ..... 21

**8.0 GEO-ENVIRONMENTAL RISK ASSESSMENT ..... 23**

8.1 Introduction ..... 23
8.2 Soils Test Results and Risk Assessment – Human Health ..... 23
8.3 Summary – Human Health Risk Assessment ..... 25
8.4 Soil, Water and Leachate Test Results – Controlled Waters ..... 25
8.5 Permanent Ground Gas and Vapours Results ..... 25
8.6 Ground Gas Risk Assessment ..... 25
8.7 Qualitative Risk Assessment ..... 26
8.8 Outline Remedial Measures ..... 29
8.9 Health and Safety Issues ..... 29

## CONTENTS

**9.0 WASTE SOIL CLASSIFICATION & ASSESSMENT ..... 31**

9.1 SUMMARY ..... 31
9.2 SOILS WASTE CLASSIFICATION PROCEDURE ..... 31
9.3 WASTE CLASSIFICATION AND WASTE ACCEPTANCE CRITERIA (WAC) ..... 32
9.4 RE-USE OF SOILS ..... 33

**10.0 CONCLUSIONS ..... 35**

10.1 GEO-ENVIRONMENTAL ..... 35
10.2 GEOTECHNICAL ..... 35
10.3 FURTHER WORK ..... 35

**11.0 ABBREVIATIONS AND DEFINITIONS ..... 36**

**12.0 REFERENCES ..... 39**

## DRAWINGS

| Drawing Number | Rev | Title |
|---|---|---|
| 8353-LRW-ZZ-00-DR-A-00-178 | P15 | Proposed Development Layout Plan (Ground Floor) |
| C5540/01 | - | Site Location Plan |
| C5540/02 | - | Site Features Plan |
| C5540/03 | - | Exploratory Hole Location Plan |

## APPENDICIES

| 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 Phase II Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for FG Vivere Manchester Ltd on a site off Dinton Street, Manchester and has been completed in general accordance with the following guidance:

- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
- 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.

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 residential end use comprising a 24-storey apartment building with associated car park areas, highways, public open space (POS) areas and infrastructure as shown on the proposed development plan, drawing No. 8353-LRW-ZZ-00-DR-A-00-178 P15 provided to BSL by the client.

## 1.3 Previous Reports

This report should be read in conjunction with BSL Phase I Geo-Environmental Assessment Report (AH/C5540/12504) issued in October 2023.

## 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.

The factual and interpretive Phase II sections of this report are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance. 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 Desk Study, 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 trial pitting, window sampling, cable percussive drilling, rotary drilling, ground 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, FG Vivere Manchester 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. This report may not be relied upon by the client or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full.

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.

Asbestos in structures was not covered in this report. It should be noted that an asbestos demolition survey will be required prior to any demolition of structures. If asbestos is present in soils, these will need to be dealt with in accordance with the Control of Asbestos Regulations (CAR) 2012.

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 Cornbrook Road, Manchester, M15 4WB, centred on National Grid Reference 382409, 397044 as shown on the Site Location Plan, Drawing No. C5540/01.

## 2.2 Site Description

A site reconnaissance survey was carried out at the site on 5th October 2023. The main site features and potential issues identified are detailed below and are shown on the Site Features Plan, Drawing No. C5540/02. A selection of photographs from the site walkover are presented to the rear of this report.

| Feature | Description |
|---|---|
| Site Area | 0.23 hectares. |
| Site Access | Access to the site is gained off Dinton Street to the north-west. |
| Current Land Use and Site Features | The site comprises a linear cobbled road trending north-west to south-east, edged with asphalt pavement. Remnants of a red brick wall to the south and wooden and concrete fencing to the north of the cobble road. The north-east part of the site comprises a combination of gravel and concrete slab surfacing and the north part of the site comprises intermittent asphalt surfacing with dense vegetation. |
| Potential Sources of Gross Contamination | Localised areas of fly tipping were noted across the site, which could contain unknown contaminants, although no visible asbestos or hydrocarbons were noted during the walkover. |
| Vegetation / Ecology | Vegetation is present across the majority of the site, including shrubs, grasses and small trees, with denser coverage to the south and east which restricted access to an extent. |
| Topography | The site is generally flat, although the cobbled road lies approximately 150-200mm below adjacent areas. |
| Site Boundaries | Wooden hoarding and temporary heras fencing encloses the site. |
| Surrounding Area | The site is set within a mixed residential and commercial area with residential plots to the east and south-east. The site is bordered by a high-rise apartment building to the north-east. A metro line and canal are within 150m to the north to north-west of the site, beyond which is the Manchester Ship Canal circa 200m away from the site. |

## 3.0 SUMMARY OF PREVIOUS REPORTS

A summary of the relevant points from the Phase I Geo-Environmental Assessment report completed by BSL (reference AH/C5540/12504, dated October 2023) is presented below:

- The site has included various industrial uses from pre- 1891 up until the present day, initially covered with terraced housing and public houses. Runcorn Street was constructed prior to 1891 and remains on site as the cobbled street observed during the walkover. An unspecified works, now believed to have been demolished, was present in the centre of the site between approximately 1976 and 2020.
- Historical land use in the surrounding area has been predominantly industrial with numerous works, factories and warehouses with associated tanks and chimneys within the vicinity of the site, in addition to railway sidings and several tracks located to the north-west of the site.
- Geology comprises glaciofluvial sheet deposits in the majority (Secondary A Aquifer), the western corner comprises glacial till. Bedrock comprises Chester Formation - Sandstone (Principal Aquifer).
- No faults are within an influencing distance of the site.
- The site is located within a Coal Mining Reporting Area but not in a development high risk area.
- There are no records of shallow mines in and around the site.
- The nearest watercourse is Corn Brook circa 55m to the southwest of the site.
- The site is located in a Zone 1 floodplain.
- The risk to human health is considered to be low to moderate.
- The risk from ground gas is considered to be moderate and the site is not located in an area requiring radon protection measures.
- The risk to controlled waters is moderate / low.
- The site is located in the UXO high risk zone.
- Recommendations were for an appropriate Phase II ground investigation to be carried out to confirm the identified risks and obtain information for preliminary design.

# 4.0 METHOD OF INVESTIGATION

## 4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Geo-Environmental Assessment.

The aim of the fieldwork was to:

- Investigate ground conditions on the site and the potential need for detailed investigation.
- Install standpipes to allow future monitoring.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.
- Give an assessment of the geo-environmental risks associated with redevelopment of the site.

## 4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation between the dates of 7th November and 11th November 2024 as well as an additional day on the 18th November 2024.

| Method | No. | Range Depths (m bgl) | Purpose |
|---|---|---|---|
| Trial pits – JCB 3CX | 11 | 0.70 – 3.00 | Establish general ground conditions and gain good coverage. Undertake hand shear vanes in cohesive strata to determine soil strengths for preliminary foundation design. TP01 to TP06 SA01, SA02, SA02A to SA04 |
| Cable percussive borehole with Rotary cored boreholes | 3 | 24.50 – 26.00 | Assess deeper ground conditions, carry out SPTs and obtain samples for contamination and geotechnical and testing. Determine soil strengths/densities for preliminary foundation design, as well as to obtain rock core for geotechnical testing and parameters for preliminary foundation design. Installation of ground gas and water monitoring wells. BH01 to BH03 |
| Rotary open boreholes | 2 | 15.00 | To obtain deeper installations to capture groundwater within the bedrock. BH01A & BH03A |
| Infiltration tests (in Trial Pits) | 4 | 1.95 – 2.30 | Obtain infiltration rates for drainage design. SA01, SA02B, SA03, SA04 |

The surveyed locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C5540/04. 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.

As a specialist UXO study, commissioned as part of the Desk Study, identified a medium risk of UXO and in order to minimise the risk to operatives during the ground investigation works, all exploratory locations were scanned with a hand-held magnetometer and works supervised by a specialist UXO surveyor.

No magnetic anomalies were noted.

### 4.3 Sampling Strategy

Representative samples were taken from exploratory holes 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.

Investigatory hole locations were determined by reference to the conditions identified in the preliminary risk assessment. No specific sampling statistics or grid were utilised in this instance.

### 4.4 Laboratory Testing

As part of the initial assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

In the absence of particularly contaminative processes on site and the lack of visual evidence of potential hydrocarbon impaction representative soil samples were screened for the following general suite of determinands 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. | 6 |
| Petroleum Hydrocarbons (TPH CWG) inc BTEX and MTBE. | 2 |
| Asbestos Screen. | 6 |
| 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 |
|---|---|
| pH Value. | 6 |
| Water Soluble Sulphate Contents. | 6 |
| SD1 BRE Full Suite. | 3 |
| Point Load Testing. | 9 |
| Unconfined Compressive Strength (UCS). | 6 |

The Geotechnical Laboratory Testing Results are presented in Appendix D.

## 4.5 Monitoring

Ground gas and ground water monitoring standpipes were installed in a number of boreholes as detailed in the table further below.

A total of 7 monitoring visits were undertaken out of 6 proposed as part of the current scope, in line with the recommendations of BS8485.

All gas monitoring was undertaken using either a GA5000 or 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 ($O_2$), carbon dioxide ($CO_2$) and methane ($CH_4$) 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 |
|---|---|---|---|---|
| BH01 | 50mm HDPE | 1.50 – 7.00 | Superficial | Ground Gas |
| BH01A | 50mm HDPE | 8.00 – 15.00 | Bedrock | Ground Gas & Groundwater |
| BH02 | 50mm HDPE | 0.20 – 1.20 | Made Ground | Ground Gas |
| BH03 | 50mm HDPE | 1.50 – 6.50 | Superficial | Ground Gas |
| BH03A | 50mm HDPE | 7.00 – 15.00 | Bedrock | Ground Gas & Groundwater |

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.

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 | 0.00 | 0.10 - 0.40 | 0.10 - 0.40 | Concrete |
| | 0.00 - 0.40 | 0.20 – 1.60 | 0.20 – 1.20 | Clayey gravelly sand. |
| | 0.00 – 0.30 | 1.80 – 2.30 | 1.80 – 2.00 | Cobbles. |
| Natural Superficial Strata | 0.40 – 5.30 | 2.00 – 6.50 | 0.83 – 2.80 | Clayey SAND & GRAVEL / SAND with varying amounts of clay, silt and gravel. |
| | 0.50 – 6.50 | 1.17 - 7.30 | 0.30 - 4.10 | Firm to stiff sandy gravelly CLAY. |
| Solid Geology | 6.80 - 7.30 | 24.48 – 26.00 | 5.80 – 17.20 | SANDSTONE. |
| | 13.10 – 24.48 | 13.33 – 25.00 | 0.15 – 0.52 | MUDSTONE (interbedded). |

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 0.40 and 2.30m bgl.

Hardstanding surfacing of concrete was present across the majority of the north of the site recorded between 0.10m and 0.40m thick. Sandstone bricks were present at the surface of SA04 to 0.06m bgl.

The composition of the made ground was fairly consistent across the site and represented demolition material comprising gravelly sand. Cobbles of brick and concrete ranged from low to medium content.

Some ash was identified within the made ground of SA04 between 0.06m and 0.50m bgl.

Brick walls and concrete obstructions associated with previous developments (basements and cellars) were encountered within localised areas of the site within the trial pits (SA02, TP02, TP03 and TP04).

## 5.3 Natural Superficial Strata

The natural strata underlying the site comprised a mixture of firm to stiff clay, silty sand and a sand and gravel with varying amounts of constituents. Natural strata were encountered at the base of the made ground to depths of between 6.80m bgl and 7.30m bgl.

Shear vane readings in the cohesive soils indicate the clays are generally medium and high strength.

## 5.4 Solid Geology

Weak sandstone bedrock was encountered from depths of between 6.80m and 7.30m bgl. This was proven to a maximum depth of 26.00m bgl across the site and is interpreted to represent the Chester Formation.

The discontinuities described generally ranged from being extremely closely to medium spaced, rough, being horizontal to slightly sub-horizontal in orientation with occasional vertical fractures.

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 87%. Similarly, Solid Core Recovery (SCR) ranged between 0% to 100% and averaged 77%.

Rock Quality Designation (RQD) percentages ranged between 0% up to 83%, although considerable variation in the RQD was recorded with depth. Within core runs which commenced in the top 15m bgl, the RQD over the majority of core runs did not exceed 60%.

## 5.5 Groundwater

The depths to groundwater and locations present during site works are shown in the table below:

| Location | Depth During Site Works (m) | Comments |
|---|---|---|
| BH01 – BH03 | NGW | - |
| BH01A, BH03A | 12.00 | - |
| SA01 – SA04 | NGW | - |
| TP01 – TP06 | NGW | - |

NGW – No Groundwater Encountered

Post site works monitoring has revealed the following depths to groundwater:

| Location | Depth During Monitoring Period (range) (m) | |
|---|---|---|
| | Min | Max |
| Overall min/max | 0.87 | 7.00 |
| BH01 | 2.04 | 4.60 |
| BH01A | 1.37 | 7.00 |
| BH02 | 0.87 | NGW |
| BH03 | 2.90 | 6.11 |
| BH03A | 5.47 | 6.11 |

## 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 observed as a minor constituent in the made ground soil within SA04, no other evidence of contamination was observed at the site.

*Stability of Excavations/Boreholes*
The sides of the trial pits were generally unstable due to the presence of deep granular made ground across the site.

*Obstructions*
There are numerous obstructions throughout the made ground on site. The obstructions identified are summarised in the table below:

| Location | Depth (m bgl) | Comments |
|---|---|---|
| SA02 | 0.70 | Concrete. |
| TP02 | 2.00 | Concrete. |
| TP03 | 2.30 | Concrete. |
| TP04 | 1.80 | Concrete. |

*UXO*

No magnetic anomalies were encountered during the works.

# 6.0 TEST RESULTS

## 6.1 Geotechnical Laboratory Testing

*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*IS50 for sandstone (ISRM).

| Point Load Index (MPa) (range) | | UCS Range (MPa) | Method | No. of results |
|---|---|---|---|---|
| Is | IS50 | | | |
| 0.11 – 0.19 | 0.14 - 0.24 | - | Point load (Diametral) | 9 |
| - | | 3.36 – 5.76 | Point load correlation (ISRM) | 9 |
| - | | 10.9 – 11.5 | UCS test | 6 |

## 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 7.7 of this report.

## 6.3 In Situ Geotechnical Testing

*In Situ Hand Shear Vane Tests*
Hand shear vane tests were carried out on suitable cohesive soils where possible. Each shear vane result recorded represents the mean value of three tests undertaken at the specified depth.

The results and distribution of the hand shear vane tests are recorded in kPa on the Exploratory Hole Logs which are presented in Appendix B.

*In Situ Standard Penetration Tests*
Standard Penetration Tests (SPTs) were carried out within the 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.

*Soil Infiltration Test Results*
Soil infiltration test tests were undertaken within trial pits, a summary of the results is presented in the table below. These were carried out in general accordance with BRE Digest 365 (BRE 2016) where infiltration rates allow three test runs during a working day (or where there is no infiltration), but where low infiltration rates were encountered the available time may not have been sufficient to fully comply with the BRE test method.

Where less than three tests were possible in a particular location the results provided should be considered as indicative only. Further discussion concerning the suitability of infiltration testing at the site is provided in Section 7.9.

| Location | Stratum Type | Depth (m) | Infiltration Rate (m/sec) | | |
|---|---|---|---|---|---|
| | | | Test 1 | Test 2 | Test 3 |
| SA01 | Sl gravelly sandy CLAY over clayey SAND and GRAVEL. | 2.00 | $1.02x10^{-4}$ | $4.37x10^{-5}$ | $3.08x10^{-5}$ |
| SA02B | Sl gravelly sandy CLAY. | 1.95 | $1.05x10^{-7}$ | - | - |
| SA03 | Sl gravelly sandy CLAY over Sl clayey gravelly SAND. | 2.30 | $1.09x10^{-3}$ | $2.48x10^{-6}$ | $7.31x10^{-6}$ |
| SA04 | Sl sandy l gravelly CLAY. | 2.30 | $1.78x10^{-5}$ | - | - |

The full test results are presented in Appendix D.

## 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 8.2 of this report.

*Ground Gas Monitoring*
Ground gas monitoring results are presented in Appendix E and are summarised and assessed within Section 8.6 of this report.

# 7.0 GEOTECHNICAL ASSESSMENT

## 7.1 Ground Model

The site is currently a small disused parcel of land with sporadic vegetation surfaced in concrete and made ground. There are known basements and cellars associated with the previous uses within localised areas of the site within the trial pits (SA02, TP02, TP03 and TP04).

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

- Made ground generally comprising clayey gravelly sand from ground level to between 0.20m and 2.30m bgl.
- Natural superficial deposits comprising a mixture of sand, clay and sand and gravel are proven to depths between 6.80m and 7.30m bgl.
- Solid geology comprising sandstone with some thin bands of interbedded mudstone is proven to depths ranging between 24.50m and 26.00m bgl.
- Groundwater was encountered at 12.00m during site works in two locations, with no further groundwater encountered in any other exploratory hole during the site investigation.
- Post site works monitoring levels ranging between 0.87m and 7.00m bgl.

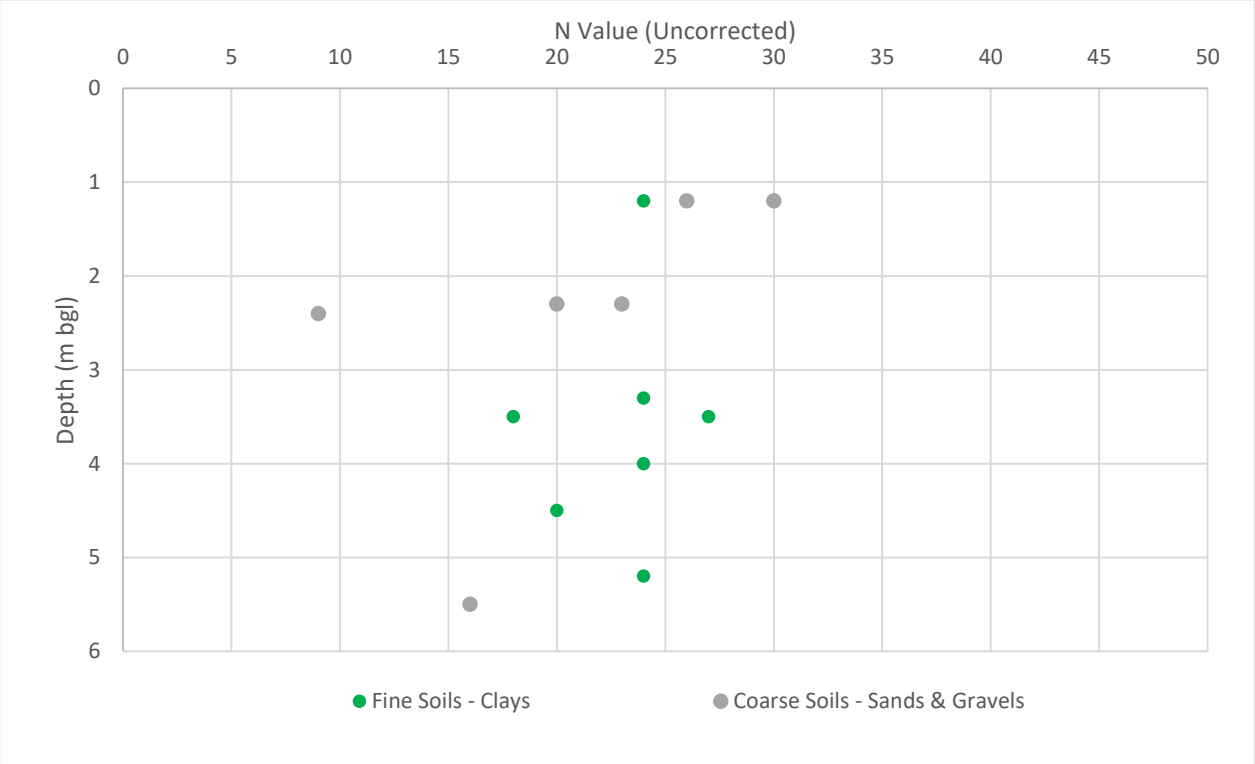
A moderate UXO risk zone spans across the site. There are also numerous concrete obstructions throughout the made ground that will need removal during enabling works.

## 7.2 Design Soil Parameters

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

*Characteristic Values – Made Ground and Shallow Superficial Deposits*
The site is underlain by cohesive and granular superficial deposits.

A depth (m bgl) vs SPT N value graph is provided below to provide a profile of the granular and cohesive materials underlying the site.




The above graph does not show any real correlation between soil density and depth. However, with one exception, all results are greater than 15, meaning stiff cohesive material or medium dense granular material.

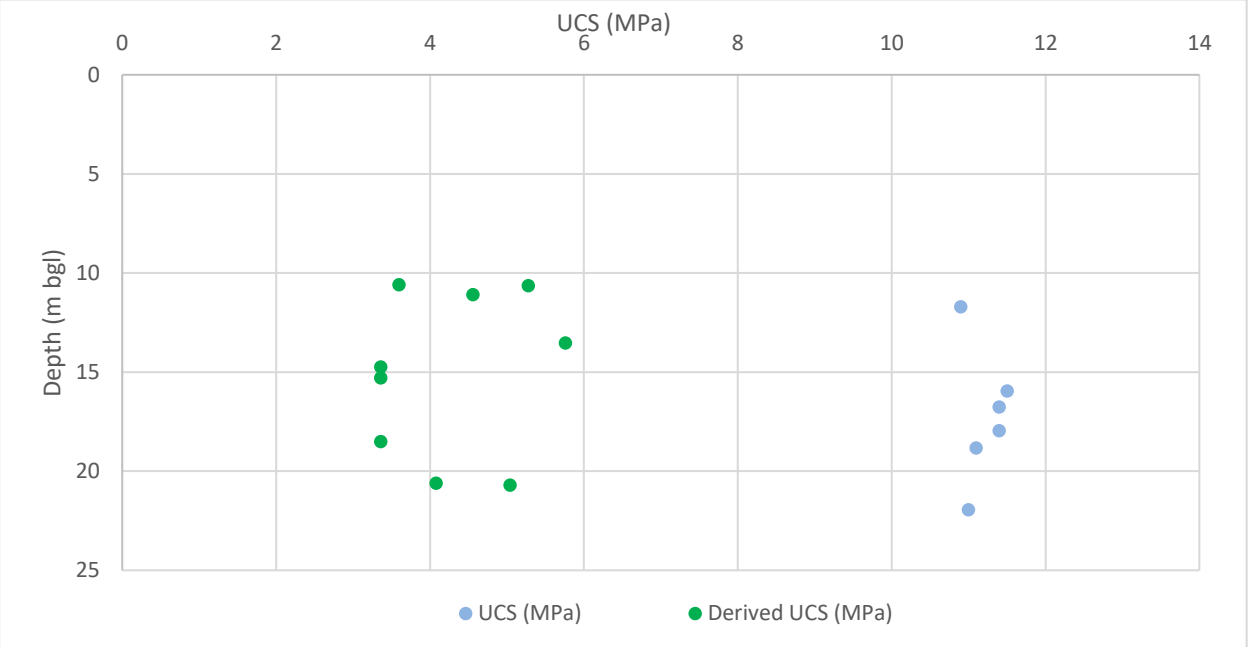
Given the inherent variability of the made ground, characteristic values have not been derived for this stratum.

The characteristic SPT N value in the granular deposits at 1.20m bgl is interpreted to be 27. Therefore, the characteristic ϕ' value at 1.20m bgl is interpreted to be 35° for Ultimate Limit State conditions.

The characteristic SPT N value in the cohesive deposits at 1.20m bgl is interpreted to be 24. Based on the correlation of Stroud (1975) based on 'average' plasticity and adopting an f1 value of 5, this gives a characteristic shear strength of 214 kN/m$^2$.

*Characteristic Values – Solid Geology*
All SPTs undertaken in bedrock refused with an N value of 50.

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*IS50 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 above graph shows a very weak positive correlation between an increase in rock strength with depth. This trend is strengthened with the removal of the correlated Point Load Index results. There do not appear to be any significant or definitive lower strength zones, with the vast majority of results being above 4 MPa (weak rock) as can be expected of the Chester Formation, and all UCS testing data being above 10MPa. Note there is a tendency for bias within the UCS and point load data; UCS is typically undertaken on more intact samples, whereas lower strength area of rock tend to provide samples of rock unsuitable for UCS analysis, hence point load data is used as a proxy for UCS strengths. This should be considered during estimation of characteristic values.

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 | 12 | 10.90 |
| | 17 | 11.35 |
| | 22 | 11.00 |

A graph showing the variations in RQD percentages with depth in each borehole is presented below, where RQD should be considered in respect to reduction factors for shaft resistance during detailed design (Rowe 2001).

The RQD of BH01, BH02 and BH03 averaged 41%, 53% and 28% respectively along the entire profile. Based on the above, the characteristic RQD values for the solid geology underlying the site at various depths have been derived, taking into consideration the averages above and are summarised in the table below, selected to the nearest 5% RQD:

| Bedrock Strata | Depth (m) | Characteristic RQD (%) |
|---|---|---|
| Sandstone | 12 | 29.8 |
| | 17 | 58.1 |
| | 22 | 46.4 |

## 7.3 Foundations

The development will comprise a 24-storey apartment building with associated electrical substation, car parking areas and public open space 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. Note that the made ground, present to depths down to 2.30m bgl, is not considered to be a suitable bearing stratum.

Preliminary structural loads of 3,000 to 3,900kN have been provided by the structural engineer. However, the following recommendations are provisional and should be reviewed at the detailed design stage.

This assessment is based on the existing ground levels and does not take into consideration any cut/fill exercise, which should be considered at the detailed design stage.

*Piles Socketed into Bedrock*
In view of the variation in made ground thickness over the building footprint and the magnitude of the column loads expected to be imposed by the proposed development, the use of shallow foundations is not considered to be feasible. Therefore, the most suitable foundations are considered to be piles extending through the made ground and superficial deposits, socketed into the sandstone bedrock which was observed from depths between 6.80m to 7.30m bgl and proven to a maximum depth of 25.00m bgl.

The selection of pile type and detailed design of pile foundations is typically completed by specialist piling contractors; the following general information is provided for guidance only. Based on the information from the site investigation, a replacement type piled solution will be required, such as rotary bored piles.

To provide a guide on potential requirements, preliminary calculations were undertaken for a circular concrete pile, taking into account shaft resistance, end bearing resistance and potential effects of negative skin friction. For piles socketed into 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, $\delta$ is the angle of interface friction 35°, and $\sigma'_v$ 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 characteristic RQD of 50%, BSL has adopted reduction factor of 0.6 for the ultimate shaft resistance in the preliminary calculations.

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 | | |
|---|---|---|---|---|
| | | 600mm | 750mm | 900mm |
| 12 | 5 | 3.7 | 5.1 | 6.7 |
| 17 | 10 | 5.7 | 7.6 | 9.7 |
| 22 | 15 | 7.7 | 10.1 | 12.7 |

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

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.

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.
- As groundwater was observed during the boring of the intrusive holes and monitoring, temporary casing may be required for bored piles.
- Bored piles through coarse soils will likely result in loosening, with resultant reduced shaft friction.
- Discussions should be made with the pilling 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.
- Driven piling work should be undertaken in accordance with BS EN 12699:2015 'Execution of Special Geotechnical Work - Displacement piles', replacement piles should be carried out in accordance with BS EN 1536:2010(+A1:2015) 'Execution of Special Geotechnical Works - Bored Piles'.
- In accordance with Eurocode 7 it would be prudent to verify the compressive resistance of the strata and the pile design by static load testing on working piles to at least 1.5 times the characteristic load on more than 1% of working piles.

*Working Platform*

Prior to the commencement of penetrative works (piling/vibro), 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/vibro.

*Piling Risk Assessment*

A risk assessment is likely to be necessary for piling and/or the installation of VSCs, as there is a possibility that this could lead to creation of new pathways for migration of contamination.

## 7.4 Floor Slabs

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

Ground bearing slabs may also 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.
- 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.

### 7.5 Site Preparation and Construction

The existing structures will need to be demolished and relict foundations/infrastructure grubbed out. Topsoil and subsoil should be removed from beneath all proposed 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 the natural granular deposits and made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Collapsing of the trial pit sides was observed in the natural strata and temporary shoring maybe required. Otherwise the foundation excavations will be significantly wider than anticipated and costs will be incurred for additional volumes of concrete.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360$^{o}$ or similar) is recommended to maintain the build programme. Breaking equipment may also be required locally to penetrate old foundations associated with intact rock quality strata.

In the centre of the site, underlying the cobble road, ash within the made ground was identified. These materials should be kept away from foundations, floor slabs and utilities where feasible as these soils typically contain sulphates, which reacts with moisture and attacks concrete.

The presence of substantial depths of made ground within localised areas of 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.

Recorded post site works groundwater levels ranged between 1.37m and 6.11m bgl 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.

### 7.6 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 mobile given the site is underlain by granular deposits.

| Stratum | No. Samples | Characteristic $SO_4$ (g/l) | Characteristic pH | DS Class | ACEC Class |
|---|---|---|---|---|---|
| Made Ground | 6 | 1720 | 7 | DS3 | AC-3 |
| Natural Superficial Strata | 2 | 67 | 7.9 | DS1 | AC-1 |
| Solid Geology - Sandstone | 7 | 54 | 7.9 | DS1 | AC-1 |

Based on the above, the results of laboratory pH and sulphate content, alongside the BRE full suite tests, indicate that sulphate class DS-1 and ACEC Class AC-1 conditions are indicated within the natural deposits and bedrock while sulphate class DS3 and ACEC Class AC-3 conditions are indicated within the made ground deposits in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

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.

## 7.7 Highways

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 40% are likely to be achieved in undisturbed natural granular soils and 5% for natural clays soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Equilibrium CBR values are likely to be 2% within the made ground, which is indicated to be present at likely formation levels across the entirety of the site.

Where the CBR is found to be less than 2%, the sub-grade is unlikely to be suitable for both the trafficking of site plant and as a permanent highway foundation without improvement of the soils.

To achieve the required design CBR value, improvement works should be carried out in accordance with DMRB IAN 73/06 Rev 1 Chapter 5 and may include proof rolling, excavation and re-engineering / replacement of weaker soils, the inclusion of a geogrid or use of stabilisation techniques such as the addition of hydraulic binders (e.g. cement/lime).

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.

## 7.8 Site Drainage

The tests undertaken across the site indicate generally good drainage conditions, particularly in the central and southern areas of the site. Based on the infiltration rates obtained, between the orders of $10^{-3}$ and $10^{-7}$ m/s, it is likely that drainage to soakaways will be feasible at the site. We recommend the design of soakaway drainage is carried out in accordance with BRE 365 and CIRIA C753. Consideration should also be given to future maintenance, where infiltration capacity can be reduced as a result of blinding through ingress of fines.

Note the base of any soakaway incorporated into the future development of the site is required to be at least 1m above the water table.

If drainage to soakaways is to be considered, it is suggested that this is discussed with the Local Authority at the earliest opportunity, to confirm the adequacy of proposed testing and to allow their inspection of any test results.

# 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 residential end use without homegrown produce have been adopted as Tier 1 generic screening values.

