



**Fusion Manchester Devco Ltd**

# **Deansgate, Manchester**

**Ground Investigation Report**

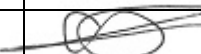




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# Deansgate, Manchester

## Ground Investigation Report

| ISSUE RECORD                        |                |                                                                                                                     |                                                                                      |                                                                                       |                                                                                       |
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| -                                   | October 2022   | -                                                                                                                   |                                                                                      |                                                                                       |                                                                                       |
|                                     |                |                                                                                                                     | Mitchell Tucker                                                                      | Claire Hooley / Richard Evans                                                         | Richard Evans                                                                         |
| A                                   | August 2023    | Minor amendments to the human health risk assessment and ground gas risk assessment following comments from Client. |                                                                                      |                                                                                       |                                                                                       |
|                                     |                |                                                                                                                     | Mitchell Tucker                                                                      | Sophie Thomas                                                                         | Claire Hooley                                                                         |
| B                                   | September 2023 | Minor amendment to text                                                                                             |                                                                                      |                                                                                       |                                                                                       |
|                                     |                |                                                                                                                     | Claire Hooley                                                                        | Ruth Easterbrook                                                                      | Claire Hooley                                                                         |
| C                                   | October 2023   | Amendments following feedback from Manchester City Council                                                          |  |  |  |
|                                     |                |                                                                                                                     | Ruth Easterbrook                                                                     | Claire Hooley                                                                         | Claire Hooley                                                                         |
| Report Liability Date: October 2022 |                |                                                                                                                     |                                                                                      |                                                                                       |                                                                                       |

TEC is ISO 9001:2015 and ISO 14001:2015 certified by Advanced Certification Limited, a UKAS Accredited Certification Body (number 8872) and ISO 45001:2018 certified by QMS International Ltd for the scope of 'Specialist consultancy services across the UK in contaminated land assessment, ground engineering, waste management and construction phase monitoring'.

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## EXECUTIVE SUMMARY

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|------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SITE INFORMATION       | Client                                         | Fusion Manchester Devco Ltd                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                        | Site Details                                   | Deansgate, Manchester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                        | Current Land Use and Description               | The site is a roughly triangular shaped plot of disused land located between the junction of Deansgate and the A56 Bridgwater Viaduct. The site is approximately 0.06ha, with the centre of the site situated at approximate National Grid Reference SJ 83294 97433. The nearest postcode is M15 4TP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                        | Proposed Development                           | It is understood the proposed development is to comprise the construction of 534 purpose-built student accommodation units housed within a 28-storey building (Manchester City Council Planning Ref: 129406/FO/2021, superseded by Appeal Decision Notice Ref: APP/B4215/W/21/3287525). As part of this construction, all made ground and significant depths of soil and rock will be removed from site to enable construction of the basement structure and raft foundations, thereby reducing existing ground levels by ~5.8m.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| BACKGROUND INFORMATION | Previous Site Investigation (Structural Soils) | <p>Previous intrusive works by Structural Soils have recorded the presence of made ground between 0.8 to greater than 2.2mbgl, underlain by gravelly sand with gravel of sandstone to depths between 1.8m and 2.9mbgl and very weak to weak thinly to moderately bedded medium to coarse sandstone to a maximum depth of 20mbgl and considered representative of the Sherwood Sandstone Group.</p> <p>Limited visual and olfactory contamination was recorded as pockets of ash and a strong hydrocarbon odour/staining between 0.6m and 1.9m in both made ground and underlying sandstone. Contaminants of potential concern including lead, naphthalene, petroleum hydrocarbons and 1,2,4-trimethylbenzene were identified within the made ground deposits. Laboratory analysis of recovered groundwater samples recorded exceedances of UK Drinking Water standards for total TPH compounds and benzene, with additional exceedances of the Environmental Quality Standards for cyanide, chromium, copper, lead, nickel, naphthalene and aromatic TPH compound EC10-EC12.</p> |
| GROUND INVESTIGATION   | Ground Investigation Rationale                 | The scope of the ground investigation works was to provide information regarding the site conditions and constraints including an assessment of the potential presence of contamination owing to historic use as a petrol filling station and to determine the potential ground gas regime for the site. In addition, general recommendations and comments relating to the ground engineering for the proposed development have been made based on the findings of the exploratory ground investigation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                        | Scope of Works                                 | <p>5No. Sonic boreholes to a maximum depth of 25mbgl to determine the depth of any made ground, the nature of underlying ground materials and allow sampling of encountered materials.</p> <p>5No. Trial pits to provide spatial coverage and to ascertain existing foundations and dimensions of retaining wall.</p> <p>Installation of shallow and deep ground gas and groundwater monitoring boreholes across the accessible site area.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                        | UXO                                            | A detailed UXO desk study was undertaken, which indicates that the site resides within a moderate risk area with respect to WWII bombing. An unexploded ordnance (UXO) explosive ordnance disposal (EOD) engineer was present for the duration of the intrusive works and consideration to UXO will be required as part of CDM for the proposed development. Additionally, the detailed UXO desk study recommends that intrusive magnetometer probe surveying is undertaken at all pile positions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                        | Ground Conditions                              | <p>Made ground was encountered across the site to a maximum depth of 4.0mbgl and typically comprises of reinforced concrete underlain by gravelly sand or clayey gravel, with gravel of brick, concrete, asphalt, and limestone.</p> <p>The Chester Formation was encountered beneath the made ground in all locations and typically observed as medium dense reddish brown slightly clayey fine to medium sand to depths between 1.0 and 7.0mbgl, underlain by moderately strong to strong reddish brown fine to medium sandstone to a maximum depth of 25mbgl.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                    |                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LAND CONTAMINATION | <b>Contamination Characterisation</b>                   | <p>Visual and olfactory evidence of potential contamination was reported within reworked natural materials, recorded as slight hydrocarbon odour and small amount of visible staining within the upper part of the Chester Formation in BH102, whilst made ground materials sampled from BH101 were noted to have a weak petrol odour with VOC concentrations recorded with a PID of a maximum of 305ppmv.</p> <p>Laboratory analysis of made ground recorded marginal exceedances at a single location (TP102) of the relevant GACs for PAH compounds for residential site end use without homegrown produce. No contaminants of potential concern were identified within the natural ground.</p> <p>Leachable CoPCs (heavy metals and total phenol) have been identified within sampled made ground/upper part of the natural Chester Formation. In addition, PAH, total phenol, benzene and Aromatic TPH EC5-EC7 have been identified within the groundwater at the site in excess of the UK Drinking Water Standards.</p>                                                                                                                                                                                                                                                                                                                                     |
|                    | <b>Ground Gas</b>                                       | No credible source of ground gas has been identified within the assessment by WSP, Structural Soils and TEC; and the confirmatory gas monitoring undertaken by both Structural Soils and TEC confirms the site would be classified as Characteristic Situation 1. No ground gas protection of further assessment is deemed to be required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                    | <b>Identified Pollutant Linkages</b>                    | <p>Human health (end users and construction workers) from potential exposure to vapours arising from contaminated soils and groundwater.</p> <p>Risks to controlled waters from leaching of potential contaminants from made ground and vertical migration through the saturated zone to controlled waters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                    | <b>Remediation Appraisal / Likely Remedial Approach</b> | <p>Across the site, it is proposed to reduce levels by ~5.8m depth (including up to 4.00m of sandstone bedrock) to accommodate the basement and raft foundation for the building. As a result, the source of potential hydrocarbon contamination will be removed, breaking the contaminant linkage for human health receptors and resulting in overall betterment in terms of groundwater quality.</p> <p>As part of this work, the underground storage tanks (UST's), and associated infrastructure will require decommissioning, and likely removal, as part of the proposed development works. Any such works should be undertaken by an appropriate contractor.</p> <p>Although no evidence of potential significant hydrocarbon contamination has been recorded within this area, it would be recommended that a watching brief is undertaken by a suitably experienced geoenvironmental consultant to confirm that significant or widespread contamination is not present beneath USTs in this area. Should any such contamination be identified at depths greater than 5.8mbgl (although not anticipated at this stage), further post remediation assessment may be required.</p> <p>The presence of hardstanding/building footprint would also effectively mitigate the risk to site end users from the identified contaminants of potential concern.</p> |
| GROUND ENGINEERING | <b>Foundations</b>                                      | Given the loads associated with the proposed development, a pile foundation solution is considered to be the most appropriate for the 28-storey building. For budgetary and indicative purposes only, it is anticipated that a 900mm bored pile socketed to 5m into the Chester Formation may be appropriate to provide the estimated resistance of 6300kN required for the building. It is estimated that piles of this length and diameter would provide an allowable resistance in tension in the order of 3300kN in tension.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                    | <b>Ground Floor Slabs</b>                               | Given the granular nature of the underlying Chester Formation, a ground bearing floor slab is considered appropriate for the scheme.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                    | <b>Buried Concrete</b>                                  | Both the made ground and natural Chester Formation have been found to require an Aggressive Chemical Environment Class (ACEC) of AC-1, requiring a Design Sulphate Class of DS-1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

## 1 INTRODUCTION

### 1.1 Terms of Reference

1.1.1 TEC has been appointed by Shear Design on behalf of Fusion Manchester Devco Ltd to undertake a geoenvironmental and geotechnical assessment of Deansgate, Manchester. All works were undertaken in accordance with our proposal letter dated 13<sup>th</sup> July 2022 and referenced RE.2006023.001C.

### 1.2 Background

1.2.1 The site is a roughly triangular shaped plot of disused land located off the junction between Deansgate and the A56 Bridgewater Viaduct in the southwest of Manchester City centre. The site is approximately 0.06ha in size, with the centre of the site located at approximate National Grid Reference SJ 83294 97433. The nearest postcode is M15 4TP (Figure 1).

1.2.2 The proposed development is understood to comprise the construction of 534 Purpose Built Student Accommodation units within a 28-storey building (Figure 2). It is understood that a planning application (Ref: 129406/FO/2021) was submitted to Manchester City Council and ultimately refused. This has been subsequently superseded by Appeal Decision Notice APP/B4215/W/21/3287525.

1.2.3 A number of previous assessments have been undertaken at the site. These include the following reports:

- Deansgate South, Manchester: *Phase I (Desk Study) Investigation Report* by Opus. Report ref: J-W0501.02 prepared for Knott Mill Securities Ltd.
- Deansgate South, Manchester: *Phase I Preliminary Risk Assessment Report* by WSP. Report ref: 11742(1) prepared for Fusion Manchester Devco Ltd.
- Deansgate South, Manchester: *Factual Report on Ground Investigation* by Structural Soils Ltd. Report ref: 764121 prepared for Buro Happold Engineering.

1.2.4 These previous reports have been provided to TEC and reviewed in Section 2 of this report. It is assumed these previous reports can be relied upon, although TEC hold no responsibility for the validity of third-party information. Reference should be made to these reports for full information.

1.2.5 The aim of these works is to provide information on land contamination risk and the ground engineering conditions and constraints associated with the site with regard to the proposed development and to comply with the requirements of Condition 6 of the above-mentioned decision notice.

### 1.3 Scope of Works

1.3.1 The scope of work undertaken as part of this report is presented below:

- **Land Contamination - Generic Quantitative Risk Assessment:** this phase of assessment involves updating the site conceptual model developed as part of the Preliminary Risk Assessment based on the findings of the ground investigation. Generic assessment criteria and assumptions, if appropriate, are used to identify relevant pollutant linkages.
- **Ground Engineering:** general recommendations in relation to ground engineering for the proposed development are provided on the basis of the findings of the ground investigation.

1.3.2 The above scope of work has been undertaken in accordance with current guidance such as LCRM - *Land contamination: risk management* (Environment Agency, 2023), BS10175+A2 (2017), BS5930:2015+A1:2020 and, where appropriate, Eurocode 7 and NHBC/ LABC.

## 2 PRELIMINARY RISK ASSESSMENT

### 2.1 Introduction

2.1.1 Information for this preliminary risk assessment (PRA) has been obtained from a site reconnaissance survey and a review of the previous reporting undertaken for the site together with published available information where relevant.

### 2.2 Site Setting

2.2.1 A site reconnaissance survey was undertaken on 08<sup>th</sup> August 2022. A summary of the observations is presented in Table 2.1. Photographs taken during the site reconnaissance survey are presented in Appendix A.

**Table 2.1: Site Details**

| Feature                                                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Current Site Use</b>                                      | <p>The site is a triangular shaped plot of disused land covered entirely with concrete hardstanding, although areas of scrub vegetation are present in areas where the slab have been damaged.</p> <p>The site is bordered by wooden hoarding on all sides except for along the north-eastern perimeter where a brick built retaining structure is present. In the northern corner of site, a section of brick wall that appears to be the remnants of a historical structure, as evidenced by blocked windows and vents, bridges over a small section of the adjacent access road just off site and runs southeast into the site by approximately five metres.</p> <p>Access to the site was obtained through a gate in the western corner of the hoarding off Deansgate road near the junction with the A56.</p>                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Site Context</b>                                          | The site is located with a predominantly residential area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Site Boundary Features</b>                                | North Residential apartments and the Bridgewater Viaduct.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                              | East Residential apartments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                              | South Residential apartments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                              | West Residential apartments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Site Topography</b>                                       | A topographical survey completed by EDI Surveys Ltd in November 2020 indicates the site is predominantly flat and situated at approximately 30m above ordnance datum (AOD), whilst notably a small concrete ramp in the western corner rises to approximately 30.9m AOD. The other side of the retaining wall just off site along the unnamed access road to the east is situated at approximately 27m AOD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Hard and Soft Landscaping</b>                             | The site is covered entirely by hardstanding, with a contemporary concrete slab along the north of the site laid on top of an older concrete slab of deteriorating condition which has allowed small sections of scrub vegetation to emerge.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Trees</b>                                                 | There are no trees on site and only a few small semi-mature deciduous trees located just off the south-eastern corner.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Fuel, Hazardous Chemicals and Waste Materials Storage</b> | <p>No evidence of fuel, hazardous chemicals or waste materials storage was observed on site during the site reconnaissance survey.</p> <p>However, during the site reconnaissance a ground penetrating radar (GPR) survey was completed by Groundscan (Appendix B), due to the sites historical use as a Petrol Filling Station (PFS). This survey identified four possible underground fuel storage tanks located along the southern boundary, as well as a possible former pump island under the contemporary concrete slab, with an unknown scar on the ground also identified and interpreted as a possible former fuel line. Anecdotal evidence from a local resident corroborates this layout and suggests that a forecourt building was present along the north-eastern perimeter and that the remaining brick wall on site was likely part of this structure.</p> <p>Infilled manhole covers were identified on top of each tank location, with the GPR survey suggesting each tank to be approximately 3m long and varying between 1.5m to 3m wide. Based on the reflection of the GPR signal three of these tanks are located approximately 0.45mbgl with the other one slightly deeper at approximately 0.82mbgl.</p> |

| Feature                                    | Description                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Asbestos Containing Materials</b>       | No potential asbestos containing materials were recorded during the site reconnaissance.                                                                                                                                                                                                                                                                                                                                       |
| <b>Site Drainage</b>                       | Surface water drains were observed running from the southern perimeter and along the edge of the contemporary concrete slab near to the historical fuel infrastructure/tank locations. Two broken, previously infilled manhole covers were located under a wooden board to the east of the site and appeared to be the remains of possible surface water drains. However, they were in poor condition and unable to be traced. |
| <b>Evidence of Potential Contamination</b> | No visual or olfactory evidence of potentially gross contamination was noted during the site reconnaissance.                                                                                                                                                                                                                                                                                                                   |
| <b>Ground Stability Hazards</b>            | No visual evidence of ground subsidence or movement observed.                                                                                                                                                                                                                                                                                                                                                                  |

## 2.3 Previous Site Report Summary

2.3.1 Information for the site has also been obtained through a review of the following reports undertaken for the site:

- Deansgate South, Manchester: *Phase I (Desk Study) Investigation Report* by Opus. Report ref: J-W0501.02 prepared for Knott Mill Securities Ltd.
- Deansgate South, Manchester: *Phase I Preliminary Risk Assessment Report* by WSP. Report ref: 11742(1) prepared for Fusion Manchester Devco Ltd.
- Deansgate South, Manchester: *Factual Report on Ground Investigation* by Structural Soils Ltd. Report ref: 764121 prepared for Buro Happold Engineering.

2.3.2 A summary of the relevant information from these previous reports, in relation to this assessment is summarised in Table 2.2. Reference should be made to these previous reports for full information. It is assumed that these previous reports can be relied upon for the current assessment.

**Table 2.2: Previous Reporting Summary**

|                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site History</b>          | <p>The earliest available historical mapping (1851) indicates the site formed part of the wider 'The Old Warehouse' wharf development to the north. The western part of the site was occupied by several buildings, with an additional smaller building to the north and notably a 'pump' in the eastern corner. This layout was changed by 1893, with the site appearing distinctly separate from adjacent works areas, and featured two buildings parallel with the north-eastern boundary. The WSP 2021 report suggests that the retaining structure along the north-eastern perimeter was likely constructed prior to 1893.</p> <p>Minor alterations to the site layout reportedly occurred in 1948 and 1951 when buildings were removed and replaced by a garage in 1960, interpreted by WSP to include a canopy/forecourt to the west and a building to the east which was likely a shop. No notable changes occur to the site layout was reported until mapping dating to 2010 which suggested the site was vacant. Imagery from Google Earth Pro shows that the contemporary concrete slab was likely associated with construction activities on a nearby site.</p>                                                                                                                                                        |
| <b>Environmental Setting</b> | <p>The geology for the site is reported to comprise sands and gravels of the superficial Glaciofluvial Deposits, underlain by sandstone bedrock of the Chester Formation.</p> <p>The Glaciofluvial Deposits are designated by the Environment Agency as a Secondary A Aquifer, whilst the Chester Formation is designated as a Principal Aquifer. Whilst the site is not located within a Source Protection Zone, there are eight groundwater abstractions recorded within 1km of the site, the nearest of which is reported approximately 575m to the north.</p> <p>The nearest surface water feature was identified as the River Medlock located approximately 50m east of the site, which supplies the Castlefield Canal Basin 50m to the north. It is reported that the eastern half of the site lies within an Environment Agency Zone 2 flood zone.</p> <p>There are no historical landfill sites recorded within 250m of the site, nor any records of historical mining or historical cavities within 1km. A number of potentially significant current and historic land uses have been reported within 500m of the site, including numerous industrial or engineering sites, two petrol/fuel sites (both of which listed as obsolete), sixty-five historical garages or vehicle repair sites and ten historical tanks.</p> |

|                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UXO</b>                                                  | As part of the WSP report in 2021 a review of the Manchester Bomb Record was undertaken which suggests numerous damaged or demolished buildings as a result of historical bombing, with one recorded incidence of 'high explosives' located just northwest of the site. Online Zetica Bomb Risk Maps shows the site to be in a moderate risk area for the potential presence of unexploded bombs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Encountered Ground Conditions</b>                        | The encountered ground conditions across the site generally comprised a thickness of made ground to depths of between 0.8m to in excess of 2.2mbgl, recorded as reinforced concrete underlain by brick fill, silty sandy gravel or silty gravelly sand. The gravel component typically comprised brick and sandstone. It is noted that the base of the ground was not proven in TP02.<br>The made ground was recorded to be underlain by gravelly sand with gravel of sandstone to depths of between 1.8m to 2.9mbgl, beneath which very weak to weak thinly to moderately bedded medium to coarse sandstone was observed to a maximum depth of 20mbgl and was considered representative of the Sherwood Sandstone Group.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Groundwater</b>                                          | Groundwater was struck only in BH02 at 15.2mbgl, with resting levels recorded as 6.9mbgl after a period of 20 minutes. During subsequent monitoring works, groundwater was reported at depths ranging from 6.25m and 9.06mbgl.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Contamination</b>                                        | Limited visual and olfactory evidence of contamination was recorded during the ground investigation works and noted to include localised pockets of ash within the made ground, a strong hydrocarbon odour and staining between 0.6m and 1.9mbgl in made ground and underlying sandstone in TP04 and similarly in TP05 between 0.9m and 1.8mbgl. Elevated Photo-Ionisation Detector (PID) readings were recorded to a maximum of 1700ppm and 2100ppm in TP04 and TP05 respectively.<br>Laboratory analysis of samples recovered recorded localised exceedances of the relevant Residential Without Plant Uptake land use thresholds with respect to lead (1No. location), naphthalene (2No. locations), petroleum hydrocarbons (1No. location) and 1,2,4-trimethylbenzene (1No. location).<br>Waste Assessment (WAC testing) was undertaken on 5No. samples which suggested the analysed materials were likely to be accepted at an inert landfill.<br>Laboratory analysis of 3No. groundwater samples recovered from BH02, recorded exceedances of UK Drinking Water Standards for total aliphatic/aromatic TPH compounds and benzene, with additional exceedances of Environmental Quality Standards (EQS- Freshwater, AA) for cyanide, chromium, copper, lead, nickel, naphthalene and aromatic EC10-EC12 TPH compound. |
| <b>Ground Gas/Radon</b>                                     | 4No. rounds of ground gas monitoring were undertaken by Structural Soils, within two installed boreholes screening made ground. Results of the ground gas monitoring indicated the site would likely be classified as Characteristic Situation 1, with no further monitoring required, nor any gas protection measures considered necessary.<br>In addition, WSP reports that the site is not located within a Radon Affected Area and therefore, no radon protective measures are reported to be required within new properties on site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Land Contamination Recommendations and Further Works</b> | Based on the localised hydrocarbon impact on subsurface soils identified by Structural Soils, Buro Happold reports that the visually impacted soils should be removed to a maximum depth of 2.0mbgl or a vapour resistant gas barrier should be installed in the proposed development. Additionally, whilst hardstanding is proposed across the majority of the site, Buro Happold recommended that a minimum build-up of clean material of 600mm installed along with a geotextile membrane in any areas of soft landscaping.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Ground Engineering</b>                                   | Buro Happold recommended the use of a piled foundation solution with multiple piles per column due to the anticipated high column loadings. Bored piles socketed 6 to 8m into the Chester Formation were recommended with provisional working loads for 600mm diameter piles of approximately 2000kN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 2.4 Detailed UXO Risk Assessment

2.4.1 A Stage 2 Detailed UXO Risk Assessment was obtained for the site, produced by Brimstone Site Investigation. The report is presented in full in Appendix C and summarised as follows:

- Greater Manchester experienced a high bombing density during four major raids and several medium scale attacks during WWII, with confirmed Luftwaffe bombing targets in the area.
- There are no recorded bombing incidents on site or the immediate vicinity, the nearest bomb strike was located 130m to the south.

- During the Blitz, the site was reported to be occupied with structures to the northeast and west and likely formed part of the wider engineering works. A comparison of OS mapping and aerial photography by Brimstone confirms that structure in the west of the site was cleared and several structures in the vicinity are listed as damaged/destroyed. Whilst the site itself is not labelled as damaged; Brimstone concludes that it is likely that the structure to the west was cleared due to bomb damage.
- Within potential areas of damaged structures, it is considered conceivable that a UXB entry hole could have gone unnoticed and unreported. Additionally, it is possible that a UXB falling at a certain impact angle window could have penetrated to several meters and come to rest under undamaged structures nearby.
- Numerous (>30) permanent heavy anti-aircraft batteries were active within range of the during WWII. Luftwaffe activity was relatively frequent and intense and as such it is possible that an unexploded anti-aircraft shell struck the site.
- The site has undergone development since WWII. However, it is not possible to confirm the nature of these structures, but their foundations are not considered to have been deeper than 2m. The risk associated with any UXBs will have only been mitigated at the locations and down to a maximum depth of any redevelopment works. Even if deep intrusions have been carried out since WWII, it is considered that the proposed works will disturb a significant amount of virgin soils at deep depths and that a deep buried UXB could conceivably remain underneath the site.
- An Intrusive Magnetometer Probe Survey is recommended at all pile positions for the proposed development.

## 2.5 Coal Mining – Coal Authority Report

2.5.1 The site is recorded to be located within a Coal Mining Reporting Area and a Coal Authority Report has been obtained for the site. The full report is presented in Appendix D and summarised as follows:

- The site is not within a surface area that could be affected by present underground mining.
- The site is not in an area where a license has been granted to remove or otherwise work coal using underground methods. The site is not in an area likely to be affected from any planned future underground coal mining. However, reserves of coal exist in the local area which could be worked at some time in the future.
- No notices have been given, under Section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.
- The Coal Authority is not aware of any damages due to geological faults or other lines of weakness that have been affected by coal mining.
- The site is not within the boundary of an opencast site from which coal has been removed by opencast methods.
- There are no license requests outstanding to remove coal by opencast methods within 500m of the boundary.
- The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50m of the enquiry boundary since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property.
- The Coal Authority has no record of a mine gas emission requiring action.
- The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call out procedures.
- The site is not in an area where a notice to withdraw support has been given.
- The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification of amendment thereof.

- The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

## 2.6 Regulatory Consultations

2.6.1 Regulatory consultations were undertaken with the relevant departments at Manchester City Council with respect to possible environmental issues and ground conditions on-site and in the surrounding area. A summary of the responses is provided below in Table 2.3. The full responses are presented in Appendix E.

**Table 2.3: Regulatory Consultations Summary**

|                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental Health<br/>Department of<br/>Manchester City Council</b>     | <ul style="list-style-type: none"><li>• No records are held by the Council regarding landfill sites, waste management licences nor radioactive substances registrations within 250m of the site.</li><li>• The site and surrounding area within 250m have not been identified as contaminated land under Part 2A of the Environmental Protection Act.</li><li>• No Part A Permitted Processes are recorded within 250m.</li><li>• There is 1No. Part B Permitted Process within 250m: Tom Garner Motors, which has been revoked.</li><li>• The council holds information on four historical planning applications for the site in December 1997, September 1999, July 2002 and July 2005. Review of the Councils planning portal shows that no information relating to contaminated land was received for these applications.</li></ul> |
| <b>Greater Manchester Fire<br/>and Rescue Service<br/>(Petroleum Officer)</b> | <ul style="list-style-type: none"><li>• The Greater Manchester Combined Authority which is the enforcing authority for the Petroleum (Consolidation) Regulations 2014, have no records for any past or current licensed storage of petroleum at the site.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

### 3 GROUND INVESTIGATION METHODOLOGY

#### 3.1 Background

3.1.1 The exploratory ground investigation undertaken was designed to provide information on the ground conditions to aid with the design of the development, to investigate the potential pollutant linkages identified as part of previous works completed at the site and in particular to comply with the requirements of Condition 6 of Planning Permission 129406/FO/2021. In addition, the ground investigation aims to address the risk items identified in Buro Happold Design Note BCG-01.

3.1.2 All site works were undertaken in accordance with BS5930:2015+A1:2020, BS10175+A2:2017 and, where appropriate, Eurocode 7. Works were supervised by a suitably experienced geoenvironmental consultant from TEC.

#### 3.2 Methodology

3.2.1 A summary of the ground investigation works undertaken and the rationale for each location is provided in Table 3.1, as follows:

**Table 3.1: Summary of Ground Investigation Works**

| Investigation Method    | Location             | Date(s)                 | Location Rationale                                                                             | Purpose                                                                                                                                                                                        |
|-------------------------|----------------------|-------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Trial Pitting           | TP101 – TP105        | 09.08.2022              | Positioned to provide spatial coverage across the site area                                    | Characterisation of shallow ground conditions<br>Collection of geochemical and geotechnical samples for analysis<br>Determination of existing foundation type and dimensions of retaining wall |
| Sonic Drilling Borehole | BH101, BH104 & BH105 | 10.08.2022 – 17.08.2022 | Positioned to provide spatial coverage across the site                                         | Characterisation of deeper ground conditions for piled foundation information.<br>Installation of groundwater monitoring well                                                                  |
|                         | BH102 & BH103        |                         | Positioned in close proximity to former pump islands and historical underground storage tanks. | Assess for potential contamination/ leakages associated with historical petrol station infrastructure<br>Installation of groundwater monitoring well.                                          |

3.2.2 Exploratory hole locations are presented on Figure 3 and detailed descriptions of encountered ground conditions are shown on exploratory hole logs presented in Appendix F.

#### 3.3 Limitations

3.3.1 Due to the presence of existing PFS infrastructure and limited space on site, TEC were restricted with regards to available locations in which to advance exploratory boreholes.

3.3.2 It should be noted that due to the selected drilling methodology (sonic drilling), that sample recovery, groundwater depths on completion of drilling and observations (including contamination observations) may have been affected by the addition of water during the construction of the boreholes.

### 3.4 Field Testing

3.4.1 A summary of in situ field testing undertaken as part of these ground investigation works is provided in Table 3.2

**Table 3.2: Summary of Field Testing**

| Field Test                      | Purpose                                                                                                              |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Hand Shear Vane (HSV)           | Estimation of undrained shear strengths of cohesive strata                                                           |
| Pocket Penetrometer (PP)        | Indication of unconfined compressive strength of cohesive strata                                                     |
| Standard Penetration Test (SPT) | Provision of strength profile of underlying ground conditions<br>Provision of in situ densities of granular deposits |
| Photo-Ionisation Detector (PID) | Indication of the presence/concentrations of volatile organic compounds (VOCs)                                       |
| Dual Phase Interface Probe      | Indication of the presence of free product                                                                           |

### 3.5 Monitoring Works

3.5.1 A summary of the monitoring works completed at the site to date is provided below in Table 3.3;

**Table 3.3: Summary of Monitoring Works**

| Monitoring  | Instrument/ Kit                 | No. of Rounds | Date(s)                                |
|-------------|---------------------------------|---------------|----------------------------------------|
| Ground Gas  | GFM430/436 Landfill Gas Monitor | 3             | 17.08.2022<br>31.08.2022<br>29.09.2022 |
| Groundwater | Waterra inertial pump           | 1             | 01.09.2022                             |

### 3.6 Chemical Testing

3.6.1 Laboratory testing was scheduled on the basis of the Preliminary Risk Assessment and field observations.

3.6.2 Representative soil and groundwater samples were collected and chemically tested at i2 Analytical Ltd, a UKAS/MCERTS accredited laboratory, for a selection of the following parameters:

#### Soils (Totals)

- Heavy metals and metalloids;
- Total Organic Carbon (TOC);
- Phenols (monohydric);
- Total Cyanide;
- Sulphate, sulphide, elemental sulphur and pH;
- Speciated Polyaromatic Hydrocarbons (PAH);
- Total Petroleum Hydrocarbons (TPH-CWG), including BTEX and MTBE; and
- Asbestos Screen.

#### Soils (Leachable)

- Heavy metals (arsenic, chromium, cadmium, copper, lead, selenium, zinc, barium, mercury, nickel, beryllium, vanadium and water soluble boron);
- Phenol (monohydric);
- Total Cyanide;
- Sulphate, sulphide, pH; and
- Speciated Polycyclic Aromatic Hydrocarbons (PAHs).

#### Waters

- *Heavy metals and metalloids;*
- *Phenols (monohydric);*
- *Total Cyanide;*
- *General Inorganics;*
- *Speciated Polyaromatic Hydrocarbons (PAH); and*
- *Total Petroleum Hydrocarbons (TPH-CWG), including BTEX and MTBE.*

3.6.3 Geochemical certificates of analysis are presented Appendix G.

### **3.7 Geotechnical Testing**

3.7.1 Selected soil samples were submitted for geotechnical analysis at K4 Soils Ltd and The Environmental Laboratory Ltd. Laboratory testing was scheduled upon the basis of field observations for a selection of the following:

- *Particle size distribution (PSD) tests;*
- *Large shearbox test;*
- *Point load tests;*
- *Unconfined compressive strength;*
- *BRE SD1 Suite C – Water soluble sulphates, water soluble chlorides, water soluble nitrates and pH.*

3.7.2 Soil geotechnical certificates of analysis are presented in Appendix H.

### **3.8 General Sampling**

3.8.1 Samples were collected in accordance with the following guidance;

- BS5930:2015+A1:2020 – Code of practice for ground investigations;
- BS-EN 1997-2:2007 - Eurocode 7 — Geotechnical design —Part 2: Ground investigation and testing
- BS ISO 10175:2011+A2:2017 - Investigation of potentially contaminated sites – Code of practice;
- BS ISO 18400-105 Soil quality – Sampling - Packaging, transport, storage and preservation of samples; and
- BS ISO 18400-106 Soil quality – Sampling - Quality control and quality assurance.

## 4 GROUND INVESTIGATION FINDINGS

### 4.1 Introduction

4.1.1 A summary of encountered ground conditions for the site is provided below while detailed descriptions are shown on exploratory hole logs presented in Appendix F. Photographs of the materials encountered are presented within Appendix A.

4.1.2 A selection of photographs showing the samples recovered is presented within Appendix A.

#### Made Ground

4.1.3 Made ground materials were encountered in all borehole locations to a maximum depth of 4.0mbgl, and typically comprised a layer of reinforced light grey concrete underlain by either brown slightly gravelly sand with gravel of brick, concrete and asphalt or dark brown to greyish brown slightly clayey gravel of tarmac, concrete and limestone

#### Superficial Deposits

4.1.4 None recorded.

#### Solid Geology (Chester Formation)

4.1.5 Materials considered representative of the Chester Formation were encountered in all borehole locations except for BH105 (which was terminated at 1.5mbgl) and generally comprised dense to very dense reddish brown sand underlain by extremely weak to weak, becoming moderately strong to strong reddish brown fine to medium grained sandstone, with fractures closely spaced and infilled with a reddish brown silty sand.

### 4.2 Generalised Ground Profile

4.2.1 The general ground profile encountered at the site is summarised in Table 4.1 below.

**Table 4.1: Generalised Ground Profile**

| Depth (mbgl)                             | Encountered Material                                                                                                                        |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MADE GROUND</b>                       |                                                                                                                                             |
| 0.0 – 0.23/0.5                           | Light grey reinforced concrete with 3-5mm rebar.                                                                                            |
| 0.23 – 1.0/3.5                           | Reddish brown slightly clayey slightly gravelly sand with low cobble content. Gravels and cobbles of concrete, chert, sandstone and quartz. |
| 0.5 – 4.0 (BH101)                        | Brown slightly gravelly sand with gravel of brick, concrete and asphalt and weak petrol odour.                                              |
| 0.23 – 1.0 (BH102)                       | Dark brown to greyish brown slightly clayey gravel of tarmac, concrete and limestone                                                        |
| <b>SOLID GEOLOGY – CHESTER FORMATION</b> |                                                                                                                                             |
| 1.5/3.5 – 2.0/4.45 (BH102 & BH103)       | Firm reddish brown to dark brown slightly gravelly slightly sandy clay with gravel of fine to medium sub-angular to rounded chert           |
| 1.5/4.0 – 1.0/7.0                        | Medium dense reddish brown slightly clayey fine to medium sand.                                                                             |
| 1.0/7.0 – >25.0                          | Extremely weak to weak becoming moderately strong to strong reddish brown fine to medium sandstone                                          |

### 4.3 Groundwater

4.3.1 Groundwater strikes were unable to be discerned during drilling due to water added to aid drilling. Standing depths of the groundwater within the boreholes recorded as part of subsequent monitoring visits are summarised in Table 4.2 below.

**Table 4.2: Summary of Groundwater Conditions**

| Location            | Standing Depths<br>(mbgl) |            |            | Strata            |
|---------------------|---------------------------|------------|------------|-------------------|
|                     | 17.08.2022                | 31.08.2022 | 29.09.2022 |                   |
| BH101               | 2.7                       | 7.12       | 7.07       | Chester Formation |
| BH102               | 2.5                       | 7.28       | 7.08       |                   |
| BH103               | 3.31                      | -          | -          |                   |
| BH104               | 2.94                      | -          | -          |                   |
| BH03 <sup>(1)</sup> | -                         | -          | -          |                   |

Notes:

1. Borehole installed by Structural Soils in 2016

4.3.2 Groundwater levels during the initial monitoring visit conducted immediately post drilling show groundwater levels resting at approximately 2.5 to 3.3mbgl. However, during subsequent monitoring visits standing groundwater levels were noted to have fallen to depths of approximately 7.0mbgl.

4.3.3 It should be noted that groundwater conditions recorded during the investigation may not be representative of long term conditions and that groundwater levels may vary in response to meteorological/ seasonal changes.

#### 4.4 Contamination Observations

4.4.1 Hydrocarbon odours and black staining were recorded within the made ground and the upper part of the Chester Formation in BH102 (recorded as Slight hydrocarbon odour and small amount of visual staining). However, screening of the soil samples with a photo-ionisation detector (PID) recorded no concentrations of VOC above the instrument's minimum detection limit.

4.4.2 Screening of made ground materials from BH101 (noted to have a weak petrol odour), which was positioned in proximity to the locations of former petrol station tanks, with a PID, recorded VOC concentrations of 5.5ppmv at 0.6mbgl, which increased to a maximum of 305ppmv at 1.5mbgl, before decreasing to 81.5ppmv at 3.5mbgl. Screening of the natural Chester Formation underlying these made ground materials recorded VOC concentrations that continued to decrease to 0.7ppmv at 6.3mbgl.

4.4.3 A summary of the visual and olfactory evidence together with elevated VOC concentrations recorded by both TEC and Structural Soils during the respective intrusive works is presented in Table 4.3 below.

**Table 4.3: Summary of Contamination**

| Location  | Depth<br>(mbgl) | Visual / Olfactory Record                                    | PID Concentration (ppm) |
|-----------|-----------------|--------------------------------------------------------------|-------------------------|
| TEC BH101 | 0.6             | -                                                            | 5.5                     |
|           | 1.0 – 3.0       | Weak petrol dour                                             | -                       |
|           | 1.2             | Weak petrol dour                                             | 58.8                    |
|           | 1.5             | Weak petrol dour                                             | 305.4                   |
|           | 2.5             | Weak petrol dour                                             | 52.8                    |
|           | 3.5             | -                                                            | 81.5                    |
|           | 4.3             | -                                                            | 33.6                    |
|           | 6.3             | -                                                            | 0.7                     |
| TEC BH102 | 0.8 – 1.0       | Slight hydrocarbon odour and small amount of visual staining | 0.00                    |
|           | 1.0 – 1.5       | Slight hydrocarbon odour and small amount of visual staining | 0.00                    |

| Location | Depth (mbgl) | Visual / Olfactory Record             | PID Concentration (ppm)    |
|----------|--------------|---------------------------------------|----------------------------|
| SS TP02  | 1.2 – 1.4    | Localised pockets of ash fill         | 0.0                        |
| SS TP04  | 0.67 – 0.95  | Strong hydrocarbon odour              | 495.0                      |
|          | 0.95 – 1.17  | Hydrocarbon odour and staining        | 1650.0                     |
|          | 1.17 - >1.95 | Strong hydrocarbon odour and staining | 1700 (1.4m)<br>1400 (1.8m) |
| SS TP05  | 0.9 – 1.1    | Strong hydrocarbon odour and staining | 600.0                      |
|          | 1.1 – 1.8    | Strong hydrocarbon odour              | 1610 (1.2m)<br>2100 (1.8m) |

4.4.4 In addition, a rock sample recovered from a depth of 6.4m at BH102, records a “hydrocarbon smell” within the geotechnical laboratory sample description, although no significant olfactory evidence of this was recorded on site during the advancement of this borehole. (Appendix H),.

## 5 LAND CONTAMINATION - GENERIC QUANTITATIVE RISK ASSESSMENT

- 5.1.1 The generic quantitative risk assessment comprises a screening of identified contaminants against generic assessment criteria (GAC) that are appropriate to the site setting and the receptors concerned.

### 5.2 Human Health

#### Methodology

- 5.2.1 Detailed information on the background legislation and selection of the GAC used within this assessment for human health is presented in Appendix I.
- 5.2.2 The standard land use for the site, for use in this generic assessment, has been defined as “*residential without home grown produce*” based on the proposed development and in accordance with current guidance.
- 5.2.3 As the site investigation methodology involved targeted sampling, statistical analysis has not been undertaken and the results have been directly compared to the GAC.

#### Summary of Results

- 5.2.4 The full human health generic quantitative risk assessment is presented in Appendix I.

#### Made Ground

- 5.2.5 The results of the assessment recorded a single exceedance of the GAC and therefore the following contaminant of potential concern (CoPC) has been identified within the made ground when considering a residential site end use with homegrown produce:

- PAHs (*Benzo(b)fluoranthene, dibenz(a,h)anthracene and benzo(a)pyrene*)

- 5.2.6 An asbestos screen completed on samples of the made ground at the laboratory recorded no suspected asbestos containing material or detectable asbestos fibres.

#### Natural Ground

- 5.2.7 A single sample of the natural ground (BH103 at 3.7-4.0mbgl) was submitted for TPH analysis. All determinands were recorded to be below the relevant GAC and therefore no contaminants of potential concern (CoPC) have been identified within the natural ground.

### 5.3 Controlled Waters

#### Methodology

- 5.3.1 Detailed information on the background legislation and selection of the GAC used within this assessment for controlled waters is presented in Appendix J.
- 5.3.2 Based on the conceptual understanding, the nearest significant controlled waters receptor is considered to be the underlying Principal Aquifer associated with the Chester Formation.
- 5.3.3 Therefore, an initial assessment of the potential risk to controlled waters has been undertaken by comparing the soil leachate and groundwater analytical results to published Drinking Water Standards where available. In the absence of DWS values, Environmental Quality Standards have been utilised.

#### Summary of Results – Leachate

- 5.3.4 Leachate analysis of representative made ground materials was undertaken as part of the Waste Acceptance Criteria testing (detailed further in Section 8), the results of which are presented within Appendix J.
- 5.3.5 The results of the assessment recorded a number of exceedances of the GAC and therefore, the following leachable contaminants of potential concern (CoPC) have been identified at the site:
- Heavy metals (chromium, mercury, zinc and barium);
  - Total phenol (monohydric)

#### Summary of Results - Groundwater

- 5.3.6 Groundwater samples were collected from the two deeper installed borehole monitoring wells (BH101 and BH102), the response zones for which are within the natural ground (Chester Formation).
- 5.3.7 The results of the groundwater samples are summarised in Appendix J.
- 5.3.8 The results of the assessment recorded exceedances of the GAC and therefore, the following contaminants of potential concern (CoPC) have been identified within the groundwater at the site:
- PAH (naphthalene);
  - Total phenol (monohydric);
  - TPH-CWG Aromatic (EC5 – EC7); and
  - Benzene.
- 5.3.9 In addition, a number of VOC concentrations were detected above the minimum detection limit within the groundwater, including: BTEX, Isopropylbenzene, n-Propylbenzene and 1,3,5-Trimethylbenzene. Further, a number of SVOC concentrations were also detected, including: Aniline, 2,4-Dimethylphenol and 2-Methylnaphthalene.
- 5.3.10 It is noted the leachable heavy metals identified within the made ground were not detected at significant concentrations within the sampled groundwater considered to pose a risk to the identified controlled water receptors.

#### **5.4 Ground Gas Risk Assessment**

- 5.4.1 The risks to the development from ground gases have been assessed in accordance with the empirical, semi-quantitative approach as outlined in BS8485:2015+A1:2019 (BS8485). This process includes combining the qualitative assessment of risk (using the CSM) with ground investigation and monitoring data to derive a Characteristic Situation for the site.
- 5.4.2 The following potential on-site sources of ground gas have been identified:
- Made ground observed to a maximum depth of 4.0mbgl; and
  - Hydrocarbon impacted materials associated with the former PFS.

#### Ground Gas Monitoring Results

- 5.4.3 All TEC gas monitoring was undertaken using a calibrated GFM430/436 infra-red gas analyser fitted with an internal flow pod. TEC monitoring results are presented in Appendix K and summarised in Table 5.1. Calibration certificates for both the GFM430 and GFM436 as well as both the MiniRae Lites used throughout TEC's monitoring visits are presented within Appendix L.
- 5.4.4 To-date, 3No. gas monitoring visits have been completed at the within all of the boreholes installed by TEC (BH101 to BH104) in addition to the previously installed BH03 (Structural Soils) which was located during the intrusive works.
- 5.4.5 The ground gas monitoring results from TEC boreholes BH101 and BH102 have not been considered further as part of this risk assessment given that their corresponding response zone was located within the bedrock of the Chester Formation which has not been identified as a potential source of ground gas. These installations were to allow for the collection of groundwater samples.
- 5.4.6 BH01 and BH02 installed by Structural Soils, were not able to be located during the works completed by TEC. However, upon review of Burohappold Engineering Design Note BCG-01 dated June 2017, provided to TEC for review indicated that 7No. rounds of historical ground gas monitoring was completed as part of their investigation phase for BH01 and BH03, however only 2No. rounds are available for BH02. Again, we have not included a summary of data for BH02 as the install response zone is located within the bedrock, Chester Formation.
- 5.4.7 Following review, all available ground gas monitoring data has been summarised below in Table 5.1.

**Table 5.1: Summary of All Available Ground Gas Monitoring Data**

| Borehole            | Response Zone/Strata | Potential source of ground gas                     | No. of monitoring occasions | Maximum (Steady State) Methane (%) | Maximum Carbon dioxide (Steady State) (%) | Minimum (Steady State) Oxygen (%) | Maximum (Steady State) Flow Rate (l/hr) | Water levels (mbgl) | Range of atmospheric pressure (mb) |
|---------------------|----------------------|----------------------------------------------------|-----------------------------|------------------------------------|-------------------------------------------|-----------------------------------|-----------------------------------------|---------------------|------------------------------------|
| BH103               | Made ground          | Potentially infilled ground                        | 3                           | 0.1                                | <0.1                                      | 19.6                              | <0.1                                    | Dry – 3.31          | 1003 - 1032                        |
| BH104               |                      | Potential contamination from historic fuel station | 3                           | <0.1                               | <0.1                                      | 19.3                              | <0.1                                    | Dry – 2.94          | 1004 - 1031                        |
| BH01 <sup>(1)</sup> |                      | Potentially infilled ground                        | 7                           | 0.1                                | 0.8                                       | 14.6                              | 0.1                                     | Dry <sup>(2)</sup>  | 998 - 1026                         |
| BH03 <sup>(1)</sup> |                      |                                                    | 10                          | 0.2                                | 0.9                                       | 19.2                              | <0.1                                    | Dry                 | 987 - 1032                         |

Notes:

1. Borehole installed by Structural Soils in 2016
2. Groundwater data only available for the first 4No. monitoring visits conducted by Structural Soils.

5.4.8 Overall, atmospheric pressures have generally been high and rising during the monitoring undertaken by TEC to date and therefore the results may not represent worst case conditions. However, monitoring of BH01 to BH03 by Structural Soils from January 2017 to April 2017 record both falling and rising pressures (~1021mb in January, falling to ~990mb in February and rising back to ~1026mb in April).

Borehole Hazardous Gas Flow Rate ( $Q_{hg}$ )

5.4.9 Hazardous gas flow rates calculated for each borehole standpipe and for each monitoring event, together with the resulting implied maximum Characteristic Situation (CS), are summarised in Table 5.2.

**Table 5.2: Borehole Hazardous Gas Flow Rates**

| Borehole | Date       | Methane - Hazardous Flow Rate<br>$CH_4$ $Q_{hg}$ (l/hr) <sup>(1)</sup> | Carbon Dioxide – Hazardous Flow Rate<br>$CO_2$ $Q_{hg}$ (l/hr) <sup>(1)</sup> | Implied $CH_4$ CS | Implied $CO_2$ CS |
|----------|------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------|-------------------|
| BH01     | 04.01.2017 | 0.0001                                                                 | 0.0003                                                                        | 1                 | 1                 |
|          | 17.01.2017 | 0.0001                                                                 | 0.0002                                                                        | 1                 | 1                 |
|          | 02.02.2017 | 0.0001                                                                 | 0.0008                                                                        | 1                 | 1                 |
|          | 13.02.2017 | 0.0001                                                                 | 0.0003                                                                        | 1                 | 1                 |
|          | 24.02.2017 | 0.0001                                                                 | 0.0004                                                                        | 1                 | 1                 |
|          | 10.03.2017 | 0.0001                                                                 | 0.0005                                                                        | 1                 | 1                 |
|          | 07.04.2017 | 0.0001                                                                 | 0.0005                                                                        | 1                 | 1                 |
| BH03     | 04.01.2017 | 0.0002                                                                 | 0.0018                                                                        | 1                 | 1                 |
|          | 17.01.2017 | 0.0001                                                                 | 0.0008                                                                        | 1                 | 1                 |
|          | 02.02.2017 | 0.0001                                                                 | 0.0007                                                                        | 1                 | 1                 |
|          | 13.02.2017 | 0.0001                                                                 | 0.0008                                                                        | 1                 | 1                 |
|          | 24.02.2017 | 0.0001                                                                 | 0.0008                                                                        | 1                 | 1                 |
|          | 10.03.2017 | 0.0001                                                                 | 0.0005                                                                        | 1                 | 1                 |
|          | 07.04.2017 | 0.0001                                                                 | 0.0006                                                                        | 1                 | 1                 |
|          | 17.08.2022 | 0.0001                                                                 | 0.0009                                                                        | 1                 | 1                 |
|          | 31.08.2022 | 0.0001                                                                 | 0.0001                                                                        | 1                 | 1                 |
|          | 29.09.2022 | 0.0001                                                                 | 0.0008                                                                        | 1                 | 1                 |

| Borehole | Date       | Methane - Hazardous Flow Rate<br>CH <sub>4</sub> Qhg (l/hr) <sup>(1)</sup> | Carbon Dioxide – Hazardous Flow Rate<br>CO <sub>2</sub> Qhg (l/hr) <sup>(1)</sup> | Implied CH <sub>4</sub> CS | Implied CO <sub>2</sub> CS |
|----------|------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------|----------------------------|
| BH103    | 17.08.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |
|          | 31.08.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |
|          | 29.09.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |
| BH104    | 17.08.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |
|          | 31.08.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |
|          | 29.09.2022 | 0.0001                                                                     | 0.0001                                                                            | 1                          | 1                          |

Note 1: Where flow rates of <0.1l/hr or concentrations of <0.1% have been recorded, a value of 0.1 (limit of detection of the instrument) has been assumed to calculate the Q<sub>hg</sub>

#### Worst Case Check

5.4.10

The plausible worst-case condition has also been calculated for each gas by multiplying the maximum recorded flow and gas concentration (for standpipes located in the same strata), to provide the worst-case implied CS, as summarised in Table 5.3. Peak negative flows have been judged to be unrepresentative and have therefore been discounted.

**Table 5.3: Worst Case Check – Ground Gas**

| Boreholes                 | Response Zone/ Strata | Max. Flow Rate (l/hr) | Max. Methane Conc. (%) | Max. Carbon Dioxide Conc. (%) | Maximum Methane - Hazardous Flow Rate<br>CH <sub>4</sub> Qhg (l/hr) <sup>1</sup> | Maximum Carbon Dioxide – Hazardous Flow Rate<br>CO <sub>2</sub> Qhg (l/hr) <sup>1</sup> | Implied CH <sub>4</sub> CS | Implied CO <sub>2</sub> CS |
|---------------------------|-----------------------|-----------------------|------------------------|-------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------|----------------------------|
| BH01, BH03, BH103 & BH104 | Made Ground           | 0.2                   | <0.1                   | 0.9                           | 0.0002                                                                           | 0.0018                                                                                  | 1                          | 1                          |

Note 1: Where flow rates of <0.1l/hr or concentrations of <0.1% have been recorded, a value of 0.1 (limit of detection of the instrument) has been assumed to calculate the Q<sub>hg</sub>

#### Gas Screening Values (GSVs)

5.4.11

On the basis of the conceptual site model and all gas monitoring completed to date by both Structural Soils and TEC, it is considered that the data is adequate to characterise the site.

5.4.12

Therefore, the site GSV is taken to be 0.0018l/hr, which is the worst case for methane and carbon dioxide. This GSV lies within the range of values designated for Characteristic Situation 1 and therefore, no specific ground gas protection measures are considered necessary within the proposed buildings.

### **5.5 Updated Conceptual Model**

5.5.1

The findings of the site investigation and the GQRA have been used to update the conceptual model and confirm the relevant pollutant linkages associated with the proposed development.

5.5.2

It should be noted, however, that it is proposed to reduce levels at the site by ~5.8mbgl to accommodate the proposed basement structure and raft foundations. This will remove made ground, together with up to 4.0m of residual soils and the upper layer of solid bedrock of the Chester Formation and will also remove the identified shallow sources of contamination from the site. As a result, although contamination sources have been identified within the site investigation, the updated CSM below, reflects the site conditions, following completion of the site enabling works.

Identified Sources

5.5.3 Sources of contamination/ ground gas identified on and within the vicinity of the site are summarised below:

*On Site Sources*

- Made ground
- Hydrocarbon impacted materials and infrastructure associated with former PFS

5.5.4 Notwithstanding this, current construction proposals indicate that site will be reduced by approximately 5.8m across the site to accommodate the basement and raft foundation, which will effectively remove the PFS infrastructure, made ground and identified hydrocarbon impacted materials for the site. While verification of this will be required, the potential on site source associated with these can be discounted.

*Off Site Sources*

- Surrounding historical industrial land uses.

Identified Receptors

5.5.5 Receptors identified as part of this updated conceptual model are:

- Current/future site users;
- Construction workers;
- Controlled waters (Principal Aquifer and surface waters);
- Proposed development/ structures.

Identified Pathways

5.5.6 Potential contaminant pathways relating to the identified receptors and contaminants of concern include:

- Dermal contact – contact with soil, dust or water;
- Ingestion - ingestion of soil, dust or water;
- Inhalation – inhalation of soil, dust or vapours;
- Vertical migration –leaching of hydrocarbon impact within the shallow soils/unsaturated zone resulting in vertical contaminant migration to the underlying aquifer; and
- Horizontal migration – e.g. lateral migration of contaminants within the saturated zone and along preferential pathways such as drainage pipe bedding.

5.5.7 The updated conceptual model is presented in Table 5.4. References to risk estimations are made in accordance with the methodology presented in CIRIA publication C552 (2001) titled 'Contaminated Land Risk Assessment: A Guide to Good Practice' and summarised in Appendix M.

Table 5.4: Updated Conceptual Model (Hazard Assessment and Risk Estimation)

| Identified Hazard/<br>Source | Identified Receptor                                                             | Identified Pathway                                                                                                                      | Potential Consequence of<br>Source-Pathway-Receptor<br>Contaminant Linkage | Likelihood for Source-Pathway-Receptor Contaminant Linkage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Risk<br>Classification   |
|------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Made Ground                  | Current and future site users, neighbouring site users and construction workers | Exposure to potential contaminants through ingestion, inhalation and dermal contact.                                                    | Medium                                                                     | <b>Low Likelihood:</b> Made ground was encountered across the site to a maximum observed depth of 4.0mbgl. Laboratory analysis of representative samples during the recent TEC works together with results from previous investigations on site have recorded the presence of PAHs, TPH and heavy metals when considering residential site end use without homegrown produce. During site enabling works, ~5.8m of material including all made ground will be removed from site therefore the source will be removed and there is no longer a significant contaminant linkage. In addition, all of the proposed development will be laid to hardstanding or within the footprint of the proposed structures, which will mitigate any residual pathways. However, enabling/remediation works will need to be undertaken adopting best practice for construction on brownfield sites and verified to confirm successful source removal. | <b>Moderate/low Risk</b> |
|                              | Controlled waters                                                               | Leaching of potential contaminants from made ground and vertical and lateral migration through the saturated zone to controlled waters. | Medium                                                                     | <b>Low Likelihood:</b> While elevated contaminant concentrations have been recorded within the deeper underlying groundwater, it is considered this is likely attributed to the presence of hydrocarbon impacted material associated with the former PFS and made ground on site, which is proposed to be removed during the site enabling works which will reduce the current ground levels by ~5.8m. It should be noted that verification of the remediation works will be required, to confirm removal of the source and prove betterment to the groundwater quality has been achieved.                                                                                                                                                                                                                                                                                                                                            | <b>Moderate/low Risk</b> |
|                              | Current and future site users, construction workers and proposed development    | Migration, ingress and accumulation of ground gasses.                                                                                   | Severe                                                                     | <b>Unlikely:</b> Ground gas monitoring undertaken as part of the current and previous assessments indicate the site is likely to be characterised as Characteristic Situation 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Moderate/low Risk</b> |

| Identified Hazard/<br>Source                                                 | Identified Receptor                                                             | Identified Pathway                                                                                                                                               | Potential Consequence of<br>Source-Pathway-Receptor<br>Contaminant Linkage | Likelihood for Source-Pathway-Receptor Contaminant Linkage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Risk<br>Classification      |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Hydrocarbon impacted materials and infrastructure associated with former PFS | Current and future site users, neighbouring site users and construction workers | Exposure to potential contaminants through ingestion, inhalation and dermal contact.                                                                             | Medium                                                                     | <b>Low Likelihood:</b> Visual and olfactory evidence of hydrocarbon contamination was recorded within the soils in proximity to the identified USTs associated with the former PFS. While screening of this material with a PID recorded elevated VOC concentrations, geochemical laboratory analysis recorded TPH concentrations to be below the current GACs.<br><br>As noted above, the site levels are to be reduced by ~5.8m which will remove made ground and the upper residual soil horizon and top of the bedrock of the underlying Chester Formation, removing the contamination source. The enabling/remediation works will need to be undertaken adopting best practice for construction on brownfield sites, and will require verification, to prove that any residual risk of hydrocarbon contamination has been successfully remediated during the site preparatory works.                               | <b>Moderate/low Risk</b>    |
|                                                                              | Controlled waters                                                               | Leaching of potential contaminants and vertical and lateral migration through the saturated zone to controlled waters.                                           | Medium                                                                     | <b>Low Likelihood to Likely:</b> Laboratory analysis of sampled groundwater from site recorded TPH, phenol, benzene and PAH concentrations above the screening values deemed protective of the underlying groundwater. However, it is proposed that made ground, and the upper residual soils and rock of the Chester Formation will be removed during the site enabling works which will reduce the current ground levels by ~5.8m, which will remove the on-site contaminant source, resulting in betterment of the groundwater quality associated with the site. It should be noted that verification of the remediation works will be required to confirm removal of the source and prove betterment to the groundwater quality.                                                                                                                                                                                    | <b>Low to Moderate Risk</b> |
|                                                                              | Current and future site users, construction workers and proposed development    | Migration, ingress and accumulation of vapours.                                                                                                                  | Medium                                                                     | <b>Low Likelihood to Likely:</b> Visual and olfactory evidence of potential hydrocarbon contamination was recorded on site. Screening of these materials with a PID reported the presence of elevated VOC concentrations. In addition, laboratory analysis of groundwater samples recorded the presence of TPH (banding C5-7). Furthermore, given the potential for further hydrocarbon impacted materials associated with the former PFS infrastructure, the potential risk from vapours cannot be fully discounted at this time, although it is considered that site preparatory and remediation works (excavation of ~5.8m made ground, soil and bedrock) will remove the source. Site remediation and enabling works will need to be verified and should there be a risk of residual deeper contamination or residual contamination extending away from the site boundary, then further assessment may be required. | <b>Low to Moderate Risk</b> |
| Potentially contaminative current and historic processes – off site          | Current and future site users, construction workers and proposed development    | Potential on-site contamination/ground gas migration from off-site sources. Exposure to potential contaminants through ingestion, inhalation and dermal contact. | Medium                                                                     | <b>Unlikely:</b> Potentially contaminative current and historic land uses have been identified in proximity to the development site. Notwithstanding this, laboratory test results, field test data and visual/ olfactory observations during the intrusive investigation suggest no potential significant contaminant migration from off site sources.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Low Risk</b>             |

## 6 LAND CONTAMINATION - CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Introduction

- 6.1.1 Visual and olfactory evidence of potential hydrocarbon impacted material was recorded during the intrusive works within shallow made ground and also within the residual soil and upper surface of the underlying Chester Formation. Screening of these materials with a photo-ionisation detector recorded elevated VOC concentrations, with a maximum concentration of 305ppmv recorded within BH101 at a depth of 1.5mbgl.
- 6.1.2 While laboratory analysis of representative soil samples did not record elevated TPH concentrations, an exceedance was reported for PAH compounds in a single location (TP102) when considering a residential without home grown produce site end use.
- 6.1.3 In addition, the previous investigation undertaken by Structural Soils, recorded hydrocarbon odours and staining. Screening of the encountered materials with a PID reported a maximum of 2100ppmv within SS TP05 at a depth of 1.8mbgl.
- 6.1.4 Laboratory soil analysis of made ground reported by Structural Soils indicated marginal exceedances of the relevant GACs for PAH compounds for a residential without home grown produce site end use.
- 6.1.5 Leachable CoPCs (heavy metals and total phenol) have been recorded within sampled made ground/natural Chester Formation from both investigations. Further, laboratory analysis of groundwater samples collected by TEC from the site, recorded TPH concentrations above the screening values deemed protective of the identified controlled water receptors, together with elevated PAH, phenol and benzene concentrations. In addition to these determinands, Structural Soils recorded the presence of elevated concentrations of Aromatic TPH EC5-EC7 with the groundwater. While leachable heavy metals were recorded within the sampled made ground as part of the waste testing, no exceedances of these metals were recorded within the underlying groundwater.
- 6.1.6 Given the elevated VOC concentrations associated with the identified hydrocarbon impacted materials, elevated TPH concentrations within the underlying groundwater, and the presence of significant below ground infrastructure associated with the former PFS on site, the potential risk from vapours cannot be discounted at this stage. Notwithstanding this, as noted above, it is proposed to reduce site levels by a depth of ~5.8m to accommodate the proposed basement and raft foundation for the proposed building. The reduction in levels will remove made ground from the site, together with up to 4.0m of residual soil and the upper rock surface of the underlying Chester Formation. This is considered to effectively remove the contamination source, mitigating the risks associated with potentially volatile contaminants of concern and also resulting in overall betterment in the groundwater quality.
- 6.1.7 To-date, 10No. rounds of ground gas monitoring have been completed at BH03, 7No. rounds at BH01, and 3No. rounds completed on the recently installed BH103 and BH104 with both falling and rising atmospheric pressures observed across these visits. Based on the monitoring undertaken to date, together with the conceptual site model, it is suggested that the site may be considered as Characteristic Situation 1 and no further ground gas monitoring is required. In addition, no radon protective measures are reported as necessary within the construction of new homes.

### 6.2 Remedial Appraisal

#### *Human Health*

- 6.2.1 Localised contaminants of potential concern (CoPC) have been recorded within the made ground materials when considering a residential without home grown produce site end use setting. Notwithstanding this, it is understood that site levels will be reduced by ~5.8m to accommodate the basement structure and raft foundations therefore removing the contamination source. Additionally, the entire site will be covered with hardstanding or within the footprint of the proposed structures, which will effectively break the contaminant pathway should any residual contamination remain following the site enabling works. These remediation/enabling works will require verification, to confirm removal of the contamination source. Additionally, should the proposed development layout change, a potential risk may be present and remedial measures may need to be incorporated to mitigate any potential risk.
- 6.2.2 Given the identified hydrocarbon impacted materials, and potential for further hydrocarbon contamination associated with the former PFS infrastructure on site, further assessment may be required during the

remediation/enabling works, to determine the risk from vapours on site, should the site preparatory works (including removal of made ground, soil and bedrock to a depth of 5.8m bgl) not fully remove the identified source. Alternatively, if residual contamination remains, following completion of the remediation works, and a potential hydrocarbon vapour risk remains, then vapour protection such as a hydrocarbon resistant membrane may be required within the proposed development. This will be confirmed on completion of the remediation/enabling works.

6.2.3 It is considered likely that the underground storage tanks (USTs) and any associated infrastructure will require decommissioning and removal, as part of the proposed development works. Any such works should be undertaken by an appropriately qualified contractor. Although no evidence of significant hydrocarbon contamination has been recorded within this area to-date, it would be recommended that a watching brief is undertaken by a suitably experienced geoenvironmental consultant to confirm the presence or otherwise of any potential hydrocarbon contamination associated with the PFS infrastructure. Should any such contamination be identified, further assessment may be required.

6.2.4 The potential for further USTs to be present at the site cannot be discounted. Should any such features be encountered during development works, site attendance by a suitably qualified geoenvironmental consultant would be recommended to assess for the presence of any contamination that may be associated with such features.

#### *Controlled Waters*

6.2.5 Given the identified contaminants of potential concern recorded within the underlying groundwater, a potential risk to controlled waters cannot be discounted. Notwithstanding this, it is understood that as part of the development works, the former PFS infrastructure, together with any associated contaminated made ground and soils will be removed, and it is considered that such works would likely provide contamination source removal also resulting in significant risk reduction against the potential risk to controlled waters and overall betterment in groundwater quality.

6.2.6 Given the presence of the underlying Principal Aquifer, a Foundation Works Risk Assessment may be required by the Environment Agency. In addition, it is considered likely that a programme of groundwater monitoring will be required by the Environment Agency during and after the construction works.

### **6.3 General Considerations**

6.3.1 Given the presence of general made ground, good brownfield site working practices should be adopted by construction workers to mitigate against potential risks.

6.3.2 Should water supply pipes be placed within the made ground encountered at the site, due consideration would need to be given to the UK Water Industry Research Ltd (UKWIR) guidance.

6.3.3 Based on our conceptual understanding of the site to-date, it would be anticipated that similar ground conditions to those encountered as part of this assessment exist across the site areas where access has been possible. However, should significant additional contamination be identified during the remediation/enabling works then further assessment and a revised remediation strategy may be required.

## 7 GROUND ENGINEERING

### 7.1 Proposed Development

7.1.1 The proposed development is understood to comprise the construction of 534 No Purpose Built Student Accommodation units within a 28-storey building (Figure 2).

7.1.2 Although full details have not been provided to TEC, for the purpose of this preliminary assessment, maximum column loads of up to 6300kN have been assumed for the proposed structure (as provided by Shear Design), and general recommendation with regards to the ground engineering have been made on this basis.

### 7.2 Site Preparation

7.2.1 A number of underground services including surface water drains are noted to be present within the site area, and consideration to the possible removal or re-routing of these features will be required during the construction process.

7.2.2 Additionally, consideration will also be required to the removal of any existing foundations, tanks and below ground structures associated with the historical fuel station.

### 7.3 Geotechnical Test Data Summary

7.3.1 Laboratory test data are presented in Appendix H while in situ test results are presented on the engineering logs in Appendix F.

#### Particle Size Distribution

7.3.2 Particle Size Distribution (PSD) testing was undertaken on 4 No. samples of the granular Chester Formation, summarised in Table 7.1 below:

**Table 7.1: Summary of Laboratory Test Results**

| Fines Component (<0.063mm) (%) | Silt Component (0.02 – 0.063mm) (%) | Sand Component (0.063 – 2mm) (%) | Gravel Component (2 – 63mm) (%) | Very Coarse (>63mm) (%) |
|--------------------------------|-------------------------------------|----------------------------------|---------------------------------|-------------------------|
| 4.7 - 14.6                     | 13.2 - 19                           | 59.3 - 76.7                      | 2.8 - 12                        | 0.0                     |

#### Soil Strength

7.3.3 A summary of the geotechnical field test data is provided in Table 7.2 below.

**Table 7.2: Summary of Geotechnical Field Test Data**

| <i>SPT 'N' Values</i>                                                                                                                 |                 |                                     |                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------|--------------------------------------------------------------|
| Strata (depth)                                                                                                                        | Number of Tests | Range of Results, 'N' Values Ranges | Equivalent Undrained Shear Strength (Cu, kPa) <sup>(1)</sup> |
| Made Ground (0 – 4.0m)                                                                                                                | 7               | 41- >50<br>(Average 48)             | 184.5– >225<br>(Average 216)                                 |
| Chester Formation: Firm reddish brown slightly gravelly very sandy clay (3.5 – 4.45) (BH103)                                          | 1               | 40                                  | 180                                                          |
| Chester Formation: Medium dense to very dense reddish brown slightly clayey slightly gravelly fine to coarse sand (1.5/4.0 – 3.4/7.0) | 9               | 42 - >50<br>(Average 46.4)          | -                                                            |
| Chester Formation: Moderately weak to strong reddish brown fine to medium sandstone (3.4/7.0 – 25m)                                   | 4               | >50                                 | -                                                            |

| Large Shear Box Results                                         |                 |                             |                                                                 |                                             |
|-----------------------------------------------------------------|-----------------|-----------------------------|-----------------------------------------------------------------|---------------------------------------------|
| Strata (depth)                                                  | Number of Tests | Cohesion (c') (kN/m²)       | Friction angle (Φ') (degrees)                                   |                                             |
| Chester Formation: Reddish brown clayey gravelly sand (2.0mbgl) | 1               | 18                          | 37.5                                                            |                                             |
| Uniaxial Compressive Strength                                   |                 |                             |                                                                 |                                             |
| Strata (depth)                                                  | Number of Tests | Range of Results (UCS, MPa) | Rock Strength Classification <sup>(2)</sup>                     |                                             |
| Chester Formation: Reddish brown sandstone (19.68 – 25.0mbgl)   | 3               | 4.3 – 9.8                   | Weak                                                            |                                             |
| Point Load Test Results                                         |                 |                             |                                                                 |                                             |
| Strata                                                          | Number of Tests | Is (50)                     | Approximate Correlated Undrained Compressive Strength (qu, MPa) | Rock Strength Classification <sup>(2)</sup> |
| Chester Formation: Diametral                                    | 31              | 0.01 – 0.32                 | 0.23 – 7.36 (Average 4.17)                                      | Extremely weak to weak (Very Weak)          |
| Chester Formation: Axial                                        | 50              | 0.09 - 0.65                 | 2.07 – 14.95 (average 10.23)                                    | Extremely weak to weak (Weak)               |
| Chester Formation: Irregular Lump                               | 14              | 0.03 – 0.58                 | 0.69 – 13.34 (Average 7.06)                                     | Extremely weak to weak (Weak)               |

Note 1: Based on published correlations (Stroud, 1975)

Note 2: Based on published correlations (Broch and Franklin, 1972).

## 7.4 Existing Retaining Walls

- 7.4.1 Exploratory locations TP103 and TP105 were excavated along the existing retaining wall that forms the north-eastern perimeter. The locations of these trial pits are presented within Figure 3, with photos of the excavations presented within Appendix A. Diagrammatic representations and descriptions of the encountered ground conditions are presented in Figure 4 and Figure 5.
- 7.4.2 In TP103, the foundation associated with the brick wall was found to extend approximately 1.0mbgl and was underlain by made ground materials to 1.6mbgl, which in turn was underlain by the natural Chester Formation to >2.2mbgl. Similarly, in TP05, the foundations of the brick wall were observed to extend 1.0mbgl and underlain by made ground materials to approximately 2.34mbgl with the Chester Formation observed to a depth of >2.8mbgl.

## 7.5 Foundations

### Preliminary Foundation Design Recommendations

- 7.5.1 It is considered that conventional foundations will not be suitable for the proposed 28-storey development due to the anticipated loads and thus a piled foundation solution will be required. Notwithstanding this, while settlements of less 10mm are anticipated should a rigid conventional foundation be utilised, with an assumed uniform load of 800kN/m<sup>2</sup> formed directly on the competent sandstone, it is anticipated that tension piles would be required due to building height.
- 7.5.2 If a piled solution is chosen, the proximity of adjacent structures will need to be carefully considered when choosing the most appropriate pile type and methodology, as such, it is suggested that a specialist piling contractor should be consulted regarding the piling options and detailed design of the most appropriate option. However, it is anticipated that a bored pile system would be appropriate for the site.

- 7.5.3 For budgetary and indicative purposes only, using the approach developed by Kulhawy and Carter (1975), the total rock socket lengths required to achieve an approximate 6300kN resistance are detailed below (Table 7.3).

**Table 7.3: Indicative Pile Bearing Resistance**

| Pile diameter | Rock socket length to achieve 6300kN resistance | Estimated settlement | Tension resistance |
|---------------|-------------------------------------------------|----------------------|--------------------|
| 900mm         | 5m (~10m depth)                                 | ~5mm                 | ~3300kN/m          |
| 750mm         | 7m (~12m depth)                                 | ~6.5mm               | ~3750kN/m          |

## 7.6 Ground Floor Slabs

- 7.6.1 Given the likely foundation option, a suspended floor slab may be suitable for the scheme due to the significant thickness of made ground recorded in some areas of the site.

## 7.7 Excavations

- 7.7.1 Excavations of materials immediately beneath the site should be achievable using conventional excavation plant.
- 7.7.2 Standing groundwater levels were initially recorded at depths of between 2.94m and 7.54mbgl immediately following intrusive works. Subsequent monitoring recorded standing levels of between 7.07m and 7.28mbgl. Based on observations made during the ground investigations, groundwater ingress into excavations is considered unlikely to be significantly problematic although some dewatering may be required, particularly where excavations are left open for any length of time. It would be recommended that formation levels are protected to mitigate against softening associated with any such water ingress.
- 7.7.3 It should be noted that groundwater levels might fluctuate according to the season and from year to year. This may have implications on recommendations, including those for foundations and excavations and the recommendations presented in this report may be subject to amendment should additional information becoming available.
- 7.7.4 It is recommended that appropriate shoring/temporary works are used in accordance with current Health and Safety requirements where access for personnel is required into excavations.

## 7.8 Protection of Buried Concrete

- 7.8.1 Observations of the encountered ground materials during the intrusive works indicate the site would be categorised as 'Brownfield locations', including potential aggressive materials or leachates, that contain pyrite.
- 7.8.2 In addition, observations made during the intrusive works suggest the groundwater conditions to be 'mobile', as flow is likely to be into excavations or is percolating through the ground.
- 7.8.3 The results of the testing of the soil and groundwater samples, together with the resulting Aggressive Chemical Environment for Concrete (ACEC) Class and Design Sulphate (DS) Class, as derived in accordance with BRE Special Digest 1, are presented in Table 7.4. The full laboratory results are presented in Appendix G and Appendix H

**Table 7.4: Summary of ACEC**

| Stratum           | No. of tests | pH          | Water Soluble Sulphate (mg/l) | Sulphate Concentration in Groundwater (mg/l) | ACEC                | DS Class            |
|-------------------|--------------|-------------|-------------------------------|----------------------------------------------|---------------------|---------------------|
| Made Ground       | 2            | 11.8 – 12.2 | 24 - 113                      | -                                            | AC-1 <sup>(1)</sup> | DS-1 <sup>(1)</sup> |
| Chester Formation | 9            | 8.4 – 11.1  | <20 - 78                      | 23.7 - 64                                    | AC-1 <sup>(2)</sup> | DS-1 <sup>(2)</sup> |

Note 1: Based on a characteristic value derived for a data set of <5 samples per stratum (maximum water-soluble sulphate concentration/ lowest pH) as per BRE SD1.

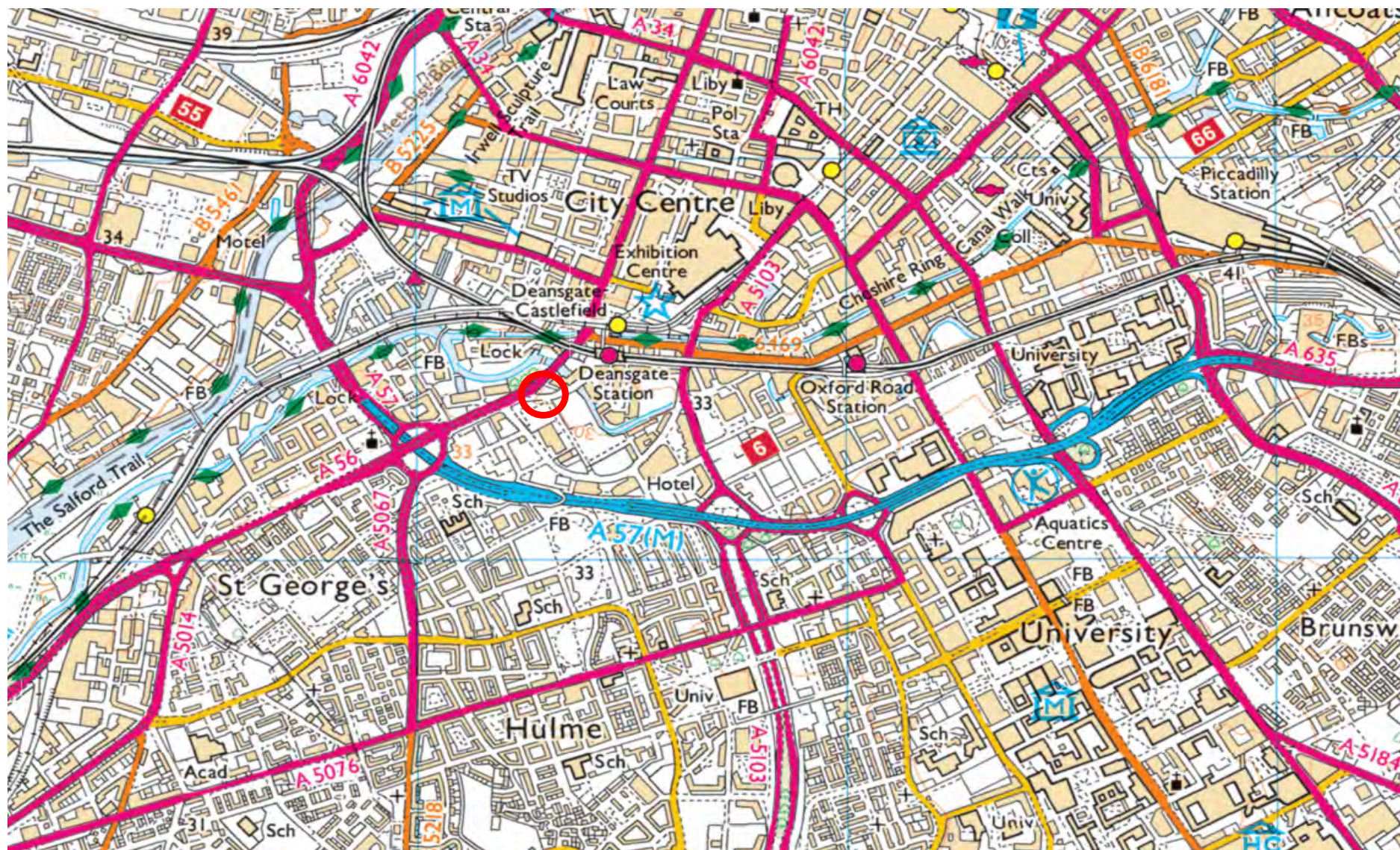
Note 2: Based on a characteristic value derived for a data set of 5-9 samples per stratum (mean of the two highest sulphate test results and two lowest pH tests) as per BRE SD1.

## 8 WASTE

- 8.1.1 Four samples of the made ground encountered on site were collected and scheduled for Basic Characterisation testing (including WAC testing), in accordance with the guidance outlined within the Environment Agency document '*Waste Sampling and Testing for Disposal to Landfill*' (EBPRI 11507B; March 2013). The results are presented within Appendix G.
- 8.1.2 The materials encountered were generally described as:
- TP102 (0.4 - 0.8) – Reddish brown, brown and grey mottled gravelly sand with medium cobble content. Gravels of brick, concrete and pipe.
  - TP104 (0.8 - 1.2) – Brown gravelly sand with low cobble content. Gravels of brick, concrete, textile, glass and tile.
  - BH102 (0.8 – 1.0) – Dark grey to greyish brown slightly sandy slightly gravelly clay with low cobble content. Gravels and cobbles of chert and sandstone.
  - BH102 (1.2 – 1.4) – Firm reddish brown to dark brown slightly gravelly slightly sandy clay. Gravels of chert.
- 8.1.3 The Environment Agency's technical guidance '*Waste Classification (WM3, 1st Edition v1.2GB 2021)*' provides the basis for the methodology to classify waste materials. Basic characterisation requires solids testing for potential contaminants, derived from the knowledge of the site history (in the case of contaminated soil). The classification assesses the composition of the material and determines the concentrations of hazardous substances in the material. The assessment of contaminated soil (excavated soil) to determine whether it is hazardous waste is dependent on the presence of "hazardous substances" exceeding particular thresholds.
- 8.1.4 The characterisation also determines the most appropriate List of Waste (LoW) code(s) for the waste. The List of Wastes (England) Regulations 2005 indicates those wastes that are "absolute entries" (hazardous waste regardless of their concentration) and those that are "mirror entries" (hazardous waste only if hazardous substances are present above threshold concentrations).
- 8.1.5 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 (as well as any other permit conditions for the particular landfill). WAC testing includes solids and leachate testing to assess which class of landfill can accept the waste.
- 8.1.6 While characterisation of the potential waste materials has not been included as part of the current commission, the WAC tests results indicate that should sampled materials be required to be disposed of to landfill, the made ground materials encountered may be accepted at an inert landfill.
- 8.1.7 However, it should be noted that the final decision with regard to waste classification is dependent upon the individual landfill operator. Therefore, it is recommended that the Basic Characterisation test results, WAC tests data, as well as all total contaminant results and background information regarding the waste source and origin (as contained within this report) are forwarded to the selected landfill/waste facility to gain confirmation with regards to the acceptability of the waste materials that may be generated from the site.
- 8.1.8 It should also be noted that inert, non-hazardous and hazardous waste must be treated before it can be sent to landfill, in accordance with the requirements of the Landfill Directive and in the context of these works treatment could include "source segregation". This would involve careful separation of waste material types on site to demonstrate the minimisation of the disposal of waste to landfill.
- 8.1.9 Should re-use of excavated materials be proposed, consideration will need to be given to appropriate regulatory guidance.

## TEC

## Figures and Drawings



Approximate Site Location: 

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TEC  
The Old Chapel  
35a Southover  
Wells, Somerset  
BAS 1UH

Tel: 01749 677760  
Email: info@tecon.co.uk  
Web: www.tecon.co.uk

Site Name:  
Deansgate, Manchester

Drawing Name:  
Site Location Plan

Client Name:  
Fusion Manchester Devco Ltd

Project No:  
2006023.001

Figure No:  
1

Date:  
October 2022

Scale:  
NTS



|                                                                                 |                                                                                                                                                          |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>TEC<br/>The Old Chapel<br/>35a Southover<br/>Wells, Somerset<br/>BA5 1UH</p> | <p>Tel: 01749 677760<br/>Email: <a href="mailto:info@tecon.co.uk">info@tecon.co.uk</a><br/>Web: <a href="http://www.tecon.co.uk">www.tecon.co.uk</a></p> |
|---------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|

|            |                       |
|------------|-----------------------|
| Site Name: | Deansgate, Manchester |
|------------|-----------------------|

Drawing Name: Proposed Development Plan

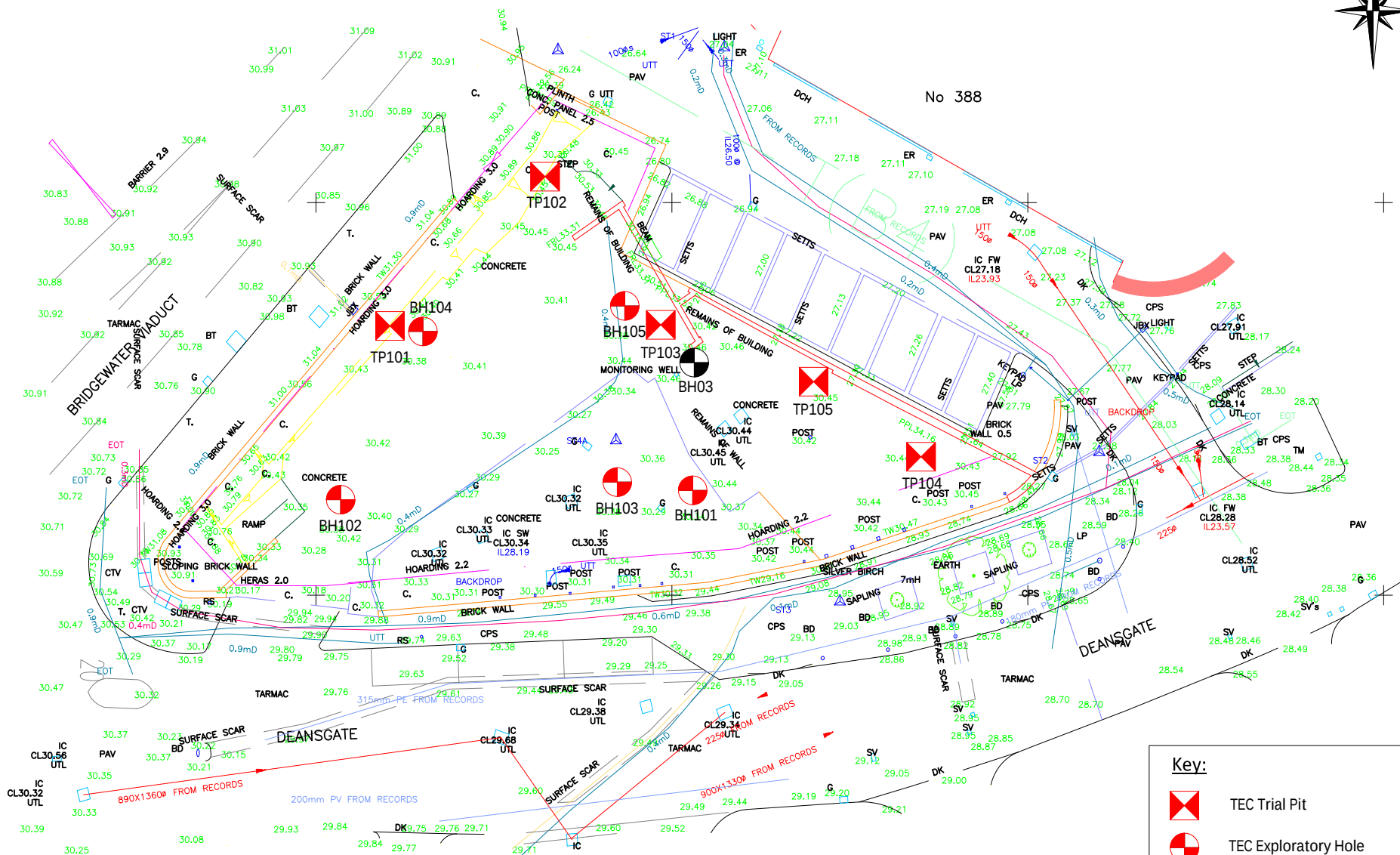
|              |                             |
|--------------|-----------------------------|
| Client Name: | Fusion Manchester Devco Ltd |
|--------------|-----------------------------|

|             |             |
|-------------|-------------|
| Project No: | 2006023.001 |
|-------------|-------------|

Figure No:  
2

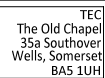
|       |              |
|-------|--------------|
| Date: | October 2022 |
|-------|--------------|

Scale:  
NTS



-  TEC Trial Pit
-  TEC Exploratory Hole
-  Previous Structural Soils Exploratory Hole

\*All locations are approximate



Tel: 01749 677760  
Email: [info@tecon.co.uk](mailto:info@tecon.co.uk)  
Web: [www.tecon.co.uk](http://www.tecon.co.uk)

Drawing Name:  
Exploratory Hole Location Plan

|              |                             |
|--------------|-----------------------------|
| Client Name: | Fusion Manchester Devco Ltd |
|--------------|-----------------------------|

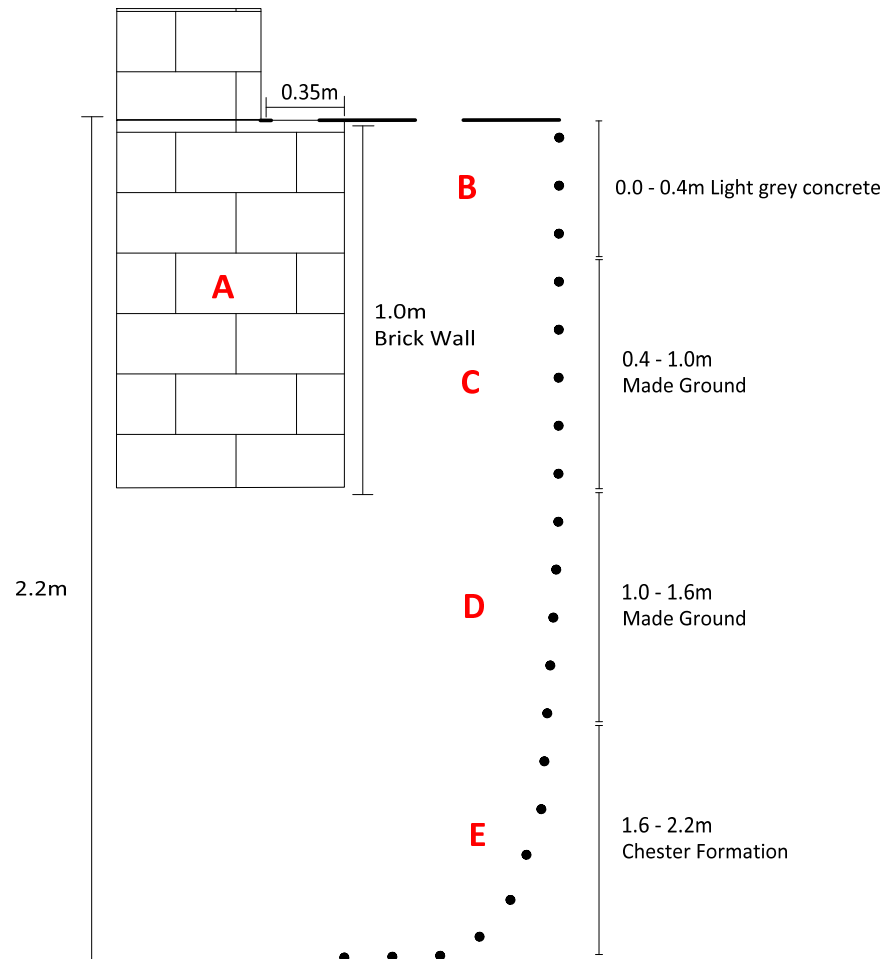
|             |             |
|-------------|-------------|
| Project No: | 2006023.001 |
|-------------|-------------|

Figure No:  
3

|       |              |
|-------|--------------|
| Date: | October 2022 |
|-------|--------------|

Scale:  
NTS

# TP103 - FOUNDATION EXPOSURE



- A - Brick Wall
- B - Concrete Slab
- C - Made Ground
- D - Made Ground
- E - Natural Ground - Chester Formation



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Wells, Somerset  
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Tel: 01749 677760  
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Site Name:  
Deansgate, Manchester

Drawing Name:  
Foundation Exposure - TP103

Client Name:  
Fusion Manchester Devco Ltd

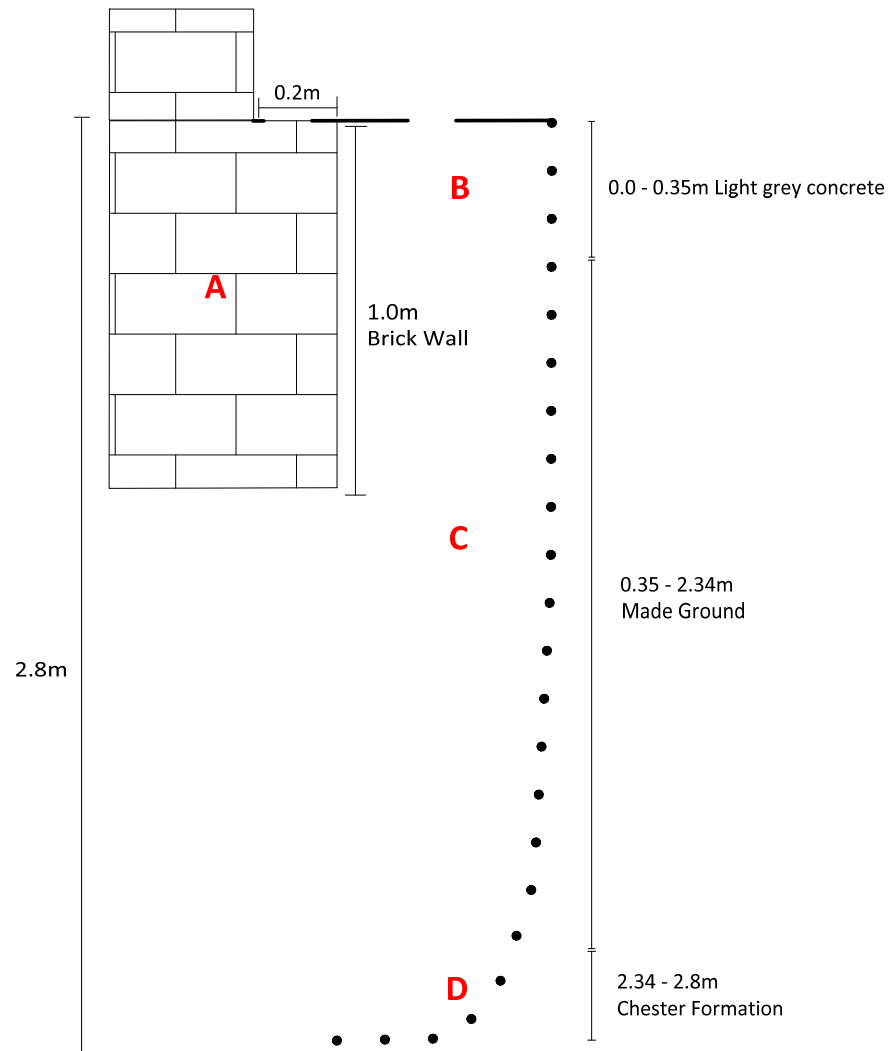
Project No:  
2006023.001

Figure No:  
4

Date:  
October 2022

Scale:  
NTS

# TP105 - FOUNDATION EXPOSURE



A - Brick Wall  
B - Concrete Slab  
C - Made Ground  
D - Natural Ground - Chester Formation



TEC  
The Old Chapel  
35a Southover  
Wells, Somerset  
BA5 1UH  
Tel: 01749 677760  
Email: info@tecon.co.uk  
Web: www.tecon.co.uk

Site Name:  
Deansgate, Manchester

Drawing Name:  
Foundation Exposure - TP105

Client Name:  
Fusion Manchester Devco Ltd

Project No:  
2006023.001

Figure No:  
5

Date:  
October 2022

Scale:  
NTS

## Appendix A

### Site Photographs



Photograph 1: View looking west across site.



Photograph 2: View looking east across site.



Photograph 3: View of southeast corner, showing derelict manholes.



Photograph 4: View of brick retaining wall exposed in TP103.



Photograph 5: View of brick retaining wall exposed in TP105.



Photograph 6: View of materials recovered from 0.8 – 2.0mbgl in BH102.



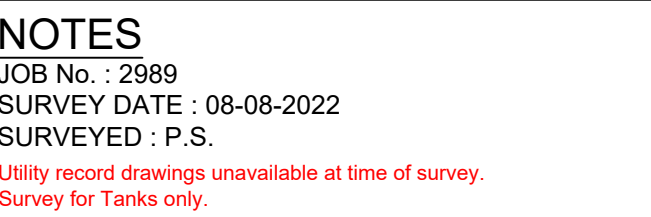
Photograph 7: View of sandstone recovered from 6.0 to 8.0mbgl in BH102.



Photograph 8: View of sand/sandstone recovered from 18.0 to 20.0mbgl in BH102.

Appendix B

GPR Survey



LECTRO-MAGNETIC TECHNIQUES AND/OR GROUND PENETRATING RADAR HAVE BEEN USED IN THE LOCATION OF UNDERGROUND SERVICES. THE RESULTS ARE NOT INFALLIBLE AND TRENCH EXCAVATIONS ARE REQUIRED TO CONFIRM THE LOCATION OF SERVICES. THE RESULTS OF THESE INVESTIGATIONS THEREFORE ARE CRITICAL, ALTHOUGH A REASONABLE EFFORT HAS BEEN MADE IN OBTAINING THE BEST AVAILABLE INFORMATION. THE INFORMATION IS NOT GUARANTEED AND THE INFORMATION CANNOT BE GUARANTEED. THE METHODS OF SURVEY DO NOT DIFFERENTIATE BETWEEN SERVICES THAT ARE IDENTICAL AND THOSE THAT ARE NOT IDENTICAL.

WHERE SERVICES ARE NON-METALLIC, POSITIONS MAY BE TAKEN FROM RECORDS, TRENCH MARKS AND SURFACE DATA. WHERE LOCATED, DEPTHS ESTIMATES ARE GENERALLY TO THE CENTRE OF THE SERVICE. THE DEPTHS OF GROVE VARIATIONS AND DEPTHS ARE GENERALLY TO INVERT LEVELS UNLESS STATE OTHERWISE.

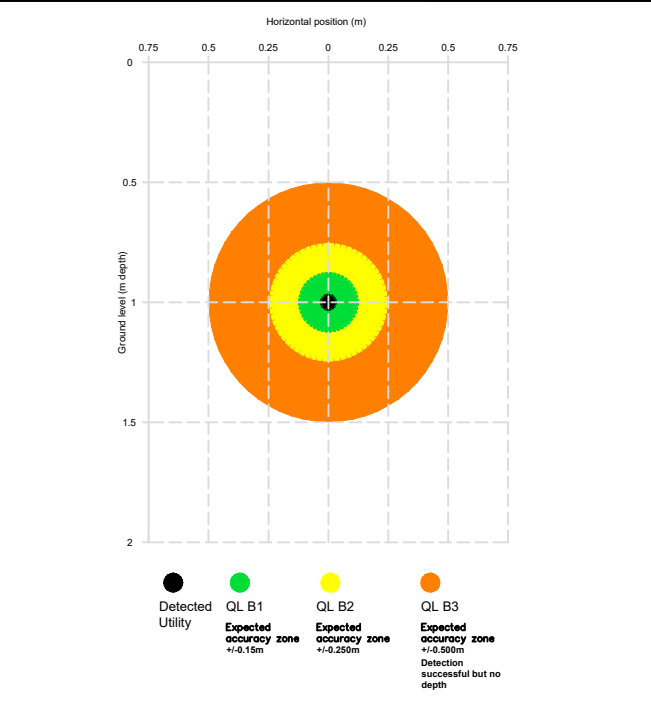
PIPE SIZES WHICH CANNOT BE OBTAINED BY VISUAL SURVEY ARE TAKEN FROM RECORD DRAWINGS AND/OR MANHOLE PLATES.

WHERE GROUND PENETRATING RADAR HAS BEEN USED IT WILL PRIMARILY HAVE BEEN TO IDENTIFY UNDERGROUND UTILITIES IF POSSIBLE. WE WILL ALSO IDENTIFY UNDERGROUND STRUCTURES, TANKS AND CULVERTS.

THE USE OF RADAR CAN NOT BE LIMITED BY SURFACE CONDITIONS AND ALSO BY SOIL TYPE. DEPTHS ESTIMATES WOULD NOT NORMALLY BE PROVIDED FOR SERVICES LOCATED UNDER

PAS 128 : 2014

| SURVEY CATEGORY    | QUALITY LEVEL | CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL                                                                                       |
|--------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| TYPE B - DETECTION | QL-6A         | A UTILITY DETECTED WHICH IS POSITIVE FOR THE UTILITY BUT NOT BEEN SEGMENTED AND NOT KNOWN AS AN ASSIGNED ROUTE<br>(NO DETECTION POSSIBLE) |
|                    | QL-8C         | POSITION OF THE UTILITY DETECTED BY ONE OF THE GEOSPATIAL TECHNOLOGIES (RM, OR - SPR DETECTION, UNLIMITED DEPTH)                          |
|                    | QL-8B         | POSITION AND DEPTHS OF THE UTILITY DETECTED BY ONE OF THE GEOSPATIAL TECHNOLOGIES (RM, OR - SPR DETECTION, LIMITED DEPTH)                 |
|                    | QL-8I         | POSITION AND DEPTHS OF THE UTILITY DETECTED BY MULTIPLE GEOSPATIAL TECHNOLOGIES (RM, OR - SPR DETECTION)                                  |



|     |                   |      |                    |
|-----|-------------------|------|--------------------|
| AR  | ASSUMED ROUTE     | PE   | POLYETHYLENE       |
| BL  | BACKDROP          | PR   | PIPER RISER        |
| BL  | BLACK             | PVC  | POLYVINYL CHLORIDE |
| CB  | CLOCKED IN        | R    | RODDING EYE        |
| CB  | CABLE IRON        | RWP  | RAIN WATER PIPE    |
| CL  | COVER LEVEL       | ST   | STOP TAP           |
| CL  | CABLE PIT         | SV   | SOFT VALVE         |
| CP  | CABLE             | SWP  | SOIL VENT PIPE     |
| EM  | EARTH MAT         | TFR  | TAKEN FROM RECORDS |
| EM  | ELECTRICITY POLE  | TL   | TRAFFIC LIGHTS     |
| EOT | END OF TRAIL      | TEL  | TELEGRAPH POLE     |
| FO  | FOOTING POINT     | UTL  | UNABLE TO LOCATE   |
| FR  | FIRE HYDRANT      | UTL  | UNABLE TO RAISE    |
| GV  | GV VALVE          | UTS  | UNABLE TO SURVEY   |
| GY  | GULLY             | UTS  | UNABLE TO TRACE    |
| IC  | INJECTION CHAMBER | VL   | VENT PIPE          |
| LP  | LEVEL POINT       | VR   | VAPOUR RECOVERY    |
| LP  | LMPT POST         | WL   | WATER LEVEL        |
| MA  | MANHOLE           | WM   | WATER METER        |
| NH  | NH PIPE VISIBLE   | WWSH | WASHOUT LEVEL      |
| NSA | NORTH SURVEY AREA | WWP  | WASTE WATER PIPE   |

|                                                                                       |                   |
|---------------------------------------------------------------------------------------|-------------------|
|  | BOREHOLE (BH)     |
|  | BOREHOLE PROPOSED |
|  | LOCATION          |
|  | BT                |
|  | CABLE TV CATV     |
|  | CLOSED CIRCUIT TV |
|  | COMMS             |
|  | EARTH             |
|  | EMPTY DUCT        |
|  | FIBRE OPTICS      |
|  | GAUGE LINES       |
|  | TRAFFIC SIGNALS   |
|  | ELECTRIC HV       |
|  | ELECTRIC          |
|  | FUEL LINES        |
|  | OFFSET FILL       |
|  | VENT              |
|  | FUEL PIPE         |
|  | GAS               |
|  | WATER             |
|  | OIL               |
|  | COMPRESSED AIR    |
|  | RADAR TRACE       |
|  | UNKNOWN TRACE     |
|  | DRAINAGE FOUL     |
|  | DRAINAGE SURFACE  |
|  | OUTFALL           |
|  | RISING MAIN       |
|  | END OF TRACE      |
|  | SURVEYED AREA     |

**groundscan**  
Unit 4, The Old Glove Factory,  
Bristol Road,  
Sherborne,  
Dorset DT9 4HP  
Tel: 01935 389123  
Website: [www.groundscan.co.uk](http://www.groundscan.co.uk)  
Company Reg: 07847795

Client: **TEC**

Survey Location:  
Deansgate  
Manchester

Survey type: For Tanks Only

Drawing ref: 2989

Drawn/QA: A.B.

Scale: 1:200@A1  
Sheet: 1 of 1

Date: 11-08-2021

Issue: 1

## Appendix C

### Detailed UXO Risk Assessment



**BRIMSTONE**  
**SITE INVESTIGATION**

**DETAILED**  
**UXO RISK ASSESSMENT**

INTEGRITY



PROFESSIONALISM



KNOWLEDGE



## STAGE 2 DETAILED UXO RISK ASSESSMENT

**Client:** Fusion Devco Manchester Ltd  
**Project Ref:** TWEE66R  
**Site:** Deansgate, Manchester  
**Report Ref:** DRA-22-1433-TWEE66R-Deansgate,Manchester  
**Revision:** 0  
**Status:** Final  
**Release Date:** 4<sup>th</sup> August 2022

|                       |                |                     |                                 |
|-----------------------|----------------|---------------------|---------------------------------|
| <b>Written By:</b>    | Harry Smith    | Project Researcher  | harry.smith@brimstoneuxo.com    |
| <b>Reviewed By:</b>   | Will Hunnisett | Research Supervisor | will.hunnisett@brimstoneuxo.com |
| <b>Authorised By:</b> | Aaron Florence | Managing Director   |                                 |

## EXECUTIVE SUMMARY

**RESULT:** Brimstone Site Investigation concludes that UXO poses a **MODERATE RISK** to the proposed works.

**THE SITE:** The Site (approximately centred on the National Grid Ref: SJ 83296 97434) is located in Manchester, in the north-west of England, approximately 160m south-west of Deansgate railway station.

It is occupied by an area of brownfield land, with a small area of car parking along the north-eastern boundary. The Site is bordered by the A56 to the north-west, hard standing and an accessway to the north-east and east, Deansgate Street to the south and Deansgate Street and A56 junction to the south-west.

**THE PROPOSED WORKS:** The proposed ground investigation works includes 2no. boreholes to 25m bgl and 3no. shallower boreholes to 5m bgl with trial pitting along the retaining wall in the east to inspect any footings. The proposed development comprises the construction of a 28-storey residential building.

### UXO RISK ASSESSMENT:

#### German UXO:

- Greater Manchester was the 11<sup>th</sup> most heavily bombed British conurbation during WWII. Like today, the Site occupied a relatively central location during the Blitz with confirmed Luftwaffe bombing targets in the area. Consequently, it experienced a high bombing density, the result of four major raids (defined as >100 tonnes of HE bombs dropped) and some medium scale attacks.
- A bomb plot and damage map covering all air raids on the city was analysed, as was a bomb map displaying all bomb strikes resulting in at least one fatality. These do not record any bombing incidents within the study area or vicinity. The nearest bomb strike was located approximately 130m to the south.
- The high density of bombing makes it impossible to identify individual bombload alignments in relation to the Site. The records of exploded and unexploded HE bombs dropped during the Manchester Blitz give a failure rate of 16.6%; a significantly higher figure than the widely accepted 10% average for Britain as a whole.
- At the commencement of the Blitz, the Site was occupied by open ground with a structure in the north-east and west, potentially linked with the nearby engineering works. A comparison of OS mapping and aerial photography confirms that the structure in the west of the Site was cleared, which is indicative of bomb damage. Several structures in vicinity of the Site were labelled as completely destroyed and were visibly cleared in aerial imagery. Whilst the Site was not labelled as damaged, given the previously mentioned inconsistencies within the record set (**Section 9.1**), combined with the known substantial bomb damage in the area, it is considered likely that the structure on Site was cleared due to bomb damage.
- Following the potential destruction of the building on Site, this area would have been abandoned / cordoned off for the remainder of the war. Buildings in the wider area would likely have been evacuated for periods as a result of the substantial damage in the area. This marked decrease in access greatly reduces the likelihood that evidence of a UXB would have been observed within this area.
- Within potential areas of damaged structures, the ground cover is not considered to have been conducive to the observation of a UXB. Consequently, it is conceivable that a UXB entry hole could have gone unnoticed and unreported. Even if the site had been accessed, the diameter of the smallest German HE bomb (which was also the most commonly deployed over Britain) was just 200mm; creating a small entry hole, easily obscured in vegetated or bomb damaged areas.
- It is also possible that a UXB, falling within a certain impact angle window could have penetrated to several meters depth and come to rest under undamaged wartime structures nearby, due to the J-Curve (lateral offset) Effect. Therefore, due to the relatively small size of the Site boundary, it has not been possible to discount the potential for a UXB across the entire Site and it has been assessed to be at a **Moderate** Risk of contamination from German UXO. The risk from UXO on Site is considered to be mitigated down to the depth of any post-war redevelopment works.

**British / Allied UXO:**

- Numerous (>30) permanent HAA batteries were active within range of the Site during WWII. Luftwaffe activity was relatively frequent and intense over the wider area and therefore these guns would have expended a significant quantity of ammunition. Consequently, it is possible that an unexploded AA shell struck the Site.
- No evidence of historic military activity within the Site boundary has been found and it is highly unlikely that any has occurred historically. Consequently, the risk from associated UXO is low.

**Likelihood of UXO Remaining and UXO Encounter:**

- The Site has undergone development since the WWII-era with the development of structures across the Site, which have since been cleared. It has not been possible to confirm the nature of these structures but foundations for these buildings are considered most likely to have disturbed ground to shallow (1-2m) depths, although this has not been possible to confirm. It is not thought likely that any structures on Site will have required deep (>2m) foundations.
- The risk associated with any shallow or deep buried German UXBs will only have been mitigated at the locations and down to the maximum depths of any post-war redevelopment works. It has not been possible to confirm the depths of post-war development works and it cannot be assumed that the risk from any deep buried UXBs down to the maximum bomb penetration depth has been mitigated. Even if deep intrusions have been carried out post-WWII, it is considered that the proposed works will disturb a significant amount of virgin soil at deep depths.
- A deep buried UXB could conceivably remain under all sections of vegetated ground on Site, as well as underneath the structures present during WWII or developed post-war after accounting for the possibility of the 'J-Curve Effect'. Post-conflict ground works will have mitigated the risk at very shallow (<1m) depths across the Site.

**RECOMMENDED RISK MITIGATION MEASURES:** The measures detailed below are recommended to mitigate the risk to ALARP level.

| Risk Mitigation Measure             | Recommendation                                   |
|-------------------------------------|--------------------------------------------------|
| UXO Safety Awareness Briefings      | Prior to all intrusive works commencing on Site. |
| EOD Engineer - On Site Supervision  | During all open excavations.                     |
| Intrusive Magnetometer Probe Survey | At all pile positions.                           |

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## QUALITY MANAGEMENT

Brimstone Site Investigation is committed to the provision of UXO risk mitigation services, including the safe removal and disposal, in the UK and overseas. Since our inception in 2016 it has been our goal to provide unsurpassed UXO risk mitigation services. Brimstone is a client-driven organisation, we aim to provide the client the services they need, to the agreed requirement, in accordance with national and international standards.

We are committed to providing a safe, cost-effective and quality service, underpinned by our three core values;

- Integrity in advice, information and the manner in which we conduct ourselves and our operations,
- Professionalism in the way we handle our operations, people and processes, and
- Knowledge in new skills and information, to ensure we remain at the forefront of innovation and strategy.

We are committed to the applicable requirements of the ISO 9001 standards. We set and review quality monitoring objectives to measure the performance of our quality management system. Brimstone wholly endorses the ethos of 'continual improvement efforts' and allocates resources to meet this requirement.

This policy applies to the whole of the Brimstone Site Investigation Ltd services and affects roles from the managing director down. All staff are responsible for helping manage quality, seeking improvement through constant review, and by encouraging supplier and subcontractor involvement. We are committed to achieving customer satisfaction using quality procedures, which will be operated to meet or exceed the applicable requirements of ISO 9001.



Aaron Florence

**Founder and Managing Director**

**Brimstone Site Investigation Ltd.**

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The contents of this report are confidential. This report has been prepared for the use of the client and shall not be distributed or made available to any other company or person without the knowledge and written consent of either the client or Brimstone Site Investigation.



# 1 INTRODUCTION

## 1.1 Background

Fusion Devco Manchester Ltd (the Client) has commissioned BSI to carry out a Stage 2 Detailed Unexploded Ordnance Risk Assessment (DRA) of the proposed redevelopment works at the Deansgate, Manchester site (the Site).

## 1.2 Legislation

There are no regulations that specifically govern the UXO risk mitigation industry in the UK. There are however two pieces of legislation that require consideration. It is industry best practice (and common sense) to frame your site in the context of UXO, and to put in place measures to protect people from risks. In 2009, CIRIA published Unexploded Ordnance (UXO) - A Guide for the Construction Industry C681. This publication, though not legally binding, provides the gold-standard framework to which UXO and construction companies operate.

### 1.2.1 Construction Design and Management Regulations (CDM) 2015

The regulations identify the client, the CDM coordinator, the designer, and the principal contractor as responsible parties. Under the regulations, responsible parties are held accountable for the way a construction project is managed and for the health and safety of workers. Responsible parties must:

- Provide an appropriate assessment of potential UXO risks, or ensure an assessment is completed by another party.
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks.
- Ensure the preparation of an emergency response plan.

### 1.2.2 The Health and Safety at Work Act 1974

The Health and Safety at Work Act 1974 had a transformative impact on health and safety, saving thousands of lives since its enactment. Employers must consider their employees, workers not in their employment, and members of the public. The act places a duty on every employer 'as far as is reasonably practicable' to protect workers from risks. It also says that information must be provided about aspects of health and safety that affect their role.

## 1.3 Commercial Contractor and the Authorities

### 1.3.1 Commercial Contractors

If your site has been given a moderate or high-risk rating, then control measures will be recommended. The measures will be specific to the scope of works on site, usually in relation to the depth and extent of excavations, piling and similar activities. There are a range of different methods at BSI's disposal, including:

- Non-intrusive surveying (including drone surveying)
- Intrusive surveying
- Search and clear
- Watching brief
- Support to geotechnical investigations
- Target investigation
- Site-specific training packages
- Site safety briefings

Our UXO Engineers can assess suspicious items on site when they are found. This will avoid unnecessary site evacuations. If our engineer(s) decide the item is UXO, they will coordinate with the authorities, manage

disruptions, and advise on control measures, such as evacuations and a cordon.

### 1.3.2 UK Authorities

If BSI is not on site and a suspicious item is found, the local police must be immediately called on the non-emergency number. Police will visit the site. They will then inform the Joint Services Explosive Ordnance Disposal (JSEOD) office, which will coordinate the callout of an army or navy response team.

A precautionary cordon will initially be put into effect, with possible evacuation of homes and businesses, road and rail closures. The cordon may be extended following the advice from JSEOD's response team.

To manage their resources, JSEOD triages incidents. A consideration of the type, size and location of the UXO is made. If an incident is not given a high priority rating, a team may not be available for up to two days following the initial report.

The use of JSEOD is under the Military Aid to Civil Authorities (MACA) framework, therefore the budget and personnel is limited, and there are no statutory obligations made of the MOD. Often the MOD will recommend involvement of a commercial UXO contractor to manage the ongoing risk – this is especially true of former airfields and training areas where contact with land service ammunition can be frequent.

## 1.4 UXO Risk in the UK

Fortunately, to the best of our knowledge, there has not been a single post-war incident in the UK where a construction worker has been killed or injured because of an item of UXO exploding. There have been cases in mainland Europe where UXO had been struck and then exploded, killing workers. In 2019 a WWII general purpose bomb spontaneously detonating in a field north of Frankfurt, Germany.

However, the incident in Frankfurt is not comparable to the UK, due to the way different countries manufactured ordnance. Bombs made in different countries have different associated hazards. British WWII bombs, for example, have a fuzing system which uses chemicals which makes them very unsafe. Please see **APPENDIX 1** for recent examples of UK UXO incidents.

Between 2013 and 2016 JSEOD responded to 7,500 callouts. These callouts range from falsely identified objects, inert objects, small items of UXO and large WWII German unexploded bombs (UXBs). Each year the construction industry inadvertently unearths UXO; often this goes unreported. UXO contamination comes from three main sources:

- **Enemy action:** during WWI and WWII the air forces of Germany, and to a lesser extent Italy, bombed targets throughout the UK. The German navy bombarded several coastal targets in eastern England during WWI and then in WWII German long-range artillery on the French coast bombarded parts of Kent.
- **Allied military activity:** during WWI and WWII several Allied nations used the UK as a staging area for military action in the European Theatre; predominantly the US and Canada.
- **UK military activity:** domestic British Army, Royal Air Force (RAF) and Royal Navy (RN) training activities during peacetime and conflict as well as anti-aircraft gun and rocket batteries during WWI and WWII.

## 1.5 UXO Detonations

A detonation is a violent chemical reaction which creates a huge volume of gas. This reaction appears to happen instantaneously – the velocity of the shockwave moving is up to 9000m per second. This chemical reaction is started using a small amount of very sensitive explosives called primary explosives. These types of explosives are highly sensitive to shock, friction, heat, and spark. As the explosive charge undergoes high order decomposition (detonation), the brisance, or shattering effect, causes the casing to splinter, projecting razor-sharp shrapnel across long distances.

The blast wave effect and the shrapnel effect can cause significant damage. Calculating safety distances is a complex process. As a rule of thumb, in open ground, a 250kg explosive charge (as would be found inside a typical 500kg bomb) would require an omnidirectional safety distance of at least 1.6km.

Bombs work by amplifying the explosive charge from the sensitive primary explosive through to the main charge

or fill of the item. This process is called an explosive train, if any link in that chain is broken, the item will fail to function as intended. This can be due to mechanical, electrical, or manufacturing tolerances or faults. Amongst other reasons, detonation of UXO could occur under the following circumstances:

- **UXO body impact:** A substantial impact onto the main body of a UXO; borehole rigs, piling rigs, jack hammers and mechanical excavator buckets.
- **Fuse impact:** Environmental conditions during decades of burial can result in the primary explosives located in the fuse pocket to crystallise and become shock sensitive. It would then take a relatively small impact or friction impact to cause the fuse to function and detonate the UXO.
- **Re-starting a timer:** A small proportion of German WWII bombs used clockwork fuses. In 2002 an Army EOD Engineer reported that the clockwork fuse in a UXB re-started. Decades of burial cause substantial corrosion in WWII German UXBs and therefore an incident such as this is extremely rare.

## 2 ASSESSMENT METHODOLOGY

### 2.1 Introduction

This assessment has been produced in accordance with the relevant CIRIA guidelines; *Unexploded Ordnance (UXO) - A Guide for the Construction Industry C681* (published in 2009). CIRIA C681 is a publication which originated from round table best practice discussions from industry leaders.

### 2.2 SPRC Risk Model

The Source, Pathway, Receptor, Consequence (SPRC) risk model can be applied to buried UXO as follows:

- **Sources:** UK and allied UXO sources include military firing ranges, bases, storage depots, munitions factories, anti-aircraft batteries, amongst others. There are many wartime causes of UXO contamination. The source for enemy contamination is overwhelmingly from WWII German air raids.
- **Pathways:** the pathway describes how the UXO reaches receptors. Usually UXO is buried and therefore pathways can be any activity which involve breaking ground. Examples include ground investigation works, site enabling works and excavations.
- **Receptors:** receptors are the people, assets and infrastructure that can be adversely affected by UXO exposure. This includes site personnel, plant, equipment, buildings, the general public, , and the environment.
- **Consequence:** the consequences of an inadvertent UXO detonation are catastrophic. They include injury and loss of life, as well as damage to property. Fortunately, the likelihood of UXO detonating is low, even when it is uncovered during works. Another consequence to consider however is delays to works, which itself can be a risk.

### 2.3 Assessment Structure

In accordance with CIRIA C681 this assessment addresses the following considerations in the appropriate order:

- The likelihood that the site was contaminated with UXO.
- The type of UXO that could have contaminated the site, and their associated hazards.
- The likelihood that UXO remains on the site.
- Theoretical bomb penetration depths.
- The likelihood that UXO will be uncovered during the proposed works.
- Risk rating and risk mapping (as appropriate).
- Risk mitigation recommendations.

## 2.4 Information Sources

To complete this risk assessment BSI has gathered information from a wide range of sources. BSI's research team has completed detailed historical research, including access of original archived records. The following is a general list of information sources that are consulted during the research process:

- The National Archives,
- Local archive centres,
- Ministry of Defence,
- The Council for British Archaeology,
- Groundsure mapping services,
- Historical aerial photography (Historic England, Britain From Above, Bluesky),
- Google open source mapping,
- The British Geological Society,
- Open sources; published book, articles, web resources,
- Site specific information supplied by the Client,
- BSI's library and historical database, and
- BSI's former armed forces employees.

## 2.5 ALARP Principle

The ALARP (as low as reasonably practicable) principle corresponds to the actions that should be taken to reduce risks. The term 'ALARP' is in the Health and Safety at Work Act 1974, which says that risks must be controlled in a reasonable way.

Infinite time, effort and money could be spent trying to eliminate risk entirely. HSE uses the example that spending £1m to prevent five employees bruising their knees is disproportionate, whereas spending the same amount to prevent an explosion which could kill 150 people is proportionate.

Using this principle, BSI aims to reduce client costs by recommending strategies that are proportionate to the assessed risks, if any elevated risk is found at all.

## 2.6 Risk Tolerances

The BSI risk assessment process divides UXO risk into two tolerances:

- **Tolerable:** negligible risk or low risk ratings are tolerable. Where the risk cannot be completely discounted, it may be a useful strategy to opt for a low-cost measure, such as a UXO safety briefing from a qualified UXO engineer.
- **Intolerable:** moderate risk or high-risk ratings are intolerable. Proactive risk mitigation measures should be put in place. Various strategies are at BSI's disposal to meet your project-specific needs.

## 2.7 Reliance and Limitations

This report has been prepared using published information and information provided by the Client. BSI is not liable for any information which has become available following the publication of this report. No third-party liability or duty of care is extended. Any third-party using information contained in this assessment do so at their own risk.

## 3 THE PROJECT

### 3.1 The Site

The Site (approximately centred on the National Grid Ref: SJ 83296 97434) is located in Manchester, in the north-west of England, approximately 160m south-west of Deansgate railway station.

It is occupied by an area of brownfield land, with a small area of car parking along the north-eastern boundary. The Site is bordered by the A56 to the north-west, hard standing and an accessway to the north-east and east, Deansgate Street to the south and Deansgate Street and A56 junction to the south-west.

**FIGURE 1:** Site Location Maps      **FIGURE 2:** Recent Aerial Photograph

### 3.2 The Proposed Works

The proposed ground investigation works includes 2no. boreholes to 25m bgl and 3no. shallower boreholes to 5m bgl with trial pitting along the retaining wall in the east to inspect any footings.

The proposed development comprises the construction of a 28-storey residential building.

**FIGURE 3:** Existing Site Plan

## 4 SITE HISTORY

### 4.1 Introduction

Site-specific history can be assessed by reviewing historical mapping, historical aerial photography and by carrying out additional Site-specific research where appropriate. Below are descriptions of a selection of records relevant to the Site:

### 4.2 Mapping

| Period    | Map Date  | Map Scale | Review                                                                                                                                                                                                                                                                                                                                           |
|-----------|-----------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pre-WWI   | 1894      | 1:10,560  | The Site is occupied by structures in the north-east and west of the Site with open ground occupying the remaining sections. Chester Road is located to the east, south and south-west of the Site. An unlabelled roadway is located to the north-west.                                                                                          |
|           | 1909      | 1:10,560  | No significant changes appear to have been carried out on Site.                                                                                                                                                                                                                                                                                  |
| Pre-WWII  | 1923      | 1:10,560  | No significant changes appear to have been carried out on Site.                                                                                                                                                                                                                                                                                  |
| Pre-WWII  | 1938      | 1:10,560  | <b>FIGURE 3.1:</b> Although this map is of small scale and lacks detail, it can be said that no significant changes have occurred on Site or in the surrounding area.                                                                                                                                                                            |
| Post-WWII | 1950-1951 | 1:2,500   | <b>FIGURE 3.2:</b> The structure previously located in the west of the Site has been cleared. The structure in the east of the Site is still present. The structure to the north-east is labelled as an 'Engineering Works'. Structures to the south of the Site, along Chester Road, have been cleared and another has been labelled as 'Ruin'. |

### 4.3 Aerial Photography

| Period    | Photo Date                  | Review                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Post-WWII | 16 <sup>th</sup> April 1948 | <b>FIGURE 4:</b> While the quality of the photograph limits detailed analysis, it appears that a structure is still present in the north-eastern section of the Site.<br>A structure previously located in the south-western section of the Site appears to have been cleared/destroyed and is occupied by an area of disturbed ground.<br>Several areas of clearance, which corroborate bomb damage mapping, have been highlighted to the south of the Site. |
|           | 1940's era                  | <b>FIGURE 5:</b> Similar to the above, this image is of a poor quality, but it does show that the structure previously located in the south-western section of the Site has been cleared and is occupied by open ground.<br>The structure in the north-eastern section of the Site is still present and appears to be structurally intact.                                                                                                                    |

### 4.4 Additional Site-Specific History

Some sites will have been occupied by landmarks or significant buildings historically and in such cases specific written histories including significant wartime details are occasionally available in the public domain. However, research has not located any relevant Site-specific details.

## 5 UXO RISK - GERMAN BOMBING

### 5.1 WWII Bombing History of the Site

#### 5.1.1 Greater Manchester

Greater Manchester was home to a number of vital wartime industries during WWII, many of which were located in Trafford Park. Infrastructure of strategic importance was also present in the form of Manchester Docks and the Manchester Ship Canal.

Between 29<sup>th</sup> July 1940 and 30<sup>th</sup> July 1942, Greater Manchester experienced 41 air raids, most of which were small in scale, often executed by a solitary bomber. At least nine relatively insignificant raids were carried out during the autumn of 1940, with the first medium scale raid affecting a wide area, occurring on the 28<sup>th</sup> August. Then on 1<sup>st</sup> October, a medium to heavy raid was executed.

The Luftwaffe mounted consecutive major attacks on the nights of 22<sup>nd</sup>/23<sup>rd</sup> and 23<sup>rd</sup>/24<sup>th</sup> December 1940 (the 'Christmas Blitz'). These left large areas of Manchester, Salford and Stretford devastated. NB: a major attack was a Luftwaffe designation for a raid delivering >100 tonnes of HE (in addition to incendiaries) to a target area.

In total, these two attacks involved 441 German bombers dropping 272 tonnes of HE on the first night and 195 tonnes of HE on the second night. Seven conflagrations and 600 smaller fires were reported, the result of tens of thousands of small incendiary bombs (IBs). The Christmas Blitz caused the total destruction of >4,000 houses as well as serious damage to a further 12,000. 805 HE bombs were reported across Manchester, Salford, Stretford and Manchester Docks, including 134 UXBs.

During 1941, two additional major\* raids were launched on 9<sup>th</sup> January and 1<sup>st</sup> June. Although each involved half as many aircraft as the 22<sup>nd</sup> December 1940 raid, they still delivered a further 208 tonnes of HE bombs and numerous IBs onto the city and surrounding area. Three medium scale raids were also mounted in 1941, during the spring.

\*The fourth and final major raid actually only delivered 97 tonnes of HE. However, it is close enough to 100 tonnes to be considered 'major'.

### 5.1.2 Site Specific

In addition to Salford Docks and the heavy industries of Trafford Park, Manchester city centre was part of the Luftwaffe's primary aiming point for raids on the wider conurbation. Original Luftwaffe target maps of Manchester highlight several facilities within 1km of the Site including Central Station (approximately 340m to the north-east) and a gas works (approximately 500m to the east). Consequently, the Site would have been particularly vulnerable to indiscriminate carpet-bombing as well as accurate targeted attacks.

### 5.1.3 Bombing Decoy Sites

In mid-1940 bombing decoys were introduced. The decoys used either;

- A system of lighting to simulate an urban area or a military airfield's runway
- Deliberately started fires to simulate a previously bombed target
- Dummy buildings and vehicles to simulate a military facility

792 static decoy sites were built at 593 locations in Britain. They were estimated to have drawn at least 5% of the total weight of bombs away from their intended targets. No decoys were operational within a significant radius of the Site during WWII. The closest was approximately 9km to the south-east.

## 5.2 WWII Bombing Records

### 5.2.1 Introduction

The bomb census recorded the location and type of bomb strikes to help with intelligence gathering and planning. It was compiled using information recorded by ARP wardens. These records were gathered by the Ministry of Home Security to calculate bombing density within administrative areas.

The bomb census was unreliable in the early stages of the war, though by 1941 procedures had been standardised. The quality of the census records also depended on where in the UK the records were produced. Some records are held at the National Archives and some are held at local borough archives.

Relevant records held at the National Archives and Manchester Archives were obtained for this risk assessment.

### 5.2.2 Bombing Density Statistics

The table below records the Ministry of Home Security's bombing density calculation for the County Borough of Manchester. It gives a breakdown of the types of large German bombs reported and is understood to not include UXBs.

| Area Acreage                                  | 27,255    |
|-----------------------------------------------|-----------|
| High Explosive Bombs (all types/weights)      | 712       |
| High Explosive Parachute Mines                | 18        |
| Flam (Oil) Bombs                              | 17        |
| 40kg Phosphorus Incendiary Bombs (IBs)        | 0         |
| 40kg 'Fire Pot' IBs                           | 0         |
| V1 Flying Bomb                                | 1         |
| V2 Long Range Rocket                          | 0         |
| Total (excluding V-Weapons and 1kg / 2kg IBs) | 737       |
| <b>Bombs Per 1,000 Acres</b>                  | <b>27</b> |

1kg / 2kg incendiary bombs (IBs) and 2kg anti-personnel (AP) bombs were often too numerous to record accurately and therefore are not included in the above figures. The latter were not dropped on London. Small IBs were however dropped in vast numbers (>100,000) over the capital.

### 5.2.3 Manchester Bomb Plot & Damage Map: 1940-1941

BSI has reviewed an original bomb plot and damage map for the wider study area. This map was produced by Manchester City Council's Architect's Department (Building Surveyor's Division) during the war and was updated throughout the conflict to reflect all raids on the city. No original legend / key accompanies this map, however a contemporary description does confirm some symbols. No symbol for UXBs was identified and any IB strike symbol with a number written within it represents the number of individual IBs falling at that location. Three categories of damage are illustrated on this map: solid red, hatched red and red outline. These are likely to represent 'total destruction or severe damage', 'moderate damage' and 'minor blast damage' respectively.

A small section of the map covering the study area is presented at **FIGURE 6** and described below.

- No bombing incidents or damage have been recorded on Site.
- The closest HE strike was located approximately 130m south of the Site.
- An incident was also recorded within Chester Road, approximately 30m east, however, it has not been possible to identify the nature of this incident.
- Severe bomb damage was recorded to several structures and Knott Mil, located on the southern side of Chester Road, opposite the Site.

### 5.2.4 Manchester Civilian Fatalities Map

A contemporary digital map of Greater Manchester recording the locations of every Christmas Blitz bombing incident that resulted in at least one fatality, was reviewed. This map (published by the Manchester Evening News) was compiled using data from the Commonwealth War Graves Commission; however, it only covers the two heaviest air raids on the city. Although a potentially significant source of bombing incident locations, many bombs did not cause a fatality and therefore this map should not be viewed as comprehensive.