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:

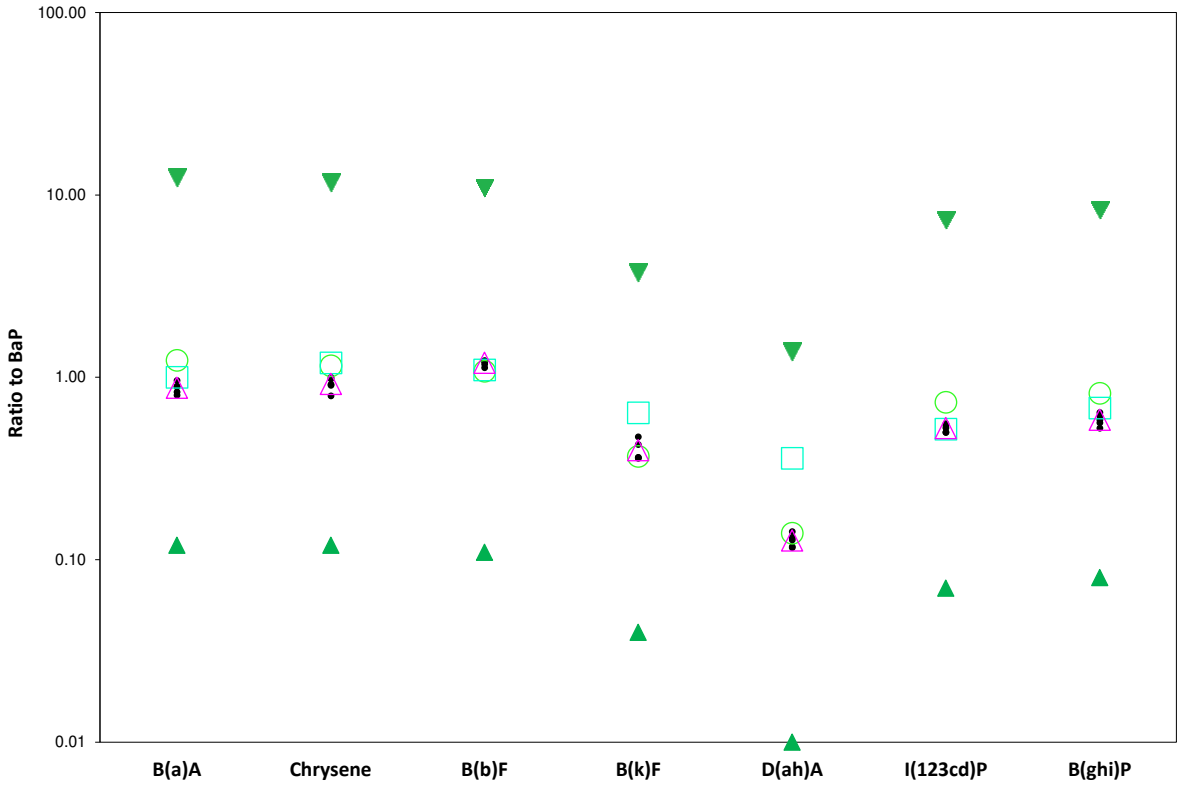
| Exploratory Hole | Depth (m) | Stratum | Metal | Concentration (mg/kg) | Adopted Screening Value (mg/kg) |
|---|---|---|---|---|---|
| TP01 | 0.00-0.05 | Made Ground | Lead | 380 | 310 |
| TP02 | 0.00-0.20 | Made Ground | Lead | 450 | 310 |
| | | | Hexavalent Chromium (VI) | 18 | 6 |
| TP04 | 0.06-0.50 | Made Ground | Lead | 850 | 310 |
| SA03 | 0.00-0.80 | Made Ground | Lead | 560 | 310 |
| | | | Mercury | 1.7 | 1.2 |

*Asbestos*
No asbestos fibres have been detected in any of the 6 samples screened.

*Poly Aromatic Hydrocarbons (PAHs)*
BSL consider the main risk drivers for PAHs to be benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P being one of the most toxic of the PAHs, and naphthalene the most volatile and soluble. Category 4 Screening Levels (C4SLs) suggest the potential use of B(a)P as a surrogate marker for carcinogenic PAHs, if PAH mixtures fall within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible. Given the difference in chemical properties between the two, naphthalene will be treated separately using the LQM S4ULs. Further guidance on this approach is presented in Appendix A.

*PAHs and B(a)P as a Surrogate Marker*
Based on the above approach, the graph below summarises the site data with respect to how the ratios of carcinogenic PAHs relate to B(a)P, within the confidence limits provided in the PHE documents.

Note that results from SA04 are not considered within this approach due to the made ground within this exploratory, assumed to extend across the site under the access road, is not representative of the general made ground underlying the site.




**Key:**

- Ratio to B(a)P for all data
- Mean ratio to B(a)P from all data at the site
- Upper and Lower limits (order of magnitude from Culp data)
- Mean ratio to B(a)P for Culp data
- Mean ratio to B(a)P for UK data presented by PHE

All the data points that could be used to calculate ratios fall inside the upper or lower limits (order of magnitude above or below that of the study material). Based on this distribution of data it is considered that B(a)P can be used as a surrogate marker for carcinogenic PAHs and the C4SL criteria is suitable for this dataset.

Based on the above, no elevated PAHs were recorded across the site. However elevated PAHs were recorded within the SA04 made ground sample and the B(a)P surrogate marker approach wasn't suitable for this sample, the exceedances from this sample are detailed in the table below:

| Exploratory Hole | Depth (m) | Stratum | Species | Concentration (mg/kg) | Adopted Screening Value (mg/kg) |
|---|---|---|---|---|---|
| SA04 | 0.06-0.50 | Made Ground | Naphthalene | 18 | 2.3 |
| | | | Benzo(a)anthracene | 180 | 11 |
| | | | Chrysene | 190 | 30 |
| | | | Benzo(b)fluoranthene | 310 | 3.9 |
| | | | Benzo(k)fluoranthene | 310 | 110 |
| | | | Benzo(a)pyrene | 190 | 77 |
| | | | Indeno(1,2,3-cd)pyrene | 1300 | 45 |
| | | | Dibenz(a,h)anthracene | 630 | 0.31 |
| | | | Benzo(ghi)perylene | 1400 | 360 |

* Based on Soil Organic Matter content

*Total Petroleum Hydrocarbons (TPH CWG)*

No petroleum hydrocarbons 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 across the site and PAHs around SA04 underlying the access road attributed to ash within the made ground strata.

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

## 8.4 Soil, Water and Leachate Test Results – Controlled Waters

*Soils*
No significant contaminants were identified in soils as an indicator of potential impaction on groundwater.

## 8.5 Permanent Ground Gas and Vapours Results

A total of 7 ground gas monitoring visits have been carried out between the dates of 23rd October and 1st January 2025. Results are summarised in the table below:

| | $CH_4$ (%) | | $CO_2$ (%) | | $O_2$ (%) | | CO (ppm) | | $H_2S$ (ppm) | | TVOC (ppm) | | Steady Flow (l/hr) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Peak | 0.0 | 0.3 | 0.0 | 3.7 | 0.5 | 23.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -3.4 | 3.4 |
| Steady | 0.0 | 0.1 | 0.0 | 1.3 | 11.2 | 22.4 | | | | | | | 0.0 | 1.3 |

Notes: $CH_4$ = Methane; $CO_2$= Carbon dioxide; $O_2$= Oxygen; CO= Carbon Monoxide; $H_2S$= Hydrogen Sulphide; TVOC (PID)= Total Volatile Organic Compounds (as measured with Photo Ionisation Detector); ppm= Parts Per Million.

Methane was not detected above the limit of detection on the majority of the visits undertaken. The maximum concentration recorded was 0.3% in BH01 on the third visit. The highest carbon dioxide concentrations were recorded in BH03 (3.7% v/v) on the fifth visit.

The atmospheric pressure ranged between 975mb and 1034mb over the monitoring period, of which visits were conducted over a range of falling, steady and raising pressure trends.

Groundwater levels were recorded above the response zones in BH01A and BH03 in the fourth to seventh visit.

## 8.6 Ground Gas Risk Assessment

*Basis of Assessment*
In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from BS8485:2015+A1:2019 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' and CL:AIRE Technical Bulletin TB17 'Ground Gas Monitoring and 'Worst-Case' Conditions'.

*Rationale and Suitability of Dataset*
As per the Phase 1 Desk Study, in accordance with BS8485 and as set out in Appendix A of this report, the ground gas generation potential is considered to be **very low** (sources as made ground). The sensitivity of the development is **medium** on account of the proposed high-rise residential development.

In line with current guidance, it is recommended gas monitoring should comprise 6 visits over a 3-month period. Gas monitoring is Complete.

As installations have been monitored under falling pressure on a number of occasions and what can be considered to be "worse case" conditions, the data set is considered to be suitable for assessment purposes and no further visits would be required – further visits would be unlikely to change the outcome of this assessment given the readings obtained under the conditions observed (as per CL:AIRE TB17 and BS8576).

*Assessment of Data*
Derivation of a Gas Screening Values (GSV) has been undertaken based on the guidance with BS8485 using the following equation: (max gas concentration / 100) x maximum steady flow.

A maximum steady flow of 0.1l/hr has been used to derive the worst credible GSVs. The GSV's for the site are presented below.

A maximum typical steady positive flow of 0.1l/hr has been used to derive the GSVs.

| Ground Gas | Adopted Typical Steady Flow Rate (l/hr) | Max Concentration (% v/v) | Worst Credible GSV (l/h) | Classification based on GSV | Typical Threshold Concentration Exceeded |
|---|---|---|---|---|---|
| Methane | 1.3 | 0.3 | <0.07 | CS1 | No – CS1 |
| Carbon Dioxide | 1.3 | 3.7 | <0.07 | CS1 | No – CS1 |

The GSVs 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 guidance states ***consideration*** should be given to increasing the site classification as part of assessment; monitoring is ongoing at this stage therefore this should be considered during the final assessment.

Based on the gas monitoring programme, the site should be preliminarily classified as CS1.

## 8.7 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** Heavy metals, PAH, TPH, asbestos | Ingestion, Direct contact, inhalation of dusts, migration into/chemical attack of water supply pipelines | End-users Water Pipelines | Low likelihood | Medium | Moderate / Low | Testing of the general made ground identified minor elevations of heavy metals within 1 order of magnitude of the screening values. No other elevations from the general made ground was identified. Therefore, the risk is considered moderate to low at this stage and mitigation in the form of a cover system in areas of soft landscaping will be required. |
| **On site Made ground associated with the access road** Heavy metals, PAH, TPH, asbestos | Ingestion, Direct contact, inhalation of dusts, migration into/chemical attack of water supply pipelines | End-users Water Pipelines | Low likelihood | Medium | Moderate | Testing of the localised ashy made ground underlying the access road within SA04, has multiple exceedances up to 2 orders of magnitude larger than the screening values associated with the ash present. Elevated levels of naphthalene were recorded in this area of the site which poses a risk from volatile ingress to the proposed development. Therefore, the risk is considered moderate at this stage and mitigation in the form of source removal will be required. |
| **On site Made ground** Ground gases (carbon dioxide and methane) | Migration into confined spaces, inhalation and asphyxiation/ explosion | End-users / property / structures | Unlikely | Severe | Moderate / Low | The monitoring programme undertaken has indicated no elevated levels of methane or carbon dioxide therefore the risk is considered to be moderate / low. |

| Controlled Waters | | | | | | |
|---|---|---|---|---|---|---|
| Potential Source | Potential Pathway | Potential Receptor | Likelihood | Severity | Level of Risk | Justification |
| **Made Ground** Metals, PAHs | Overland flow, / migration through saturated zone | Inland River – Corn Brook (Surface waters) | Unlikely | Medium | Low | It is considered contaminants associated with the made ground and other past industrial uses have a low likelihood of impacting Corn Brook. Due to the relative permeability of the sand and gravel underlying the area, lateral migration is possible, although this would be somewhat inhibited by the underlying cohesive deposits present above the principal aquifer across the site. Further to this the risk is considered to be reduced due to the distance which would allow some degree of degradation and attenuation of contaminants. The proposed development will result in increased building cover, hard surfacing, new drainage system and limited surface water infiltration is envisaged. The risk is therefore considered to be low. |
| | Leaching through unsaturated zone / Migration through saturated zone | Secondary A Aquifer (Groundwater) | Unlikely | Medium | Low | Limited mobile contamination was recorded at the site within the site soils. It is considered contaminants associated with the made ground and other past industrial uses have a low likelihood of impacting Secondary A Aquifer. Due to the relative permeability of the sand and gravel underlying the area, migration is possible, although this would be inhibited by the underlying cohesive deposits. The proposed development will result in increased building cover, hard surfacing, new drainage system and limited surface water infiltration is envisaged. Therefore by virtue of the development taking place, this should contribute to an overall "betterment" of groundwater quality. The risk is therefore considered to be low. |
| | Migration through saturated zone | Principal Aquifer (Groundwater) | Unlikely | Medium | Low | Limited mobile contamination was recorded at the site within the site soils. As previously stated the underlying geology comprises permeable sands, however due to the presence of low permeability deposits underlying these strata and above the bedrock vertical migration will be suitably inhibited. However, there are no groundwater abstraction licences or Source Protection Zones near the site, and the proposed development will result in increased building cover, hard surfacing, new drainage system and limited surface water infiltration is envisaged under this scenario. As stated above, by virtue of the development taking place, this should contribute to an overall "betterment" of groundwater quality. The risk is therefore considered to be low. |

## 8.8 Outline Remedial Measures

Elevated levels of heavy metals and PAHs were present across the site. Where soft landscaping are present a cover of "clean" subsoil and topsoil should be provided to break the pathway to site end users as described in CIRIA Special Publication 124 - Barriers, liners and cover systems for containment and control of land contamination. This should be 450mm in soft landscaping areas (Public Open Space – POS). This will allow plants to be grown and prevent undesirable soils mixing or being brought to the surface. The inclusion of a geotextile marker layer at the base or a coarse granular, 'hard dig' layer is recommended due to the presence of heavy metals and PAHs.

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.

Where elevated naphthalene was recorded in the ashy made ground local to SA04 and the former road roadway, this should be removed to reduce the risk and appropriately validated upon completion.

*Utilities*
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.

*Ground Gas Protection Systems*
Based on the ground gas monitoring results, no mitigation measures are required and no radon protection is required for new buildings at this location.

## 8.9 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, PAHs) | Ingestion, direct contact, inhalation of dusts. | Construction Workers | Likely | Mild | Moderate/low |

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.

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.

# 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).

It should be noted that testing requirements for contaminated land risk assessment differ to those for waste classification purposes. Unless otherwise stated, the assessment in this section has been carried out to provide initial indications in respect to disposal of waste soils, however this may not be fully compliant with waste testing requirements or frequencies, with further testing potentially required.

## 9.2 Soils 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.

Waste classification should be based on soils analyses that are representative of the actual waste load. At the stage of ground investigation, the materials that will become waste have generally not been defined yet, however test data can provide a useful guide to the likely waste classification before it is generated.

Further guidance is provided in Appendix A.

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.

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:

| | PRIOR TO LEAVING SITE | | | |
|---|---|---|---|---|
| **Classification based on Total Concentrations[1]** | **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).

*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. See Appendix A for further guidance.

## 9.3 Waste Classification and Waste Acceptance Criteria (WAC)

We have reviewed the testing results and assessed them through a waste classification database (HazwasteOnline™) 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").

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

The Waste Classification Report and WAC testing results are presented in Appendix F Locations of hazardous soils are presented in the table below, alongside the WAC analysis test results.

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

| Location | Depth (m) | Stratum | Waste Classification | WAC Analysis | Landfill | Comments |
|---|---|---|---|---|---|---|
| SA03 | 0.00-0.80 | MADE GROUND | Non-hazardous | Stable Non-reactive Hazardous | Non-hazardous landfill | HP3i |
| TP04 | 0.06 -0.50 | MADE GROUND | Non-hazardous | Stable Non-reactive Hazardous | Non-hazardous landfill | HP3i |

Based on the waste classification database assessment, the majority of the made ground soils have been classified as **non-hazardous.**

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 as summarised below:

| Waste | Conc. by Weight (%) | EWC 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)<br><br>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.<br>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. |

*General*
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.

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.

Where possible, the option that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route should be explored.

## 9.4 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”.

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.

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.

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-complaint with the CoP can be referred to the EA for further investigation.

Note that for re-use of landfilled materials or mining wastes, the DoWCoP may not apply and a Waste Recovery Permit (or others) may be required. Liaison with the Environment Agency would be needed on a case by case basis to determine the best option.

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*

Other potentially suitable re-use mechanisms may include U1 Exemptions, WRAP quality protocols (for aggregates) or Waste Framework Directive (WFD) Exclusions, amongst other mechanisms. Further details are provided in Appendix A.

# 10.0 CONCLUSIONS

## 10.1 Geo-Environmental

*Geo-Environmental – Human Health – Soils*
Testing of the made ground at the site revealed exceedances of heavy metals across the site as well as PAHs within one location (SA04) associated with ash within the made ground below the accessway.

*Geo-Environmental – Ground Gases and Vapours*
Ground gas monitoring has revealed no exceedances of methane or carbon dioxide. Based on the gas monitoring the site is classified as Characteristic Situation 1 and ground gas protection measures are not 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 samples of made ground obtained, any waste made ground generated is classified as non-hazardous and is considered to be acceptable at a non-hazardous landfill.

## 10.2 Geotechnical

*Foundations*
Based on the proposed development, the recommended foundation type is a replacement pile technique, such as emplacement by rotary bored methods, socketed into the competent sandstone bedrock. As a preliminary guide, allowable axial loads for a circular pile range between 3.7MN for a 600mm diameter pile with 5m embedment up to 12.7MN for a 900mm diameter pile with 15m embedment. Detailed foundation design should be completed by a suitably qualified specialist.

*Floor slabs*
Suspended and ground bearing floor slabs may be adopted.

*Concrete classification*
DS1 AC-1 conditions within the natural superficial deposits and bedrock and DS3 AC-3 conditions are indicated to be present within the made ground strata.

*Highways*
CBR values of 40% within granular, 5% within natural clays and 2% within the made ground strata are likely to be achieved, with made ground likely to be encountered at formation levels.

*Drainage (SuDS)*
Indicative soil infiltration rates range from $10^{-3}$ m/s to $10^{-7}$ m/s. Drainage to soakaways is considered potentially suitable or this site.

## 10.3 Further Work

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

- Detailed foundation design by a structural engineer.
- Design of Remedial Strategy and confirmation with the Local Authority /EA / warranty provider.
- Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.
- Implementation of the Remedial Strategy and verification of the remedial works.

## 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.<br>There is no assumption in this definition that harm results from the presence of the contamination.<br>Naturally enhanced concentrations of harmful substances can fall within this definition of contamination.<br>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. |

| GLOSSARY | |
|---|---|
| **Term / Abbreviation** | **Definition** |
| **GAC** | Generic Assessment Criteria. |
| **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. |

| GLOSSARY | |
|---|---|
| **Term / Abbreviation** | **Definition** |
| **TPH CWG** | Total Petroleum Hydrocarbon (Criteria Working Group). |
| **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 |

## 12.0 REFERENCES

References used in the production of this report are listed below; note not all of the below are relevant to the subject site and may not have been utilised.

Association of Ground Investigation Specialists. 'Guidelines for Good Practice in Site Investigation'. Issue 2, March 2006.

Association of Ground Investigation Specialists. 'Description Of Anthropogenic Materials– A Practitioners' Guide'. 2018.

Black, W.P.M. & Lister, N.W. The strength of clay fill subgrades, its prediction in relation to road performance Report LR889, TRRL. 1979.

BRE Special Digest 1: 'Concrete in Aggressive Ground' 3rd Ed 2005.

BRE Report BR211, Scivyer, C. 'Radon – Guidance on protective measures for new buildings' 2023 Edition.

BRE Digest, vols. 240 and 241 'Low-rise buildings on shrinkable clay soils'. 1993.

BRE Digest 298 'The influence of trees on house foundations in clay soils'. 1999.

BRE Digest 365 'Soakaway Design'. 2016.

BRE Report 391 "Specifying vibro stone columns". 2000.

BRE Report 414. 'Protective measures for housing on gas contaminated land. Building Research Establishment Report'. 2011.

BRE Report 470 'Working platforms for tracked plant: good practice guide to the design, installation, maintenance and repair of ground-supported working platforms'. 2004.

British Geological Survey Technical Report WD/97/34. 312pp. Environment Agency R&D Publication 8. 'The physical properties of major aquifers in England and Wales'. 1997.

British Geological Survey Technical Report WD/00/04. 234pp. Environment Agency R&D Publication 68 'The physical properties of minor aquifers in England and Wales'.

British Geological Survey 'The advanced soil geochemical atlas of England and Wales'. 2012.

BS 1377 'Method of Test for Soils for Civil Engineering Purposes'. 1990.

BS EN 1997-1. 'Eurocode 7 – Geotechnical design - Part 1: General rules'. Plus associated UK National Annex. 2004.

BS EN 1997-2. 'Eurocode 7 – Geotechnical design - Part 2: 'Geotechnical investigation and testing'. Plus associated UK National Annex. 2007.

BS 3882: 'Specification for topsoil'. 2015.

BS 5837: 'Trees in relation to design, demolition and construction Recommendations'. 2012.

BS 5930+A1:2020: 'Code of Practice for Site Investigations'. 2020.

BS 6031: 'Code of practice for earthworks'. 2009.

BS 8004: 'Code of practice for foundations'. 2015.

BS 8485+A1: 'Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings'. 2019.

BS 8500-1 AMD 2. Concrete. Complementary BS to BS EN 206. Part 1. 'Method of specifying and guidance for the specifier'. 2018.

BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.

BS 10175:2011+A2 'Investigation of Potentially Contaminated sites - code of practice'. 2017.

BS 10176:2020 'Taking soil samples for determination of volatile organic compounds (VOCs)'. 2020.

BS EN ISO 14688 'Geotechnical investigation and testing – Identification and classification of soil'. 2018.

BS EN ISO 14689 'Geotechnical investigation and testing – Identification and classification of rock'. 2018.

BS EN ISO 17892 'Geotechnical investigation and testing. Laboratory testing of soil.' Parts 1-12 :2018.

BULL ET AL. Promoting the Use of B(a)P as a Marker for PAH Exposure in UK Soils. February 2013.

CIRIA Special Publication SP32, PSA Civil Engineering Technical Guide 34, 'Construction over abandoned mine workings'. 1984.

CIRIA Special Publications 101-112, 'Remedial Treatment for Contaminated Land'. 1998.

CIRIA Special Publication 124, 'Barriers, liners and cover systems for containment and control of land contamination'. 1996.

CIRIA R143, 'The Standard Penetration Test (SPT): methods and use'. 1995.

CIRIA 149 'Protecting Development from Methane'. 1995.

CIRIA 150 'Methane Investigation Strategies'. 1995.

CIRIA 151 'Interpreting Measurements of Gas in the Ground'. 1995.

CIRIA 152 'Risk assessment for Methane and Other Gases from the Ground'. 1995.

CIRIA 552 'Contaminated Land Risk Assessment – A guide to good practice'. 2001.

CIRIA C574 'Engineering in Chalk'. 2002.

CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings.' 2006.

CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.

CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.

CIRIA C716 'Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination'. 2012.

CIRIA C733 'Asbestos in Soil And Made Ground: A Guide To Understanding And Managing Risks'. 2014.

CIRIA C735 'Good Practice on The Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'. 2014.

CIRIA C748 'Guidance on the Use of Plastic Membranes as VOC Vapour Barriers'. 2014.

CIRIA C750 'Groundwater control: design and practice, second edition". 2016.

CIRIA C753 'The SuDS Manual'. 2015.

CIRIA C758 'Abandoned Mine Workings Manual'. 2019.

CL:AIRE and CIEH. 'Guidance on Comparing Soil Contamination Data with a Critical Concentration'. May 2008.

CL:AIRE 'The Definition of Waste: Development Industry Code of Practice'. Version 2. March 2011.

CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.

CL:AIRE TB17 'Ground Gas Monitoring and 'Worst-Case' Conditions'. 2018.

CL:AIRE TB18 'Continuous Ground-Gas Monitoring and the Lines of Evidence Approach to Risk Assessment'. 2019.

CL:AIRE TB19 'Managing Risks and Liabilities associated with Per and Polyfluoroalkyl Substances (PFASs)'. 2019.

CL:AIRE TB22 'An overview of the uses of PFAS to assist with identification of sites of concern'. 2023.

CL:AIRE SP1010 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'. Rev 2 2014.

CL:AIRE 'Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – CAR-SOILTM'. 2016.

CL:AIRE 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' Version 1. March 2017.

CULP, S.J., ET AL., A comparison of the tumours induced by coal tar and benzo[a]pyrene in a 2-year bioassay. Carcinogenesis. 1998.

DEFRA and the Environment Agency, CLR10 'Soil Guideline Value Reports for Individual Soil Contaminants'. 2002-2004.

DEFRA and the Environment Agency, CLR Report No 11 'Model Procedures for the Management of Contaminated Land'. 2004. [Withdrawn 2019.]

Department of the Environment, CLR Report No 1 'A framework for assessing the impact of contaminated land on groundwater and surface water'. 1994.

Department of the Environment, CLR Report No 2 'Guidance on Preliminary Site Inspection of Contaminated Land'. 1994.

Department of the Environment, CLR Report No 3 'Documentary research on Industrial Sites'. 1994.

Department of the Environment, CLR Report No 4 'Sampling Strategies for Contaminated Land'. 1994.

Department of the Environment Waste Management Paper No. 27. 'Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas'. 1992.

Department of the Environment. 'Industry Profiles' - 48 separate publications available from The Stationery Office, London. 1995.

DETR. Circular: Contaminated Land. 2006.

EC Regulation 1272/2008 'The Classification, labelling and packaging of substances and mixtures (CLP)' 2008.

Environment Agency guidance - Land Contamination: Risk Management (LCRM). 2020.

Environment Agency 'Using Soil Guideline Values'. 2009.

Environment Agency, 'Updated Technical Background to the CLEA model'. 2009.

Environment Agency, 'Human health toxicological assessment of contaminants in soil'. 2009.

Environment Agency Hazardous Waste: 'Guidance on the classification and assessment of waste' WM3 ver 1.1 May 2018.

Environment Agency. 'Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination'. 2006.

Environment Agency & NHBC. R&D Publication 66. 'Guidance for the Safe Development of Housing on Land Affected by Contamination'. 2008.

Environment Agency. R&D Publication 20. 'Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources'. 1999.

Environment Agency Technical Guidance Note 01. Hydrogeological Risk Assessment for Landfills. [Withdrawn Feb 2016. Replaced with below].

Environment Agency and DEFRA 'Landfill developments: groundwater risk assessment for leachate'. 2016.

Environment Agency Petroleum Hydrocarbons in Groundwater 'Supplementary Guidance for Hydrogeological Risk Assessment'. 2009.

Environment Agency 'Groundwater protection: Principles and practice (GP3)'. 2013. [Superseded 2017 by www.gov.uk online guidance].

Environmental Permitting Guidance: version 3.1 'The Landfill Directive for the Environmental Permitting (England and Wales) Regulations'. 2010.

Environmental Quality Standards. 2008.

European Parliament Directive 2008/98/EC of the Council of 19 November 2008 on waste and repealing certain Directives. 2008.

European Parliament. Directive 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.

Ground Engineering. Wilson & Card 'Proposed method classifying gassing sites' /1999.

Hazardous Waste (England and Wales) Regulations. 2005.

Health & Safety Executive (HSE). 'Protection of Workers & the General Public during the Development of Contaminated Land'. 1991.

Health and Safety Executive (HSE). Control of Asbestos Regulations (CAR). 2012.

Highways Agency. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London. 2009. [Withdrawn 30th May 2017].

ICE Thomas Telford 'Applications of Dynamic Cone Penetrometer testing in East Anglia'. 1989.

Land Quality Press, Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R. C. and Nathanail, J.F. 'The LQM/CIEH S4ULs for Human Health Risk Assessment.' 2015.

Landfill Directive 'Directive 1999/31/EC on the landfilling of waste'. 1999.

Japanese Geotechnical Society. Hatanaka and Uchida 'Empirical correlation between penetration resistance and effective friction of sandy soil'. Soils & Foundations, 36 (4), 1-9. 1996.

Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. [Withdrawn 30th May 2017].

Manual of Contract Documents for Highway Works, Specification for Highways Works – Series 600 Earthworks November 2006. [Withdrawn 30th May 2017, Replacement unknown].

National Planning Policy Framework (NPPF). 2023.

National Planning Policy Framework - Technical Guidance. March 2012.

NHBC Standards, Part 1 'Introduction and Technical Requirements.'

NHBC Standards, Part 4 'Foundations.'

NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions.

NHBC. 'Hazardous Ground Gas - An essential guide for housebuilders'. May 2023.

Public Health England (PHE). Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs). September 2017.

Total Petroleum Hydrocarbon Criteria Working Group Volume 1 'Analysis of Petroleum Hydrocarbons in Environmental Media'. 1999.

Total Petroleum Hydrocarbon Criteria Working Group Volume 2 Composition of Petroleum Mixtures. May 1998.

Total Petroleum Hydrocarbon Criteria Working Group Volume 3 'Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. July 1997.

Total Petroleum Hydrocarbon Criteria Working Group Volume 4 'Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)'. 1997

Total Petroleum Hydrocarbon Criteria Working Group Volume 5 'Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach' June 1999.

SEPA 'Land remediation and waste management guidelines' publication date unknown.

UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184).

UKTAG. Updated recommendations on environmental standards. River Basin Management (2015-21). UK Technical Advisory Group on the Water Framework Directive. November 2013 (updated January 2018).

UKTAG-WFD. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. 2014.-

UKWIR Report 10/WM/03/21 2010 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' 2010.

Water Framework Directive, 2000.

Water UK HBF. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation.

# DRAWINGS




NOTE: ALL LAYOUTS ARE SUBJECT TO DETAIL DESIGN AND STAGE 3 CO-ORDINATION WITH CONSULTANT DESIGN TEAM. ALL AREAS AND DIMENSIONS ARE SUBJECT TO A TOLERANCE OF +/- 5%

## GENERAL NOTES:

ALL DIMENSIONS ARE TO BE CHECKED ON SITE WITH ANY DISCREPANCIES REPORTED TO THE ARCHITECT PRIOR TO THE WORKS BEING CARRIED OUT.

ALL WORKS ARE TO BE IN ACCORDANCE WITH THE PLANNING APPROVAL AND ANY SUBSEQUENT APPROVED LOCAL AUTHORITY PLANNING CORRESPONDENCE INCLUDING DRAWINGS, DOCUMENTS AND REPORTS.

ALL WORKS ARE TO COMPLY WITH THE BUILDING REGULATIONS, BRITISH STANDARDS, CODE OF PRACTICE, AND ANY LOCAL STATUTORY REQUIREMENTS.

ALL WORKS ARE TO COMPLY WITH CURRENT HEALTH AND SAFETY LEGISLATION, H.S.E. RECOMMENDATIONS/GUIDANCE AND THE CURRENT C.D.M. REGULATIONS.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH LEACH RHODES WALKER ARCHITECTS GENERAL ARRANGEMENT (L CODE) DRAWINGS, TOGETHER WITH RELEVANT DETAILED (A CODE) DRAWINGS AND SPECIFICATIONS.

FOR ALL STRUCTURAL WORKS REFER TO THE STRUCTURAL ENGINEERS INFORMATION.

FOR ALL MECHANICAL AND ELECTRICAL WORKS REFER TO THE MECHANICAL AND ELECTRICAL ENGINEERS INFORMATION.

FOR ALL ABOVE GROUND DRAINAGE WORKS REFER TO THE PUBLIC HEALTH ENGINEERS INFORMATION.