No fatalities were recorded at or adjacent to the Site. The nearest plotted incident was plotted at '3 Trafford Street, 3 fatalities' (approximately 200m north of the Site).

### 5.2.5 Abandoned Bomb Register

Due to the overstretched bomb disposal units during WW2, many bombs were intentionally left undisturbed. UXBs were triaged based on where they were and how big they were. If they didn't pose a significant risk they were 'abandoned'. The locations of these bombs were recorded on the abandoned bomb register.

The abandoned bomb register is a public record document held at the Parliamentary Archives of the House of Commons, from which BSI has obtained a copy. The register should not be relied on for completeness or accuracy. No abandoned bombs are recorded on or near the Site.

### 5.3 Likelihood of UXB Contamination

Where detailed bombing records exist, it is possible to predict whether any UXBs could be found on a site. This likelihood is discussed in the following table:

| Density of Bombing                                                                                       |                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of Air Raids in the Vicinity:                                                                     | A comparison of the bombing incident records confirms that at least one air raid affected the area surrounding the Site. NB: this number is almost certainly higher as documented raids on the area are not comprehensive and it is not clear if the damage surrounding the Site occurred on the same date or at different periods of time. |
| Intensity of these Air Raids:                                                                            | Almost all bombs dropped locally were likely part of large-scale indiscriminate carpet-bombing raids, almost all of which were carried out at night.<br>Targeted raids on nearby Luftwaffe targets may have also affected the area.                                                                                                         |
| Bomb Strike Positions                                                                                    |                                                                                                                                                                                                                                                                                                                                             |
| Closest Bomb Strikes                                                                                     | HE bombs: 130m south.<br>1kg / 2kg IBs: None recorded within significant distance of the Site.                                                                                                                                                                                                                                              |
| Alignment of recorded Bomb Strikes:                                                                      | It has not been possible to identify alignment of bomb strikes due to the lack of a comprehensive record set.                                                                                                                                                                                                                               |
| Bomb Failure Rate                                                                                        |                                                                                                                                                                                                                                                                                                                                             |
| Evidence to suggest that the generally accepted failure rate of 10% differs in the vicinity of the site: | None.                                                                                                                                                                                                                                                                                                                                       |
| UXBs recorded in close proximity to the site:                                                            | None plotted in the wider Site area.                                                                                                                                                                                                                                                                                                        |

### 5.4 Likelihood of Subsequent UXB Detection

A range of circumstances determine whether a UXB strike location would have been identified, during and after the war. This is discussed in the following table.

| Historic Access                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A UXB falling on a site which was frequently accessed would have had a better chance of being found. ARP Wardens actively searched for UXBs in heavily bombed residential areas. The importance of a site or nearby buildings and infrastructure was also a factor. Many industrial facilities had fire watchers tasked with extinguishing incendiary bombs and reporting UXBs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>The vast majority of local air raids likely occurred at night when residents and workers would have been indoors and / or sheltering. As such there is generally a lower probability of anyone witnessing any UXB strike to the Site as it fell / occurred. NB: no evidence of fire watches active in the vicinity (providing night-time observation) was found.</p> <p>Aerial photography and historical OS mapping indicate that the Site occupied a small area of land, comprising two structures and open ground, with no obvious usage. As a result, it cannot be assumed that the Site would have been subject to a frequent degree of access.</p> <p>As the Site was insignificant, it is unlikely to have been subject to specific post-raid searches for delayed action (DA) bomb / UXB entry holes, carried out by ARP wardens.</p> <p>Following the potential destruction of the building on Site, this area would have been abandoned / cordoned off for the remainder of the war. Buildings in the wider area would likely have been evacuated for periods as a result of the substantial damage in the area. This marked decrease in access greatly reduces the likelihood that evidence of a UXB would have been observed within this area.</p> |

| Bomb Damage                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| As the bombing campaign continued, damaged areas became vulnerable to unreported UXBs. Bombsite wreckage or soil disturbance at a bomb crater could obscure evidence of a subsequent UXB strike.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>Aerial photography and post-war OS mapping highlights one area of clearance/disturbed ground in the western section of the Site, which is indicative of potential bomb damage. The surrounding area was subject to a significant amount of bomb damage with several structures being completely destroyed within the vicinity of the Site. Given the reference to bombing and damage in the area, it is conceivable that the Site sustained bomb damage.</p> <p>The eastern section of the Site does not show any obvious signs of ground disturbance/bomb damage. Detection of evidence of UXO is not considered likely within poorly maintained open ground. Any HE UXB strike to the potentially damaged or open areas of the Site could have easily gone unnoticed, its entry hole obscured by the open vegetation or debris/rubble. NB: the diameter of the smallest German HE bomb (which was also the most commonly deployed over Britain) was 200mm, creating a small easily obscured entry hole.</p> |
| Ground Cover Type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| A UXB which falls on open field could easily go unnoticed, whereas a UXB dropped on a hard-surfaced car park would have been easily observed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Any UXB strike to the undamaged structures on Site would have caused incontrovertible evidence of its incidence as it passed through the structure and into the ground beneath. However, any UXB strike occurring in areas of damage / clearance, may have gone unnoticed due to reasons previously mentioned.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 5.5 Bombing During WWI

During WWI, an estimated 9,000 German bombs were dropped on London, Eastern England and South-Eastern England during some 51 Zeppelin airship raids and 52 fixed-wing aircraft raids. London suffered the worst of the bombing with an estimated 250 tonnes of HE and incendiary bombs recorded across the Capital, over half of which fell on the City of London district.

The WWI bombing campaign waged by Germany was on a far smaller scale than the WWII campaign, in terms of the number of raids, the weight of ordnance dropped during each attack and the size of the bombs used. When coupled with the fact that most WWI bombed locations have since been redeveloped, German WWI UXB finds are extremely rare. Furthermore, most air raids took place during daylight hours and as it was the first time Britain had experienced strategic aerial bombardment, the raids often attracted public interest and even spectators, increasing the chances of any UXBs being reported.

A complete collection of written air raid reports for the region was reviewed. These confirm that Manchester did not experience any bombing raids during WWI. Consequently, there is no risk associated with WWI German UXO.

## 6 WWII GERMAN BOMBS

### 6.1 Bombs Dropped on the UK

Nazi Germany used different types of ordnance against the UK for different effects. Some types were designed to cause fires, others for their destructive blast effect and other for their penetration capability. Each type of ordnance was fitted with at least one fuze. For some bombs multiple fuzes were used. Many different types of fuzes were available for use – each with its own set of associated hazards.

Data sheets on those bombs most likely to be encountered today are included at **APPENDIX 2**.

- **HE bombs – moderate NEQ (net explosive quantity):** the most common types of HE bombs dropped were the SC (general purpose - GP) and SD (semi-armour piercing - SAP) series of bombs. The NEQ is between 30-50%. SAP bombs are engineered to attack light fortifications, whereas GP bombs are used in a mixed destructive blast and anti-personnel fragmentation role. 70% of bombs dropped on the UK were the 50kg type.
- **HE bombs – high NEQ:** blast bombs and parachute mines have bodies made of thin steel, allowing for larger HE charges. These were designed to detonate above ground, maximising the blast effect. Parachute mines were weapons slowed by parachutes and designed to detonate without penetrating the ground. Although, in some marshland areas, partially buried parachute mines have been observed. Consequently, it is highly unlikely that any unexploded blast bombs remain buried in the UK today.
- **HE bombs – low NEQ:** The PC series were armour piercing bombs used against heavy fortifications and reinforced bunkers. They were not commonly used over the UK.
- **Small incendiary bombs:** The 1kg and 2kg incendiaries were the most dropped bomb. Up to 620 x 1kg incendiaries could be packed into the largest container unit, which opened at a pre-determined height scattering its payload over a wide area. These small bombs could fully penetrate soft ground due to their small diameter. Variants of the 1kg and 2kg incendiary bombs contained a small HE charge designed for an anti-personnel role, and to increase its incendiary effect.
- **Large incendiary bombs - Thick skinned:** The C50 has a thick body and contained a mixture of incendiary liquids and white phosphorus. Another version of the C50 had a white phosphorus fill. The C50 'firepot' contained thermite incendiary containers (aka firepots) and a small HE charge.
- **Large incendiary bombs - Thin skinned:** The Flam 250 and Flam 500 models had thin steel bodies designed to break up on impact, spreading their oil-incendiary mixture, which was ignited by a small HE charge. Consequently, it is highly unlikely that any unexploded Flam bombs remain buried in the UK today. Their unreliability meant withdrawal from frontline use by January 1941.
- **Submunitions:** The SD2 'butterfly' bomb was a 2kg submunition dropped on several British cities and towns. It contained a 225gram HE charge. SD2s had no ground penetration ability so the vast majority were recovered at the time. However, SD2s are still found across Britain today.
- **V1 flying bombs and V2 rockets:** In the final year of WWII Germany began using pilotless weapons against England. Both V Weapons had 1,000kg HE warheads. Due to their light-body construction, they had no penetration ability and any impact left a noticeable debris field. As such, there is negligible risk from unexploded V weapons today.

### 6.2 Bomb Failures

Records from September 1940 to July 1941 show that an average of 84 UXBs were dropped on civilian targets each day. Around 8% of these were time delay bombs – designed to strike the ground and start a predetermined countdown which could last days.

There is a generally accepted 10% failure rate for WWII German HE bombs. This is estimated from records gathered by bomb disposal units. These statistics do not account for UXBs that went by unnoticed.

Failures can happen for different reasons, including:

- Equipment or human error in arming the bombs before release,
- Failure of a mechanism within the fuze (out of tolerance),
- Jettisoning payloads if the bomber was under attack or crashing, or
- Partially functioned bombs (e.g. cracks in the cast TNT)

## 6.3 Bomb Ground Penetration

### 6.3.1 Introduction

Using data gathered during WWII by the Ministry of Home Security, estimations can be made about how deep a bomb is likely to penetrate the ground. Over one thousand incidents were reported by the bomb disposal units to support this research. Further tests were carried out, dropping bombs of different sizes into chalk and measuring the depths they reached. This research is held at the National Archives. The estimates are:

| Bomb weight (kg) | Ground Type (m) |      |         |      |         |      |         |      |
|------------------|-----------------|------|---------|------|---------|------|---------|------|
|                  | Sand            |      | Gravel  |      | Chalk   |      | Clay    |      |
|                  | Average         | Max. | Average | Max. | Average | Max. | Average | Max. |
| 50               | 2.8             | 7.8  | 2.8     | 7.8  | 3.5     | 7.7  | 4.0     | 9.1  |
| 250              | 4.8             | 13.7 | 4.8     | 13.7 | 6.0     | 13.1 | 6.8     | 15.8 |
| 500              | 6.0             | 17.3 | 6.0     | 17.3 | 7.6     | 16.4 | 8.7     | 19.8 |
| 1,000            | 7.6             | 21.9 | 7.6     | 21.9 | 9.6     | 20.7 | 10.9    | 24.9 |

Different layers of geology affect penetration depths. For example, 1m of made ground, then 1m of gravel before reaching clay – as is many areas of London – is not easily calculated from the data above.

When calculating how deep a bomb could have reached, we must make three assumptions:

- **Impact velocity:** German bombing raids were carried out at altitudes in excess of 5,000m. The velocity of impact is roughly  $313\text{ms}^{-1}$  (not accounting for resistance). It is the same velocity regardless of mass.
- **Impact angle:** strike angles of 10 to 15 degrees to the vertical. It must be assumed that the bomb was stable at the moment of ground penetration.
- **Bomb design:** Some larger German bombs were occasionally fitted with 'kopfrings' - a metal ring, triangular in cross section, fitted around the nose of the bomb to help prevent penetration. It must be assumed that no 'kopfrings' were fitted.

### 6.3.2 The J-Curve Effect

During WWII BDUs reported that most buried UXBs were found horizontal or upturned. This observation confirmed the 'J-curve effect'. As an HE bomb penetrates the ground, slightly offset from the vertical, its passage underground creates a 'J' shape.

This is relevant because the J-curve effect results in a horizontal offset between the buried UXB and its point of entry. This distance is estimated to be one third of the theoretical penetration depth. A low altitude attack, meaning a low impact angle, could produce an even greater offset, of up to 15m.

### 6.3.3 Site Specific Geology

| BGS Mapping | Superficial Deposits:<br>None recorded                                                                                                                                                                                                                                                                                                                                                                     | Bedrock Deposits:<br>Chester Formation – Sandstone |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| SI Data     | No recent SI data was provided by the Client. However, local BGS borehole logs were available. The closest BGS SI through the same mapped geology as the Site is located approximately 450m west of the Site (BGS ID:1043492). This SI (November 1991) encountered the following ground conditions:<br>-0.2m of topsoil.<br>-4m of made ground, sand soil and brick.<br>-4.5m of clay.<br>-1.5m sandstone. |                                                    |

### 6.3.4 Site Specific Maximum Bomb Penetration Depth

During WWII the Luftwaffe dropped many different types of HE bomb. The SC (general purpose) series was by far the most numerous and of this series, the SC 500 model (weighing 500kg) was the largest of the most commonly deployed and therefore this will be used as the benchmark weapon for the Site-specific bomb penetration depth calculations.

To calculate an approximate maximum bomb penetration depth, BSI would usually take the average of the averages of the figure for the predominant Site-specific geologies in the table above. However, due to the presence of sandstone this has not proved possible on this occasion.

NB: theoretically penetration depths could be greater if the UXB was larger, however, War Office statistics confirm that between October 1940 and May 1941 the majority of HE UXBs (>90%) were either 50kg or 250kg, with the 500kg bombs making up most of the remaining 10%.

## 7 UXO RISK - BRITISH/ALLIED ACTIVITY

### 7.1 Introduction

The table below lists potential sources of UXO (excluding enemy action). Those which are potentially relevant to the Site are discussed in the subsequent section(s).

| Potential UXO Source                   | Potentially Significant |
|----------------------------------------|-------------------------|
| Army or RAF training areas / ranges    | ✗                       |
| Military bases and other installations | ✗                       |
| Munitions and explosives factories     | ✗                       |
| Military storage depots                | ✗                       |
| Defensive fortifications               | ✗                       |
| Wartime site requisitions              | ✗                       |
| WWII defensive mining (landmines)      | ✗                       |
| WWII Home Guard activity               | ✗                       |
| Wartime anti-aircraft fire             | ✓                       |

### 7.2 Potential Sources of UXO

#### 7.2.1 Introduction

Research has not located any evidence of significant British or Allied army, RAF or Royal Navy activity specifically on Site and none is likely to have occurred historically. The only likely potential source of British UXO contamination is therefore WWII AA artillery fire.

#### 7.2.2 WWII Anti-Aircraft Fire

Anti-Aircraft (AA) Command was a British Army command established in 1939 to defend the UK during the anticipated German bombing campaign. It controlled the Territorial Army AA artillery and searchlight units. From 1940 to 1945 BDUs dealt with 7,000 unexploded AA shells in Britain. There were three main types of AA battery used for home defence (see below). Data sheets on these AA defences are included at **APPENDIX 3**.

- **Heavy Anti-Aircraft (HAA):** large calibre guns (3.7" and 4.5") for engaging high altitude bomber formations. Hundreds of permanent batteries were constructed in and around major cities and military bases during the 1930s. Some 2,000 of these guns were available during the Blitz. Each gun could fire between 10 and 20 rounds per minute and consequently HAA batteries could expend large quantities of shells during each engagement.

British time fuses were poorly manufactured during WWII and this led to high failure rate for HAA shells, up to 30%. Unexploded HAA shells had the potential to land up to 27km from their battery, although more typically landed within a 15km radius.

- **Light Anti-Aircraft (LAA):** smaller calibre guns for engaging dive bombers and low altitude intruders. As such they were mostly used to defend specific industrial and military targets which were subject to precision bomber attack. LAA guns were either .303" calibre machine guns or 20mm and 40mm calibre cannon. The latter were fitted with simply impact fuses and small incendiary or HE bursting charges.

The 40mm Bofors gun could fire 120 x HE shells / minute to a ceiling of 1,800m. Each shell was designed to self-destruct if it didn't strike an aircraft, however, inevitably some failed and fell back to earth.

- **Z (Rocket) Batteries:** a Z-Battery comprised a grid formation of 64 rocket projectors which fired 2" and later 3" Unrotated Projectile (UP) rockets to a maximum altitude of 5,800m; a ground range of some 9,000m. They were deployed in cities all around the UK from 1941 and proved to be an effective addition to the existing AA guns.

The rockets measured 0.9m (2") and 1.8m (3") in length with four stabilising fins at the base and were fitted with 3.5kg or 8.2kg HE warheads. The larger warhead had an effective airborne blast radius of up to 20m. Some variants deployed a form of aerial mine described as a "small yellow bomb" which was designed to detach from the rocket at height and descend on a parachute with the objective of becoming snagged on target aircraft and then detonating.

Unlike bombs which were designed to strike the ground, AA projectiles and rockets were designed to function in the air. Due to their shape, and centre of gravity they would often not strike the ground nose first. This coupled with the lower mass of AA UXO resulted in shallower ground penetration depths, compared to UXBs. Although, in very soft conditions, unexploded AA projectiles have been found deeper than 1.5m bgl.

Numerous (>30) permanent HAA batteries were active within range of the Site during WWII. No evidence of permanent LAA gun batteries defending Vulnerable Points within range of the Site was found, although they were likely present at some point during WWII. Luftwaffe activity was relatively frequent and intense over the wider area and therefore these guns would have expended a significant quantity of ammunition.

## 8 UXO RISK MITIGATING CIRCUMSTANCES

### 8.1 Introduction

Works on a UXO contaminated site could result in the partial or complete removal of UXO risk. Construction or earthworks may have uncovered any UXO contamination, which would then have been reported and removed by the authorities. A site may have been subject to an explosive ordnance clearance (EOC) task conducted by the armed forces. EOC tasks involve surveying, subsequent target investigation and removal of UXO. Although the effectiveness of historic EOC tasks will have often been unsatisfactory.

### 8.2 Explosive Ordnance Clearance Tasks

The division of EOD tasks has been complex throughout British military history. It used to be the case that anything under the water level would be dealt with by navy units, and anything on land would be dealt with by army units. In recent years RAF EOD capability has been discontinued, and now only the Royal Navy and the British Army have EOD units. In the army, the Royal Logistics Corps and Royal Engineer EOD units have been amalgamated to form 29 EOD & Search Group. Often taskings are assigned to either the naval or army elements based on where in the country the threat is and the nature of the threat.

BSI has access to a database of historic EOC tasks. This database is only complete up until the early 2000s and therefore does not include recent EOC tasks. No such database for the RAF and Royal Navy EOD units is easily accessible. A search of this database has not resulted in any Army EOC tasks in the vicinity of the Site.

UXO encounters on civilian land are often reported in the media and therefore a web search of local media outlets was also carried out. No recent incidents within close proximity to the Site were identified.

### 8.3 Ground Works

The Site has undergone development since the WWII-era with the development of structures across the Site, which have since been cleared. It has not been possible to confirm the nature of these structures but foundations for these buildings are considered most likely to have disturbed ground to shallow (1-2m) depths, although this has not been possible to confirm. It is not thought likely that any structures on Site will have required deep (>2m) foundations.

### 8.4 Deductions

The risk associated with any shallow or deep buried German UXBs will only have been mitigated at the locations and down to the maximum depths of any post-war redevelopment works. It has not been possible to confirm the depths of post-war development works and it cannot be assumed that the risk from any deep buried UXBs down to the maximum bomb penetration depth has been mitigated. Even if deep intrusions have been carried out post-WWII, it is considered that the proposed works will disturb a significant amount of virgin soil at deep depths.

A deep buried UXB could conceivably remain under all sections of vegetated ground on Site, as well as underneath the structures present during WWII or developed post-war after accounting for the possibility of the 'J-Curve Effect'. Post-conflict ground works will have mitigated the risk at very shallow (<1m) depths across the Site.

## 9 CONCLUSION

### 9.1 Accuracy of Historical Records

Occasionally, the accuracy of some historical records can prove to be poor when compared with other sources of information. One significant consequence of this can be the possibility of unrecorded German bomb strikes in the study area.

- The bomb plot / damage map shows several areas of damage with no corresponding bomb strike. It is likely therefore that further bomb strikes or damage (unrecorded) occurred in the surrounding area.
- There is a nine-strike discrepancy in the number of parachute mines recorded in Manchester Borough between the Ministry of Home Security records and those included within a local history publication (Smith. P, J, C, 2003). This further highlights the difficulties in wartime ARP record keeping.

### 9.2 The Risk of UXO Contamination on Site

#### 9.2.1 Key Findings - German UXO Risk

- Greater Manchester was the 11<sup>th</sup> most heavily bombed British conurbation during WWII. Like today, the Site occupied a relatively central location during the Blitz with confirmed Luftwaffe bombing targets in the area. Consequently, it experienced a high bombing density, the result of four major raids (defined as >100 tonnes of HE bombs dropped) and some medium scale attacks.
- A bomb plot and damage map covering all air raids on the city was analysed, as was a bomb map displaying all bomb strikes resulting in at least one fatality. These do not record any bombing incidents within the study area or vicinity. The nearest bomb strike was located approximately 130m to the south.

- The high density of bombing makes it impossible to identify individual bombload alignments in relation to the Site. The records of exploded and unexploded HE bombs dropped during the Manchester Blitz give a failure rate of 16.6%; a significantly higher figure than the widely accepted 10% average for Britain as a whole.
- At the commencement of the Blitz, the Site was occupied by open ground with a structure in the north-east and west, potentially linked with the nearby engineering works. A comparison of OS mapping and aerial photography confirms that the structure in the west of the Site was cleared, which is indicative of bomb damage. Several structures in vicinity of the Site were labelled as completely destroyed and were visibly cleared in aerial imagery. Whilst the Site was not labelled as damaged, given the previously mentioned inconsistencies within the record set (**Section 9.1**), combined with the known substantial bomb damage in the area, it is considered likely that the structure on Site was cleared due to bomb damage.
- Following the potential destruction of the building on Site, this area would have been abandoned / cordoned off for the remainder of the war. Buildings in the wider area would likely have been evacuated for periods as a result of the substantial damage in the area. This marked decrease in access greatly reduces the likelihood that evidence of a UXB would have been observed within this area.
- Within potential areas of damaged structures, the ground cover is not considered to have been conducive to the observation of a UXB. Consequently, it is conceivable that a UXB entry hole could have gone unnoticed and unreported. Even if the site had been accessed, the diameter of the smallest German HE bomb (which was also the most commonly deployed over Britain) was just 200mm; creating a small entry hole, easily obscured in vegetated or bomb damaged areas.
- It is also possible that a UXB, falling within a certain impact angle window could have penetrated to several meters depth and come to rest under undamaged wartime structures nearby, due to the J-Curve (lateral offset) Effect. Therefore, due to the relatively small size of the Site boundary, it has not been possible to discount the potential for a UXB across the entire Site and it has been assessed to be at a **Moderate** Risk of contamination from German UXO. The risk from UXO on Site is considered to be mitigated down to the depth of any post-war redevelopment works.

#### 9.2.2 Key Findings - British UXO Risk

- Numerous (>30) permanent HAA batteries were active within range of the Site during WWII. Luftwaffe activity was relatively frequent and intense over the wider area and therefore these guns would have expended a significant quantity of ammunition. Consequently, it is possible that an unexploded AA shell struck the Site.
- No evidence of historic military activity within the Site boundary has been found and it is highly unlikely that any has occurred historically. Consequently, the risk from associated UXO is low.

### 9.3 Site-Specific UXO Hazards

Different types of UXO pose differing types of hazard, depending on their structural design, Net Explosive Quantity (NEQ), fill type and likely contamination depth. The table below lists the main types of UXO most often encountered on urban UK sites and their relative hazard levels.

| UXO Type                                | NEQ (NEQ Range)                                    | Likely Burial Depth       | Hazard Posed       |
|-----------------------------------------|----------------------------------------------------|---------------------------|--------------------|
| WWII German General Purpose HE Bombs    | 25kg - 220kg (most commonly deployed bomb weights) | Likely deep burial (>2m)  | HIGH RISK          |
| WWII British Heavy Anti-Aircraft Shells | 1.1kg - 1.7kg                                      | Shallow burial (1-2m)     | MODERATE-HIGH RISK |
| WWII British Land Service Ammunition    | <2kg                                               | Shallow burial (1-2m)     |                    |
| WWII German 2kg Incendiary / HE Bombs   | 680g incendiary hazard + ~500g explosive hazard    | Shallow burial (1-2m)     |                    |
| WWII German 1kg IBs                     | 680g (incendiary, not explosive hazard)            | Shallow burial (1-2m)     | MODERATE RISK      |
| WWII British Light Anti-Aircraft Shells | 4g - 70g                                           | Very shallow burial (<1m) | LOW-MODERATE RISK  |

### 9.4 The Likelihood of UXO Encounter

#### 9.4.1 Introduction

This report assesses the risk of UXO in relation to the proposed works, not simply the risk that UXO remains buried on site. The likelihood of UXO encounter during intrusive ground works will vary depending on the type of UXO and the type of construction methods employed during the project. With increased soil disturbance i.e. more excavations, the likelihood of encountering UXO increases.

Within an area of elevated UXO contamination likelihood, the sub-surface volume of potential UXO contamination will comprise the natural soil / geology in between WWII ground level and the maximum bomb penetration depth. Therefore, any intrusions into this layer will be at risk of UXO encounter.

Any post-WWII fill material deposited on a site is unlikely to be contaminated with UXO and therefore the risk of encountering UXO on such a site could vary with depth.

In the wake of the initial nine-month Blitz, many cities and towns were left with vast quantities of bomb site rubble that required removal and relocation. This material was put to use for in a variety of ways, for example >750,000 tons of London's rubble was used to build runways for new RAF and USAAF airfields and much of Liverpool's rubble was used to create and maintain sea / flood defences throughout Merseyside.

It is quite possible that unexploded British AA projectiles and German 1kg incendiaries were overlooked during removal, resulting in UXO contaminated fill material ending up on otherwise low UXO risk sites, possibly many miles from any high bombing density areas.

#### 9.4.2 German UXBs

Although most German UXBs came to rest several metres below WWII ground level, these weapons can be found at any level between just below WWII ground level and the maximum bomb penetration depth. There are a number of reasons why these heavy bombs might be found at surprisingly shallow depths.

- **Tip and run:** When enemy aircraft had to take evasive action to escape RAF fighter intercepts or AA defences, they often dropped their bomb loads from a reduced height, potentially resulting in extreme J-curve effect.

- **Deflection:** the shape of German bomb nose sections meant they were susceptible to deflection when striking surface or shallow sub-surface obstacles, occasionally resulting in shallow burial or even UXBs skidding across hardstanding.
- **Aircraft Crash Site:** if an aircraft was unable to dump its bomb load before impacting the ground, due to mechanical fault, any externally fitted bombs could have become buried on impact.

German 1kg / 2kg incendiaries were cylindrical and approximately 50mm in diameter. They had tail sections, and so landed nose first. Within soft ground this could result in full penetration of the bomb below the surface. Such UXBs are usually found close to the surface.

#### 9.4.3 British / Allied UXO

The nature of British/Allied military activity involving LSA and SAA and the smaller size of these munitions (in relation to German HE bombs) indicates that any resulting UXO contamination on a site will be limited to shallow depths, usually within 1.5m of the surface, notwithstanding added material to raise the ground level.

Domestic military LSA and SAA contamination will either be the result of expending blinds (dud ammunition) which bury into the ground on impact or munitions purposefully buried, for a number of reasons. Either way, these types of UXO are all found at shallow depth.

#### 9.4.4 Deductions

As deep intrusions (piling) are required within the area of elevated UXB contamination risk, a risk pathway exists between these works and deep buried (large) German UXBs. NB: piling is the engineering activity most at risk of initiating a large German UXB, due to the forces involved and the 'blind' nature of the intrusion.

It is also conceivable that a UXB could be encountered during any shallow mechanical excavations beneath the existing ground level in this location.

## 10 OVERALL RISK RATING

Ratings for the likelihood of UXO contaminating the Site, remaining within the Site up to the present day and being encountered during the proposed works, inform the overall risk rating. The UXO risk to the proposed works has been assessed as **Moderate**.

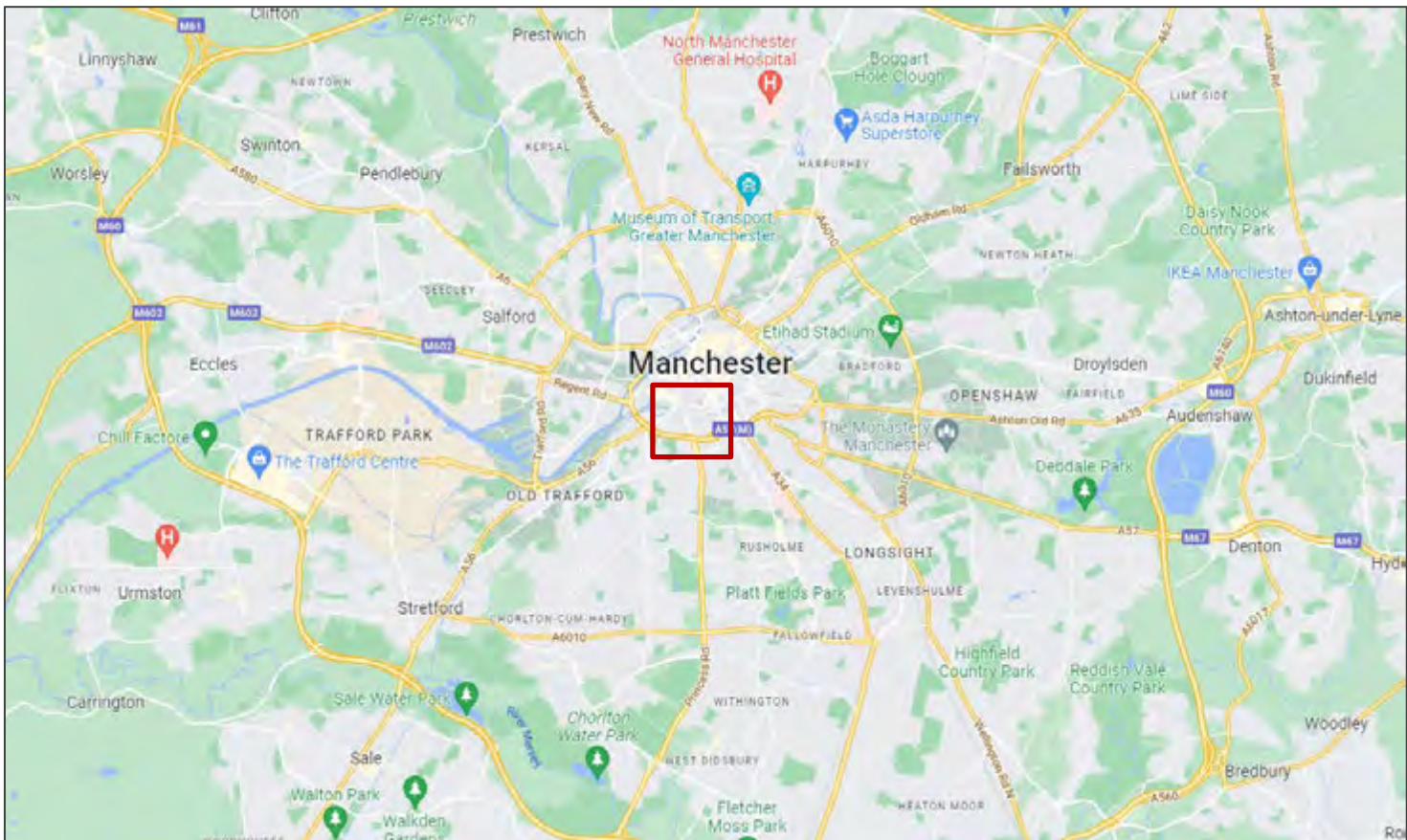
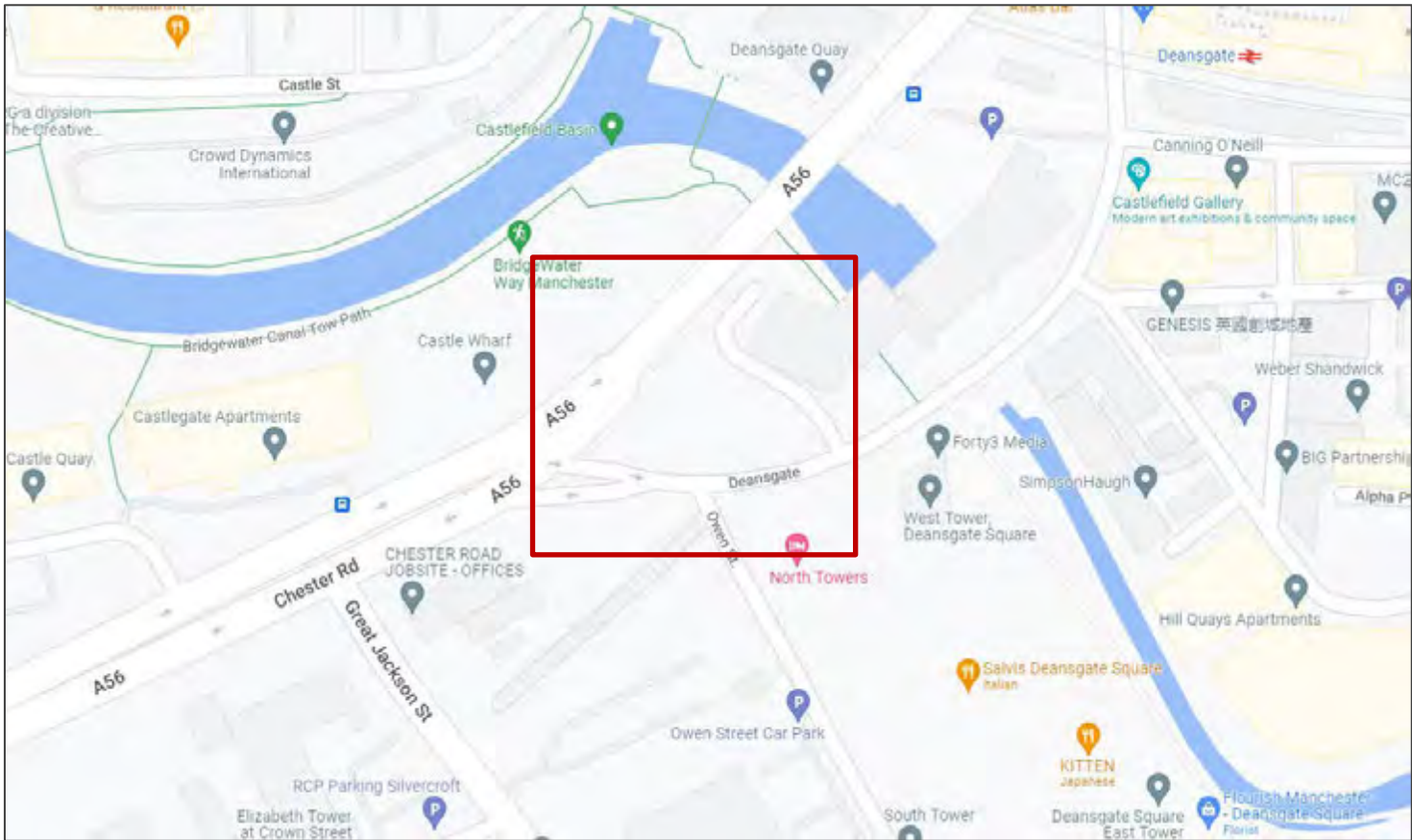
| Risk Table: Moderate Risk               |                                    |                                |                            |                        |
|-----------------------------------------|------------------------------------|--------------------------------|----------------------------|------------------------|
| UXO TYPE<br>(ASSOCIATED HAZARD)         | LIKELIHOOD OF UXO<br>CONTAMINATION | LIKELIHOOD OF UXO<br>REMAINING | LIKELIHOOD OF<br>ENCOUNTER | OVERALL RISK<br>RATING |
| WWII German 'Iron' Bombs                | Moderate                           | Moderate-High                  | Moderate-High              | Moderate               |
| WWII British Heavy Anti-Aircraft Shells | Moderate                           | Low-Moderate                   | High                       | Low-Moderate           |
| WWII British Land Service Ammunition    | Low                                | n/a                            |                            | Low                    |
| WWII German 2kg Incendiary / HE Bombs   | Low                                | n/a                            |                            |                        |
| WWII German 1kg Incendiary Bombs        | Low                                | n/a                            |                            |                        |
| WWII British Light Anti-Aircraft Shells | Low                                | n/a                            |                            |                        |

## 11 RISK MITIGATION RECOMMENDATIONS

BSI has identified an elevated UXO risk to the proposed works. The measures detailed below are recommended to mitigate the risk to ALARP level.

| Risk Mitigation Measure                                                                                                                                                                                                                                                                                                                                                         | Recommendation                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>UXO Safety Awareness Briefings:</b> To all personnel conducting intrusive works on Site. An essential part of the Health & Safety Plan for a site. Conforms to the requirements of CDM2015.                                                                                                                                                                                  | Prior to all intrusive works commencing.                                              |
| <b>EOD Engineer - On Site Supervision:</b> Watching brief for open excavations below WWII ground level. Portable magnetometer instruments for clearing ground ahead of shallow excavations (where / when appropriate). Positive identification of suspicious (non UXO) objects. Liaison during confirmed UXO incidents. Provision of additional UXO Safety Awareness Briefings. | Watching brief of all open excavations and magnetometer survey of borehole locations. |
| <b>Intrusive Magnetometer Probe Survey:</b> A range of intrusive magnetometer methodologies can be deployed to survey the ground (down to the maximum bomb penetration depth) prior to deep intrusive works; pile foundations. The appropriate technique is governed by a number of factors, the most important being the site-specific ground conditions.                      | Of all pile positions                                                                 |

# Figures: 1 - 6



|                                                                                    |                                                                                                           |              |                             |  |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------|-----------------------------|--|
|  | Project                                                                                                   |              | Deansgate, Manchester       |  |
|                                                                                    | Client:                                                                                                   |              | Fusion Devco Manchester Ltd |  |
|                                                                                    | Report Ref:                                                                                               |              | DRA-22-1433                 |  |
|                                                                                    |  General Site Location | Info Source: | Google (open-source)        |  |



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|                                                                                    |                                                                                                           |              |                             |  |                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------|-----------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Project                                                                                                   |              | Deansgate, Manchester       |  | <br>Suite 6, Delta House<br>Laser Quay, Culpeper Close<br>Rochester, Kent<br>ME2 4HU<br><br>+44 (0) 207 117 2492<br><a href="http://www.brimstoneuxo.com">www.brimstoneuxo.com</a><br><a href="mailto:enquire@brimstoneuxo.com">enquire@brimstoneuxo.com</a> |
|                                                                                    | Client:                                                                                                   |              | Fusion Devco Manchester Ltd |  |                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                    | Report Ref:                                                                                               |              | DRA-22-1433                 |  |                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                    |  Approx. Site Boundary | Info Source: | Google (open-source)        |  |                                                                                                                                                                                                                                                                                                                                                   |

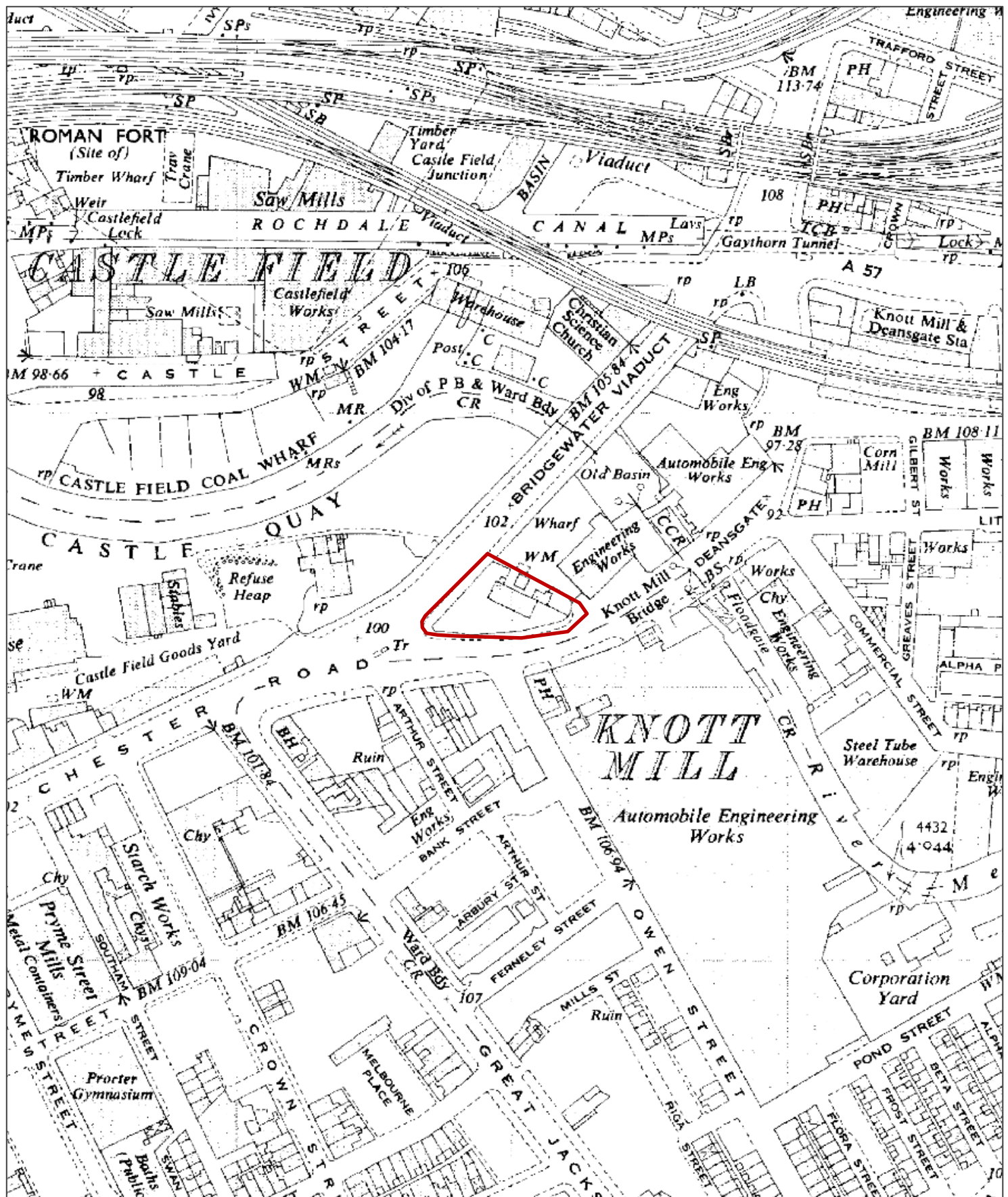


|                                                                                                           |                             |               |
|-----------------------------------------------------------------------------------------------------------|-----------------------------|---------------|
| Project                                                                                                   | Deansgate, Manchester       |               |
| Client:                                                                                                   | Fusion Devco Manchester Ltd |               |
| Report Ref:                                                                                               | DRA-22-1433                 |               |
|  Approx. Site Boundary | Info Source:                | Landmark Maps |

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Project

Deansgate, Manchester

Client:

Fusion Devco Manchester Ltd

Report Ref:

DRA-22-1433

 Approx. Site Boundary

Info Source:

Landmark Maps

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|                                                                                                           |                             |                  |
|-----------------------------------------------------------------------------------------------------------|-----------------------------|------------------|
| Project                                                                                                   | Deansgate, Manchester       |                  |
| Client:                                                                                                   | Fusion Devco Manchester Ltd |                  |
| Report Ref:                                                                                               | DRA-22-1433                 |                  |
|  Approx. Site Boundary | Info Source:                | Historic England |



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|             |                             |
|-------------|-----------------------------|
| Project     | Deansgate, Manchester       |
| Client:     | Fusion Devco Manchester Ltd |
| Report Ref: | DRA-22-1433                 |

 Approx. Site Boundary      Info Source: <https://manchesterhistory.net/manchester/gallery.html>

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# Appendices: 1 - 5



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### Recent German UXB Finds in the UK + Historical Analysis

- **23<sup>rd</sup> May 2019** - An SC250 (standard 250kg HE bomb) was found during shallow excavations at a building site in Kingston upon Thames, London. *Historical Analysis: The UXB landed in a small residential back garden belonging to an undamaged terraced house. It came to rest approximately 3 to 4m bgl.*
- **15<sup>th</sup> May 2017** - An SC250 (standard 250kg HE bomb) was found during shallow excavations at a building site in Aston, Birmingham. *Historical Analysis: The UXB landed in a small back garden belonging to a terraced house, part of a row. It J-Curved under a neighbouring garden and came to rest at just 1.4m bgl. NB: These houses had not sustained bomb damage.*
- **2<sup>nd</sup> March 2017** - A 250kg HE bomb was found during deep excavations at a building site in Brondesbury Park, London. *Historical Analysis: UXB landed in a large residential back garden. A single storey building was built on top of the UXB post-WWII.*
- **19<sup>th</sup> January 2017** - An SD50 (semi-armour piercing 50kg HE bomb) was dredged from the Thames during barge dredging works near Westminster Bridge, London.
- **12<sup>th</sup> May 2016** - A 500kg HE bomb was found buried just 1m below the playground of the former Royal High Junior School in Bath. *Historical Analysis: The UXB landed in a plot of neglected, unmaintained vegetation in between the school gym and main school building.*
- **23<sup>rd</sup> September 2015** - A 1,000kg HE bomb was encountered by a mechanical excavator on a building site in Paradise Street, Coventry. *Historical Analysis: the UXB landed in a large residential back garden occupied by dense vegetation. A two storey building was built on top of the UXB post-WWII.*
- **10<sup>th</sup> August 2015** - A 250kg HE bomb was found immediately beneath a basement floor during refurbishment works in Temple Street, Bethnal Green (London). *Historical Analysis: The UXB struck a house that had been damaged beyond repair during a previous air raid. The existing house was then built on top of UXB post-WWII.*
- **21<sup>st</sup> May 2015** - An SC50 (general purpose 50kg HE bomb) was found during deep excavations at a construction site in Wembley, London. *Historical Analysis: UXB landed in a large residential back garden.*
- **23<sup>rd</sup> March 2015** - A 250kg HE bomb was found during deep excavations at a building site in Grange Walk, Bermondsey (London). *Historical Analysis: inconclusive - reported UXB position is likely inaccurate.*

**NB:** Domestic UXO finds in the UK are too numerous to list. Between 2006 and 2009, over 15,000 items of British / Allied UXO (excluding small arms ammunition) were found on UK construction sites (CIRIA).

### Initiation of WWII Allied Bombs

- **6<sup>th</sup> January 2014** - Mechanical excavator stuck a WWII bomb in Euskirchen (Germany) causing it to explode, killing the operator and injuring 13 more, two critically. The explosion was so large it damaged buildings 400m away.
- **1<sup>st</sup> March 2013** - During piling at a construction site in Ludwigshafen (Germany) a small buried WWII bomb exploded, injuring one worker.
- **2<sup>nd</sup> June 2010** - A British 500kg bomb detonated whilst being defused, killing three EOD engineers in Goettingen, Germany. The bomb was found as builders dug the foundations for a new sports hall. Several houses had their fronts blown off by the blast.
- **19<sup>th</sup> September 2008** - Seventeen people were injured and buildings were damaged when an excavator apparently drove over and set off a 250kg American bomb at a construction site in Hattingen, Germany.
- **23<sup>rd</sup> October 2006** - A construction worker breaking up tarmac at the side of a highway near the south-western German town of Aschaffenburg was killed when his machine struck and detonated a WWII bomb. In addition, the blast injured several motorists who were driving past.
- **2006** - A piling rig and dump truck were destroyed when a piling rig struck an Allied bomb on a construction site in Austria.
- **2003** - In the Austrian city of Salzburg, two people were killed while attempting to defuse a 250kg Allied bomb.
- **1994** - At a central Berlin construction site a piling rig struck a large WWII Allied bomb. 3 were killed and 14 more were injured. Dozens of cars in a 250m radius were wrecked, the top 10 floors of neighbouring office building collapsed and human remains were found 100m away.
- **1990** - In Wetzlar (Germany) two EOD engineers were blown up as they removed the detonator of an allied WWII UXB.

Project

Deansgate, Manchester

Client:

Fusion Devco Manchester Ltd

Report Ref:

DRA-22-1433

Info Source:

Various

**BRIMSTONE**  
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SC 50

**Bomb Weight:** 40-54kg (110-119lb)

**Explosive Weight:** 25kg (55lb)

**Filling:** TNT, Amatol or Trialen

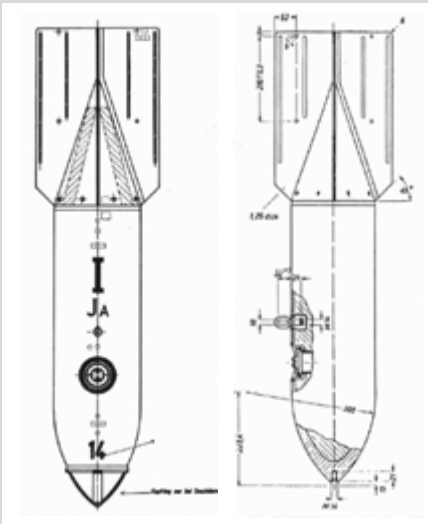
**Charge/Weight Ratio:** 46%

**Fuse Type:** Electrical impact fuse or mechanical delayed action fuse

**Body Dimensions:** 1,100mm length x 200mm diameter

**Appearance:** Bomb body and tail painted grey/green with a yellow stripe on the tail unit. Steel construction.

**Variants:** 8 x variants. Additional fittings: Kopfring nose for limited penetration and Stabbo nose for dive-bombing.



SC 250

**Bomb Weight:** 245-256kg (540-564lb)

**Explosive Weight:** 125-130kg (276-287lb)

**Filling:** TNT, Amatol and Trialen mix

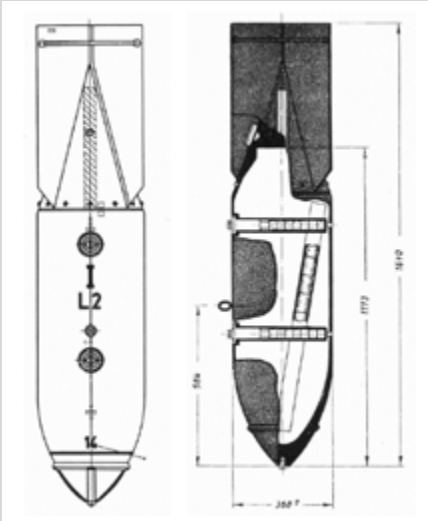
**Charge/Weight Ratio:** 44%

**Fuse Type:** 1 or 2 electrical impact fuse(s) or mechanical delayed action fuse(s)

**Body Dimensions:** 1,173mm length x 368mm diameter

**Appearance:** Bomb body and tail painted grey/green with a yellow stripe on the tail unit. Steel construction.

**Variants:** 8 x variants. Kopfring nose for limited penetration. Stabbo nose for dive-bombing.



SC 500

**Bomb Weight:** 480-520kg (1,058-1,146lb)

**Explosive Weight:** 220kg (485lb)

**Filling:** TNT, Amatol and Trialen mix

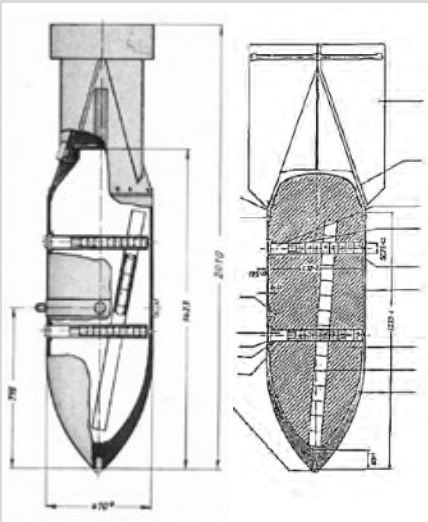
**Charge/Weight Ratio:** 44%

**Fuse Type:** 2 electrical impact fuses or mechanical delayed action fuses

**Body Dimensions:** 1,423mm length x 470mm diameter

**Appearance:** Bomb body and tail painted grey/green or buff with a yellow stripe on the tail unit. Steel construction.

**Variants:** 3 x variants. Kopfring nose for limited penetration.



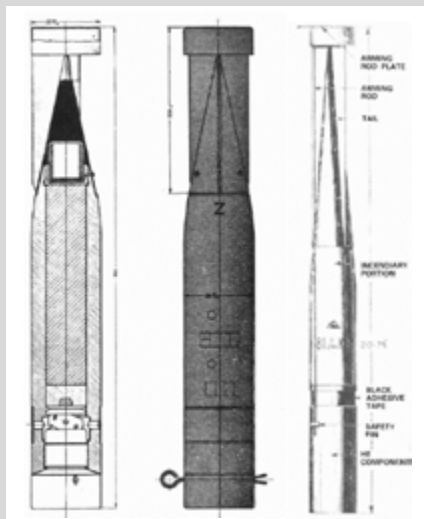
|              |                                       |
|--------------|---------------------------------------|
| Project      | Deansgate, Manchester                 |
| Client:      | Fusion Devco Manchester Ltd           |
| Report Ref:  | DRA-22-1433                           |
| Info Source: | W, Ramsey.1988 / various news sources |



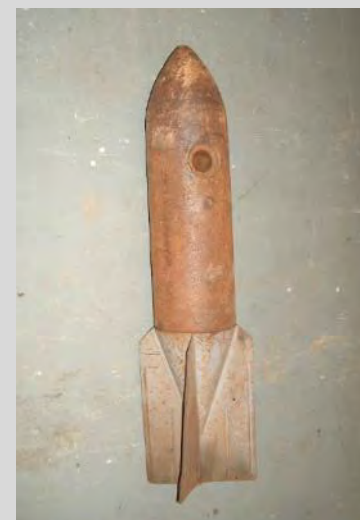
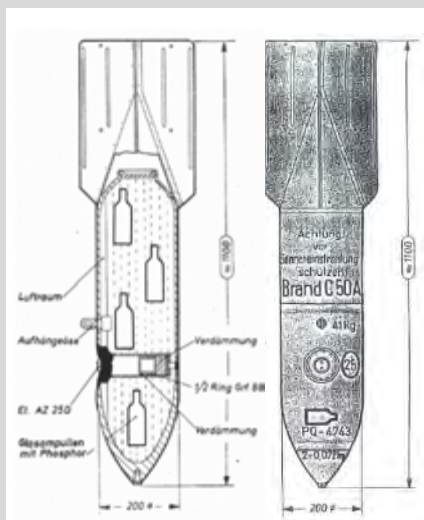
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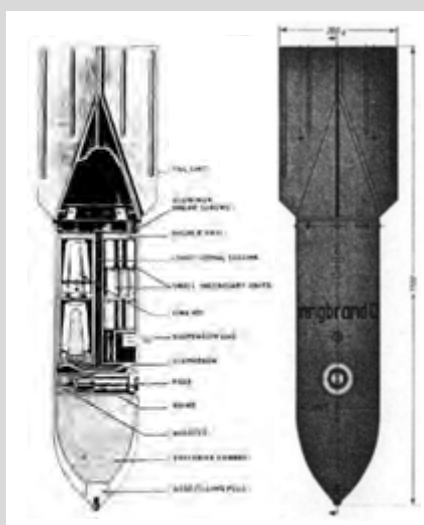
|                           |                                                                                                        |
|---------------------------|--------------------------------------------------------------------------------------------------------|
| <b>Bomb Weight:</b>       | 1-1.3kg (2.2-2.87lb)                                                                                   |
| <b>Incendiary Weight:</b> | 680g (1.4lb)                                                                                           |
| <b>Filling:</b>           | Thermite                                                                                               |
| <b>Fuse Type:</b>         | Simple impact fuse                                                                                     |
| <b>Body Dimensions:</b>   | 247mm length x 50mm diameter                                                                           |
| <b>Appearance:</b>        | Grey body and dark green painted tail unit. Magnesium alloy case.                                      |
| <b>Operation:</b>         | Small percussion charge ignites Thermite (>1,000 °C burn).                                             |
| <b>Variants:</b>          | Most common variant: B 2EZ (2kg) included a small HE charge                                            |
| <b>Remarks:</b>           | Drop containers varied in size. The smallest cluster bomb held 36 x B-1Es and the largest 620 x B-1Es. |



|                           |                                                                                                                                       |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Bomb Weight:</b>       | 41kg (90.4lb)                                                                                                                         |
| <b>Incendiary Weight:</b> | 13kg (30lb)                                                                                                                           |
| <b>Filling:</b>           | Main fill (86% Benzine, 10% Rubber)<br>plus 4% Phosphorus in glass bottles                                                            |
| <b>Fuse Type:</b>         | 1 x electrical impact fuse                                                                                                            |
| <b>Bomb Dimensions:</b>   | 762mm length x 203mm diameter                                                                                                         |
| <b>Appearance:</b>        | bomb body and tail painted grey or<br>green with the rear of the<br>bomb painted red and a red band<br>around the centre of the body. |
| <b>Variants:</b>          | C 50 B: 77% White Phos fill<br>C 250 A: 87.7% Petroleum, 11.7%<br>Polystyrene, 0.5% White Phos (185kg<br>version)                     |



|                          |                                                                                                                                 |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Bomb Weight:</b>      | 34kg (75lb)                                                                                                                     |
| <b>Explosive Weight:</b> | 9kg (20lb)                                                                                                                      |
| <b>Filling:</b>          | TNT burster charge, 6 x Thermite containers (fire pots) and 67 x small triangular incendiary elements.                          |
| <b>Fuse Type:</b>        | 1 x electrical impact fuses or aerial burst fuse                                                                                |
| <b>Bomb Dimensions:</b>  | 711mm length x 203mm diameter                                                                                                   |
| <b>Appearance:</b>       | Bomb body and tail painted grey/green or pale blue with red base plug and red or green incendiary markings. Steel construction. |
| <b>Operation:</b>        | A charge blows off the base plate, firing a plume of incendiary mixture 100 yds. Approx 1 second later the HE charge detonates. |



|             |                                                           |
|-------------|-----------------------------------------------------------|
| Project     | Deansgate, Manchester                                     |
| Client:     | Fusion Devco Manchester Ltd                               |
| Report Ref: | DRA-22-1433                                               |
|             | Info Source: <i>W. Ramsev.1988 / various news sources</i> |

HAA Battery - 3.7” QF Shell

Shell Weight: 12.7kg

Shell Dimensions: 94mm x 438mm

Fill Weight: 1.1kg

Fill Type: TNT

Fuse Type: Mechanical Time Delay fuse

Appearance: Grey body, copper driving bands, brass neck

Rate of Fire: 10 - 20 rpm

Ceiling: 9,000 - 18,000m

Variants: HE or shrapnel shells.

Note, the 4.5” gun was also used in an HAA role throughout the UK.



LAA Battery - 40mm Bofors Shell

Shell Weight: 0.84kg

Shell Dimensions: 40mm x 180mm

Fill Weight: 70g

Fill Type: TNT

Fuse Type: Impact fuse

Appearance: Grey body, copper driving bands, brass neck

Rate of Fire: 120 rpm

Ceiling: 7,000m

Variants: HE or AP shells. Both with rear tracer compartment



Z Battery - 3” U.P Rocket

Rocket Weight: 24.5kg

Warhead Weight: 1.94kg

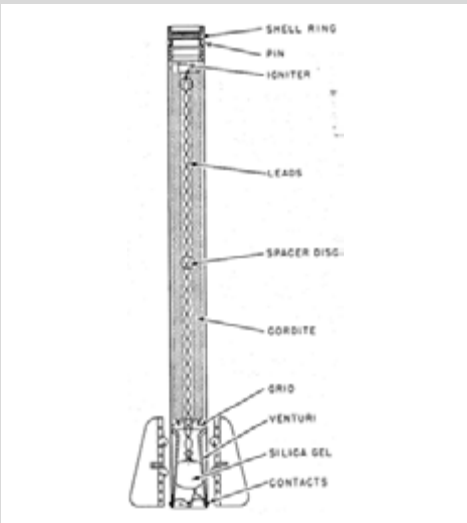
Filling: TNT warhead. Black Powder solid fuel rocket motor.

Fuse Type: Mechanical Time Delay fuse

Rocket Dimensions: 1,930mm x 76mm

Ceiling: 6,770m

Operation: Fired from single, tandem and (later) 36 x rail launchers (Z Batteries). Limited use throughout the UK.



|              |                                       |
|--------------|---------------------------------------|
| Project      | Deansgate, Manchester                 |
| Client:      | Fusion Devco Manchester Ltd           |
| Report Ref:  | DRA-22-1433                           |
| Info Source: | W, Ramsey.1988 / various news sources |



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|           |                                              |
|-----------|----------------------------------------------|
| AA        | Anti-Aircraft (defences)                     |
| AFS       | Auxiliary Fire Service                       |
| AP        | Anti-Personnel                               |
| ARP       | Air Raid Precautions                         |
| ASW       | Anti-Submarine Warfare                       |
| BDU       | Bomb Disposal Unit (historic term for EOD)   |
| Bgl       | Below Ground Level                           |
| EOC       | Explosive Ordnance Clearance                 |
| EOD       | Explosive Ordnance Disposal                  |
| FP        | Fire Pot (German bomb)                       |
| GI        | Ground Investigation                         |
| HAA       | Heavy Anti-Air (gun battery)                 |
| Ha        | Hectare (10,000m2)                           |
| HE        | High Explosive                               |
| IB        | Incendiary Bomb                              |
| Kg        | Kilogram                                     |
| LAA       | Light Anti Air (gun battery)                 |
| LCC       | London County Council                        |
| LRRB      | Long Range Rocket Bomb (V2)                  |
| LSA       | Land Service Ammunition                      |
| Luftwaffe | German Air Force                             |
| OB        | Oil Bomb (German bomb)                       |
| PM        | Parachute Mine (German bomb)                 |
| RAF       | Royal Air Force                              |
| RFC       | Royal Flying Corps                           |
| RN        | Royal Navy (British)                         |
| RNAS      | Royal Naval Air Service                      |
| ROF       | Royal Ordnance Factory                       |
| SAA       | Small Arms Ammunition                        |
| SD2       | 2kg AP bomb (German bomb)                    |
| SI        | Site Investigation                           |
| U/C       | Unclassified (German) bomb                   |
| UP        | Unrotating Projectile (British 3” AA rocket) |
| USAAF     | United States Army Air Force                 |
| UX        | Unexploded                                   |
| UXB       | Unexploded Bomb                              |
| UXO       | Unexploded Ordnance                          |
| V1        | German Flying (pilotless) bomb - “Doodlebug” |
| V2        | German LRRB - “Big Ben”                      |
| WAAF      | Women’s Auxiliary Air Force                  |
| WWI       | World War One                                |
| WWII      | World War Two                                |

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## Appendix D

### Coal Mining Consultants Report



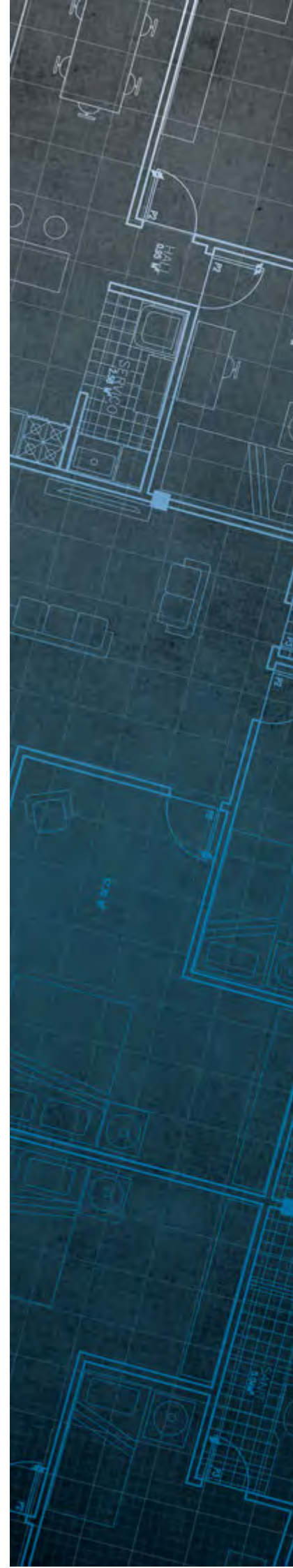
The Coal  
Authority

# Consultants Coal Mining Report

Site At 383300, 397430  
Greater Manchester

|                        |                   |
|------------------------|-------------------|
| Date of enquiry:       | 12 September 2022 |
| Date enquiry received: | 12 September 2022 |
| Issue date:            | 12 September 2022 |

|                 |                |
|-----------------|----------------|
| Our reference:  | 51003311022001 |
| Your reference: | 301108734_1    |



# Consultants

## Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

### Client name

NLIS Hub

### Enquiry address

Site At 383300, 397430  
Greater Manchester

### How to contact us

0345 762 6848 (UK)  
+44 (0)1623 637 000 (International)

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 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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# Section 1 – Mining activity and geology

## **Past underground mining**

No past mining recorded.

## **Probable unrecorded shallow workings**

None.

## **Spine roadways at shallow depth**

No spine roadway recorded at shallow depth.

## **Mine entries**

None recorded within 100 metres of the enquiry boundary.

## **Abandoned mine plan catalogue numbers**

None available.

## **Outcrops**

No outcrops recorded.

## **Geological faults, fissures and breaklines**

No faults, fissures or breaklines recorded.

## **Opencast mines**

None recorded within 500 metres of the enquiry boundary.

## **Coal Authority managed tips**

None recorded within 500 metres of the enquiry boundary.

## Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

### Site investigations

None recorded within 50 metres of the enquiry boundary.

### Remediated sites

None recorded within 50 metres of the enquiry boundary.

### Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

### Mine gas

None recorded within 500 metres of the enquiry boundary.

### Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

## Section 3 – Licensing and future mining activity

### Future underground mining

None recorded.

### Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

### Court orders

None recorded.

### Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

### Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

### Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

## Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

## Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at [groundstability@coal.gov.uk](mailto:groundstability@coal.gov.uk)**.

### Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

### Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

### Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

### Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

### Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

### Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

### Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

### **Opencast mines**

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

### **Coal Authority managed tips**

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

### **Site investigations**

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

### **Remediated sites**

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

### **Coal mining subsidence**

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

### **Mine gas**

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

### **Mine water treatment schemes**

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

### **Future underground mining**

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

### **Coal mining licensing**

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

### **Court orders**

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

### **Section 46 notices**

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

### **Withdrawal of support notices**

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

### **Payment to owners of former copyhold land**

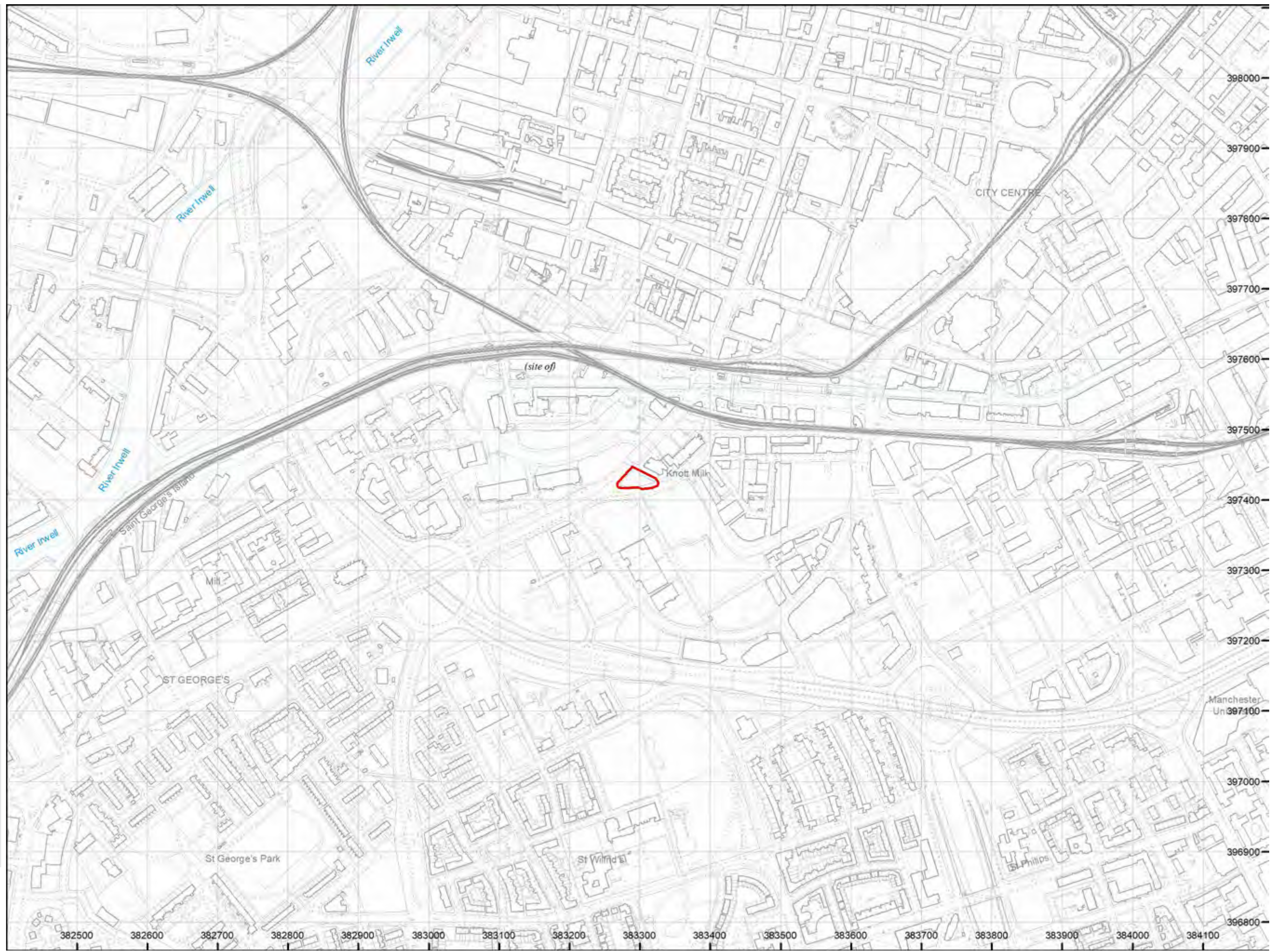
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

**Key**

Approximate position of the enquiry boundary shown 

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0345 762 6848 (UK)  
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[www.groundstability.com](http://www.groundstability.com)



## Appendix E

### Regulatory Correspondence

## **1. Environmental Information Data**

DATE: 29 July 2022    TIME: 14:15

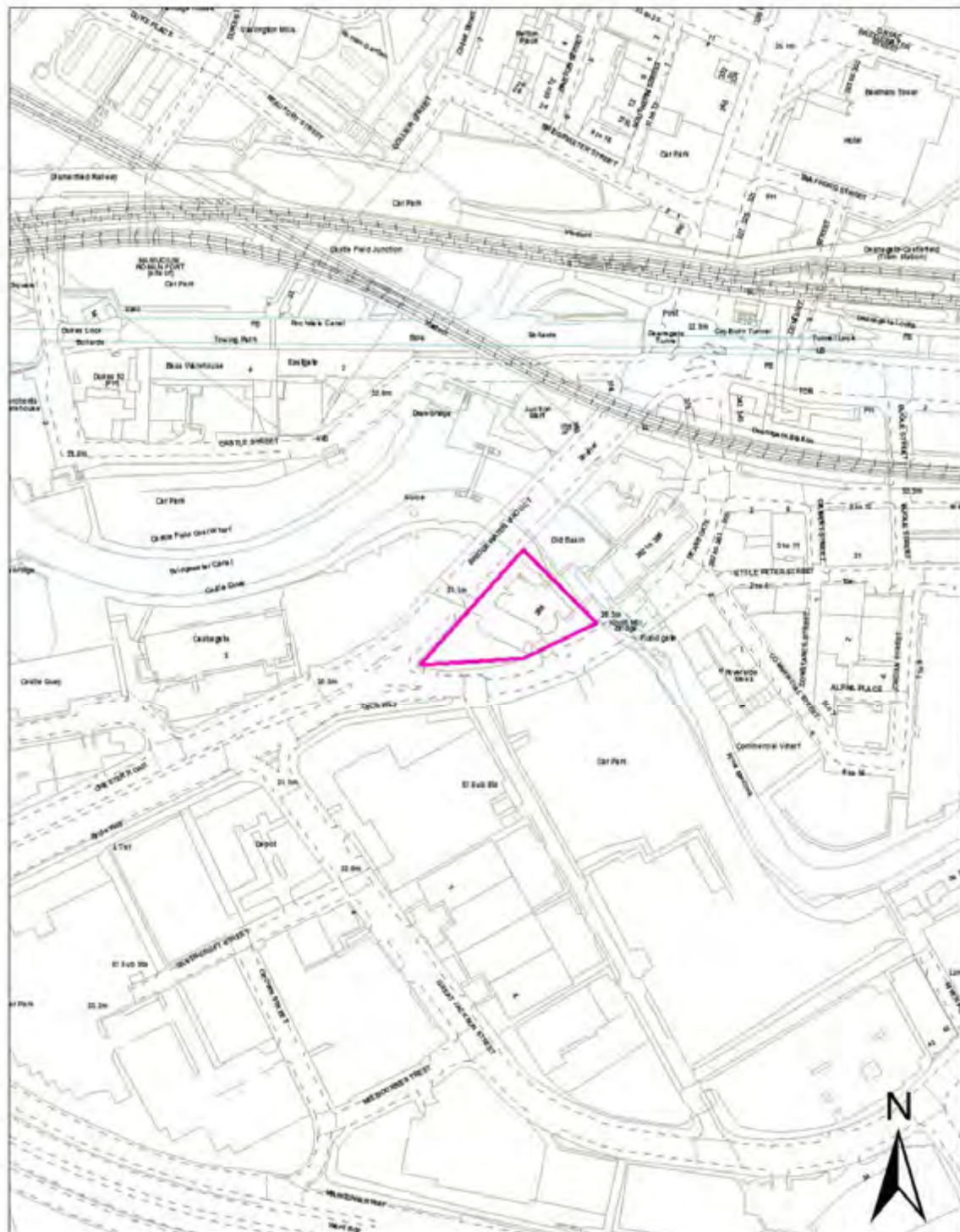
Buffer Search Radius: 25, 100, 250, 2000 metres

Site Centre Coordinates (British National Grid): 383313, 397442

Approx. area of search feature: 1851m<sup>2</sup>

Polygon buffer search

## 2. Site Location Map



**MANCHESTER**  
CITY COUNCIL

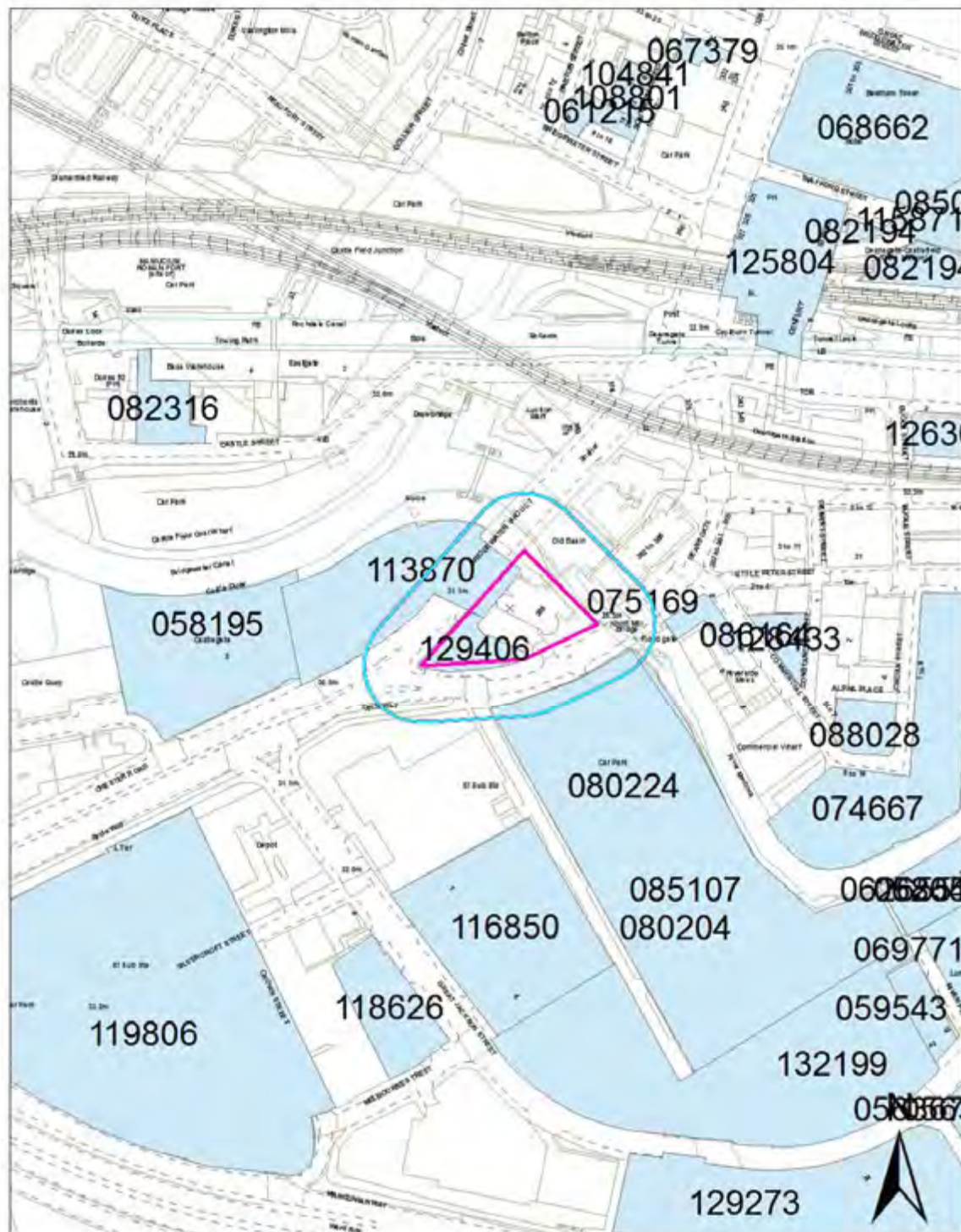
Contaminated Land Section

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Ordnance Survey 100019568.

028Meters  
1:1

### 3. CLS Records (2006-present)

Contaminated Land Section records of contamination issues at the site and land adjacent to the site (2006-present):



### 3.1 GIS Attribute Data for CLS Records (2006-present)

*Selection Summary for layer*

2 feature(s) identified on site.

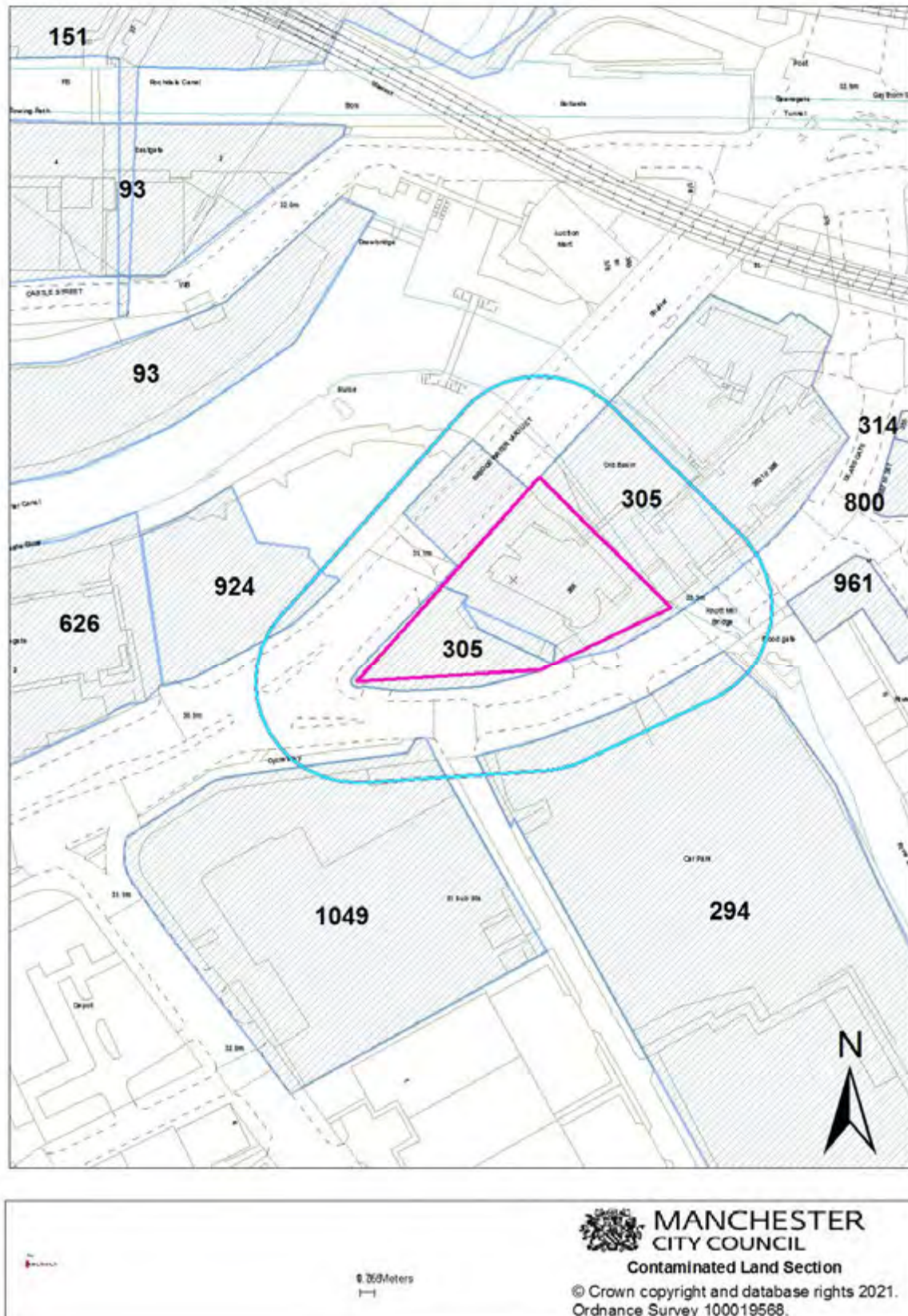
2 feature(s) identified off site within 25 metres

| PLANNING                                | Status     | Address                                                                              | DD_MM_YYYY | Reports | Grid Ref.      |
|-----------------------------------------|------------|--------------------------------------------------------------------------------------|------------|---------|----------------|
| <b>On Site</b>                          |            |                                                                                      |            |         |                |
| 129406                                  | Pending    | Street record, Deansgate, Manchester                                                 |            |         | 383294, 397429 |
| 113870                                  | Discharged | Street record, Chester Road, Manchester                                              | 04/07/2022 |         | 383259, 397455 |
| <b>Identified Off-site - Within 25m</b> |            |                                                                                      |            |         |                |
| 080224                                  | Pending    | Land bounded by Owen Street/ Chester Road and the River Medlock, City.               |            |         | 383360, 397380 |
| 085107                                  | Pending    | Land bounded by Owen Street/ Pond Street/ Old Deansgate and the River Medlock, City. |            |         | 383388, 397333 |

The search has identified that the Contaminated Land Section may hold some information pertaining to ground conditions at or adjacent to this site, as shown on the above plan. Please contact us to arrange access to any available reports.

#### 4. CLS Records (pre-2006)

Contaminated Land Section records of contamination issues at the site and land adjacent to the site (pre-2006):



#### 4.1 GIS Attribute Data for CLS Records (pre-2006)

*Selection Summary for layer*

2 feature(s) identified on site.

3 feature(s) identified off site within 25 metres

| SITE_REF                                | Address                                        | Reports | Grid Ref. | Comments                                                                                                                                                          |
|-----------------------------------------|------------------------------------------------|---------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>On Site</b>                          |                                                |         |           |                                                                                                                                                                   |
| 305                                     | Knott Mill, Bridgewater Viaduct.               |         |           | (1 of 2). Mixed use development. Boundary from planning application nos. 057461/065560/075170. Desk study & SI, archeological desk study, Groundwater assessment. |
| 305                                     | Knott Mill, Bridgewater Viaduct.               |         |           | (2 of 2) Residential development, Boundary from planning application no. 053514.                                                                                  |
| <b>Identified Off-site - Within 25m</b> |                                                |         |           |                                                                                                                                                                   |
| 924                                     | 2-4 Chester Road.                              |         |           |                                                                                                                                                                   |
| 1049                                    | Chester Road/Great Jackson Street. Knott Mill. |         |           | Pre-planning, propped redevelopment of garage.                                                                                                                    |
| 294                                     | Knott Mill, Owen Street.                       |         |           | Residential development. Boundary from planning application no. 062996. Desk study, SI, Remediation Strat, development didn't occur                               |

The search has identified that the Contaminated Land Section may hold some information pertaining to ground conditions at or adjacent to this site, as shown on the above plan. Please contact us to arrange access to any available reports.

## **5. MCC Landfill**

### **Landfill sites within 250 metres.**

No records were identified within 250m

## **6. Part 2A Determined Land**

Environmental Protection Act 1990 Part 2A, sites determined to be statutory contaminated land within 250 metres:

No records were identified within 250M

The council have not identified the site or surrounding area as being contaminated land as defined under the Environmental Protection Act 1990, Part 2A. The council have not assigned a risk rating to the site, and have no current proposals to investigate the site or surrounding area under the Environmental Protection Act 1990, Part 2A.

Manchester City Councils contaminated land inspection strategy can be found at the following link.

[https://secure.manchester.gov.uk/info/100006/environmental\\_problems/2366/contaminated\\_land\\_and\\_environmental\\_searches/5](https://secure.manchester.gov.uk/info/100006/environmental_problems/2366/contaminated_land_and_environmental_searches/5)

Manchester City Council contaminated land public register can be found at the following

[https://www.manchester.gov.uk/directories/500217/licence-public\\_registers](https://www.manchester.gov.uk/directories/500217/licence-public_registers)

## **7. Notices**

Environmental Protection Act 1990 Notices

No records were identified within 100m

## **8. Waste Management Licences**

Environmental Permitting (England & Wales) Regulations 2010, Waste Management Licences within 250 metres (MCC current and historic):

No records were identified within 250m

## **9. Waste Management Licences**

Environmental Permitting (England & Wales) Regulations 2016, Waste Management Licences within 250 metres (EA current):

No records were identified within 250m

## **10. Part A(1) Permitted Processes**

Environmental Permitting (England & Wales) Regulation 2016, Part A(1) Permitted Processes within 250 metres (MCC current and historic):

No records were identified within 250m

## **11. Part A(1) Permitted Processes**

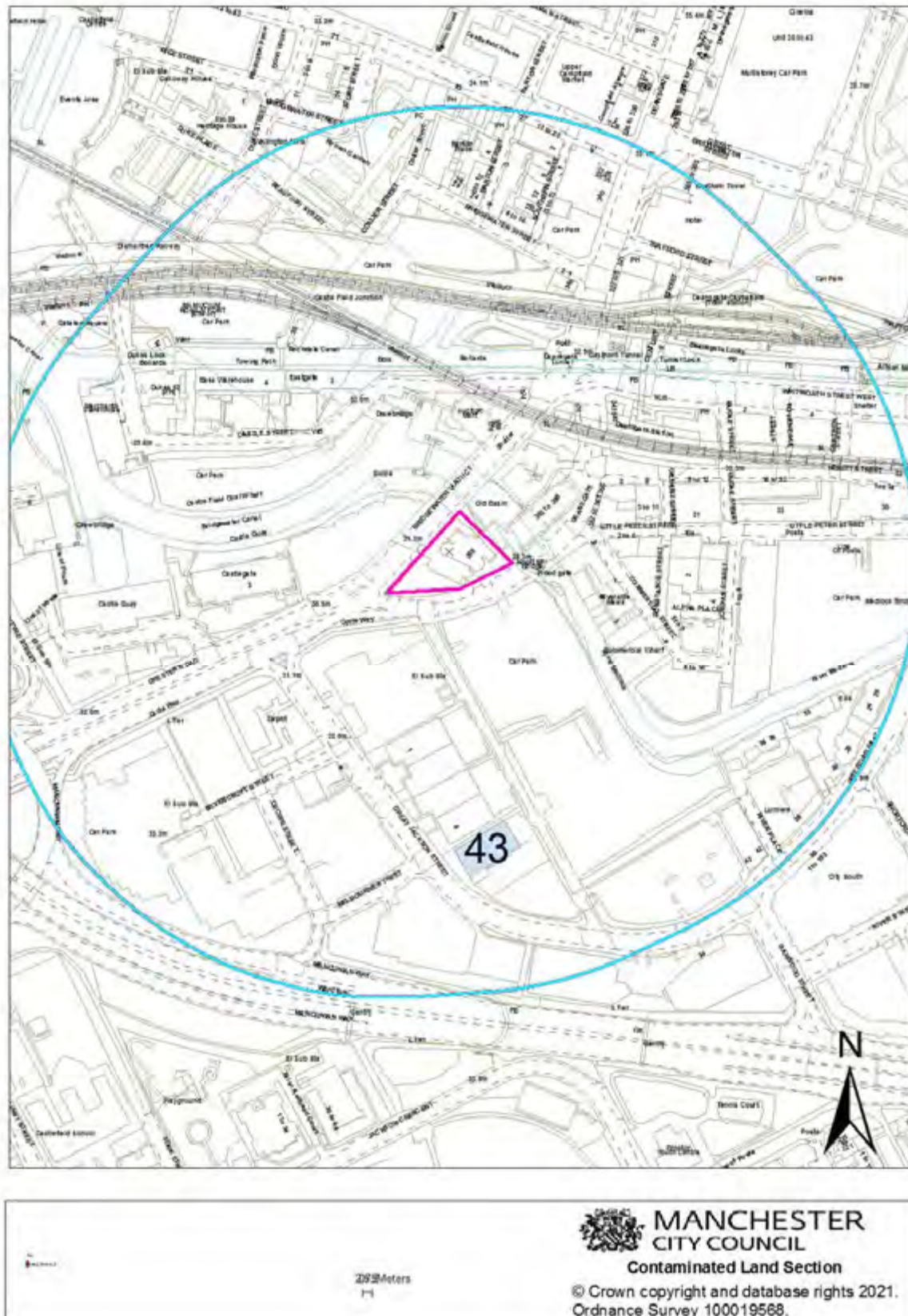
Environmental Permitting (England & Wales) Regulations 2016, Part A(1) Permitted Process within 250 metres (EA Current):  
No records were identified within 250m

## **12. Part A(2) Permitted Processes**

Environmental Permitting (England & Wales) Regulations 2016, Part A2 Permitted Processes within 250 metres:  
No records were identified within 250m

### 13. Part B Permitted Processes

Environmental Permitting (England & Wales) Regulations 2016, Part B Permitted Processes within 250 metres of the site:



### 13.1 GIS Attribute Data for Part B Permitted Processes

*Selection Summary for layer*

0 feature(s) identified on site.

1 feature(s) identified off site within 250 metres

| Site Number                                | BUSINESS           | ADDRESS                                                  | Permit Number  | Status  | Grid Ref.      |
|--------------------------------------------|--------------------|----------------------------------------------------------|----------------|---------|----------------|
| <b>On Site</b>                             |                    |                                                          |                |         |                |
| None                                       |                    |                                                          |                |         |                |
| <b>Identified Off-site - Within 0-250m</b> |                    |                                                          |                |         |                |
| 43                                         | Tom Garner Motors. | A branch of Robins & Day Limited, Chester Road, M15 4GA. | PPC/B/35/05/AW | Revoked | 383335, 397264 |

#### **14. Private Water Supplies**

Private Water Supplies Regulations 2016, registered abstractions within 2000 metres:

Manchester City Council currently have 4 Private water supplies that come under the Private Water Supplies Regulation 2016. However, only one of these is currently online.

If you require further information on these private water supplies, then please contact us.

#### **15. Radioactive Substances Registrations**

Radioactive Substances Act 1993, current registrations at or adjacent to the site:  
No records were identified within 25m

End of Report.

Your Reference

Our Reference PE1002500

Contact [petroleum@manchesterfire.gov.uk](mailto:petroleum@manchesterfire.gov.uk)

Reinier van der Kuip  
Tweedie Evans Consulting  
The Old Chapel  
35A Southover  
Wells  
BA5 1UH

23<sup>rd</sup> August 2022

**Chief Fire Officer**

Dave Russel, BSc, MIFireE

Greater Manchester Fire and Rescue  
Service  
146 Bolton Road  
Swinton  
Manchester  
M27 8US

Tel: 0161 736 5866  
[www.manchesterfire.gov.uk](http://www.manchesterfire.gov.uk)

## **Request for historical petroleum storage information under the Environmental Information Regulations 2004**

### **Re Site Address: Deansgate, Bridgewater Viaduct M15 4SA – As plan provided**

I am writing on behalf of Greater Manchester Combined Authority (the Authority) which is the Fire Authority for Greater Manchester and the enforcing authority for the Petroleum (Consolidation) Regulations 2014 and the Dangerous Substance and Explosives Atmosphere Regulations 2002. Greater Manchester Fire and Rescue Service (GMFRS) carries out these functions on behalf of the GMCA.

The Authority has reviewed the site historical files and records for any past or current licensed storage of petroleum within the site address above. The review has not identified any evidence that petroleum spirit was stored at this site.

However, if whilst undertaking future works and at any time it becomes apparent to contractors that above or underground petroleum tanks are present, which may not have been rendered permanently safe, the Authority must be informed immediately.

Please be aware that disused petrol tanks that have been certified as having been made safe by the use of resin generated foam may still be in an unsafe condition. It has been proven that foam filled underground tanks may be dangerous if disturbed due to the foam degrading over time and the risk of ullage spaces in the tanks filling with explosive, flammable and hazardous atmospheres. Any work being carried out on or near to tank(s) or the tank removed, should only be carried out by people that are competent to carry out this type of work and who have the necessary skills and knowledge to take the appropriate precautions necessary to deal with potential flammable atmospheres.

It should also be noted that the Authority only took over responsibility for petroleum licensing in 1986. Prior to this date the licensing was carried out by the Local Authority Trading Standards. Whilst every endeavour has been made to search back, we cannot guarantee that there was no storage prior to 1986. The Authority only has responsibility for petroleum and related products that are legally required to be licensed. Any diesel tanks in the area would not have required notification, therefore no records of such tanks may be available.

Yours Faithfully,

A handwritten signature in cursive script, appearing to read 'Leech'.

Nicola Leech  
Petroleum & Explosives Manager

Greater Manchester Fire and Rescue Service  
on behalf of the Greater Manchester Combined Authority

## Appendix F

### Exploratory Hole Logs



# Trial Pit Log

Trial Pit No.

**TP101**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 09/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383282.00 N397436.00 |
| Project No. 2006023.001             | Drilling Equipment: JCB 3CX            | Level:                         |
| Hole Type: TP                       | Logged By: MT                          | Scale: 1:25                    |

| Water Strikes | Sample and In Situ Testing |      |           | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                  |   |
|---------------|----------------------------|------|-----------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | Depth (m)                  | Type | Results   |           |           |        |                                                                                                                                                                      |   |
|               | 0.40 - 0.70                | ES   |           | 0.40      |           |        | Light grey concrete (MADE GROUND)                                                                                                                                    |   |
|               | 0.60                       | PID  | 0.00 ppmv |           |           |        | Reddish brown, brown and grey mottled gravelly SAND with low cobble content. Gravel of brick, concrete, glass and slag. Cobbles of brick and concrete (MADE GROUND). | 1 |
|               |                            |      |           | 1.20      |           |        | End of Trial Pit at 1.20m                                                                                                                                            | 2 |
|               |                            |      |           |           |           |        |                                                                                                                                                                      | 3 |
|               |                            |      |           |           |           |        |                                                                                                                                                                      | 4 |

| Dimensions     |               | Trial Pit Support |              | Soakage Testing |           |                  |                              | Remarks |
|----------------|---------------|-------------------|--------------|-----------------|-----------|------------------|------------------------------|---------|
| Pit Length (m) | Pit Width (m) | Pit Stability     | Shoring Used | Test No.        | Date Test | Duration (hh:mm) | Soil Infiltration Rate (m/s) |         |
| 3.10           | 1.30          | Stable            | None         |                 |           |                  |                              |         |

Remarks:  
Terminated at 1.2mbgl as cable encountered. Groundwater was not encountered.





# Trial Pit Log

Trial Pit No.

**TP102**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 09/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383292.00 N397442.00 |
| Project No. 2006023.001             | Drilling Equipment: JCB 3CX            | Level:                         |
| Hole Type: TP                       | Logged By: MT                          | Scale: 1:25                    |

| Water Strikes | Sample and In Situ Testing |           |           | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                                                                  |   |
|---------------|----------------------------|-----------|-----------|-----------|-----------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | Depth (m)                  | Type      | Results   |           |           |        |                                                                                                                                                                                                                                      |   |
|               | 0.40 - 0.80                | ES        |           | 0.50      |           |        | Light grey concrete with frequent rebar approximately 5mm diameter (MADE GROUND)                                                                                                                                                     |   |
|               | 0.60                       | PID       | 0.00 ppmv |           |           |        | Reddish brown, brown and grey mottled gravelly SAND with medium cobble content. Gravel and cobbles of brick concrete and pipe (MADE GROUND).<br><u>Textile membrane</u><br><u>Pocket of brown and black mottled very sandy CLAY.</u> | 1 |
|               | 2.00 - 2.40                | B         |           | 1.80      |           |        | Orangish brown gravelly SAND. Gravel is fine to coarse sub-angular sandstone. Sand is fine to coarse (CHESTER FORMATION).                                                                                                            | 2 |
|               | 2.20 - 2.40<br>2.30        | ES<br>PID | 0.00 ppmv | 2.40      |           |        | End of Trial Pit at 2.40m                                                                                                                                                                                                            | 3 |
|               |                            |           |           |           |           |        |                                                                                                                                                                                                                                      | 4 |

| Dimensions     |               | Trial Pit Support |              | Soakage Testing |           |                  |                              | Remarks |
|----------------|---------------|-------------------|--------------|-----------------|-----------|------------------|------------------------------|---------|
| Pit Length (m) | Pit Width (m) | Pit Stability     | Shoring Used | Test No.        | Date Test | Duration (hh:mm) | Soil Infiltration Rate (m/s) |         |
| 2.50           | 1.20          | Stable            | None         |                 |           |                  |                              |         |

|                                              |  |
|----------------------------------------------|--|
| Remarks:<br>Groundwater was not encountered. |  |
|----------------------------------------------|--|



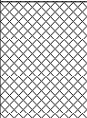
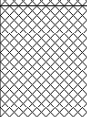
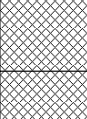
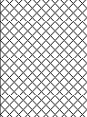
# Trial Pit Log

Trial Pit No.

**TP103**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 09/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383298.00 N397436.00 |
| Project No. 2006023.001             | Drilling Equipment: JCB 3CX            | Level:                         |
| Hole Type: TP                       | Logged By: MT                          | Scale: 1:25                    |

| Water Strikes | Sample and In Situ Testing |      |           | Depth (m) | Level (m) | Legend                                                                            | Stratum Description                                                                                                       |   |
|---------------|----------------------------|------|-----------|-----------|-----------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---|
|               | Depth (m)                  | Type | Results   |           |           |                                                                                   |                                                                                                                           |   |
|               |                            |      |           | 0.40      |           |  | Light grey concrete (MADE GROUND).                                                                                        |   |
|               | 1.00 - 1.40                | ES   |           | 1.00      |           |  | Reddish brown and red mottled GRAVEL of brick (MADE GROUND).                                                              | 1 |
|               | 1.20                       | PID  | 0.00 ppmv | 1.60      |           |  | Brown and grey mottled gravelly SAND. Gravel of brick and concrete (MADE GROUND).                                         |   |
|               |                            |      |           | 2.20      |           |  | Orangish brown gravelly SAND. Gravel of fine to coarse sub-angular sandstone. Sand is fine to coarse (CHESTER FORMATION). | 2 |
|               |                            |      |           |           |           |                                                                                   | End of Trial Pit at 2.20m                                                                                                 | 3 |
|               |                            |      |           |           |           |                                                                                   |                                                                                                                           | 4 |

| Dimensions                                   |               | Trial Pit Support |              | Soakage Testing |           |                  |                              | Remarks                                                                               |
|----------------------------------------------|---------------|-------------------|--------------|-----------------|-----------|------------------|------------------------------|---------------------------------------------------------------------------------------|
| Pit Length (m)                               | Pit Width (m) | Pit Stability     | Shoring Used | Test No.        | Date Test | Duration (hh:mm) | Soil Infiltration Rate (m/s) |                                                                                       |
| 3.10                                         | 1.20          | Stable            | None         |                 |           |                  |                              |                                                                                       |
| Remarks:<br>Groundwater was not encountered. |               |                   |              |                 |           |                  |                              |  |



# Trial Pit Log

Trial Pit No.

**TP104**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 09/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383313.00 N397430.00 |
| Project No. 2006023.001             | Drilling Equipment: JCB 3CX            | Level:                         |
| Hole Type: TP                       | Logged By: MT                          | Scale: 1:25                    |

| Water Strikes | Sample and In Situ Testing |      |           | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                           |   |
|---------------|----------------------------|------|-----------|-----------|-----------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------|---|
|               | Depth (m)                  | Type | Results   |           |           |        |                                                                                                                                               |   |
|               | 0.80 - 1.20                | ES   |           | 0.40      |           |        | Light grey concrete with frequent rebar approximately 3 to 5mm diameter (MADE GROUND).                                                        |   |
|               | 1.10                       | PID  | 0.00 ppmv |           |           |        | Brown gravelly SAND with low cobble content. Gravel of brick, concrete, textile, glass and tile. Cobbles of brick and concrete (MADE GROUND). | 1 |
|               |                            |      |           | 1.80      |           |        | End of Trial Pit at 1.80m                                                                                                                     | 2 |
|               |                            |      |           |           |           |        |                                                                                                                                               | 3 |
|               |                            |      |           |           |           |        |                                                                                                                                               | 4 |

| Dimensions     |               | Trial Pit Support |              | Soakage Testing |           |                  |                              | Remarks |
|----------------|---------------|-------------------|--------------|-----------------|-----------|------------------|------------------------------|---------|
| Pit Length (m) | Pit Width (m) | Pit Stability     | Shoring Used | Test No.        | Date Test | Duration (hh:mm) | Soil Infiltration Rate (m/s) |         |
| 3.20           | 1.20          | Stable            | None         |                 |           |                  |                              |         |

|                                                                                          |  |
|------------------------------------------------------------------------------------------|--|
| Remarks:<br>Terminated at 1.8mbgl due to concrete slab. Groundwater was not encountered. |  |
|------------------------------------------------------------------------------------------|--|



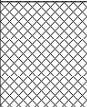
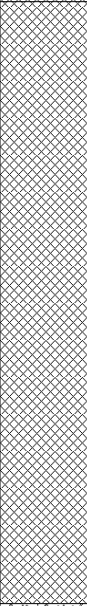
# Trial Pit Log

Trial Pit No.

**TP105**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 09/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383307.00 N397433.00 |
| Project No. 2006023.001             | Drilling Equipment: JCB 3CX            | Level:                         |
| Hole Type: TP                       | Logged By: MT                          | Scale: 1:25                    |

| Water Strikes | Sample and In Situ Testing |      |           | Depth (m) | Level (m) | Legend                                                                              | Stratum Description                                                                                                             |   |
|---------------|----------------------------|------|-----------|-----------|-----------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---|
|               | Depth (m)                  | Type | Results   |           |           |                                                                                     |                                                                                                                                 |   |
|               | 0.40 - 0.80                | ES   |           | 0.35      |           |    | Light grey concrete with frequent rebar approximately 3 to 5mm diameter (MADE GROUND).                                          |   |
|               | 0.80                       | PID  | 0.00 ppmv |           |           |   | Dark brown mottled reddish brown gravelly SAND with low cobble content. Gravel and cobbles of brick and concrete (MADE GROUND). | 1 |
|               |                            |      |           | 2.34      |           |  | Orangish brown gravelly SAND. Gravel of fine to medium sub-angular sandstone. Sand is fine to coarse (CHESTER FORMATION).       | 2 |
|               |                            |      |           | 2.80      |           |                                                                                     | End of Trial Pit at 2.80m                                                                                                       | 3 |
|               |                            |      |           |           |           |                                                                                     |                                                                                                                                 | 4 |

| Dimensions     |               | Trial Pit Support |              | Soakage Testing |           |                  |                              | Remarks |
|----------------|---------------|-------------------|--------------|-----------------|-----------|------------------|------------------------------|---------|
| Pit Length (m) | Pit Width (m) | Pit Stability     | Shoring Used | Test No.        | Date Test | Duration (hh:mm) | Soil Infiltration Rate (m/s) |         |
| 2.20           | 1.20          | Stable            | None         |                 |           |                  |                              |         |

Remarks:  
Groundwater was not encountered.





# Borehole Log

Borehole No.

**BH101**

Sheet 1 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 10/08/2022-15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383298.00 N397430.00

Project No. 2006023.001

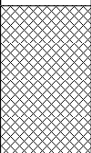
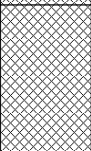
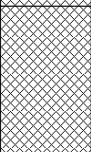
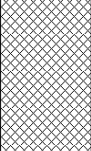
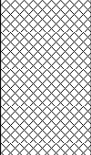
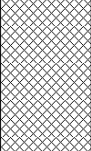
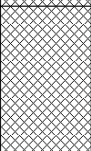
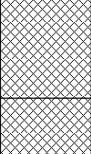
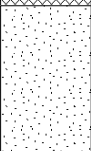
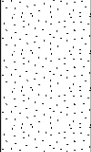
Drilling Equipment: Mito+Hand Tools

Level:

Hole Type: RC

Logged By: MT

Scale: 1:25

| Well                                                                               | Water Strikes | Depth (m)                          | Type            | Results                               | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend                                                                               | Stratum Description                                                                                                                                            |                                                                                       |      |        |         |         |
|------------------------------------------------------------------------------------|---------------|------------------------------------|-----------------|---------------------------------------|------------|----------|------|-----------------------------|------------|-------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|--------|---------|---------|
|                                                                                    |               |                                    |                 |                                       | TCR        | SCR      | RQD  | If (mm)                     |            |             |                                                                                      |                                                                                                                                                                |                                                                                       |      |        |         |         |
|  |               | 0.00 - 1.00                        | LB              |                                       |            |          |      |                             |            |             |    | Light grey concrete with frequent rebar 10 to 15mm diameter (MADE GROUND).                                                                                     |                                                                                       |      |        |         |         |
|                                                                                    |               | 0.50 - 0.80<br>0.60                | ES<br>PID       | 5.50 ppmv                             |            |          |      |                             | 0.50       |             |    | Brown slightly gravelly SAND. Gravel of brick, concrete and asphalt (MADE GROUND).                                                                             |                                                                                       |      |        |         |         |
|                                                                                    |               | 1.00 - 1.30<br>1.00<br>1.20        | D<br>SPT<br>PID | 50 (11,14/50 for 150mm)<br>58.80 ppmv |            |          |      |                             | 1.00       |             |    | Light brown gravelly SAND with weak petrol odour. Gravel of quartz (MADE GROUND).<br><u>No recovery</u>                                                        | 1                                                                                     |      |        |         |         |
|                                                                                    |               | 1.50 - 1.80<br>1.50 - 1.80<br>1.50 | D<br>ES<br>PID  | 305.40 ppmv                           |            |          |      |                             |            |             |    |                                                                                                                                                                |                                                                                       |      |        |         |         |
|                                                                                    |               | 2.00 - 2.38<br>2.00                | D<br>SPT        | N=50 (7,9/50 for 225mm)               |            |          |      |                             |            |             |   |                                                                                                                                                                | 2                                                                                     |      |        |         |         |
|                                                                                    |               | 2.30 - 2.60<br><br>2.50            | D<br><br>PID    | 52.80 ppmv                            |            |          |      |                             |            |             |  |                                                                                                                                                                |                                                                                       |      |        |         |         |
|                                                                                    |               | 3.00 - 3.45<br>3.00                | D<br>SPT        | N=48<br>(5,10/12,10,13,13)            |            |          |      |                             | 3.00       |             |  | Dark brown gravelly SAND with weak petrol odour (MADE GROUND).<br><u>Poor recovery</u>                                                                         | 3                                                                                     |      |        |         |         |
|                                                                                    |               | 3.50<br>3.60 - 6.70                | PID<br>D        | 81.50 ppmv                            |            |          |      |                             | 3.80       |             |  |                                                                                                                                                                |                                                                                       |      |        |         |         |
|                                                                                    |               | 4.00 - 4.45<br>4.00                | D<br>SPT        | N=44<br>(6,7/9,9,12,14)               |            |          |      |                             | 4.00       |             |  | Light grey concrete recovered as fine to coarse gravel with frequent metal fragments (MADE GROUND).                                                            | 4                                                                                     |      |        |         |         |
|                                                                                    |               | 4.30<br>4.40 - 4.80                | PID<br>D        | 33.60 ppmv                            |            |          |      |                             |            |             |  | Dense to very dense reddish brown SAND with weak petrol odour. Sand is fine to coarse. Assessed as loose to medium-dense from field tests (CHESTER FORMATION). |                                                                                       |      |        |         |         |
|                                                                                    |               | 5.00 - 5.40                        | D               |                                       |            |          |      |                             |            |             |                                                                                      |                                                                                                                                                                |                                                                                       |      |        |         |         |
| Hole Diameter                                                                      |               | Casing Diameter                    |                 | Chiselling                            |            |          |      | Inclination and Orientation |            |             |                                                                                      | Drilling Flush                                                                                                                                                 |                                                                                       |      |        |         |         |
| Depth Base                                                                         | Diameter      | Depth Base                         | Diameter        | Depth Top                             | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation                                                                          | Depth Top                                                                                                                                                      | Depth Base                                                                            | Type | Colour | Min (%) | Max (%) |
|                                                                                    |               | 3.00                               | 150             |                                       |            |          |      |                             |            |             |                                                                                      |                                                                                                                                                                |                                                                                       |      |        |         |         |
| Remarks:                                                                           |               |                                    |                 |                                       |            |          |      |                             |            |             |                                                                                      |                                                                                                                                                                |  |      |        |         |         |
| Groundwater strikes not discernible due to water added during drilling.            |               |                                    |                 |                                       |            |          |      |                             |            |             |                                                                                      |                                                                                                                                                                |                                                                                       |      |        |         |         |



# Borehole Log

Borehole No.

**BH101**

Sheet 2 of 5

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 10/08/2022-15/08/2022    |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383298.00 N397430.00 |
| Project No. 2006023.001             | Drilling Equipment: Mito+Hand Tools    | Level:                         |
| Hole Type: RC                       | Logged By: MT                          | Scale: 1:25                    |

| Well | Water Strikes | Depth (m)    | Type | Results                     | Coring |     |     |                  | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                            |   |
|------|---------------|--------------|------|-----------------------------|--------|-----|-----|------------------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               |              |      |                             | TCR    | SCR | RQD | If (mm)          |           |           |        |                                                                                                                                                                |   |
|      |               | 5.00         | SPT  | N=50 (7,9/50 for 250mm)     |        |     |     |                  |           |           |        | Dense to very dense reddish brown SAND with weak petrol odour. Sand is fine to coarse. Assessed as loose to medium-dense from field tests (CHESTER FORMATION). |   |
|      |               | 5.40 - 5.80  | D    |                             |        |     |     |                  |           |           |        |                                                                                                                                                                |   |
|      |               | 6.00 - 6.35  | D    |                             |        |     |     |                  | 6.00      |           |        | Very dense reddish brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium sub-angular quartz (CHESTER FORMATION)                                 | 6 |
|      |               | 6.00         | SPT  | 50 (10,10/50 for 200mm)     |        |     |     |                  |           |           |        |                                                                                                                                                                |   |
|      |               | 6.30         | PID  | 0.70 ppmv                   |        |     |     |                  | 6.30      |           |        | Very dense reddish brown fine to medium SAND. Assessed as loose to medium dense from field tests (CHESTER FORMATION).                                          |   |
|      |               |              |      |                             |        |     |     |                  | 7.00      |           |        |                                                                                                                                                                |   |
|      |               | 7.50 - 7.58  | D    |                             |        |     |     | 60<br>100<br>130 |           |           |        | Medium strong reddish brown fine to medium SANDSTONE (CHESTER FORMATION).                                                                                      | 7 |
|      |               | 7.50         | SPT  | 50 (25 for 75mm/50 for 0mm) | 53     | 53  | 41  |                  |           |           |        | No recovery                                                                                                                                                    |   |
|      |               | 7.00 - 8.00  |      |                             |        |     |     |                  |           |           |        |                                                                                                                                                                | 8 |
|      |               |              |      |                             |        |     |     |                  |           |           |        |                                                                                                                                                                |   |
|      |               | 8.86 - 8.94  | C    |                             |        |     |     | NI<br>40<br>80   |           |           |        |                                                                                                                                                                |   |
|      |               | 8.00 - 9.00  |      |                             |        |     |     |                  |           |           |        | Recovered as reddish brown very gravelly SAND. Gravel of fine to medium quartz. Sand is fine to coarse                                                         | 9 |
|      |               |              |      |                             |        |     |     |                  | 9.40      |           |        | Moderately weak to medium strong reddish brown fine to medium SANDSTONE (CHESTER FORMATION).                                                                   |   |
|      |               |              |      |                             |        |     |     |                  | 9.80      |           |        | Extremely weak to very weak fine to medium SANDSTONE (CHESTER FORMATION).                                                                                      |   |
|      |               | 9.00 - 10.00 |      |                             |        |     |     |                  |           |           |        |                                                                                                                                                                |   |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 3.00            | 150      |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

## Remarks:

Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH101**

Sheet 3 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 10/08/2022-15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383298.00 N397430.00

Project No. 2006023.001

Drilling Equipment: Mito+Hand Tools

Level:

Hole Type: RC

Logged By: MT

Scale: 1:25

| Well | Water Strikes | Depth (m)     | Type | Results | Coring |     |     |                   | Depth (m) | Level (m) | Legend | Stratum Description                                                                             |    |
|------|---------------|---------------|------|---------|--------|-----|-----|-------------------|-----------|-----------|--------|-------------------------------------------------------------------------------------------------|----|
|      |               |               |      |         | TCR    | SCR | RQD | If (mm)           |           |           |        |                                                                                                 |    |
|      |               | 10.89 - 10.96 | C    |         |        |     |     |                   |           |           |        | Extremely weak to very weak fine to medium SANDSTONE (CHESTER FORMATION).<br><i>No recovery</i> |    |
|      |               | 11.40 - 11.60 | D    |         | 100    | 33  | 10  |                   |           |           |        | Recovered as reddish brown fine to medium SAND. Assessed as medium dense from field tests.      | 11 |
|      |               | 11.00 - 12.00 |      |         |        |     |     |                   |           |           |        | <i>No recovery</i>                                                                              | 12 |
|      |               | 14.86 - 14.92 | C    |         | 100    | 37  | 13  | 300<br>400<br>850 | 14.80     |           |        | Weak to moderately weak reddish brown fine to coarse SANDSTONE (CHESTER FORMATION)              | 14 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 3.00            | 150      |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

Remarks:

Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH101**

Sheet 4 of 5

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 10/08/2022-15/08/2022    |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383298.00 N397430.00 |
| Project No. 2006023.001             | Drilling Equipment: Mito+Hand Tools    | Level:                         |
| Hole Type: RC                       | Logged By: MT                          | Scale: 1:25                    |

| Well | Water Strikes | Depth (m)                      | Type | Results | Coring |     |     |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                              |    |
|------|---------------|--------------------------------|------|---------|--------|-----|-----|---------|-----------|-----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|      |               |                                |      |         | TCR    | SCR | RQD | If (mm) |           |           |        |                                                                                                                                                                  |    |
|      |               | 14.00 - 15.00                  |      |         |        |     |     |         | 15.30     |           |        | Weak to moderately weak reddish brown fine to coarse SANDSTONE (CHESTER FORMATION)<br><i>Recovered as reddish brown fine to coarse SAND</i>                      |    |
|      |               | 15.68 - 15.76                  | C    |         | 100    | 63  | 10  |         |           |           |        | Weak to moderately weak reddish brown fine to coarse SANDSTONE (CHESTER FORMATION).                                                                              |    |
|      |               | 15.00 - 16.00                  |      |         |        |     |     |         |           |           |        |                                                                                                                                                                  | 16 |
|      |               | 16.62 - 16.72                  | C    |         | 100    | 73  | 15  |         |           |           |        |                                                                                                                                                                  |    |
|      |               | 16.00 - 17.00                  |      |         |        |     |     |         |           |           |        |                                                                                                                                                                  | 17 |
|      |               | 17.00 - 18.00                  |      |         |        |     |     |         |           |           |        | No recovery                                                                                                                                                      | 18 |
|      |               | 18.00 - 19.00<br>19.00 - 19.10 | C    |         |        |     |     |         |           |           |        |                                                                                                                                                                  | 19 |
|      |               | 19.65 - 19.74                  | C    |         |        |     |     |         | 19.50     |           |        | Moderately strong to strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION). |    |
|      |               |                                |      |         |        |     |     |         |           |           |        |                                                                                                                                                                  |    |
|      |               |                                |      |         |        |     |     |         |           |           |        |                                                                                                                                                                  |    |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 3.00            | 150      |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

## Remarks:

Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH101**

Sheet 5 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 10/08/2022-15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383298.00 N397430.00

Project No. 2006023.001

Drilling Equipment: Mito+Hand Tools

Level:

Hole Type: RC

Logged By: MT

Scale: 1:25

| Well                                                                                  | Water Strikes | Depth (m)                                                      | Type     | Results    | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend      | Stratum Description                                                                                                                                              |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|---------------------------------------------------------------------------------------|---------------|----------------------------------------------------------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------|---------|---------|--|--|--|--|--|--|--|
|                                                                                       |               |                                                                |          |            | TCR        | SCR      | RQD  | If (mm)                     |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               | 20.45 - 20.55                                                  | C        |            |            |          |      |                             |            |             |             | Moderately strong to strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION). | 21                                                                                                                                                                       |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               | Recovered as reddish brown slightly silty fine to medium SAND. |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               | 22.09 - 22.16                                                  | C        |            |            |          |      |                             |            |             |             | Poor recovery                                                                                                                                                    | 22                                                                                                                                                                       |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  | 23                                                                                                                                                                       |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  | 24                                                                                                                                                                       |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               | 24.87 - 25.00                                                  | C        |            |            |          |      |                             | 24.50      |             |             |                                                                                                                                                                  | Moderately strong to strong reddish brown fine to medium grained SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION). |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|                                                                                       |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  | End of Borehole at 25.000m                                                                                                                                               |      |        |         |         |  |  |  |  |  |  |  |
| Hole Diameter                                                                         |               | Casing Diameter                                                |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush                                                                                                                                                   |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
| Depth Base                                                                            | Diameter      | Depth Base                                                     | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top                                                                                                                                                        | Depth Base                                                                                                                                                               | Type | Colour | Min (%) | Max (%) |  |  |  |  |  |  |  |
|                                                                                       |               | 3.00                                                           | 150      |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
| Remarks:                                                                              |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
| Groundwater strikes not discernible due to water added during drilling.               |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |
|  |               |                                                                |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                  |                                                                                                                                                                          |      |        |         |         |  |  |  |  |  |  |  |







# Borehole Log

Borehole No.

**BH102**

Sheet 2 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 16/08/2022-17/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383279.00 N397427.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well | Water Strikes | Depth (m)   | Type | Results                    | Coring |     |     |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                                                                                                                                                                          |   |
|------|---------------|-------------|------|----------------------------|--------|-----|-----|---------|-----------|-----------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               |             |      |                            | TCR    | SCR | RQD | If (mm) |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               | 5.00        | SPT  | 50 (21,4/50 for 95mm)      |        |     |     |         | 5.10      |           |        | Moderately strong to strong reddish brown fine to medium grained SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).<br>Moderately strong to strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION). | 6 |
|      |               | 6.00        | SPT  | 50 (25 for 0mm/50 for 0mm) |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               | 6.41 - 6.50 | C    |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               | 7.00 - 7.10 | C    |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              | 7 |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |
|      |               |             |      |                            |        |     |     |         |           |           |        |                                                                                                                                                                                                                                                                                                                                              |   |



# Borehole Log

Borehole No.

**BH102**

Sheet 3 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 16/08/2022-17/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383279.00 N397427.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well                                                                                | Water Strikes | Depth (m)       | Type     | Results    | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend      | Stratum Description                                                                                                                                                                      |            |      |        |         |         |
|-------------------------------------------------------------------------------------|---------------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|--------|---------|---------|
|                                                                                     |               |                 |          |            | TCR        | SCR      | RQD  | If (mm)                     |            |             |             |                                                                                                                                                                                          |            |      |        |         |         |
|                                                                                     |               | 12.00 - 12.20   | D        |            |            |          |      |                             | 12.60      |             |             | Moderately strong to strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).<br><u>Poor recovery</u> | 11         |      |        |         |         |
|                                                                                     |               |                 |          |            |            |          |      |                             |            |             |             | <u>Poor recovery: Recovered as reddish brown slightly clayey fine to medium SAND.</u>                                                                                                    | 12         |      |        |         |         |
|                                                                                     |               | 12.90 - 13.00   | C        |            |            |          |      |                             |            |             |             | Moderately strong to strong reddish brown fine to medium grained SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).                 | 13         |      |        |         |         |
|                                                                                     |               | 13.28 - 13.37   | C        |            |            |          |      |                             |            |             |             |                                                                                                                                                                                          |            |      |        |         |         |
|                                                                                     |               | 13.77 - 13.86   | C        |            |            |          |      |                             |            |             |             |                                                                                                                                                                                          | 14         |      |        |         |         |
|                                                                                     |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                          |            |      |        |         |         |
| Hole Diameter                                                                       |               | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush                                                                                                                                                                           |            |      |        |         |         |
| Depth Base                                                                          | Diameter      | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top                                                                                                                                                                                | Depth Base | Type | Colour | Min (%) | Max (%) |
|                                                                                     |               | 3.00            | 150      |            |            |          |      |                             |            |             |             |                                                                                                                                                                                          |            |      |        |         |         |
| Remarks:<br>Groundwater strikes not discernible due to water added during drilling. |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                          |            |      |        |         |         |



# Borehole Log

Borehole No.

**BH102**

Sheet 4 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 16/08/2022-17/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383279.00 N397427.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well | Water Strikes | Depth (m)     | Type | Results | Coring |     |     |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                                                                                                                                                       |    |
|------|---------------|---------------|------|---------|--------|-----|-----|---------|-----------|-----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|      |               |               |      |         | TCR    | SCR | RQD | If (mm) |           |           |        |                                                                                                                                                                                                                                                                                           |    |
|      |               | 17.60 - 17.80 | D    |         |        |     |     |         |           |           |        | Moderately strong to strong reddish brown fine to medium grained SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).<br><i>Poor recovery: Recovered as reddish brown slightly clayey fine to medium SAND.</i><br><i>Poor recovery</i> | 16 |
|      |               |               |      |         |        |     |     |         |           |           |        | <i>Poor recovery: Recovered as reddish brown slightly gravelly, slightly clayey fine to medium SAND. Gravel of fine to medium sub-angular sandstone.</i>                                                                                                                                  | 17 |
|      |               |               |      |         |        |     |     |         |           |           |        | <i>Poor recovery: Recovered as reddish brown slightly gravelly very sandy CLAY. Sand is fine to medium and gravel of fine to medium angular cemented sandstone.</i>                                                                                                                       | 18 |
|      |               |               |      |         |        |     |     |         |           |           |        | <i>Poor recovery: Recovered as reddish brown slightly clayey fine to coarse SAND.</i>                                                                                                                                                                                                     | 19 |
|      |               | 19.68 - 19.78 | C    |         |        |     |     |         | 19.25     | 19.55     |        | Moderately strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).                                                                                                                                    |    |
|      |               |               |      |         |        |     |     |         | 19.55     |           |        | Moderately strong reddish brown fine to medium SANDSTONE with soft sandy clay on the edges. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).                                                                                                  |    |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 3.00            | 150      |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

Remarks:

Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH102**

Sheet 5 of 5

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 16/08/2022-17/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383279.00 N397427.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well                                                                    | Water Strikes | Depth (m)       | Type     | Results    | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend      | Stratum Description                                                                                                                                                                                                                                                               |                                                                                                                                         |      |        |         |         |
|-------------------------------------------------------------------------|---------------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|--------|---------|---------|
|                                                                         |               |                 |          |            | TCR        | SCR      | RQD  | If (mm)                     |            |             |             |                                                                                                                                                                                                                                                                                   |                                                                                                                                         |      |        |         |         |
|                                                                         |               | 21.42 - 21.51   | C        |            |            |          |      |                             | 20.70      |             |             | Moderately strong reddish brown fine to medium SANDSTONE with soft sandy clay on the edges. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).<br><i>Poor recovery: Recovered as reddish brown slightly clayey fine to coarse SAND.</i> |                                                                                                                                         |      |        |         |         |
|                                                                         |               | 21.90 - 22.00   | D        |            |            |          |      |                             |            |             |             | Moderately strong to strong reddish brown fine to medium SANDSTONE. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).                                                                                                                  | 21                                                                                                                                      |      |        |         |         |
|                                                                         |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                                                                                                                   | <i>Poor recovery: Recovered as reddish brown slightly gravelly fine to medium SAND. Gravel of fine to medium sub-angular sandstone.</i> | 22   |        |         |         |
|                                                                         |               | 23.70 - 23.78   | C        |            |            |          |      |                             | 23.50      |             |             | Moderately strong to strong reddish brown fine to coarse SANDSTONE. Fractures are closely spaced and infilled with reddish brown sand (CHESTER FORMATION).                                                                                                                        | 24                                                                                                                                      |      |        |         |         |
|                                                                         |               | 24.72 - 24.92   | C        |            |            |          |      |                             | 24.20      |             |             | Moderately strong reddish brown fine to medium SANDSTONE with soft sandy clay on the edges. Fractures are closely spaced and infilled with reddish brown silty sand (CHESTER FORMATION).                                                                                          |                                                                                                                                         |      |        |         |         |
|                                                                         |               |                 |          |            |            |          |      |                             | 25.00      |             |             | End of Borehole at 25.000m                                                                                                                                                                                                                                                        |                                                                                                                                         |      |        |         |         |
| Hole Diameter                                                           |               | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush                                                                                                                                                                                                                                                                    |                                                                                                                                         |      |        |         |         |
| Depth Base                                                              | Diameter      | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top                                                                                                                                                                                                                                                                         | Depth Base                                                                                                                              | Type | Colour | Min (%) | Max (%) |
|                                                                         |               | 3.00            | 150      |            |            |          |      |                             |            |             |             |                                                                                                                                                                                                                                                                                   |                                                                                                                                         |      |        |         |         |
| Remarks:                                                                |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                                                                                                                   |                                                                                                                                         |      |        |         |         |
| Groundwater strikes not discernible due to water added during drilling. |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                                                                                                                   |                                                                                                                                         |      |        |         |         |
|                                                                         |               |                 |          |            |            |          |      |                             |            |             |             |                                                                                                                                                                                                                                                                                   |                                                                                                                                         |      |        |         |         |



# Borehole Log

Borehole No.