ALL PRODUCTS SPECIFIED ARE TO BE INSTALLED STRICTLY IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS, SPECIFICATION AND DETAILS.

| rev | description | drwn | auth | date |
|---|---|---|---|---|
| P15 | MINOR LAYOUT AMENDS. | JDC | CJG | 02.10.24 |
| P14 | HOTEL STAIRS ADDED. GENERAL UPDATES. | JDC | CJG | 25.09.24 |
| P13 | ROOM AREA NOTES UPDATED. | JDC | CJG | 23.05.24 |
| P12 | UPDATED LANDSCAPING & MINOR LAYOUT CHANGES | JDC | CJG | 17.05.24 |
| P11 | AMENDED WITH HIGHWAYS COMMENTS | JDC | CJG | 11.03.24 |
| P10 | LANDSCAPING UPDATED | JDC | CJG | 25.01.24 |
| P09 | GENERATOR & SUBSTATION POSITIONS AMENDED. PARKING ADJUSTED. | JDC | CJG | 19.01.24 |
| P08 | BOUNDARY FENCE ADDED TO PARKING AREA. | JDC | CJG | 17.01.24 |
| P07 | COMMERCIAL UNIT ADDED & ENTRANCE LOBBIES/ BoH RECONFIGURED. | JDC | CJG | 09.01.24 |
| P06 | RED LINE UPDATED. ISSUED FOR PLANNING | JDC | CJG | 19.12.23 |
| P05 | BREAKERS YARD SHOWN AS EXISTING | JDC | CJG | 13.12.23 |
| P04 | CYCLES & BoH LAYOUT AMENDED. EXTERNAL & FFL LEVELS ADDED. | JDC | CJG | 05.12.23 |
| P03 | UPDATED STRUCTURE & LAYOUT | EB | CJG | 10.11.23 |
| P02 | CYCLE STORE AMENDMENT | EB | CJG | 02.11.23 |
| P01 | FIRST ISSUED | EB | CJG | 26.10.23 |

DO NOT SCALE OFF THIS DRAWING
© LEACH RHODES WALKER

LeachRhodesWalker Architects
info@lrw.co.uk | www.lrw.co.uk
H.Q. 50 Dearmans Place Manchester M3 5LH
**Manchester** +44 (0)161 833 0211
**London** +44 (0)207 993 1363

CLIENT: FORSHAW GROUP
PROJECT: CORNBROOK RESIDENTIAL
DOCUMENT NAME: 8353-LRW-ZZ-00-DR-A-00-178
DESCRIPTION: PROPOSED GROUND FLOOR PLAN

| REVISION | SCALE |
|---|---|
| P15 | 1:250@ A3 |

| LRW PROJECT No. | DATE CREATED | CREATED BY | AUTHORISED BY |
|---|---|---|---|
| 8353 | 26.10.23 | EB | DL |

File:I:\8353\Comms\Issued\Drawings\Dwg\Dwgs\Issued\8353-LRW-ZZ-00-DR-A-00-178_Proposed Ground Floor Plan.dwg




SITE LOCATION

NEAREST POSTCODE: M15 4WB

SITE ENTRANCE WHAT3WORDS: ///HERO.ANKLE.FITS




| REV | DATE | DESCRIPTION | BY | CKD |
|---|---|---|---|---|
| | | | | |

BROWNFIELD SOLUTIONS LTD
CEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

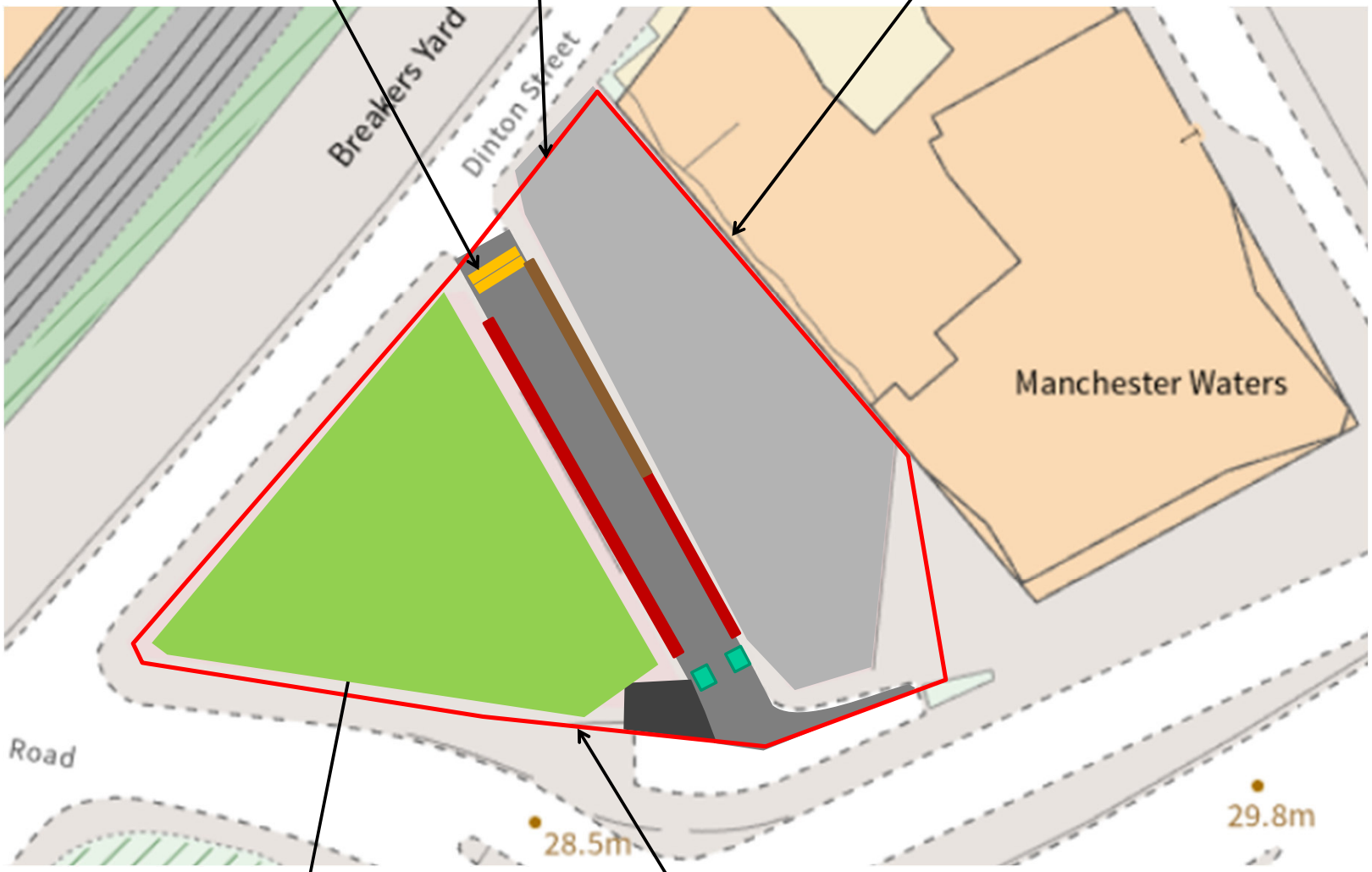
CLIENT
RENAISSANCE ASSOCIATES LTD

PROJECT TITLE
CORNBROOK RESIDENTIAL, MANCHESTER

DRAWING TITLE
SITE LOCATION PLAN

| DRAWING No. | REVISION | SCALE | DATE |
|---|---|---|---|
| C5540/01 | - | NTS | 02/10/23 |

| DRAWN BY | CHECKED BY |
|---|---|
| SD | TM |




## KEY

- APPROXIMATE SITE BOUNDARY
- GATE
- CONCRET SLAB / GRAVEL
- COBBLED ROAD
- ASPHALT SURFACING
- BRICK WALL
- CONCRETE POST WOOD PANNEL FENCING
- DRAINAGE COVERS
- DENSE VEGETATION

| REV | DATE | DESCRIPTION | BY | CKD |
|---|---|---|---|---|
| | | | | |
| | | | | |

BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

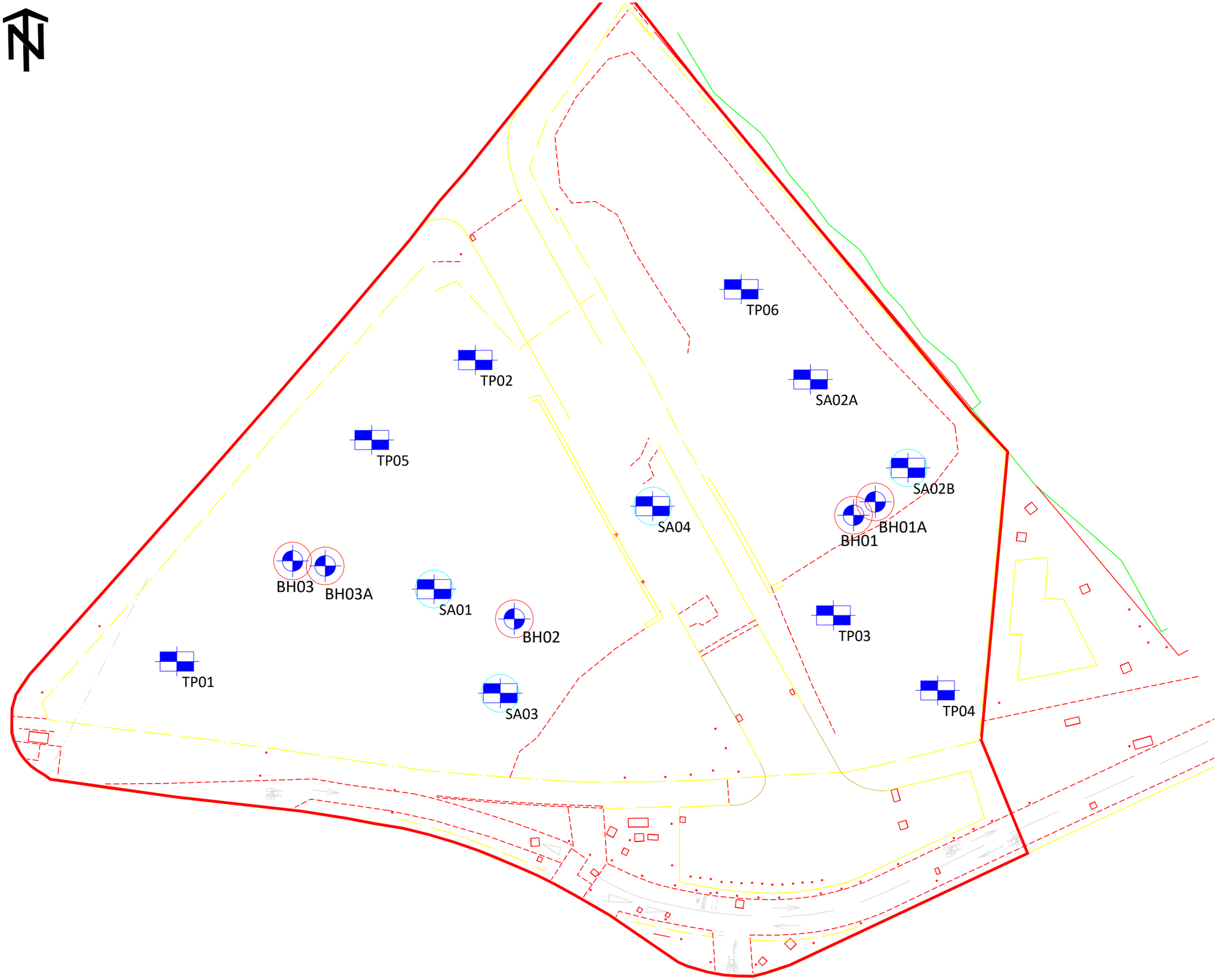
CLIENT
RENAISSANCE ASSOCIATES LTD

PROJECT TITLE
CORNBROOK RESIDENTIAL, MANCHESTER

DRAWING TITLE
SITE FEATURES PLAN

| DRAWING No. | REVISION | SCALE | DATE |
|---|---|---|---|
| C5540/02 | - | NTS | 05/10/23 |

| DRAWN BY | CHECKED BY |
|---|---|
| AH | TM |




| KEY | |
|---|---|
| | APPROXIMATE SITE BOUNDARY |
| TPXX | TRIAL PIT |
| BHXX | BOREHOLE |
| | SOAKAWAY INFILTRATION TEST |
| | BOREHOLE INSTALLATION |

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

| REV | DATE | DESCRIPTION | BY | CKD |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

BROWNFIELD SOLUTIONS LTD

CLIENT

FG VIVERE MANCHESTER LTD

PROJECT TITLE

CORNBROOK RESIDENTIAL, MANCHESTER

DRAWING TITLE

EXPLORATORY HOLE LOCATION PLAN

| DRAWING No. | REVISION | SCALE | DATE |
|---|---|---|---|
| C5540/04 | - | NTS | 16/10/24 |

| DRAWN BY | CHECKED BY |
|---|---|
| AH | NS |

# APPENDIX A

**BSL Methodology and Guidance**

## BSL Phase I & II Geo-Environmental Assessment Reports - Methodology and Guidance

**Background**

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.

Phase I reports are written in general accordance with the description of a Preliminary Investigation as defined in BS10175:2011+A2:2017 and are also produced in general accordance with the recommendations for a Tier 1 Preliminary Risk Assessment as described in LCRM guidance.

The first stage of the investigation and assessment of a site is the Preliminary Investigation/Tier 1 Preliminary Risk Assessment, often referred to as a Phase 1 Desk Study, comprising a desk study and walk-over survey and collation of desk-based searches, which culminates in the Preliminary Risk Assessment and the development of a preliminary/initial **Conceptual Site Model (CSM)**. From this are identified any potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. In the case of the geotechnical hazard identification, this is referred to as the **Ground Model.**

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 as part of Phase II investigations and reports.

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 an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

**Contaminated Land - Legislative Background**

Land contamination can be addressed in several ways, e.g. during planning, under Part 2A, following an incident, during an investigation into environmental damages, or during the application of an environmental permit, or its surrender.

For the planning process the key test is **as a minimum the site cannot be determined as contaminated land**, e.g. there is not significant harm, significant possibility of significant harm to human health or that there is not significant harm to, or the significant possibility that the pollution of controlled waters will occur.

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 Statutory Guidance, DEFRA – April 2012.
- The Contaminated Land (England) Regulations 2006.
- The Contaminated Land (England) Amendment Regulations 2012.
- Water Resources Act.
- Water Framework Directive.
- Environmental Damage Regulations.
- Environment Agency (EA) - Land Contamination Risk Management (LCRM) 2019.

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, and the impact of that migration on the source e.g. attenuation.
**Receptor** - a receptor that may be harmed, for example the water environment, humans and water, considering the sensitivity of the receptor.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused.




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

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 S-P-R 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: Environmental Protection Act 1990: Part IIA: Contaminated land. 2012.
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
- BS 10175:2011+A2:2017.
- Environment Agency (EA) - Land Contamination Risk Management (LCRM). 2019.
- Groundwater Protection https://www.gov.uk/government/collections/groundwater-protection
- UK Technical Advisory Group (UKTAG) - Water Framework Directive
- Incidents and their classification: the Common Incident Classification Scheme (CICS) – Used by the Environment Agency to classify pollution incidents.

*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).
- The Environmental Damage (Prevention and Remediation) Regulations (2009).
- Environmental Permitting Regulations (England and Wales) Regulations (2010).
- The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017).
- Health and Safety at Work Act.
- National Planning Policy Framework (NPPF) – latest version.

**Contaminated Land Risk Assessment Approach**

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:




LCRM 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 LCRM, three tiers of risk assessment exist – Stage/Tier Preliminary Risk Assessment, Stage 2 Generic Quantitative and Stage 3 Detailed Quantitative.

Further information can be found at the below site:
https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm

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, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report if applied.

The likelihood of a given receptor being impacted is related to a number of factors, e.g. the geology which could inhibit contaminant migration. For example, a site with a significant thickness of clay between it and a receptor may reduce migration of contamination via the subsurface, which will reduce the likelihood of a given receptor being impacted. The geology or drainage for example could offer a preferential pathway e.g. mines shafts/faults increasing the likelihood and potential magnitude of an impact. The depth of contamination will also affect the exposure pathway, for example petroleum hydrocarbons at depth are unlikely to reach a receptor via dermal contact but could via vapour pathways which will influence the likelihood of an impact being felt e.g. if there are no buildings on site.

The terms and definitions used for the assessment of the likelihood are provided below:

**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.
*Examples - Extensive areas with concentrations above saturation limits for mobile contamination e.g. petroleum hydrocarbons within the water table.*

**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.
*Examples – Localised areas of contaminants with concentrations above saturation limits for mobile contamination e.g. localised petroleum hydrocarbons within the water table; shallow contamination above relevant human health generic assessment criteria is present with little or no hardstanding,*

**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.
*Examples - A thickness/distance of low permeability deposits preventing contaminant migration to a receptor is present; a site is mostly covered hard standing preventing exposure to soil contamination.*

**Unlikely**: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.
*Examples – A site is underlain by a substantial thickness of low permeability clays, between the source and potential receptors which will inhibit significantly, but not completely rule out migration to sensitive receptors.*

The severity is also classified using a system based on CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report, if applied. 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 |
| | Negligible | Negligible Risk / No Linkage | | | |

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 'negligible risk' and 'no linkage' in the summary table, which give rise to an overall **negligible** risk category and no further action is required.

**Contaminated Land Screening Values**

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

***General***
The purpose of using generic 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 remedial action based on the data to hand is cost effective.

***Human Health***
Current UK guidance on risks to human health is provided by DEFRA and the Environment Agency (EA). Under the land use planning system where the aim is to demonstrate 'suitability for use' the key will usually be to confidently determine that the level of contamination of the land is low relative to some appropriate measure of risk at a particular critical connection.

Publications forming part of the guidance include the CLEA Model and toxicological reports collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values or Generic Assessment Criteria (GACs) for soils contamination based on standard land uses and soil assumptions. The critical concentrations referred to above can be the relevant GAC.

CLEA guidance has gone through a number of revisions over time. Tier 1 generic S4UL values (or GACs) have been published using the CLEA 1.06 Model by CIEH/LQM. 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.

C4SL values for six determinands including lead were published by DEFRA/CL:AIRE in December 2014. Additional determinands were added in 2021. They represent a low risk as opposed to minimal risk, however they are still strongly precautionary. These screening values were published by DEFRA for Part 2A use, although DEFRA have also confirmed acceptability for use under planning. However, S4ULs remain the first reference point for BSL due to the broader range of end uses scenarios and the availability of a wide array of determinands with various soil organic contents.

As part of Tier 1 assessments, the following data sources are used in the order of preference given below, unless further justification is provided to adopt less conservative criteria:

- CIEH S4UL values (derived by CIEH/LQM).
- DEFRA/CL:AIRE C4SL's https://www.claire.co.uk/projects-and-initiatives/category-4-screening-levels
- CL:AIRE GAC values.
- Guidance from other European countries.
- Guidance from the outside Europe.

Dependent on requirements, test results may be divided into representative data sets for assessment against the above referenced screening criteria, based on the conceptual model and taking into account such characteristics as variation in soil properties, historical, existing or proposed land uses. The soils in these areas are considered likely to form the ground cover in critical receptor areas (e.g. gardens, soft landscaping etc)

where pathways may exist. The critical part of the soil column is typically taken as the upper metre in terms of contact with end users of a development site for the purposes of initial assessment.

The screening criteria adopted by BSL are presented overleaf.

*Further Assessment*
When screening values are exceeded then further consideration is required. This could include further additional detailed investigation and assessment to further define the risk or to design appropriate remedial measures to either remove the source or break the pathway. In some cases, dependant on the Conceptual Site Model (CSM), no action may be required.

*PAHs and B(a)P as a Surrogate Marker for Adoption of C4SLs*
As stated above, S4ULs remain the first reference point as screening levels unless further justification is provided. In order to determine if the C4SL can be adopted, benzo(a)pyrene (B(a)P), the following guidance within SP1010 Appendix E for B(a)P and Public Heath England (PHE) may be adopted with our assessments where appropriate.

Guidance states that benzo(a)pyrene is considered to be one of the most potent PAHs, and it would be appropriate to assume the cancer risk in a mixture is proportional to the concentration of a surrogate marker PAH (benzo(a)pyrene) in the mixture. The ratio of PAHs within the mixture can be assessed to ensure that the profile is similar to that seen for the test material (coal tar mixtures) in the toxicological study by Culp et al. The International Programme on Chemical Safety (IPCS) considered that the PAH profile of the soil sample may deviate from the average profile by about an order of magnitude (up or down).

A more recent study by Bull et al (2013) which analysed PAH concentrations in soil samples from 274 sites, showed that the levels of PAH relative to B(a)P showed little variability and were similar to that recorded for the coal tar mix used in the Culp et al study. Given this, it was concluded that benzo(a)pyrene is a suitable surrogate marker to represent mixtures of PAH in soil.

In order to risk assess the PAH mixture for site specific soil samples using human health guideline values, notably the C4SLs, as detailed in SP10101 the ratio of the seven genotoxic PAHs as shown below, relative to B(a)P, should be calculated to ensure it is similar to the test material used in the Culp study (PHE 2010). To be considered sufficiently similar, the ratio relative to B(a)P should fit within the upper and lower limits (representing an order of magnitude above and below the mean ratio to B(a)P of test material used in the Culp et al study). In such cases B(a)P is considered an adequate surrogate marker and the Low Level of Toxicological concern (LLTC) for B(a)P (i.e., the C4SL) may be used in the risk assessment.

*Statistical Analysis on Soils*
Guidance on the use of statistics is taken from the CL:AIRE publication "Comparing Soil Contamination Data with a Critical Concentration" 2020, the basis of which in statistics is termed Central Limit Theorem (CLT), which says "*The distribution of sample means converges to a normal distribution as the sample size increases*".

If the critical concentrations have been exceeded, as part of a further assessment, statistical analysis may be undertaken on a dataset to demonstrate that the mean concentration on the site (or a particular area) is actually below the critical concentration. The true mean concentration of a contaminant is never known because all the site soil has not been tested. An estimation of the true mean can be obtained from the samples tested during the investigation. The greater the number of samples tested, the closer the mean of these values is to the true mean.

As discussed above, test results are typically divided into representative data sets for assessment and may be referred to as 'averaging areas' to which statistics can be applied, although several statements need to be satisfied before applying the guidance:

- Averaging areas have been defined based on the CSM.
- Sample locations – random/grid sampling adopted as opposed to targeted investigation.
- Samples are evenly spread and not clustered.

- Analysis do not suggest a hotspot/outlier or cluster established by histogram or other means.
- Samples are of same/similar depth and taken from one population (e.g. just topsoil).
- Analyses do not show a spatial trend or other spatial pattern across that zone.
- The number of samples has been shown to be sufficient for statistical analysis.

Once the above have been satisfied, when undertaking statistical analysis, the question "*are mean soil concentrations within the averaging area equal to, or greater than, the GAC*?" is being asked. Typically, outliers or "hotspots" are treated as separate zones or averaging areas. The sampling strategy and assessment should also take into account uncertainty (for example, spatial heterogeneity) in contaminant concentrations. There is the assumption that sampling was random or stratified and systematic (e.g. on a grid) and not targeted at specific sources; data from such targeted areas should be omitted from the statistical analysis. Data should be from one population (i.e. the same materials).

The statistical test that is carried out is used to demonstrate that there is a certain probability that the true mean falls below the critical concentration (typically the GAC in a screening exercise). The main tool used to draw conclusions based on the 2020 guidance is a comparison of a 2-way confidence interval with the critical concentration. A confidence interval consists of two sets of numbers; an interval i.e. a range of values plus a pre-determined level of confidence e.g. 80%. A common interpretation of a confidence interval of say 80% is that "*there is an 80% chance that the true mean concentration level of the contaminant in a sampling zone lies between X concentration and Y concentration*".

The current guidance for planning says that the site has to be "safe" which suggests we should use a large confidence interval such as 95% or higher to make a decision. This means that there is a 95% chance of the true mean concentration lying in this interval, there is also a 5% chance it lies outside this interval. One could then conclude that the requirements of planning have been met if the 95% confidence interval lies below the critical concentration.

The guidance recommends that at least two confidence levels are used such as 90% and 99% or 80% and 95%. By using two differing confidence intervals, we can use the smaller confidence interval (e.g. 80% confidence interval) to say "*we think the mean is most likely to be inside this range*" and the larger confidence interval (e.g. 95% confidence interval) to say "*we think the mean is most unlikely to be outside this range*".

If the confidence interval extends to above the critical concentration, then further action may be required.

***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 (Water Quality Targets – WQTs) 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 Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 and The Private Water Supplies (England) Regulations 2016. SI 2016 / 618). In Scotland, the Public Water Supplies (Scotland) Regulations 2014 apply. 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 impaction of contamination on controlled waters are Environmental Quality Standards (EQS). These cover a large number of compounds. EQS are available for inland surface waters (freshwater) and other surface waters (transitional and marine).

Several EQS are based on bioavailable metal proportions (i.e. copper, lead, manganese, nickel and zinc). A software tool (M-BAT) is available from the Water Framework Directive - UK TAG website for calculating the bioavailable fraction. Where this tool has been used, the bioavailability has been taken into account by calculating site-specific $PNEC_{dissolved}$ (Predicted No Effect Concentration) values. These enable the dissolved concentration data to be compared with the PNEC as if it were an EQS.

UK Drinking Water Standards (DWS) apply to waters abstracted for human consumption. Where no UK or EU drinking water standard exists, reference is made to the World Health Organisation criteria (2011).

The DWS apply to groundwater or to surface water used for abstraction and the EQS apply to surface water where the aquatic ecosystem is the receptor. Where the most appropriate water quality target cannot be determined with certainty, the lowest one is adopted in line with the precautionary principle.

In some instances, the laboratory detection limits (LODs) may be greater than the water quality target it is being screened against, but it should be noted that these comparisons are an initial screening assessment. It may be the case that lower LODs could be obtained using a more specialised technique, but it would be disproportionately expensive to adopt the more costly specialist technique for initial screening exercises.

The preference of BSL is to have testing carried out on actual samples of ground/surface water rather than theoretical values obtained from leachate testing, which is considered to often be highly conservative. Data from water samples obtained or from leachate analysis is then compared against the screening criteria adopted by BSL, which are presented overleaf.

When screening values are exceeded then further consideration is required. This could include further additional detailed investigation and detailed quantitative risk assessment (DQRA) to further define the risk or to design appropriate remedial measures to either remove the source or break the pathway.

**Ground Gas Risk Assessment**

BS8485:2015+A1:2019, BS 8576:2013, CL:AIRE RB17, and NHBC 'Hazardous Ground Gas - An essential guide for housebuilders' 2023, are the current guidance which gives up-to-date advice on all aspects of permanent ground gas risk. BS8576 alongside CIRIA C682 also provides guidance on assessment of hydrocarbon vapour intrusion.

The CL:AIRE publication 'Good Practice for Coal Mine Gas Emissions" 2021 provides guidance on the assessment of risks from mine gas sources.

The above all outline good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to ground gas contamination. The aim of the guidance is for a consistent approach to decision making, particularly relating to the scope of protective design measures on a site-specific basis.

*Legislative Framework*
BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665 provides technical guidance, however they also recognise 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.*

*Generation Potential of Sources*

BS 8576:2013 Figure 6 provides a basis for assessing the generation potential from sources identified as part of the Phase I Assessment. These are summarised below:

| Generation Potential | Typical Sources |
|---|---|
| Very Low | • Natural carbonate soil and strata, e.g. chalk and limestone.<br>• Natural soil strata with a low degradable organic content, e.g. alluvium, peat.<br>• In-filled pond less than 15 m diameter, in-filled before 1930s to 1940s.<br>• Made ground with low degradable organic content (e.g. up to 5% organic material such as pieces of wood, pieces of paper, rags, etc. with a high proportion of ash and no food or other easily degradable waste).<br>• Mine workings shallow or shaft (where there is clear evidence that they are flooded).<br>• Inert landfill sites (and pre -1945 landfills). |
| Low | • Natural soil strata with a high degradable organic content (DOC).<br>• Made ground with total organic carbon (TOC) up to 6% (e.g. dock silt, no food or other easily degradable waste).<br>• Foundry sand (includes phenolic binders, rags and wood that decay, albeit at low rates).<br>• Landfill 1945 to mid 1960s (see also Moderate below). |
| Moderate | • Sewage sludge.<br>• Mine workings – unflooded, more than 50 years since last worked (gas is liberated from coal when mine workings are excavated; this continues for up to about 50 years).<br>• Landfill 1945 to mid 1960s (this could also be “low” or, if disturbed, “high”). |
| High | • Landfill mid 1960s to early 1990s.<br>• Mine workings – unflooded – less than 50 years since last worked. |
| Very High | • Municipal landfill sites.<br>• Landfill early 1990s onward. |

*Frequency and Duration of Monitoring*

BS8576 notes to determine where and how to monitor ground gases requires consideration of credible pathways of possible exposure of the receptors, taking into account what is known about the geology and hydrogeology, building construction and services layout, foreseeable events such as flooding, changes in groundwater level, climate change, extreme weather conditions, the closure of mines, and possible changes to the gas regime caused by future development.

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

The benefits of 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 ground 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. CL:AIRE publication TB17 “Ground Gas Monitoring and ‘Worst-Case’ Conditions” provides further guidance.

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 (Apartments) | 2 months | 3 months | 6 months | 12 months | 24 months |
| | High (Low rise Residential) | 3 months | 6 months | 6 months | 12 months | 24 months |

*Typical/idealised frequency of monitoring/Number of Visits Required*

| | | Gas Generation of Potential Source | | | | |
|---|---|---|---|---|---|---|
| | | Very Low | Low | Moderate | High | Very High |
| Sensitivity of Development | Low (Commercial) | 4 | 6 | 6 | 12 | 12 |
| | Moderate (Apartments) | 6 | 6 | 9 | 12 | 24 |
| | High (Low rise Residential) | 6 | 9 | 12 | 24 | 24 |

**Notes**

1 Generation potential of sources based on descriptions within BS 8576:2013.

2 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.

*Gas Risk Assessment*

Within BS8485:2015+A1:2019 a semi-quantitative method is set out for the assessment of risk.

This method (Modified Wilson and Card) uses the concept of Gas Screening Values (GSVs) and typical threshold concentrations of carbon dioxide and methane to identify levels of risk. Sites are then classified into a 'Characteristic Situation' or 'CS' from CS1 where no mitigation is required and CS2 increasing up to CS6 where protection measures are required.

The NHBC guide 'Hazardous Ground Gas - An essential guide for housebuilders' 2023 provides further assessment tools for ground gas monitoring data, including the use of ternary plots to determine ground gas sources.

A separate approach to assessment without monitoring data is discussed under the RB17 header further below.

CIRIA C682 and BS 8576:2013 provide guidance on assessment of VOC intrusion risk.

*Ground Gas Mitigation*

Where a risk is determined to be present by assessment, BS8485:2015+A1:2019 provides guidance for the design of protection systems based on a points scoring system depending on the characteristic situation, structure type, structural barrier types, ventilation and a gas resistant membrane. Source removal can also be considered.

The design requires the structures to be categorised into one of four building types: Type A, Type B, Type C or Type D, related to the construction and end use of the building, together with the control of future structural changes and maintenance.

CIRIA C748 provides advice on the use of membranes as VOC vapour barriers.

CIRIA C735 sets out the approach for verification of installed mitigation measures. Note that if a membrane is installed it must be verified in accordance with CIRIA C735 or it will score zero points and assumed to not afford any protection.

*RB17 Approach*
CL:AIRE RB17 (Card et al 2012) is a pragmatic approach to ground gas risk assessment and was developed because gas concentration, pressure and flow rate measured in a well headspace may not be representative of the conditions in the surrounding formation.

In these low-risk situations, the approach is to use the conceptual site model and the estimation of the likely gas generation from a source to identify where or if gas monitoring is required to better define the risks.

Under this approach, for sites with natural soils only with no credible methane source, then no action is required (no monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1).

*Radon*
Advice on radon protection in England is provided by the UK Health Security Agency, https://www.ukradon.org/information/ukmaps and by the BRE (BR 211 (Scivyer 2023).

Areas of the country can be categorised according to the percentage of existing homes where radon is present above the Action Level:

- 0-1% lower probability.
- 1-3% and 3-10% intermediate probability.
- >10% higher probability.

Basic radon protection measures are required in new buildings and extensions in areas of England and Wales where 3-10% of properties exceed the Action Level and full radon protection measures where >10% exceed the Action Level.

**Unexploded Ordnance (UXO) Guidance**

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA report C681.

BSL carry out non-specialist UXO screening exercises by considering any evidence of UK defence activities on or near the site evident from gathered desk study information and the unexploded aerial delivered bomb (UXB) online risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available online Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experienced and considered competent in the assessment of UXO.

**Geotechnical Guidance**

A preliminary risk assessment of geotechnical hazards is carried out at the desk study stage and confirmed (or amended) at the ground investigation stage.

The CD 622 'Managing Geotechnical Risk' guidance document defines the technical approval and certification procedures to be used to ensure that the risk associated with the geotechnical activities are appropriately managed.

The desk-based stage may also include the requirements for a Coal Mining Risk Assessment (CMRA) which specifically assesses the risks from mining induced instability and related issues in high risk development areas: https://www.gov.uk/guidance/planning-applications-coal-mining-risk-assessments.

In order to establish the requirements of a project, the Geotechnical Category which is based on a consideration of project complexity, proposed geotechnical activities, presence of geo-hazards and severity of geotechnical risks, shall also be considered. These range from Category 1 (small/simple structures) to Category 3 (very large, unusual or complex activities/structures, such as tunnels). It is envisaged most projects typically fall into Category 2, including conventional types of geotechnical structures, earthworks and activities.

In the case of the geotechnical hazard identification at the intrusive investigation stage, this is referred to as the **ground model**.

The geotechnical sections of the report contain the factual information on the geology and relevant site data, including both in situ and laboratory testing, with a geotechnical evaluation of the information stating the assumptions made in the interpretation of the data.

Derived values of geotechnical parameters are obtained from test results by theory (book values), correlation or empiricism in general accordance with BS EN 1997-2:2007 (EC7).

Where derived geotechnical parameters are to be used in designs in accordance with EC7, the selection of characteristic values for geotechnical parameters using the derived values is carried out by well-established experience.

The characteristic value is a cautious estimate of the value affecting the occurrence of the limit state. For any particular material type there may be more than one characteristic value for each parameter because there may be more than one limit state.

The second stage is the selection of design values. The design values are either derived from the characteristic value by applying the relevant partial factors or assessed directly. Similarly, there can be several design values for the same material type.

In the event that geotechnical designs are included in this report, selection of the characteristic and design values is included. Otherwise, it is the duty of the geotechnical designer to determine these within a separate design report (a GDR).

Where it has not been possible to reasonably use an EC7 compliant 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.

In addition to the above:

- Assessments for highways designs are based on CD 622 Managing Geotechnical Risk.
- The assessment of sustainable drainage is based on BRE365 and CIRIA C753 'The SuDS Manual'.
- Earthworks Assessments are based on SHW Series 600 and BS6031.
- Risks from mining (both at the desk based and intrusive stages) are assessed adopting guidance from CIRIA C758.