**BH103**

Sheet 1 of 1

|                                     |                                        |                                |
|-------------------------------------|----------------------------------------|--------------------------------|
| Project Name: Deansgate, Manchester | Client: Fusion Manchester Devco Ltd    | Date: 15/08/2022               |
| Location: Manchester                | Contractor: Borehole Solutions Limited | Co-ords: E383294.00 N397430.00 |
| Project No. 2006023.001             | Drilling Equipment: Mito               | Level:                         |
| Hole Type: RC                       | Logged By: ST                          | Scale: 1:25                    |

| Well | Water Strikes | Depth (m)           | Type      | Results                     | Coring |     |     |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                        |   |
|------|---------------|---------------------|-----------|-----------------------------|--------|-----|-----|---------|-----------|-----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               |                     |           |                             | TCR    | SCR | RQD | If (mm) |           |           |        |                                                                                                                                                            |   |
|      |               | 0.80 - 0.90<br>0.80 | ES<br>PID | 0.00 ppmv                   |        |     |     |         | 0.23      |           |        | Light grey reinforced concrete with 3mm rebar (MADE GROUND).                                                                                               |   |
|      |               | 1.00 - 1.30<br>1.00 | D<br>SPT  | 50 (6,15/50 for 150mm)      |        |     |     |         |           |           |        | Reddish brown slightly clayey, slightly gravelly SAND with low cobble content. Gravels and cobbles of concrete, chert, sandstone and quartz (MADE GROUND). | 1 |
|      |               | 1.50                | PID       | 0.00 ppmv                   |        |     |     |         | 1.60      |           |        |                                                                                                                                                            |   |
|      |               | 2.00 - 2.08<br>2.00 | D<br>SPT  | 50 (25 for 80mm/50 for 0mm) |        |     |     |         | 2.00      |           |        | Light brown slightly gravelly CLAY. Gravel of sandstone and chert (MADE GROUND).<br><i>Metal fragment, possible tank encountered.</i>                      | 2 |
|      |               | 2.60                | PID       | 0.00 ppmv                   |        |     |     |         |           |           |        | Light brown slightly clayey fine to medium SAND with occasional cobbles of limestone and sandstone (MADE GROUND).                                          |   |
|      |               | 3.00 - 3.45<br>3.00 | D<br>SPT  | N=41<br>(8,8/9,12,10,10)    |        |     |     |         | 3.00      |           |        | Brown to light brown slightly gravelly clayey SAND with gravel of cemented sandstone and chert (MADE GROUND).                                              | 3 |
|      |               | 3.20                | PID       | 0.00 ppmv                   |        |     |     |         |           |           |        | <i>Metal fragment, possible tank encountered.</i>                                                                                                          |   |
|      |               | 3.50 - 3.70         | ES        |                             |        |     |     |         | 3.50      |           |        | Firm reddish brown slightly gravelly very sandy CLAY. Gravel of medium sub-rounded chert and fine to medium sand (CHESTER FORMATION).                      |   |
|      |               | 3.70<br>3.80 - 4.00 | PID<br>D  | 0.00 ppmv                   |        |     |     |         |           |           |        |                                                                                                                                                            |   |
|      |               | 4.00 - 4.45<br>4.00 | D<br>SPT  | N=40<br>(7,10/9,9,9,13)     |        |     |     |         | 4.00      |           |        | End of Borehole at 4.000m                                                                                                                                  | 4 |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 0.00            | 3        |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

## Remarks:

Borehole terminated on instruction from EOD engineer. Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH104**

Sheet 1 of 2

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383282.00 N397436.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well | Water Strikes | Depth (m)           | Type     | Results                        | Coring |     |     |         | Depth (m) | Level (m) | Legend | Stratum Description                                                                                                                                       |   |
|------|---------------|---------------------|----------|--------------------------------|--------|-----|-----|---------|-----------|-----------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|      |               |                     |          |                                | TCR    | SCR | RQD | If (mm) |           |           |        |                                                                                                                                                           |   |
|      |               | 0.10                | PID      | 0.00 ppmv                      |        |     |     |         |           |           |        | Reddish brown slightly clayey slightly gravelly SAND with low cobble content. Gravels and cobbles of concrete, chert, sandstone and quartz (MADE GROUND). |   |
|      |               | 0.60                | PID      | 0.00 ppmv                      |        |     |     |         |           |           |        |                                                                                                                                                           |   |
|      |               | 1.00 - 1.31<br>1.00 | D<br>SPT | 50 (9,14/50 for 160mm)         |        |     |     |         | 1.00      |           |        | Medium dense reddish brown slightly gravelly clayey fine to medium SAND. Gravel of medium to coarse angular sandstone (CHESTER FORMATION).                | 1 |
|      |               | 2.00 - 2.45<br>2.00 | D<br>SPT | N=42<br>(8,9/11,10,9,12)       |        |     |     |         |           |           |        | Material recovered as damp.                                                                                                                               | 2 |
|      |               | 2.50 - 3.00         | B        |                                |        |     |     |         |           |           |        |                                                                                                                                                           |   |
|      |               | 3.00 - 3.28<br>3.00 | D<br>SPT | 50 (25 for 120mm/50 for 155mm) |        |     |     |         |           |           |        |                                                                                                                                                           | 3 |
|      |               | 4.00                | SPT      | 50 (25 for 40mm/50 for 0mm)    |        |     |     |         |           |           |        |                                                                                                                                                           | 4 |
|      |               | 5.00                | SPT      |                                |        |     |     |         | 5.00      |           |        |                                                                                                                                                           |   |

| Hole Diameter |          | Casing Diameter |          | Chiselling |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush |            |      |        |         |         |
|---------------|----------|-----------------|----------|------------|------------|----------|------|-----------------------------|------------|-------------|-------------|----------------|------------|------|--------|---------|---------|
| Depth Base    | Diameter | Depth Base      | Diameter | Depth Top  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top      | Depth Base | Type | Colour | Min (%) | Max (%) |
|               |          | 0.00            | 3        |            |            |          |      |                             |            |             |             |                |            |      |        |         |         |

Remarks:

Groundwater strikes not discernible due to water added during drilling.





# Borehole Log

Borehole No.

**BH104**

Sheet 2 of 2

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383282.00 N397436.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well                                                                                | Water Strikes | Depth (m)       | Type     | Results                    | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend      | Stratum Description       |            |                                                                                       |        |         |         |
|-------------------------------------------------------------------------------------|---------------|-----------------|----------|----------------------------|------------|----------|------|-----------------------------|------------|-------------|-------------|---------------------------|------------|---------------------------------------------------------------------------------------|--------|---------|---------|
|                                                                                     |               |                 |          |                            | TCR        | SCR      | RQD  | If (mm)                     |            |             |             |                           |            |                                                                                       |        |         |         |
|                                                                                     |               |                 |          | 50 (25 for 0mm/50 for 0mm) |            |          |      |                             |            |             |             | End of Borehole at 5.000m |            |                                                                                       |        |         |         |
|                                                                                     |               |                 |          |                            |            |          |      |                             |            |             |             |                           | 6          |                                                                                       |        |         |         |
|                                                                                     |               |                 |          |                            |            |          |      |                             |            |             |             |                           | 7          |                                                                                       |        |         |         |
|                                                                                     |               |                 |          |                            |            |          |      |                             |            |             |             |                           | 8          |                                                                                       |        |         |         |
|                                                                                     |               |                 |          |                            |            |          |      |                             |            |             |             |                           | 9          |                                                                                       |        |         |         |
|                                                                                     |               |                 |          |                            |            |          |      |                             |            |             |             |                           |            |                                                                                       |        |         |         |
| Hole Diameter                                                                       |               | Casing Diameter |          | Chiselling                 |            |          |      | Inclination and Orientation |            |             |             | Drilling Flush            |            |                                                                                       |        |         |         |
| Depth Base                                                                          | Diameter      | Depth Base      | Diameter | Depth Top                  | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation | Depth Top                 | Depth Base | Type                                                                                  | Colour | Min (%) | Max (%) |
|                                                                                     |               | 0.00            | 3        |                            |            |          |      |                             |            |             |             |                           |            |                                                                                       |        |         |         |
| Remarks:<br>Groundwater strikes not discernible due to water added during drilling. |               |                 |          |                            |            |          |      |                             |            |             |             |                           |            |  |        |         |         |



# Borehole Log

Borehole No.

**BH105**

Sheet 1 of 1

Project Name: Deansgate, Manchester

Client: Fusion Manchester Devco Ltd

Date: 15/08/2022

Location: Manchester

Contractor: Borehole Solutions Limited

Co-ords: E383294.00 N397436.00

Project No. 2006023.001

Drilling Equipment: Mito

Level:

Hole Type: RC

Logged By: ST

Scale: 1:25

| Well                                                    | Water Strikes | Depth (m)           | Type     | Results                        | Coring     |          |      |                             | Depth (m)  | Level (m)   | Legend                                                                                                                                                                     | Stratum Description                                          |            |      |        |                                                                                       |         |
|---------------------------------------------------------|---------------|---------------------|----------|--------------------------------|------------|----------|------|-----------------------------|------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|------------|------|--------|---------------------------------------------------------------------------------------|---------|
|                                                         |               |                     |          |                                | TCR        | SCR      | RQD  | If (mm)                     |            |             |                                                                                                                                                                            |                                                              |            |      |        |                                                                                       |         |
|                                                         |               | 0.60                | PID      | 0.00 ppmv                      |            |          |      |                             | 0.25       |             |                                                                                                                                                                            | Light grey reinforced concrete with 3mm rebar (MADE GROUND). | 1          |      |        |                                                                                       |         |
|                                                         |               | 1.00 - 1.24<br>1.00 | D<br>SPT | 50 (25 for 125mm/50 for 110mm) |            |          |      |                             | 1.50       |             | Reddish brown to dark brown slightly clayey, slightly gravelly SAND with low cobble content. Gravel and cobbles of concrete, chert, sandstone and quartzite (MADE GROUND). |                                                              |            |      |        |                                                                                       |         |
|                                                         |               |                     |          |                                |            |          |      |                             |            |             | End of Borehole at 1.500m                                                                                                                                                  | 2                                                            |            |      |        |                                                                                       |         |
|                                                         |               |                     |          |                                |            |          |      |                             |            |             |                                                                                                                                                                            | 3                                                            |            |      |        |                                                                                       |         |
|                                                         |               |                     |          |                                |            |          |      |                             |            |             |                                                                                                                                                                            | 4                                                            |            |      |        |                                                                                       |         |
|                                                         |               |                     |          |                                |            |          |      |                             |            |             |                                                                                                                                                                            |                                                              |            |      |        |                                                                                       |         |
| Hole Diameter                                           |               | Casing Diameter     |          | Chiselling                     |            |          |      | Inclination and Orientation |            |             |                                                                                                                                                                            | Drilling Flush                                               |            |      |        |                                                                                       |         |
| Depth Base                                              | Diameter      | Depth Base          | Diameter | Depth Top                      | Depth Base | Duration | Tool | Depth Top                   | Depth Base | Inclination | Orientation                                                                                                                                                                | Depth Top                                                    | Depth Base | Type | Colour | Min (%)                                                                               | Max (%) |
|                                                         |               |                     |          |                                |            |          |      |                             |            |             |                                                                                                                                                                            |                                                              |            |      |        |                                                                                       |         |
| Remarks:<br>Hole terminated due to loss of water flush. |               |                     |          |                                |            |          |      |                             |            |             |                                                                                                                                                                            |                                                              |            |      |        |  |         |

## Appendix G

### Geochemical Certificates of Analysis

**Mitchell Tucker**

Tweedie Evans Consulting Ltd  
The Old Chapel  
35a Southover  
Wells  
Somerset  
BA5 1UH

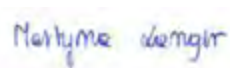
**t:** 01749 677 760  
**f:** 01749 679 345  
**e:** mitchell.tucker@tecon.co.uk

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 : 22-78035**

|                             |                                     |                                                        |            |
|-----------------------------|-------------------------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | Deansgate, Manchester               | <b>Samples received on:</b>                            | 16/08/2022 |
| <b>Your job number:</b>     | 2006023 001                         | <b>Samples instructed on/<br/>Analysis started on:</b> | 16/08/2022 |
| <b>Your order number:</b>   |                                     | <b>Analysis completed by:</b>                          | 30/08/2022 |
| <b>Report Issue Number:</b> | 1                                   | <b>Report issued on:</b>                               | 30/08/2022 |
| <b>Samples Analysed:</b>    | 5 leachate samples - 7 soil samples |                                                        |            |

  
**Signed:**

Martyna Langer  
Junior Reporting Specialist  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

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

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                         | 2387985       | 2387986       | 2387987       | 2387988       | 2387989       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | TP101 ES1     | TP102 ES1     | TP102 ES2     | TP103 ES1     | TP104 ES1     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.40-0.70     | 0.40-0.80     | 2.20-2.40     | 1.00-1.40     | 0.80-1.20     |
| Date Sampled                            |       |                    |                         | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |
| Stone Content                           | %     | 0.1                | NONE                    | < 0.1         | < 0.1         | < 0.1         | 43            | 58            |
| Moisture Content                        | %     | 0.01               | NONE                    | 10            | 11            | 11            | 6.1           | 6.6           |
| Total mass of sample received           | kg    | 0.001              | NONE                    | 1.3           | 1.3           | 0.3           | 1.3           | 1.3           |

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

#### General Inorganics

|                                                                         |          |         |        |       |       |       |       |       |
|-------------------------------------------------------------------------|----------|---------|--------|-------|-------|-------|-------|-------|
| pH - Automated                                                          | pH Units | N/A     | MCERTS | 9.7   | -     | 8.3   | 8.5   | -     |
| Total Cyanide                                                           | mg/kg    | 1       | MCERTS | 2.3   | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Total Sulphate as SO <sub>4</sub>                                       | mg/kg    | 50      | MCERTS | 960   | -     | 150   | 770   | -     |
| Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent) | g/l      | 0.00125 | MCERTS | 0.084 | -     | 0.019 | 0.27  | -     |
| Sulphide                                                                | mg/kg    | 1       | MCERTS | < 1.0 | -     | < 1.0 | < 1.0 | -     |
| Ammoniacal Nitrogen as NH <sub>3</sub>                                  | mg/kg    | 0.5     | MCERTS | -     | < 0.5 | -     | -     | < 0.5 |
| Total Organic Carbon (TOC) - Automated                                  | %        | 0.1     | MCERTS | 1.3   | -     | 0.3   | 1.1   | -     |

#### Total Phenols

|                            |       |   |        |       |       |       |       |       |
|----------------------------|-------|---|--------|-------|-------|-------|-------|-------|
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
|----------------------------|-------|---|--------|-------|-------|-------|-------|-------|

#### Speciated PAHs

|                        |       |      |        |        |        |        |        |        |
|------------------------|-------|------|--------|--------|--------|--------|--------|--------|
| Naphthalene            | mg/kg | 0.05 | MCERTS | < 0.05 | 0.67   | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene         | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthene           | mg/kg | 0.05 | MCERTS | < 0.05 | 1.2    | < 0.05 | 0.49   | < 0.05 |
| Fluorene               | mg/kg | 0.05 | MCERTS | < 0.05 | 0.84   | < 0.05 | 0.38   | < 0.05 |
| Phenanthrene           | mg/kg | 0.05 | MCERTS | 0.91   | 7.6    | < 0.05 | 2.2    | < 0.05 |
| Anthracene             | mg/kg | 0.05 | MCERTS | 0.23   | 1.6    | < 0.05 | 0.42   | < 0.05 |
| Fluoranthene           | mg/kg | 0.05 | MCERTS | 1.4    | 9.7    | < 0.05 | 1.7    | < 0.05 |
| Pyrene                 | mg/kg | 0.05 | MCERTS | 1.4    | 8.6    | < 0.05 | 1.4    | < 0.05 |
| Benzo(a)anthracene     | mg/kg | 0.05 | MCERTS | 0.96   | 5.7    | < 0.05 | 0.96   | < 0.05 |
| Chrysene               | mg/kg | 0.05 | MCERTS | 1      | 4.3    | < 0.05 | 0.78   | < 0.05 |
| Benzo(b)fluoranthene   | mg/kg | 0.05 | MCERTS | 1      | 4.8    | < 0.05 | 0.73   | < 0.05 |
| Benzo(k)fluoranthene   | mg/kg | 0.05 | MCERTS | 0.54   | 2.6    | < 0.05 | 0.38   | < 0.05 |
| Benzo(a)pyrene         | mg/kg | 0.05 | MCERTS | 0.82   | 4.7    | < 0.05 | 0.58   | < 0.05 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 0.58   | 2.1    | < 0.05 | 0.33   | < 0.05 |
| Dibenz(a,h)anthracene  | mg/kg | 0.05 | MCERTS | < 0.05 | 0.61   | < 0.05 | < 0.05 | < 0.05 |
| Benzo(ghi)perylene     | mg/kg | 0.05 | MCERTS | 0.72   | 2.6    | < 0.05 | 0.38   | < 0.05 |

#### Total PAH

|                             |       |     |        |      |      |        |      |        |
|-----------------------------|-------|-----|--------|------|------|--------|------|--------|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 9.65 | 57.6 | < 0.80 | 10.7 | < 0.80 |
|-----------------------------|-------|-----|--------|------|------|--------|------|--------|

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |  |  |  | 2387985       | 2387986            | 2387987              | 2387988       | 2387989       |
|-----------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|---------------|
| Sample Reference                        |  |  |  | TP101 ES1     | TP102 ES1          | TP102 ES2            | TP103 ES1     | TP104 ES1     |
| Sample Number                           |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                               |  |  |  | 0.40-0.70     | 0.40-0.80          | 2.20-2.40            | 1.00-1.40     | 0.80-1.20     |
| Date Sampled                            |  |  |  | 09/08/2022    | 09/08/2022         | 09/08/2022           | 09/08/2022    | 09/08/2022    |
| Time Taken                              |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |               |

#### Heavy Metals / Metalloids

|                                     |       |      |           |       |       |       |       |       |
|-------------------------------------|-------|------|-----------|-------|-------|-------|-------|-------|
| Antimony (aqua regia extractable)   | mg/kg | 1    | ISO 17025 | -     | 4     | -     | -     | 2.7   |
| Arsenic (aqua regia extractable)    | mg/kg | 1    | MCERTS    | 38    | 10    | 5.8   | 14    | 5.4   |
| Barium (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 390   | 66    | 43    | 150   | 220   |
| Beryllium (aqua regia extractable)  | mg/kg | 0.06 | MCERTS    | 1.2   | 0.66  | 0.58  | 0.95  | 0.58  |
| Boron (water soluble)               | mg/kg | 0.2  | MCERTS    | 0.6   | 0.3   | < 0.2 | 0.8   | 0.2   |
| Cadmium (aqua regia extractable)    | mg/kg | 0.2  | MCERTS    | < 0.2 | 0.6   | < 0.2 | < 0.2 | 0.4   |
| Chromium (hexavalent)               | mg/kg | 1.2  | NONE      | 1.8   | -     | < 1.2 | < 1.2 | -     |
| Chromium (hexavalent)               | mg/kg | 1.8  | MCERTS    | -     | < 1.8 | -     | -     | < 1.8 |
| Chromium (III)                      | mg/kg | 1    | NONE      | -     | 13    | -     | -     | 22    |
| Chromium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | 22    | 13    | 14    | 22    | 22    |
| Copper (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 170   | 30    | 15    | 37    | 12    |
| Lead (aqua regia extractable)       | mg/kg | 1    | MCERTS    | 310   | 95    | 27    | 78    | 21    |
| Manganese (aqua regia extractable)  | mg/kg | 1    | MCERTS    | -     | 200   | -     | -     | 530   |
| Mercury (aqua regia extractable)    | mg/kg | 0.3  | MCERTS    | < 0.3 | < 0.3 | < 0.3 | < 0.3 | < 0.3 |
| Molybdenum (aqua regia extractable) | mg/kg | 0.25 | MCERTS    | -     | 0.86  | -     | -     | 0.29  |
| Nickel (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 31    | 15    | 12    | 20    | 20    |
| Selenium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Vanadium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | 29    | -     | 19    | 24    | -     |
| Zinc (aqua regia extractable)       | mg/kg | 1    | MCERTS    | 390   | 200   | 50    | 58    | 140   |

#### Monoaromatics & Oxygenates

|                                    |       |   |        |       |       |       |       |       |
|------------------------------------|-------|---|--------|-------|-------|-------|-------|-------|
| Benzene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                                                |       |     |        |   |       |   |   |       |
|----------------------------------------------------------------|-------|-----|--------|---|-------|---|---|-------|
| Petroleum Range Organics (C6 - C10) <small>HS_1D_TOTAL</small> | mg/kg | 0.1 | MCERTS | - | < 0.1 | - | - | < 0.1 |
|----------------------------------------------------------------|-------|-----|--------|---|-------|---|---|-------|

|                                             |       |    |        |     |    |      |    |     |
|---------------------------------------------|-------|----|--------|-----|----|------|----|-----|
| TPH C10 - C40 <small>EH_CU_1D_TOTAL</small> | mg/kg | 10 | MCERTS | 160 | 55 | < 10 | 20 | 120 |
|---------------------------------------------|-------|----|--------|-----|----|------|----|-----|

|                                                                |       |       |        |         |   |         |         |   |
|----------------------------------------------------------------|-------|-------|--------|---------|---|---------|---------|---|
| TPH-CWG - Aliphatic >EC5 - EC6 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aliphatic >EC6 - EC8 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aliphatic >EC8 - EC10 <small>HS_1D_AL</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aliphatic >EC10 - EC12 <small>EH_CU_1D_AL</small>    | mg/kg | 1     | MCERTS | < 1.0   | - | < 1.0   | < 1.0   | - |
| TPH-CWG - Aliphatic >EC12 - EC16 <small>EH_CU_1D_AL</small>    | mg/kg | 2     | MCERTS | < 2.0   | - | < 2.0   | < 2.0   | - |
| TPH-CWG - Aliphatic >EC16 - EC21 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | < 8.0   | - | < 8.0   | < 8.0   | - |
| TPH-CWG - Aliphatic >EC21 - EC35 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | 87      | - | < 8.0   | < 8.0   | - |
| TPH-CWG - Aliphatic (EC5 - EC35) <small>EH_CU+HS_1D_AL</small> | mg/kg | 10    | MCERTS | 92      | - | < 10    | < 10    | - |

|                                                               |       |       |        |         |   |         |         |   |
|---------------------------------------------------------------|-------|-------|--------|---------|---|---------|---------|---|
| TPH-CWG - Aromatic >EC5 - EC7 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aromatic >EC7 - EC8 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aromatic >EC8 - EC10 <small>HS_1D_AR</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 | - |
| TPH-CWG - Aromatic >EC10 - EC12 <small>EH_CU_1D_AR</small>    | mg/kg | 1     | MCERTS | < 1.0   | - | < 1.0   | < 1.0   | - |
| TPH-CWG - Aromatic >EC12 - EC16 <small>EH_CU_1D_AR</small>    | mg/kg | 2     | MCERTS | < 2.0   | - | < 2.0   | < 2.0   | - |
| TPH-CWG - Aromatic >EC16 - EC21 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | < 10    | - | < 10    | < 10    | - |
| TPH-CWG - Aromatic >EC21 - EC35 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | 22      | - | < 10    | 12      | - |
| TPH-CWG - Aromatic (EC5 - EC35) <small>EH_CU+HS_1D_AR</small> | mg/kg | 10    | MCERTS | 31      | - | < 10    | 20      | - |

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |  |  |  | 2387985       | 2387986            | 2387987              | 2387988       | 2387989       |
|-----------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|---------------|
| Sample Reference                        |  |  |  | TP101 ES1     | TP102 ES1          | TP102 ES2            | TP103 ES1     | TP104 ES1     |
| Sample Number                           |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                               |  |  |  | 0.40-0.70     | 0.40-0.80          | 2.20-2.40            | 1.00-1.40     | 0.80-1.20     |
| Date Sampled                            |  |  |  | 09/08/2022    | 09/08/2022         | 09/08/2022           | 09/08/2022    | 09/08/2022    |
| Time Taken                              |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |               |

#### VOCs

|                                       |       |   |           |   |       |   |   |       |
|---------------------------------------|-------|---|-----------|---|-------|---|---|-------|
| Chloromethane                         | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Chloroethane                          | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| Bromomethane                          | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Vinyl Chloride                        | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| Trichlorofluoromethane                | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| 1,1-Dichloroethene                    | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| 1,1,2-Trichloro 1,2,2-Trifluoroethane | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Cis-1,2-dichloroethene                | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether)    | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1-Dichloroethane                    | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 2,2-Dichloropropane                   | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Trichloromethane                      | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1,1-Trichloroethane                 | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,2-Dichloroethane                    | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1-Dichloropropene                   | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Trans-1,2-dichloroethene              | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| Benzene                               | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Tetrachloromethane                    | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,2-Dichloropropane                   | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Trichloroethene                       | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Dibromomethane                        | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Bromodichloromethane                  | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Cis-1,3-dichloropropene               | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Trans-1,3-dichloropropene             | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Toluene                               | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1,2-Trichloroethane                 | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,3-Dichloropropane                   | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Dibromochloromethane                  | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Tetrachloroethene                     | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| 1,2-Dibromoethane                     | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| Chlorobenzene                         | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1,1,2-Tetrachloroethane             | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Ethylbenzene                          | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| p & m-Xylene                          | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Styrene                               | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Tribromomethane                       | µg/kg | 1 | NONE      | - | < 1.0 | - | - | < 1.0 |
| o-Xylene                              | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,1,1,2,2-Tetrachloroethane           | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Isopropylbenzene                      | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Bromobenzene                          | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| n-Propylbenzene                       | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| 2-Chlorotoluene                       | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 4-Chlorotoluene                       | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,3,5-Trimethylbenzene                | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| tert-Butylbenzene                     | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,2,4-Trimethylbenzene                | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| sec-Butylbenzene                      | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,3-Dichlorobenzene                   | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| p-Isopropyltoluene                    | µg/kg | 1 | ISO 17025 | - | < 1.0 | - | - | < 1.0 |
| 1,2-Dichlorobenzene                   | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| 1,4-Dichlorobenzene                   | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |
| Butylbenzene                          | µg/kg | 1 | MCERTS    | - | < 1.0 | - | - | < 1.0 |

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                      | 2387985       | 2387986       | 2387987       | 2387988       | 2387989       |
|-----------------------------------------|-------|--------------------|----------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                      | TP101 ES1     | TP102 ES1     | TP102 ES2     | TP103 ES1     | TP104 ES1     |
| Sample Number                           |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                      | 0.40-0.70     | 0.40-0.80     | 2.20-2.40     | 1.00-1.40     | 0.80-1.20     |
| Date Sampled                            |       |                    |                      | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    |
| Time Taken                              |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation Status |               |               |               |               |               |
| 1,2-Dibromo-3-chloropropane             | µg/kg | 1                  | ISO 17025            | -             | < 1.0         | -             | -             | < 1.0         |
| 1,2,4-Trichlorobenzene                  | µg/kg | 1                  | MCERTS               | -             | < 1.0         | -             | -             | < 1.0         |
| Hexachlorobutadiene                     | µg/kg | 1                  | MCERTS               | -             | < 1.0         | -             | -             | < 1.0         |
| 1,2,3-Trichlorobenzene                  | µg/kg | 1                  | ISO 17025            | -             | < 1.0         | -             | -             | < 1.0         |

#### SVOCs

|                             |       |      |           |   |        |   |   |        |
|-----------------------------|-------|------|-----------|---|--------|---|---|--------|
| Aniline                     | mg/kg | 0.1  | NONE      | - | < 0.1  | - | - | < 0.1  |
| Phenol                      | mg/kg | 0.2  | ISO 17025 | - | < 0.2  | - | - | < 0.2  |
| 2-Chlorophenol              | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| Bis(2-chloroethyl)ether     | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| 1,3-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| 1,2-Dichlorobenzene         | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| 1,4-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| Bis(2-chloroisopropyl)ether | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| 2-Methylphenol              | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Hexachloroethane            | mg/kg | 0.05 | MCERTS    | - | < 0.05 | - | - | < 0.05 |
| Nitrobenzene                | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| 4-Methylphenol              | mg/kg | 0.2  | NONE      | - | < 0.2  | - | - | < 0.2  |
| Isophorone                  | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| 2-Nitrophenol               | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| 2,4-Dimethylphenol          | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Bis(2-chloroethoxy)methane  | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| 1,2,4-Trichlorobenzene      | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Naphthalene                 | mg/kg | 0.05 | MCERTS    | - | 0.67   | - | - | < 0.05 |
| 2,4-Dichlorophenol          | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| 4-Chloroaniline             | mg/kg | 0.1  | NONE      | - | < 0.1  | - | - | < 0.1  |
| Hexachlorobutadiene         | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| 4-Chloro-3-methylphenol     | mg/kg | 0.1  | NONE      | - | < 0.1  | - | - | < 0.1  |
| 2,4,6-Trichlorophenol       | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| 2,4,5-Trichlorophenol       | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| 2-Methylnaphthalene         | mg/kg | 0.1  | NONE      | - | < 0.1  | - | - | < 0.1  |
| 2-Chloronaphthalene         | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| Dimethylphthalate           | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| 2,6-Dinitrotoluene          | mg/kg | 0.1  | MCERTS    | - | < 0.1  | - | - | < 0.1  |
| Acenaphthylene              | mg/kg | 0.05 | MCERTS    | - | < 0.05 | - | - | < 0.05 |
| Acenaphthene                | mg/kg | 0.05 | MCERTS    | - | 1.2    | - | - | < 0.05 |
| 2,4-Dinitrotoluene          | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| Dibenzofuran                | mg/kg | 0.2  | MCERTS    | - | 0.6    | - | - | < 0.2  |
| 4-Chlorophenyl phenyl ether | mg/kg | 0.3  | ISO 17025 | - | < 0.3  | - | - | < 0.3  |
| Diethyl phthalate           | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| 4-Nitroaniline              | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| Fluorene                    | mg/kg | 0.05 | MCERTS    | - | 0.84   | - | - | < 0.05 |
| Azobenzene                  | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Bromophenyl phenyl ether    | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| Hexachlorobenzene           | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Phenanthrene                | mg/kg | 0.05 | MCERTS    | - | 7.6    | - | - | < 0.05 |
| Anthracene                  | mg/kg | 0.05 | MCERTS    | - | 1.6    | - | - | < 0.05 |
| Carbazole                   | mg/kg | 0.3  | MCERTS    | - | 0.7    | - | - | < 0.3  |
| Dibutyl phthalate           | mg/kg | 0.2  | MCERTS    | - | < 0.2  | - | - | < 0.2  |
| Anthraquinone               | mg/kg | 0.3  | MCERTS    | - | < 0.3  | - | - | < 0.3  |
| Fluoranthene                | mg/kg | 0.05 | MCERTS    | - | 9.7    | - | - | < 0.05 |
| Pyrene                      | mg/kg | 0.05 | MCERTS    | - | 8.6    | - | - | < 0.05 |
| Butyl benzyl phthalate      | mg/kg | 0.3  | ISO 17025 | - | < 0.3  | - | - | < 0.3  |

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                         | 2387985       | 2387986       | 2387987       | 2387988       | 2387989       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | TP101 ES1     | TP102 ES1     | TP102 ES2     | TP103 ES1     | TP104 ES1     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.40-0.70     | 0.40-0.80     | 2.20-2.40     | 1.00-1.40     | 0.80-1.20     |
| Date Sampled                            |       |                    |                         | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    | 09/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |               |
| Benzo(a)anthracene                      | mg/kg | 0.05               | MCERTS                  | -             | 5.7           | -             | -             | < 0.05        |
| Chrysene                                | mg/kg | 0.05               | MCERTS                  | -             | 4.3           | -             | -             | < 0.05        |
| Benzo(b)fluoranthene                    | mg/kg | 0.05               | MCERTS                  | -             | 4.8           | -             | -             | < 0.05        |
| Benzo(k)fluoranthene                    | mg/kg | 0.05               | MCERTS                  | -             | 2.6           | -             | -             | < 0.05        |
| Benzo(a)pyrene                          | mg/kg | 0.05               | MCERTS                  | -             | 4.7           | -             | -             | < 0.05        |
| Indeno(1,2,3-cd)pyrene                  | mg/kg | 0.05               | MCERTS                  | -             | 2.1           | -             | -             | < 0.05        |
| Dibenz(a,h)anthracene                   | mg/kg | 0.05               | MCERTS                  | -             | 0.61          | -             | -             | < 0.05        |
| Benzo(ghi)perylene                      | mg/kg | 0.05               | MCERTS                  | -             | 2.6           | -             | -             | < 0.05        |

#### Environmental Forensics

|                   |       |     |      |   |       |   |   |       |
|-------------------|-------|-----|------|---|-------|---|---|-------|
| Hexabromobiphenyl | mg/kg | 0.1 | NONE | - | < 0.1 | - | - | < 0.1 |
|-------------------|-------|-----|------|---|-------|---|---|-------|

#### Stockholm convention POPs list A

|       |       |   |      |   |       |   |   |       |
|-------|-------|---|------|---|-------|---|---|-------|
| Mirex | mg/kg | 1 | NONE | - | < 1.0 | - | - | < 1.0 |
|-------|-------|---|------|---|-------|---|---|-------|

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

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                         | 2387990       | 2387991       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH101 ES1     | BH101 ES2     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                            |       |                    |                         | 10/08/2022    | 11/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| Stone Content                           | %     | 0.1                | NONE                    | 33            | < 0.1         |
| Moisture Content                        | %     | 0.01               | NONE                    | 3.7           | 15            |
| Total mass of sample received           | kg    | 0.001              | NONE                    | 1.3           | 0.3           |

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

#### General Inorganics

|                                                                         |          |         |        |          |       |
|-------------------------------------------------------------------------|----------|---------|--------|----------|-------|
| pH - Automated                                                          | pH Units | N/A     | MCERTS | 11.7     | 11.6  |
| Total Cyanide                                                           | mg/kg    | 1       | MCERTS | < 1.0    | < 1.0 |
| Total Sulphate as SO <sub>4</sub>                                       | mg/kg    | 50      | MCERTS | 1700     | 1700  |
| Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent) | g/l      | 0.00125 | MCERTS | < 0.0013 | 0.68  |
| Sulphide                                                                | mg/kg    | 1       | MCERTS | 2.7      | 3.8   |
| Ammoniacal Nitrogen as NH <sub>3</sub>                                  | mg/kg    | 0.5     | MCERTS | -        | -     |
| Total Organic Carbon (TOC) - Automated                                  | %        | 0.1     | MCERTS | 0.2      | < 0.1 |

#### Total Phenols

|                            |       |   |        |       |       |
|----------------------------|-------|---|--------|-------|-------|
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
|----------------------------|-------|---|--------|-------|-------|

#### Speciated PAHs

|                        |       |      |        |        |        |
|------------------------|-------|------|--------|--------|--------|
| Naphthalene            | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Acenaphthylene         | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Acenaphthene           | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Fluorene               | mg/kg | 0.05 | MCERTS | 0.21   | < 0.05 |
| Phenanthrene           | mg/kg | 0.05 | MCERTS | 1      | < 0.05 |
| Anthracene             | mg/kg | 0.05 | MCERTS | 0.18   | < 0.05 |
| Fluoranthene           | mg/kg | 0.05 | MCERTS | 0.45   | < 0.05 |
| Pyrene                 | mg/kg | 0.05 | MCERTS | 0.58   | < 0.05 |
| Benzo(a)anthracene     | mg/kg | 0.05 | MCERTS | 0.34   | < 0.05 |
| Chrysene               | mg/kg | 0.05 | MCERTS | 0.22   | < 0.05 |
| Benzo(b)fluoranthene   | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Benzo(k)fluoranthene   | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Benzo(a)pyrene         | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Dibenz(a,h)anthracene  | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |
| Benzo(ghi)perylene     | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 |

#### Total PAH

|                             |       |     |        |      |        |
|-----------------------------|-------|-----|--------|------|--------|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 2.98 | < 0.80 |
|-----------------------------|-------|-----|--------|------|--------|

Analytical Report Number: 22-78035  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                      | 2387990       | 2387991       |
|-----------------------------------------|-------|--------------------|----------------------|---------------|---------------|
| Sample Reference                        |       |                    |                      | BH101 ES1     | BH101 ES2     |
| Sample Number                           |       |                    |                      | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                      | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                            |       |                    |                      | 10/08/2022    | 11/08/2022    |
| Time Taken                              |       |                    |                      | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation Status |               |               |
| <b>Heavy Metals / Metalloids</b>        |       |                    |                      |               |               |
| Antimony (aqua regia extractable)       | mg/kg | 1                  | ISO 17025            | -             | -             |
| Arsenic (aqua regia extractable)        | mg/kg | 1                  | MCERTS               | 15            | 4             |
| Barium (aqua regia extractable)         | mg/kg | 1                  | MCERTS               | 39            | 53            |
| Beryllium (aqua regia extractable)      | mg/kg | 0.06               | MCERTS               | 0.28          | 0.26          |
| Boron (water soluble)                   | mg/kg | 0.2                | MCERTS               | 0.6           | 0.4           |
| Cadmium (aqua regia extractable)        | mg/kg | 0.2                | MCERTS               | < 0.2         | 0.3           |
| Chromium (hexavalent)                   | mg/kg | 1.2                | NONE                 | < 1.2         | < 1.2         |
| Chromium (hexavalent)                   | mg/kg | 1.8                | MCERTS               | -             | -             |
| Chromium (III)                          | mg/kg | 1                  | NONE                 | -             | -             |
| Chromium (aqua regia extractable)       | mg/kg | 1                  | MCERTS               | 8.9           | 12            |
| Copper (aqua regia extractable)         | mg/kg | 1                  | MCERTS               | 12            | 11            |
| Lead (aqua regia extractable)           | mg/kg | 1                  | MCERTS               | 28            | 7             |
| Manganese (aqua regia extractable)      | mg/kg | 1                  | MCERTS               | -             | -             |
| Mercury (aqua regia extractable)        | mg/kg | 0.3                | MCERTS               | < 0.3         | < 0.3         |
| Molybdenum (aqua regia extractable)     | mg/kg | 0.25               | MCERTS               | -             | -             |
| Nickel (aqua regia extractable)         | mg/kg | 1                  | MCERTS               | 7.1           | 7.6           |
| Selenium (aqua regia extractable)       | mg/kg | 1                  | MCERTS               | < 1.0         | < 1.0         |
| Vanadium (aqua regia extractable)       | mg/kg | 1                  | MCERTS               | 15            | 13            |
| Zinc (aqua regia extractable)           | mg/kg | 1                  | MCERTS               | 56            | 33            |

#### Monoaromatics & Oxygenates

|                                    |       |   |        |       |       |
|------------------------------------|-------|---|--------|-------|-------|
| Benzene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
| Toluene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
| o-xylene                           | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                                                |       |     |        |   |   |
|----------------------------------------------------------------|-------|-----|--------|---|---|
| Petroleum Range Organics (C6 - C10) <small>HS_1D_TOTAL</small> | mg/kg | 0.1 | MCERTS | - | - |
|----------------------------------------------------------------|-------|-----|--------|---|---|

|                                             |       |    |        |    |      |
|---------------------------------------------|-------|----|--------|----|------|
| TPH C10 - C40 <small>EH_CU_1D_TOTAL</small> | mg/kg | 10 | MCERTS | 14 | < 10 |
|---------------------------------------------|-------|----|--------|----|------|

|                                                                |       |       |        |         |         |
|----------------------------------------------------------------|-------|-------|--------|---------|---------|
| TPH-CWG - Aliphatic >EC5 - EC6 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC6 - EC8 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC8 - EC10 <small>HS_1D_AL</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC10 - EC12 <small>EH_CU_1D_AL</small>    | mg/kg | 1     | MCERTS | < 1.0   | < 1.0   |
| TPH-CWG - Aliphatic >EC12 - EC16 <small>EH_CU_1D_AL</small>    | mg/kg | 2     | MCERTS | < 2.0   | < 2.0   |
| TPH-CWG - Aliphatic >EC16 - EC21 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | < 8.0   | < 8.0   |
| TPH-CWG - Aliphatic >EC21 - EC35 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | < 8.0   | < 8.0   |
| TPH-CWG - Aliphatic (EC5 - EC35) <small>EH_CU+HS_1D_AL</small> | mg/kg | 10    | MCERTS | < 10    | < 10    |

|                                                               |       |       |        |         |         |
|---------------------------------------------------------------|-------|-------|--------|---------|---------|
| TPH-CWG - Aromatic >EC5 - EC7 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC7 - EC8 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC8 - EC10 <small>HS_1D_AR</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC10 - EC12 <small>EH_CU_1D_AR</small>    | mg/kg | 1     | MCERTS | < 1.0   | < 1.0   |
| TPH-CWG - Aromatic >EC12 - EC16 <small>EH_CU_1D_AR</small>    | mg/kg | 2     | MCERTS | < 2.0   | < 2.0   |
| TPH-CWG - Aromatic >EC16 - EC21 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | < 10    | < 10    |
| TPH-CWG - Aromatic >EC21 - EC35 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | < 10    | < 10    |
| TPH-CWG - Aromatic (EC5 - EC35) <small>EH_CU+HS_1D_AR</small> | mg/kg | 10    | MCERTS | 14      | < 10    |

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| Lab Sample Number                       |       |                    |                         | 2387990       | 2387991       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH101 ES1     | BH101 ES2     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                            |       |                    |                         | 10/08/2022    | 11/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| <b>VOCs</b>                             |       |                    |                         |               |               |
| Chloromethane                           | µg/kg | 1                  | ISO 17025               | -             | -             |
| Chloroethane                            | µg/kg | 1                  | NONE                    | -             | -             |
| Bromomethane                            | µg/kg | 1                  | ISO 17025               | -             | -             |
| Vinyl Chloride                          | µg/kg | 1                  | NONE                    | -             | -             |
| Trichlorofluoromethane                  | µg/kg | 1                  | NONE                    | -             | -             |
| 1,1-Dichloroethene                      | µg/kg | 1                  | NONE                    | -             | -             |
| 1,1,2-Trichloro 1,2,2-Trifluoroethane   | µg/kg | 1                  | ISO 17025               | -             | -             |
| Cis-1,2-dichloroethene                  | µg/kg | 1                  | MCERTS                  | -             | -             |
| MTBE (Methyl Tertiary Butyl Ether)      | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1-Dichloroethane                      | µg/kg | 1                  | MCERTS                  | -             | -             |
| 2,2-Dichloropropane                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| Trichloromethane                        | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1,1-Trichloroethane                   | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,2-Dichloroethane                      | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1-Dichloropropene                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| Trans-1,2-dichloroethene                | µg/kg | 1                  | NONE                    | -             | -             |
| Benzene                                 | µg/kg | 1                  | MCERTS                  | -             | -             |
| Tetrachloromethane                      | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,2-Dichloropropane                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| Trichloroethene                         | µg/kg | 1                  | MCERTS                  | -             | -             |
| Dibromomethane                          | µg/kg | 1                  | MCERTS                  | -             | -             |
| Bromodichloromethane                    | µg/kg | 1                  | MCERTS                  | -             | -             |
| Cis-1,3-dichloropropene                 | µg/kg | 1                  | ISO 17025               | -             | -             |
| Trans-1,3-dichloropropene               | µg/kg | 1                  | ISO 17025               | -             | -             |
| Toluene                                 | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1,2-Trichloroethane                   | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,3-Dichloropropane                     | µg/kg | 1                  | ISO 17025               | -             | -             |
| Dibromochloromethane                    | µg/kg | 1                  | ISO 17025               | -             | -             |
| Tetrachloroethene                       | µg/kg | 1                  | NONE                    | -             | -             |
| 1,2-Dibromoethane                       | µg/kg | 1                  | ISO 17025               | -             | -             |
| Chlorobenzene                           | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1,1,2-Tetrachloroethane               | µg/kg | 1                  | MCERTS                  | -             | -             |
| Ethylbenzene                            | µg/kg | 1                  | MCERTS                  | -             | -             |
| p & m-Xylene                            | µg/kg | 1                  | MCERTS                  | -             | -             |
| Styrene                                 | µg/kg | 1                  | MCERTS                  | -             | -             |
| Tribromomethane                         | µg/kg | 1                  | NONE                    | -             | -             |
| o-Xylene                                | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,1,2,2-Tetrachloroethane               | µg/kg | 1                  | MCERTS                  | -             | -             |
| Isopropylbenzene                        | µg/kg | 1                  | MCERTS                  | -             | -             |
| Bromobenzene                            | µg/kg | 1                  | MCERTS                  | -             | -             |
| n-Propylbenzene                         | µg/kg | 1                  | ISO 17025               | -             | -             |
| 2-Chlorotoluene                         | µg/kg | 1                  | MCERTS                  | -             | -             |
| 4-Chlorotoluene                         | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,3,5-Trimethylbenzene                  | µg/kg | 1                  | ISO 17025               | -             | -             |
| tert-Butylbenzene                       | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,2,4-Trimethylbenzene                  | µg/kg | 1                  | ISO 17025               | -             | -             |
| sec-Butylbenzene                        | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,3-Dichlorobenzene                     | µg/kg | 1                  | ISO 17025               | -             | -             |
| p-Isopropyltoluene                      | µg/kg | 1                  | ISO 17025               | -             | -             |
| 1,2-Dichlorobenzene                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,4-Dichlorobenzene                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| Butylbenzene                            | µg/kg | 1                  | MCERTS                  | -             | -             |

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| Lab Sample Number                       |       |                    |                         | 2387990       | 2387991       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH101 ES1     | BH101 ES2     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                            |       |                    |                         | 10/08/2022    | 11/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| 1,2-Dibromo-3-chloropropane             | µg/kg | 1                  | ISO 17025               | -             | -             |
| 1,2,4-Trichlorobenzene                  | µg/kg | 1                  | MCERTS                  | -             | -             |
| Hexachlorobutadiene                     | µg/kg | 1                  | MCERTS                  | -             | -             |
| 1,2,3-Trichlorobenzene                  | µg/kg | 1                  | ISO 17025               | -             | -             |

#### SVOCs

|                             |       |      |           |   |   |
|-----------------------------|-------|------|-----------|---|---|
| Aniline                     | mg/kg | 0.1  | NONE      | - | - |
| Phenol                      | mg/kg | 0.2  | ISO 17025 | - | - |
| 2-Chlorophenol              | mg/kg | 0.1  | MCERTS    | - | - |
| Bis(2-chloroethyl)ether     | mg/kg | 0.2  | MCERTS    | - | - |
| 1,3-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | - |
| 1,2-Dichlorobenzene         | mg/kg | 0.1  | MCERTS    | - | - |
| 1,4-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | - |
| Bis(2-chloroisopropyl)ether | mg/kg | 0.1  | MCERTS    | - | - |
| 2-Methylphenol              | mg/kg | 0.3  | MCERTS    | - | - |
| Hexachloroethane            | mg/kg | 0.05 | MCERTS    | - | - |
| Nitrobenzene                | mg/kg | 0.3  | MCERTS    | - | - |
| 4-Methylphenol              | mg/kg | 0.2  | NONE      | - | - |
| Isophorone                  | mg/kg | 0.2  | MCERTS    | - | - |
| 2-Nitrophenol               | mg/kg | 0.3  | MCERTS    | - | - |
| 2,4-Dimethylphenol          | mg/kg | 0.3  | MCERTS    | - | - |
| Bis(2-chloroethoxy)methane  | mg/kg | 0.3  | MCERTS    | - | - |
| 1,2,4-Trichlorobenzene      | mg/kg | 0.3  | MCERTS    | - | - |
| Naphthalene                 | mg/kg | 0.05 | MCERTS    | - | - |
| 2,4-Dichlorophenol          | mg/kg | 0.3  | MCERTS    | - | - |
| 4-Chloroaniline             | mg/kg | 0.1  | NONE      | - | - |
| Hexachlorobutadiene         | mg/kg | 0.1  | MCERTS    | - | - |
| 4-Chloro-3-methylphenol     | mg/kg | 0.1  | NONE      | - | - |
| 2,4,6-Trichlorophenol       | mg/kg | 0.1  | MCERTS    | - | - |
| 2,4,5-Trichlorophenol       | mg/kg | 0.2  | MCERTS    | - | - |
| 2-Methylnaphthalene         | mg/kg | 0.1  | NONE      | - | - |
| 2-Chloronaphthalene         | mg/kg | 0.1  | MCERTS    | - | - |
| Dimethylphthalate           | mg/kg | 0.1  | MCERTS    | - | - |
| 2,6-Dinitrotoluene          | mg/kg | 0.1  | MCERTS    | - | - |
| Acenaphthylene              | mg/kg | 0.05 | MCERTS    | - | - |
| Acenaphthene                | mg/kg | 0.05 | MCERTS    | - | - |
| 2,4-Dinitrotoluene          | mg/kg | 0.2  | MCERTS    | - | - |
| Dibenzofuran                | mg/kg | 0.2  | MCERTS    | - | - |
| 4-Chlorophenyl phenyl ether | mg/kg | 0.3  | ISO 17025 | - | - |
| Diethyl phthalate           | mg/kg | 0.2  | MCERTS    | - | - |
| 4-Nitroaniline              | mg/kg | 0.2  | MCERTS    | - | - |
| Fluorene                    | mg/kg | 0.05 | MCERTS    | - | - |
| Azobenzene                  | mg/kg | 0.3  | MCERTS    | - | - |
| Bromophenyl phenyl ether    | mg/kg | 0.2  | MCERTS    | - | - |
| Hexachlorobenzene           | mg/kg | 0.3  | MCERTS    | - | - |
| Phenanthrene                | mg/kg | 0.05 | MCERTS    | - | - |
| Anthracene                  | mg/kg | 0.05 | MCERTS    | - | - |
| Carbazole                   | mg/kg | 0.3  | MCERTS    | - | - |
| Dibutyl phthalate           | mg/kg | 0.2  | MCERTS    | - | - |
| Anthraquinone               | mg/kg | 0.3  | MCERTS    | - | - |
| Fluoranthene                | mg/kg | 0.05 | MCERTS    | - | - |
| Pyrene                      | mg/kg | 0.05 | MCERTS    | - | - |
| Butyl benzyl phthalate      | mg/kg | 0.3  | ISO 17025 | - | - |

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| Lab Sample Number                       |       |                    |                         | 2387990       | 2387991       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH101 ES1     | BH101 ES2     |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                            |       |                    |                         | 10/08/2022    | 11/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| Benzo(a)anthracene                      | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Chrysene                                | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Benzo(b)fluoranthene                    | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Benzo(k)fluoranthene                    | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Benzo(a)pyrene                          | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Indeno(1,2,3-cd)pyrene                  | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Dibenz(a,h)anthracene                   | mg/kg | 0.05               | MCERTS                  | -             | -             |
| Benzo(ghi)perylene                      | mg/kg | 0.05               | MCERTS                  | -             | -             |

#### Environmental Forensics

|                   |       |     |      |   |   |
|-------------------|-------|-----|------|---|---|
| Hexabromobiphenyl | mg/kg | 0.1 | NONE | - | - |
|-------------------|-------|-----|------|---|---|

#### Stockholm convention POPs list A

|       |       |   |      |   |   |
|-------|-------|---|------|---|---|
| Mirex | mg/kg | 1 | NONE | - | - |
|-------|-------|---|------|---|---|

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



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| Lab Sample Number                           |  |  |  | 2387992       | 2387993            | 2387994              | 2387995       | 2387996       |
|---------------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|---------------|
| Sample Reference                            |  |  |  | TP101 ES1     | TP102 ES2          | TP105 ES1            | BH101 ES1     | BH101 ES2     |
| Sample Number                               |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                                   |  |  |  | 0.40-0.70     | 2.20-2.40          | 0.40-0.80            | 0.50-0.80     | 1.50-1.80     |
| Date Sampled                                |  |  |  | 09/08/2022    | 09/08/2022         | 09/08/2022           | 10/08/2022    | 11/08/2022    |
| Time Taken                                  |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter<br>(Leachate Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |               |

#### General Inorganics

|                             |          |     |           |       |       |       |       |       |
|-----------------------------|----------|-----|-----------|-------|-------|-------|-------|-------|
| pH (automated)              | pH Units | N/A | ISO 17025 | 7.9   | 7.5   | 7.7   | 11.1  | 12    |
| Total Cyanide               | µg/l     | 10  | ISO 17025 | < 10  | < 10  | < 10  | 13    | 13    |
| Sulphate as SO <sub>4</sub> | mg/l     | 0.1 | ISO 17025 | 4.1   | 3.4   | 79.6  | 11.1  | 6.6   |
| Sulphide                    | µg/l     | 5   | NONE      | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Total Organic Carbon (TOC)  | mg/l     | 0.1 | NONE      | 6.65  | 11.7  | 6.42  | 5.28  | 4.64  |

#### Total Phenols

|                            |      |    |           |      |      |      |      |    |
|----------------------------|------|----|-----------|------|------|------|------|----|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | < 10 | < 10 | < 10 | < 10 | 16 |
|----------------------------|------|----|-----------|------|------|------|------|----|

#### Speciated PAHs

|                        |      |      |           |        |        |        |        |        |
|------------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | NONE      | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | NONE      | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | NONE      | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |     |      |       |       |       |       |       |
|-------------------|------|-----|------|-------|-------|-------|-------|-------|
| Total EPA-16 PAHs | µg/l | 0.2 | NONE | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
|-------------------|------|-----|------|-------|-------|-------|-------|-------|

#### Heavy Metals / Metalloids

|                       |      |      |           |        |        |        |        |        |
|-----------------------|------|------|-----------|--------|--------|--------|--------|--------|
| Arsenic (dissolved)   | µg/l | 1    | ISO 17025 | 7.2    | 2.1    | 1.7    | 8      | 2      |
| Barium (dissolved)    | µg/l | 0.05 | ISO 17025 | 14     | 4.8    | 11     | 18     | 720    |
| Beryllium (dissolved) | µg/l | 0.2  | ISO 17025 | 0.3    | 0.3    | 0.2    | 0.3    | 0.2    |
| Boron (dissolved)     | µg/l | 10   | ISO 17025 | 19     | 13     | 38     | 26     | < 10   |
| Cadmium (dissolved)   | µg/l | 0.08 | ISO 17025 | < 0.08 | < 0.08 | < 0.08 | < 0.08 | < 0.08 |
| Chromium (dissolved)  | µg/l | 0.4  | ISO 17025 | 1.7    | 0.9    | 1.4    | 3.5    | 2.5    |
| Copper (dissolved)    | µg/l | 0.7  | ISO 17025 | 3.2    | 15     | 19     | 21     | 1.9    |
| Lead (dissolved)      | µg/l | 1    | ISO 17025 | 2.5    | 3.4    | 3.2    | 2.9    | 7.2    |
| Mercury (dissolved)   | µg/l | 0.5  | ISO 17025 | < 0.5  | 1.1    | 0.8    | < 0.5  | < 0.5  |
| Nickel (dissolved)    | µg/l | 0.3  | ISO 17025 | 3.7    | 4      | 4.6    | 4.2    | 3.3    |
| Selenium (dissolved)  | µg/l | 4    | ISO 17025 | < 4.0  | < 4.0  | < 4.0  | < 4.0  | < 4.0  |
| Vanadium (dissolved)  | µg/l | 1.7  | ISO 17025 | 4.1    | 2.6    | 1.8    | 15     | 4      |
| Zinc (dissolved)      | µg/l | 0.4  | ISO 17025 | 5      | 7.7    | 13     | 8.2    | 4.8    |

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

**Analytical Report Number : 22-78035**
**Project / Site name: Deansgate, 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 *               |
|-------------------|------------------|---------------|-----------|------------------------------------|
| 2387985           | TP101 ES1        | None Supplied | 0.40-0.70 | Brown sand with gravel.            |
| 2387986           | TP102 ES1        | None Supplied | 0.40-0.80 | Brown clay and sand with gravel.   |
| 2387987           | TP102 ES2        | None Supplied | 2.20-2.40 | Brown sand with gravel.            |
| 2387988           | TP103 ES1        | None Supplied | 1.00-1.40 | Brown sand with gravel and stones. |
| 2387989           | TP104 ES1        | None Supplied | 0.80-1.20 | Brown sand with gravel and stones. |
| 2387990           | BH101 ES1        | None Supplied | 0.50-0.80 | Brown sand with gravel and stones. |
| 2387991           | BH101 ES2        | None Supplied | 1.50-1.80 | Brown sand with gravel.            |

**Analytical Report Number : 22-78035**

**Project / Site name: Deansgate, 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 |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Sulphate, water soluble, in soil (16hr extraction) | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).              | In house method.                                                                                                | L038-PL       | D                  | MCERTS               |
| Metals in soil by ICP-OES                          | Determination of metals in soil by aqua-regia digestion followed by ICP-OES.                                                                                           | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L038-PL       | D                  | MCERTS               |
| NRA Leachate Prep                                  | 10:1 extract with de-ionised water shaken for 24 hours then filtered.                                                                                                  | In-house method based on National Rivers Authority                                                              | L020-PL       | W                  | NONE                 |
| 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                                                                                | A001-PL       | D                  | ISO 17025            |
| Metals by ICP-OES in leachate                      | Determination of metals in leachate by acidification followed by ICP-OES.                                                                                              | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| Boron in leachate                                  | Determination of boron in leachate. Sample acidified and followed by ICP-OES.                                                                                          | In-house method based on MEWAM                                                                                  | L039-PL       | W                  | ISO 17025            |
| Boron, water soluble, in soil                      | Determination of water soluble boron in soil by hot water extract followed by ICP-OES.                                                                                 | In-house method based on Second Site Properties version 3                                                       | L038-PL       | D                  | MCERTS               |
| Moisture Content                                   | Moisture content, determined gravimetrically. (30 oC)                                                                                                                  | In house method.                                                                                                | L019-UK/PL    | W                  | NONE                 |
| Monohydric phenols in leachate                     | 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 (skalar) | L080-PL       | W                  | ISO 17025            |
| Monohydric phenols in soil                         | Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.                                                 | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL       | W                  | MCERTS               |
| Speciated EPA-16 PAHs in leachate                  | Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.                        | In-house method based on USEPA 8270                                                                             | L102B-PL      | W                  | ISO 17025            |
| Speciated EPA-16 PAHs in soil                      | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.                 | In-house method based on USEPA 8270                                                                             | L064-PL       | D                  | MCERTS               |
| pH in soil (automated)                             | Determination of pH in soil by addition of water followed by automated electrometric measurement.                                                                      | In house method.                                                                                                | L099-PL       | D                  | MCERTS               |
| pH at 20oC in leachate (automated)                 | Determination of pH in leachate by electrometric measurement.                                                                                                          | In house method.                                                                                                | L099B         | W                  | ISO 17025            |
| PRO (Soil)                                         | Determination of hydrocarbons C6-C10 by headspace GC-MS.                                                                                                               | In-house method based on USEPA8260                                                                              | L088-PL       | W                  | MCERTS               |
| Sulphide in leachate                               | Determination of sulphide in leachate by ion selective electrode.                                                                                                      | In-house method                                                                                                 | L010-PL       | W                  | NONE                 |
| Sulphide in soil                                   | Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode. | In-house method                                                                                                 | L010-PL       | D                  | MCERTS               |

**Analytical Report Number : 22-78035**

**Project / Site name: Deansgate, 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 |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Total sulphate (as SO <sub>4</sub> in soil) | Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.                                                               | In house method.                                                                                                | L038-PL       | D                  | MCERTS               |
| Stones content of soil                      | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.                           | In-house method based on British Standard Methods and MCERTS requirements.                                      | L019-UK/PL    | D                  | NONE                 |
| Semi-volatile organic compounds in soil     | Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.                               | In-house method based on USEPA 8270                                                                             | L064-PL       | D                  | MCERTS               |
| Total cyanide in leachate                   | Determination of total cyanide by distillation followed by colorimetry.                                                                               | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| Total cyanide in soil                       | Determination of total cyanide by distillation followed by colorimetry.                                                                               | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | MCERTS               |
| Total organic carbon in leachate            | 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          | L037-PL       | W                  | NONE                 |
| Total organic carbon (Automated) in soil    | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.                         | In house method.                                                                                                | L009-PL       | D                  | MCERTS               |
| Volatile organic compounds in soil          | Determination of volatile organic compounds in soil by headspace GC-MS.                                                                               | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | MCERTS               |
| BTEX and MTBE in soil (Monoaromatics)       | Determination of BTEX in soil by headspace GC-MS.                                                                                                     | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | MCERTS               |
| Ammonia as NH <sub>3</sub> 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          | L082-PL       | W                  | MCERTS               |
| Cr (III) in soil                            | In-house method by calculation from total Cr and Cr VI.                                                                                               | In-house method by calculation                                                                                  | L080-PL       | W                  | NONE                 |
| TPHCWG (Soil)                               | Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.                                                                             | In-house method with silica gel split/clean up.                                                                 | L088/76-PL    | W                  | MCERTS               |
| TPH Banding in Soil by FID                  | Determination of hexane extractable hydrocarbons in soil by GC-FID.                                                                                   | In-house method, TPH with carbon banding and silica gel split/cleanup.                                          | L076-PL       | D                  | MCERTS               |
| EF - Hexabromobiphenyl in soil by GC-Q      | Hexabromobiphenyl by GC-Q                                                                                                                             | In-house method                                                                                                 | UK            | W                  | NONE                 |
| EF - Annex A POPs                           | Annex A POPs                                                                                                                                          | In house method - Annex A POPs                                                                                  | UK            | W                  | NONE                 |
| Sulphate in leachates                       | Determination of sulphate in leachate by acidification followed by ICP-OES.                                                                           | In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil <sup>100</sup>              | L039-PL       | W                  | ISO 17025            |
| Hexavalent chromium in soil (Lower Level)   | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry. | In-house method                                                                                                 | L080-PL       | W                  | NONE                 |

**Analytical Report Number : 22-78035**

**Project / Site name: Deansgate, 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 |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|--------------------|----------------------|
| 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               |
| D.O. for Gravimetric Quant if Screen/ID positive | Dependent option for Gravimetric Quant if Screen/ID positive scheduled.                                                           | In house asbestos methods A001 & A006. | A006-PL       | D                  | NONE                 |

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

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

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

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

## 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 - understore to separate acronyms (exception for +)           |
| +       | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total     |

**Mitchell Tucker**

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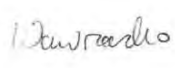
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## **Analytical Report Number : 22-78037**

|                             |                       |                                                        |            |
|-----------------------------|-----------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | Deansgate, Manchester | <b>Samples received on:</b>                            | 16/08/2022 |
| <b>Your job number:</b>     | 2006023 001           | <b>Samples instructed on/<br/>Analysis started on:</b> | 16/08/2022 |
| <b>Your order number:</b>   |                       | <b>Analysis completed by:</b>                          | 31/08/2022 |
| <b>Report Issue Number:</b> | 1                     | <b>Report issued on:</b>                               | 31/08/2022 |
| <b>Samples Analysed:</b>    | 2 10:1 WAC samples    |                                                        |            |

  
**Signed:**

Joanna Wawrzeczko  
Reporting Specialist  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

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

## i2 Analytical

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### Waste Acceptance Criteria Analytical Results

| Waste Acceptance Criteria Analytical Results                                                                         |                       |  |  |          |                                                    |                                                               |                          |
|----------------------------------------------------------------------------------------------------------------------|-----------------------|--|--|----------|----------------------------------------------------|---------------------------------------------------------------|--------------------------|
| Report No:                                                                                                           | 22-78037              |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Client: TWEEDIE                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Location                                                                                                             | Deansgate, Manchester |  |  |          |                                                    |                                                               |                          |
| Lab Reference (Sample Number)                                                                                        | 2388001 / 2388002     |  |  |          | Landfill Waste Acceptance Criteria                 |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Limits                                             |                                                               |                          |
| Sampling Date                                                                                                        | 09/08/2022            |  |  |          | Inert Waste Landfill                               | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| Sample ID                                                                                                            | TP102 ES1             |  |  |          |                                                    |                                                               |                          |
| Depth (m)                                                                                                            | 0.40-0.80             |  |  |          |                                                    |                                                               |                          |
| Solid Waste Analysis                                                                                                 |                       |  |  |          |                                                    |                                                               |                          |
| TOC (%)**                                                                                                            | 0.7                   |  |  |          | 3%                                                 | 5%                                                            | 6%                       |
| Loss on Ignition (%) **                                                                                              | 2.7                   |  |  |          | --                                                 | --                                                            | 10%                      |
| BTEX (µg/kg) **                                                                                                      | < 10                  |  |  |          | 6000                                               | --                                                            | --                       |
| Sum of PCBs (mg/kg) **                                                                                               | < 0.007               |  |  |          | 1                                                  | --                                                            | --                       |
| Mineral Oil (mg/kg) <small>EH_ID_CU_AL</small>                                                                       | < 10                  |  |  |          | 500                                                | --                                                            | --                       |
| Total PAH (WAC-17) (mg/kg)                                                                                           | 57.6                  |  |  |          | 100                                                | --                                                            | --                       |
| pH (units)**                                                                                                         | 8.5                   |  |  |          | --                                                 | >6                                                            | --                       |
| Acid Neutralisation Capacity (mmol / kg)                                                                             | 10                    |  |  |          | --                                                 | To be evaluated                                               | To be evaluated          |
| Eluate Analysis                                                                                                      | 10:1                  |  |  | 10:1     | Limit values for compliance leaching test          |                                                               |                          |
| (BS EN 12457 - 2 preparation utilising end over end leaching procedure)                                              | mg/l                  |  |  | mg/kg    | using BS EN 12457-2 at L/S 10 l/kg (mg/kg)         |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Arsenic *                                                                                                            | 0.0047                |  |  | 0.0431   | 0.5                                                | 2                                                             | 25                       |
| Barium *                                                                                                             | 0.0191                |  |  | 0.174    | 20                                                 | 100                                                           | 300                      |
| Cadmium *                                                                                                            | < 0.0001              |  |  | < 0.0008 | 0.04                                               | 1                                                             | 5                        |
| Chromium *                                                                                                           | 0.0045                |  |  | 0.041    | 0.5                                                | 10                                                            | 70                       |
| Copper *                                                                                                             | 0.037                 |  |  | 0.34     | 2                                                  | 50                                                            | 100                      |
| Mercury *                                                                                                            | < 0.0005              |  |  | < 0.0050 | 0.01                                               | 0.2                                                           | 2                        |
| Molybdenum *                                                                                                         | 0.0056                |  |  | 0.0514   | 0.5                                                | 10                                                            | 30                       |
| Nickel *                                                                                                             | 0.0065                |  |  | 0.059    | 0.4                                                | 10                                                            | 40                       |
| Lead *                                                                                                               | 0.0094                |  |  | 0.086    | 0.5                                                | 10                                                            | 50                       |
| Antimony *                                                                                                           | < 0.0017              |  |  | < 0.017  | 0.06                                               | 0.7                                                           | 5                        |
| Selenium *                                                                                                           | < 0.0040              |  |  | < 0.040  | 0.1                                                | 0.5                                                           | 7                        |
| Zinc *                                                                                                               | 0.0063                |  |  | 0.057    | 4                                                  | 50                                                            | 200                      |
| Chloride *                                                                                                           | 11                    |  |  | 98       | 800                                                | 15000                                                         | 25000                    |
| Fluoride                                                                                                             | 0.44                  |  |  | 4.0      | 10                                                 | 150                                                           | 500                      |
| Sulphate *                                                                                                           | 16                    |  |  | 140      | 1000                                               | 20000                                                         | 50000                    |
| TDS*                                                                                                                 | 240                   |  |  | 2200     | 4000                                               | 60000                                                         | 100000                   |
| Phenol Index (Monohydric Phenols) *                                                                                  | < 0.010               |  |  | < 0.10   | 1                                                  | -                                                             | -                        |
| DOC                                                                                                                  | 7.22                  |  |  | 65.7     | 500                                                | 800                                                           | 1000                     |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Leach Test Information                                                                                               |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Stone Content (%)                                                                                                    | < 0.1                 |  |  |          |                                                    |                                                               |                          |
| Sample Mass (kg)                                                                                                     | 1.3                   |  |  |          |                                                    |                                                               |                          |
| Dry Matter (%)                                                                                                       | 89                    |  |  |          |                                                    |                                                               |                          |
| Moisture (%)                                                                                                         | 11                    |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| 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.

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### Waste Acceptance Criteria Analytical Results

| Waste Acceptance Criteria Analytical Results                                                                         |                       |  |  |          |                                                    |                                                               |                          |
|----------------------------------------------------------------------------------------------------------------------|-----------------------|--|--|----------|----------------------------------------------------|---------------------------------------------------------------|--------------------------|
| Report No:                                                                                                           | 22-78037              |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Client: TWEEDIE                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Location                                                                                                             | Deansgate, Manchester |  |  |          |                                                    |                                                               |                          |
| Lab Reference (Sample Number)                                                                                        | 2388003 / 2388004     |  |  |          | Landfill Waste Acceptance Criteria                 |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Limits                                             |                                                               |                          |
| Sampling Date                                                                                                        | 09/08/2022            |  |  |          | Inert Waste Landfill                               | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| Sample ID                                                                                                            | TP104 ES1             |  |  |          |                                                    |                                                               |                          |
| Depth (m)                                                                                                            | 0.80-1.20             |  |  |          |                                                    |                                                               |                          |
| Solid Waste Analysis                                                                                                 |                       |  |  |          |                                                    |                                                               |                          |
| TOC (%)**                                                                                                            | 0.3                   |  |  |          | 3%                                                 | 5%                                                            | 6%                       |
| Loss on Ignition (%) **                                                                                              | 1.7                   |  |  |          | --                                                 | --                                                            | 10%                      |
| BTEX (µg/kg) **                                                                                                      | < 10                  |  |  |          | 6000                                               | --                                                            | --                       |
| Sum of PCBs (mg/kg) **                                                                                               | 0.051                 |  |  |          | 1                                                  | --                                                            | --                       |
| Mineral Oil (mg/kg) <small>EH_ID_CU_AL</small>                                                                       | 130                   |  |  |          | 500                                                | --                                                            | --                       |
| Total PAH (WAC-17) (mg/kg)                                                                                           | < 0.85                |  |  |          | 100                                                | --                                                            | --                       |
| pH (units)**                                                                                                         | 9.8                   |  |  |          | --                                                 | >6                                                            | --                       |
| Acid Neutralisation Capacity (mmol / kg)                                                                             | 12                    |  |  |          | --                                                 | To be evaluated                                               | To be evaluated          |
| Eluate Analysis                                                                                                      | 10:1                  |  |  | 10:1     | Limit values for compliance leaching test          |                                                               |                          |
| (BS EN 12457 - 2 preparation utilising end over end leaching procedure)                                              | mg/l                  |  |  | mg/kg    | using BS EN 12457-2 at L/S 10 l/kg (mg/kg)         |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Arsenic *                                                                                                            | 0.0012                |  |  | 0.0112   | 0.5                                                | 2                                                             | 25                       |
| Barium *                                                                                                             | 0.0181                |  |  | 0.163    | 20                                                 | 100                                                           | 300                      |
| Cadmium *                                                                                                            | < 0.0001              |  |  | < 0.0008 | 0.04                                               | 1                                                             | 5                        |
| Chromium *                                                                                                           | 0.0085                |  |  | 0.077    | 0.5                                                | 10                                                            | 70                       |
| Copper *                                                                                                             | 0.0061                |  |  | 0.055    | 2                                                  | 50                                                            | 100                      |
| Mercury *                                                                                                            | < 0.0005              |  |  | < 0.0050 | 0.01                                               | 0.2                                                           | 2                        |
| Molybdenum *                                                                                                         | 0.0025                |  |  | 0.0225   | 0.5                                                | 10                                                            | 30                       |
| Nickel *                                                                                                             | 0.0045                |  |  | 0.041    | 0.4                                                | 10                                                            | 40                       |
| Lead *                                                                                                               | 0.0033                |  |  | 0.030    | 0.5                                                | 10                                                            | 50                       |
| Antimony *                                                                                                           | < 0.0017              |  |  | < 0.017  | 0.06                                               | 0.7                                                           | 5                        |
| Selenium *                                                                                                           | < 0.0040              |  |  | < 0.040  | 0.1                                                | 0.5                                                           | 7                        |
| Zinc *                                                                                                               | 0.0053                |  |  | 0.047    | 4                                                  | 50                                                            | 200                      |
| Chloride *                                                                                                           | 1.3                   |  |  | 12       | 800                                                | 15000                                                         | 25000                    |
| Fluoride                                                                                                             | 0.54                  |  |  | 4.9      | 10                                                 | 150                                                           | 500                      |
| Sulphate *                                                                                                           | 14                    |  |  | 130      | 1000                                               | 20000                                                         | 50000                    |
| TDS*                                                                                                                 | 89                    |  |  | 800      | 4000                                               | 60000                                                         | 100000                   |
| Phenol Index (Monohydric Phenols) *                                                                                  | < 0.010               |  |  | < 0.10   | 1                                                  | -                                                             | -                        |
| DOC                                                                                                                  | 5.50                  |  |  | 49.6     | 500                                                | 800                                                           | 1000                     |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Leach Test Information                                                                                               |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Stone Content (%)                                                                                                    | 58                    |  |  |          |                                                    |                                                               |                          |
| Sample Mass (kg)                                                                                                     | 1.3                   |  |  |          |                                                    |                                                               |                          |
| Dry Matter (%)                                                                                                       | 93                    |  |  |          |                                                    |                                                               |                          |
| Moisture (%)                                                                                                         | 6.6                   |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Results are expressed on a dry weight basis, after correction for moisture content where applicable.                 |                       |  |  |          | ** = UKAS accredited (liquid eluate analysis only) |                                                               |                          |
| Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation |                       |  |  |          | ** = MCERTS accredited                             |                                                               |                          |

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



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**Analytical Report Number : 22-78037****Project / Site name: Deansgate, 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 *               |
|-------------------|------------------|---------------|-----------|------------------------------------|
| 2388001           | TP102 ES1        | None Supplied | 0.40-0.80 | Brown clay and sand with gravel.   |
| 2388003           | TP104 ES1        | None Supplied | 0.80-1.20 | Brown sand with gravel and stones. |

**Analytical Report Number : 22-78037**  
**Project / Site name: Deansgate, 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 |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------|--------------------|
| BS EN 12457-2 (10:1) Leachate Prep       | 10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.                              | In-house method based on BSEN12457-2.                                                                   | L043-PL       | W                  |
| Acid neutralisation capacity of soil     | Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.                                              | In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance"" | L046-PL       | W                  |
| Loss on ignition of soil @ 450oC         | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.                                        | In house method.                                                                                        | L047-PL       | D                  |
| Mineral Oil (Soil) C10 - C40             | Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.                                                                | In-house method with silica gel split/clean up.                                                         | L076-PL       | D                  |
| Moisture Content                         | Moisture content, determined gravimetrically. (30 oC)                                                                                                  | In house method.                                                                                        | L019-UK/PL    | W                  |
| Speciated WAC-17 PAHs in soil            | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270. MCERTS accredited except Coronene.                                 | L064-PL       | D                  |
| PCB's By GC-MS in soil                   | Determination of PCB by extraction with acetone and hexane followed by GC-MS.                                                                          | In-house method based on USEPA 8082                                                                     | L027-PL       | D                  |
| pH at 20oC in soil                       | Determination of pH in soil by addition of water followed by electrometric measurement.                                                                | In house method.                                                                                        | L005-PL       | W                  |
| Stones content of soil                   | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.                            | In-house method based on British Standard Methods and MCERTS requirements.                              | L019-UK/PL    | D                  |
| Total organic carbon (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.                          | In house method.                                                                                        | L009-PL       | D                  |
| BTEX in soil (Monoaromatics)             | Determination of BTEX in soil by headspace GC-MS.                                                                                                      | In-house method based on USEPA8260                                                                      | L073B-PL      | W                  |
| Total BTEX in soil (Poland)              | Determination of BTEX in soil by headspace GC-MS.                                                                                                      | In-house method based on USEPA8260                                                                      | L073-PL       | W                  |
| Metals in leachate by ICP-OES            | Determination of metals in leachate by acidification followed by ICP-OES.                                                                              | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""                   | L039-PL       | W                  |
| Chloride 10:1 WAC                        | Determination of Chloride colorimetrically by discrete analyser.                                                                                       | In house based on MEWAM Method ISBN 0117516260.                                                         | L082-PL       | W                  |
| Fluoride 10:1 WAC                        | Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.                                          | In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"     | L033B-PL      | W                  |
| Sulphate 10:1 WAC                        | Determination of sulphate in leachate by ICP-OES                                                                                                       | In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""                   | L039-PL       | W                  |

**Analytical Report Number : 22-78037**  
**Project / Site name: Deansgate, 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 |
|-----------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------|--------------------|
| Total dissolved solids 10:1 WAC   | Determination of total dissolved solids in water by EC probe using a factor of 0.6. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L031          | W                  |
| 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                  |
| Dissolved organic carbon 10:1 WAC | Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.   | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L037-PL       | W                  |

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

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

**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by 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 to 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     |



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| Accreditation Status |
|----------------------|
| NONE                 |
| NONE                 |
| MCERTS               |
| NONE                 |
| NONE                 |
| MCERTS               |
| MCERTS               |
| MCERTS               |
| NONE                 |
| MCERTS               |
| MCERTS               |
| MCERTS               |
| ISO 17025            |
| ISO 17025            |
| ISO 17025            |
| ISO 17025            |



| Accreditation Status |
|----------------------|
| ISO 17025            |
| ISO 17025            |
| NONE                 |

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ted by



**Sophie Thomas**

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## **Analytical Report Number : 22-79146**

|                             |                       |                                                        |            |
|-----------------------------|-----------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | Deansgate, Manchester | <b>Samples received on:</b>                            | 19/08/2022 |
| <b>Your job number:</b>     | 2006023 001           | <b>Samples instructed on/<br/>Analysis started on:</b> | 22/08/2022 |
| <b>Your order number:</b>   |                       | <b>Analysis completed by:</b>                          | 06/09/2022 |
| <b>Report Issue Number:</b> | 1                     | <b>Report issued on:</b>                               | 06/09/2022 |
| <b>Samples Analysed:</b>    | 4 soil samples        |                                                        |            |

**Signed:**

Adam Fenwick  
Technical Reviewer  
**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

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

Analytical Report Number: 22-79146  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                      | 2395903       | 2395904       | 2395905       | 2395906       |
|-----------------------------------------|-------|--------------------|----------------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                      | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                      | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                      | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation Status |               |               |               |               |
| Stone Content                           | %     | 0.1                | NONE                 | < 0.1         | < 0.1         | < 0.1         | < 0.1         |
| Moisture Content                        | %     | 0.01               | NONE                 | 11            | 9.9           | 13            | 10            |
| Total mass of sample received           | kg    | 0.001              | NONE                 | 0.3           | 0.3           | 0.7           | 1.1           |

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

#### General Inorganics

|                                                                         |          |         |        |       |   |       |       |
|-------------------------------------------------------------------------|----------|---------|--------|-------|---|-------|-------|
| pH - Automated                                                          | pH Units | N/A     | MCERTS | 11.4  | - | -     | -     |
| Total Cyanide                                                           | mg/kg    | 1       | MCERTS | < 1.0 | - | < 1.0 | < 1.0 |
| Total Sulphate as SO <sub>4</sub>                                       | mg/kg    | 50      | MCERTS | 460   | - | -     | -     |
| Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent) | g/l      | 0.00125 | MCERTS | 0.042 | - | -     | -     |
| Sulphide                                                                | mg/kg    | 1       | MCERTS | 2.8   | - | -     | -     |
| Ammoniacal Nitrogen as NH <sub>3</sub>                                  | mg/kg    | 0.5     | MCERTS | -     | - | 1.1   | < 0.5 |
| Total Organic Carbon (TOC) - Automated                                  | %        | 0.1     | MCERTS | 0.2   | - | -     | -     |

#### Total Phenols

|                            |       |   |        |       |   |       |       |
|----------------------------|-------|---|--------|-------|---|-------|-------|
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | - | < 1.0 | < 1.0 |
|----------------------------|-------|---|--------|-------|---|-------|-------|

#### Speciated PAHs

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

#### Total PAH

|                             |       |     |        |        |   |        |        |
|-----------------------------|-------|-----|--------|--------|---|--------|--------|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | < 0.80 | - | < 0.80 | < 0.80 |
|-----------------------------|-------|-----|--------|--------|---|--------|--------|

Analytical Report Number: 22-79146  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                      | 2395903       | 2395904       | 2395905       | 2395906       |
|-----------------------------------------|-------|--------------------|----------------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                      | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                      | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                      | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation Status |               |               |               |               |

#### Heavy Metals / Metalloids

|                                     |       |      |           |       |   |       |       |
|-------------------------------------|-------|------|-----------|-------|---|-------|-------|
| Antimony (aqua regia extractable)   | mg/kg | 1    | ISO 17025 | -     | - | 2.5   | 3.2   |
| Arsenic (aqua regia extractable)    | mg/kg | 1    | MCERTS    | 15    | - | 6.1   | 5.9   |
| Barium (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 16    | - | 78    | 76    |
| Beryllium (aqua regia extractable)  | mg/kg | 0.06 | MCERTS    | 0.25  | - | 0.78  | 0.79  |
| Boron (water soluble)               | mg/kg | 0.2  | MCERTS    | 0.3   | - | < 0.2 | < 0.2 |
| Cadmium (aqua regia extractable)    | mg/kg | 0.2  | MCERTS    | < 0.2 | - | < 0.2 | < 0.2 |
| Chromium (hexavalent)               | mg/kg | 1.2  | NONE      | < 1.2 | - | -     | -     |
| Chromium (hexavalent)               | mg/kg | 1.8  | MCERTS    | -     | - | < 1.8 | < 1.8 |
| Chromium (III)                      | mg/kg | 1    | NONE      | -     | - | 18    | 20    |
| Chromium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | 7.1   | - | 18    | 20    |
| Copper (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 5.8   | - | 15    | 14    |
| Lead (aqua regia extractable)       | mg/kg | 1    | MCERTS    | 33    | - | 11    | 8.7   |
| Manganese (aqua regia extractable)  | mg/kg | 1    | MCERTS    | -     | - | 350   | 570   |
| Mercury (aqua regia extractable)    | mg/kg | 0.3  | MCERTS    | < 0.3 | - | < 0.3 | < 0.3 |
| Molybdenum (aqua regia extractable) | mg/kg | 0.25 | MCERTS    | -     | - | 0.5   | 0.38  |
| Nickel (aqua regia extractable)     | mg/kg | 1    | MCERTS    | 7.1   | - | 20    | 21    |
| Selenium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | < 1.0 | - | < 1.0 | < 1.0 |
| Vanadium (aqua regia extractable)   | mg/kg | 1    | MCERTS    | 12    | - | -     | -     |
| Zinc (aqua regia extractable)       | mg/kg | 1    | MCERTS    | 130   | - | 66    | 58    |

#### Monoaromatics & Oxygenates

|                                    |       |   |        |       |       |       |       |
|------------------------------------|-------|---|--------|-------|-------|-------|-------|
| Benzene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Toluene                            | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Ethylbenzene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| p & m-xylene                       | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| o-xylene                           | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether) | µg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                                                |       |     |        |   |   |       |       |
|----------------------------------------------------------------|-------|-----|--------|---|---|-------|-------|
| Petroleum Range Organics (C6 - C10) <small>HS_1D_TOTAL</small> | mg/kg | 0.1 | MCERTS | - | - | < 0.1 | < 0.1 |
|----------------------------------------------------------------|-------|-----|--------|---|---|-------|-------|

|                                             |       |    |        |      |   |      |      |
|---------------------------------------------|-------|----|--------|------|---|------|------|
| TPH C10 - C40 <small>EH_CU_1D_TOTAL</small> | mg/kg | 10 | MCERTS | < 10 | - | < 10 | < 10 |
|---------------------------------------------|-------|----|--------|------|---|------|------|

|                                                                |       |       |        |         |         |   |   |
|----------------------------------------------------------------|-------|-------|--------|---------|---------|---|---|
| TPH-CWG - Aliphatic >EC5 - EC6 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aliphatic >EC6 - EC8 <small>HS_1D_AL</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aliphatic >EC8 - EC10 <small>HS_1D_AL</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aliphatic >EC10 - EC12 <small>EH_CU_1D_AL</small>    | mg/kg | 1     | MCERTS | < 1.0   | < 1.0   | - | - |
| TPH-CWG - Aliphatic >EC12 - EC16 <small>EH_CU_1D_AL</small>    | mg/kg | 2     | MCERTS | < 2.0   | < 2.0   | - | - |
| TPH-CWG - Aliphatic >EC16 - EC21 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | < 8.0   | < 8.0   | - | - |
| TPH-CWG - Aliphatic >EC21 - EC35 <small>EH_CU_1D_AL</small>    | mg/kg | 8     | MCERTS | < 8.0   | < 8.0   | - | - |
| TPH-CWG - Aliphatic (EC5 - EC35) <small>EH_CU+HS_1D_AL</small> | mg/kg | 10    | MCERTS | < 10    | < 10    | - | - |

|                                                               |       |       |        |         |         |   |   |
|---------------------------------------------------------------|-------|-------|--------|---------|---------|---|---|
| TPH-CWG - Aromatic >EC5 - EC7 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aromatic >EC7 - EC8 <small>HS_1D_AR</small>         | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aromatic >EC8 - EC10 <small>HS_1D_AR</small>        | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | - |
| TPH-CWG - Aromatic >EC10 - EC12 <small>EH_CU_1D_AR</small>    | mg/kg | 1     | MCERTS | < 1.0   | < 1.0   | - | - |
| TPH-CWG - Aromatic >EC12 - EC16 <small>EH_CU_1D_AR</small>    | mg/kg | 2     | MCERTS | < 2.0   | < 2.0   | - | - |
| TPH-CWG - Aromatic >EC16 - EC21 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | < 10    | < 10    | - | - |
| TPH-CWG - Aromatic >EC21 - EC35 <small>EH_CU_1D_AR</small>    | mg/kg | 10    | MCERTS | < 10    | < 10    | - | - |
| TPH-CWG - Aromatic (EC5 - EC35) <small>EH_CU+HS_1D_AR</small> | mg/kg | 10    | MCERTS | < 10    | < 10    | - | - |

Analytical Report Number: 22-79146  
Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |  |  |  | 2395903       | 2395904            | 2395905              | 2395906       |
|-----------------------------------------|--|--|--|---------------|--------------------|----------------------|---------------|
| Sample Reference                        |  |  |  | BH103         | BH103              | BH102                | BH102         |
| Sample Number                           |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied |
| Depth (m)                               |  |  |  | 0.80-0.90     | 3.50-3.70          | 0.80-1.00            | 1.20-1.40     |
| Date Sampled                            |  |  |  | 15/08/2022    | 15/08/2022         | 16/08/2022           | 16/08/2022    |
| Time Taken                              |  |  |  | None Supplied | None Supplied      | None Supplied        | None Supplied |
| Analytical Parameter<br>(Soil Analysis) |  |  |  | Units         | Limit of detection | Accreditation Status |               |

#### VOCs

|                                       |       |   |           |   |   |       |       |
|---------------------------------------|-------|---|-----------|---|---|-------|-------|
| Chloromethane                         | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Chloroethane                          | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| Bromomethane                          | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Vinyl Chloride                        | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| Trichlorofluoromethane                | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| 1,1-Dichloroethene                    | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| 1,1,2-Trichloro 1,2,2-Trifluoroethane | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Cis-1,2-dichloroethene                | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether)    | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1-Dichloroethane                    | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 2,2-Dichloropropane                   | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Trichloromethane                      | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1,1-Trichloroethane                 | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,2-Dichloroethane                    | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1-Dichloropropene                   | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Trans-1,2-dichloroethene              | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| Benzene                               | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Tetrachloromethane                    | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,2-Dichloropropane                   | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Trichloroethene                       | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Dibromomethane                        | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Bromodichloromethane                  | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Cis-1,3-dichloropropene               | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Trans-1,3-dichloropropene             | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Toluene                               | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1,2-Trichloroethane                 | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,3-Dichloropropane                   | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Dibromochloromethane                  | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Tetrachloroethene                     | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| 1,2-Dibromoethane                     | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| Chlorobenzene                         | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1,1,2-Tetrachloroethane             | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Ethylbenzene                          | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| p & m-Xylene                          | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Styrene                               | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Tribromomethane                       | µg/kg | 1 | NONE      | - | - | < 1.0 | < 1.0 |
| o-Xylene                              | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,1,1,2,2-Tetrachloroethane           | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Isopropylbenzene                      | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Bromobenzene                          | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| n-Propylbenzene                       | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| 2-Chlorotoluene                       | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 4-Chlorotoluene                       | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,3,5-Trimethylbenzene                | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| tert-Butylbenzene                     | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,2,4-Trimethylbenzene                | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| sec-Butylbenzene                      | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene                   | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| p-Isopropyltoluene                    | µg/kg | 1 | ISO 17025 | - | - | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene                   | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene                   | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |
| Butylbenzene                          | µg/kg | 1 | MCERTS    | - | - | < 1.0 | < 1.0 |

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| Lab Sample Number                       |       |                    |                         | 2395903       | 2395904       | 2395905       | 2395906       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                         | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |
| 1,2-Dibromo-3-chloropropane             | µg/kg | 1                  | ISO 17025               | -             | -             | < 1.0         | < 1.0         |
| 1,2,4-Trichlorobenzene                  | µg/kg | 1                  | MCERTS                  | -             | -             | < 1.0         | < 1.0         |
| Hexachlorobutadiene                     | µg/kg | 1                  | MCERTS                  | -             | -             | < 1.0         | < 1.0         |
| 1,2,3-Trichlorobenzene                  | µg/kg | 1                  | ISO 17025               | -             | -             | < 1.0         | < 1.0         |

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|                                         |       |                    |                         |               |               |               |               |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|
| Lab Sample Number                       |       |                    |                         | 2395903       | 2395904       | 2395905       | 2395906       |
| Sample Reference                        |       |                    |                         | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                         | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |

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Project / Site name: Deansgate, Manchester

| Lab Sample Number                       |       |                    |                         | 2395903       | 2395904       | 2395905       | 2395906       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                         | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |

#### SVOCs

|                             |       |      |           |   |   |        |        |
|-----------------------------|-------|------|-----------|---|---|--------|--------|
| Aniline                     | mg/kg | 0.1  | NONE      | - | - | < 0.1  | < 0.1  |
| Phenol                      | mg/kg | 0.2  | ISO 17025 | - | - | < 0.2  | < 0.2  |
| 2-Chlorophenol              | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| Bis(2-chloroethyl)ether     | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 1,3-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 1,2-Dichlorobenzene         | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| 1,4-Dichlorobenzene         | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| Bis(2-chloroisopropyl)ether | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| 2-Methylphenol              | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Hexachloroethane            | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Nitrobenzene                | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| 4-Methylphenol              | mg/kg | 0.2  | NONE      | - | - | < 0.2  | < 0.2  |
| Isophorone                  | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 2-Nitrophenol               | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| 2,4-Dimethylphenol          | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Bis(2-chloroethoxy)methane  | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| 1,2,4-Trichlorobenzene      | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Naphthalene                 | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| 2,4-Dichlorophenol          | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| 4-Chloroaniline             | mg/kg | 0.1  | NONE      | - | - | < 0.1  | < 0.1  |
| Hexachlorobutadiene         | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| 4-Chloro-3-methylphenol     | mg/kg | 0.1  | NONE      | - | - | < 0.1  | < 0.1  |
| 2,4,6-Trichlorophenol       | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| 2,4,5-Trichlorophenol       | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 2-Methylnaphthalene         | mg/kg | 0.1  | NONE      | - | - | < 0.1  | < 0.1  |
| 2-Chloronaphthalene         | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| Dimethylphthalate           | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| 2,6-Dinitrotoluene          | mg/kg | 0.1  | MCERTS    | - | - | < 0.1  | < 0.1  |
| Acenaphthylene              | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Acenaphthene                | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| 2,4-Dinitrotoluene          | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| Dibenzofuran                | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 4-Chlorophenyl phenyl ether | mg/kg | 0.3  | ISO 17025 | - | - | < 0.3  | < 0.3  |
| Diethyl phthalate           | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| 4-Nitroaniline              | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| Fluorene                    | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Azobenzene                  | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Bromophenyl phenyl ether    | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| Hexachlorobenzene           | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Phenanthrene                | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Anthracene                  | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Carbazole                   | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Dibutyl phthalate           | mg/kg | 0.2  | MCERTS    | - | - | < 0.2  | < 0.2  |
| Anthraquinone               | mg/kg | 0.3  | MCERTS    | - | - | < 0.3  | < 0.3  |
| Fluoranthene                | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Pyrene                      | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Butyl benzyl phthalate      | mg/kg | 0.3  | ISO 17025 | - | - | < 0.3  | < 0.3  |
| Benzo(a)anthracene          | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Chrysene                    | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Benzo(b)fluoranthene        | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Benzo(k)fluoranthene        | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |
| Benzo(a)pyrene              | mg/kg | 0.05 | MCERTS    | - | - | < 0.05 | < 0.05 |

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| Lab Sample Number                       |       |                    |                         | 2395903       | 2395904       | 2395905       | 2395906       |
|-----------------------------------------|-------|--------------------|-------------------------|---------------|---------------|---------------|---------------|
| Sample Reference                        |       |                    |                         | BH103         | BH103         | BH102         | BH102         |
| Sample Number                           |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                               |       |                    |                         | 0.80-0.90     | 3.50-3.70     | 0.80-1.00     | 1.20-1.40     |
| Date Sampled                            |       |                    |                         | 15/08/2022    | 15/08/2022    | 16/08/2022    | 16/08/2022    |
| Time Taken                              |       |                    |                         | None Supplied | None Supplied | None Supplied | None Supplied |
| Analytical Parameter<br>(Soil Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |               |               |
| Indeno(1,2,3-cd)pyrene                  | mg/kg | 0.05               | MCERTS                  | -             | -             | < 0.05        | < 0.05        |
| Dibenz(a,h)anthracene                   | mg/kg | 0.05               | MCERTS                  | -             | -             | < 0.05        | < 0.05        |
| Benzo(ghi)perylene                      | mg/kg | 0.05               | MCERTS                  | -             | -             | < 0.05        | < 0.05        |

#### Environmental Forensics

|                   |       |     |      |   |   |       |       |
|-------------------|-------|-----|------|---|---|-------|-------|
| Hexabromobiphenyl | mg/kg | 0.1 | NONE | - | - | < 0.1 | < 0.1 |
|-------------------|-------|-----|------|---|---|-------|-------|

#### Stockholm convention POPs list A

|       |       |   |      |   |   |       |       |
|-------|-------|---|------|---|---|-------|-------|
| Mirex | mg/kg | 1 | NONE | - | - | < 1.0 | < 1.0 |
|-------|-------|---|------|---|---|-------|-------|

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

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**Project / Site name: Deansgate, 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 *          |
|-------------------|------------------|---------------|-----------|-------------------------------|
| 2395903           | BH103            | None Supplied | 0.80-0.90 | Brown sand with gravel.       |
| 2395904           | BH103            | None Supplied | 3.50-3.70 | Brown sandy clay with gravel. |
| 2395905           | BH102            | None Supplied | 0.80-1.00 | Brown clay.                   |
| 2395906           | BH102            | None Supplied | 1.20-1.40 | Brown clay.                   |

**Analytical Report Number : 22-79146**

**Project / Site name: Deansgate, 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 |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Sulphate, water soluble, in soil (16hr extraction) | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).              | In house method.                                                                                                | L038-PL       | D                  | MCERTS               |
| Metals in soil by ICP-OES                          | Determination of metals in soil by aqua-regia digestion followed by ICP-OES.                                                                                           | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L038-PL       | D                  | MCERTS               |
| Asbestos identification in soil                    | Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.                                                 | In house method based on HSG 248                                                                                | A001-PL       | D                  | ISO 17025            |
| Boron, water soluble, in soil                      | Determination of water soluble boron in soil by hot water extract followed by ICP-OES.                                                                                 | In-house method based on Second Site Properties version 3                                                       | L038-PL       | D                  | MCERTS               |
| Moisture Content                                   | Moisture content, determined gravimetrically. (30 oC)                                                                                                                  | In house method.                                                                                                | L019-UK/PL    | W                  | NONE                 |
| Monohydric phenols in soil                         | Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.                                                 | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL       | W                  | MCERTS               |
| Speciated EPA-16 PAHs in soil                      | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.                 | In-house method based on USEPA 8270                                                                             | L064-PL       | D                  | MCERTS               |
| pH in soil (automated)                             | Determination of pH in soil by addition of water followed by automated electrometric measurement.                                                                      | In house method.                                                                                                | L099-PL       | D                  | MCERTS               |
| PRO (Soil)                                         | Determination of hydrocarbons C6-C10 by headspace GC-MS.                                                                                                               | In-house method based on USEPA8260                                                                              | L088-PL       | W                  | MCERTS               |
| Sulphide in soil                                   | Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode. | In-house method                                                                                                 | L010-PL       | D                  | MCERTS               |
| Total sulphate (as SO <sub>4</sub> in soil)        | Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.                                                                                | In house method.                                                                                                | L038-PL       | D                  | MCERTS               |
| Stones content of soil                             | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.                                            | In-house method based on British Standard Methods and MCERTS requirements.                                      | L019-UK/PL    | D                  | NONE                 |
| Semi-volatile organic compounds in soil            | Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.                                                | In-house method based on USEPA 8270                                                                             | L064-PL       | D                  | MCERTS               |
| Total cyanide in soil                              | Determination of total cyanide by distillation followed by colorimetry.                                                                                                | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | 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.                                          | In house method.                                                                                                | L009-PL       | D                  | MCERTS               |
| Volatile organic compounds in soil                 | Determination of volatile organic compounds in soil by headspace GC-MS.                                                                                                | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | MCERTS               |
| BTEX and MTBE in soil (Monoaromatics)              | Determination of BTEX in soil by headspace GC-MS.                                                                                                                      | In-house method based on USEPA8260                                                                              | L073B-PL      | W                  | MCERTS               |

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**Project / Site name: Deansgate, 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 |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Ammonia as NH <sub>3</sub> 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 | L082-PL       | W                  | MCERTS               |
| Cr (III) in soil                                 | In-house method by calculation from total Cr and Cr VI.                                                                                               | In-house method by calculation                                                                         | L080-PL       | W                  | NONE                 |
| TPHCWG (Soil)                                    | Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.                                                                             | In-house method with silica gel split/clean up.                                                        | L088/76-PL    | W                  | MCERTS               |
| TPH Banding in Soil by FID                       | Determination of hexane extractable hydrocarbons in soil by GC-FID.                                                                                   | In-house method, TPH with carbon banding and silica gel split/clean up.                                | L076-PL       | D                  | MCERTS               |
| EF - Hexabromobiphenyl in soil by GC-Q           | Hexabromobiphenyl by GC-Q                                                                                                                             | In-house method                                                                                        | UK            | W                  | NONE                 |
| EF - Annex A POPs                                | Annex A POPs                                                                                                                                          | In house method - Annex A POPs                                                                         | UK            | W                  | NONE                 |
| Hexavalent chromium in soil (Lower Level)        | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry. | In-house method                                                                                        | L080-PL       | 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               |
| D.O. for Gravimetric Quant if Screen/ID positive | Dependent option for Gravimetric Quant if Screen/ID positive scheduled.                                                                               | In house asbestos methods A001 & A006.                                                                 | A006-PL       | D                  | NONE                 |

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

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

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

**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 - understore to separate acronyms (exception for +)           |



Analytical Report Number : 22-79146  
 Project / Site name: Deansgate, 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 |
|----------------------|-------------------------------|-----------------------------|---------------|--------------------|----------------------|
|----------------------|-------------------------------|-----------------------------|---------------|--------------------|----------------------|

+ Operator to indicate cumulative e.g. EH+HS\_Total or EH\_CU+HS\_Total

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## **Analytical Report Number : 22-79152**

|                             |                       |                                                        |            |
|-----------------------------|-----------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | Deansgate, Manchester | <b>Samples received on:</b>                            | 19/08/2022 |
| <b>Your job number:</b>     | 2006023 001           | <b>Samples instructed on/<br/>Analysis started on:</b> | 22/08/2022 |
| <b>Your order number:</b>   |                       | <b>Analysis completed by:</b>                          | 06/09/2022 |
| <b>Report Issue Number:</b> | 1                     | <b>Report issued on:</b>                               | 06/09/2022 |
| <b>Samples Analysed:</b>    | 2 10:1 WAC Samples    |                                                        |            |

  
**Signed:**

Adam Fenwick  
Technical Reviewer  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

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

## i2 Analytical

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### Waste Acceptance Criteria Analytical Results

| Waste Acceptance Criteria Analytical Results                                                                         |                       |  |  |          |                                                    |                                                               |                          |
|----------------------------------------------------------------------------------------------------------------------|-----------------------|--|--|----------|----------------------------------------------------|---------------------------------------------------------------|--------------------------|
| Report No:                                                                                                           | 22-79152              |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Client: TWEEDIE                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Location                                                                                                             | Deansgate, Manchester |  |  |          |                                                    |                                                               |                          |
| Lab Reference (Sample Number)                                                                                        | 2395937 / 2395938     |  |  |          | Landfill Waste Acceptance Criteria                 |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Limits                                             |                                                               |                          |
| Sampling Date                                                                                                        | 16/08/2022            |  |  |          | Inert Waste Landfill                               | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| Sample ID                                                                                                            | BH102                 |  |  |          |                                                    |                                                               |                          |
| Depth (m)                                                                                                            | 0.80-1.00             |  |  |          |                                                    |                                                               |                          |
| Solid Waste Analysis                                                                                                 |                       |  |  |          |                                                    |                                                               |                          |
| TOC (%)**                                                                                                            | 0.7                   |  |  |          | 3%                                                 | 5%                                                            | 6%                       |
| Loss on Ignition (%) **                                                                                              | 1.6                   |  |  |          | --                                                 | --                                                            | 10%                      |
| BTEX (µg/kg) **                                                                                                      | 630                   |  |  |          | 6000                                               | --                                                            | --                       |
| Sum of PCBs (mg/kg) **                                                                                               | < 0.007               |  |  |          | 1                                                  | --                                                            | --                       |
| Mineral Oil (mg/kg) <small>EH_ID_CU_AL</small>                                                                       | < 10                  |  |  |          | 500                                                | --                                                            | --                       |
| Total PAH (WAC-17) (mg/kg)                                                                                           | < 0.85                |  |  |          | 100                                                | --                                                            | --                       |
| pH (units)**                                                                                                         | 7.0                   |  |  |          | --                                                 | >6                                                            | --                       |
| Acid Neutralisation Capacity (mmol / kg)                                                                             | 0.00                  |  |  |          | --                                                 | To be evaluated                                               | To be evaluated          |
| Eluate Analysis                                                                                                      | 10:1                  |  |  | 10:1     | Limit values for compliance leaching test          |                                                               |                          |
| (BS EN 12457 - 2 preparation utilising end over end leaching procedure)                                              | mg/l                  |  |  | mg/kg    | using BS EN 12457-2 at L/S 10 l/kg (mg/kg)         |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Arsenic *                                                                                                            | 0.0028                |  |  | 0.0251   | 0.5                                                | 2                                                             | 25                       |
| Barium *                                                                                                             | 0.0197                |  |  | 0.176    | 20                                                 | 100                                                           | 300                      |
| Cadmium *                                                                                                            | < 0.0001              |  |  | < 0.0008 | 0.04                                               | 1                                                             | 5                        |
| Chromium *                                                                                                           | 0.0020                |  |  | 0.017    | 0.5                                                | 10                                                            | 70                       |
| Copper *                                                                                                             | 0.0048                |  |  | 0.043    | 2                                                  | 50                                                            | 100                      |
| Mercury *                                                                                                            | 0.0006                |  |  | 0.0050   | 0.01                                               | 0.2                                                           | 2                        |
| Molybdenum *                                                                                                         | 0.0101                |  |  | 0.0903   | 0.5                                                | 10                                                            | 30                       |
| Nickel *                                                                                                             | 0.0036                |  |  | 0.032    | 0.4                                                | 10                                                            | 40                       |
| Lead *                                                                                                               | 0.0041                |  |  | 0.037    | 0.5                                                | 10                                                            | 50                       |
| Antimony *                                                                                                           | < 0.0017              |  |  | < 0.017  | 0.06                                               | 0.7                                                           | 5                        |
| Selenium *                                                                                                           | 0.0090                |  |  | 0.081    | 0.1                                                | 0.5                                                           | 7                        |
| Zinc *                                                                                                               | 0.0052                |  |  | 0.046    | 4                                                  | 50                                                            | 200                      |
| Chloride *                                                                                                           | 1.2                   |  |  | 11       | 800                                                | 15000                                                         | 25000                    |
| Fluoride                                                                                                             | 0.52                  |  |  | 4.6      | 10                                                 | 150                                                           | 500                      |
| Sulphate *                                                                                                           | 3.9                   |  |  | 35       | 1000                                               | 20000                                                         | 50000                    |
| TDS*                                                                                                                 | 37                    |  |  | 330      | 4000                                               | 60000                                                         | 100000                   |
| Phenol Index (Monohydric Phenols) *                                                                                  | < 0.010               |  |  | < 0.10   | 1                                                  | -                                                             | -                        |
| DOC                                                                                                                  | 14.6                  |  |  | 130      | 500                                                | 800                                                           | 1000                     |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Leach Test Information                                                                                               |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Stone Content (%)                                                                                                    | < 0.1                 |  |  |          |                                                    |                                                               |                          |
| Sample Mass (kg)                                                                                                     | 1.1                   |  |  |          |                                                    |                                                               |                          |
| Dry Matter (%)                                                                                                       | 87                    |  |  |          |                                                    |                                                               |                          |
| Moisture (%)                                                                                                         | 13                    |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| 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 |                       |  |  |          | ** = MCFETS accredited                             |                                                               |                          |

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

\*= UKAS accredited (liquid eluate analysis only)

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

\*\* = MCERTS accredited

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

## i2 Analytical

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### Waste Acceptance Criteria Analytical Results

| Waste Acceptance Criteria Analytical Results                                                                         |                       |  |  |          |                                                    |                                                               |                          |
|----------------------------------------------------------------------------------------------------------------------|-----------------------|--|--|----------|----------------------------------------------------|---------------------------------------------------------------|--------------------------|
| Report No:                                                                                                           | 22-79152              |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Client: TWEEDIE                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Location                                                                                                             | Deansgate, Manchester |  |  |          |                                                    |                                                               |                          |
| Lab Reference (Sample Number)                                                                                        | 2395939 / 2395940     |  |  |          | Landfill Waste Acceptance Criteria                 |                                                               |                          |
|                                                                                                                      |                       |  |  |          | Limits                                             |                                                               |                          |
| Sampling Date                                                                                                        | 16/08/2022            |  |  |          | Inert Waste Landfill                               | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| Sample ID                                                                                                            | BH102                 |  |  |          |                                                    |                                                               |                          |
| Depth (m)                                                                                                            | 1.20-1.40             |  |  |          |                                                    |                                                               |                          |
| Solid Waste Analysis                                                                                                 |                       |  |  |          |                                                    |                                                               |                          |
| TOC (%)**                                                                                                            | 1.0                   |  |  |          | 3%                                                 | 5%                                                            | 6%                       |
| Loss on Ignition (%) **                                                                                              | 1.7                   |  |  |          | --                                                 | --                                                            | 10%                      |
| BTEX (µg/kg) **                                                                                                      | < 10                  |  |  |          | 6000                                               | --                                                            | --                       |
| Sum of PCBs (mg/kg) **                                                                                               | < 0.007               |  |  |          | 1                                                  | --                                                            | --                       |
| Mineral Oil (mg/kg) <small>EH_ID_CU_AL</small>                                                                       | < 10                  |  |  |          | 500                                                | --                                                            | --                       |
| Total PAH (WAC-17) (mg/kg)                                                                                           | < 0.85                |  |  |          | 100                                                | --                                                            | --                       |
| pH (units)**                                                                                                         | 7.1                   |  |  |          | --                                                 | >6                                                            | --                       |
| Acid Neutralisation Capacity (mmol / kg)                                                                             | 0.54                  |  |  |          | --                                                 | To be evaluated                                               | To be evaluated          |
| Eluate Analysis                                                                                                      | 10:1                  |  |  | 10:1     | Limit values for compliance leaching test          |                                                               |                          |
| (BS EN 12457 - 2 preparation utilising end over end leaching procedure)                                              | mg/l                  |  |  | mg/kg    | using BS EN 12457-2 at L/S 10 l/kg (mg/kg)         |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Arsenic *                                                                                                            | 0.0012                |  |  | 0.0106   | 0.5                                                | 2                                                             | 25                       |
| Barium *                                                                                                             | 0.0041                |  |  | 0.0367   | 20                                                 | 100                                                           | 300                      |
| Cadmium *                                                                                                            | < 0.0001              |  |  | < 0.0008 | 0.04                                               | 1                                                             | 5                        |
| Chromium *                                                                                                           | 0.0010                |  |  | 0.0093   | 0.5                                                | 10                                                            | 70                       |
| Copper *                                                                                                             | 0.0059                |  |  | 0.053    | 2                                                  | 50                                                            | 100                      |
| Mercury *                                                                                                            | < 0.0005              |  |  | < 0.0050 | 0.01                                               | 0.2                                                           | 2                        |
| Molybdenum *                                                                                                         | 0.0020                |  |  | 0.0183   | 0.5                                                | 10                                                            | 30                       |
| Nickel *                                                                                                             | 0.0032                |  |  | 0.028    | 0.4                                                | 10                                                            | 40                       |
| Lead *                                                                                                               | 0.0052                |  |  | 0.047    | 0.5                                                | 10                                                            | 50                       |
| Antimony *                                                                                                           | < 0.0017              |  |  | < 0.017  | 0.06                                               | 0.7                                                           | 5                        |
| Selenium *                                                                                                           | < 0.0040              |  |  | < 0.040  | 0.1                                                | 0.5                                                           | 7                        |
| Zinc *                                                                                                               | 0.0046                |  |  | 0.042    | 4                                                  | 50                                                            | 200                      |
| Chloride *                                                                                                           | 0.96                  |  |  | 8.6      | 800                                                | 15000                                                         | 25000                    |
| Fluoride                                                                                                             | 0.35                  |  |  | 3.1      | 10                                                 | 150                                                           | 500                      |
| Sulphate *                                                                                                           | 1.4                   |  |  | 13       | 1000                                               | 20000                                                         | 50000                    |
| TDS*                                                                                                                 | 19                    |  |  | 170      | 4000                                               | 60000                                                         | 100000                   |
| Phenol Index (Monohydric Phenols) *                                                                                  | < 0.010               |  |  | < 0.10   | 1                                                  | -                                                             | -                        |
| DOC                                                                                                                  | 14.1                  |  |  | 127      | 500                                                | 800                                                           | 1000                     |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Leach Test Information                                                                                               |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| Stone Content (%)                                                                                                    | < 0.1                 |  |  |          |                                                    |                                                               |                          |
| Sample Mass (kg)                                                                                                     | 1.1                   |  |  |          |                                                    |                                                               |                          |
| Dry Matter (%)                                                                                                       | 90                    |  |  |          |                                                    |                                                               |                          |
| Moisture (%)                                                                                                         | 10                    |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
|                                                                                                                      |                       |  |  |          |                                                    |                                                               |                          |
| 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 |                       |  |  |          | ** = MCFETS accredited                             |                                                               |                          |

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

\*= UKAS accredited (liquid eluate analysis only)

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

\*\* = MCERTS accredited

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

**Analytical Report Number : 22-79152**

**Project / Site name: Deansgate, 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 * |
|-------------------|------------------|---------------|-----------|----------------------|
| 2395937           | BH102            | None Supplied | 0.80-1.00 | Brown clay.          |
| 2395939           | BH102            | None Supplied | 1.20-1.40 | Brown clay.          |

**Analytical Report Number : 22-79152**

**Project / Site name: Deansgate, 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 |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| BS EN 12457-2 (10:1) Leachate Prep       | 10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.                              | In-house method based on BSEN12457-2.                                                                   | L043-PL       | W                  | NONE                 |
| Acid neutralisation capacity of soil     | Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.                                              | In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance"" | L046-PL       | W                  | NONE                 |
| Loss on ignition of soil @ 450oC         | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.                                        | In house method.                                                                                        | L047-PL       | D                  | MCERTS               |
| Mineral Oil (Soil) C10 - C40             | Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.                                                                | In-house method with silica gel split/clean up.                                                         | L076-PL       | D                  | NONE                 |
| Moisture Content                         | Moisture content, determined gravimetrically. (30 oC)                                                                                                  | In house method.                                                                                        | L019-UK/PL    | W                  | NONE                 |
| Speciated WAC-17 PAHs in soil            | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270. MCERTS accredited except Coronene.                                 | L064-PL       | D                  | MCERTS               |
| PCB's By GC-MS in soil                   | Determination of PCB by extraction with acetone and hexane followed by GC-MS.                                                                          | In-house method based on USEPA 8082                                                                     | L027-PL       | D                  | MCERTS               |
| pH at 20oC in soil                       | Determination of pH in soil by addition of water followed by electrometric measurement.                                                                | In house method.                                                                                        | L005-PL       | W                  | MCERTS               |
| Stones content of soil                   | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.                            | In-house method based on British Standard Methods and MCERTS requirements.                              | L019-UK/PL    | D                  | NONE                 |
| Total organic carbon (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.                          | In house method.                                                                                        | L009-PL       | D                  | MCERTS               |
| BTEX in soil (Monoaromatics)             | Determination of BTEX in soil by headspace GC-MS.                                                                                                      | In-house method based on USEPA8260                                                                      | L073B-PL      | W                  | MCERTS               |
| Total BTEX in soil (Poland)              | Determination of BTEX in soil by headspace GC-MS.                                                                                                      | In-house method based on USEPA8260                                                                      | L073-PL       | W                  | MCERTS               |
| Metals in leachate by ICP-OES            | Determination of metals in leachate by acidification followed by ICP-OES.                                                                              | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""                   | L039-PL       | W                  | ISO 17025            |
| Chloride 10:1 WAC                        | Determination of Chloride colorimetrically by discrete analyser.                                                                                       | In house based on MEWAM Method ISBN 0117516260.                                                         | L082-PL       | W                  | ISO 17025            |
| Fluoride 10:1 WAC                        | Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.                                          | In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"     | L033B-PL      | W                  | ISO 17025            |
| Sulphate 10:1 WAC                        | Determination of sulphate in leachate by ICP-OES                                                                                                       | In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""                   | L039-PL       | W                  | ISO 17025            |
| Total dissolved solids 10:1 WAC          | Determination of total dissolved solids in water by EC probe using a factor of 0.6.                                                                    | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton  | L031          | W                  | ISO 17025            |

**Analytical Report Number : 22-79152**

**Project / Site name: Deansgate, 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 |
|-----------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Monohydric phenols 10:1 WAC       | Determination of phenols in leachate by distillation followed by colorimetry.     | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L080-PL       | W                  | ISO 17025            |
| Dissolved organic carbon 10:1 WAC | Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L037-PL       | W                  | NONE                 |

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

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

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

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

## 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 - understore to separate acronyms (exception for +)           |
| +       | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total     |

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## **Analytical Report Number : 22-81754**

|                             |                      |                                                        |            |
|-----------------------------|----------------------|--------------------------------------------------------|------------|
| <b>Project / Site name:</b> | Deansgate Manchester | <b>Samples received on:</b>                            | 05/09/2022 |
| <b>Your job number:</b>     | 2006023 001          | <b>Samples instructed on/<br/>Analysis started on:</b> | 05/09/2022 |
| <b>Your order number:</b>   |                      | <b>Analysis completed by:</b>                          | 20/09/2022 |
| <b>Report Issue Number:</b> | 1                    | <b>Report issued on:</b>                               | 20/09/2022 |
| <b>Samples Analysed:</b>    | 2 water samples      |                                                        |            |

**Signed:**

Dominika Warjan  
Junior Reporting Specialist  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

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



Analytical Report Number: 22-81754  
Project / Site name: Deansgate Manchester

|                                          |       |                    |                         |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |

#### General Inorganics

|                                  |          |      |           |       |       |
|----------------------------------|----------|------|-----------|-------|-------|
| pH                               | pH Units | N/A  | ISO 17025 | 9.3   | 7.9   |
| Electrical Conductivity at 20 °C | µS/cm    | 10   | ISO 17025 | 470   | 280   |
| Total Cyanide                    | µg/l     | 10   | ISO 17025 | < 10  | < 10  |
| Complex Cyanide                  | µg/l     | 10   | ISO 17025 | < 10  | < 10  |
| Free Cyanide                     | µg/l     | 10   | ISO 17025 | < 10  | < 10  |
| Sulphate as SO4                  | µg/l     | 45   | ISO 17025 | 64000 | 23700 |
| Sulphide                         | µg/l     | 5    | NONE      | < 5.0 | < 5.0 |
| Chloride                         | mg/l     | 0.15 | ISO 17025 | 27    | 22    |
| Ammoniacal Nitrogen as NH4       | µg/l     | 15   | ISO 17025 | 71    | < 15  |
| Total Organic Carbon (TOC)       | mg/l     | 0.1  | ISO 17025 | 8.08  | 7.26  |

#### Total Phenols

|                            |      |    |           |    |      |
|----------------------------|------|----|-----------|----|------|
| Total Phenols (monohydric) | µg/l | 10 | ISO 17025 | 53 | < 10 |
|----------------------------|------|----|-----------|----|------|

#### Speciated PAHs

|                        |      |      |           |        |        |
|------------------------|------|------|-----------|--------|--------|
| Naphthalene            | µg/l | 0.01 | ISO 17025 | 5.69   | 6.59   |
| Acenaphthylene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Acenaphthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Fluorene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Phenanthrene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Anthracene             | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Fluoranthene           | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Pyrene                 | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(a)anthracene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Chrysene               | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene   | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(a)pyrene         | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Indeno(1,2,3-cd)pyrene | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Dibenz(a,h)anthracene  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(ghi)perylene     | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |

#### Total PAH

|                   |      |      |           |      |      |
|-------------------|------|------|-----------|------|------|
| Total EPA-16 PAHs | µg/l | 0.16 | ISO 17025 | 5.69 | 6.59 |
|-------------------|------|------|-----------|------|------|



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|                                          |       |                    |                         |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |

#### Heavy Metals / Metalloids

|                        |      |       |           |       |       |
|------------------------|------|-------|-----------|-------|-------|
| Boron (dissolved)      | µg/l | 10    | ISO 17025 | 84    | 56    |
| Calcium (dissolved)    | mg/l | 0.012 | ISO 17025 | 37    | 25    |
| Chromium (hexavalent)  | µg/l | 5     | ISO 17025 | < 5.0 | < 5.0 |
| Iron (dissolved)       | mg/l | 0.004 | ISO 17025 | 0.017 | 0.059 |
| Magnesium (dissolved)  | mg/l | 0.005 | ISO 17025 | 4.7   | 4.5   |
| Phosphorus (dissolved) | µg/l | 20    | ISO 17025 | 367   | 245   |
| Potassium (dissolved)  | mg/l | 0.025 | ISO 17025 | 24    | 6.6   |
| Sodium (dissolved)     | mg/l | 0.01  | ISO 17025 | 40    | 16    |

|                        |      |      |           |        |        |
|------------------------|------|------|-----------|--------|--------|
| Antimony (dissolved)   | µg/l | 0.4  | ISO 17025 | 1.4    | 2.1    |
| Arsenic (dissolved)    | µg/l | 0.15 | ISO 17025 | 4.76   | 2.18   |
| Barium (dissolved)     | µg/l | 0.06 | ISO 17025 | 23     | 85     |
| Beryllium (dissolved)  | µg/l | 0.1  | ISO 17025 | < 0.1  | < 0.1  |
| Cadmium (dissolved)    | µg/l | 0.02 | ISO 17025 | < 0.02 | < 0.02 |
| Chromium (dissolved)   | µg/l | 0.2  | ISO 17025 | 0.6    | < 0.2  |
| Cobalt (dissolved)     | µg/l | 0.2  | ISO 17025 | 0.2    | 0.5    |
| Copper (dissolved)     | µg/l | 0.5  | ISO 17025 | 1.1    | 2.7    |
| Lead (dissolved)       | µg/l | 0.2  | ISO 17025 | 3.9    | 0.5    |
| Manganese (dissolved)  | µg/l | 0.05 | ISO 17025 | 5.6    | 820    |
| Mercury (dissolved)    | µg/l | 0.05 | ISO 17025 | 0.24   | < 0.05 |
| Molybdenum (dissolved) | µg/l | 0.05 | ISO 17025 | 6.2    | 13     |
| Nickel (dissolved)     | µg/l | 0.5  | ISO 17025 | 1      | 1.5    |
| Selenium (dissolved)   | µg/l | 0.6  | ISO 17025 | 3      | 0.9    |
| Tin (dissolved)        | µg/l | 0.2  | ISO 17025 | 1.2    | < 0.20 |
| Vanadium (dissolved)   | µg/l | 0.2  | ISO 17025 | 4.3    | 0.5    |
| Zinc (dissolved)       | µg/l | 0.5  | ISO 17025 | 1.5    | 3.4    |

#### Monoaromatics & Oxygenates

|                                    |      |   |           |       |       |
|------------------------------------|------|---|-----------|-------|-------|
| Benzene                            | µg/l | 1 | ISO 17025 | 52.6  | < 1.0 |
| Toluene                            | µg/l | 1 | ISO 17025 | 5.8   | 5.3   |
| Ethylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | 40.6  |
| p & m-xylene                       | µg/l | 1 | ISO 17025 | < 1.0 | 5.4   |
| o-xylene                           | µg/l | 1 | ISO 17025 | < 1.0 | 22.3  |
| MTBE (Methyl Tertiary Butyl Ether) | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |

#### Petroleum Hydrocarbons

|                                                        |      |    |      |      |        |
|--------------------------------------------------------|------|----|------|------|--------|
| Mineral Oil (C10 - C40) EH_1D_AL_#1_#2_MS              | µg/l | 10 | NONE | 1460 | < 10.0 |
| Diesel Range Organics (C10 - C25) EH_1D_TOTAL_#1_#2_MS | µg/l | 10 | NONE | 510  | 230    |

|                                    |      |    |           |      |     |
|------------------------------------|------|----|-----------|------|-----|
| TPH1 (C10 - C40) EH_2D_TOTAL_#1_#2 | µg/l | 10 | ISO 17025 | 1700 | 230 |
|------------------------------------|------|----|-----------|------|-----|

|                             |      |    |           |    |     |
|-----------------------------|------|----|-----------|----|-----|
| TPH2 (C6 - C10) HS_1D_TOTAL | µg/l | 10 | ISO 17025 | 58 | 130 |
|-----------------------------|------|----|-----------|----|-----|

|                                                     |      |    |           |       |       |
|-----------------------------------------------------|------|----|-----------|-------|-------|
| TPH-CWG - Aliphatic >C5 - C6 HS_1D_AL               | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C6 - C8 HS_1D_AL               | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C8 - C10 HS_1D_AL              | µg/l | 1  | ISO 17025 | < 1.0 | < 1.0 |
| TPH-CWG - Aliphatic >C10 - C12 EH_1D_AL_#1_#2_MS    | µg/l | 10 | NONE      | < 10  | < 10  |
| TPH-CWG - Aliphatic >C12 - C16 EH_1D_AL_#1_#2_MS    | µg/l | 10 | NONE      | 40    | < 10  |
| TPH-CWG - Aliphatic >C16 - C21 EH_1D_AL_#1_#2_MS    | µg/l | 10 | NONE      | 160   | < 10  |
| TPH-CWG - Aliphatic >C21 - C35 EH_1D_AL_#1_#2_MS    | µg/l | 10 | NONE      | 1300  | < 10  |
| TPH-CWG - Aliphatic (C5 - C35) HS+EH_1D_AL_#1_#2_MS | µg/l | 10 | NONE      | 1500  | < 10  |



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|                                          |       |                    |                         |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |

|                                                               |      |    |           |       |       |
|---------------------------------------------------------------|------|----|-----------|-------|-------|
| TPH-CWG - Aromatic >C5 - C7 <sub>HS_1D_AR</sub>               | µg/l | 1  | ISO 17025 | 53    | < 1.0 |
| TPH-CWG - Aromatic >C7 - C8 <sub>HS_1D_AR</sub>               | µg/l | 1  | ISO 17025 | 5.8   | 5.3   |
| TPH-CWG - Aromatic >C8 - C10 <sub>HS_1D_AR</sub>              | µg/l | 1  | ISO 17025 | < 1.0 | 130   |
| TPH-CWG - Aromatic >C10 - C12 <sub>EH_1D_AR_#1_#2_MS</sub>    | µg/l | 10 | NONE      | 170   | 200   |
| TPH-CWG - Aromatic >C12 - C16 <sub>EH_1D_AR_#1_#2_MS</sub>    | µg/l | 10 | NONE      | 20    | 30    |
| TPH-CWG - Aromatic >C16 - C21 <sub>EH_1D_AR_#1_#2_MS</sub>    | µg/l | 10 | NONE      | < 10  | < 10  |
| TPH-CWG - Aromatic >C21 - C35 <sub>EH_1D_AR_#1_#2_MS</sub>    | µg/l | 10 | NONE      | < 10  | < 10  |
| TPH-CWG - Aromatic (C5 - C35) <sub>HS+EH_1D_AR_#1_#2_MS</sub> | µg/l | 10 | NONE      | 250   | 360   |



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|                                          |       |                    |                         |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |

#### VOCs

|                                       |      |   |           |       |       |
|---------------------------------------|------|---|-----------|-------|-------|
| Chloromethane                         | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Chloroethane                          | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Bromomethane                          | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Vinyl Chloride                        | µg/l | 1 | NONE      | < 1.0 | < 1.0 |
| Trichlorofluoromethane                | µg/l | 1 | NONE      | < 1.0 | < 1.0 |
| 1,1-Dichloroethene                    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Cis-1,2-dichloroethene                | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| MTBE (Methyl Tertiary Butyl Ether)    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,1-Dichloroethane                    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 2,2-Dichloropropane                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Trichloromethane                      | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,1,1-Trichloroethane                 | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,2-Dichloroethane                    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,1-Dichloropropene                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Trans-1,2-dichloroethene              | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Benzene                               | µg/l | 1 | ISO 17025 | 52.6  | < 1.0 |
| Tetrachloromethane                    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,2-Dichloropropane                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Trichloroethene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Dibromomethane                        | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Bromodichloromethane                  | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Cis-1,3-dichloropropene               | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Trans-1,3-dichloropropene             | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Toluene                               | µg/l | 1 | ISO 17025 | 5.8   | 5.3   |
| 1,1,2-Trichloroethane                 | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,3-Dichloropropane                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Dibromochloromethane                  | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Tetrachloroethene                     | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,2-Dibromoethane                     | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Chlorobenzene                         | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,1,1,2-Tetrachloroethane             | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Ethylbenzene                          | µg/l | 1 | ISO 17025 | < 1.0 | 40.6  |
| p & m-Xylene                          | µg/l | 1 | ISO 17025 | < 1.0 | 5.4   |
| Styrene                               | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Tribromomethane                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| o-Xylene                              | µg/l | 1 | ISO 17025 | < 1.0 | 22.3  |
| 1,1,2,2-Tetrachloroethane             | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Isopropylbenzene                      | µg/l | 1 | ISO 17025 | < 1.0 | 4.9   |
| Bromobenzene                          | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| n-Propylbenzene                       | µg/l | 1 | ISO 17025 | < 1.0 | 14.9  |
| 2-Chlorotoluene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 4-Chlorotoluene                       | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,3,5-Trimethylbenzene                | µg/l | 1 | ISO 17025 | < 1.0 | 39.3  |
| tert-Butylbenzene                     | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,2,4-Trimethylbenzene                | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| sec-Butylbenzene                      | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,3-Dichlorobenzene                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| p-Isopropyltoluene                    | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,2-Dichlorobenzene                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| 1,4-Dichlorobenzene                   | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |
| Butylbenzene                          | µg/l | 1 | ISO 17025 | < 1.0 | < 1.0 |



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Project / Site name: Deansgate Manchester

| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| 1,2-Dibromo-3-chloropropane              | µg/l  | 1                  | ISO 17025               | < 1.0         | < 1.0         |
| 1,2,4-Trichlorobenzene                   | µg/l  | 1                  | ISO 17025               | < 1.0         | < 1.0         |
| Hexachlorobutadiene                      | µg/l  | 1                  | ISO 17025               | < 1.0         | < 1.0         |
| 1,2,3-Trichlorobenzene                   | µg/l  | 1                  | ISO 17025               | < 1.0         | < 1.0         |



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|                                          |       |                    |                         |               |               |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |

#### SVOCs

|                             |      |      |           |        |        |
|-----------------------------|------|------|-----------|--------|--------|
| Aniline                     | µg/l | 0.05 | NONE      | 1.2    | 0.99   |
| Phenol                      | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2-Chlorophenol              | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Bis(2-chloroethyl)ether     | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 1,3-Dichlorobenzene         | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 1,2-Dichlorobenzene         | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 1,4-Dichlorobenzene         | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Bis(2-chloroisopropyl)ether | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2-Methylphenol              | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Hexachloroethane            | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Nitrobenzene                | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 4-Methylphenol              | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Isophorone                  | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2-Nitrophenol               | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2,4-Dimethylphenol          | µg/l | 0.05 | NONE      | 0.67   | 2      |
| Bis(2-chloroethoxy)methane  | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 1,2,4-Trichlorobenzene      | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Naphthalene                 | µg/l | 0.01 | ISO 17025 | 5.7    | 6.6    |
| 2,4-Dichlorophenol          | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 4-Chloroaniline             | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Hexachlorobutadiene         | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 4-Chloro-3-methylphenol     | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2,4,6-Trichlorophenol       | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2,4,5-Trichlorophenol       | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2-Methylnaphthalene         | µg/l | 0.05 | NONE      | 1.5    | 1.1    |
| 2-Chloronaphthalene         | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Dimethylphthalate           | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 2,6-Dinitrotoluene          | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Acenaphthylene              | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Acenaphthene                | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| 2,4-Dinitrotoluene          | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Dibenzofuran                | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 4-Chlorophenyl phenyl ether | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Diethyl phthalate           | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| 4-Nitroaniline              | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Fluorene                    | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Azobenzene                  | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Bromophenyl phenyl ether    | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Hexachlorobenzene           | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Phenanthrene                | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Anthracene                  | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Carbazole                   | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Dibutyl phthalate           | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Anthraquinone               | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Fluoranthene                | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Pyrene                      | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Butyl benzyl phthalate      | µg/l | 0.05 | NONE      | < 0.05 | < 0.05 |
| Benzo(a)anthracene          | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Chrysene                    | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(b)fluoranthene        | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(k)fluoranthene        | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |
| Benzo(a)pyrene              | µg/l | 0.01 | ISO 17025 | < 0.01 | < 0.01 |



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Project / Site name: Deansgate Manchester

| Lab Sample Number                        |       |                    |                         | 2411438       | 2411439       |
|------------------------------------------|-------|--------------------|-------------------------|---------------|---------------|
| Sample Reference                         |       |                    |                         | BH101         | BH102         |
| Sample Number                            |       |                    |                         | None Supplied | None Supplied |
| Depth (m)                                |       |                    |                         | None Supplied | None Supplied |
| Date Sampled                             |       |                    |                         | 01/09/2022    | 01/09/2022    |
| Time Taken                               |       |                    |                         | None Supplied | None Supplied |
| Analytical Parameter<br>(Water Analysis) | Units | Limit of detection | Accreditation<br>Status |               |               |
| Indeno(1,2,3-cd)pyrene                   | µg/l  | 0.01               | ISO 17025               | < 0.01        | < 0.01        |
| Dibenz(a,h)anthracene                    | µg/l  | 0.01               | ISO 17025               | < 0.01        | < 0.01        |
| Benzo(ghi)perylene                       | µg/l  | 0.01               | ISO 17025               | < 0.01        | < 0.01        |
| 3&4-Methylphenol                         |       |                    |                         | < 0.10        | < 0.10        |