**Re-Use of Waste Soils Guidance**

*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 drainage trenches, foundation arisings, site strips etc. It is no longer required in its original location, therefore it is considered to be waste. Without an appropriate materials management plan, permit or exemption 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.

*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".

https://www.claire.co.uk/projects-and-initiatives/dow-cop

Developers and contractors are advised to complete all works under the DoWCoP where applicable.

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 principle, 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).

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 e.g. Hub site.

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 is 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 (e.g. bioremediation, stabilisation etc) may require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use.

Construction activities carried out on uncontaminated soils solely for the purpose of improving geotechnical properties are not generally regarded as waste treatment operations and do not require a permit.

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.

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

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. Note that for re-use of landfilled materials or mining wastes, the DoWCoP may not apply and a Waste Recovery Permit (or others) may be required. Liaison with the Environment Agency would be needed on a case by case basis to determine the best option.

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-complaint with the CoP can be referred to the EA for further investigation.

*Soils Re-use under Exemptions and Permits*
Other potential options to allow the re-use and/or import of soils and aggregates on site are provided in the table below. Applies to England/Wales only – Scotland differs.

| 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:<br>• Factory Production Control Manual.<br>• Facility Permit (or Exemption).<br>• 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:<br>• Screening soil on a demolition site to remove wood and rubble.<br>• 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).<br>• Crushing waste (except bricks, tiles and concrete) before screening or blending<br>• 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. |

There are also potential non-enforcement positions for re-use e.g. a site has a large volume waste illegally deposited on it (not by landowner). The new owner is keen to re-use waste where possible to reprofile the site (planning condition granted). The DoWCoP could not be used as materials already excavated and deposited as a waste (illegally). The EA may agree that although the DoWCoP not applicable, they would take a non-enforcement position if the works were completed in accordance with the DoWCoP – this would need to be agreed in advance.

**Waste Classification and Disposal Guidance for Soils**

*Introduction*
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. 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*
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 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 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 (e.g. 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** and classified as either hazardous or non-hazardous waste. WAC analysis must not be used for waste classification.

*Waste Definitions*

| | |
|---|---|
| **Inert** | • Will not undergo any significant physical, chemical or biological transformations.<br>• Will not dissolve.<br>• Will not burn.<br>• Will not physically or chemically react.<br>• Will not biodegrade.<br>• 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.<br>• Has insignificant total leachability and pollutant content.<br>• Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate). |
| **Non-Hazardous** | Is not inert (see above).<br>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) then 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 | |
|---|---|---|---|---|
| WAC testing | Below inert WAC limit values: | Above inert WAC limit values: | Below hazardous WAC limit values | > 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.

*Greenfield Sites and Inert Waste*
The possibility of automatic inert classification naturally occurring "clean" soils should be explored in accordance with the requirements of paragraph 10 (wastes acceptable without testing at landfills for inert waste) of the Landfill (England and Wales) (Amendment) Regulations (2005). 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 (e.g. the waste producer can characterise the waste based on visual assessment and written description with supporting evidence such as a desk study, subject to agreement by the landfill operator).

*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*

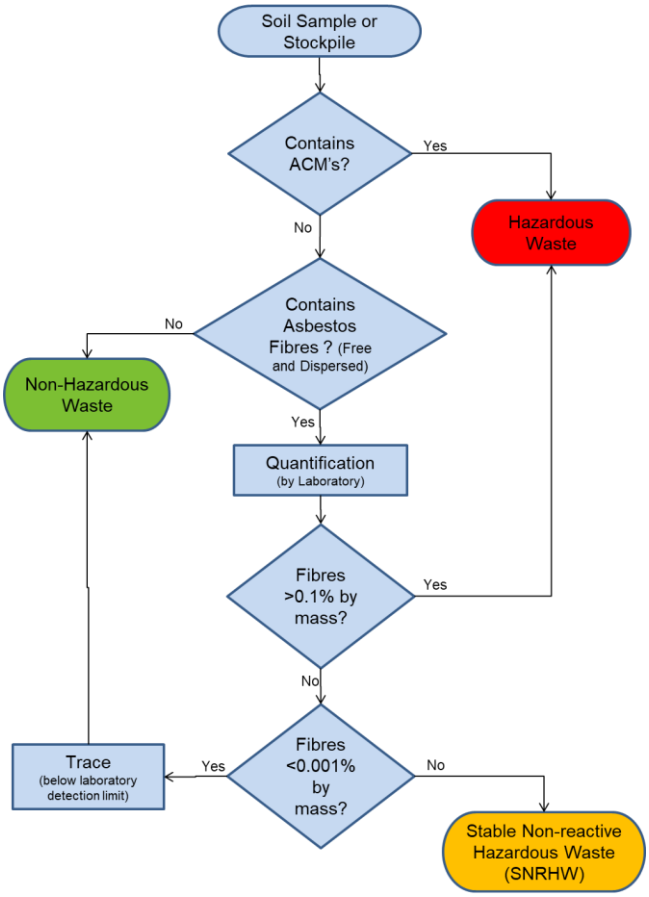

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert 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).

*Waste Containing Asbestos*

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.




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 as summarised below:

| Waste | Conc. by Weight (%) | EWC 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. |

| Waste | Conc. by Weight (%) | EWC 2002 Catalogue Entry Code | Waste Disposal Route |
|---|---|---|---|
| Non-hazardous Soils containing ACM (Mechanically separable) | >0.1% | 17 06 05 (construction material containing asbestos)<br><br>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.<br>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. |

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 site[1]. 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 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 (e.g. 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.

Asbestos containing materials can remain in situ under a suitable cover system which may be hard surfacing 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.

Publications from the JIWG provide guides for decision making in relation to construction.

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. Re-use of soils containing asbestos should be as per CARSOILS.

The re-use of soils containing asbestos at concentrations above hazardous waste levels may be met 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 | Haz | | 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 contractor's 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.<br>Basic asbestos management good practice will be required. Typically precautions would include:<br>• Ensuring soils do not dry out to become dusty.<br>• Site personnel have the risk communicated at induction stage. | Yes<br>Soils can be re-used under CL:AIRE CoP with the correct precautions in place. | 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.<br>Typical precautions would include:<br>• Site personnel have the risk communicated at induction stage.<br>• Ensuring personnel have suitable training.<br>• Task monitoring to inform PPE requirements.<br>• Ensuring soils do not dry out to become dusty and that misting is available during groundworks.<br>• Separate stockpiling.<br>• Clean haulage routes. | Possibly.<br>Soils may be able to be re-used under CL:AIRE CoP, subject to a satisfactory Risk Assessment and regulatory agreement with the correct precautions in place. | Clean cover with hard dig/demarcation layer or hardstanding cover required. |
| 0.1+% | | | | √ | Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement.<br>Typical precautions would include:<br>• Site personnel have the risk communicated at induction stage.<br>• Ensuring personnel have suitable training.<br>• Task monitoring to inform PPE requirements.<br>• Site wide and or perimeter monitoring.<br>• Ensuring soils do not dry out to become dusty and that misting is available during groundworks.<br>• Separate stockpiling. | Unlikely [3]<br>Re-use of soils containing asbestos within an earthworks scheme will involve significant engineering and the risk for generating dusts will be significantly | Clean cover and a hard dig / demarcation layer. A plan should be in place for future excavations as part of the Health and Safety File. |

| Concentration (by weight) | Waste Disposal | | | | Construction Issues | End Use | |
|---|---|---|---|---|---|---|---|
| | Recycle | Inert | SNR | Haz | | Suitable for re-use on site | Precautions |
| | | | | | • Clean haulage routes.<br>• Decontamination unit | increased with repeated handling and compaction. | |

1. 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.

2 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.

**BH01**

Sheet 1 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382423E, 397039N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.74m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 09/10/24 - 14/10/24 |

**Hole Type:** CP+RC

**Scale:** 1:51

**Logged:** AH **Checked:** NS

| Well | Water Strikes | Sample and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | 0.00-0.30 | ES | | 0.13 | 28.61 | | MADE GROUND: Concrete underlain by white geotextile membrane and metal wire mesh. |
| | | 0.20 | D | | 0.40 | 28.34 | | MADE GROUND: Brown slightly clayey gravelly sand. Sand is fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. |
| | | 0.80 | D | | 0.70 | 28.04 | | MADE GROUND: Light brown gravelly sand with high cobble content. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete and sandstone. Cobbles are angular to sub-angular of brick, concrete and sandstone up to 180mm in diameter. |
| | | 1.20-1.65 | D | | | | | |
| | | 1.20 | SPT | N=26 (2,2/5,7,7,7) | | | | Medium dense orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is angular to sub-angular to sub-rounded fine to coarse of sandstone, siltstone and coal. |
| | | 2.00 | D | | | | | |
| | | 2.40-2.85 | D | | 2.40 | 26.34 | | |
| | | 2.40 | SPT | N=9 (1,2/3,2,2,2) | | | | Loose orangish brown slightly gravelly silty SAND. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse sandstone and coal. |
| | | | | | 3.20 | 25.54 | | |
| | | 3.50 | SPT | N=18 (2,3/4,4,4,6) | | | | Firm to stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to medium of coal and sandstone. |
| | | 4.00 | SPT | N=24 (3,4/5,6,7,6) | | | | *4.00m-4.45m bgl: No SPT recovery.* |
| | | 4.20 | D | | | | | |
| | | 5.20-5.65 | D | | | | | *Becomes silty from 5.00m bgl.* |
| | | 5.20 | SPT | N=24 (3,4/5,6,7,6) | | | | |
| | | 6.80 | D | | | | | |
| | | 6.90-7.30 | D | | | | | |
| | | 6.90 | SPT | N≥50 (5,5/50 for 265mm) | 7.30 | 21.44 | | Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. |
| | | 8.50 - 10.00 | NR | 33 27 0 | | | | |
| | | | NI | | | | | |
| | | | 4 | | | | | |
| | | | | 67 45 30 | | | | |
| | | | | TCR SCR RQD | | | | |

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.50m bgl with rotary cored follow on to 25.00m bgl.
6. Installation to 7.00m bgl: 1.50m plain 50mm PVC, 5.50m slotted PVC upon completion.

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.

**BH01**

Sheet 2 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382423E, 397039N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.74m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 09/10/2024 - 14/10/2024 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| CP+RC | 1:51 | AH | NS |

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 10.00 - 11.50 | NR | | | | | | | |
| | | | NI | | | | | | | |
| | | | 6 | | | | | | | |
| | | | NI | 100 | 100 | 33 | | | | |
| | | 11.50 - 13.00 | 10 | | | | | | | |
| | | | NI | 83 | 77 | 52 | 13.10 | 15.64 | | |
| | | 13.00 - 14.50 | 8 | | | | 13.33 | 15.41 | | Very weak to weak red partially weathered MUDSTONE. *13.20m-14.24m bgl: Discontinuities are very close to closely spaced partly open rough undulating horizontal to 5 degrees sub-horizontal.* |
| | | | NI | | | | | | | Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. *Sandstone becomes fine to medium from 13.33m bgl up to 13.50m bgl.* |
| | | | 2 | 100 | 93 | 70 | | | | *14.24m-14.34m bgl: Non intact.* *14.34m-14.50m bgl: Discontinuities are closely spaced open rough undulating horizontal to 10 degrees sub-horizontal.* *14.50m-15.58m bgl: Discontinuities are close to medium spaced partly open rough undulating horizontal to 10 degrees sub-horizontal.* |
| | | 14.50 - 16.00 | 7 | | | | | | | |
| | | | NI | | | | | | | *15.58m-15.68m bgl: Non intact.* *15.68m-16.00m bgl: Discontinuities are closely spaced partly open rough undulating horizontal.* |
| | | | 3 | 100 | 100 | 60 | | | | *16.00m-17.50m bgl: Discontinuities are extremely close to closely spaced partly open rough undulating horizontal to 10 degrees sub-horizontal.* |
| | | 16.00 - 17.50 | 9 | | | | | | | |
| | | 17.50 - 19.00 | 6 | 100 | 87 | 43 | | | | *17.50m-18.50m bgl: Discontinuities are very close to closely spaced partly open to wide rough horizontal.* |
| | | | NI | | | | | | | *18.50m-18.75m bgl: Non intact.* |
| | | | 3 | 100 | 93 | 27 | | | | *18.75m-19.00m bgl: Discontinuities are very closely spaced partly open to wide rough undulating horizontal to 45 degrees sub-horizontal.* *19.00m-20.14m bgl: Discontinuities are very close to closely spaced partly open to wide rough undulating horizontal to 20 degrees sub-horizontal.* |
| | | 19.00 - 20.50 | 9 | | | | | | | *Sandstone becomes fine to medium from 19.35m bgl up to 19.90m bgl.* |

11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.50m bgl with rotary cored follow on to 25.00m bgl.
6. Installation to 7.00m bgl: 1.50m plain 50mm PVC, 5.50m slotted PVC upon completion.

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.

**BH01**

Sheet 3 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382423E, 397039N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.74m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 09/10/2024 - 14/10/2024 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| CP+RC | 1:51 | AH | NS |

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | NI 3 | 100 | 100 | 37 | | | | *20.14m-20.22m bgl: Non intact.* *20.22m-20.50 bgl: Discontinuities are very closely spaced partly open to wide rough undulating horizontal to 45 degrees sub-horizontal.* *20.50m-22.00m bgl: Discontinuities are extremely close to closely spaced partly open rough undulating horizontal to 25 degrees sub-horizontal.* |
| | | 20.50 - 22.00 | 12 | | | | | | | |
| | | | NI 2 | 100 | 93 | 57 | | | | *22.00m-22.05m bgl: Non intact.* *22.05m-22.20m bgl: Discontinuities are closely spaced partly open rough horizontal to 10 degrees sub-horizontal.* *22.20m-22.70m bgl: Non intact.* |
| | | 22.00 - 23.50 | NI 5 | | | | | | | *22.70m-23.50m bgl: Discontinuities are close to medium spaced partly open rough undulating horizontal to 10 degrees sub-horizontal.* |
| | | 23.50 - 25.00 | 9 | 100 | 100 | 57 | | | | *23.50m-25.00m bgl: Discontinuities are very close to closely spaced partly open rough undulating horizontal to 5 degrees sub-horizontal.* |
| | | | | | | | 24.48 | 4.26 | | Very weak to weak red MUDSTONE. |
| | | | | | | | 25.00 | 3.74 | | End of Borehole at 25.00m |

21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.50m bgl with rotary cored follow on to 25.00m bgl.
6. Installation to 7.00m bgl: 1.50m plain 50mm PVC, 5.50m slotted PVC upon completion.

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

Rotary Open Hole Borehole No.

**BH01A**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382424E, 397040N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.74m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 18/11/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| RO | 1:75 | AH | NS |

| Well | Water Strikes | Sample and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 0.40 | 28.34 | | MADE GROUND: Brown slightly clayey gravelly sand. Sand is fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. |
| | | | | | 2.40 | 26.34 | | Orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is angular to sub-angular to sub-rounded fine to coarse of sandstone, siltstone and coal. |
| | | | | | 3.20 | 25.54 | | Silty SAND. (Drilling description) |
| | | | | | 7.30 | 21.44 | | Silty boulder CLAY. (Drilling description) |
| | | | | | 15.00 | 13.74 | | Red and grey SANDSTONE. (Drilling description). |
| | | | | | | | | End of Borehole at 15.00m |

1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny.
2. Hand pit excavation to 1.20m bgl.
3. Groundwater encountered at 12.00m bgl.
4. Borehole sides stable.
5. Installation to 15.00m bgl: 8.00m plain 50mm PVC, 7.00m slotted PVC upon completion.

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.

**BH02**

Sheet 1 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382398E, 397032N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.36m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 08/10/24 - 11/10/24 |

**Hole Type:** CP+RC

**Scale:** 1:51

| Logged | Checked |
|---|---|
| AH | NS |

| Well | Water Strikes | Sample and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | 0.00-0.40 | ES | | | | | MADE GROUND: Brown slightly clayey gravelly sand. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. |
| | | 0.20 | D | | | | | *Cobbles of sub-angular concrete up to 180mm in diameter from 0.30m to 0.40m bgl.* |
| | | 1.00 | D | | | | | |
| | | 1.20-1.65 | D | | 1.20 | 27.16 | | Stiff orangish brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone. |
| | | 1.20 | SPT | N=24 (3,4/6,6,6,6) | 1.65 | 26.71 | | Medium dense orangish brown slightly clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is angular to sub-angular to sub-rounded fine to coarse of sandstone, siltstone and coal. |
| | | 2.00 | D | | | | | |
| | | 2.30-2.75 | D | | | | | |
| | | 2.30 | SPT | N=23 (6,6/6,6,6,5) | | | | |
| | | 3.00 | D | | | | | |
| | | 3.30-3.75 | D | | | | | |
| | | 3.30 | SPT | N=24 (3,4/5,5,6,8) | 3.40 | 24.96 | | Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to medium of coal and sandstone. |
| | | 3.80 | D | | | | | |
| | | 4.40-4.85 | U | | | | | *Becomes silty from 4.40m bgl.* |
| | | 4.90 | D | | | | | |
| | | | | | 5.30 | 23.06 | | Medium dense orangish brown slightly silty fine to coarse SAND. |
| | | 5.50-5.95 | D | | | | | |
| | | 5.50 | SPT | N=16 (2,2/3,3,4,6) | | | | |
| | | 6.00 | D | | | | | |
| | | | | | 6.50 | 21.86 | | Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to medium of coal and sandstone. |
| | | 6.70 | D | | | | | |
| | | 6.80-7.05 | D | | 6.80 | 21.56 | | Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. |
| | | 6.80 | SPT | N≥50 (7,18/50 for 105mm) | | | | |
| | | 8.10-8.20 | D | | | | | *8.00m-10.00m bgl: No recovery.* |
| | | 8.10 | SPT | 0 (75 for 90mm) / N≥50 / 0 for 0mm | | | | *Continued as rotary cored borehole from 8.20m bgl.* |
| | | 8.00 - 9.50 | NR | | | | | |
| | | | NR | 67 / 47 / 23 | | | | |
| | | | | TCR / SCR / RQD | | | | |

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.20m bgl with rotary cored follow on to 26.00m bgl.
6. Installation to 1.20m bgl: 0.20m plain 50mm PVC, 1.00m slotted PVC upon completion.

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.

**BH02**

Sheet 2 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382398E, 397032N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.36m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 08/10/2024 - 11/10/2024 |

**Hole Type:** CP+RC

**Scale:** 1:51

**Logged:** AH **Checked:** NS

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 9.50 - 11.00 | NI<br>8<br>NI | 100 | 70 | 47 | | | | *10.00m-10.30m bgl: Non Intact.*<br>*10.00m-11.00m bgl: Discontinuities are close to medium spaced rough partly open horizontal to 45 degrees sub-horizontal.* |
| | | 11.00 - 12.50 | 4<br>NI<br>2<br>NI<br>12 | 100 | 100 | 60 | | | | *11.00m-11.05m bgl: Non Intact.*<br>*11.00m-12.50m bgl: Discontinuities are close to medium spaced rough partly open to medium wide horizontal to 20 degrees sub-horizontal.*<br>*11.35m-11.40m bgl: Non Intact.*<br>*11.45m-11.50m bgl: Non Intact.* |
| | | 12.50 - 14.00 | 15 | 100 | 100 | 83 | | | | *12.50m-14.00m bgl: Discontinuities are extremely close to medium spaced rough undulating partly open to medium wide horizontal to 45 degrees sub-horizontal.* |
| | | 14.00 - 15.50 | 10 | 100 | 100 | 60 | | | | *14.00m-15.50m bgl: Discontinuities are extremely close to medium spaced rough undulating partly open to medium wide horizontal to 20 degrees sub-horizontal.* |
| | | 15.50 - 17.00 | 11 | 100 | 100 | 67 | | | | *15.50m-17.00m bgl: Discontinuities are very close to medium spaced rough undulating partly open to medium wide horizontal to 20 degrees sub-horizontal.* |
| | | 17.00 - 18.50 | 7 | 100 | 90 | 70 | | | | *17.00m-18.50m bgl: Discontinuities are close to medium spaced closed to medium wide rough undulating horizontal.* |
| | | 18.50 - 20.00 | 2<br>NI<br>2<br>NI | 100 | 100 | 53 | 18.88<br>19.28 | 9.48<br>9.08 | | *18.50m-20.00m bgl: Discontinuities are close to medium spaced partly open to medium wide rough undulating horizontal.*<br>Very weak to weak red partially weathered MUDSTONE.<br>*18.88m-18.98m bgl: Non Intact.*<br>*19.14m-19.19m bgl: Non Intact.*<br>Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. |

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.20m bgl with rotary cored follow on to 26.00m bgl.
6. Installation to 1.20m bgl: 0.20m plain 50mm PVC, 1.00m slotted PVC upon completion.

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.

**BH02**

Sheet 3 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382398E, 397032N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.36m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 08/10/2024 - 11/10/2024 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| CP+RC | 1:51 | AH | NS |

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| [redacted] | | 20.00 - 21.50 | 14 | 100 | 93 | 60 | 26.00 | 2.36 | | *20.00m-21.50m bgl: Discontinuities are extremely close to medium spaced partly open rough undulating horizontal to 10 degrees sub-horizontal. Vertical fractures at 20.00m-20.05m bgl and 21.10m-21.50m bgl.* |
| | | 21.50 - 23.00 | 7 | | | | | | | *21.50m-23.00m bgl: Discontinuities are extremely close to medium spaced partly open rough horizontal to 30 degrees sub-horizontal. Vertical fractures at 22.70m-22.80m bgl.* |
| | | | NI | | | | | | | *22.55m-22.65m bgl: Non Intact.* |
| | | | 4 | | | | | | | |
| | | 23.00 - 24.50 | 4 | 100 | 93 | 57 | | | | *23.00m-24.50m bgl: Discontinuities are closely spaced partly open rough undulating horizontal to 10 degrees sub-horizontal.* |
| | | | NI | | | | | | | *23.40m-23.50m bgl; Non Intact.* |
| | | | 6 | | | | | | | *Sandstone becomes fine to medium from 23.55m bgl up to 24.50m bgl.* |
| | | 24.50 - 26.00 | 3 | 100 | 97 | 53 | | | | *24.50m-26.00m bgl: Discontinuities are closely spaced partly open to wide rough undulating horizontal to 25 degrees sub-horizontal.* |
| | | | NI | | | | | | | *24.80m-24.85m bgl: Non Intact.* |
| | | | 6 | | | | | | | |
| | | | | | | | | | | End of Borehole at 26.00m |

21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.20m bgl with rotary cored follow on to 26.00m bgl.
6. Installation to 1.20m bgl: 0.20m plain 50mm PVC, 1.00m slotted PVC upon completion.

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.

**BH03**

Sheet 1 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382382E, 397036N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.31m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 - 10/10/24 |

**Hole Type:** CP+RC

**Scale:** 1:51

**Logged:** AH **Checked:** NS

| Well | Water Strikes | Sample and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | 0.00-1.00<br>0.20 | ES<br>D | | | | | MADE GROUND: Brown slightly clayey gravelly sand. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. |
| | | 1.20-1.65<br>1.20 | D<br>SPT | N=30<br>(10,5/7,7,8,8) | 1.20 | 27.11 | | Dense orangish brown slightly clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is angular to sub-angular to sub-rounded fine to coarse of sandstone, siltstone and coal. |
| | | 2.00 | D | | | | | |
| | | 2.30-2.75<br>2.30 | D<br>SPT | N=20<br>(7,7/7,5,4,4) | | | | *Becomes medium dense from 2.30m bgl.* |
| | | 3.00 | D | | | | | |
| | | 3.50-3.95<br>3.50 | D<br>SPT | N=27<br>(3,3/7,7,6,7) | 3.60 | 24.71 | | Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to medium of coal and sandstone. |
| | | 4.50<br>4.60 | SPT<br>D | N=20<br>(4,4/5,5,5,5) | | | | |
| | | 5.50-5.95 | U | | | | | *Becomes silty from 5.00m bgl.* |
| | | 6.00 | D | | | | | |
| | | 6.80-7.05<br>6.80 | D<br>SPT | N≥50<br>(7,18/50 for 105mm) | 6.80 | 21.51 | | Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. |
| | | 8.00-8.10 | D | | | | | |
| | | 8.00<br>8.00 - 9.50 | SPT<br>NR | 0<br>(75 for 0mm) | N≥50<br>120mm | 0<br>/0 for | | *8.00m-9.50m bgl: No recovery.*<br>*Continued as rotary cored borehole from 8.10m bgl.* |
| | | | NI<br>3<br>2 | 100 | 43 | 7 | | *9.50m-9.65m bgl: Non Intact.*<br>*9.65m-11.00m bgl: Discontinuities are very closely spaced partly open to medium wide rough horizontal to 10 degrees sub-horizontal.*<br>*9.75m-9.80m bgl: Non Intact.*<br>*9.90m-10.10m bgl: Non Intact.* |
| | | | | **TCR** | **SCR** | **RQD** | | |

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.10m bgl with rotary cored follow on to 24.50m bgl.
6. Installation to 6.50m bgl: 1.50m plain 50mm PVC, 5.00m slotted PVC upon completion.

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.

**BH03**

Sheet 2 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382382E, 397036N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.31m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/2024 - 10/10/2024 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| CP+RC | 1:51 | AH | NS |

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 9.50 - 11.00 | NI | | | | | | | |
| | | | 6 | | | | | | | |
| | | | NI | | | | | | | |
| | | | 3 | 67 | 30 | 0 | | | | |
| | | 11.00 - 12.50 | NR | | | | | | | |
| | | | NI | | | | | | | |
| | | | 4 | | | | | | | |
| | | | NI | | | | | | | |
| | | | 2 | | | | | | | |
| | | 12.50 - 14.00 | 2 | 100 | 77 | 13 | | | | |
| | | | NI | | | | | | | |
| | | | 11 | | | | | | | |
| | | 14.00 - 15.50 | 11 | 100 | 87 | 33 | | | | |
| | | | NI | | | | | | | |
| | | | 2 | 100 | 100 | 40 | | | | |
| | | 15.50 - 17.00 | 17 | | | | | | | |
| | | 17.00 - 18.50 | 2 | 100 | 97 | 67 | | | | |
| | | | NI | | | | | | | |
| | | | 5 | | | | | | | |
| | | 18.50 - 20.00 | 4 | 100 | 97 | 47 | | | | |
| | | | NI | | | | | | | |
| | | | 3 | | | | | | | |
| | | | | 80 | 50 | 27 | | | | |

*10.60m-10.80m bgl: Non Intact.*

*11.00m-11.50m bgl: No recovery.*

*11.50m-11.55m bgl: Non Intact.*
*11.50m-12.50m bgl: Discontinuities are extremely close to closely spaced partly open to wide rough horizontal.*
*11.70m-12.20m bgl: Non Intact.*

*12.50m-14.00m bgl: Discontinuities are extremely close to closely spaced partly open to medium wide rough undulating horizontal to 15 degrees sub-horizontal. Vertical fractures at 13.55m-13.70m bgl and 13.9m-13.95m bgl.*
*12.65m-13.00m bgl: Not intact.*

*14.00m-15.50m bgl: Discontinuities are closely spaced partly open to medium wide rough undulating horizontal to 30 degrees sub-horizontal.*

*15.00m-15.05m bgl: Non Intact.*
*15.20m-15.35m bgl: Not intact.*

*15.50m-17.00m bgl: Discontinuities are very close to closely spaced partly open to wide rough undulating horizontal to 20 degrees sub-horizontal. Vertical fractures at 15.70m-16.00m bgl.*

*17.00m-18.50m bgl: Discontinuities are very close to medium spaced partly open rough undulating up to 5 degrees sub-horizontal.*
*17.40m-17.45m bgl: Non Intact.*

*17.00m-18.50m bgl: Discontinuities are close to medium spaced partly open to medium wide rough undulating horizontal to 25 degrees sub-horizontal.*

*19.40m-19.45m bgl: Non Intact.*

*Sandstone becomes fine to medium from 19.80m bgl up to 20.00m bgl.*

11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.10m bgl with rotary cored follow on to 24.50m bgl.
6. Installation to 6.50m bgl: 1.50m plain 50mm PVC, 5.00m slotted PVC upon completion.

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.

**BH03**

Sheet 3 of 3

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382382E, 397036N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.31m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/2024 - 10/10/2024 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| CP+RC | 1:51 | AH | NS |

| Well | Water Strike | Depth (m) | Type / FI | Coring TCR (%) | Coring SCR (%) | Coring RQD (%) | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 20.00 - 21.50 | NR | 67 | 37 | 13 | | | | *20.00m-20.40m bgl: No recovery.* |
| | | | 5 | | | | | | | *20.40m-21.50m bgl: Discontinuities are extremely close the very closely spaced partly open to wide rough undulating horizontal.* |
| | | | NI | | | | | | | *20.70m-20.90m bgl: Non Intact.* |
| | | | 2 | | | | | | | *21.00m-21.10m bgl: Non Intact.* |
| | | | NI | | | | | | | *21.30m-21.40m bgl: Non Intact.* |
| | | | 2 | | | | | | | |
| | | | NI | | | | | | | |
| | | | 2 | | | | | | | |
| | | 21.50 - 23.00 | NR | | | | | | | *22.00m-23.00m bgl: Discontinuities are very close to closely spaced medium wide to wide rough undulating horizontal to 30 degrees sub-horizontal.* |
| | | | 2 | | | | | | | |
| | | | NI | | | | | | | |
| | | | 3 | | | | | | | |
| | | | NI | | | | | | | |
| | | | 2 | 100 | 87 | 67 | | | | *23.00m-24.50m bgl: Discontinuities are very close to closely spaced partly open to medium wide rough undulating horizontal to 10 degrees sub-horizontal.* |
| | | 23.00 - 24.50 | 6 | | | | | | | |
| | | | NI | | | | 24.00 | 4.31 | | Very weak to weak red partially weathered MUDSTONE. |
| | | | 4 | | | | 24.15 | 4.16 | | Very weak to weak red and grey fine to coarse grained partially weathered SANDSTONE. |
| | | | | | | | 24.50 | 3.81 | | End of Borehole at 24.50m |

21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. Hand pit excavation to 1.20m bgl.
3. No groundwater encountered.
4. Borehole sides stable.
5. Cable percussive borehole to 8.10m bgl with rotary cored follow on to 24.50m bgl.
6. Installation to 6.50m bgl: 1.50m plain 50mm PVC, 5.00m slotted PVC upon completion.

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

Rotary Open Hole Borehole No.

**BH03A**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 3823823E, 397037N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.31m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 18/11/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| RO | 1:75 | AH | NS |

| Well | Water Strikes | Sample and In Situ Testing: Depth (m) | Type | Results | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1.20 | 27.11 | | MADE GROUND: Brown slightly clayey gravelly sand. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. |
| | | | | | 3.60 | 24.71 | | Clayey SAND and GRAVEL. (Drilling description). |
| | | | | | 6.80 | 21.51 | | Sandy Gravelly CLAY. (Drilling description). |
| | | | | | 15.00 | 13.31 | | Red and Grey SANDSTONE. (Drilling description). |
| | | | | | | | | End of Borehole at 15.00m |

1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny.
2. Hand pit excavation to 1.20m bgl.
3. Groundwater encountered at 12.00m bgl.
4. Borehole sides stable.
5. Installation to 15.00m bgl: 7.00m plain 50mm PVC, 8.00m slotted PVC upon completion.