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

**Analytical Report Number : 22-81754**

**Project / Site name: Deansgate 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 |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Metals in water by ICP-MS (dissolved)    | Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.                                  | In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS. | L012-PL       | W                  | ISO 17025            |
| Metals in water by ICP-OES (dissolved)   | Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).                                                 | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| Boron in water                           | Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW                                                                        | In-house method based on MEWAM                                                                                  | L039-PL       | W                  | ISO 17025            |
| Complex cyanide in water                 | Determination of complex cyanide by calculation. Accredited matrices SW, PW, GW.                                                                                           | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| Hexavalent chromium in water             | Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.                                                 | In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.                                    | L080-PL       | W                  | ISO 17025            |
| Electrical conductivity at 20oC of water | Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW                                                             | In-house method                                                                                                 | L031-PL       | W                  | ISO 17025            |
| Free cyanide in water                    | Determination of free cyanide by distillation followed by colorimetry.Accredited matrices SW, GW, PW.                                                                      | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| Mineral Oil (Waters) C10 - C40           | Determination of dichloromethane extractable hydrocarbons in water by GC-MS.                                                                                               | In-house method                                                                                                 | L070-PL       | W                  | NONE                 |
| Monohydric phenols in water              | Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW                                                                               | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL       | W                  | ISO 17025            |
| Speciated EPA-16 PAHs in water           | Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW | In-house method based on USEPA 8270                                                                             | L102B-PL      | W                  | ISO 17025            |
| Sulphide in water                        | Determination of sulphide in water by ion selective electrode.                                                                                                             | In-house method                                                                                                 | L029-PL       | W                  | NONE                 |
| Sulphate in water                        | Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.                                                  | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.                            | L039-PL       | W                  | ISO 17025            |
| Semi-volatile organic compounds in water | Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.                                                           | In-house method based on USEPA 8270                                                                             | L102B-PL      | W                  | ISO 17025            |
| TPH2 (Waters)                            | Determination of hydrocarbons C6-C10 by headspace GC-MS. Accredited Matrices SW, PW. GW.                                                                                   | In-house method based on USEPA8260                                                                              | L088-PL       | W                  | ISO 17025            |
| TPHCWG (Waters)                          | Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.                                                                 | In-house method                                                                                                 | L070-PL       | W                  | ISO 17025            |
| Total cyanide in water                   | Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW                                                                      | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL       | W                  | ISO 17025            |
| Total organic carbon in water            | Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.                                                                | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton          | L037-PL       | W                  | ISO 17025            |



**Analytical Report Number : 22-81754**

**Project / Site name: Deansgate 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 |
|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------|--------------------|----------------------|
| Volatile organic compounds in water    | Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW                                      | In-house method based on USEPA8260                                                                     | L073B-PL      | W                  | ISO 17025            |
| BTEX and MTBE in water (Monoaromatics) | Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW                                                   | In-house method based on USEPA8260                                                                     | L073B-PL      | W                  | ISO 17025            |
| Ammonium as NH4 in water               | Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L082-PL       | W                  | ISO 17025            |
| DRO (Waters)                           | Determination of dichloromethane extractable hydrocarbons in water by GC-MS.                                                                | In-house method                                                                                        | L070-PL       | W                  | NONE                 |
| pH at 20oC in water (automated)        | Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW                                                    | In house method.                                                                                       | L099-PL       | W                  | ISO 17025            |
| TPH1 (Waters)                          | Determination of dichloromethane extractable hydrocarbons in water by GC-MS.                                                                | In-house method                                                                                        | L070-PL       | W                  | ISO 17025            |
| Chloride in water                      | Determination of Chloride (diissolved) colorimetrically by discrete analyser.                                                               | In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.                       | L082-PL       | W                  | ISO 17025            |

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

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

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

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

## 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 - understore to separate acronyms (exception for +)           |
| +       | Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total     |

## Sample Deviation Report



**Analytical Report Number : 22-81754**

**Project / Site name: Deansgate Manchester**

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.

| Sample ID | Other ID      | Sample Type | Lab Sample Number | Sample Deviation | Test Name                                | Test Ref | Test Deviation |
|-----------|---------------|-------------|-------------------|------------------|------------------------------------------|----------|----------------|
| BH101     | None Supplied | W           | 2411438           | c                | Ammoniacal Nitrogen as N in water        | L082-PL  | c              |
| BH101     | None Supplied | W           | 2411438           | c                | Ammonium as NH4 in water                 | L082-PL  | c              |
| BH101     | None Supplied | W           | 2411438           | c                | Electrical conductivity at 20oC of water | L031-PL  | c              |
| BH101     | None Supplied | W           | 2411438           | c                | pH at 20oC in water (automated)          | L099-PL  | c              |
| BH102     | None Supplied | W           | 2411439           | c                | Ammoniacal Nitrogen as N in water        | L082-PL  | c              |
| BH102     | None Supplied | W           | 2411439           | c                | Ammonium as NH4 in water                 | L082-PL  | c              |
| BH102     | None Supplied | W           | 2411439           | c                | Electrical conductivity at 20oC of water | L031-PL  | c              |
| BH102     | None Supplied | W           | 2411439           | c                | pH at 20oC in water (automated)          | L099-PL  | c              |

## Appendix H

### Geotechnical Laboratory Report



## Summary of Point Load Test Results

| Job No.<br>32308                                                                               |        | Project Name<br>Deansgate, Manchester |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             | Samples received<br>25/08/2022  |         | Programme                                                        |  |
|------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------|-----------------------------|---------------------|-----------------------------|-------------|---------------------------------|---------|------------------------------------------------------------------|--|
| Project No.<br>2006023.001                                                                     |        | Client<br>TEC                         |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             | Schedule received<br>25/08/2022 |         |                                                                  |  |
|                                                                                                |        |                                       |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             | Project started<br>26/08/2022   |         |                                                                  |  |
|                                                                                                |        |                                       |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             | Date started<br>05/09/2022      |         |                                                                  |  |
| Hole No.                                                                                       | Sample |                                       |        |      | Description                                                                                                                                           | Test Type      | Sample Width<br>W (mm) | Platen Separation<br>D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F             | Is (50) | Remarks                                                          |  |
|                                                                                                | Ref    | Top m                                 | Base m | Type |                                                                                                                                                       |                |                        |                             |                     |                             |             |                                 |         |                                                                  |  |
| BH101                                                                                          | -      | 8.86                                  | 8.94   | C    | Reddish brown SANDSTONE core                                                                                                                          | Diametral      | 84.00                  | 84.00                       | 1.41                | 94.78                       | 0.16        | 1.33                            | 0.21    |                                                                  |  |
| BH101                                                                                          | -      | 8.86                                  | 8.94   | C    | Reddish brown SANDSTONE core                                                                                                                          | Axial          | 84.00                  | 39.00                       | 2.00                | 64.58                       | 0.48        | 1.12                            | 0.54    |                                                                  |  |
| BH101                                                                                          | -      | 8.86                                  | 8.94   | C    | Reddish brown SANDSTONE core                                                                                                                          | Axial          | 84.00                  | 33.00                       | 1.80                | 59.41                       | 0.51        | 1.08                            | 0.55    |                                                                  |  |
| BH101                                                                                          | -      | 8.86                                  | 8.94   | C    | Reddish brown SANDSTONE core                                                                                                                          | Irregular lump | 49.00                  | 42.00                       | 0.60                | 51.19                       | 0.23        | 1.01                            | 0.23    |                                                                  |  |
| BH101                                                                                          | -      | 8.86                                  | 8.94   | C    | Reddish brown SANDSTONE core                                                                                                                          | Irregular lump | 41.00                  | 40.00                       | 0.55                | 45.70                       | 0.26        | 0.96                            | 0.25    |                                                                  |  |
| BH101                                                                                          | -      | 10.89                                 | 10.96  | C    | Reddish brown SANDSTONE core                                                                                                                          | Diametral      | 79.00                  | 79.00                       | 0.65                | 89.14                       | 0.08        | 1.30                            | 0.11    |                                                                  |  |
| BH101                                                                                          | -      | 10.89                                 | 10.96  | C    | Reddish brown SANDSTONE core                                                                                                                          | Axial          | 79.00                  | 24.00                       | 0.83                | 49.13                       | 0.34        | 0.99                            | 0.34    |                                                                  |  |
| BH101                                                                                          | -      | 10.89                                 | 10.96  | C    | Reddish brown SANDSTONE core                                                                                                                          | Axial          | 79.00                  | 39.00                       | 1.10                | 62.63                       | 0.28        | 1.11                            | 0.31    |                                                                  |  |
| BH101                                                                                          | -      | 10.89                                 | 10.96  | C    | Reddish brown SANDSTONE core                                                                                                                          | Irregular lump | 40.00                  | 40.00                       | 0.35                | 45.14                       | 0.17        | 0.95                            | 0.16    |                                                                  |  |
| BH101                                                                                          | -      | 10.89                                 | 10.96  | C    | Reddish brown SANDSTONE core                                                                                                                          | Irregular lump | 40.00                  | 39.00                       | 0.30                | 44.57                       | 0.15        | 0.95                            | 0.14    |                                                                  |  |
| BH101                                                                                          | -      | 14.86                                 | 14.92  | C    | Reddish brown SANDSTONE core                                                                                                                          | Diametral      | 86.00                  | 86.00                       | 1.50                | 97.04                       | 0.16        | 1.35                            | 0.21    |                                                                  |  |
| Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength |        |                                       |        |      | Test Report by K4 SOILS LABORATORY<br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |                |                        |                             |                     |                             |             |                                 |         | Checked and Approved<br><br>Initials J.P<br><br>Date: 15/09/2022 |  |
| Approved Signatories: K.Phaure (Tech.Mar) J.Phaure (Lab.Mar)                                   |        |                                       |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             |                                 |         |                                                                  |  |
| MSF-5-R33                                                                                      |        |                                       |        |      |                                                                                                                                                       |                |                        |                             |                     |                             |             |                                 |         |                                                                  |  |

|                      |        | Summary of Point Load Test Results    |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                     |         |
|-------------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|---------------------------------------------------------------------|---------|
| Job No.<br>32308                                                                                      |        | Project Name<br>Deansgate, Manchester |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             | Programme           |                                                                     |         |
|                                                                                                       |        |                                       |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             | Samples received    | 25/08/2022                                                          |         |
|                                                                                                       |        |                                       |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             | Schedule received   | 25/08/2022                                                          |         |
| Project No.<br>2006023.001                                                                            |        | Client<br>TEC                         |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             | Project started     | 26/08/2022                                                          |         |
|                                                                                                       |        |                                       |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             | Date started        | 05/09/2022                                                          |         |
| Hole No.                                                                                              | Sample |                                       |        |      | Description                                                                      | Test Type                                                                                                                                                    | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)                                                             | Remarks |
|                                                                                                       | Ref    | Top m                                 | Base m | Type |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                     |         |
| BH101                                                                                                 | -      | 14.86                                 | 14.92  | C    | Reddish brown SANDSTONE core                                                     | Diametral                                                                                                                                                    | 86.00               | 86.00                    | 1.45                | 97.04                       | 0.15        | 1.35                | 0.21                                                                |         |
| BH101                                                                                                 | -      | 14.86                                 | 14.92  | C    | Reddish brown SANDSTONE core                                                     | Axial                                                                                                                                                        | 86.00               | 37.00                    | 2.35                | 63.65                       | 0.58        | 1.11                | 0.65                                                                |         |
| BH101                                                                                                 | -      | 14.86                                 | 14.92  | C    | Reddish brown SANDSTONE core                                                     | Axial                                                                                                                                                        | 86.00               | 30.00                    | 1.60                | 57.31                       | 0.49        | 1.06                | 0.52                                                                |         |
| BH101                                                                                                 | -      | 14.86                                 | 14.92  | C    | Reddish brown SANDSTONE core                                                     | Axial                                                                                                                                                        | 86.00               | 12.00                    | 0.90                | 36.25                       | 0.68        | 0.87                | 0.59                                                                |         |
| BH101                                                                                                 | -      | 15.68                                 | 15.76  | C    | Reddish brown SANDSTONE core with occasional intrusions of fm sub-angular gravel | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 1.20                | 95.91                       | 0.13        | 1.34                | 0.17                                                                |         |
| BH101                                                                                                 | -      | 15.68                                 | 15.76  | C    | Reddish brown SANDSTONE core with occasional intrusions of fm sub-angular gravel | Axial                                                                                                                                                        | 85.00               | 40.00                    | 1.55                | 65.80                       | 0.36        | 1.13                | 0.41                                                                |         |
| BH101                                                                                                 | -      | 15.68                                 | 15.76  | C    | Reddish brown SANDSTONE core with occasional intrusions of fm sub-angular gravel | Axial                                                                                                                                                        | 85.00               | 41.00                    | 1.90                | 66.61                       | 0.43        | 1.14                | 0.49                                                                |         |
| BH101                                                                                                 | -      | 15.68                                 | 15.76  | C    | Reddish brown SANDSTONE core with occasional intrusions of fm sub-angular gravel | Irregular lump                                                                                                                                               | 43.00               | 49.00                    | 0.75                | 51.79                       | 0.28        | 1.02                | 0.28                                                                |         |
| BH101                                                                                                 | -      | 15.68                                 | 15.76  | C    | Reddish brown SANDSTONE core with occasional intrusions of fm sub-angular gravel | Irregular lump                                                                                                                                               | 43.00               | 44.00                    | 0.07                | 49.08                       | 0.03        | 0.99                | 0.03                                                                |         |
| BH101                                                                                                 | -      | 16.62                                 | 16.72  | C    | Reddish brown SANDSTONE core                                                     | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 1.95                | 95.91                       | 0.21        | 1.34                | 0.28                                                                |         |
| BH101                                                                                                 | -      | 16.62                                 | 16.72  | C    | Reddish brown SANDSTONE core                                                     | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 2.00                | 95.91                       | 0.22        | 1.34                | 0.29                                                                |         |
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> |        |                                       |        |      |                                                                                  | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |                     |                          |                     |                             |             |                     | <b>Checked and Approved</b><br><br>Initials J.P<br>Date: 15/09/2022 |         |
| Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                          |        |                                       |        |      |                                                                                  |                                                                                                                                                              |                     |                          |                     |                             |             |                     | MSF-5-R33                                                           |         |

|                      |        | Summary of Point Load Test Results    |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                      |         |
|-------------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|----------------------------------------------------------------------------------------------------------------------|---------|
| Job No.<br>32308                                                                                      |        | Project Name<br>Deansgate, Manchester |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             | Programme           |                                                                                                                      |         |
|                                                                                                       |        |                                       |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             | Samples received    | 25/08/2022                                                                                                           |         |
|                                                                                                       |        |                                       |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             | Schedule received   | 25/08/2022                                                                                                           |         |
| Project No.<br>2006023.001                                                                            |        | Client<br>TEC                         |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             | Project started     | 26/08/2022                                                                                                           |         |
|                                                                                                       |        |                                       |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             | Date started        | 05/09/2022                                                                                                           |         |
| Hole No.                                                                                              | Sample |                                       |        |      | Description                  | Test Type                                                                                                                                                    | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)                                                                                                              | Remarks |
|                                                                                                       | Ref    | Top m                                 | Base m | Type |                              |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                      |         |
| BH101                                                                                                 | -      | 16.62                                 | 16.72  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 37.00                    | 1.35                | 63.28                       | 0.34        | 1.11                | 0.37                                                                                                                 |         |
| BH101                                                                                                 | -      | 16.62                                 | 16.72  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 32.00                    | 1.85                | 58.85                       | 0.53        | 1.08                | 0.57                                                                                                                 |         |
| BH101                                                                                                 | -      | 16.62                                 | 16.72  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 25.00                    | 1.30                | 52.02                       | 0.48        | 1.02                | 0.49                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.00                                 | 19.10  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 2.00                | 95.91                       | 0.22        | 1.34                | 0.29                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.00                                 | 19.10  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 2.12                | 95.91                       | 0.23        | 1.34                | 0.31                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.00                                 | 19.10  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 34.00                    | 2.20                | 60.66                       | 0.60        | 1.09                | 0.65                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.00                                 | 19.10  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 31.00                    | 2.00                | 57.92                       | 0.60        | 1.07                | 0.64                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.00                                 | 19.10  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 19.00                    | 1.30                | 45.35                       | 0.63        | 0.96                | 0.61                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.65                                 | 19.74  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 0.98                | 95.91                       | 0.11        | 1.34                | 0.14                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.65                                 | 19.74  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 0.75                | 95.91                       | 0.08        | 1.34                | 0.11                                                                                                                 |         |
| BH101                                                                                                 | -      | 19.65                                 | 19.74  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                        | 85.00               | 38.00                    | 1.52                | 64.13                       | 0.37        | 1.12                | 0.41                                                                                                                 |         |
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> |        |                                       |        |      |                              | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |                     |                          |                     |                             |             |                     | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                         15/09/2022 |         |
| Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                          |        |                                       |        |      |                              |                                                                                                                                                              |                     |                          |                     |                             |             |                     | MSF-5-R33                                                                                                            |         |

|  |        | Summary of Point Load Test Results |        |      |                              |                |                     |                          |                     |                             |             |                     |            |         |
|-----------------------------------------------------------------------------------|--------|------------------------------------|--------|------|------------------------------|----------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|------------|---------|
| Job No.                                                                           |        | Project Name                       |        |      |                              |                |                     |                          |                     |                             |             | Programme           |            |         |
| 32308                                                                             |        | Deansgate, Manchester              |        |      |                              |                |                     |                          |                     |                             |             | Samples received    | 25/08/2022 |         |
| Project No.                                                                       |        | Client                             |        |      |                              |                |                     |                          |                     |                             |             | Schedule received   | 25/08/2022 |         |
| 2006023.001                                                                       |        | TEC                                |        |      |                              |                |                     |                          |                     |                             |             | Project started     | 26/08/2022 |         |
|                                                                                   |        |                                    |        |      |                              |                |                     |                          |                     |                             |             | Date started        | 05/09/2022 |         |
| Hole No.                                                                          | Sample |                                    |        |      | Description                  | Test Type      | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)    | Remarks |
|                                                                                   | Ref    | Top m                              | Base m | Type |                              |                |                     |                          |                     |                             |             |                     |            |         |
| BH101                                                                             | -      | 19.65                              | 19.74  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 29.00                    | 1.00                | 56.02                       | 0.32        | 1.05                | 0.34       |         |
| BH101                                                                             | -      | 19.65                              | 19.74  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 22.00                    | 0.80                | 48.80                       | 0.34        | 0.99                | 0.33       |         |
| BH101                                                                             | -      | 20.45                              | 20.55  | C    | Reddish brown SANDSTONE core | Diametral      | 85.00               | 85.00                    | 1.50                | 95.91                       | 0.16        | 1.34                | 0.22       |         |
| BH101                                                                             | -      | 20.45                              | 20.55  | C    | Reddish brown SANDSTONE core | Diametral      | 85.00               | 85.00                    | 1.59                | 95.91                       | 0.17        | 1.34                | 0.23       |         |
| BH101                                                                             | -      | 20.45                              | 20.55  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 39.00                    | 1.30                | 64.97                       | 0.31        | 1.13                | 0.35       |         |
| BH101                                                                             | -      | 20.45                              | 20.55  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 32.00                    | 1.49                | 58.85                       | 0.43        | 1.08                | 0.46       |         |
| BH101                                                                             | -      | 20.45                              | 20.55  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 26.00                    | 0.91                | 53.05                       | 0.32        | 1.03                | 0.33       |         |
| BH101                                                                             | -      | 22.09                              | 22.16  | C    | Reddish brown SANDSTONE core | Diametral      | 85.00               | 85.00                    | 0.50                | 95.91                       | 0.05        | 1.34                | 0.07       |         |
| BH101                                                                             | -      | 22.09                              | 22.16  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 28.00                    | 0.62                | 55.05                       | 0.20        | 1.04                | 0.21       |         |
| BH101                                                                             | -      | 22.09                              | 22.16  | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 34.00                    | 1.60                | 60.66                       | 0.43        | 1.09                | 0.47       |         |
| BH101                                                                             | -      | 22.09                              | 22.16  | C    | Reddish brown SANDSTONE core | Irregular lump | 39.00               | 36.00                    | 1.00                | 42.28                       | 0.56        | 0.93                | 0.52       |         |

|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |
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| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |  | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                         15/09/2022 |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

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|  |        | Summary of Point Load Test Results |        |      |                              |                |                     |                          |                     |                             |             |                     |            |         |
|-----------------------------------------------------------------------------------|--------|------------------------------------|--------|------|------------------------------|----------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|------------|---------|
| Job No.                                                                           |        | Project Name                       |        |      |                              |                |                     |                          |                     |                             |             | Programme           |            |         |
| 32308                                                                             |        | Deansgate, Manchester              |        |      |                              |                |                     |                          |                     |                             |             | Samples received    | 25/08/2022 |         |
| Project No.                                                                       |        | Client                             |        |      |                              |                |                     |                          |                     |                             |             | Schedule received   | 25/08/2022 |         |
| 2006023.001                                                                       |        | TEC                                |        |      |                              |                |                     |                          |                     |                             |             | Project started     | 26/08/2022 |         |
|                                                                                   |        |                                    |        |      |                              |                |                     |                          |                     |                             |             | Date started        | 05/09/2022 |         |
| Hole No.                                                                          | Sample |                                    |        |      | Description                  | Test Type      | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)    | Remarks |
|                                                                                   | Ref    | Top m                              | Base m | Type |                              |                |                     |                          |                     |                             |             |                     |            |         |
| BH101                                                                             | -      | 22.09                              | 22.16  | C    | Reddish brown SANDSTONE core | Irregular lump | 44.00               | 32.00                    | 1.12                | 42.34                       | 0.62        | 0.93                | 0.58       |         |
| BH102                                                                             | -      | 3.43                               | 3.51   | C    | Reddish brown SANDSTONE core | Diametral      | 85.00               | 85.00                    | 0.70                | 95.91                       | 0.08        | 1.34                | 0.10       |         |
| BH102                                                                             | -      | 3.43                               | 3.51   | C    | Reddish brown SANDSTONE core | Diametral      | 85.00               | 85.00                    | 0.35                | 95.91                       | 0.04        | 1.34                | 0.05       |         |
| BH102                                                                             | -      | 3.43                               | 3.51   | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 34.00                    | 0.80                | 60.66                       | 0.22        | 1.09                | 0.24       |         |
| BH102                                                                             | -      | 3.43                               | 3.51   | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 31.00                    | 0.52                | 57.92                       | 0.15        | 1.07                | 0.17       |         |
| BH102                                                                             | -      | 3.43                               | 3.51   | C    | Reddish brown SANDSTONE core | Axial          | 85.00               | 18.00                    | 0.18                | 44.14                       | 0.09        | 0.95                | 0.09       |         |
| BH102                                                                             | -      | 4.18                               | 4.25   | C    | Reddish brown SANDSTONE core | Diametral      | 83.00               | 83.00                    | 0.65                | 93.66                       | 0.07        | 1.33                | 0.10       |         |
| BH102                                                                             | -      | 4.18                               | 4.25   | C    | Reddish brown SANDSTONE core | Axial          | 83.00               | 30.00                    | 0.92                | 56.31                       | 0.29        | 1.05                | 0.31       |         |
| BH102                                                                             | -      | 4.18                               | 4.25   | C    | Reddish brown SANDSTONE core | Axial          | 83.00               | 32.00                    | 0.78                | 58.15                       | 0.23        | 1.07                | 0.25       |         |
| BH102                                                                             | -      | 4.18                               | 4.25   | C    | Reddish brown SANDSTONE core | Irregular lump | 43.00               | 32.00                    | 0.65                | 41.86                       | 0.37        | 0.92                | 0.34       |         |
| BH102                                                                             | -      | 4.18                               | 4.25   | C    | Reddish brown SANDSTONE core | Irregular lump | 41.00               | 29.00                    | 0.62                | 38.91                       | 0.41        | 0.89                | 0.37       |         |

|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |
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| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |  | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                         15/09/2022 |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                      |

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

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|  |        | Summary of Point Load Test Results |        |      |                              |           |                     |                          |                     |                             |             |                     |            |                   |
|-----------------------------------------------------------------------------------|--------|------------------------------------|--------|------|------------------------------|-----------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|------------|-------------------|
| Job No.                                                                           |        | Project Name                       |        |      |                              |           |                     |                          |                     |                             |             | Programme           |            |                   |
| 32308                                                                             |        | Deansgate, Manchester              |        |      |                              |           |                     |                          |                     |                             |             | Samples received    | 25/08/2022 |                   |
| Project No.                                                                       |        | Client                             |        |      |                              |           |                     |                          |                     |                             |             | Schedule received   | 25/08/2022 |                   |
| 2006023.001                                                                       |        | TEC                                |        |      |                              |           |                     |                          |                     |                             |             | Project started     | 26/08/2022 |                   |
|                                                                                   |        |                                    |        |      |                              |           |                     |                          |                     |                             |             | Date started        | 05/09/2022 |                   |
| Hole No.                                                                          | Sample |                                    |        |      | Description                  | Test Type | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)    | Remarks           |
|                                                                                   | Ref    | Top m                              | Base m | Type |                              |           |                     |                          |                     |                             |             |                     |            |                   |
| BH102                                                                             | -      | 6.41                               | 6.50   | C    | Reddish brown SANDSTONE core | Diametral | 86.00               | 86.00                    | 1.50                | 97.04                       | 0.16        | 1.35                | 0.21       | Hydrocarbon smell |
| BH102                                                                             | -      | 6.41                               | 6.50   | C    | Reddish brown SANDSTONE core | Diametral | 86.00               | 86.00                    | 1.20                | 97.04                       | 0.13        | 1.35                | 0.17       | Hydrocarbon smell |
| BH102                                                                             | -      | 6.41                               | 6.50   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 32.00                    | 1.25                | 59.19                       | 0.36        | 1.08                | 0.38       | Hydrocarbon smell |
| BH102                                                                             | -      | 6.41                               | 6.50   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 26.00                    | 1.40                | 53.36                       | 0.49        | 1.03                | 0.51       | Hydrocarbon smell |
| BH102                                                                             | -      | 6.41                               | 6.50   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 28.00                    | 1.55                | 55.37                       | 0.51        | 1.05                | 0.53       | Hydrocarbon smell |
| BH102                                                                             | -      | 7.00                               | 7.10   | C    | Reddish brown SANDSTONE core | Diametral | 86.00               | 86.00                    | 1.19                | 97.04                       | 0.13        | 1.35                | 0.17       |                   |
| BH102                                                                             | -      | 7.00                               | 7.10   | C    | Reddish brown SANDSTONE core | Diametral | 86.00               | 86.00                    | 0.95                | 97.04                       | 0.10        | 1.35                | 0.14       |                   |
| BH102                                                                             | -      | 7.00                               | 7.10   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 38.00                    | 1.40                | 64.51                       | 0.34        | 1.12                | 0.38       |                   |
| BH102                                                                             | -      | 7.00                               | 7.10   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 36.00                    | 1.35                | 62.78                       | 0.34        | 1.11                | 0.38       |                   |
| BH102                                                                             | -      | 7.00                               | 7.10   | C    | Reddish brown SANDSTONE core | Axial     | 86.00               | 20.00                    | 1.32                | 46.80                       | 0.60        | 0.97                | 0.59       |                   |
| BH102                                                                             | -      | 8.62                               | 8.72   | C    | Reddish brown SANDSTONE core | Diametral | 86.00               | 86.00                    | 0.99                | 97.04                       | 0.11        | 1.35                | 0.14       |                   |

|                                                                                                       |                                                                                                                                                              |  |                                                                                                                       |
|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------|
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |  | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                          15/09/2022 |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                       |
|                                                                                                       |                                                                                                                                                              |  |                                                                                                                       |

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

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|                      |        | Summary of Point Load Test Results    |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                       |         |
|-------------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------------------|---------|
| Job No.<br>32308                                                                                      |        | Project Name<br>Deansgate, Manchester |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             | Programme           |                                                                                                                       |         |
|                                                                                                       |        |                                       |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             | Samples received    | 25/08/2022                                                                                                            |         |
|                                                                                                       |        |                                       |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             | Schedule received   | 25/08/2022                                                                                                            |         |
| Project No.<br>2006023.001                                                                            |        | Client<br>TEC                         |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             | Project started     | 26/08/2022                                                                                                            |         |
|                                                                                                       |        |                                       |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             | Date started        | 05/09/2022                                                                                                            |         |
| Hole No.                                                                                              | Sample |                                       |        |      | Description                                                                   | Test Type                                                                                                                                                    | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)                                                                                                               | Remarks |
|                                                                                                       | Ref    | Top m                                 | Base m | Type |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                       |         |
| BH102                                                                                                 | -      | 8.62                                  | 8.72   | C    | Reddish brown SANDSTONE core                                                  | Diametral                                                                                                                                                    | 86.00               | 86.00                    | 1.05                | 97.04                       | 0.11        | 1.35                | 0.15                                                                                                                  |         |
| BH102                                                                                                 | -      | 8.62                                  | 8.72   | C    | Reddish brown SANDSTONE core                                                  | Axial                                                                                                                                                        | 86.00               | 43.00                    | 1.65                | 68.62                       | 0.35        | 1.15                | 0.40                                                                                                                  |         |
| BH102                                                                                                 | -      | 8.62                                  | 8.72   | C    | Reddish brown SANDSTONE core                                                  | Axial                                                                                                                                                        | 86.00               | 32.00                    | 1.10                | 59.19                       | 0.31        | 1.08                | 0.34                                                                                                                  |         |
| BH102                                                                                                 | -      | 8.62                                  | 8.72   | C    | Reddish brown SANDSTONE core                                                  | Axial                                                                                                                                                        | 86.00               | 19.00                    | 0.50                | 45.61                       | 0.24        | 0.96                | 0.23                                                                                                                  |         |
| BH102                                                                                                 | -      | 12.90                                 | 13.00  | C    | Reddish brown SANDSTONE core with rare intrusion of medium sub-rounded gravel | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 0.10                | 95.91                       | 0.01        | 1.34                | 0.01                                                                                                                  |         |
| BH102                                                                                                 | -      | 12.90                                 | 13.00  | C    | Reddish brown SANDSTONE core with rare intrusion of medium sub-rounded gravel | Axial                                                                                                                                                        | 85.00               | 37.00                    | 2.05                | 63.28                       | 0.51        | 1.11                | 0.57                                                                                                                  |         |
| BH102                                                                                                 | -      | 12.90                                 | 13.00  | C    | Reddish brown SANDSTONE core with rare intrusion of medium sub-rounded gravel | Axial                                                                                                                                                        | 85.00               | 36.00                    | 1.50                | 62.42                       | 0.38        | 1.10                | 0.43                                                                                                                  |         |
| BH102                                                                                                 | -      | 12.90                                 | 13.00  | C    | Reddish brown SANDSTONE core with rare intrusion of medium sub-rounded gravel | Irregular lump                                                                                                                                               | 42.00               | 40.00                    | 0.60                | 46.25                       | 0.28        | 0.97                | 0.27                                                                                                                  |         |
| BH102                                                                                                 | -      | 12.90                                 | 13.00  | C    | Reddish brown SANDSTONE core with rare intrusion of medium sub-rounded gravel | Irregular lump                                                                                                                                               | 45.00               | 35.00                    | 1.15                | 44.78                       | 0.57        | 0.95                | 0.55                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.28                                 | 13.37  | C    | Reddish brown fractured SANDSTONE core                                        | Diametral                                                                                                                                                    | 84.00               | 84.00                    | 0.70                | 94.78                       | 0.08        | 1.33                | 0.10                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.28                                 | 13.37  | C    | Reddish brown fractured SANDSTONE core                                        | Axial                                                                                                                                                        | 84.00               | 33.00                    | 0.80                | 59.41                       | 0.23        | 1.08                | 0.24                                                                                                                  |         |
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> |        |                                       |        |      |                                                                               | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |                     |                          |                     |                             |             |                     | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                          15/09/2022 |         |
| Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                          |        |                                       |        |      |                                                                               |                                                                                                                                                              |                     |                          |                     |                             |             |                     | MSF-5-R33                                                                                                             |         |

|                      |        | Summary of Point Load Test Results    |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                       |         |
|-------------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|---------------------|-----------------------------------------------------------------------------------------------------------------------|---------|
| Job No.<br>32308                                                                                      |        | Project Name<br>Deansgate, Manchester |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             | Programme           |                                                                                                                       |         |
|                                                                                                       |        |                                       |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             | Samples received    | 25/08/2022                                                                                                            |         |
|                                                                                                       |        |                                       |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             | Schedule received   | 25/08/2022                                                                                                            |         |
| Project No.<br>2006023.001                                                                            |        | Client<br>TEC                         |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             | Project started     | 26/08/2022                                                                                                            |         |
|                                                                                                       |        |                                       |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             | Date started        | 05/09/2022                                                                                                            |         |
| Hole No.                                                                                              | Sample |                                       |        |      | Description                            | Test Type                                                                                                                                                    | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F | Is (50)                                                                                                               | Remarks |
|                                                                                                       | Ref    | Top m                                 | Base m | Type |                                        |                                                                                                                                                              |                     |                          |                     |                             |             |                     |                                                                                                                       |         |
| BH102                                                                                                 | -      | 13.28                                 | 13.37  | C    | Reddish brown fractured SANDSTONE core | Axial                                                                                                                                                        | 84.00               | 14.00                    | 0.38                | 38.70                       | 0.25        | 0.89                | 0.23                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.28                                 | 13.37  | C    | Reddish brown fractured SANDSTONE core | Irregular lump                                                                                                                                               | 84.00               | 34.00                    | 0.90                | 60.30                       | 0.25        | 1.09                | 0.27                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.28                                 | 13.37  | C    | Reddish brown fractured SANDSTONE core | Irregular lump                                                                                                                                               | 46.00               | 30.00                    | 0.25                | 41.92                       | 0.14        | 0.92                | 0.13                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.77                                 | 13.86  | C    | Reddish brown SANDSTONE core           | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 1.50                | 95.91                       | 0.16        | 1.34                | 0.22                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.77                                 | 13.86  | C    | Reddish brown SANDSTONE core           | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 0.90                | 95.91                       | 0.10        | 1.34                | 0.13                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.77                                 | 13.86  | C    | Reddish brown SANDSTONE core           | Axial                                                                                                                                                        | 85.00               | 32.00                    | 1.40                | 58.85                       | 0.40        | 1.08                | 0.44                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.77                                 | 13.86  | C    | Reddish brown SANDSTONE core           | Axial                                                                                                                                                        | 85.00               | 14.00                    | 0.60                | 38.92                       | 0.40        | 0.89                | 0.35                                                                                                                  |         |
| BH102                                                                                                 | -      | 13.77                                 | 13.86  | C    | Reddish brown SANDSTONE core           | Axial                                                                                                                                                        | 85.00               | 21.00                    | 0.85                | 47.67                       | 0.37        | 0.98                | 0.37                                                                                                                  |         |
| BH102                                                                                                 | -      | 21.42                                 | 21.51  | C    | Reddish brown SANDSTONE core           | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 2.20                | 95.91                       | 0.24        | 1.34                | 0.32                                                                                                                  |         |
| BH102                                                                                                 | -      | 21.42                                 | 21.51  | C    | Reddish brown SANDSTONE core           | Diametral                                                                                                                                                    | 85.00               | 85.00                    | 1.30                | 95.91                       | 0.14        | 1.34                | 0.19                                                                                                                  |         |
| BH102                                                                                                 | -      | 21.42                                 | 21.51  | C    | Reddish brown SANDSTONE core           | Axial                                                                                                                                                        | 85.00               | 35.00                    | 2.12                | 61.55                       | 0.56        | 1.10                | 0.61                                                                                                                  |         |
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> |        |                                       |        |      |                                        | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: James@k4soils.com |                     |                          |                     |                             |             |                     | <b>Checked and Approved</b><br><br>Initials                      J.P<br><br>Date:                          15/09/2022 |         |
| Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                          |        |                                       |        |      |                                        |                                                                                                                                                              |                     |                          |                     |                             |             |                     | MSF-5-R33                                                                                                             |         |

|                      |        | Summary of Point Load Test Results    |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
|-------------------------------------------------------------------------------------------------------|--------|---------------------------------------|--------|------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------------|---------------------|-----------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------|
| Job No.<br>32308                                                                                      |        | Project Name<br>Deansgate, Manchester |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             | Programme<br>Samples received 25/08/2022<br>Schedule received 25/08/2022<br>Project started 26/08/2022<br>Date started 05/09/2022 |                                                                 |         |
| Project No.<br>2006023.001                                                                            |        | Client<br>TEC                         |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
| Hole No.                                                                                              | Sample |                                       |        |      | Description                  | Test Type                                                                                                                                                | Sample Width W (mm) | Platen Separation D (mm) | Failure Load P (kN) | Equivalent Diameter De (mm) | P/De2 (Mpa) | Correction Factor F                                                                                                               | Is (50)                                                         | Remarks |
|                                                                                                       | Ref    | Top m                                 | Base m | Type |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
| BH102                                                                                                 | -      | 21.42                                 | 21.51  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                    | 85.00               | 24.00                    | 1.32                | 50.96                       | 0.51        | 1.01                                                                                                                              | 0.51                                                            |         |
| BH102                                                                                                 | -      | 21.42                                 | 21.51  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                    | 85.00               | 21.00                    | 1.19                | 47.67                       | 0.52        | 0.98                                                                                                                              | 0.51                                                            |         |
| BH102                                                                                                 | -      | 23.70                                 | 23.78  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                | 85.00               | 85.00                    | 1.15                | 95.91                       | 0.13        | 1.34                                                                                                                              | 0.17                                                            |         |
| BH102                                                                                                 | -      | 23.70                                 | 23.78  | C    | Reddish brown SANDSTONE core | Diametral                                                                                                                                                | 85.00               | 85.00                    | 1.18                | 95.91                       | 0.13        | 1.34                                                                                                                              | 0.17                                                            |         |
| BH102                                                                                                 | -      | 23.70                                 | 23.78  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                    | 85.00               | 31.00                    | 1.80                | 57.92                       | 0.54        | 1.07                                                                                                                              | 0.57                                                            |         |
| BH102                                                                                                 | -      | 23.70                                 | 23.78  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                    | 85.00               | 22.00                    | 1.25                | 48.80                       | 0.52        | 0.99                                                                                                                              | 0.52                                                            |         |
| BH102                                                                                                 | -      | 23.70                                 | 23.78  | C    | Reddish brown SANDSTONE core | Axial                                                                                                                                                    | 85.00               | 23.00                    | 1.35                | 49.89                       | 0.54        | 1.00                                                                                                                              | 0.54                                                            |         |
|                                                                                                       | -      |                                       |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
|                                                                                                       | -      |                                       |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
|                                                                                                       | -      |                                       |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
|                                                                                                       | -      |                                       |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |
| <b>Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength</b> |        |                                       |        |      |                              | <b>Test Report by K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach<br>Watford Herts WD18 9RU<br>Tel: 01923 711 288<br>Email: James@k4soils.com |                     |                          |                     |                             |             |                                                                                                                                   | <b>Checked and Approved</b><br>Initials J.P<br>Date: 15/09/2022 |         |
| Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                          |        |                                       |        |      |                              |                                                                                                                                                          |                     |                          |                     |                             |             |                                                                                                                                   |                                                                 |         |

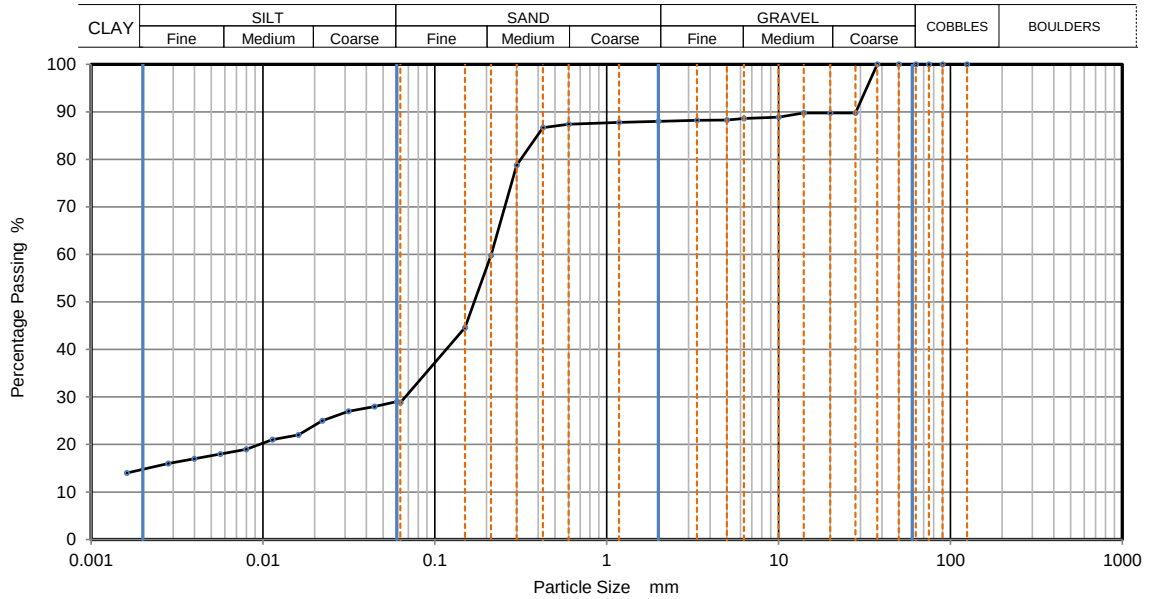


# PARTICLE SIZE DISTRIBUTION

|                    |            |
|--------------------|------------|
| Job Ref            | 32308      |
| Borehole/Pit No.   | BH101      |
| Sample No.         | -          |
| Depth Top          | 4.40 m     |
| Depth Base         | 4.80 m     |
| Sample Type        | D          |
| Samples received   | 25/08/2022 |
| Schedules received | 25/08/2022 |
| Project started    | 26/08/2022 |
| Date tested        | 09/09/2022 |

|                  |                                                                                               |        |     |
|------------------|-----------------------------------------------------------------------------------------------|--------|-----|
| Site Name        | Deansgate, Manchester                                                                         |        |     |
| Project No.      | 2006023.001                                                                                   | Client | TEC |
| Soil Description | Reddish brown and brown gravelly silty clayey SAND (gravel is fmc and sub-angular to rounded) |        |     |
| Test Method      | BS1377:Part 2: 1990, clause 9.0                                                               |        |     |

These results only apply to the items tested



| Sieving          |           | Sedimentation                            |           |
|------------------|-----------|------------------------------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm                         | % Passing |
| 125              | 100       | 0.0600                                   | 29        |
| 90               | 100       | 0.0445                                   | 28        |
| 75               | 100       | 0.0314                                   | 27        |
| 63               | 100       | 0.0221                                   | 25        |
| 50               | 100       | 0.0161                                   | 22        |
| 37.5             | 100       | 0.0113                                   | 21        |
| 28               | 90        | 0.0080                                   | 19        |
| 20               | 90        | 0.0056                                   | 18        |
| 14               | 90        | 0.0040                                   | 17        |
| 10               | 89        | 0.0028                                   | 16        |
| 6.3              | 89        | 0.0016                                   | 14        |
| 5                | 88        |                                          |           |
| 3.35             | 88        |                                          |           |
| 2                | 88        |                                          |           |
| 1.18             | 88        |                                          |           |
| 0.6              | 87        | Particle density (assumed)<br>2.70 Mg/m3 |           |
| 0.425            | 87        |                                          |           |
| 0.3              | 79        |                                          |           |
| 0.212            | 60        |                                          |           |
| 0.15             | 45        |                                          |           |
| 0.063            | 29        |                                          |           |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Very coarse        | 0.0        |
| Gravel             | 12.0       |
| Sand               | 59.3       |
| Silt               | 14.1       |
| Clay               | 14.6       |

| Grading Analysis       |    |
|------------------------|----|
| D100                   | mm |
| D60                    | mm |
| D30                    | mm |
| D10                    | mm |
| Uniformity Coefficient |    |
| Curvature Coefficient  |    |

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

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## K4 Soils Laboratory

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## Checked and Approved

Initials: J.P  
Date: 15/09/2022

2519 Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R3

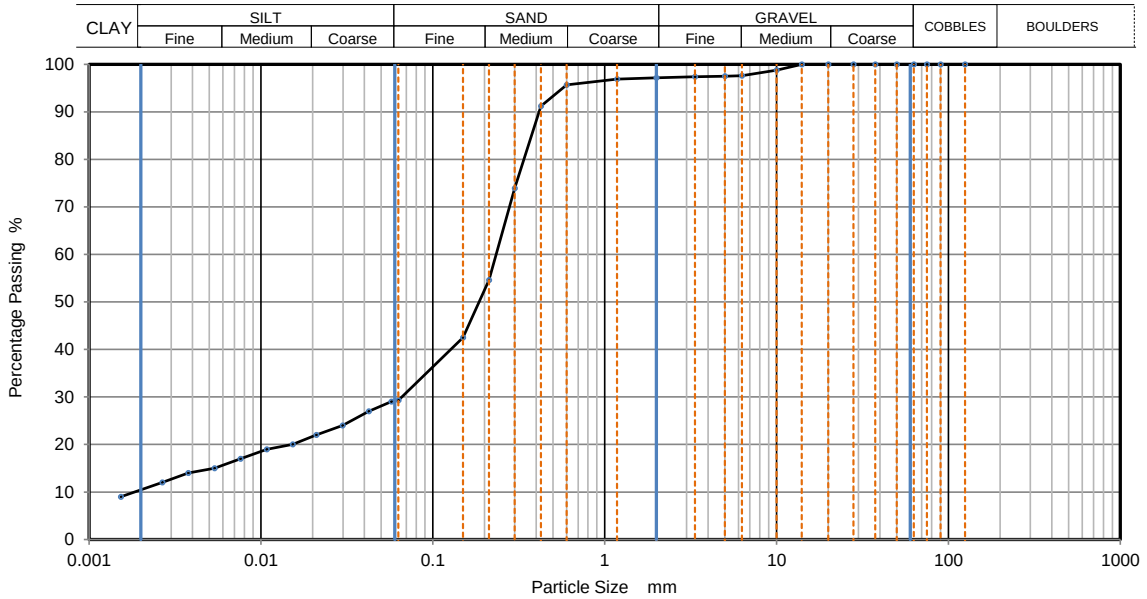


# PARTICLE SIZE DISTRIBUTION

|                    |            |
|--------------------|------------|
| Job Ref            | 32308      |
| Borehole/Pit No.   | BH101      |
| Sample No.         | -          |
| Depth Top          | 5.40 m     |
| Depth Base         | 5.80 m     |
| Sample Type        | D          |
| Samples received   | 25/08/2022 |
| Schedules received | 25/08/2022 |
| Project started    | 26/08/2022 |
| Date tested        | 09/09/2022 |

|                  |                                                                                                                          |        |     |
|------------------|--------------------------------------------------------------------------------------------------------------------------|--------|-----|
| Site Name        | Deansgate, Manchester                                                                                                    |        |     |
| Project No.      | 2006023.001                                                                                                              | Client | TEC |
| Soil Description | Reddish brown clayey silty SAND with rare fm sub-angular weakly cemented sandstone fragments and rare sub-rounded gravel |        |     |
| Test Method      | BS1377:Part 2: 1990, clause 9.0                                                                                          |        |     |

These results only apply to the items tested



| Sieving          |           | Sedimentation                            |           |
|------------------|-----------|------------------------------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm                         | % Passing |
| 125              | 100       | 0.0573                                   | 29        |
| 90               | 100       | 0.0424                                   | 27        |
| 75               | 100       | 0.0299                                   | 24        |
| 63               | 100       | 0.0210                                   | 22        |
| 50               | 100       | 0.0153                                   | 20        |
| 37.5             | 100       | 0.0108                                   | 19        |
| 28               | 100       | 0.0076                                   | 17        |
| 20               | 100       | 0.0054                                   | 15        |
| 14               | 100       | 0.0038                                   | 14        |
| 10               | 99        | 0.0027                                   | 12        |
| 6.3              | 98        | 0.0015                                   | 9         |
| 5                | 98        |                                          |           |
| 3.35             | 97        |                                          |           |
| 2                | 97        |                                          |           |
| 1.18             | 97        |                                          |           |
| 0.6              | 96        | Particle density (assumed)<br>2.70 Mg/m3 |           |
| 0.425            | 91        |                                          |           |
| 0.3              | 74        |                                          |           |
| 0.212            | 55        |                                          |           |
| 0.15             | 43        |                                          |           |
| 0.063            | 29        |                                          |           |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Very coarse        | 0.0        |
| Gravel             | 2.8        |
| Sand               | 67.9       |
| Silt               | 19.0       |
| Clay               | 10.3       |

| Grading Analysis       |     |
|------------------------|-----|
| D100                   | mm  |
| D60                    | mm  |
| D30                    | mm  |
| D10                    | mm  |
| Uniformity Coefficient | 130 |
| Curvature Coefficient  | 9.9 |

Remarks  
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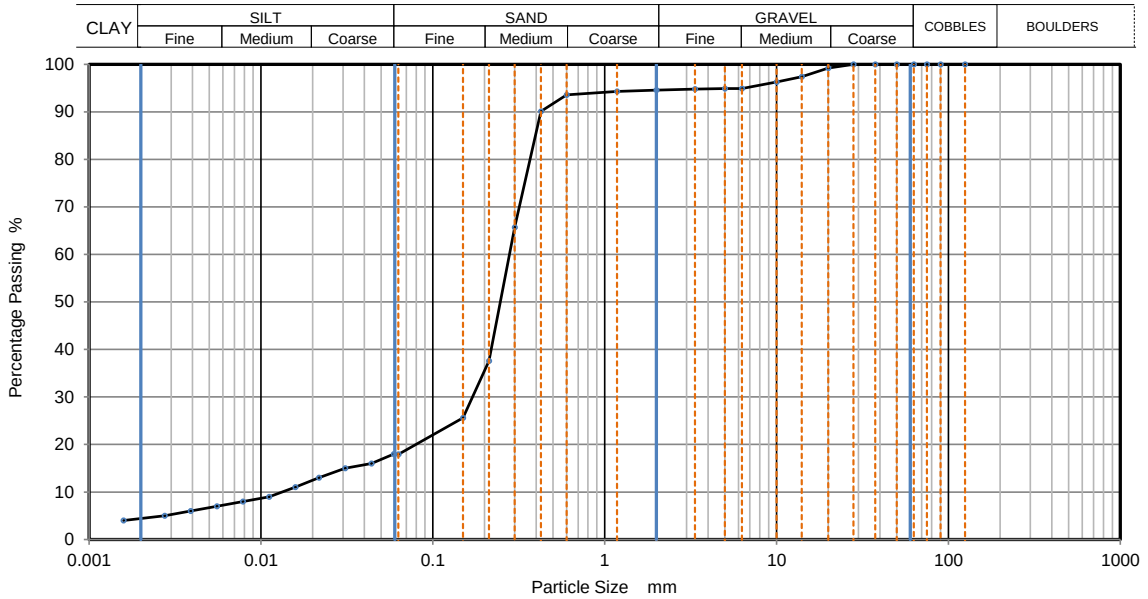
|                                                                                                                             |  |                                                           |
|-----------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------|
| <b>K4 Soils Laboratory</b><br>Unit 8, Olds Close, Watford, Herts, WD18 9RU<br>Email: james@k4soils.com<br>Tel: 01923 711288 |  | Checked and Approved<br>Initials: J.P<br>Date: 15/09/2022 |
| 2519 Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                                           |  | MSF-5-R3                                                  |



## PARTICLE SIZE DISTRIBUTION

|                                                                                   |                                                                          |        |     |                    |            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------|--------|-----|--------------------|------------|
|  | PARTICLE SIZE DISTRIBUTION                                               |        |     | Job Ref            | 32308      |
|                                                                                   |                                                                          |        |     | Borehole/Pit No.   | BH102      |
| Site Name                                                                         | Deansgate, Manchester                                                    |        |     | Sample No.         | -          |
| Project No.                                                                       | 2006023.001                                                              | Client | TEC | Depth Top          | 2.00 m     |
| Soil Description                                                                  | Reddish brown clayey gravelly silty SAND (gravel is fmc and sub-rounded) |        |     | Depth Base         | 2.80 m     |
|                                                                                   |                                                                          |        |     | Sample Type        | B          |
|                                                                                   |                                                                          |        |     | Samples received   | 25/08/2022 |
|                                                                                   |                                                                          |        |     | Schedules received | 25/08/2022 |
| Test Method                                                                       | BS1377:Part 2: 1990, clause 9.0                                          |        |     | Project started    | 26/08/2022 |
| These results only apply to the items tested                                      |                                                                          |        |     | Date tested        | 09/09/2022 |

These results only apply to the items tested



| Sieving          |           | Sedimentation                            |           |
|------------------|-----------|------------------------------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm                         | % Passing |
| 125              | 100       | 0.0593                                   | 18        |
| 90               | 100       | 0.0439                                   | 16        |
| 75               | 100       | 0.0309                                   | 15        |
| 63               | 100       | 0.0218                                   | 13        |
| 50               | 100       | 0.0158                                   | 11        |
| 37.5             | 100       | 0.0111                                   | 9         |
| 28               | 100       | 0.0078                                   | 8         |
| 20               | 99        | 0.0055                                   | 7         |
| 14               | 97        | 0.0039                                   | 6         |
| 10               | 96        | 0.0028                                   | 5         |
| 6.3              | 95        | 0.0016                                   | 4         |
| 5                | 95        |                                          |           |
| 3.35             | 95        |                                          |           |
| 2                | 95        |                                          |           |
| 1.18             | 94        |                                          |           |
| 0.6              | 94        | Particle density (assumed)<br>2.70 Mg/m3 |           |
| 0.425            | 90        |                                          |           |
| 0.3              | 66        |                                          |           |
| 0.212            | 38        |                                          |           |
| 0.15             | 26        |                                          |           |
| 0.063            | 18        |                                          |           |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Very coarse        | 0.0        |
| Gravel             | 5.4        |
| Sand               | 76.7       |
| Silt               | 13.2       |
| Clay               | 4.7        |

| Grading Analysis       |     |
|------------------------|-----|
| D100                   | mm  |
| D60                    | mm  |
| D30                    | mm  |
| D10                    | mm  |
| Uniformity Coefficient | 22  |
| Curvature Coefficient  | 8.3 |

Remarks  
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Date: 15/09/2022

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

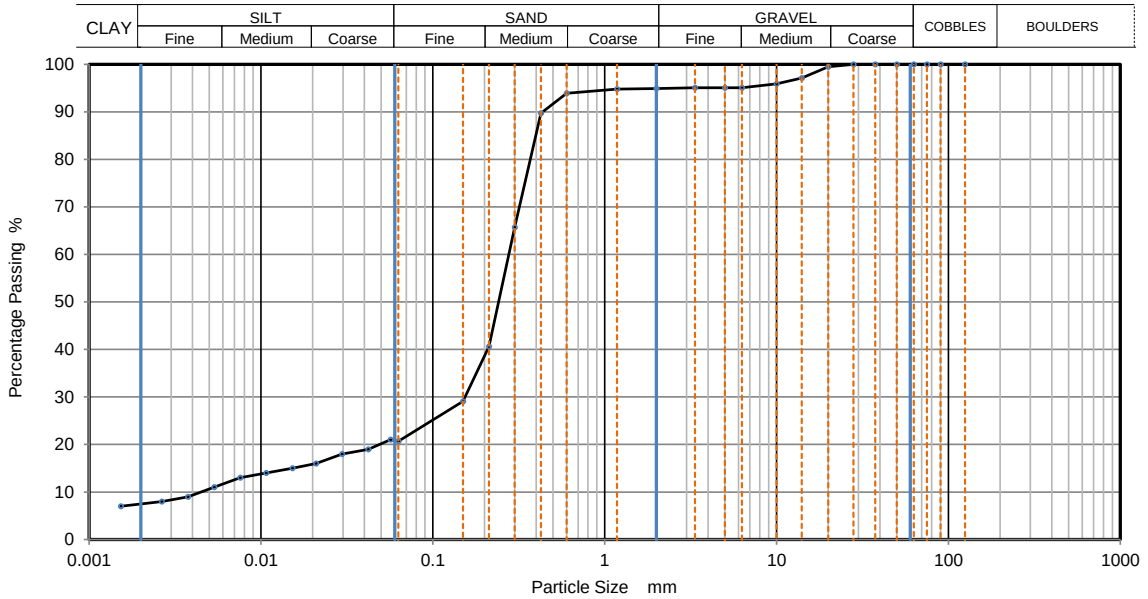
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## PARTICLE SIZE DISTRIBUTION

|                                                                                   |                                                                                              |        |     |                    |            |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|--------|-----|--------------------|------------|
|  | PARTICLE SIZE DISTRIBUTION                                                                   |        |     | Job Ref            | 32308      |
|                                                                                   |                                                                                              |        |     | Borehole/Pit No.   | BH105      |
| Site Name                                                                         | Deansgate, Manchester                                                                        |        |     | Sample No.         | -          |
| Project No.                                                                       | 2006023.001                                                                                  | Client | TEC | Depth Top          | 2.50 m     |
| Soil Description                                                                  | Reddish brown gravelly clayey silty SAND (gravel is fmc weakly cemented sandstone fragments) |        |     | Depth Base         | 3.00 m     |
|                                                                                   |                                                                                              |        |     | Sample Type        | B          |
|                                                                                   |                                                                                              |        |     | Samples received   | 25/08/2022 |
|                                                                                   |                                                                                              |        |     | Schedules received | 25/08/2022 |
| Test Method                                                                       | BS1377:Part 2: 1990, clause 9.0                                                              |        |     | Project started    | 26/08/2022 |
| These results only apply to the items tested                                      |                                                                                              |        |     | Date tested        | 09/09/2022 |

These results only apply to the items tested



| Sieving          |           | Sedimentation                            |           |
|------------------|-----------|------------------------------------------|-----------|
| Particle Size mm | % Passing | Particle Size mm                         | % Passing |
| 125              | 100       | 0.0568                                   | 21        |
| 90               | 100       | 0.0421                                   | 19        |
| 75               | 100       | 0.0297                                   | 18        |
| 63               | 100       | 0.0209                                   | 16        |
| 50               | 100       | 0.0152                                   | 15        |
| 37.5             | 100       | 0.0107                                   | 14        |
| 28               | 100       | 0.0076                                   | 13        |
| 20               | 100       | 0.0053                                   | 11        |
| 14               | 97        | 0.0038                                   | 9         |
| 10               | 96        | 0.0027                                   | 8         |
| 6.3              | 95        | 0.0015                                   | 7         |
| 5                | 95        |                                          |           |
| 3.35             | 95        |                                          |           |
| 2                | 95        |                                          |           |
| 1.18             | 95        |                                          |           |
| 0.6              | 94        | Particle density (assumed)<br>2.70 Mg/m3 |           |
| 0.425            | 90        |                                          |           |
| 0.3              | 66        |                                          |           |
| 0.212            | 41        |                                          |           |
| 0.15             | 29        |                                          |           |
| 0.063            | 21        |                                          |           |

| Sample Proportions | % dry mass |
|--------------------|------------|
| Very coarse        | 0.0        |
| Gravel             | 5.1        |
| Sand               | 74.3       |
| Silt               | 13.3       |
| Clay               | 7.3        |

| Grading Analysis       |    |
|------------------------|----|
| D100                   | mm |
| D60                    | mm |
| D30                    | mm |
| D10                    | mm |
| Uniformity Coefficient | 63 |
| Curvature Coefficient  | 20 |

Remarks  
Preparation and testing in accordance with BS1377 unless noted below

NOTE: The report shall not be reproduced except in full without approval of the laboratory



### K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com

Tel: 01923 711288

### Checked and Approved

Initials: J.P

Date: 15/09/2022

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5-R3



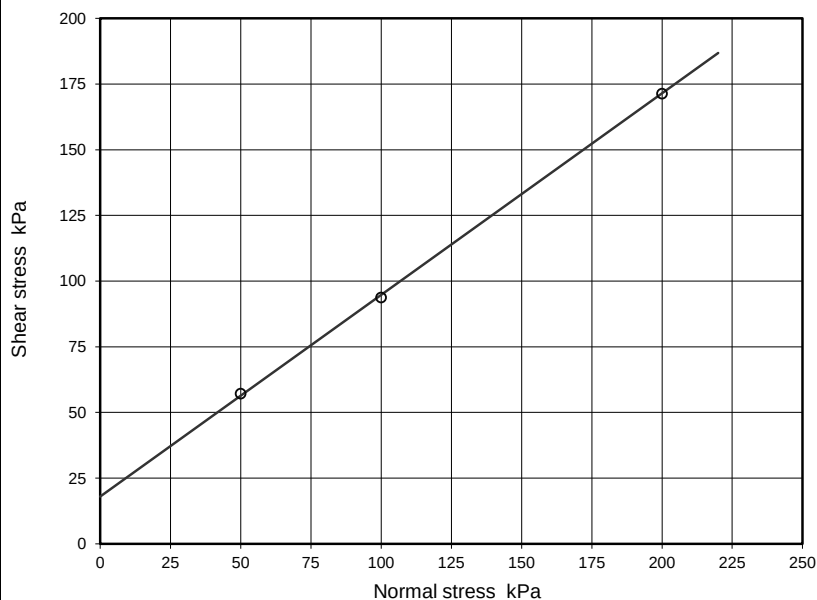
## UNIAXIAL COMPRESSION TEST ON ROCK - SUMMARY OF RESULTS

| Project No.<br>32308                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Project Name<br>Deansgate, Manchester                                                                                                   |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|------|------------------------------------------------------------------------|---------------------|--------------|-----|-----------------------|--------------------|----------------------|-------------------------------------------------------------------|------------|---------|
| Client ID<br>2006023.001                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Client<br>TEC                                                                                                                           |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
| Test Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | International Society for Rock Mechanics, The complete ISRM suggested test method for Rock Characterization Testing and Monitoring 2007 |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
| Hole No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Sample                                                                                                                                  |          |           |      | Description                                                            | Specimen Dimensions |              |     | Bulk Density<br>Mg/m3 | Water Content<br>% | Uniaxial Compression |                                                                   |            | Remarks |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Ref                                                                                                                                     | Top<br>m | Base<br>m | Type |                                                                        | Dia.<br>mm          | Length<br>mm | H/D |                       |                    | Condition            | Mode of failure                                                   | UCS<br>MPa |         |
| BH101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                                                                                                                                       | 24.87    | 25.00     | C    | Reddish brown SANDSTONE core                                           | 87.0                | 117.0        | 1.3 | 2.12                  | 12                 | as received          | AC                                                                | 7.6        |         |
| BH102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                                                                                                                                       | 19.68    | 19.78     | C    | Reddish brown SANDSTONE core                                           | 87.0                | 96.0         | 1.1 | 2.21                  | 12                 | as received          | F                                                                 | 4.3        |         |
| BH102                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                                                                                                                                       | 24.72    | 24.92     | C    | Reddish brown SANDSTONE core with rare fm sub-angular gravel intrusion | 87.0                | 142.0        | 1.6 | 2.42                  | 10                 | as received          | F                                                                 | 9.8        |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
| <div>Notes</div> <div>1 ISRM p87 test 1, water content at 105 ± 3 oC, specimen as tested for UCS<br/>2 ISRM p86 clause (vii), Caliper method used for determination of bulk volume and derivation of bulk density<br/>3 ISRM p153 part 1, determination of Uniaxial Compressive Strength ( UCS ) of Rock Materials<br/>above notes apply unless annotated otherwise in the remarks</div> <div>Mode of failure :<br/>S - Single MS - multiple shear<br/>AC - Axia F - Fragmented</div> |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      |                                                                   |            |         |
| K4 SOILS LABORATORY Unit 8 Olds Close<br>Olds Approach Watford Herts WD18 9RU<br><br>Tel: 01923 711 288<br>Email: james@K4soils.com                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                         |          |           |      |                                                                        |                     |              |     |                       |                    |                      | Checked and Approved<br><br>Initials: J.P<br><br>Date: 15/09/2022 |            |         |

|                                                                                  |                                                                            |        |                                                              |                   |            |
|----------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------|--------------------------------------------------------------|-------------------|------------|
|  | <b>Determination of shear strength using the Large Shear Box Apparatus</b> |        | Job Ref                                                      | 32308             |            |
|                                                                                  |                                                                            |        | Borehole/Pit No.                                             | TP102             |            |
| Site Name                                                                        | Deansgate, Manchester                                                      |        | Sample No.                                                   | -                 |            |
| Soil Description                                                                 | Reddish brown clayey gravelly SAND (gravel is fmc and angular to rounded)  |        | Depth m                                                      | 2.00              |            |
|                                                                                  |                                                                            |        | Sample Type                                                  | B                 |            |
| Project No.                                                                      | 2006023.001                                                                | Client | TEC                                                          | Sample received   | 25/08/2022 |
|                                                                                  |                                                                            |        |                                                              | Schedule received | 25/08/2022 |
| Test Method                                                                      | BS1377 : Part 7 : 1990, clause 5                                           |        | Date test started                                            | 07/09/2022        |            |
|                                                                                  |                                                                            |        | Date completed                                               | 08/09/2022        |            |
| Preparation Details                                                              |                                                                            |        | Prepared in accordance with BS1377 : Part 7 : 1990, clause 5 |                   |            |

| Specimen Details |                                        | Test No. | 1      | 2      | 3      |  |  |                   |
|------------------|----------------------------------------|----------|--------|--------|--------|--|--|-------------------|
| Initial          | Height                                 |          | 100.0  | 100.0  | 100.0  |  |  | mm                |
|                  | Bulk Density                           |          | 1.95   | 1.95   | 1.95   |  |  | Mg/m <sup>3</sup> |
|                  | Moisture Content                       |          | 16.4   | 16.4   | 16.4   |  |  | %                 |
|                  | Dry density                            |          | 1.68   | 1.68   | 1.68   |  |  | Mg/m <sup>3</sup> |
|                  | Voids ratio                            |          | 0.565  | 0.565  | 0.565  |  |  |                   |
|                  | Degree of Saturation                   |          | 76     | 76     | 76     |  |  | %                 |
| Consolidation    | Consolidation / Normal Stress applied  |          | 50     | 100    | 200    |  |  | kPa               |
|                  | Change in height during consolidation* |          | -0.860 | -2.150 | -2.530 |  |  | mm                |
|                  | Voids ratio after consolidation        |          | 0.552  | 0.531  | 0.525  |  |  |                   |
| After test       | Final Moisture content                 |          | 18.1   | 17.3   | 15.5   |  |  |                   |

| Shearing stage(s)    |                                             |  |         |         |         |  |  |        |
|----------------------|---------------------------------------------|--|---------|---------|---------|--|--|--------|
| Rate of displacement | Peak                                        |  | 0.04500 | 0.04500 | 0.04500 |  |  | mm/min |
|                      | Residual                                    |  |         |         |         |  |  | mm/min |
| Peak values, (o)     | Relative horizontal displacement            |  | 7.00    | 11.00   | 14.00   |  |  | mm     |
|                      | Shear stress                                |  | 57.1    | 93.7    | 171.2   |  |  | kPa    |
|                      | Vertical Movement at peak shear stress*     |  | -0.87   | -2.09   | -3.54   |  |  | mm     |
| Residual values, (x) | No. of traverses ( including peak run )     |  |         |         |         |  |  |        |
|                      | Relative horizontal displacement            |  |         |         |         |  |  | mm     |
|                      | Shear stress                                |  |         |         |         |  |  | kPa    |
|                      | Vertical movement at residual shear stress* |  |         |         |         |  |  | mm     |



#### Shear Strength Parameters

| Peak strength, (o) |         | Regression | Manual |
|--------------------|---------|------------|--------|
| c'                 | kPa     | 18         | -      |
| Ø'                 | degrees | 37.5       | -      |

| Residual strength, (x) |         |         |   |
|------------------------|---------|---------|---|
| c'R                    | kPa     | [ 0.0 ] | - |
| Ø'R                    | degrees | [ ]     | - |

Remarks :

Sheet 1 of 2

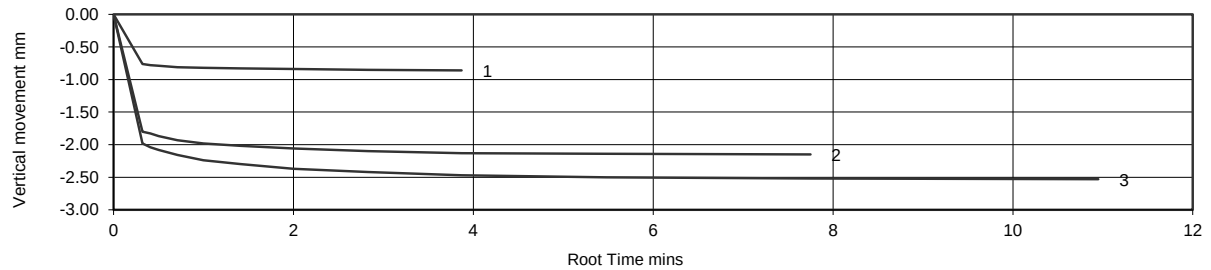
|                                                                                     |                                                                                                                                     |  |                                              |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------|
|  | <b>K4 SOILS LABORATORY</b><br>Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU<br>Tel: 01923 711 288 Email: james@K4soils.com |  | <b>Checked and Approved</b><br>Initials K.P. |
|                                                                                     | These results only apply to the items tested. The report shall not be reproduced except in full without authority of the laboratory |  | <b>Date</b> 15/09/2022                       |
|                                                                                     | 2519 Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)                                                                   |  | MSF-5-R14 (Rev. 0)                           |



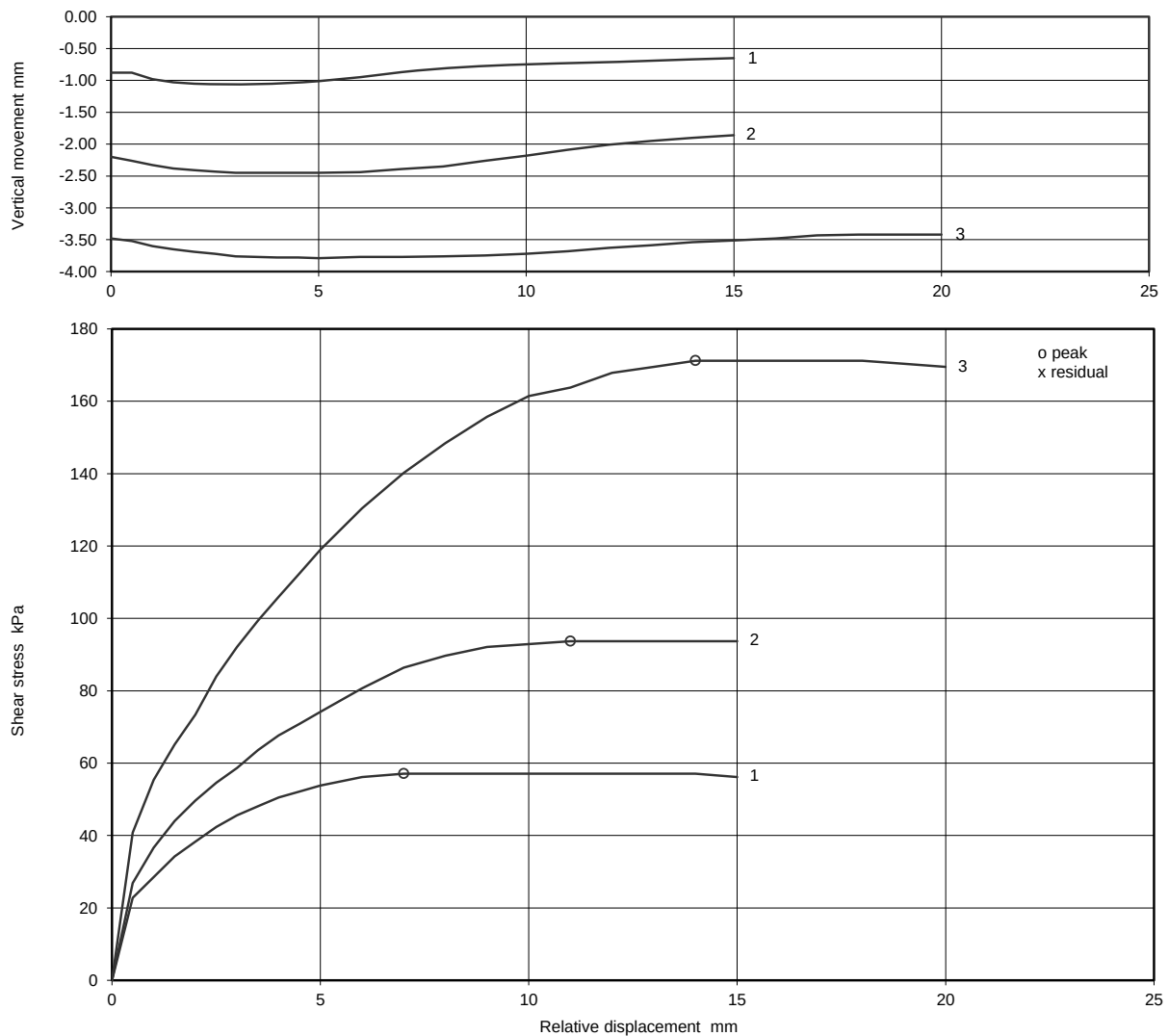
## Determination of shear strength using the Large Shear Box Apparatus

|                                                                                  |                                                                           |        |     |                  |            |
|----------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------|-----|------------------|------------|
|  | Determination of shear strength using the Large Shear Box Apparatus       |        |     | Job Ref          | 32308      |
|                                                                                  |                                                                           |        |     | Borehole/Pit No. | TP102      |
| Site Name                                                                        | Deansgate, Manchester                                                     |        |     | Sample No.       | -          |
| Soil Description                                                                 | Reddish brown clayey gravelly SAND (gravel is fmc and angular to rounded) |        |     | Depth m          | 2.00       |
|                                                                                  |                                                                           |        |     | Sample Type      | B          |
| Project No.                                                                      | 2006023.001                                                               | Client | TEC | Date of Test     | 07/09/2022 |

### Consolidation stage(s)



### Shearing stage(s)



\*Note : Vertical movement/change in height is recorded as negative for reduced height (settlement) and positive for increased height (swell).