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

# Trial Pit Log

| No. |
|---|
| SA01 |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382392E, 397034N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.26m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.60 | ES | | | | | MADE GROUND: Dark brown slightly clayey gravelly sand with moderate cobble content overlain by grass. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete and sandstone. Cobbles are angular to sub-angular of brick up to 160mm in diameter. |
| | 0.70 | D | | 0.65 | 27.61 | | Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of coal and sandstone. |
| | 1.20-1.50 | D | | 1.17 | 27.09 | | Orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone, siltstone and coal. |
| | | | | 2.00 | 26.26 | | End of Trial Pit at 2.00m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides stable.
4. Excavation terminated to undertake soakaway testing.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| SA02 |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382420E, 397049N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.75m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.20-0.70 | ES | | 0.13 | 28.62 | | MADE GROUND: Concrete underlain by white geotextile membrane and metal wire. |
| | | | | 0.70 | 28.05 | | MADE GROUND: Brown gravelly sand with high cobble content. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete and sandstone. Cobbles are angular to sub-angular of brick, concrete and sandstone up to 180mm in diameter. |
| | | | | | | | End of Trial Pit at 0.70m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides stable.
4. Excavation terminated due to basement floor obstruction encountered.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| SA02A |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382427E, 397043N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.84m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| 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 | 28.74 | | MADE GROUND: Concrete underlain by white geotextile membrane. |
| | | | | | | | MADE GROUND: Brown slightly clayey gravelly sand with high cobble content. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete, sandstone and slate. Cobbles are angular to sub-angular of brick, concrete and sandstone up to 180mm in diameter. |
| | | | | 1.00 | 27.84 | | |
| | 1.10 | D | | | | | Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to medium of coal and sandstone. |
| | 1.80 | D | | | | | |
| | | | | 1.95 | 26.89 | | End of Trial Pit at 1.95m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides stable.
4. Excavation terminated to undertake soakaway testing.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| SA03 |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382397E, 397027N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.33m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.80 | ES | | | | | MADE GROUND: Dark brown slightly clayey gravelly sand with low cobble content. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete, ceramics, slate and sandstone. Cobbles are angular of brick and concrete up to 170mm in diameter. |
| | 0.90 | D | | 0.81 | 27.52 | | Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of coal and sandstone. |
| | 1.70 | D | | 1.54 | 26.79 | | Orangish brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel is sub-angular to sub-rounded fine to coarse of sandstone. |
| | | | | 2.30 | 26.03 | | End of Trial Pit at 2.30m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable.
4. Excavation terminated to undertake soakaway testing.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| SA04 |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382408E, 397040N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.12m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.06-0.50 | ES | | 0.06 | 28.06 | | MADE GROUND: Sandstone brick layer. |
| | | | | | | | MADE GROUND: Dark grey to black slightly clayey gravelly ashy sand. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of coal, siltstone and sandstone. Cobbles are sub-angular to sub-rounded sandstone and siltstone up to 65mm in diameter. |
| | | | | 0.50 | 27.62 | | |
| | 0.60 | D | | | | | Firm orangish brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone, coal and siltstone. |
| | 1.60 | D | | | | | |
| | | | | 2.30 | 25.82 | | End of Trial Pit at 2.30m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides stable.
4. Excavation terminated to undertake soakaway testing.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP01** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382374E, 397029N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.12m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.05 | ES | | | | | MADE GROUND: Dark brown slightly clayey gravelly sand with moderate cobble content overlain by grass. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete and sandstone. Cobbles are angular to sub-angular of brick up to 160mm in diameter. |
| | 0.60 | D | | 0.50 | 27.62 | | Orangish brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is sub-angular to rounded fine to coarse of sandstone. |
| | 1.50 | D | | 1.00 | 27.12 | | Orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone, siltstone and coal. |
| | 2.50 | D | | 3.00 | 25.12 | | End of Trial Pit at 3.00m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable and collapsing from 2.50m bgl.
4. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP02** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382395E, 397051N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.13m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.20 | ES | | 0.20 | 27.93 | | MADE GROUND: Dark brown slightly clayey gravelly sand overlain by grass. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete, slate and sandstone. |
| | | | | | | | MADE GROUND: Cobbles with much finer material and occassional boulders. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick concrete, slate and sandstone. Cobbles are angular to sub-angular of brick, concrete and sandstone up to 190mm in diameter. Boulders are angular to sub-angular of concrete up to 250mm in diameter. |
| | | | | 2.00 | 26.13 | | End of Trial Pit at 2.00m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable collapsing from 0.50m bgl.
4. Excavation terminated due to collapse and basement floor obstruction encountered.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP03** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382421E, 397032N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.77m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.30 | ES | | | | | MADE GROUND: Light brown sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of concrete, brick, plastic, slate and sandstone. |
| | 0.30-1.00 | ES | | 0.30 | 28.47 | | MADE GROUND: Cobbles with much finer material. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete, metal, plastic, ceramics, slate and sandstone. Cobbles are angular to sub-angular of brick, concrete, slate and sandstone up to 180mm in diameter. Boulders are angular to sub-angular of concrete and sandstone up to 700mm in diameter. |
| | 2.00 | D | | | | | |
| | | | | 2.30 | 26.47 | | End of Trial Pit at 2.30m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable and collapsing from 0.50m bgl.
4. Excavation terminated due to collapse and basement floor obstruction encountered.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP04** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382429E, 397027N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.73m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 10/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-1.00 | ES | | | | | MADE GROUND: Cobbles with much finer material. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete, slate and sandstone. Cobbles are angular to sub-angular of brick, concrete and sandstone up to 190mm in diameter. |
| | | | | | | | *Boulders of angular to sub-angular of concrete up to 1.00m in diameter from 1.40m bgl.* |
| | | | | 1.80 | 26.93 | | End of Trial Pit at 1.80m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable and collapsing from 0.50m bgl.
4. Excavation terminated due to collapse and basement floor obstruction encountered.
5. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP05** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382388E, 397045N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.07m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | 0.00-0.40 | ES | | | | | MADE GROUND: Dark brown slightly clayey gravelly sand with moderate cobble content overlain by grass. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, concrete and sandstone. Cobbles are angular to sub-angular of brick up to 160mm in diameter. |
| | 0.50 | D | | 0.40 | 27.67 | | Orangish brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is sub-angular to rounded fine to coarse of sandstone. |
| | 1.50 | D | | 1.10 | 26.97 | | Orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone, siltstone and coal. |
| | 2.50 | D | | 3.00 | 25.07 | | End of Trial Pit at 3.00m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides unstable and collapsing from 2.50m bgl.
4. Excavation backfilled with arisings upon completion.

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

# Trial Pit Log

| No. |
|---|
| **TP06** |
| Sheet 1 of 1 |

| | | | |
|---|---|---|---|
| **PROJECT NO:** | C5540 | **CO-ORDS:** | 382415E, 397056N |
| **PROJECT NAME:** | CORNBROOK RESIDENTIAL, MANCHESTER | **LEVEL:** | 28.92m OD |
| **CLIENT:** | FG VIVERE MANCHESTER LTD | **DATES:** | 07/10/24 |

| Hole Type | Scale | Logged | Checked |
|---|---|---|---|
| TP | 1:25 | AH | NS |

| Water Strikes | Sample and In Situ Testing | | | Depth (m) | Level (m OD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth (m) | Type | Results | | | | |
| | | | | 0.40 | 28.52 | | MADE GROUND: Concrete underlain by white geotextile membrane. |
| | 0.50-1.00 | ES | | | | | MADE GROUND: Brown slightly clayey gravelly sand with high cobble content. Sand fine to coarse. Gravel is angular to sub-angular of brick, concrete, sandstone and slate. Cobbles are angualr to sub-angular of brick, concrete and sandstone up to 180mm in diameter. |
| | | | | 1.60 | 27.32 | | |
| | 1.70 | D | | | | | Firm orangish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to medium of coal and sandstone. |
| | | | | 2.10 | 26.82 | | |
| | 2.20 | D | | | | | Orangish brown clayey gravelly SAND. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone. |
| | | | | 2.80 | 26.12 | | |
| | 2.90 | D | | | | | Orangish brown clayey SAND and GRAVEL. Sand is fine to coarse. Gravel is sub-rounded to rounded fine to coarse of sandstone, siltstone and coal. |
| | | | | 3.00 | 25.92 | | End of Trial Pit at 3.00m |

1.0
2.0
3.0
4.0
5.0

**Remarks**

1. Service clearance undertaken by a BSL engineer using CAT & Genny and GPR.
2. No groundwater encountered.
3. Excavation sides stable.
4. Excavation backfilled with arisings upon completion.

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**

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

**e:** a.hunt@brownfield-solutions.co.uk

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

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

# Analytical Report Number : 24-048489

Replaces Analytical Report Number: 24-048489, issue no. 1
Client references/information amended.
Sample ID amended as per clients request

| | | | |
|---|---|---|---|
| **Project / Site name:** | Cornbrook Residential | **Samples received on:** | 17/10/2024 |
| **Your job number:** | C5540 | **Samples instructed on/ Analysis started on:** | 17/10/2024 |
| **Your order number:** | 903 | **Analysis completed by:** | 24/10/2024 |
| **Report Issue Number:** | 2 | **Report issued on:** | 22/11/2024 |
| **Samples Analysed:** | 6 soil samples | | |

**Signed:**

Caterina Bentley
Customer Service Advisor
**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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-048489**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352087 | 352088 | 352089 | 352090 | 352091 |
|---|---|---|---|---|---|---|---|---|
| Sample Reference | | | | TP06 | SA03 | TP04 | TP01 | SA04 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.50-1.00 | 0.00-0.80 | 0.06-0.50 | 0.00-0.05 | 0.06-0.50 |
| Date Sampled | | | | 07/10/2024 | 10/10/2024 | 10/10/2024 | 10/10/2024 | 10/10/2024 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | | | | |
| Stone Content | % | 0.1 | NONE | 30.5 | 14.2 | 32.3 | 35.4 | 40.9 |
| Moisture Content | % | 0.01 | NONE | 14 | 18 | 16 | 15 | 12 |
| Total mass of sample received | kg | 0.1 | NONE | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| **Asbestos** | | | | | | | | |
| Asbestos in Soil Detected/Not Detected | Type | N/A | ISO 17025 | Not-detected | Not-detected | Not-detected | Not-detected | Not-detected |
| Asbestos Analyst ID | N/A | N/A | N/A | JSW | JSW | JSW | JSW | JSW |
| **General Inorganics** | | | | | | | | |
| pH (L099) | pH Units | N/A | MCERTS | 10.8 | 7 | 8 | 8.3 | 7.3 |
| Water Soluble Sulphate as $SO_4$ 16hr extraction (2:1) | mg/kg | 2.5 | MCERTS | 450 | 3100 | 3800 | 260 | 76 |
| Water Soluble $SO_4$ 16hr extraction (2:1 Leachate Equivalent) | mg/l | 1.25 | MCERTS | 226 | 1560 | 1880 | 129 | 38.1 |
| Organic Matter (automated) | % | 0.1 | MCERTS | 1 | 2.3 | 1.7 | 2.2 | 7.7 |
| **Speciated PAHs** | | | | | | | | |
| Naphthalene | mg/kg | 0.05 | MCERTS | < 0.05 | 0.06 | 0.18 | 0.17 | 18 |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | 0.07 | 0.13 | 1.4 |
| Acenaphthene | mg/kg | 0.05 | MCERTS | 0.06 | 0.08 | 0.26 | 0.67 | 61 |
| Fluorene | mg/kg | 0.05 | MCERTS | < 0.05 | 0.07 | 0.16 | 0.48 | 44 |
| Phenanthrene | mg/kg | 0.05 | MCERTS | 0.6 | 1 | 3.4 | 5.3 | 250 |
| Anthracene | mg/kg | 0.05 | MCERTS | 0.1 | 0.19 | 0.97 | 1.1 | 91 |
| Fluoranthene | mg/kg | 0.05 | MCERTS | 0.96 | 1.9 | 11 | 7.1 | 310 |
| Pyrene | mg/kg | 0.05 | MCERTS | 0.97 | 1.9 | 9.9 | 6.7 | 290 |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | 0.47 | 0.88 | 6.9 | 3 | 180 |
| Chrysene | mg/kg | 0.05 | MCERTS | 0.52 | 1.1 | 6.1 | 3.3 | 190 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | ISO 17025 | 0.6 | 1.3 | 9.5 | 4.4 | 310 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | ISO 17025 | 0.25 | 0.4 | 3.3 | 1.3 | 310 |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | 0.53 | 1.1 | 7.7 | 3.6 | 190 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 0.28 | 0.55 | 4.2 | 1.8 | 1300 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | 0.07 | 0.13 | 1.1 | 0.42 | 630 |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | 0.34 | 0.62 | 4.5 | 1.9 | 1400 |
| **Total PAH** | | | | | | | | |
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | ISO 17025 | 5.76 | 11.3 | 69.3 | 41.2 | 5610 |
| **Heavy Metals / Metalloids** | | | | | | | | |
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 8.8 | 20 | 16 | 23 | 21 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | 0.5 | 0.7 | 0.6 | 1.4 | 0.9 |
| Chromium (hexavalent) | mg/kg | 1.8 | MCERTS | < 1.8 | < 1.8 | < 1.8 | < 1.8 | < 1.8 |
| Chromium (III) | mg/kg | 1 | NONE | 15 | 20 | 14 | 26 | 20 |
| Chromium (aqua regia extractable) | mg/kg | 1 | MCERTS | 16 | 21 | 16 | 26 | 21 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 490 | 72 | 450 | 310 | 140 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 130 | 560 | 850 | 380 | 230 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | < 0.3 | 1.7 | 0.5 | 0.3 | 0.6 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 14 | 16 | 12 | 23 | 36 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 | 1.1 | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 180 | 260 | 260 | 310 | 160 |

**Analytical Report Number: 24-048489**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352087 | 352088 | 352089 | 352090 | 352091 |
|---|---|---|---|---|---|---|---|---|
| Sample Reference | | | | TP06 | SA03 | TP04 | TP01 | SA04 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.50-1.00 | 0.00-0.80 | 0.06-0.50 | 0.00-0.05 | 0.06-0.50 |
| Date Sampled | | | | 07/10/2024 | 10/10/2024 | 10/10/2024 | 10/10/2024 | 10/10/2024 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | | | | |
| **Petroleum Hydrocarbons** | | | | | | | | |
| TPHCWG - Aliphatic >EC5 - EC6 HS_1D_AL | mg/kg | 0.01 | MCERTS | - | < 0.010 | < 0.010 | - | - |
| TPHCWG - Aliphatic >EC6 - EC8 HS_1D_AL | mg/kg | 0.01 | MCERTS | - | < 0.010 | < 0.010 | - | - |
| TPHCWG - Aliphatic >EC8 - EC10 HS_1D_AL | mg/kg | 0.01 | MCERTS | - | < 0.010 | < 0.010 | - | - |
| TPHCWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL | mg/kg | 1 | MCERTS | - | < 1.0 | < 1.0 | - | - |
| TPHCWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL | mg/kg | 2 | MCERTS | - | < 2.0 | < 2.0 | - | - |
| TPHCWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL | mg/kg | 8 | MCERTS | - | < 8.0 | < 8.0 | - | - |
| TPHCWG - Aliphatic >EC16 - EC35 EH_CU_1D_AL | mg/kg | 10 | MCERTS | - | < 10 | < 10 | - | - |
| TPHCWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL | mg/kg | 8 | MCERTS | - | < 8.0 | < 8.0 | - | - |
| TPHCWG - Aliphatic >EC35 - EC40 EH_CU_1D_AL | mg/kg | 10 | NONE | - | < 10 | < 10 | - | - |
| TPHCWG - Aliphatic >EC5 - EC35 EH_CU+HS_1D_AL | mg/kg | 10 | NONE | - | < 10 | < 10 | - | - |
| TPHCWG - Aliphatic >EC5 - EC40 EH_CU+HS_1D_AL | mg/kg | 10 | NONE | - | < 10 | < 10 | - | - |
| TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR | mg/kg | 0.01 | MCERTS | - | < 0.010 | < 0.010 | - | - |
| TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR | mg/kg | 0.01 | MCERTS | - | < 0.010 | < 0.010 | - | - |
| TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR | mg/kg | 0.02 | MCERTS | - | < 0.020 | < 0.020 | - | - |
| TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR | mg/kg | 1 | MCERTS | - | < 1.0 | < 1.0 | - | - |
| TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR | mg/kg | 2 | MCERTS | - | < 2.0 | < 2.0 | - | - |
| TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR | mg/kg | 10 | MCERTS | - | < 10 | 22 | - | - |
| TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR | mg/kg | 10 | MCERTS | - | < 10 | 58 | - | - |
| TPHCWG - Aromatic >EC35 - EC40 EH_CU_1D_AR | mg/kg | 10 | NONE | - | < 10 | < 10 | - | - |
| TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR | mg/kg | 10 | NONE | - | < 10 | 81 | - | - |
| TPHCWG - Aromatic >EC5 - EC40 EH_CU+HS_1D_AR | mg/kg | 10 | NONE | - | < 10 | 81 | - | - |
| TPH (>EC5 - EC10) HS_1D_TOTAL | mg/kg | 1 | NONE | - | < 1.0 | < 1.0 | - | - |
| TPH (>EC16 - EC40) EH_CU_1D_TOTAL | mg/kg | 10 | NONE | - | 16 | 88 | - | - |
| TPH Total >EC5 - EC40 EH_CU+HS_1D_TOTAL | mg/kg | 10 | NONE | - | < 10 | 81 | - | - |
| **VOCs** | | | | | | | | |
| MTBE (Methyl Tertiary Butyl Ether) | mg/kg | 0.005 | MCERTS | - | < 0.005 | < 0.005 | - | - |
| Benzene | mg/kg | 0.005 | MCERTS | - | < 0.005 | < 0.005 | - | - |
| Toluene | mg/kg | 0.005 | MCERTS | - | < 0.005 | < 0.005 | - | - |
| Ethylbenzene | mg/kg | 0.005 | MCERTS | - | < 0.005 | < 0.005 | - | - |
| p & m-xylene | mg/kg | 0.008 | MCERTS | - | < 0.008 | < 0.008 | - | - |
| o-Xylene | mg/kg | 0.005 | MCERTS | - | < 0.005 | < 0.005 | - | - |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-048489**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352092 |
|---|---|---|---|---|
| Sample Reference | | | | TP02 |
| Sample Number | | | | None Supplied |
| Depth (m) | | | | 0.00-0.20 |
| Date Sampled | | | | 10/10/2024 |
| Time Taken | | | | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | |
| Stone Content | % | 0.1 | NONE | < 0.1 |
| Moisture Content | % | 0.01 | NONE | 15 |
| Total mass of sample received | kg | 0.1 | NONE | 0.6 |

**Asbestos**

| | | | | |
|---|---|---|---|---|
| Asbestos in Soil Detected/Not Detected | Type | N/A | ISO 17025 | Not-detected |
| Asbestos Analyst ID | N/A | N/A | N/A | JSW |

**General Inorganics**

| | | | | |
|---|---|---|---|---|
| pH (L099) | pH Units | N/A | MCERTS | 8.2 |
| Water Soluble Sulphate as $SO_4$ 16hr extraction (2:1) | mg/kg | 2.5 | MCERTS | 68 |
| Water Soluble $SO_4$ 16hr extraction (2:1 Leachate Equivalent) | mg/l | 1.25 | MCERTS | 34 |
| Organic Matter (automated) | % | 0.1 | MCERTS | 1.9 |

**Speciated PAHs**

| | | | | |
|---|---|---|---|---|
| Naphthalene | mg/kg | 0.05 | MCERTS | 0.22 |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | 0.25 |
| Acenaphthene | mg/kg | 0.05 | MCERTS | 0.76 |
| Fluorene | mg/kg | 0.05 | MCERTS | 0.6 |
| Phenanthrene | mg/kg | 0.05 | MCERTS | 6.9 |
| Anthracene | mg/kg | 0.05 | MCERTS | 1.9 |
| Fluoranthene | mg/kg | 0.05 | MCERTS | 11 |
| Pyrene | mg/kg | 0.05 | MCERTS | 10 |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | 5 |
| Chrysene | mg/kg | 0.05 | MCERTS | 4.7 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | ISO 17025 | 6.4 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | ISO 17025 | 1.9 |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | 5.2 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 2.9 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | 0.67 |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | 3.2 |

**Total PAH**

| | | | | |
|---|---|---|---|---|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | ISO 17025 | 62 |

**Heavy Metals / Metalloids**

| | | | | |
|---|---|---|---|---|
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 19 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | 2.2 |
| Chromium (hexavalent) | mg/kg | 1.8 | MCERTS | 18 |
| Chromium (III) | mg/kg | 1 | NONE | 13 |
| Chromium (aqua regia extractable) | mg/kg | 1 | MCERTS | 31 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 91 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 450 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | 0.6 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 24 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 340 |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-048489**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352092 |
|---|---|---|---|---|
| Sample Reference | | | | TP02 |
| Sample Number | | | | None Supplied |
| Depth (m) | | | | 0.00-0.20 |
| Date Sampled | | | | 10/10/2024 |
| Time Taken | | | | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | |
| **Petroleum Hydrocarbons** | | | | |
| TPHCWG - Aliphatic >EC5 - EC6 HS_1D_AL | mg/kg | 0.01 | MCERTS | - |
| TPHCWG - Aliphatic >EC6 - EC8 HS_1D_AL | mg/kg | 0.01 | MCERTS | - |
| TPHCWG - Aliphatic >EC8 - EC10 HS_1D_AL | mg/kg | 0.01 | MCERTS | - |
| TPHCWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL | mg/kg | 1 | MCERTS | - |
| TPHCWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL | mg/kg | 2 | MCERTS | - |
| TPHCWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL | mg/kg | 8 | MCERTS | - |
| TPHCWG - Aliphatic >EC16 - EC35 EH_CU_1D_AL | mg/kg | 10 | MCERTS | - |
| TPHCWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL | mg/kg | 8 | MCERTS | - |
| TPHCWG - Aliphatic >EC35 - EC40 EH_CU_1D_AL | mg/kg | 10 | NONE | - |
| TPHCWG - Aliphatic >EC5 - EC35 EH_CU+HS_1D_AL | mg/kg | 10 | NONE | - |
| TPHCWG - Aliphatic >EC5 - EC40 EH_CU+HS_1D_AL | mg/kg | 10 | NONE | - |
| TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR | mg/kg | 0.01 | MCERTS | - |
| TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR | mg/kg | 0.01 | MCERTS | - |
| TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR | mg/kg | 0.02 | MCERTS | - |
| TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR | mg/kg | 1 | MCERTS | - |
| TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR | mg/kg | 2 | MCERTS | - |
| TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR | mg/kg | 10 | MCERTS | - |
| TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR | mg/kg | 10 | MCERTS | - |
| TPHCWG - Aromatic >EC35 - EC40 EH_CU_1D_AR | mg/kg | 10 | NONE | - |
| TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR | mg/kg | 10 | NONE | - |
| TPHCWG - Aromatic >EC5 - EC40 EH_CU+HS_1D_AR | mg/kg | 10 | NONE | - |
| TPH (>EC5 - EC10) HS_1D_TOTAL | mg/kg | 1 | NONE | - |
| TPH (>EC16 - EC40) EH_CU_1D_TOTAL | mg/kg | 10 | NONE | - |
| TPH Total >EC5 - EC40 EH_CU+HS_1D_TOTAL | mg/kg | 10 | NONE | - |
| **VOCs** | | | | |
| MTBE (Methyl Tertiary Butyl Ether) | mg/kg | 0.005 | MCERTS | - |
| Benzene | mg/kg | 0.005 | MCERTS | - |
| Toluene | mg/kg | 0.005 | MCERTS | - |
| Ethylbenzene | mg/kg | 0.005 | MCERTS | - |
| p & m-xylene | mg/kg | 0.008 | MCERTS | - |
| o-Xylene | mg/kg | 0.005 | MCERTS | - |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 24-048489**
**Project / Site name: Cornbrook Residential**

* 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 * |
|---|---|---|---|---|
| 352087 | TP06 | None Supplied | 0.50-1.00 | Brown clay and sand with gravel and stones |
| 352088 | SA03 | None Supplied | 0.00-0.80 | Brown loam and sand with vegetation and stones |
| 352089 | TP04 | None Supplied | 0.06-0.50 | Brown loam and sand with vegetation and stones |
| 352090 | TP01 | None Supplied | 0.00-0.05 | Brown loam and clay with gravel and stones |
| 352091 | SA04 | None Supplied | 0.06-0.50 | Brown sand with gravel and stones |
| 352092 | TP02 | None Supplied | 0.00-0.20 | Brown loam and clay with gravel and vegetation |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 24-048489**
**Project / Site name: Cornbrook Residential**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Asbestos identification in Soil | Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques | In-house method based on HSG 248, 2021 | A001B | D | ISO 17025 |
| Organic matter (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method) | In-house method | L009B | D | MCERTS |
| Moisture Content | Moisture content, determined gravimetrically (up to 30°C) | In-house method | L019B | W | NONE |
| 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. | L019B | D | NONE |
| 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 | L038B | D | MCERTS |
| Sulphate, water soluble, in soil (16hr extraction) | Sulphate, water soluble, in soil (16hr extraction) | In-house method | L038B | D | MCERTS |
| Speciated PAHs and/or Semi-volatile organic compounds in soil | Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS | In-house method based on USEPA 8270 | L064B | D | MCERTS |
| Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil | Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic | In-house method | L076B/L088-PL | D/W | MCERTS |
| Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil | Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS | In-house method | L076B/L088-PL | D/W | NONE |
| Chromium III in soil | In-house method by calculation from total Cr and Cr VI | In-house method by calculation | L080-PL/L130B | W | NONE |
| Hexavalent chromium in soil | Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry | In-house method | L080-PL | W | 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 |
| BTEX and/or Volatile organic compounds in soil | Determination of volatile organic compounds in soil by headspace GC-MS | In-house method based on USEPA 8260 | L073B | W | MCERTS |

**Analytical Report Number : 24-048489**
**Project / Site name: Cornbrook Residential**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|

**For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).**
**For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).**
**For method numbers ending in 'PL' or 'B' 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.**

## Information in Support of Analytical Results

**List of HWOL Acronyms and Operators**

| Acronym | Descriptions |
|---|---|
| HS | Headspace Analysis |
| MS | Mass spectrometry |
| FID | Flame Ionisation Detector |
| GC | Gas Chromatography |
| EH | Extractable Hydrocarbons (i.e. everything extracted by the solvent(s)) |
| CU | Clean-up - e.g. by Florisil®, silica gel |
| 1D | GC - Single coil/column gas chromatography |
| 2D | GC-GC - Double coil/column gas chromatography |
| Total | Aliphatics & Aromatics |
| AL | Aliphatics |
| AR | Aromatics |
| #1 | EH_2D_Total but with humics mathematically subtracted |
| #2 | EH_2D_Total but with fatty acids mathematically subtracted |
| _ | Operator - underscore to separate acronyms (exception for +) |
| + | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total |

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

# Sample Deviation Report

**Analytical Report Number : 24-048489**

**Project / Site name: Cornbrook Residential**

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

| Sample ID | Other ID | Sample Type | Lab Sample Number | Sample Deviation | Test Name | Test Ref | Test Deviation |
|---|---|---|---|---|---|---|---|
| SA04 | N/A | S | 352091 | c | Speciated PAHs and/or Semi-volatile organic compounds in soil | L064B | c |
| TP04 | N/A | S | 352089 | c | BTEX and/or Volatile organic compounds in soil | L073B | c |
| TP04 | N/A | S | 352089 | c | Speciated PAHs and/or Semi-volatile organic compounds in soil | L064B | c |
| TP04 | N/A | S | 352089 | c | Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil | L076B/L088-PL | c |
| TP04 | N/A | S | 352089 | c | Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil | L076B/L088-PL | c |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

| Human Health Assessment Summary - Soils Test Data | | | | | | Soil Type: | Made Ground | Made Ground | Made Ground | Made Ground | Made Ground | Made Ground | Natural | Natural | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Location: | TP06 | SA03 | TP04 | TP01 | SA04 | TP02 | TP06 | TP01 | BH01 | BH01 | BH02 | BH02 | BH02 | BH03 | BH03 |
| | | | | | | Depth: | 0.50-1.00 | 0.00-0.80 | 0.06-0.50 | 0.00-0.05 | 0.06-0.50 | 0.00-0.20 | 2.20 | 1.50 | 6.80 | 15.58-15.68 | 3.00 | 1.00-10.30 | 18.88-18.98 | 11.70-11.80 | 19.40-19.45 |
| **Contaminant** | **GAC (mg/kg)** | **No. Samples** | **Min. Value** | **Max. Value** | **No. Samples ≥GAC** | | | | | | | | | | | | | | | | |
| Moisture Content | - | 15 | 6.80 | 18.00 | - | | 14 | 18 | 16 | 15 | 12 | 15 | 10 | 7 | 13 | 9 | 8 | 9 | 14 | 9 | 7 |
| Soil Organic Matter | - | 6 | 1.00 | 7.70 | - | | 1.0 | 2.3 | 1.7 | 2.2 | 7.7 | 1.9 | | | | | | | | | |
| pH | - | 15 | 7.00 | 10.80 | - | | 10.8 | 7.0 | 8.0 | 8.3 | 7.3 | 8.2 | 8.5 | 7.9 | 8.4 | 9.3 | 7.9 | 8.7 | 8.6 | 10.4 | 8.9 |
| Water Soluble Sulphate (2:1 Leachate Equivalent) (mg/l) | Note mg/l | 15 | 5.05 | 1880.00 | - | | 226.0 | 1560.0 | 1880.0 | 129.0 | 38.1 | 34.0 | 45.1 | 67.0 | 82.3 | 7.0 | 24.9 | 8.0 | 11.3 | 20.7 | 5.1 |
| Arsenic | 40 | 6 | 8.80 | 23.00 | 0 | | 8.8 | 20.0 | 16.0 | 23.0 | 21.0 | 19.0 | | | | | | | | | |
| Cadmium | 85 | 6 | 0.50 | 2.20 | 0 | | 0.5 | 0.7 | 0.6 | 1.4 | 0.9 | 2.2 | | | | | | | | | |
| Chromium (III) | 910 | 6 | 13.00 | 26.00 | 0 | | 15.0 | 20.0 | 14.0 | 26.0 | 20.0 | 13.0 | | | | | | | | | |
| Hexavalent Chromium (VI) | 6 | 6 | < LOD | 18.00 | 1 | | < 1.8 | < 1.8 | < 1.8 | < 1.8 | < 1.8 | 18.0 | | | | | | | | | |
| Copper | 7100 | 6 | 72.00 | 490.00 | 0 | | 490.0 | 72.0 | 450.0 | 310.0 | 140.0 | 91.0 | | | | | | | | | |
| Lead | 310 | 6 | 130.00 | 850.00 | 4 | | 130.0 | 560.0 | 850.0 | 380.0 | 230.0 | 450.0 | | | | | | | | | |
| Mercury | 1.2 | 6 | < LOD | 1.70 | 1 | | < 0.3 | 1.7 | 0.5 | 0.3 | 0.6 | 0.6 | | | | | | | | | |
| Nickel | 180 | 6 | 12.00 | 36.00 | 0 | | 14.0 | 16.0 | 12.0 | 23.0 | 36.0 | 24.0 | | | | | | | | | |
| Selenium | 430 | 6 | < LOD | 1.10 | 0 | | < 1.0 | 1.1 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | | | | | | | | |
| Zinc | 40000 | 6 | 160.00 | 340.00 | 0 | | 180.0 | 260.0 | 260.0 | 310.0 | 160.0 | 340.0 | | | | | | | | | |
| Cyanide (free) | 34 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Phenol (total) | 440 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Naphthalene | 2.3 | 6 | < LOD | 18.00 | 1 | | < 0.05 | 0.06 | 0.18 | 0.17 | 18.00 | 0.22 | | | | | | | | | |
| Acenaphthylene | 2900 | 6 | < LOD | 1.40 | 0 | | < 0.05 | < 0.05 | 0.07 | 0.13 | 1.40 | 0.25 | | | | | | | | | |
| Acenaphthene | 3000 | 6 | 0.06 | 61.00 | 0 | | 0.06 | 0.08 | 0.26 | 0.67 | 61.00 | 0.76 | | | | | | | | | |
| Fluorene | 2800 | 6 | < LOD | 44.00 | 0 | | < 0.05 | 0.07 | 0.16 | 0.48 | 44.00 | 0.60 | | | | | | | | | |
| Phenanthrene | 1300 | 6 | 0.60 | 250.00 | 0 | | 0.60 | 1.00 | 3.40 | 5.30 | 250.00 | 6.90 | | | | | | | | | |
| Anthracene | 31000 | 6 | 0.10 | 91.00 | 0 | | 0.10 | 0.19 | 0.97 | 1.10 | 91.00 | 1.90 | | | | | | | | | |
| Fluoranthene | 1500 | 6 | 0.96 | 310.00 | 0 | | 0.96 | 1.90 | 11.00 | 7.10 | 310.00 | 11.00 | | | | | | | | | |
| Pyrene | 3700 | 6 | 0.97 | 290.00 | 0 | | 0.97 | 1.90 | 9.90 | 6.70 | 290.00 | 10.00 | | | | | | | | | |
| Benzo(a)anthracene | 11 | 6 | 0.47 | 180.00 | 1 | | 0.47 | 0.88 | 6.90 | 3.00 | 180.00 | 5.00 | | | | | | | | | |
| Chrysene | 30 | 6 | 0.52 | 190.00 | 1 | | 0.52 | 1.10 | 6.10 | 3.30 | 190.00 | 4.70 | | | | | | | | | |
| Benzo(b)fluoranthene | 3.9 | 6 | 0.60 | 310.00 | 4 | | 0.60 | 1.30 | 9.50 | 4.40 | 310.00 | 6.40 | | | | | | | | | |
| Benzo(k)fluoranthene | 110 | 6 | 0.25 | 310.00 | 1 | | 0.25 | 0.40 | 3.30 | 1.30 | 310.00 | 1.90 | | | | | | | | | |
| Benzo(a)pyrene | 77.0 | 6 | 0.53 | 190.00 | 1 | | 0.53 | 1.10 | 7.70 | 3.60 | 190.00 | 5.20 | | | | | | | | | |
| Indeno(1,2,3-cd)pyrene | 45 | 6 | 0.28 | 1300.00 | 1 | | 0.28 | 0.55 | 4.20 | 1.80 | 1300.00 | 2.90 | | | | | | | | | |
| Dibenz(a,h)anthracene | 0.31 | 6 | 0.07 | 630.00 | 4 | | 0.07 | 0.13 | 1.10 | 0.42 | 630.00 | 0.67 | | | | | | | | | |
| Benzo(ghi)perylene | 360 | 6 | 0.34 | 1400.00 | 1 | | 0.34 | 0.62 | 4.50 | 1.90 | 1400.00 | 3.20 | | | | | | | | | |
| Asbestos Detected (Detected or Not-Detected) | Y | 6 | 0.00 | 0.00 | 0 | | Not-detected | Not-detected | Not-detected | Not-detected | Not-detected | Not-detected | | | | | | | | | |
| Asbestos Quantification (% w/w) | 0.001 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC5-EC6 | 42 | 2 | < LOD | <LOD | 0 | | | < 0.010 | < 0.010 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC6-EC8 | 100 | 2 | < LOD | <LOD | 0 | | | < 0.010 | < 0.010 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC8-EC10 | 27 | 2 | < LOD | <LOD | 0 | | | < 0.010 | < 0.010 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC10-EC12 | 130 | 2 | < LOD | <LOD | 0 | | | < 1.0 | < 1.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC12-EC16 | 1100 | 2 | < LOD | <LOD | 0 | | | < 2.0 | < 2.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC16-EC35 | 65000 | 2 | < LOD | <LOD | 0 | | | < 10 | < 10 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aliphatic >EC35-EC40 | 65000 | 2 | < LOD | <LOD | 0 | | | < 10 | < 10 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC5-EC7 | 370 | 2 | < LOD | <LOD | 0 | | | < 0.010 | < 0.010 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC7-EC8 | 860 | 2 | < LOD | <LOD | 0 | | | < 0.010 | < 0.010 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC8-EC10 | 47 | 2 | < LOD | <LOD | 0 | | | < 0.020 | < 0.020 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC10-EC12 | 250 | 2 | < LOD | <LOD | 0 | | | < 1.0 | < 1.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC12-EC16 | 1800 | 2 | < LOD | <LOD | 0 | | | < 2.0 | < 2.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC16-EC21 | 1900 | 2 | < LOD | 22.00 | 0 | | | < 10 | 22.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC21-EC35 | 1900 | 2 | < LOD | 58.00 | 0 | | | < 10 | 58.0 | | | | | | | | | | | | |
| Petroleum Hydrocarbons Aromatic >EC35-EC40 | 1900 | 2 | < LOD | <LOD | 0 | | | < 10 | < 10 | | | | | | | | | | | | |
| Benzene | 0.38 | 2 | < LOD | <LOD | 0 | | | < 0.005 | < 0.005 | | | | | | | | | | | | |
| Toluene | 880 | 2 | < LOD | <LOD | 0 | | | < 0.005 | < 0.005 | | | | | | | | | | | | |
| Ethyl benzene | 83 | 2 | < LOD | <LOD | 0 | | | < 0.005 | < 0.005 | | | | | | | | | | | | |
| o-Xylene | 88 | 2 | < LOD | <LOD | 0 | | | < 0.005 | < 0.005 | | | | | | | | | | | | |
| m- & p-Xylene | 161 | 2 | < LOD | <LOD | 0 | | | < 0.008 | < 0.008 | | | | | | | | | | | | |
| MTBE | 49 | 2 | < LOD | <LOD | 0 | | | < 0.005 | < 0.005 | | | | | | | | | | | | |
| Chloroethene (Vinyl Chloride) | 0.00077 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1,2-Dichloroethane (1,2-DCA) | 0.009 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1,1,1-Trichloroethane | 9.0 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | 3.9 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1,1,1,2-Tetrachloroethane | 1.5 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Tetrachloroethene (PCE) | 0.18 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Tetrachloromethane (carbon tetrachloride) | 0.026 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Trichloroethene (TCE) | 0.017 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Trichloromethane (chloroform) | 1.20 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Chlorobenzene | 0.46 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2 Dichlorobenzene | 24 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 3 Dichlorobenzene | 0.44 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 4 Dichlorobenzene | 61 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2, 3 Trichlorobenzene | 1.50 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2, 4 Trichlorobenzene | 2.60 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 3, 5 Trichlorobenzene | 0.33 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2, 3, 4 Tetrachlorobenzene | 24 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2, 3, 5 Tetrachlorobenzene | 0.75 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| 1, 2, 4, 5 Tetrachlorobenzene | 0.73 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Pentachlorobenzene | 19.0 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Hexachlorobenzene | 4.1 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| Hexachlorobutadiene | 0.32 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| ADD CoC | 0.0 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| ADD CoC | 0.0 | 0 | 0.00 | <LOD | 0 | | | | | | | | | | | | | | | | |
| **Mean Average SOM** | **2.8** | | | | | | | | | | | | | | | | | | | | |
| **Mean Average pH** | **8.5** | | | | | | | | | | | | | | | | | | | | |
| | **Residential without Homegrown Produce 1% SOM** | | | | | | **Values in RED are > the relevant screening levels and further assessment is required. Exceedance of the screening levels alone may not mean a risk is posed.** | | | | | | | | | | | | | | | |
| **Job Number:** | **C5540** | | | | | | | | | | | | | | | | | | | | |
| **Client:** | **FG Vivere Manchester Ltd** | | | | | | | | | | | | | | | | | | | | |
| **Site:** | **Cornbook Residential, Manchester** | | | | | | | | | | | | | | | | | | | | |
| **Soil Group Type** | **Combined Results** | | | | | | | | | | | | | | | | | | | | |

# APPENDIX D

**Geotechnical Testing Results**

MURRAY RIX
CONSULTANCY, SITE INVESTIGATION
CONSTRUCTION MATERIALS TESTING

# TEST REPORT

**Client** Brownfield Solutions Ltd

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

**Contract** C5824 -
Cornbrook Residential, Manchester

**Job Number** MRN 24032/35
**Date of Issue** 15 November 2024


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.

5 The results included within the report are representative of the samples submitted for analysis.

6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.

# M U R R A Y  R I X

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 Ltd |
| SITE | C5824 - Cornbrook Residential, Manchester |
| JOB NUMBER | MRN 24032/35 |

| | | | |
|---|---|---|---|
| DATE RECEIVED | 17-Oct-24 | DATE SAMPLED | 09-14-Oct-24 |
| DATE TESTED | 24-Oct-24 | SAMPLED BY | Client |
| MATERIAL TESTED | Rock Core | | |

| Sample Number | B/H No. | Sample Depth | Tested By | Diameter (mm) | Length* (mm) | L/D Ratio | Method of Preparation | Load at Failure (kN) | Compressive Strength ($N/mm^2$) | Description after Test |
|---|---|---|---|---|---|---|---|---|---|---|
| 575904 | BH01 | 11.70-12.00 | A.B. | 86 | 172 | 2.00 | Saw / Grinding | 63.4 | **10.9** | Split vertically top to bottom with no visible end defects |
| 575905 | BH01 | 17.95-18.23 | A.B. | 85 | 170 | 2.00 | Saw / Grinding | 64.5 | **11.4** | Split vertically top to bottom with no visible end defects |
| 575909 | BH02 | 15.95-16.22 | A.B. | 85 | 170 | 2.00 | Saw / Grinding | 65.2 | **11.5** | Split vertically top to bottom with no visible end defects |
| 575910 | BH02 | 21.95-22.26 | A.B. | 86 | 172 | 2.00 | Saw / Grinding | 63.8 | **11.0** | Split vertically top to bottom with no visible end defects |
| 575914 | BH03 | 16.76-17.00 | A.B. | 85 | 170 | 2.00 | Saw / Grinding | 64.7 | **11.4** | Split vertically top to bottom with no visible end defects |
| 575915 | BH03 | 18.83-19.15 | A.B. | 86 | 172 | 2.00 | Saw / Grinding | 64.3 | **11.1** | Split vertically top to bottom with no visible end defects |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Comments / Deviation from standard method / Abnormalities noted during visual inspection.

*Length after sample preparation

NAME O.P. Davies BA (Hons)
(Director / Head of Laboratory)

SIGNED 

DATE 15-Nov-24

# MURRAY RIX

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 Ltd |
| SITE | C5824 - Cornbrook Residential, Manchester |
| JOB NUMBER | MRN 24032/35 |

| | | | |
|---|---|---|---|
| DATE RECEIVED | 17-Oct-24 | DATE SAMPLED | 09-14-Oct-24 |
| DATE TESTED | 24-Oct-24 | SAMPLED BY | Client |

| | |
|---|---|
| MATERIAL | Rock Core |
| ADVISED SOURCE | Site Investigation Sample |

| Sample Number | B/H No. | Depth (m) | Test Type* | D (mm) | W** (mm) | Load (P) (kN) | $D_e^2$ ($mm^2$) | $D_e$ (mm) | Is (MPa) | F | $I_{s(50)}$ (MPa) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 575901 | BH01 | 10.60-10.70 | D | 86.5 | | 0.9 | 7482.25 | 86.50 | 0.12 | 1.28 | 0.15 |
| 575902 | BH01 | 15.30-15.45 | D | 86.4 | | 0.8 | 7464.96 | 86.40 | 0.11 | 1.28 | 0.14 |
| 575903 | BH01 | 20.60-20.75 | D | 86.6 | | 1.0 | 7499.56 | 86.60 | 0.13 | 1.28 | 0.17 |
| 575906 | BH02 | 10.65-10.78 | D | 86.5 | | 1.3 | 7482.25 | 86.50 | 0.17 | 1.28 | 0.22 |
| 575907 | BH02 | 13.54-13.67 | D | 86.5 | | 1.4 | 7482.25 | 86.50 | 0.19 | 1.28 | 0.24 |
| 575908 | BH02 | 18.50-18.60 | D | 86.4 | | 0.8 | 7464.96 | 86.40 | 0.11 | 1.28 | 0.14 |
| 575911 | BH03 | 11.10-11.21 | D | 86.5 | | 1.1 | 7482.25 | 86.50 | 0.15 | 1.28 | 0.19 |
| 575912 | BH03 | 14.75-14.93 | D | 86.4 | | 0.8 | 7464.96 | 86.40 | 0.11 | 1.28 | 0.14 |
| 575913 | BH03 | 20.70-20.80 | D | 86.5 | | 1.2 | 7482.25 | 86.50 | 0.16 | 1.28 | 0.21 |

| Test Type * | | | |
|---|---|---|---|
| A | Axial Test | D | Diametral Test |
| B | Block Test | I | Irregular Lump Test |

**W Entry required if test type is not Diametral

REMARKS

SIGNED

NAME O.P. Davies BA (Hons) DATE 15-Nov-24
(Director / Head of Laboratory)

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

**e:** a.hunt@brownfield-solutions.co.uk

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

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

# Analytical Report Number : 24-049265

| | | | |
|---|---|---|---|
| **Project / Site name:** | Cornbrook Residential, Manchester | **Samples received on:** | 22/10/2024 |
| **Your job number:** | C5640 | **Samples instructed on/ Analysis started on:** | 22/10/2024 |
| **Your order number:** | 349 | **Analysis completed by:** | 28/10/2024 |
| **Report Issue Number:** | 1 | **Report issued on:** | 31/10/2024 |
| **Samples Analysed:** | 9 soil samples | | |

**Signed:**

Anna Goc
PL Head of 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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-049265**
**Project / Site name: Cornbrook Residential, Manchester**
**Your Order No: 349**

| Lab Sample Number | | | | 355976 | 355977 | 355978 | 355979 | 355980 |
|---|---|---|---|---|---|---|---|---|
| Sample Reference | | | | TP06 | TP01 | BH01 | BH01 | BH02 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 2.20 | 1.50 | 6.80 | 15.58-15.68 | 3.00 |
| Date Sampled | | | | 07/10/2024 | 07/10/2024 | 07/10/2024 | 08/10/2024 | 08/10/2024 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | 57.1 | < 0.1 | < 0.1 | < 0.1 |
| Moisture Content | % | 0.01 | NONE | 10 | 6.8 | 13 | 8.5 | 7.8 |
| Total mass of sample received | kg | 0.1 | NONE | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| **General Inorganics** | | | | | | | | |
| pH (L099) | pH Units | N/A | MCERTS | 8.5 | 7.9 | 8.4 | 9.3 | 7.9 |
| Total Sulphate as $SO_4$ | % | 0.005 | MCERTS | 0.026 | - | 0.03 | - | - |
| Water Soluble Sulphate as $SO_4$ 16hr extraction (2:1) | mg/kg | 2.5 | MCERTS | 90 | 130 | 160 | 14 | 50 |
| Water Soluble $SO_4$ 16hr extraction (2:1 Leachate Equivalent) | mg/l | 1.25 | MCERTS | 45.1 | - | 82.3 | - | - |
| Water Soluble $SO_4$ 16hr extraction (2:1) | mg/l | 1.25 | MCERTS | - | 67 | - | 6.99 | 24.9 |
| Water Soluble Chloride (2:1) (leachate equivalent) | mg/l | 0.5 | MCERTS | 2.8 | - | 8.2 | - | - |
| Total Sulphur | mg/kg | 50 | MCERTS | 87 | - | 1200 | - | - |
| Total Sulphur | % | 0.005 | MCERTS | 0.009 | - | 0.12 | - | - |
| Ammoniacal Nitrogen as $NH_4^+$ | mg/kg | 0.5 | MCERTS | < 0.5 | - | < 0.5 | - | - |
| Ammonium as $NH_4^+$ (10:1 leachate equivalent) | mg/l | 0.05 | MCERTS | < 0.05 | - | < 0.05 | - | - |
| Water Soluble Nitrate (2:1) as N | mg/kg | 2 | NONE | < 2.0 | - | < 2.0 | - | - |
| Water Soluble Nitrate (2:1) as N (leachate equivalent) | mg/l | 2 | NONE | < 2.0 | - | < 2.0 | - | - |
| **Heavy Metals / Metalloids** | | | | | | | | |
| Magnesium (leachate equivalent) | mg/l | 2.5 | NONE | 3.7 | - | 7 | - | - |
| Magnesium (water soluble) | mg/kg | 5 | NONE | 7.4 | - | 14 | - | - |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-049265**
**Project / Site name: Cornbrook Residential, Manchester**
**Your Order No: 349**

| Lab Sample Number | | | | 355981 | 355982 | 355983 | 355984 |
|---|---|---|---|---|---|---|---|
| **Sample Reference** | | | | BH02 | BH02 | BH03 | BH03 |
| **Sample Number** | | | | None Supplied | None Supplied | None Supplied | None Supplied |
| **Depth (m)** | | | | 1.00-10.30 | 18.88-18.98 | 11.70-11.80 | 19.40-19.45 |
| **Date Sampled** | | | | 09/10/2024 | 10/10/2024 | 08/10/2024 | 08/10/2024 |
| **Time Taken** | | | | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | < 0.1 | 24.6 | < 0.1 |
| Moisture Content | % | 0.01 | NONE | 8.8 | 14 | 8.7 | 7.3 |
| Total mass of sample received | kg | 0.1 | NONE | 0.6 | 0.5 | 0.5 | 0.5 |
| **General Inorganics** | | | | | | | |
| pH (L099) | pH Units | N/A | MCERTS | 8.7 | 8.6 | 10.4 | 8.9 |
| Total Sulphate as $SO_4$ | % | 0.005 | MCERTS | - | - | - | 0.006 |
| Water Soluble Sulphate as $SO_4$ 16hr extraction (2:1) | mg/kg | 2.5 | MCERTS | 16 | 23 | 41 | 10 |
| Water Soluble $SO_4$ 16hr extraction (2:1 Leachate Equivalent) | mg/l | 1.25 | MCERTS | - | - | - | 5.05 |
| Water Soluble $SO_4$ 16hr extraction (2:1) | mg/l | 1.25 | MCERTS | 7.98 | 11.3 | 20.7 | - |
| Water Soluble Chloride (2:1) (leachate equivalent) | mg/l | 0.5 | MCERTS | - | - | - | 3.6 |
| Total Sulphur | mg/kg | 50 | MCERTS | - | - | - | < 50 |
| Total Sulphur | % | 0.005 | MCERTS | - | - | - | < 0.005 |
| Ammoniacal Nitrogen as $NH_4^+$ | mg/kg | 0.5 | MCERTS | - | - | - | 3.2 |
| Ammonium as $NH_4^+$ (10:1 leachate equivalent) | mg/l | 0.05 | MCERTS | - | - | - | 0.23 |
| Water Soluble Nitrate (2:1) as N | mg/kg | 2 | NONE | - | - | - | < 2.0 |
| Water Soluble Nitrate (2:1) as N (leachate equivalent) | mg/l | 2 | NONE | - | - | - | < 2.0 |
| **Heavy Metals / Metalloids** | | | | | | | |
| Magnesium (leachate equivalent) | mg/l | 2.5 | NONE | - | - | - | < 2.5 |
| Magnesium (water soluble) | mg/kg | 5 | NONE | - | - | - | < 5.0 |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 24-049265**
**Project / Site name: Cornbrook Residential, 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 * |
|---|---|---|---|---|
| 355976 | TP06 | None Supplied | 2.2 | Brown clay and sand with gravel |
| 355977 | TP01 | None Supplied | 1.5 | Brown sand with stones |
| 355978 | BH01 | None Supplied | 6.8 | Brown clay and sand with gravel |
| 355979 | BH01 | None Supplied | 15.58-15.68 | Brown sand with stones |
| 355980 | BH02 | None Supplied | 3 | Brown loam and clay with gravel |
| 355981 | BH02 | None Supplied | 1.00-10.30 | Brown sand with gravel |
| 355982 | BH02 | None Supplied | 18.88-18.98 | Brown clay and sand |
| 355983 | BH03 | None Supplied | 11.70-11.80 | Brown clay and sand |
| 355984 | BH03 | None Supplied | 19.40-19.45 | Brown clay and sand |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 24-049265**
**Project / Site name: Cornbrook Residential, Manchester**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Moisture Content | Moisture content, determined gravimetrically (up to 30°C) | In-house method | L019B | W | NONE |
| 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. | L019B | D | NONE |
| Magnesium, water soluble, in soil | Determination of water soluble magnesium by extraction with water followed by ICP-OES | In-house method based on TRL 447 | L038B | D | NONE |
| Total sulphate (as SO4 in soil) | Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES | In-house method | L038B | D | MCERTS |
| Sulphate, water soluble, in soil (16hr extraction) | Sulphate, water soluble, in soil (16hr extraction) | In-house method | L038B | D | MCERTS |
| Total Sulphur in soil | Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES | In-house method | L038B | D | MCERTS |
| Water Soluble Nitrate (2:1) as N in soil | Determination of nitrate by reaction with sodium salicylate and colorimetry | In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction | L078-PL | W | NONE |
| Chloride, water soluble, in soil | Determination of Chloride colorimetrically by discrete analyser | In-house method | L082B | D | MCERTS |
| Ammonium as NH4 in soil | Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L082B | W | 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 |

**For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).**
**For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).**
**For method numbers ending in 'PL' or 'B' 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.**

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

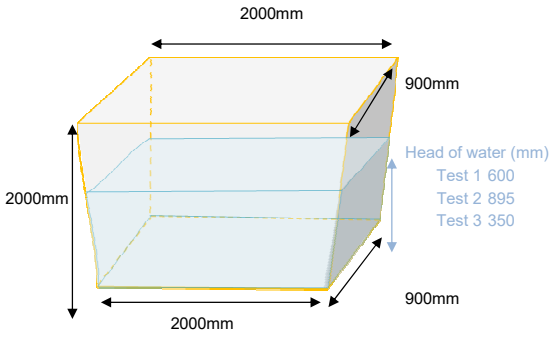
This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

| Percolation Test | FG Vivere Manchester Ltd | Date of Test: 10/10/2024 |
|---|---|---|
| | Cornbrook Residential, Manchester | Logged By: OH/AH |
| SA01 | C5540 | Checked By: NS |

BROWNFIELD SOLUTIONS LTD

| Dimensions (mm) | TEST 1 | TEST 2 | TEST 3 |
|---|---|---|---|
| Length at Top | 2000 | 2000 | 2000 |
| Length at Bottom | 2000 | 2000 | 2000 |
| Width at Top | 900 | 900 | 900 |
| Width at Bottom | 900 | 900 | 900 |
| Depth Tested (Head of Water) | 600 | 895 | 350 |
| Depth of Excavation | 2000 | 2000 | 1780 |
| Volume of Water (m3) | 1.08 | 1.611 | 0.63 |
| Void Ratio | 1 | 1 | 1 |
| Factored Volume of Water (m3) | 1.08 | 1.611 | 0.63 |
| Strata Description | Firm slightly gravelly sandy CLAY over clayey SAND and GRAVEL. | | |
| Pit Details | Open with no stone filling<br>See associated log for stratum details | | |

Test Pit Construction

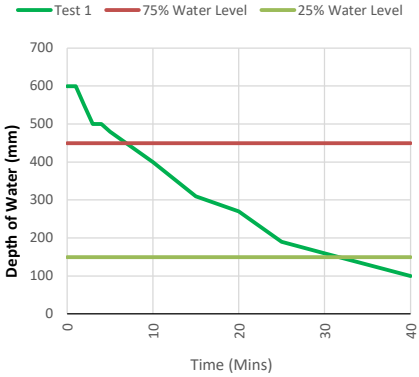


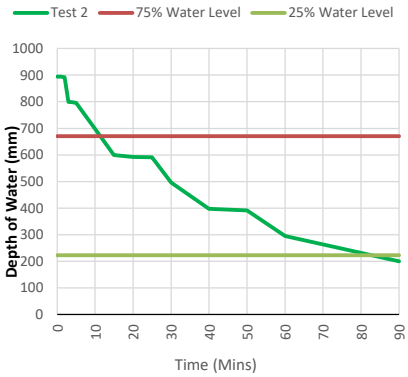

Site Recorded Data

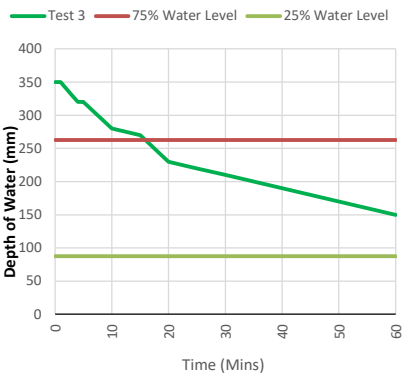
| Test 1 | | | Test 2 | | | Test 3 | | |
|---|---|---|---|---|---|---|---|---|
| Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) |
| 0.00 | 1400 | 600 | 0.00 | 1105 | 895 | 0.00 | 1430 | 350 |
| 0.08 | 1400 | 600 | 0.08 | 1105 | 895 | 0.08 | 1430 | 350 |
| 0.17 | 1400 | 600 | 0.17 | 1105 | 895 | 0.17 | 1430 | 350 |
| 0.25 | 1400 | 600 | 0.25 | 1105 | 895 | 0.25 | 1430 | 350 |
| 0.33 | 1400 | 600 | 0.33 | 1106 | 894 | 0.33 | 1430 | 350 |
| 0.42 | 1400 | 600 | 0.42 | 1106 | 894 | 0.50 | 1430 | 350 |
| 0.50 | 1400 | 600 | 0.50 | 1106 | 894 | 0.67 | 1430 | 350 |
| 0.67 | 1400 | 600 | 0.67 | 1106 | 894 | 0.83 | 1430 | 350 |
| 0.83 | 1400 | 600 | 0.83 | 1106 | 894 | 1.00 | 1430 | 350 |
| 1.00 | 1400 | 600 | 1.00 | 1106 | 894 | 2.00 | 1440 | 340 |
| 2.00 | 1450 | 550 | 2.00 | 1108 | 892 | 3.00 | 1450 | 330 |
| 3.00 | 1500 | 500 | 3.00 | 1201 | 799 | 4.00 | 1460 | 320 |
| 4.00 | 1500 | 500 | 4.00 | 1202 | 798 | 5.00 | 1460 | 320 |
| 5.00 | 1520 | 480 | 5.00 | 1204 | 796 | 10.00 | 1500 | 280 |
| 10.00 | 1600 | 400 | 10.00 | 1302 | 698 | 15.00 | 1510 | 270 |
| 15.00 | 1690 | 310 | 15.00 | 1400 | 600 | 20.00 | 1550 | 230 |
| 20.00 | 1730 | 270 | 20.00 | 1407 | 593 | 25.00 | 1560 | 220 |
| 25.00 | 1810 | 190 | 25.00 | 1409 | 591 | 30.00 | 1570 | 210 |
| 30.00 | 1840 | 160 | 30.00 | 1504 | 496 | 60.00 | 1630 | 150 |
| 40.00 | 1900 | 100 | 40.00 | 1602 | 398 | | | |
| | | | 50.00 | 1608 | 392 | | | |
| | | | 60.00 | 1704 | 296 | | | |
| | | | 90.00 | 1800 | 200 | | | |

| | | | |
|---|---|---|---|
| Percolation Test | **FG Vivere Manchester Ltd** | Date of Test: 10/10/2024 | BROWNFIELD SOLUTIONS LTD |
| | Cornbrook Residential, Manchester | Logged By: OH/AH | |
| **SA01** | C5540 | Checked By: NS | |

## Data Analysis




## Soil Infiltration Rate Calculation

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level 1 | 450.000 | 675.000 | 350.000 |
| Water Level 2 | 150.000 | 225.000 | 150.000 |
| Time to drain from Water Level 1 to Level 2 (m | 25.000 | 70.000 | 60.000 |
| Volume of Water Discharged m3) | 0.5400000 | 0.8100000 | 0.3600000 |
| Discharge Area (m3) | 3.540 | 4.410 | 3.250 |
| Soil Infiltration Rate (m/min) | 0.0061017 | 0.0026239 | 0.0018462 |
| | | | |
| Soil Infiltration Rate (m/sec) | 1.02E-04 | 4.37E-05 | 3.08E-05 |

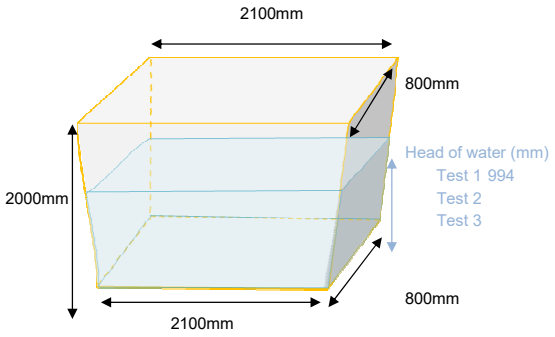
## Compliancy Check

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level at 75% effective depth (mm) | 450 | 671.25 | 262.5 |
| Water Level at 25% effective depth (mm) | 150 | 223.75 | 87.5 |
| | Compliant with BRE 365 | Compliant with BRE 365 | Not Compliant with BRE 365 - Insufficient time to drain past 25% effective depth |

| | | | |
|---|---|---|---|
| Percolation Test | **FG Vivere Manchester Ltd** | Date of Test: 07/10/2024 | BROWNFIELD SOLUTIONS LTD |
| | Cornbrook Residential, Manchester | Logged By: SJ | |
| **SA02B** | C5540 | Checked By: NS | |

| Dimensions (mm) | TEST 1 | TEST 2 | TEST 3 |
|---|---|---|---|
| Length at Top | 2100 | | |
| Length at Bottom | 2100 | | |
| Width at Top | 800 | | |
| Width at Bottom | 800 | | |
| Depth Tested (Head of Water) | 994 | | |
| Depth of Excavation | 2000 | | |
| Volume of Water (m3) | 1.66992 | | |
| Void Ratio | 1 | | |
| Factored Volume of Water (m3) | 1.66992 | | |
| Strata Description | Firm slightly gravelly sandy CLAY. | | |
| Pit Details | Open with no stone filling<br>See associated log for stratum details | | |

**Test Pit Construction**



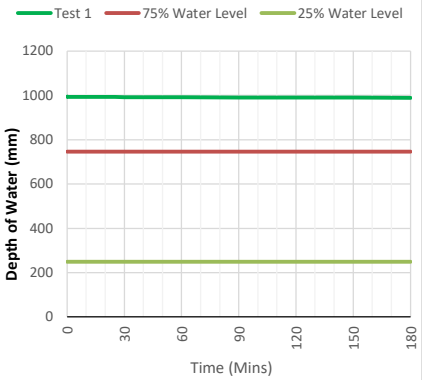

**Site Recorded Data**

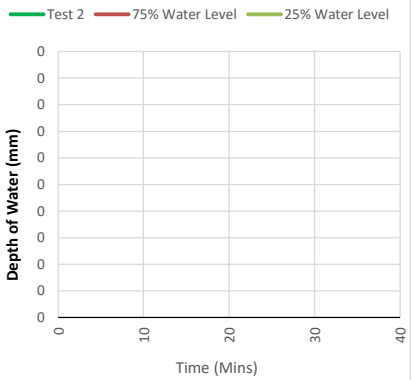
| Test 1 | | | Test 2 | | | Test 3 | | |
|---|---|---|---|---|---|---|---|---|
| Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) |
| 0.00 | 1006 | 994 | | | | | | |
| 0.08 | 1006 | 994 | | | | | | |
| 0.17 | 1006 | 994 | | | | | | |
| 0.25 | 1006 | 994 | | | | | | |
| 0.33 | 1006 | 994 | | | | | | |
| 0.42 | 1007 | 993 | | | | | | |
| 0.50 | 1007 | 993 | | | | | | |
| 0.67 | 1007 | 993 | | | | | | |
| 0.83 | 1007 | 993 | | | | | | |
| 1.00 | 1007 | 993 | | | | | | |
| 2.00 | 1007 | 993 | | | | | | |
| 3.00 | 1007 | 993 | | | | | | |
| 4.00 | 1007 | 993 | | | | | | |
| 5.00 | 1007 | 993 | | | | | | |
| 10.00 | 1007 | 993 | | | | | | |
| 15.00 | 1007 | 993 | | | | | | |
| 20.00 | 1007 | 993 | | | | | | |
| 25.00 | 1007 | 993 | | | | | | |
| 30.00 | 1008 | 992 | | | | | | |
| 40.00 | 1008 | 992 | | | | | | |
| 50.00 | 1008 | 992 | | | | | | |
| 60.00 | 1008 | 992 | | | | | | |
| 90.00 | 1009 | 991 | | | | | | |
| 120.00 | 1010 | 990 | | | | | | |
| 150.00 | 1010 | 990 | | | | | | |
| 180.00 | 1011 | 989 | | | | | | |

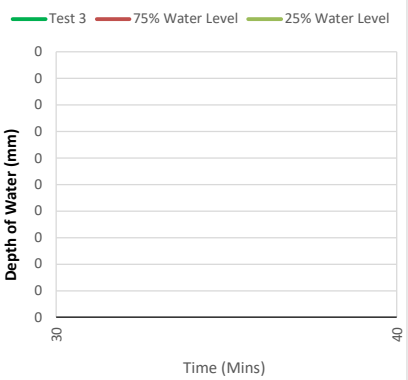
| | | |
|---|---|---|
| Percolation Test | **FG Vivere Manchester Ltd** | Date of Test: 07/10/2024 |
| | Cornbrook Residential, Manchester | Logged By: SJ |
| **SA02B** | C5540 | Checked By: NS |

BROWNFIELD SOLUTIONS LTD

## Data Analysis




## Soil Infiltration Rate Calculation

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level 1 | 994.000 | | |
| Water Level 2 | 989.000 | | |
| Time to drain from Water Level 1 to Level 2 (m | 180.000 | | |
| Volume of Water Discharged m3) | 0.0084000 | | |
| Discharge Area (m3) | 7.431 | | |
| Soil Infiltration Rate (m/min) | 0.0000063 | | |
| | | | |
| Soil Infiltration Rate (m/sec) | 1.05E-07 | | |

## Compliancy Check

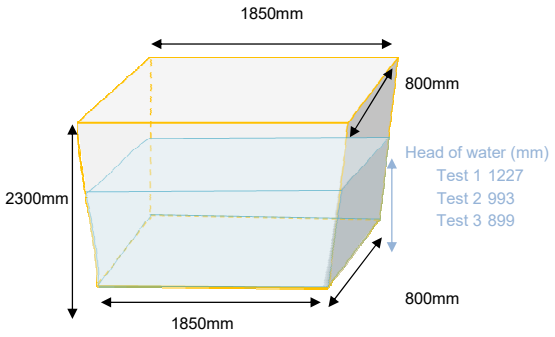
| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level at 75% effective depth (mm) | 745.5 | | |
| Water Level at 25% effective depth (mm) | 248.5 | | |
| | Not Compliant with BRE 365 - Insufficient time to drain past 25% effective depth | | |

| Percolation Test | FG Vivere Manchester Ltd | Date of Test: 10/10/2024 |
|---|---|---|
| | Cornbrook Residential, Manchester | Logged By: OH |
| SA03 | C5540 | Checked By: NS |

BROWNFIELD SOLUTIONS LTD

| Dimensions (mm) | TEST 1 | TEST 2 | TEST 3 |
|---|---|---|---|
| Length at Top | 1850 | 1850 | 1850 |
| Length at Bottom | 1850 | 1850 | 1850 |
| Width at Top | 800 | 800 | 800 |
| Width at Bottom | 800 | 800 | 800 |
| Depth Tested (Head of Water) | 1227 | 993 | 899 |
| Depth of Excavation | 2300 | 2200 | 2300 |
| Volume of Water (m3) | 1.81596 | 1.46964 | 1.33052 |
| Void Ratio | 1 | 1 | 1 |
| Factored Volume of Water (m3) | 1.81596 | 1.46964 | 1.33052 |
| Strata Description | Firm slightly gravelly sandy CLAY over Slightly clayey gravelly SAND. | | |
| Pit Details | Open with no stone filling See associated log for stratum details | | |

Test Pit Construction



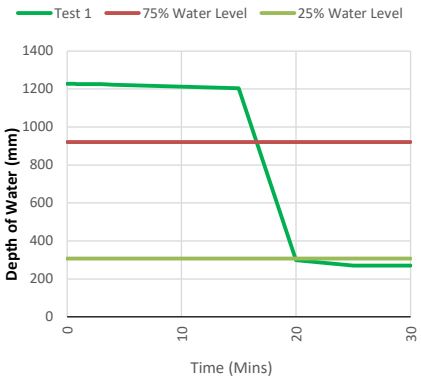

Site Recorded Data

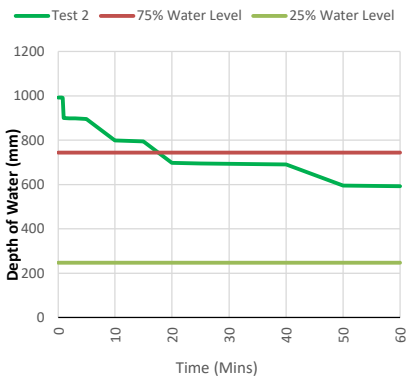
| Test 1 | | | Test 2 | | | Test 3 | | |
|---|---|---|---|---|---|---|---|---|
| Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) |
| 0.00 | 1073 | 1227 | 0.00 | 1207 | 993 | 0.00 | 1401 | 899 |
| 0.08 | 1073 | 1227 | 0.08 | 1207 | 993 | 0.08 | 1401 | 899 |
| 0.17 | 1073 | 1227 | 0.17 | 1207 | 993 | 0.17 | 1401 | 899 |
| 0.25 | 1073 | 1227 | 0.25 | 1207 | 993 | 0.25 | 1401 | 899 |
| 0.33 | 1073 | 1227 | 0.33 | 1207 | 993 | 0.33 | 1401 | 899 |
| 0.42 | 1073 | 1227 | 0.42 | 1207 | 993 | 0.42 | 1401 | 899 |
| 0.50 | 1073 | 1227 | 0.50 | 1208 | 992 | 0.50 | 1401 | 899 |
| 0.67 | 1073 | 1227 | 0.67 | 1208 | 992 | 0.67 | 1401 | 899 |
| 0.83 | 1074 | 1226 | 0.83 | 1209 | 991 | 0.83 | 1401 | 899 |
| 1.00 | 1074 | 1226 | 1.00 | 1300 | 900 | 1.00 | 1404 | 896 |
| 2.00 | 1074 | 1226 | 2.00 | 1302 | 898 | 2.00 | 1404 | 896 |
| 3.00 | 1074 | 1226 | 3.00 | 1302 | 898 | 3.00 | 1404 | 896 |
| 4.00 | 1077 | 1223 | 4.00 | 1303 | 897 | 4.00 | 1404 | 896 |
| 5.00 | 1079 | 1221 | 5.00 | 1305 | 895 | 5.00 | 1404 | 896 |
| 10.00 | 1087 | 1213 | 10.00 | 1401 | 799 | 10.00 | 1406 | 894 |
| 15.00 | 1096 | 1204 | 15.00 | 1406 | 794 | 15.00 | 1408 | 892 |
| 20.00 | 2000 | 300 | 20.00 | 1502 | 698 | 20.00 | 1500 | 800 |
| 25.00 | 2030 | 270 | 25.00 | 1505 | 695 | 25.00 | 1502 | 798 |
| 30.00 | 2030 | 270 | 30.00 | 1506 | 694 | 30.00 | 1503 | 797 |
| | | | 40.00 | 1509 | 691 | 40.00 | 1505 | 795 |
| | | | 50.00 | 1604 | 596 | 50.00 | 1507 | 793 |
| | | | 60.00 | 1607 | 593 | 60.00 | 1507 | 793 |

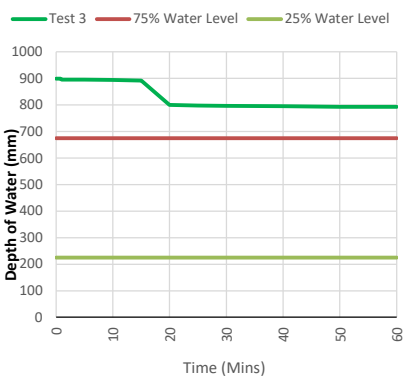
| Percolation Test | FG Vivere Manchester Ltd | Date of Test: 10/10/2024 |
|---|---|---|
| | Cornbrook Residential, Manchester | Logged By: OH |
| SA03 | C5540 | Checked By: NS |

BROWNFIELD SOLUTIONS LTD

## Data Analysis




## Soil Infiltration Rate Calculation

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level 1 | 925.000 | 993.000 | 899.000 |
| Water Level 2 | 300.000 | 953.000 | 793.000 |
| Time to drain from Water Level 1 to Level 2 (m | 3.000 | 60.000 | 60.000 |
| Volume of Water Discharged m3) | 0.9250000 | 0.0592000 | 0.1568800 |
| Discharge Area (m3) | 4.726 | 6.637 | 5.964 |
| Soil Infiltration Rate (m/min) | 0.0652385 | 0.0001487 | 0.0004384 |
| | | | |
| Soil Infiltration Rate (m/sec) | 1.09E-03 | 2.48E-06 | 7.31E-06 |

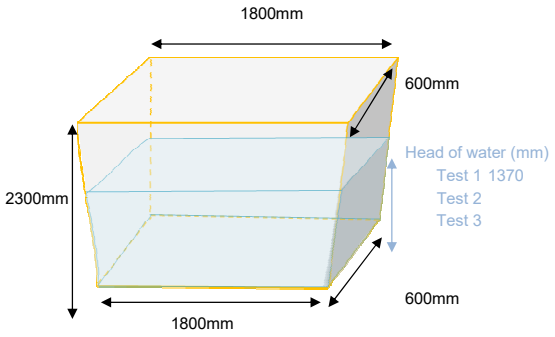
## Compliancy Check

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level at 75% effective depth (mm) | 920.25 | 744.75 | 674.25 |
| Water Level at 25% effective depth (mm) | 306.75 | 248.25 | 224.75 |
| | Compliant with BRE 365 | Not Compliant with BRE 365 - Insufficient time to drain past 25% effective depth | Not Compliant with BRE 365 - Insufficient time to drain past 25% effective depth |

| | | | |
|---|---|---|---|
| Percolation Test | **FG Vivere Manchester Ltd** | Date of Test: 10/10/2024 | BROWNFIELD SOLUTIONS LTD |
| | Cornbrook Residential, Manchester | Logged By: AH | |
| **SA04** | C5540 | Checked By: NS | |

| Dimensions (mm) | TEST 1 | TEST 2 | TEST 3 |
|---|---|---|---|
| Length at Top | 1800 | | |
| Length at Bottom | 1800 | | |
| Width at Top | 600 | | |
| Width at Bottom | 600 | | |
| Depth Tested (Head of Water) | 1370 | | |
| Depth of Excavation | 2300 | | |
| Volume of Water (m3) | 1.4796 | | |
| Void Ratio | 1 | | |
| Factored Volume of Water (m3) | 1.4796 | | |
| Strata Description | Firm slightly sandy slightly gravelly silty CLAY. | | |
| Pit Details | Open with no stone filling<br>See associated log for stratum details | | |

**Test Pit Construction**



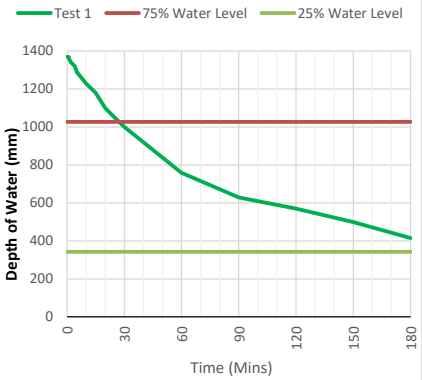

**Site Recorded Data**

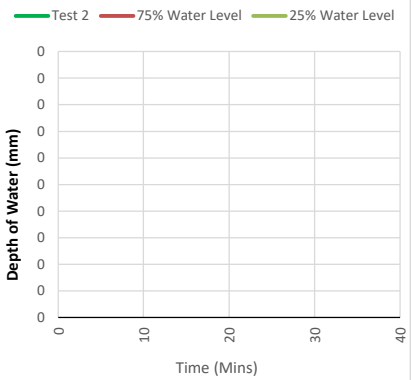
| Test 1 | | | Test 2 | | | Test 3 | | |
|---|---|---|---|---|---|---|---|---|
| Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) | Time (mins) | Depth to water (mm) | Head of water (mm) |
| 0.00 | 930 | 1370 | | | | | | |
| 0.08 | 930 | 1370 | | | | | | |
| 0.17 | 930 | 1370 | | | | | | |
| 0.25 | 930 | 1370 | | | | | | |
| 0.33 | 930 | 1370 | | | | | | |
| 0.50 | 930 | 1370 | | | | | | |
| 0.67 | 930 | 1370 | | | | | | |
| 0.83 | 930 | 1370 | | | | | | |
| 1.00 | 940 | 1360 | | | | | | |
| 2.00 | 960 | 1340 | | | | | | |
| 3.00 | 970 | 1330 | | | | | | |
| 4.00 | 980 | 1320 | | | | | | |
| 5.00 | 1010 | 1290 | | | | | | |
| 10.00 | 1070 | 1230 | | | | | | |
| 15.00 | 1120 | 1180 | | | | | | |
| 20.00 | 1200 | 1100 | | | | | | |
| 25.00 | 1250 | 1050 | | | | | | |
| 30.00 | 1300 | 1000 | | | | | | |
| 60.00 | 1540 | 760 | | | | | | |
| 90.00 | 1670 | 630 | | | | | | |
| 120.00 | 1730 | 570 | | | | | | |
| 150.00 | 1800 | 500 | | | | | | |
| 180.00 | 1885 | 415 | | | | | | |

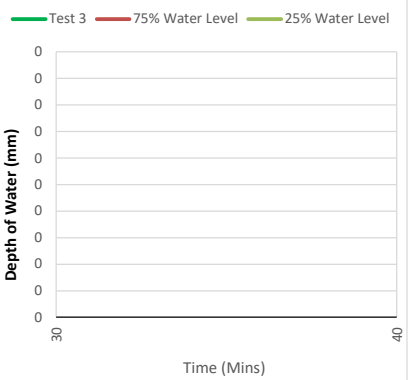
| | | |
|---|---|---|
| Percolation Test | **FG Vivere Manchester Ltd** | Date of Test: 10/10/2024 |
| | Cornbrook Residential, Manchester | Logged By: AH |
| **SA04** | C5540 | Checked By: NS |

BROWNFIELD SOLUTIONS LTD

## Data Analysis




## Soil Infiltration Rate Calculation

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level 1 | 1370.000 | | |
| Water Level 2 | 415.000 | | |
| Time to drain from Water Level 1 to Level 2 (m | 180.000 | | |
| Volume of Water Discharged m3) | 1.0314000 | | |
| Discharge Area (m3) | 5.364 | | |
| Soil Infiltration Rate (m/min) | 0.0010682 | | |
| | | | |
| Soil Infiltration Rate (m/sec) | 1.78E-05 | | |

## Compliancy Check

| | Test 1 | Test 2 | Test 3 |
|---|---|---|---|
| Water Level at 75% effective depth (mm) | 1027.5 | | |
| Water Level at 25% effective depth (mm) | 342.5 | | |
| | Not Compliant with BRE 365 - Insufficient time to drain past 25% effective depth | | |

# APPENDIX E

**Monitoring Results**

# Ground Gas Monitoring Results

BROWNFIELD SOLUTIONS LTD

| CLIENT: | Date | Operator | Analsyer | Weather Observations | | | Temp (°C) | Pressure Trend | Min Barometric Pressure (mb) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| RENAISSANCE ASSOCIATES LTD | 23/10/2024 | AR | GFM436 | Sunny | Light breeze | Cool | 12 | Falling | 1028 | |
| JOB NO. | 13/11/2024 | AR | GFM436 | Overcast | No wind | Cold | 7 | Falling | 1031 | |
| C5540 | 19/11/2024 | AR | - | Overcast | Light breeze | Cold | 2 | Rising | 1001 | **Not a GM visit, dipped from GW** |
| SITE: | 27/11/2024 | GK | GA5000 | Sunny | No wind | Cold | 6 | Rising | 1016 | |
| | 10/12/2024 | GK | GFM436 | Intermittent cloud | Light breeze | Cold | 4 | Falling | 1031 | |
| CORNBROOK RESIDENTIAL, MANCHESTER | 16/12/2024 | TW | GFM436 | Overcast | No wind | Cool | 11 | Rising | 1027 | |
| | 02/01/2025 | SJ | GA5000 | Sunny | No wind | Cold | 0 | Steady | 1014 | |
| | 24/01/2025 | SJ | GFM436 | Sunny | Heavy gusts | Cold | 6 | Falling | 975 | |

Notes: mb = milibars; $CH_4$ = methane; LEL = lower explosive limit = 5%v/v; $CO_2$ = carbon dioxide; $O_2$ = oxygen; CO=carbon monoxide; $H_2S$ = 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 availble 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 | $H_2S$ | TVOC (PID) | | | | | |
| | | | | | Summary Statistcs | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Max. values: | | 1034 | 45.0 | 3.4 | 1.3 | 0.3 | 0.1 | 6.0 | 2.2 | 3.7 | 1.3 | 23.5 | 22.4 | 0.0 | 0.0 | 0.0 | 7.0 | 13.2 | 0.000 | 0.005 | Highlight Box - Methane >1.0% v/v |
| | | | Min. values: | | 975 | -22.0 | -3.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 11.2 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 0.000 | 0.000 | Highlight Box - Carbon Dioxide >5.0% v/v |
| | | | Top | Bottom | Worst-case (note - not worst credible) GSVs based on maximum recorded steady flow and maximum individual peak concentrations: | | | | | | | | | | | | | | | | | 0.004 | 0.048 | Highlight Box - Water above Response Zone |
| 23/10/2024 | AM | Ambient | | | 1031 | | | | 0.0 | | 0.0 | | 0.0 | | 23.5 | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 23.1 | 22.0 | 0.0 | 0.0 | | 2.04 | 4.46 | 0.000 | 0.000 | |
| | | BH02 | 0.20 | 1.20 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.4 | 16.8 | 19.0 | 0.0 | 0.0 | | 1.37 | 1.37 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.4 | 18.6 | 20.2 | 0.0 | 0.0 | | 3.02 | 5.17 | 0.000 | 0.000 | |
| | | Ambient End | | | 1028 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 13/11/2024 | PM | Ambient | | | 1033 | | | | 0.0 | | 0.0 | | 0.0 | | 20.6 | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.2 | 18.6 | 20.3 | 0.0 | 0.0 | | 2.34 | 4.34 | 0.000 | 0.000 | |
| | | BH02 | 0.20 | 1.20 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 0.7 | 16.9 | 18.5 | 0.0 | 0.0 | | NGW | 1.31 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.8 | 16.0 | 18.8 | 0.0 | 0.0 | | 3.64 | 5.04 | 0.000 | 0.000 | |
| | | Ambient End | | | 1031 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 19/11/2024 | PM | BH01A | 8.00 | 15.00 | | | | | | | | | | | | | | | | 6.11 | 10.10 | | | No GM, dipped for GW |
| | | BH03A | 7.00 | 15.00 | | | | | | | | | | | | | | | | 5.8 | 13.21 | | | No GM, dipped for GW |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 27/11/2024 | PM | Ambient | | | | | | | | | | | | | | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | 0 | 0.0 | 0.0 | 0.3 | 0.1 | 6.0 | 2.0 | 2.1 | 0.7 | 0.6 | 14.2 | / | 0.0 | | NGW | 5.81 | 0.000 | 0.000 | BH01 full of water (unable to get a peak reading) |
| | | BH01A | 8.00 | 15.00 | | 0 | 0.0 | 0.0 | / | 0.1 | - | 2.0 | / | 0.2 | / | 19.1 | / | 0.0 | | NGW | 9.75 | - | - | Dip metre was faulty (NGW readings are most likely false) |
| | | BH02 | 0.20 | 1.20 | | 0 | 0.0 | 0.0 | 0.1 | 0.0 | 2.0 | 0.0 | 2.9 | 0.5 | 17.2 | 20.2 | / | 0.0 | | NGW | 1.36 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | 0 | 0.0 | 0.0 | / | 0.1 | - | 2.2 | / | 0.1 | / | 21.6 | / | 0.0 | | NGW | 5.37 | - | - | BH03 missing bung (unable to get a peak reading) |
| | | BH03A | 7.00 | 15.00 | | 0 | 0.0 | 0.0 | 0.2 | 0.1 | 4.0 | 2.0 | 1.9 | 0.7 | 0.5 | 11.2 | / | 0.0 | | NGW | 12.40 | 0.000 | 0.000 | |
| | | Ambient | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 10/12/2024 | AM | Ambient start | | | 1034 | | | | | | | | | | | | | | | - | | | | |
| | | BH01 | 1.50 | 6.50 | | NA | NA | 0.0 | NA | 0.1 | - | 2.0 | NA | 0.7 | NA | 15.5 | NA | NA | | 4.60 | 5.68 | - | - | BH01 full of water (unable to get a peak reading) |
| | | BH01A | 8.00 | 15.00 | | -22.0 | -3.4 | 0.0 | 0.1 | 0.1 | 2.0 | 2.0 | 0.0 | 0.0 | 16.3 | 18.4 | 0.0 | 0.0 | | 6.47 | 9.61 | 0.000 | 0.000 | |
| | | BH02 | 0.20 | 1.20 | | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 2.0 | 2.0 | 1.3 | 0.4 | 19.6 | 20.5 | 0.0 | 0.0 | | NGW | 1.35 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | NA | NA | 0.0 | NA | 0.1 | - | 2.0 | NA | 0.0 | NA | 20.4 | NA | NA | | 2.90 | 5.30 | - | - | BH03 missing bung (unable to get a peak reading) |
| | | BH03A | 7.00 | 15.00 | | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 2.0 | 2.0 | 3.7 | 1.3 | 3.5 | 14.3 | 0.0 | 0.0 | | 6.11 | 12.42 | 0.000 | 0.000 | |
| | | Ambient End | | | 1031 | | | | | | | | | | | | | | | | | | | |

# Ground Gas Monitoring Results

BROWNFIELD SOLUTIONS LTD

| 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 | $H_2S$ | TVOC (PID) | | | | | |
| 16/12/2024 | AM | Ambient | | | 1027 | | | | | | | | | | | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.1 | 14.1 | 19.9 | 0.0 | 0.0 | | 7.00 | 9.60 | 0.000 | 0.000 | |
| | | BH01A | 8.00 | 15.00 | | | | | | | | | | | | | | | | 0.00 | | | | Full of water |
| | | BH02 | 0.20 | 1.20 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 | 20.6 | 20.9 | 0.0 | 0.0 | | NGW | 1.30 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | | | | | | | | | | | | | | | - | | | | Bung missing |
| | | BH03A | 7.00 | 15.00 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 0.8 | 0.9 | 12.6 | 0.0 | 0.0 | | 5.60 | 12.40 | 0.000 | 0.000 | |
| | | Ambient | | | 1027 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 02/01/2025 | | Ambient | | | 1014 | | | | 0.0 | | 0.0 | | 0.1 | | 22.3 | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | 0.1 | | 0.0 | 0.0 | | 0.0 | | | 1.0 | | 18.9 | / | 0.0 | | 4.24 | 5.50 | 0.000 | 0.000 | Flooded let water drain and took steadys |
| | | BH01A | 8.00 | 15.00 | | 0.2 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.2 | 19.4 | 20.6 | / | 0.0 | | 5.89 | 9.46 | 0.000 | 0.000 | |
| | | BH02 | 0.20 | 1.20 | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.2 | 22.1 | 22.4 | / | 0.0 | | 0.87 | 1.30 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | | | | | 0.0 | | 0.0 | | | | | / | | | - | | | | Bung missing |
| | | BH03A | 7.00 | 15.00 | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 | 1.1 | 4.7 | 16.5 | / | 0.0 | | 5.80 | 12.42 | 0.000 | 0.000 | |
| | | Ambient | | | 1014 | | | | 0.0 | | 0.0 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| 24/01/2025 | | Ambient | | | 975 | | | | 0.0 | | 0.0 | | 0.0 | | 20.9 | | | | | | | | | |
| | | BH01 | 1.50 | 6.50 | | 0.0 | 0.0 | | 0.0 | | 0.0 | | | 0.6 | | 18.0 | 0.0 | 0.0 | | 4.50 | 5.57 | - | - | Flooded let water drain and took steadys |
| | | BH01A | 8.00 | 15.00 | | 45.0 | 3.4 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.1 | 11.2 | 18.0 | 0.0 | 0.0 | | 5.53 | 9.51 | 0.000 | 0.005 | |
| | | BH02 | 0.20 | 1.20 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.1 | 20.4 | 20.7 | 0.0 | 0.0 | | 1.31 | 1.36 | 0.000 | 0.000 | |
| | | BH03 | 1.50 | 7.00 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 0.0 | | 20.6 | 0.0 | 0.0 | | 3.00 | 5.50 | 0.000 | 0.000 | No bung replaced and ran steadys |
| | | BH03A | 7.00 | 15.00 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 0.7 | 3.5 | 17.2 | 0.0 | 0.0 | | 5.47 | 12.45 | 0.000 | 0.000 | |
| | | Ambient | | | 975 | | | | 0.0 | | 0.0 | | 0.0 | | 20.8 | | | | | | | | | |

# APPENDIX F

**Waste Assessment Report**

# 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:

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

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

LXJT1-1U519-GUQKD

## Job name

Cornbrook Residential, Manchester

## Description/Comments

## Project

C5540

## Site

## Classified by

Name:
**Jake Wheaton**
Date:
**22 Nov 2024 09:13 GMT**
Telephone:
**01606334844**

Company:
**Brownfield Solutions Limited**
**Brownfield Solutions Ltd**
**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:** **CERTIFIED**

| Course | Date |
|---|---|
| Hazardous Waste Classification | 07 Oct 2021 |
| Most recent 3 year Refresher | 01 Oct 2024 |

Next 3 year Refresher due by Oct 2027

## Purpose of classification

2 - Material Characterisation

## Address of the waste

Runcorn Street, Hulme, Manchester **Post Code** M15 4WB

## SIC for the process giving rise to the waste

41100 Development of building projects

## Description of industry/producer giving rise to the waste

Redevelopment of derelict residential and industrial buildings.

## Description of the specific process, sub-process and/or activity that created the waste

Waste created during the excavation of soils for development of basement complex.

## Description of the waste

Made ground comprising brown sandy soil with occasional fragments of concrete.

## Job summary

| # | Sample name | Depth [m] | Classification Result | Hazard properties | Page |
|---|---|---|---|---|---|
| 1 | TP06 | 0.50-1.00 | Non Hazardous | | 3 |
| 2 | SA03 | 0.00-0.80 | Non Hazardous | | 5 |
| 3 | TP04 | 0.06-0.50 | Non Hazardous | | 7 |
| 4 | TP01 | 0.00-0.05 | Non Hazardous | | 9 |
| 5 | SA04 | 0.06-0.50 | Non Hazardous | | 11 |
| 6 | TP02 | 0.00-0.20 | Non Hazardous | | 13 |

## Related documents

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

## Report

Created by: Jake Wheaton

Created date: 22 Nov 2024 09:13 GMT


| Appendices | Page |
|---|---|
| Appendix A: Classifier defined and non GB MCL determinands | 15 |
| Appendix B: Rationale for selection of metal species | 16 |
| Appendix C: Version | 16 |

## Classification of sample: TP06

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

## Sample details

Sample name:
**TP06**
Sample Depth:
**0.50-1.00 m**
Moisture content:
**14%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 14% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 10.8 | pH | | 10.8 | pH | 10.8 pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 8.8 | mg/kg | 1.32 | 9.992 | mg/kg | 0.000999 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 0.5 | mg/kg | 1.285 | 0.553 | mg/kg | 0.000043 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | <1.8 | mg/kg | 1.923 | <3.462 | mg/kg | <0.000346 % | | <**LOD** |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 15 | mg/kg | 1.462 | 18.854 | mg/kg | 0.00189 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 490 | mg/kg | 1.126 | 474.449 | mg/kg | 0.0474 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 130 | mg/kg | 1.56 | 174.387 | mg/kg | 0.0112 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | <0.3 | mg/kg | 1.353 | <0.406 | mg/kg | <0.0000406 % | | <**LOD** |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 14 | mg/kg | 1.579 | 19.017 | mg/kg | 0.0019 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 1.405 | <1.405 | mg/kg | <0.000141 % | | <**LOD** |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 180 | mg/kg | 2.774 | 429.438 | mg/kg | 0.0429 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 0.06 | mg/kg | | 0.0516 | mg/kg | 0.00000516 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | | | | 0.6 | mg/kg | | 0.516 | mg/kg | 0.0000516 % | ✓ | |
| | | | 201-581-5 | 85-01-8 | | | | | | | | | |
| 17 | | anthracene | | | | 0.1 | mg/kg | | 0.086 | mg/kg | 0.0000086 % | ✓ | |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 18 | | fluoranthene | | | | 0.96 | mg/kg | | 0.826 | mg/kg | 0.0000826 % | ✓ | |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 19 | | pyrene | | | | 0.97 | mg/kg | | 0.834 | mg/kg | 0.0000834 % | ✓ | |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 20 | | benzo[a]anthracene | | | | 0.47 | mg/kg | | 0.404 | mg/kg | 0.0000404 % | ✓ | |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 21 | | chrysene | | | | 0.52 | mg/kg | | 0.447 | mg/kg | 0.0000447 % | ✓ | |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 22 | | benzo[b]fluoranthene | | | | 0.6 | mg/kg | | 0.516 | mg/kg | 0.0000516 % | ✓ | |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 23 | | benzo[k]fluoranthene | | | | 0.25 | mg/kg | | 0.215 | mg/kg | 0.0000215 % | ✓ | |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | | | | 0.53 | mg/kg | | 0.456 | mg/kg | 0.0000456 % | ✓ | |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 25 | | indeno[123-cd]pyrene | | | | 0.28 | mg/kg | | 0.241 | mg/kg | 0.0000241 % | ✓ | |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 26 | | dibenz[a,h]anthracene | | | | 0.07 | mg/kg | | 0.0602 | mg/kg | 0.00000602 % | ✓ | |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 27 | | benzo[ghi]perylene | | | | 0.34 | mg/kg | | 0.292 | mg/kg | 0.0000292 % | ✓ | |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| | | | | | | | | | | Total: | 0.107 % | | |

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 Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration |
| **<LOD** | Below limit of detection |
| CLP: Note 1 | Only the metal concentration has been used for classification |

## Classification of sample: SA03

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

## Sample details

Sample name:
**SA03**
Sample Depth:
**0.00-0.80 m**
Moisture content:
**18%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 18% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 7 | pH | | 7 | pH | 7pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 20 | mg/kg | 1.32 | 21.653 | mg/kg | 0.00217 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 0.7 | mg/kg | 1.285 | 0.738 | mg/kg | 0.0000574 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | <1.8 | mg/kg | 1.923 | <3.462 | mg/kg | <0.000346 % | | <**LOD** |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 20 | mg/kg | 1.462 | 23.97 | mg/kg | 0.0024 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 72 | mg/kg | 1.126 | 66.472 | mg/kg | 0.00665 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 560 | mg/kg | 1.56 | 716.267 | mg/kg | 0.0459 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 1.7 | mg/kg | 1.353 | 1.887 | mg/kg | 0.000189 % | ✓ | |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 16 | mg/kg | 1.579 | 20.723 | mg/kg | 0.00207 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | 1.1 | mg/kg | 1.405 | 1.267 | mg/kg | 0.000127 % | ✓ | |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 260 | mg/kg | 2.774 | 591.448 | mg/kg | 0.0591 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | 0.06 | mg/kg | | 0.0492 | mg/kg | 0.00000492 % | ✓ | |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 0.08 | mg/kg | | 0.0656 | mg/kg | 0.00000656 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | 0.07 | mg/kg | | 0.0574 | mg/kg | 0.00000574 % | ✓ | |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | | | | 1 | mg/kg | | 0.82 | mg/kg | 0.000082 % | ✓ | |
| | | | 201-581-5 | 85-01-8 | | | | | | | | | |
| 17 | | anthracene | | | | 0.19 | mg/kg | | 0.156 | mg/kg | 0.0000156 % | ✓ | |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 18 | | fluoranthene | | | | 1.9 | mg/kg | | 1.558 | mg/kg | 0.000156 % | ✓ | |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 19 | | pyrene | | | | 1.9 | mg/kg | | 1.558 | mg/kg | 0.000156 % | ✓ | |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 20 | | benzo[a]anthracene | | | | 0.88 | mg/kg | | 0.722 | mg/kg | 0.0000722 % | ✓ | |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 21 | | chrysene | | | | 1.1 | mg/kg | | 0.902 | mg/kg | 0.0000902 % | ✓ | |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 22 | | benzo[b]fluoranthene | | | | 1.3 | mg/kg | | 1.066 | mg/kg | 0.000107 % | ✓ | |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 23 | | benzo[k]fluoranthene | | | | 0.4 | mg/kg | | 0.328 | mg/kg | 0.0000328 % | ✓ | |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | | | | 1.1 | mg/kg | | 0.902 | mg/kg | 0.0000902 % | ✓ | |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 25 | | indeno[123-cd]pyrene | | | | 0.55 | mg/kg | | 0.451 | mg/kg | 0.0000451 % | ✓ | |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 26 | | dibenz[a,h]anthracene | | | | 0.13 | mg/kg | | 0.107 | mg/kg | 0.0000107 % | ✓ | |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 27 | | benzo[ghi]perylene | | | | 0.62 | mg/kg | | 0.508 | mg/kg | 0.0000508 % | ✓ | |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| 28 | | benzene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <**LOD** |
| | | 601-020-00-8 | 200-753-7 | 71-43-2 | | | | | | | | | |
| 29 | | toluene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <**LOD** |
| | | 601-021-00-3 | 203-625-9 | 108-88-3 | | | | | | | | | |
| 30 | | ethylbenzene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <**LOD** |
| | | 601-023-00-4 | 202-849-4 | 100-41-4 | | | | | | | | | |
| 31 | | xylene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <**LOD** |
| | | 601-022-00-9 | 202-422-2 [1]<br>203-396-5 [2]<br>203-576-3 [3]<br>215-535-7 [4] | 95-47-6 [1]<br>106-42-3 [2]<br>108-38-3 [3]<br>1330-20-7 [4] | | | | | | | | | |
| | | | | | | | | | | Total: | 0.12 % | | |

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 Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration |
| **<LOD** | Below limit of detection |
| CLP: Note 1 | Only the metal concentration has been used for classification |

## Classification of sample: TP04

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

## Sample details

Sample name:
**TP04**
Sample Depth:
**0.06-0.50 m**
Moisture content:
**16%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 16% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 8 | pH | | 8 | pH | 8pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 16 | mg/kg | 1.32 | 17.745 | mg/kg | 0.00177 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 0.6 | mg/kg | 1.285 | 0.648 | mg/kg | 0.0000504 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | <1.8 | mg/kg | 1.923 | <3.462 | mg/kg | <0.000346 % | | <**LOD** |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 14 | mg/kg | 1.462 | 17.188 | mg/kg | 0.00172 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 450 | mg/kg | 1.126 | 425.586 | mg/kg | 0.0426 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 850 | mg/kg | 1.56 | 1113.708 | mg/kg | 0.0714 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 0.5 | mg/kg | 1.353 | 0.568 | mg/kg | 0.0000568 % | ✓ | |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 12 | mg/kg | 1.579 | 15.921 | mg/kg | 0.00159 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 1.405 | <1.405 | mg/kg | <0.000141 % | | <**LOD** |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 260 | mg/kg | 2.774 | 605.874 | mg/kg | 0.0606 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | 0.18 | mg/kg | | 0.151 | mg/kg | 0.0000151 % | ✓ | |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | 0.07 | mg/kg | | 0.0588 | mg/kg | 0.00000588 % | ✓ | |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 0.26 | mg/kg | | 0.218 | mg/kg | 0.0000218 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | 0.16 | mg/kg | | 0.134 | mg/kg | 0.0000134 % | ✓ | |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | | | | 3.4 | mg/kg | | 2.856 | mg/kg | 0.000286 % | ✓ | |
| | | | 201-581-5 | 85-01-8 | | | | | | | | | |
| 17 | | anthracene | | | | 0.97 | mg/kg | | 0.815 | mg/kg | 0.0000815 % | ✓ | |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 18 | | fluoranthene | | | | 11 | mg/kg | | 9.24 | mg/kg | 0.000924 % | ✓ | |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 19 | | pyrene | | | | 9.9 | mg/kg | | 8.316 | mg/kg | 0.000832 % | ✓ | |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 20 | | benzo[a]anthracene | | | | 6.9 | mg/kg | | 5.796 | mg/kg | 0.00058 % | ✓ | |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 21 | | chrysene | | | | 6.1 | mg/kg | | 5.124 | mg/kg | 0.000512 % | ✓ | |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 22 | | benzo[b]fluoranthene | | | | 9.5 | mg/kg | | 7.98 | mg/kg | 0.000798 % | ✓ | |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 23 | | benzo[k]fluoranthene | | | | 3.3 | mg/kg | | 2.772 | mg/kg | 0.000277 % | ✓ | |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | | | | 7.7 | mg/kg | | 6.468 | mg/kg | 0.000647 % | ✓ | |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 25 | | indeno[123-cd]pyrene | | | | 4.2 | mg/kg | | 3.528 | mg/kg | 0.000353 % | ✓ | |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 26 | | dibenz[a,h]anthracene | | | | 1.1 | mg/kg | | 0.924 | mg/kg | 0.0000924 % | ✓ | |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 27 | | benzo[ghi]perylene | | | | 4.5 | mg/kg | | 3.78 | mg/kg | 0.000378 % | ✓ | |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| 28 | | TPH (C6 to C40) petroleum group | | | | 80 | mg/kg | | 67.2 | mg/kg | 0.00672 % | ✓ | |
| | | | | TPH | | | | | | | | | |
| 29 | | benzene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <LOD |
| | | 601-020-00-8 | 200-753-7 | 71-43-2 | | | | | | | | | |
| 30 | | toluene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <LOD |
| | | 601-021-00-3 | 203-625-9 | 108-88-3 | | | | | | | | | |
| 31 | | ethylbenzene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <LOD |
| | | 601-023-00-4 | 202-849-4 | 100-41-4 | | | | | | | | | |
| 32 | | xylene | | | | <0.005 | mg/kg | | <0.005 | mg/kg | <0.0000005 % | | <LOD |
| | | 601-022-00-9 | 202-422-2 [1]<br>203-396-5 [2]<br>203-576-3 [3]<br>215-535-7 [4] | 95-47-6 [1]<br>106-42-3 [2]<br>108-38-3 [3]<br>1330-20-7 [4] | | | | | | | | | |
| | | | | | | | | | | Total: | 0.193 % | | |

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 Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration |
| **<LOD** | Below limit of detection |
| 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 for cumulative determinand results below the threshold of: 1000 mg/kg (0.1%) because: Concentration too low to be considered flammable. Low concentrations of short chain hydrocarbons. Discounted as this is a solid waste without a free draining liquid phase.

Hazard Statements hit:

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

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00672%)

## Classification of sample: TP01

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

## Sample details

Sample name:
**TP01**
Sample Depth:
**0.00-0.05 m**
Moisture content:
**15%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 15% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 8.3 | pH | | 8.3 | pH | 8.3 pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 23 | mg/kg | 1.32 | 25.812 | mg/kg | 0.00258 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 1.4 | mg/kg | 1.285 | 1.529 | mg/kg | 0.000119 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | <1.8 | mg/kg | 1.923 | <3.462 | mg/kg | <0.000346 % | | <**LOD** |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 26 | mg/kg | 1.462 | 32.3 | mg/kg | 0.00323 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 310 | mg/kg | 1.126 | 296.672 | mg/kg | 0.0297 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 380 | mg/kg | 1.56 | 503.82 | mg/kg | 0.0323 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 0.3 | mg/kg | 1.353 | 0.345 | mg/kg | 0.0000345 % | ✓ | |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 23 | mg/kg | 1.579 | 30.879 | mg/kg | 0.00309 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 1.405 | <1.405 | mg/kg | <0.000141 % | | <**LOD** |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 310 | mg/kg | 2.774 | 730.988 | mg/kg | 0.0731 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | 0.17 | mg/kg | | 0.145 | mg/kg | 0.0000145 % | ✓ | |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | 0.13 | mg/kg | | 0.111 | mg/kg | 0.0000111 % | ✓ | |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 0.67 | mg/kg | | 0.57 | mg/kg | 0.000057 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | 0.48 | mg/kg | | 0.408 | mg/kg | 0.0000408 % | ✓ | |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | 201-581-5 | 85-01-8 | | 5.3 | mg/kg | | 4.505 | mg/kg | 0.000451 % | ✓ | |
| 17 | | anthracene | 204-371-1 | 120-12-7 | | 1.1 | mg/kg | | 0.935 | mg/kg | 0.0000935 % | ✓ | |
| 18 | | fluoranthene | 205-912-4 | 206-44-0 | | 7.1 | mg/kg | | 6.035 | mg/kg | 0.000603 % | ✓ | |
| 19 | | pyrene | 204-927-3 | 129-00-0 | | 6.7 | mg/kg | | 5.695 | mg/kg | 0.00057 % | ✓ | |
| 20 | | benzo[a]anthracene | 601-033-00-9 | 200-280-6 | 56-55-3 | 3 | mg/kg | | 2.55 | mg/kg | 0.000255 % | ✓ | |
| 21 | | chrysene | 601-048-00-0 | 205-923-4 | 218-01-9 | 3.3 | mg/kg | | 2.805 | mg/kg | 0.000281 % | ✓ | |
| 22 | | benzo[b]fluoranthene | 601-034-00-4 | 205-911-9 | 205-99-2 | 4.4 | mg/kg | | 3.74 | mg/kg | 0.000374 % | ✓ | |
| 23 | | benzo[k]fluoranthene | 601-036-00-5 | 205-916-6 | 207-08-9 | 1.3 | mg/kg | | 1.105 | mg/kg | 0.000111 % | ✓ | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | 601-032-00-3 | 200-028-5 | 50-32-8 | 3.6 | mg/kg | | 3.06 | mg/kg | 0.000306 % | ✓ | |
| 25 | | indeno[123-cd]pyrene | 205-893-2 | 193-39-5 | | 1.8 | mg/kg | | 1.53 | mg/kg | 0.000153 % | ✓ | |
| 26 | | dibenz[a,h]anthracene | 601-041-00-2 | 200-181-8 | 53-70-3 | 0.42 | mg/kg | | 0.357 | mg/kg | 0.0000357 % | ✓ | |
| 27 | | benzo[ghi]perylene | 205-883-8 | 191-24-2 | | 1.9 | mg/kg | | 1.615 | mg/kg | 0.000162 % | ✓ | |
| | | | | | | | | | | Total: | 0.148 % | | |

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 |
| CLP: Note 1 | Only the metal concentration has been used for classification |

## Classification of sample: SA04

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

## Sample details

Sample name:
**SA04**
Sample Depth:
**0.06-0.50 m**
Moisture content:
**12%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 12% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 7.3 | pH | | 7.3 | pH | 7.3 pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 21 | mg/kg | 1.32 | 24.4 | mg/kg | 0.00244 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 0.9 | mg/kg | 1.285 | 1.018 | mg/kg | 0.0000792 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | <1.8 | mg/kg | 1.923 | <3.462 | mg/kg | <0.000346 % | | <**LOD** |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 20 | mg/kg | 1.462 | 25.723 | mg/kg | 0.00257 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 140 | mg/kg | 1.126 | 138.709 | mg/kg | 0.0139 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 230 | mg/kg | 1.56 | 315.707 | mg/kg | 0.0202 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 0.6 | mg/kg | 1.353 | 0.715 | mg/kg | 0.0000715 % | ✓ | |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 36 | mg/kg | 1.579 | 50.039 | mg/kg | 0.005 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 1.405 | <1.405 | mg/kg | <0.000141 % | | <**LOD** |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 160 | mg/kg | 2.774 | 390.6 | mg/kg | 0.0391 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | 18 | mg/kg | | 15.84 | mg/kg | 0.00158 % | ✓ | |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | 1.4 | mg/kg | | 1.232 | mg/kg | 0.000123 % | ✓ | |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 61 | mg/kg | | 53.68 | mg/kg | 0.00537 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | 44 | mg/kg | | 38.72 | mg/kg | 0.00387 % | ✓ | |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | | | | 250 | mg/kg | | 220 | mg/kg | 0.022 % | ✓ | |
| | | | 201-581-5 | 85-01-8 | | | | | | | | | |
| 17 | | anthracene | | | | 91 | mg/kg | | 80.08 | mg/kg | 0.00801 % | ✓ | |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 18 | | fluoranthene | | | | 310 | mg/kg | | 272.8 | mg/kg | 0.0273 % | ✓ | |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 19 | | pyrene | | | | 290 | mg/kg | | 255.2 | mg/kg | 0.0255 % | ✓ | |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 20 | | benzo[a]anthracene | | | | 180 | mg/kg | | 158.4 | mg/kg | 0.0158 % | ✓ | |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 21 | | chrysene | | | | 190 | mg/kg | | 167.2 | mg/kg | 0.0167 % | ✓ | |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 22 | | benzo[b]fluoranthene | | | | 310 | mg/kg | | 272.8 | mg/kg | 0.0273 % | ✓ | |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 23 | | benzo[k]fluoranthene | | | | 310 | mg/kg | | 272.8 | mg/kg | 0.0273 % | ✓ | |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | | | | 190 | mg/kg | | 167.2 | mg/kg | 0.0167 % | ✓ | |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 25 | | indeno[123-cd]pyrene | | | | 1300 | mg/kg | | 1144 | mg/kg | 0.114 % | ✓ | |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 26 | | dibenz[a,h]anthracene | | | | 630 | mg/kg | | 554.4 | mg/kg | 0.0554 % | ✓ | |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 27 | | benzo[ghi]perylene | | | | 1400 | mg/kg | | 1232 | mg/kg | 0.123 % | ✓ | |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| | | | | | | | | | | Total: | 0.574 % | | |

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 Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration |
| **<LOD** | Below limit of detection |
| CLP: Note 1 | Only the metal concentration has been used for classification |

## Classification of sample: TP02

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

## Sample details

Sample name:
**TP02**
Sample Depth:
**0.00-0.20 m**
Moisture content:
**15%**
(wet weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 15% Wet Weight Moisture Correction applied (MC)

| # | Determinand | EU CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | pH | | | PH | | 8.2 | pH | | 8.2 | pH | 8.2 pH | | |
| 2 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 19 | mg/kg | 1.32 | 21.323 | mg/kg | 0.00213 % | ✓ | |
| 3 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 2.2 | mg/kg | 1.285 | 2.403 | mg/kg | 0.000187 % | ✓ | |
| 4 | chromium in chromium(VI) compounds { chromium(VI) oxide } | 024-001-00-0 | 215-607-8 | 1333-82-0 | | 18 | mg/kg | 1.923 | 29.424 | mg/kg | 0.00294 % | ✓ | |
| 5 | chromium in chromium(III) compounds { chromium(III) oxide (worst case) } | | 215-160-9 | 1308-38-9 | | 13 | mg/kg | 1.462 | 16.15 | mg/kg | 0.00162 % | ✓ | |
| 6 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 91 | mg/kg | 1.126 | 87.087 | mg/kg | 0.00871 % | ✓ | |
| 7 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 450 | mg/kg | 1.56 | 596.629 | mg/kg | 0.0382 % | ✓ | |
| 8 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 0.6 | mg/kg | 1.353 | 0.69 | mg/kg | 0.000069 % | ✓ | |
| 9 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 24 | mg/kg | 1.579 | 32.222 | mg/kg | 0.00322 % | ✓ | |
| 10 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 1.405 | <1.405 | mg/kg | <0.000141 % | | <**LOD** |
| 11 | zinc { zinc chromate } | 024-007-00-3 | 236-878-9 | 13530-65-9 | | 340 | mg/kg | 2.774 | 801.728 | mg/kg | 0.0802 % | ✓ | |
| 12 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | 0.22 | mg/kg | | 0.187 | mg/kg | 0.0000187 % | ✓ | |
| 13 | acenaphthylene | | 205-917-1 | 208-96-8 | | 0.25 | mg/kg | | 0.213 | mg/kg | 0.0000212 % | ✓ | |
| 14 | acenaphthene | | 201-469-6 | 83-32-9 | | 0.76 | mg/kg | | 0.646 | mg/kg | 0.0000646 % | ✓ | |
| 15 | fluorene | | 201-695-5 | 86-73-7 | | 0.6 | mg/kg | | 0.51 | mg/kg | 0.000051 % | ✓ | |

| # | | Determinand | | | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | EU CLP index number | EC Number | CAS Number | | | | | | | | | |
| 16 | | phenanthrene | | | | 6.9 | mg/kg | | 5.865 | mg/kg | 0.000587 % | ✓ | |
| | | | 201-581-5 | 85-01-8 | | | | | | | | | |
| 17 | | anthracene | | | | 1.9 | mg/kg | | 1.615 | mg/kg | 0.000162 % | ✓ | |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 18 | | fluoranthene | | | | 11 | mg/kg | | 9.35 | mg/kg | 0.000935 % | ✓ | |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 19 | | pyrene | | | | 10 | mg/kg | | 8.5 | mg/kg | 0.00085 % | ✓ | |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 20 | | benzo[a]anthracene | | | | 5 | mg/kg | | 4.25 | mg/kg | 0.000425 % | ✓ | |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 21 | | chrysene | | | | 4.7 | mg/kg | | 3.995 | mg/kg | 0.0004 % | ✓ | |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 22 | | benzo[b]fluoranthene | | | | 6.4 | mg/kg | | 5.44 | mg/kg | 0.000544 % | ✓ | |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 23 | | benzo[k]fluoranthene | | | | 1.9 | mg/kg | | 1.615 | mg/kg | 0.000162 % | ✓ | |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 24 | | benzo[a]pyrene; benzo[def]chrysene | | | | 5.2 | mg/kg | | 4.42 | mg/kg | 0.000442 % | ✓ | |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 25 | | indeno[123-cd]pyrene | | | | 2.9 | mg/kg | | 2.465 | mg/kg | 0.000246 % | ✓ | |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 26 | | dibenz[a,h]anthracene | | | | 0.67 | mg/kg | | 0.57 | mg/kg | 0.000057 % | ✓ | |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 27 | | benzo[ghi]perylene | | | | 3.2 | mg/kg | | 2.72 | mg/kg | 0.000272 % | ✓ | |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| | | | | | | | | | | Total: | 0.143 % | | |

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 Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration |
| **<LOD** | Below limit of detection |
| CLP: Note 1 | Only the metal concentration has been used for classification |

## Supplementary Hazardous Property Information

**HP 2: Oxidizing** "waste which may, generally by providing oxygen, cause or contribute to the combustion of other materials"
Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 100 mg/kg (0.01%)
because: Concentrations too low to be considered oxidising. Furthermore following WM3 decision tree Fig C2.1, only single substance is potentially oxidising, therefore HP2 not applicable.

Hazard Statements hit:

**Ox. Sol. 1; H271** "May cause fire or explosion; strong oxidiser."

Because of determinand:

chromium(VI) oxide: (compound conc.: 0.00294%)

## Appendix A: Classifier defined and non GB MCL 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

- **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

- **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

GB MCL index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
20 Nov 2021 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

- **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

## 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 chromate}**

Worst case species based on hazard statements

**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 chromate}**

Worst case species based on hazard statements

## Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2024.304.6320.11573 (30 Oct 2024)
HazWasteOnline Database: 2024.304.6320.11573 (30 Oct 2024)

This classification utilises the following guidance and legislation:
**WM3 v1.2.GB - Waste Classification** - 1st Edition v1.2.GB - Oct 2021
**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 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
**GB MCL List** - version 1.1 of 09 June 2021
**GB MCL List v2.0** - version 2.0 of 20th October 2023
**GB MCL List v3.0** - version 3.0 of 11th January 2024
**GB MCL List v4.0** - version 4.0 of 2nd March 2024
**GB MCL List v5.0** - version 5.0 of 26th June 2024

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

**e:** a.hunt@brownfield-solutions.co.uk

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

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

# Analytical Report Number : 24-048488

Replaces Analytical Report Number: 24-048488, issue no. 1
Client references/information amended.
sample depth amended for sample 352086 as per clients request

| | | | |
|---|---|---|---|
| **Project / Site name:** | Cornbrook Residential | **Samples received on:** | 17/10/2024 |
| **Your job number:** | C5540 | **Samples instructed on/ Analysis started on:** | 17/10/2024 |
| **Your order number:** | 903 | **Analysis completed by:** | 23/10/2024 |
| **Report Issue Number:** | 2 | **Report issued on:** | 22/11/2024 |
| **Samples Analysed:** | 2 soil samples - 2 leachate samples | | |

**Signed:**

Caterina Bentley
Customer Service Advisor
**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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-048488**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352085 | 352086 |
|---|---|---|---|---|---|
| Sample Reference | | | | SA03 | SA04 |
| Sample Number | | | | None Supplied | None Supplied |
| Depth (m) | | | | 0.00-0.80 | 0.06-0.05 |
| Date Sampled | | | | 10/10/2024 | 10/10/2024 |
| Time Taken | | | | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | |
| Stone Content | % | 0.1 | NONE | 14.2 | 32.3 |
| Moisture Content | % | 0.01 | NONE | 18 | 16 |
| Total mass of sample received | kg | 0.1 | NONE | 0.6 | 0.6 |
| **General Inorganics** | | | | | |
| pH (L005B) | pH Units | N/A | MCERTS | 7.6 | 7.4 |
| Total Organic Carbon (TOC) - Automated | % | 0.1 | MCERTS | 1.3 | 1 |
| Loss on Ignition @ 450°C | % | 0.2 | MCERTS | 4.1 | 3.2 |
| Acid Neutralisation Capacity | +/- mmol/kg | -9999 | NONE | 14 | 3.4 |
| **Speciated PAHs** | | | | | |
| Naphthalene | mg/kg | 0.05 | MCERTS | 0.06 | 0.18 |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | < 0.05 | 0.07 |
| Acenaphthene | mg/kg | 0.05 | MCERTS | 0.09 | 0.29 |
| Fluorene | mg/kg | 0.05 | MCERTS | 0.07 | 0.17 |
| Phenanthrene | mg/kg | 0.05 | MCERTS | 1 | 3.4 |
| Anthracene | mg/kg | 0.05 | MCERTS | 0.17 | 0.95 |
| Fluoranthene | mg/kg | 0.05 | MCERTS | 1.9 | 11 |
| Pyrene | mg/kg | 0.05 | MCERTS | 1.9 | 10 |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | 0.85 | 6.6 |
| Chrysene | mg/kg | 0.05 | MCERTS | 1.1 | 6.3 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | ISO 17025 | 1.1 | 9.1 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | ISO 17025 | 0.52 | 3.7 |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | 1.1 | 7.7 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 0.51 | 4.2 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | 0.12 | 0.96 |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | 0.59 | 4.6 |
| Coronene | mg/kg | 0.05 | NONE | < 0.05 | < 0.05 |
| **Total PAH** | | | | | |
| Total WAC-17 PAHs | mg/kg | 0.85 | NONE | 11 | 69.2 |
| **Petroleum Hydrocarbons** | | | | | |
| Mineral Oil (EC10 - EC40) EH_CU_1D_AL | mg/kg | 10 | NONE | < 10 | < 10 |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number: 24-048488**
**Project / Site name: Cornbrook Residential**
**Your Order No: 903**

| Lab Sample Number | | | | 352085 | 352086 |
|---|---|---|---|---|---|
| Sample Reference | | | | SA03 | SA04 |
| Sample Number | | | | None Supplied | None Supplied |
| Depth (m) | | | | 0.00-0.80 | 0.06-0.05 |
| Date Sampled | | | | 10/10/2024 | 10/10/2024 |
| Time Taken | | | | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Test Limit of detection** | **Test Accreditation Status** | | |
| **VOCs** | | | | | |
| Benzene | µg/kg | 5 | MCERTS | < 5.0 | < 5.0 |
| Toluene | µg/kg | 5 | MCERTS | < 5.0 | < 5.0 |
| Ethylbenzene | µg/kg | 5 | MCERTS | < 5.0 | < 5.0 |
| p & m-Xylene | µg/kg | 8 | MCERTS | < 8.0 | < 8.0 |
| o-Xylene | µg/kg | 5 | MCERTS | < 5.0 | < 5.0 |
| Total BTEX | µg/kg | 10 | MCERTS | < 10 | < 10 |
| **PCBs by GC-MS** | | | | | |
| PCB Congener 28 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 52 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 101 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 118 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 138 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 153 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| PCB Congener 180 | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| Total PCBs | mg/kg | 0.007 | MCERTS | < 0.007 | < 0.007 |

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**i2 Analytical**
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

## Waste Acceptance Criteria Analytical Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Report No:** | **24-048488** | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | **Client: BSL** | | |
| | | | | | | | |
| **Location** | **Cornbrook Residential** | | | | | | |
| **Lab Reference (Sample Number)** | 352085 | | | | **Landfill Waste Acceptance Criteria Limits** | | |
| **Sampling Date** | 10/10/2024 | | | | Inert Waste Landfill | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| **Sample ID** | SA03 | | | | | | |
| **Depth (m)** | 0.00-0.80 | | | | | | |
| **Solid Waste Analysis** | | | | | | | |
| TOC (%)** | 1.3 | | | | 3% | 5% | 6% |
| Loss on Ignition (%) ** | 4.1 | | | | -- | -- | 10% |
| BTEX (µg/kg) ** | < 10 | | | | 6000 | -- | -- |
| Sum of PCBs (mg/kg) ** | < 0.007 | | | | 1 | -- | -- |
| Mineral Oil (mg/kg) EH_1D_CU_AL | < 10 | | | | 500 | -- | -- |
| Total PAH (WAC-17) (mg/kg) | 11.0 | | | | 100 | -- | -- |
| pH (units)** | 7.6 | | | | -- | >6 | -- |
| Acid Neutralisation Capacity (mmol / kg) | 14 | | | | -- | To be evaluated | To be evaluated |
| **Eluate Analysis** (BS EN 12457 - 2 preparation utilising end over end leaching procedure) | 10:1 mg/l | | | 10:1 mg/kg | Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg) | | |
| Arsenic * | < 0.00100 | | | < 0.0100 | 0.5 | 2 | 25 |
| Barium * | 0.0777 | | | 0.777 | 20 | 100 | 300 |
| Cadmium * | < 0.000100 | | | < 0.00100 | 0.04 | 1 | 5 |
| Chromium * | 0.0035 | | | 0.035 | 0.5 | 10 | 70 |
| Copper * | 0.019 | | | 0.19 | 2 | 50 | 100 |
| Mercury * | < 0.000500 | | | < 0.00500 | 0.01 | 0.2 | 2 |
| Molybdenum * | 0.00514 | | | 0.0514 | 0.5 | 10 | 30 |
| Nickel * | 0.0017 | | | 0.017 | 0.4 | 10 | 40 |
| Lead * | 0.0064 | | | 0.064 | 0.5 | 10 | 50 |
| Antimony * | 0.020 | | | 0.20 | 0.06 | 0.7 | 5 |
| Selenium * | < 0.0040 | | | < 0.040 | 0.1 | 0.5 | 7 |
| Zinc * | 0.024 | | | 0.24 | 4 | 50 | 200 |
| Chloride * | 0.93 | | | 9.3 | 800 | 15000 | 25000 |
| Fluoride* | 0.43 | | | 4.3 | 10 | 150 | 500 |
| Sulphate * | 770 | | | 7700 | 1000 | 20000 | 50000 |
| TDS* | 810 | | | 8100 | 4000 | 60000 | 100000 |
| Phenol Index (Monohydric Phenols) * | < 0.010 | | | < 0.10 | 1 | - | - |
| DOC | 4.59 | | | 45.9 | 500 | 800 | 1000 |
| | | | | | | | |
| **Leach Test Information** | | | | | | | |
| | | | | | | | |
| Stone Content (%) | 14.2 | | | | | | |
| Sample Mass (kg) | 0.6 | | | | | | |
| Dry Matter (%) | 82 | | | | | | |
| Moisture (%) | 18 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

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.



This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

**i2 Analytical**
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

## Waste Acceptance Criteria Analytical Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Report No:** | **24-048488** | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | **Client:** | **BSL** | |
| | | | | | | | |
| **Location** | **Cornbrook Residential** | | | | | | |
| **Lab Reference (Sample Number)** | 352086 | | | | **Landfill Waste Acceptance Criteria Limits** | | |
| **Sampling Date** | 10/10/2024 | | | | Inert Waste Landfill | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| **Sample ID** | SA04 | | | | | | |
| **Depth (m)** | 0.06-0.05 | | | | | | |
| **Solid Waste Analysis** | | | | | | | |
| TOC (%)** | 1.0 | | | | 3% | 5% | 6% |
| Loss on Ignition (%) ** | 3.2 | | | | -- | -- | 10% |
| BTEX (µg/kg) ** | < 10 | | | | 6000 | -- | -- |
| Sum of PCBs (mg/kg) ** | < 0.007 | | | | 1 | -- | -- |
| Mineral Oil (mg/kg) EH_1D_CU_AL | < 10 | | | | 500 | -- | -- |
| Total PAH (WAC-17) (mg/kg) | 69.2 | | | | 100 | -- | -- |
| pH (units)** | 7.4 | | | | -- | >6 | -- |
| Acid Neutralisation Capacity (mmol / kg) | 3.4 | | | | -- | To be evaluated | To be evaluated |
| **Eluate Analysis** (BS EN 12457 - 2 preparation utilising end over end leaching procedure) | 10:1 mg/l | | | 10:1 mg/kg | Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg) | | |
| Arsenic * | 0.00592 | | | 0.0592 | 0.5 | 2 | 25 |
| Barium * | 0.0566 | | | 0.566 | 20 | 100 | 300 |
| Cadmium * | < 0.000100 | | | < 0.00100 | 0.04 | 1 | 5 |
| Chromium * | 0.0025 | | | 0.025 | 0.5 | 10 | 70 |
| Copper * | 0.016 | | | 0.16 | 2 | 50 | 100 |
| Mercury * | < 0.000500 | | | < 0.00500 | 0.01 | 0.2 | 2 |
| Molybdenum * | 0.00351 | | | 0.0351 | 0.5 | 10 | 30 |
| Nickel * | 0.0013 | | | 0.013 | 0.4 | 10 | 40 |
| Lead * | 0.011 | | | 0.11 | 0.5 | 10 | 50 |
| Antimony * | 0.0099 | | | 0.099 | 0.06 | 0.7 | 5 |
| Selenium * | < 0.0040 | | | < 0.040 | 0.1 | 0.5 | 7 |
| Zinc * | 0.023 | | | 0.23 | 4 | 50 | 200 |
| Chloride * | 0.57 | | | 5.7 | 800 | 15000 | 25000 |
| Fluoride* | 0.67 | | | 6.7 | 10 | 150 | 500 |
| Sulphate * | 1400 | | | 14000 | 1000 | 20000 | 50000 |
| TDS* | 1200 | | | 12000 | 4000 | 60000 | 100000 |
| Phenol Index (Monohydric Phenols) * | < 0.010 | | | < 0.10 | 1 | - | - |
| DOC | 4.41 | | | 44.1 | 500 | 800 | 1000 |
| | | | | | | | |
| **Leach Test Information** | | | | | | | |
| | | | | | | | |
| Stone Content (%) | 32.3 | | | | | | |
| Sample Mass (kg) | 0.6 | | | | | | |
| Dry Matter (%) | 84 | | | | | | |
| Moisture (%) | 16 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

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.



This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number : 24-048488**
**Project / Site name: Cornbrook Residential**

* 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 * |
|---|---|---|---|---|
| 352085 | SA03 | None Supplied | 0.00-0.80 | Brown loam and sand with vegetation and stones |
| 352086 | SA04 | None Supplied | 0.06-0.05 | Brown loam and sand with vegetation and stones |

**Analytical Report Number : 24-048488**
**Project / Site name: Cornbrook Residential**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| pH at 20°C in soil | Determination of pH in soil by addition of water followed by electrometric measurement | In-house method | L005B | W | MCERTS |
| Total organic carbon (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method) | In-house method | L009B | D | MCERTS |
| Moisture Content | Moisture content, determined gravimetrically (up to 30°C) | In-house method | L019B | W | NONE |
| 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. | L019B | D | NONE |
| PCB's By GC-MS in soil | Determination of PCB by extraction with hexane followed by GC-MS | In-house method based on USEPA 8082 | L027B | D | MCERTS |
| Total dissolved solids 10:1 WAC | Determination of total dissolved solids in water by electrometric measurement | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L031B | 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 | W | ISO 17025 |
| Dissolved organic carbon 10:1 WAC | Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L037B | W | NONE |
| 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 | L039B | W | ISO 17025 |
| Sample Preparation | | In-house method | L043B | 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 | L046B | W | NONE |
| Loss on ignition of soil @ 450°C | 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 |
| Speciated PAHs and/or Semi-volatile organic compounds in soil | Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS | In-house method based on USEPA 8270 | L064B | D | MCERTS |
| BTEX and/or Volatile organic compounds in soil | Determination of volatile organic compounds in soil by headspace GC-MS | In-house method based on USEPA 8260 | L073B | W | MCERTS |
| Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil | Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS | In-house method | L076B/L088-PL | D/W | NONE |
| 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 |
| Chloride 10:1 WAC | Determination of Chloride colorimetrically by discrete analyser | In-house based on MEWAM Method ISBN 0117516260 | L082B | W | ISO 17025 |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 24-048488**
**Project / Site name: Cornbrook Residential**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|

**For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).**
**For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).**
**For method numbers ending in 'PL' or 'B' 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.**

## Information in Support of Analytical Results

**List of HWOL Acronyms and Operators**

| Acronym | Descriptions |
|---|---|
| HS | Headspace Analysis |
| MS | Mass spectrometry |
| FID | Flame Ionisation Detector |
| GC | Gas Chromatography |
| EH | Extractable Hydrocarbons (i.e. everything extracted by the solvent(s)) |
| CU | Clean-up - e.g. by Florisil®, silica gel |
| 1D | GC - Single coil/column gas chromatography |
| 2D | GC-GC - Double coil/column gas chromatography |
| Total | Aliphatics & Aromatics |
| AL | Aliphatics |
| AR | Aromatics |
| #1 | EH_2D_Total but with humics mathematically subtracted |
| #2 | EH_2D_Total but with fatty acids mathematically subtracted |
| _ | Operator - underscore to separate acronyms (exception for +) |
| + | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total |

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

# Sample Deviation Report

**Analytical Report Number : 24-048488**

**Project / Site name: Cornbrook Residential**

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

| Sample ID | Other ID | Sample Type | Lab Sample Number | Sample Deviation | Test Name | Test Ref | Test Deviation |
|---|---|---|---|---|---|---|---|
| SA04 | N/A | S | 352086 | c | BTEX and/or Volatile organic compounds in soil | L073B | c |
| SA04 | N/A | S | 352086 | c | Speciated PAHs and/or Semi-volatile organic compounds in soil | L064B | c |
| SA04 | N/A | S | 352086 | c | Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil | L076B/L088-PL | c |

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

## North

**William Smith House**
**173 – 183 Witton Street**
**Northwich**
**Cheshire**
**CW9 5LP**

**Tel: 01606 334 844**

## South

**Unit 5, Alfred Court**
**Saxon Business Park**
**Stoke Prior**
**Bromsgrove**
**Worcestershire**
**B60 4AD**

**Tel: 01215 729 014**

**www.brownfield-solutions.com**