Sheet 2 of 2



K4 SOILS LABORATORY Unit 8 Olds Close  
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Checked and Approved  
Initials K.P.  
Date 15/09/2022



2683



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## THE ENVIRONMENTAL LABORATORY LTD

---

**Analytical Report Number:** 22-42878

**Issue:** 1

**Date of Issue:** 30/08/2022

**Contact:** Mitchell Tucker

**Customer Details:** TEC  
The Old Chapel  
35A Southover  
Wells  
SomersetBA5 1UH

**Quotation No:** Q22-02525

**Order No:** 2206023.001

**Customer Reference:** 2206023.001

**Date Received:** 25/08/2022

**Date Approved:** 30/08/2022

**Details:** Deansgate, Manchester

**Approved by:**

Tim Reeve, Quality Officer

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Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

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## Sample Summary

Report No.: 22-42878, issue number 1

| Elab No. | Client's Ref.       | Date Sampled | Date Scheduled | Description      | Deviations |
|----------|---------------------|--------------|----------------|------------------|------------|
| 291431   | BH101 1.50 - 1.80   | 10/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291432   | BH101 2.30 - 2.60   | 12/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291433   | BH101 6.30 - 6.70   | 12/08/2022   | 25/08/2022     | Sandy loam       |            |
| 291434   | BH101 11.40 - 11.70 | 12/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291435   | BH101 20.90 - 21.00 | 15/08/2022   | 25/08/2022     | Sandy silty loam |            |
| 291436   | BH101 23.60 - 23.70 | 15/08/2022   | 25/08/2022     | Sandy loam       |            |
| 291437   | BH102 9.20 - 9.30   | 16/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291438   | BH102 12.00 - 12.20 | 17/08/2022   | 25/08/2022     | Sandy silty loam |            |
| 291439   | BH102 17.60 - 17.80 | 17/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291440   | BH102 21.0 - 22.00  | 17/08/2022   | 25/08/2022     | Loamy sand       |            |
| 291441   | BH103 3.80 - 4.00   | 15/08/2022   | 25/08/2022     | Loamy sand       |            |



## Results Summary

2683

Report No.: 22-42878, issue number 1

|                    |             |             |             |               |               |               |             |               |               |              |             |
|--------------------|-------------|-------------|-------------|---------------|---------------|---------------|-------------|---------------|---------------|--------------|-------------|
| ELAB Reference     | 291431      | 291432      | 291433      | 291434        | 291435        | 291436        | 291437      | 291438        | 291439        | 291440       | 291441      |
| Customer Reference |             |             |             |               |               |               |             |               |               |              |             |
| Sample ID          |             |             |             |               |               |               |             |               |               |              |             |
| Sample Type        | DISTURBED   | DISTURBED   | DISTURBED   | DISTURBED     | DISTURBED     | DISTURBED     | DISTURBED   | DISTURBED     | DISTURBED     | DISTURBED    | DISTURBED   |
| Sample Location    | BH101       | BH101       | BH101       | BH101         | BH101         | BH101         | BH102       | BH102         | BH102         | BH102        | BH103       |
| Sample Depth (m)   | 1.50 - 1.80 | 2.30 - 2.60 | 6.30 - 6.70 | 11.40 - 11.70 | 20.90 - 21.00 | 23.60 - 23.70 | 9.20 - 9.30 | 12.00 - 12.20 | 17.60 - 17.80 | 21.0 - 22.00 | 3.80 - 4.00 |
| Sampling Date      | 10/08/2022  | 12/08/2022  | 12/08/2022  | 12/08/2022    | 15/08/2022    | 15/08/2022    | 16/08/2022  | 17/08/2022    | 17/08/2022    | 17/08/2022   | 15/08/2022  |

| Determinand                               | Codes | Units    | LOD |       |       |       |       |       |       |       |       |       |       |       |
|-------------------------------------------|-------|----------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Soil sample preparation parameters</b> |       |          |     |       |       |       |       |       |       |       |       |       |       |       |
| Moisture Content                          | N     | %        | 0.1 | 14.4  | 11.1  | 12.1  | 15.3  | 13.8  | 18.4  | 17.1  | 18.7  | 10.8  | 12.7  | 11.5  |
| Material removed                          | N     | %        | 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Description of Inert material removed     | N     |          | 0   | None  | None  | None  | None  | None  | None  | None  | None  | None  | None  | None  |
| <b>Anions</b>                             |       |          |     |       |       |       |       |       |       |       |       |       |       |       |
| Water Soluble Chloride                    | M     | mg/l     | 20  | 24    | < 20  | < 20  | < 20  | < 20  | < 20  | < 20  | < 20  | < 20  | < 20  | < 20  |
| Water Soluble Nitrate                     | U     | mg/l     | 20  | 31    | 31    | < 20  | 21    | 23    | 23    | < 20  | 26    | < 20  | < 20  | 24    |
| Water Soluble Sulphate                    | M     | mg/l     | 20  | 113   | 24    | 78    | < 20  | < 20  | 25    | < 20  | 27    | < 20  | < 20  | 22    |
| <b>Miscellaneous</b>                      |       |          |     |       |       |       |       |       |       |       |       |       |       |       |
| pH                                        | M     | pH units | 0.1 | 11.8  | 12.2  | 11.1  | 10.3  | 9.8   | 9.7   | 9.8   | 9.5   | 8.4   | 8.8   | 9.4   |



## Method Summary

Report No.: 22-42878, issue number 1

| Parameter            | Codes | Analysis Undertaken On | Date Tested | Method Number | Technique          |
|----------------------|-------|------------------------|-------------|---------------|--------------------|
| <b>Soil</b>          |       |                        |             |               |                    |
| pH                   | M     | Air dried sample       | 26/08/2022  | 113           | Electromeric       |
| Water soluble anions | M     | Air dried sample       | 26/08/2022  | 172           | Ion Chromatography |

## Report Information

Report No.: 22-42878, issue number 1

### Key

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U   | hold UKAS accreditation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| M   | hold MCERTS and UKAS accreditation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| N   | do not currently hold UKAS accreditation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| ^   | MCERTS accreditation not applicable for sample matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| *   | UKAS accreditation not applicable for sample matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| S   | Subcontracted to approved laboratory UKAS Accredited for the test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| SM  | Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| NS  | Subcontracted to approved laboratory. UKAS accreditation is not applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| I/S | Insufficient Sample                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| U/S | Unsuitable sample                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| n/t | Not tested                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <   | means "less than"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| >   | means "greater than"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| LOD | <p>LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.</p> <p>Soil sample results are expressed on an air dried basis (dried at &lt; 30°C), and are uncorrected for inert material removed.</p> <p>ELAB are unable to provide an interpretation or opinion on the content of this report. The results relate only to the sample received.</p> <p>PCB congener results may include any coeluting PCBs</p> <p>Uncertainty of measurement for the determinands tested are available upon request</p> <p>Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.</p> |

### Deviation Codes

|   |                                                          |
|---|----------------------------------------------------------|
| a | No date of sampling supplied                             |
| b | No time of sampling supplied (Waters Only)               |
| c | Sample not received in appropriate containers            |
| d | Sample not received in cooled condition                  |
| e | The container has been incorrectly filled                |
| f | Sample age exceeds stability time (sampling to receipt)  |
| g | Sample age exceeds stability time (sampling to analysis) |

Where a sample has a deviation code, the applicable test result may be invalid.

### Sample Retention and Disposal

All soil samples will be retained for a period of one month  
 All water samples will be retained for 7 days following the date of the test report  
 Charges may apply to extended sample storage

### TPH Classification - HWOL Acronym System

|       |                                                                     |
|-------|---------------------------------------------------------------------|
| HS    | Headspace analysis                                                  |
| EH    | Extractable Hydrocarbons - i.e. everything extracted by the solvent |
| CU    | Clean-up - e.g. by florisil, silica gel                             |
| 1D    | GC - Single coil gas chromatography                                 |
| Total | Aliphatics & Aromatics                                              |
| AL    | Aliphatics only                                                     |
| AR    | Aromatics only                                                      |
| 2D    | GC-GC - Double coil gas chromatography                              |
| #1    | EH_Total but with humics mathematically subtracted                  |
| #2    | EH_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  |
| MS    | Mass Spectrometry                                                   |

## Appendix I

### Generic Quantitative Risk Assessment: Human Health

|                                                             |                      |                    |            |            |            |            |           |           |           |           |           |           |           |
|-------------------------------------------------------------|----------------------|--------------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Project Number: 2006023.001A                                |                      | Lab Sample Number: | 2395903    | 2395904    | 2395905    | 2395906    | 2387985   | 2387986   | 2387987   | 2387988   | 2387989   | 2387990   | 2387991   |
| Project Name: Deansgate, Manchester                         |                      | Sample Reference:  | BH103      | BH103      | BH102      | BH102      | TP101 ES1 | TP102 ES1 | TP102 ES2 | TP103 ES1 | TP104 ES1 | BH101 ES1 | BH101 ES2 |
| Site End Use:<br><br>Residential without Home Grown Produce |                      | Sample Number:     |            |            |            |            |           |           |           |           |           |           |           |
|                                                             |                      | Depth (m):         | 0.80-0.90  | 3.50-3.70  | 0.80-1.00  | 1.20-1.40  | 0.40-0.70 | 0.40-0.80 | 2.20-2.40 | 1.00-1.40 | 0.80-1.20 | 0.50-0.80 | 1.50-1.80 |
|                                                             |                      | Date Sampled:      | 15/08/2022 | 15/08/2022 | 16/08/2022 | 16/08/2022 | 44812     | 44812     | 44812     | 44812     | 44812     | 44842     | 44873     |
|                                                             |                      | Time Taken:        |            |            |            |            |           |           |           |           |           |           |           |
| Determinand                                                 | GAC                  | Units              |            |            |            |            | 5         | 6         | 7         | 8         | 9         | 10        | 11        |
| Arsenic                                                     | 40 <sup>(1)</sup>    | mg/kg              | 15         | -          | 6.1        | 5.9        | 38        | 10        | 5.8       | 14        | 5.4       | 15        | 4         |
| Boron                                                       | 11000 <sup>(3)</sup> | mg/kg              | 0.3        | -          | < 0.2      | < 0.2      | 0.6       | 0.3       | < 0.2     | 0.8       | 0.2       | 0.6       | 0.4       |
| Cadmium                                                     | 150 <sup>(1)</sup>   | mg/kg              | < 0.2      | -          | < 0.2      | < 0.2      | 0.6       | < 0.2     | < 0.2     | 0.4       | < 0.2     | < 0.2     | 0.3       |
| Chromium (total)                                            | 910 <sup>(3)</sup>   | mg/kg              | 7.1        | -          | 18         | 20         | 22        | 13        | 14        | 22        | 22        | 8.9       | 12        |
| Chromium (VI)                                               | 21 <sup>(1)</sup>    | mg/kg              | < 1.2      | -          | < 1.8      | < 1.8      | 1.8       | < 1.8     | < 1.2     | < 1.2     | < 1.8     | < 1.2     | < 1.2     |
| Copper                                                      | 7100 <sup>(3)</sup>  | mg/kg              | 5.8        | -          | 15         | 14         | 170       | 30        | 15        | 37        | 12        | 12        | 11        |
| Lead                                                        | 310 <sup>(1)</sup>   | mg/kg              | 33         | -          | 11         | 8.7        | 310       | 95        | 27        | 78        | 21        | 28        | 7         |
| Mercury                                                     | 40 <sup>(2-6)</sup>  | mg/kg              | < 0.3      | -          | < 0.3      | < 0.3      | < 0.3     | < 0.3     | < 0.3     | < 0.3     | < 0.3     | < 0.3     | < 0.3     |
| Nickel                                                      | 130 <sup>(2-6)</sup> | mg/kg              | 7.1        | -          | 20         | 21         | 31        | 15        | 12        | 20        | 20        | 7.1       | 7.6       |
| Selenium                                                    | 350 <sup>(2-6)</sup> | mg/kg              | < 1.0      | -          | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| Zinc                                                        | 40000 <sup>(3)</sup> | mg/kg              | 130        | -          | 66         | 58         | 390       | 200       | 50        | 58        | 140       | 56        | 33        |
| Beryllium                                                   | 1.7 <sup>(3)</sup>   | mg/kg              | 0.25       | -          | 0.78       | 0.79       | 1.2       | 0.66      | 0.58      | 0.95      | 0.58      | 0.28      | 0.26      |
| Vanadium                                                    | 1200 <sup>(3)</sup>  | mg/kg              | 12         | -          | -          | -          | 29        | -         | 19        | 24        | -         | 15        | 13        |
| Barium                                                      | 1300 <sup>(4)</sup>  | mg/kg              | 16         | -          | 78         | 76         | 390       | 66        | 43        | 150       | 220       | 39        | 53        |
| Cyanide (Total)                                             | 20 <sup>(5)</sup>    | mg/kg              | < 1.0      | -          | < 1.0      | < 1.0      | 2.3       | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| Phenol (Monohydric)                                         | 440 <sup>(3)</sup>   | mg/kg              | < 1.0      | -          | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| Sulphide                                                    | -                    | mg/kg              | 2.8        | -          | -          | -          | < 1.0     | -         | < 1.0     | < 1.0     | -         | 2.7       | 3.8       |
| Total Organic Carbon (TOC)                                  | -                    | %                  | 0.2        | -          | -          | -          | 1.3       | -         | 0.3       | 1.1       | -         | 0.2       | < 0.1     |
| Naphthalene                                                 | 2.3 <sup>(3)</sup>   | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | < 0.05    | 0.67      | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    |
| Acenaphthylene                                              | 2900 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    |
| Acenaphthene                                                | 3000 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | < 0.05    | 1.2       | < 0.05    | 0.49      | < 0.05    | < 0.05    | < 0.05    |
| Fluorene                                                    | 2800 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | < 0.05    | 0.84      | < 0.05    | 0.38      | < 0.05    | 0.21      | < 0.05    |
| Phenanthrene                                                | 1300 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.91      | 7.6       | < 0.05    | 2.2       | < 0.05    | 1         | < 0.05    |
| Anthracene                                                  | 31000 <sup>(3)</sup> | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.23      | 1.6       | < 0.05    | 0.42      | < 0.05    | 0.18      | < 0.05    |
| Fluoranthene                                                | 1500 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 1.4       | 9.7       | < 0.05    | 1.7       | < 0.05    | 0.45      | < 0.05    |
| Pyrene                                                      | 3700 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 1.4       | 8.6       | < 0.05    | 1.4       | < 0.05    | 0.58      | < 0.05    |
| Benzo(a)anthracene                                          | 11 <sup>(3)</sup>    | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.96      | 5.7       | < 0.05    | 0.96      | < 0.05    | 0.34      | < 0.05    |
| Chrysene                                                    | 30 <sup>(3)</sup>    | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 1         | 4.3       | < 0.05    | 0.78      | < 0.05    | 0.22      | < 0.05    |
| Benzo(b)fluoranthene                                        | 3.9 <sup>(3)</sup>   | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 1         | 4.8       | < 0.05    | 0.73      | < 0.05    | < 0.05    | < 0.05    |
| Benzo(k)fluoranthene                                        | 110 <sup>(3)</sup>   | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.54      | 2.6       | < 0.05    | 0.38      | < 0.05    | < 0.05    | < 0.05    |
| Benzo(a)pyrene                                              | 3.2 <sup>(3)</sup>   | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.82      | 4.7       | < 0.05    | 0.58      | < 0.05    | < 0.05    | < 0.05    |
| Indeno(1,2,3-cd)pyrene                                      | 45 <sup>(3)</sup>    | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.58      | 2.1       | < 0.05    | 0.33      | < 0.05    | < 0.05    | < 0.05    |
| Dibenz(a,h)anthracene                                       | 0.31 <sup>(3)</sup>  | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | < 0.05    | 0.61      | < 0.05    | < 0.05    | < 0.05    | < 0.05    | < 0.05    |
| Benzo(ghi)perylene                                          | 360 <sup>(3)</sup>   | mg/kg              | < 0.05     | -          | < 0.05     | < 0.05     | 0.72      | 2.6       | < 0.05    | 0.38      | < 0.05    | < 0.05    | < 0.05    |
| Speciated Total EPA-16 PAHs                                 | -                    | mg/kg              | < 0.80     | -          | < 0.80     | < 0.80     | 9.65      | 57.6      | < 0.80    | 10.7      | < 0.80    | 2.98      | < 0.80    |
| Benzene                                                     | 0.38 <sup>(3)</sup>  | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| Toluene                                                     | 880 <sup>(3)</sup>   | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| Ethylbenzene                                                | 83 <sup>(3)</sup>    | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| p & m-xylene                                                | 79 <sup>(3)</sup>    | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| o-xylene                                                    | 88 <sup>(3)</sup>    | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| MTBE (Methyl Tertiary Butyl Ether)                          | 73 <sup>(4)</sup>    | µg/kg              | < 1.0      | < 1.0      | < 1.0      | < 1.0      | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     | < 1.0     |
| TPH Aliphatic C5 - C6                                       | 42 <sup>(3)</sup>    | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aliphatic C6 - C8                                       | 100 <sup>(3)</sup>   | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aliphatic C8 - C10                                      | 27 <sup>(3)</sup>    | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aliphatic C10 - C12                                     | 130 <sup>(3)</sup>   | mg/kg              | < 1.0      | < 1.0      | -          | -          | < 1.0     | -         | < 1.0     | < 1.0     | -         | < 1.0     | < 1.0     |
| TPH Aliphatic C12 - C16                                     | 1100 <sup>(3)</sup>  | mg/kg              | < 2.0      | < 2.0      | -          | -          | < 2.0     | -         | < 2.0     | < 2.0     | -         | < 2.0     | < 2.0     |
| TPH Aliphatic C16 - C21                                     | 65000 <sup>(3)</sup> | mg/kg              | < 8.0      | < 8.0      | -          | -          | < 8.0     | -         | < 8.0     | < 8.0     | -         | < 8.0     | < 8.0     |
| TPH Aliphatic C21 - C35                                     | 65000 <sup>(3)</sup> | mg/kg              | < 8.0      | < 8.0      | -          | -          | 87        | -         | < 8.0     | < 8.0     | -         | < 8.0     | < 8.0     |
| TPH Aromatic C5 - C7                                        | 370 <sup>(3)</sup>   | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aromatic C7 - C8                                        | 860 <sup>(3)</sup>   | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aromatic C8 - C10                                       | 47 <sup>(3)</sup>    | mg/kg              | < 0.001    | < 0.001    | -          | -          | < 0.001   | -         | < 0.001   | < 0.001   | -         | < 0.001   | < 0.001   |
| TPH Aromatic C10 - C12                                      | 250 <sup>(3)</sup>   | mg/kg              | < 1.0      | < 1.0      | -          | -          | < 1.0     | -         | < 1.0     | < 1.0     | -         | < 1.0     | < 1.0     |
| TPH Aromatic C12 - C16                                      | 1800 <sup>(3)</sup>  | mg/kg              | < 2.0      | < 2.0      | -          | -          | < 2.0     | -         | < 2.0     | < 2.0     | -         | < 2.0     | < 2.0     |
| TPH Aromatic C16 - C21                                      | 1900 <sup>(3)</sup>  | mg/kg              | < 10       | < 10       | -          | -          | < 10      | -         | < 10      | < 10      | -         | < 10      | < 10      |
| TPH Aromatic C21 - C35                                      | 1900 <sup>(3)</sup>  | mg/kg              | < 10       | < 10       | -          | -          | 22        | -         | < 10      | 12        | -         | < 10      | < 10      |

Notes:

<sup>(1)</sup> DEFRA C4SLs (2014)<sup>(2)</sup> Environment Agency SGVs (2009)<sup>(3)</sup> LQM/CIH 54ULs (2015)<sup>(4)</sup> CLAIRe, AGS & EIS (2009)<sup>(5)</sup> Dutch Intervention Value for free cyanide (VROM 2000)

\*All GACs based on a sandy soil and Soil Organic Matter (SOM) of 1% where applicable.

Concentration does not exceed GAC

Concentration exceeds GAC

No set GAC

## Appendix J

### Generic Quantitative Risk Assessment: Controlled Waters

**Groundwater Analysis – Chester Formation (Principal Aquifer)**

| Contaminant                      | BH101 (µg/l)            | BH102 (µg/l)            | GAC (µg/l)             | No. of Exceedances |
|----------------------------------|-------------------------|-------------------------|------------------------|--------------------|
| Arsenic                          | 4.76                    | 2.18                    | 10 <sup>(1)</sup>      | 0                  |
| Boron                            | 84                      | 56                      | 1000 <sup>(2)</sup>    | 0                  |
| Cadmium                          | < 0.02 <sup>(5)</sup>   | < 0.02 <sup>(5)</sup>   | 5.0 <sup>(1)</sup>     | 0                  |
| Chromium (III)                   | 0.6                     | < 0.2 <sup>(5)</sup>    | 50 <sup>(1)</sup>      | 0                  |
| Chromium (VI)                    | < 5.0 <sup>(5)</sup>    | < 5.0 <sup>(5)</sup>    | 3.4 <sup>(3)</sup>     | 0                  |
| Copper                           | 1.1                     | 2.7                     | 2000 <sup>(1)</sup>    | 0                  |
| Lead                             | 3.9                     | 0.5                     | 10 <sup>(1)</sup>      | 0                  |
| Mercury                          | 0.24                    | < 0.05 <sup>(5)</sup>   | 1.0 <sup>(1)</sup>     | 0                  |
| Nickel                           | 1                       | 1.5                     | 20 <sup>(1)</sup>      | 0                  |
| Zinc                             | 1.5                     | 3.4                     | 10.9 <sup>(3)</sup>    | 0                  |
| Beryllium                        | < 0.1 <sup>(5)</sup>    | < 0.1 <sup>(5)</sup>    | 12 <sup>(2)</sup>      | 0                  |
| Selenium                         | 3                       | 0.9                     | 10 <sup>(1)</sup>      | 0                  |
| Vanadium                         | 4.3                     | 0.5                     | 20 <sup>(3)</sup>      | 0                  |
| Barium                           | 23                      | 85                      | 700 <sup>(2)</sup>     | 0                  |
| Cyanide (Total)                  | < 10 <sup>(5)</sup>     | < 10 <sup>(5)</sup>     | 50 <sup>(1)</sup>      | 0                  |
| Total Phenol (Monohydric)        | 53                      | < 10 <sup>(5,6)</sup>   | 7.7 <sup>(1)</sup>     | 1                  |
| Sulphate                         | 64000                   | 23700                   | 250000 <sup>(1)</sup>  | 0                  |
| Sulphide                         | < 5.0                   | < 5.0                   | -                      | -                  |
| pH                               | 9.3                     | 7.9                     | -                      | -                  |
| Naphthalene                      | 5.69                    | 6.59                    | 4 <sup>(3)</sup>       | 2                  |
| Acenaphthylene                   | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Acenaphthene                     | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Fluorene                         | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Phenanthrene                     | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Anthracene                       | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | 0.1 <sup>(3)</sup>     | 0                  |
| Fluoranthene                     | < 0.01 <sup>(5,6)</sup> | < 0.01 <sup>(5,6)</sup> | 0.0063 <sup>(1)</sup>  | 0                  |
| Pyrene                           | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Benzo(a)anthracene               | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Chrysene                         | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Benzo(b)fluoranthene             | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | 0.10 <sup>(3)</sup>    | 0                  |
| Benzo(k)fluoranthene             | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | 0.10 <sup>(3)</sup>    | 0                  |
| Benzo(a)pyrene                   | < 0.01 <sup>(5,6)</sup> | < 0.01 <sup>(5,6)</sup> | 0.00017 <sup>(3)</sup> | 0                  |
| Indeno(1,2,3-cd)pyrene           | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | 0.10 <sup>(3)</sup>    | 0                  |
| Benzo(g,h,i)perylene             | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Dibenz(a,h)anthracene            | < 0.01 <sup>(5)</sup>   | < 0.01 <sup>(5)</sup>   | -                      | -                  |
| Total PAH                        | 5.69                    | 6.59                    | -                      | -                  |
| TPH-CWG – Aliphatic >EC5 – EC6   | < 1.0 <sup>(5)</sup>    | < 1.0 <sup>(5)</sup>    | 15000 <sup>(2)</sup>   | 0                  |
| TPH-CWG – Aliphatic >EC6 – EC8   | < 1.0 <sup>(5)</sup>    | < 1.0 <sup>(5)</sup>    | 15000 <sup>(2)</sup>   | 0                  |
| TPH-CWG – Aliphatic >EC8 – EC10  | < 1.0 <sup>(5)</sup>    | < 1.0 <sup>(5)</sup>    | 300 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aliphatic >EC10 – EC12 | < 10 <sup>(5)</sup>     | < 10 <sup>(5)</sup>     | 300 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aliphatic >EC12 – EC16 | 40                      | < 10 <sup>(5)</sup>     | 300 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aliphatic >EC16 – EC21 | 160                     | < 10 <sup>(5)</sup>     | -                      | -                  |
| TPH-CWG – Aliphatic >EC21 – EC35 | 1300                    | < 10 <sup>(5)</sup>     | -                      | -                  |
| TPH-CWG – Aromatic >EC5 – EC7    | 53                      | < 1.0 <sup>(5)</sup>    | 10 <sup>(2)</sup>      | 1                  |
| TPH-CWG – Aromatic >EC7 – EC8    | 5.8                     | 5.3                     | 700 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aromatic >EC8 – EC10   | < 1.0 <sup>(5)</sup>    | 130                     | 300 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aromatic >EC10 – EC12  | 170                     | 200                     | 500 <sup>(2)</sup>     | 0                  |
| TPH-CWG – Aromatic >EC12 – EC16  | 20                      | 30                      | 90 <sup>(2)</sup>      | 0                  |
| TPH-CWG – Aromatic >EC16 – EC21  | < 10 <sup>(5)</sup>     | < 10 <sup>(5)</sup>     | 90 <sup>(2)</sup>      | 0                  |

| Contaminant                     | BH101 (µg/l)         | BH102 (µg/l)          | GAC (µg/l)         | No. of Exceedances |
|---------------------------------|----------------------|-----------------------|--------------------|--------------------|
| TPH-CWG – Aromatic >EC21 – EC35 | < 10 <sup>(5)</sup>  | < 10 <sup>(5)</sup>   | 90 <sup>(2)</sup>  | 0                  |
| Benzene                         | 52.6                 | < 1.0 <sup>(5)</sup>  | 1 <sup>(3)</sup>   | 1                  |
| Toluene                         | 5.8                  | 5.3                   | 74 <sup>(3)</sup>  | 0                  |
| Ethylbenzene                    | < 1.0 <sup>(5)</sup> | 40.6                  | 300 <sup>(2)</sup> | 0                  |
| P & m-xylene                    | < 1.0 <sup>(5)</sup> | 5.4                   | 500 <sup>(3)</sup> | 0                  |
| o-xylene                        | < 1.0 <sup>(5)</sup> | 22.3                  | 500 <sup>(3)</sup> | 0                  |
| MTBE                            | < 1.0 <sup>(5)</sup> | < 1.0 <sup>(5)</sup>  | 15 <sup>(3)</sup>  | 0                  |
| Mineral Oil (C10-C40)           | 1460                 | < 10.0 <sup>(5)</sup> | -                  | -                  |
| Diesel Range Organics (C10-C25) | 510                  | 230                   | -                  | -                  |

Notes:

- 1 Water Supply (Water Quality) Regulations 2018 – Drinking Water Standards (DWS)
- 2 WHO Guidelines for Drinking Water Quality (2008)
- 3 EQS, Annual Average (AA) – Freshwaters
- 4 EQS, Maximum Allowable Concentrations (MAC) – Freshwaters
- 5 Laboratory Limit of Detection
- 6 Laboratory Limit of Detection greater than SSV

### Leachability Analysis

| Contaminant                  | TP101 ES1<br>0.4-0.7mbgl<br>(µg/l) | TP102 ES2<br>2.2-2.4mbgl<br>(µg/l) | TP105 ES1<br>0.4-0.8mbgl<br>(µg/l) | BH101 ES1<br>0.5-0.8mbgl<br>(µg/l) | BH101 ES2<br>1.5-1.8mbgl<br>(µg/l) | GAC<br>(µg/l)          | No. of<br>Exceedances |
|------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------|-----------------------|
| Arsenic                      | 7.2                                | 2.1                                | 1.7                                | 8                                  | 2                                  | 10 <sup>(1)</sup>      | 0                     |
| Boron                        | 19                                 | 13                                 | 38                                 | 26                                 | < 10                               | 1000 <sup>(2)</sup>    | 0                     |
| Cadmium                      | < 0.08 <sup>(5)</sup>              | < 0.08 <sup>(5)</sup>              | < 0.08 <sup>(5)</sup>              | < 0.08 <sup>(5)</sup>              | < 0.08 <sup>(5)</sup>              | 5.0 <sup>(4)</sup>     | 0                     |
| Chromium (VI)                | 1.7                                | 0.9                                | 1.4                                | 3.5                                | 2.5                                | 3.4 <sup>(3)</sup>     | 1                     |
| Copper                       | 3.2                                | 15                                 | 19                                 | 21                                 | 1.9                                | 2000 <sup>(1)</sup>    | 0                     |
| Lead                         | 2.5                                | 3.4                                | 3.2                                | 2.9                                | 7.2                                | 10 <sup>(1)</sup>      | 0                     |
| Mercury                      | < 0.5 <sup>(5)</sup>               | 1.1                                | 0.8                                | < 0.5 <sup>(5)</sup>               | < 0.5 <sup>(5)</sup>               | 1.0 <sup>(4)</sup>     | 1                     |
| Nickel                       | 3.7                                | 4                                  | 4.6                                | 4.2                                | 3.3                                | 20 <sup>(1)</sup>      | 0                     |
| Zinc                         | 5                                  | 7.7                                | 13                                 | 8.2                                | 4.8                                | 10.9 <sup>(3)</sup>    | 1                     |
| Beryllium                    | 0.3                                | 0.3                                | 0.2                                | 0.3                                | 0.2                                | 12 <sup>(2)</sup>      | 0                     |
| Selenium                     | < 4.0 <sup>(5)</sup>               | < 4.0 <sup>(5)</sup>               | < 4.0 <sup>(5)</sup>               | < 4.0 <sup>(5)</sup>               | < 4.0 <sup>(5)</sup>               | 10 <sup>(1)</sup>      | 0                     |
| Vanadium                     | 4.1                                | 2.6                                | 1.8                                | 15                                 | 4                                  | 20 <sup>(3)</sup>      | 0                     |
| Barium                       | 14                                 | 4.8                                | 11                                 | 18                                 | 720                                | 700 <sup>(2)</sup>     | 1                     |
| Cyanide (Total)              | < 10 <sup>(5)</sup>                | < 10 <sup>(5)</sup>                | < 10 <sup>(5)</sup>                | 13                                 | 13                                 | 50 <sup>(1)</sup>      | 0                     |
| Total Phenol<br>(Monohydric) | < 10 <sup>(5,6)</sup>              | < 10 <sup>(5,6)</sup>              | < 10 <sup>(5,6)</sup>              | < 10 <sup>(5,6)</sup>              | 16 <sup>(6)</sup>                  | 7.7 <sup>(1)</sup>     | 1                     |
| Sulphate                     | 4.1                                | 3.4                                | 79.6                               | 11.1                               | 6.6                                | 250000 <sup>(1)</sup>  | 0                     |
| Sulphide                     | < 5.0 <sup>(5)</sup>               | < 5.0 <sup>(5)</sup>               | < 5.0 <sup>(5)</sup>               | < 5.0 <sup>(5)</sup>               | < 5.0 <sup>(5)</sup>               | -                      | -                     |
| pH                           | 7.9                                | 7.5                                | 7.7                                | 11.1                               | 12                                 | -                      | -                     |
| Naphthalene                  | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 4 <sup>(3)</sup>       | 0                     |
| Acenaphthylene               | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Acenaphthene                 | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Fluorene                     | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Phenanthrene                 | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Anthracene                   | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 0.1 <sup>(3)</sup>     | 0                     |
| Fluoranthene                 | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 0.0063 <sup>(1)</sup>  | 0                     |
| Pyrene                       | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Benzo(a)anthracene           | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Chrysene                     | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Benzo(b)fluoranthene         | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 0.10 <sup>(3)</sup>    | 0                     |
| Benzo(k)fluoranthene         | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 0.10 <sup>(3)</sup>    | 0                     |
| Benzo(a)pyrene               | < 0.01 <sup>(5,6)</sup>            | < 0.01 <sup>(5,6)</sup>            | < 0.01 <sup>(5,6)</sup>            | < 0.01 <sup>(5,6)</sup>            | < 0.01 <sup>(5,6)</sup>            | 0.00017 <sup>(3)</sup> | 0                     |
| Indeno(1,2,3-cd)pyrene       | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | 0.10 <sup>(3)</sup>    | 0                     |
| Benzo(g,h,i)perylene         | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Dibenz(a,h)anthracene        | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | < 0.01 <sup>(5)</sup>              | -                      | -                     |
| Total PAH                    | < 0.2 <sup>(5)</sup>               | < 0.2 <sup>(5)</sup>               | < 0.2 <sup>(5)</sup>               | < 0.2 <sup>(5)</sup>               | < 0.2 <sup>(5)</sup>               | -                      | -                     |

Notes:

- 1 Water Supply (Water Quality) Regulations 2018 – Drinking Water Standards (DWS)
- 2 WHO Guidelines for Drinking Water Quality (2008)
- 3 EQS, Annual Average (AA) – Freshwaters
- 4 EQS, Maximum Allowable Concentrations (MAC) – Freshwaters
- 5 Laboratory Limit of Detection
- 6 Laboratory Limit of Detection greater than SSV

## Appendix K

### Ground Gas Monitoring Results



Ground Gas Monitoring Results

|                 |                       |               |                |                              |                                |                            |                                                                  |
|-----------------|-----------------------|---------------|----------------|------------------------------|--------------------------------|----------------------------|------------------------------------------------------------------|
| Project:        | Deansgate, Manchester | Gas analyser: | GFM 436        | Preceding Weather Conditions |                                | On-site weather conditions | General Site Conditions / Ground Conditions / On-site Activities |
| Project Number: | 2006023.001           | Condition:    | Calibrated     | Atmospheric trend:           | 1001 - 1014mbar (stable/fluctu | Light rain shower          | General site works including Sonic drilling                      |
| Location:       | Manchester            | Dip meter:    | 30m dual phase | Temperature range:           | 16-20°C                        |                            |                                                                  |
| Test Date:      | 17/08/2022            | Operator:     | ST             | Rainfall:                    | 1.5mm                          |                            |                                                                  |

GAS MONITORING TO BE UNDERTAKEN IN ACCORDANCE WITH TEC METHOD STATEMENT

| Borehole Information                        | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|---------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                             |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH101                               | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         | 6.99mbgl          | 23.96          | PID: 0.0ppm |
|                                             | 15       | 0.0                       | 0       | 0.2                | 0.0        | 20.0      | 19.6    | 0        | 0         |                   |                |             |
| Time: 09:20                                 | 30       | 0.0                       | 0       | 0.2                | 0.0        | 20.0      | 49.1    | 0        | 0         |                   |                |             |
|                                             | 45       | 0.0                       | 0       | 0.3                | 0.0        | 19.9      | 68.9    | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1012mbar  | 60       | 0.0                       | 0       | 0.3                | 0.0        | 19.8      | 86.4    | 0        | 0         |                   |                |             |
|                                             | 120      | 0.0                       | 0       | 0.4                | 0.0        | 19.8      | >>>>    | 0        | 0         |                   |                |             |
|                                             | 180      | 0.0                       | 0       | 0.4                | 0.0        | 19.7      | >>>>    | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after: 1014 mbar |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                             |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                             |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                         |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH102                              | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.4      | 0.0     | 0        | 0         | 7.54mbgl          | 17.40mbgl      | PID: 0.0ppm |
|                                            | 15       | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         |                   |                |             |
| Time: 12:58                                | 30       | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 45       | 0.0                       | 0       | 0.0                | 0.0        | 20.1      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1013mbar | 60       | 0.0                       | 0       | 0.0                | 0.0        | 20.1      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 120      | 0.0                       | 0       | 0.1                | 0.0        | 20.1      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 180      | 0.0                       | 0       | 0.0                | 0.0        | 20.1      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after: 1014mbar |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                        | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|---------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                             |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH103                               | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.4      | 0.0     | 0        | 0         | 3.31mbgl          | 3.44mbgl       | PID: 0.0ppm |
|                                             | 15       | 0.0                       | 0       | 0.0                | 0.0        | 20.4      | 0.0     | 0        | 0         |                   |                |             |
| Time: 10:16                                 | 30       | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         |                   |                |             |
|                                             | 45       | 0.0                       | 0       | 0.0                | 0.0        | 20.4      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1014mbar  | 60       | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         |                   |                |             |
|                                             | 120      | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         |                   |                |             |
|                                             | 180      | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after: 1014 mbar |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                             |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                             |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                         |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH104                              | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.3      | 0.0     | 0        | 0         | 2.94mbgl          | 3.34mbgl       | PID: 0.0ppm |
|                                            | 15       | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
| Time: 09:40                                | 30       | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 45       | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1015mbar | 60       | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 120      | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 180      | 0.0                       | 0       | 0.0                | 0.0        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after: 1014mbar |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH03 (SS WS)                       | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.4      | 0.0     | 0        | 0         | Dry               | 1.96mbgl       | PID: 0.0ppm |
|                                            | 15       | 0.0                       | 0       | 0.0                | 0.4        | 20.2      | 0.0     | 0        | 0         |                   |                |             |
| Time: 10:03                                | 30       | 0.0                       | 0       | 0.0                | 0.7        | 20.0      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 45       | 0.0                       | 0       | 0.0                | 0.8        | 19.9      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1015mbar | 60       | 0.0                       | 0       | 0.0                | 0.9        | 19.8      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 120      | 0.0                       | 0       | 0.0                | 0.9        | 19.8      | 0.0     | 0        | 0         |                   |                |             |
|                                            | 180      | 0.0                       | 0       | 0.0                | 0.9        | 19.8      | 0.0     | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after: 1014mbar |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |             |



# Ground Gas Monitoring Results

|                 |                       |               |                |                              |                      |                            |                                                                  |
|-----------------|-----------------------|---------------|----------------|------------------------------|----------------------|----------------------------|------------------------------------------------------------------|
| Project:        | Deansgate, Manchester | Gas analyser: | GFM 430        | Preceding Weather Conditions |                      | On-site weather conditions | General Site Conditions / Ground Conditions / On-site Activities |
| Project Number: | 2006023.001           | Condition:    | Calibrated     | Atmospheric trend:           | 1012 - 1018 (Rising) | Dry and sunny              |                                                                  |
| Location:       | Manchester            | Dip meter:    | 30m dual phase | Temperature range:           | 15-19°C              |                            |                                                                  |
| Test Date:      | 31/08/2022            | Operator:     | MT             | Rainfall:                    | 0 mm                 |                            |                                                                  |

## GAS MONITORING TO BE UNDERTAKEN IN ACCORDANCE WITH TEC METHOD STATEMENT

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|----------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |          |
| BH ref: BH101                              | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         | 7.12mbgl          | 16.68mbgl      |          |
|                                            | 15       | 0.0                       | 0       | 1.9                | 0.0        | 18.1      | 60.2    | 11       | 0         |                   |                |          |
| Time: 13:45                                | 30       | 0.0                       | 0       | 2.7                | 0.0        | 17.4      | 64.3    | 21       | 0         |                   |                |          |
|                                            | 45       | 0.0                       | 0       | 2.9                | 0.0        | 17.2      | 6737.0  | 35       | 0         |                   |                |          |
| Atmospheric pressure (mb) before: 1033mbar | 60       | 0.0                       | 0       | 3.0                | 0.0        | 17.2      | 71.1    | 40       | 1         |                   |                |          |
|                                            | 120      | 0.0                       | 0       | 3.5                | 0.0        | 17.0      | 80.5    | 48       | 4         |                   |                |          |
| Atmospheric preasure (mb) after: 1033 mbar | 180      | 0.0                       | 0       | 3.7                | 0.0        | 16.9      | 85.1    | 50       | 4         |                   |                |          |
|                                            | 240      | 0.0                       | 0       | 3.9                | 0.0        | 16.8      | 90.2    | 55       | 4         |                   |                |          |
|                                            | 300      | 0.0                       | 0       | 4.1                | 0.0        | 16.7      | 94.7    | 58       | 4         |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|----------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |          |
| BH ref: BH102                              | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.8      | 0.0     | 0        | 0         | 7.28mbgl          | 16.16mbgl      |          |
|                                            | 15       | 0.0                       | 0       | 0.0                | 0.0        | 20.1      | 0.0     | 0        | 0         |                   |                |          |
| Time: 16:08                                | 30       | 0.0                       | 0       | 0.0                | 0.0        | 19.6      | 0.0     | 0        | 0         |                   |                |          |
|                                            | 45       | 0.0                       | 0       | 0.0                | 0.0        | 19.3      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric pressure (mb) before: 1031mbar | 60       | 0.0                       | 0       | 0.0                | 0.0        | 19.1      | 0.0     | 0        | 0         |                   |                |          |
|                                            | 120      | 0.0                       | 0       | 0.0                | 0.0        | 17.3      | 4.1     | 0        | 0         |                   |                |          |
| Atmospheric preasure (mb) after: 1031mbar  | 180      | 0.0                       | 0       | 0.3                | 0.0        | 16.7      | 9.1     | 0        | 0         |                   |                |          |
|                                            | 240      | 0.0                       | 0       | 0.4                | 0.0        | 16.4      | 11.3    | 0        | 0         |                   |                |          |
|                                            | 300      | 0.0                       | 0       | 0.5                | 0.0        | 16.0      | 13.3    | 0        | 0         |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |

| Borehole Information                       | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments |
|--------------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|----------|
|                                            |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |          |
| BH ref: BH103                              | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.9      | 0.0     | 0        | 0         | Dry               | 3.49mbgl       |          |
|                                            | 15       | 0.0                       | 0       | 0.0                | 0.0        | 20.9      | 0.0     | 0        | 0         |                   |                |          |
| Time: 15:40                                | 30       | 0.0                       | 0       | 0.0                | 0.0        | 20.9      | 0.0     | 0        | 0         |                   |                |          |
|                                            | 45       | 0.0                       | 0       | 0.0                | 0.0        | 20.9      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric pressure (mb) before: 1032mbar | 60       | 0.0                       | 0       | 0.0                | 0.0        | 20.8      | 0.0     | 0        | 0         |                   |                |          |
|                                            | 120      | 0.0                       | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric preasure (mb) after: 1032mbar  | 180      | 0.0                       | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Condition: Good                       |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |
| Well Diameter: 50mm                        |          |                           |         |                    |            |           |         |          |           |                   |                |          |
|                                            |          |                           |         |                    |            |           |         |          |           |                   |                |          |

| Borehole Information                          | Time (s) | Borehole Flow Rate<br>(l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments |
|-----------------------------------------------|----------|------------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|----------|
|                                               |          |                              |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |          |
| BH ref: BH104                                 | 0        | 0.0                          | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         | Dry               | 3.27mbgl       |          |
|                                               | 15       | 0.0                          | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         |                   |                |          |
| Time: 16:00                                   | 30       | 0.0                          | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 45       | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric pressure (mb) before:<br>1031mbar | 60       | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 120      | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 180      | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric preassure (mb) after:<br>1031mbar |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |
| Well Condition: Good                          |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |
| Well Diameter: 50mm                           |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |

| Borehole Information                          | Time (s) | Borehole Flow Rate<br>(l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments |
|-----------------------------------------------|----------|------------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|----------|
|                                               |          |                              |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |          |
| BH ref: BH03 (SS WS)                          | 0        | 0.0                          | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         | Dry               | 1.96mbgl       |          |
|                                               | 15       | 0.0                          | 0       | 0.0                | 0.0        | 20.8      | 0.0     | 0        | 0         |                   |                |          |
| Time: 15:50                                   | 30       | 0.0                          | 0       | 0.0                | 0.0        | 20.7      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 45       | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric pressure (mb) before:<br>1032mbar | 60       | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 120      | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
|                                               | 180      | 0.0                          | 0       | 0.0                | 0.0        | 20.6      | 0.0     | 0        | 0         |                   |                |          |
| Atmospheric preassure (mb) after:<br>1031mbar |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |
| Well Condition: Good                          |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |
| Well Diameter: 50mm                           |          |                              |         |                    |            |           |         |          |           |                   |                |          |
|                                               |          |                              |         |                    |            |           |         |          |           |                   |                |          |



Ground Gas Monitoring Results

|                 |                       |               |                |                              |                   |                              |                                                                  |
|-----------------|-----------------------|---------------|----------------|------------------------------|-------------------|------------------------------|------------------------------------------------------------------|
| Project:        | Deansgate, Manchester | Gas analyser: | GFM 436        | Preceding Weather Conditions |                   | On-site weather conditions   | General Site Conditions / Ground Conditions / On-site Activities |
| Project Number: | 2006023.001           | Condition:    | Calibrated     | Atmospheric trend:           | 991- 998 (Rising) | Overcast & Light rain shower |                                                                  |
| Location:       | Manchester            | Dip meter:    | 30m dual phase | Temperature range:           | 9-12°C            |                              |                                                                  |
| Test Date:      | 29.09.2022            | Operator:     | MT             | Rainfall:                    | 0 mm              |                              |                                                                  |

GAS MONITORING TO BE UNDERTAKEN IN ACCORDANCE WITH TEC METHOD STATEMENT

| Borehole Information                   | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments     |
|----------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|--------------|
|                                        |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |              |
| BH ref: BH101                          | 0        | 0.0                       | 0       | 2.3                | 0.1        | 16.3      | 53.4    | 0        | 0         | 7.07mbgl          | 16.69mbgl      | PID: 67.7ppm |
|                                        | 15       | 0.0                       | 0       | 5.7                | 0.0        | 11        | >>>>    | 0        | 10        |                   |                |              |
| Time: 12:01                            | 30       | 0.0                       | 0       | 6.1                | 0.0        | 11.4      | >>>>    | 0        | 10        |                   |                |              |
|                                        | 45       | 0.0                       | 0       | 6.1                | 0.0        | 11.8      | >>>>    | 0        | 10        |                   |                |              |
| Atmospheric pressure (mb) before: 1003 | 60       | 0.0                       | 0       | 5.8                | 0.0        | 12.1      | >>>>    | 0        | 10        |                   |                |              |
|                                        | 120      | 0.0                       | 0       | 6.0                | 0.0        | 12.0      | >>>>    | 0        | 10        |                   |                |              |
|                                        | 180      | 0.0                       | 0       | 5.8                | 0.0        | 11.3      | >>>>    | 0        | 10        |                   |                |              |
| Atmospheric preasure (mb) after: 1002  |          |                           |         |                    |            |           |         |          |           |                   |                |              |
|                                        |          |                           |         |                    |            |           |         |          |           |                   |                |              |
|                                        |          |                           |         |                    |            |           |         |          |           |                   |                |              |
| Well Condition: Good                   |          |                           |         |                    |            |           |         |          |           |                   |                |              |
| Well Diameter: 50mm                    |          |                           |         |                    |            |           |         |          |           |                   |                |              |

| Borehole Information                   | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|----------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                        |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH102                          | 0        | 0.0                       | 0       | 0.0                | 0.0        | 20.1      | <<<<    | 0        | 0         | 7.08mbgl          | 14.11mbgl      | PID: 0.0ppm |
|                                        | 15       | 0.0                       | 0       | 0.0                | 3.7        | 7.5       | 2.5     | 0        | 0         |                   |                |             |
| Time: 11:50                            | 30       | 0.0                       | 0       | 0.6                | 4.2        | 5.3       | 18.0    | 0        | 0         |                   |                |             |
|                                        | 45       | 0.0                       | 0       | 0.9                | 4.3        | 4.8       | 23.5    | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1003 | 60       | 0.0                       | 0       | 1.1                | 4.5        | 4.3       | 27.7    | 0        | 0         |                   |                |             |
|                                        | 120      | 0.0                       | 0       | 1.8                | 5.2        | 2.2       | 43.6    | 0        | 0         |                   |                |             |
|                                        | 180      | 0.0                       | 0       | 2.1                | 5.7        | 1.4       | 50.6    | 0        | 0         |                   |                |             |
| Atmospheric preasure (mb) after: 1003  | 240      | 0.0                       | 0       | 2.4                | 5.9        | 0.9       | 56.2    | 0        | 0         |                   |                |             |
|                                        | 300      | 0.0                       | 0       | 2.9                | 6.1        | 0.5       | 56.8    | 0        | 0         |                   |                |             |
|                                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                   |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                    |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                   | Time (s) | Borehole Flow Rate (l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|----------------------------------------|----------|---------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                        |          |                           |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH103                          | 0        | -0.5                      | -2      | 0.0                | 0.0        | 20.2      | <<<<    | 0        | 0         | Dry               | 3.46mbgl       | PID: 5.9ppm |
|                                        | 15       | -0.4                      | -2      | 0.1                | 0.0        | 20        | <<<<    | 0        | 0         |                   |                |             |
| Time: 11:34                            | 30       | -0.4                      | -2      | 0.1                | 0.0        | 19.9      | <<<<    | 0        | 0         |                   |                |             |
|                                        | 45       | -0.1                      | 0       | 0.1                | 0.0        | 19.8      | <<<<    | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before: 1004 | 60       | -0.1                      | 0       | 0.1                | 0.0        | 19.7      | <<<<    | 0        | 0         |                   |                |             |
|                                        | 120      | -0.3                      | -1      | 0.1                | 0.0        | 19.7      | <<<<    | 0        | 0         |                   |                |             |
|                                        | 180      | -0.3                      | -1      | 0.1                | 0.0        | 19.6      | <<<<    | 0        | 0         |                   |                |             |
| Atmospheric preasure (mb) after: 1003  |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
|                                        |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                   |          |                           |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                    |          |                           |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                      | Time (s) | Borehole Flow Rate<br>(l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|-------------------------------------------|----------|------------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                           |          |                              |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH104                             | 0        | 0.0                          | 0       | 0.0                | 0.0        | 20.5      | <<<.<   | 0        | 0         | Dry               | 3.27mbgl       | PID: 0.0ppm |
|                                           | 15       | -0.1                         | 0       | 0.0                | 0.0        | 19.4      | <<<.<   | 0        | 0         |                   |                |             |
| Time: 11:22                               | 30       | 0.0                          | 0       | 0.0                | 0.0        | 19.3      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 45       | 0.0                          | 0       | 0.0                | 0.0        | 19.3      | <<<.<   | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before:<br>1004 | 60       | 0.0                          | 0       | 0.0                | 0.0        | 19.3      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 120      | 0.1                          | 1       | 0.0                | 0.0        | 19.3      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 180      | 0.0                          | 0       | 0.0                | 0.0        | 19.9      | <<<.<   | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after:<br>1004 |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                      |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                       |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |

| Borehole Information                      | Time (s) | Borehole Flow Rate<br>(l/hr) | DP (Pa) | Gas Concentrations |            |           |         |          |           | Groundwater Level | Borehole Depth | Comments    |
|-------------------------------------------|----------|------------------------------|---------|--------------------|------------|-----------|---------|----------|-----------|-------------------|----------------|-------------|
|                                           |          |                              |         | CH4 (%v/v)         | CO2 (%v/v) | O2 (%v/v) | LEL (%) | CO (ppm) | H2S (ppm) |                   |                |             |
| BH ref: BH03 (SS WS)                      | 0        | -0.5                         | -2      | 0.0                | 0.0        | 20.1      | <<<.<   | 0        | 0         | Dry               | 1.93mbgl       | PID: 0.0ppm |
|                                           | 15       | -0.3                         | -1      | 0.0                | 0.7        | 19.9      | <<<.<   | 0        | 0         |                   |                |             |
| Time: 11:42                               | 30       | -0.5                         | -2      | 0.0                | 0.8        | 19.8      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 45       | -0.3                         | -1      | 0.0                | 0.8        | 19.7      | <<<.<   | 0        | 0         |                   |                |             |
| Atmospheric pressure (mb) before:<br>1003 | 60       | -0.5                         | -2      | 0.0                | 0.8        | 19.7      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 120      | -0.3                         | -1      | 0.0                | 0.8        | 19.7      | <<<.<   | 0        | 0         |                   |                |             |
|                                           | 180      | -0.4                         | -2      | 0.0                | 0.8        | 19.7      | <<<.<   | 0        | 0         |                   |                |             |
| Atmospheric preassure (mb) after:<br>1003 |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |
| Well Condition: Good                      |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |
| Well Diameter: 50mm                       |          |                              |         |                    |            |           |         |          |           |                   |                |             |
|                                           |          |                              |         |                    |            |           |         |          |           |                   |                |             |

## Appendix L

### Calibration Certificates

| TEST DATE AND CONDITIONS |  |            |    |
|--------------------------|--|------------|----|
| Date                     |  | 26/09/2022 |    |
| Atmospheric Pressure     |  | 982        | mB |
| Ambient Temperature      |  | 20.2       | °C |
| EnviroNics Serial No.    |  | 5089       |    |

**GFM430 Final Inspection & Calibration  
Check Certificate**

**GAS DATA LTD**

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311



**GAS DATA**  
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|                    |                          |
|--------------------|--------------------------|
| Customer           | Tweedie Evans Consulting |
| Certificate Number | 123519                   |
| Order Number       | 332093                   |

|                  |                   |
|------------------|-------------------|
| Serial Number    | 10220             |
| Software Version | G430-00.0024/0013 |

|                        |
|------------------------|
| Recalibration DUE Date |
| 26/09/23               |

| Instrument Checks   |     |                     |                    |     |                     |
|---------------------|-----|---------------------|--------------------|-----|---------------------|
| Keyboard            | ✓   |                     | Display Contrast   | ✓   |                     |
| Pump Flow In        | 400 | Accept > 200 cc/min | Pump Flow @ -200mB | 300 | Accept > 200 cc/min |
| Clock Set / Running | ✓   |                     | Labels Fitted      | ✓   |                     |

| Gas Checks                       |                 |                  |                 |                  |                |                  |
|----------------------------------|-----------------|------------------|-----------------|------------------|----------------|------------------|
| Sensor                           | CH <sub>4</sub> |                  | CO <sub>2</sub> |                  | O <sub>2</sub> |                  |
|                                  | Instrument Gas  | True Gas Value % | Instrument Gas  | True Gas Value % | Instrument Gas | True Gas Value % |
|                                  | Readings %      |                  | Readings %      |                  | Readings %     |                  |
|                                  | 60.0            | 60               | 39.6            | 40               | 20.9           | 20.9             |
|                                  | Accept ±3.0     |                  | Accept ±3.0     |                  | Accept ±0.5    |                  |
|                                  | 5.0             | 5                | 5.1             | 5                | 6.0            | 6                |
|                                  | Accept ±0.3     |                  | Accept ±0.3     |                  | Accept ±0.3    |                  |
| Zero Reading 100% N <sub>2</sub> | 0.0             | 0                | 0.0             | 0                | 0.0            | 0                |
|                                  | Accept ±0.0     |                  | Accept ±0.0     |                  | Accept ±0.1    |                  |

| Optional Gas Checks |             |                              |                           |             |                        |             |
|---------------------|-------------|------------------------------|---------------------------|-------------|------------------------|-------------|
| Applied Gas & Range |             | Concentration Tested @ (ppm) | Instrument Readings (ppm) |             |                        |             |
| Toxic Gas           | Range (ppm) |                              | Zero Reading              |             | Instrument Gas Reading |             |
| H <sub>2</sub> S    | 2000        | 1500                         | 0                         | Accept ±0.0 | 1502                   | Accept ±5.0 |
| CO                  | 2000        | 1000                         | 0                         | Accept ±0.0 | 1002                   | Accept ±5.0 |

| Cross Gas Effects              |               |                           |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
|--------------------------------|---------------|---------------------------|-----|----------|---------------------------|----------|--------------------------|-----|-------------|-------------------------|--|--|-----------------------------------|-------------|
| Applied Gas (ppm)              |               | Instrument Readings (ppm) |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
| Toxic Gas                      | Concentration | Toxic 1:                  | H2S | Toxic 2: | CO                        | Toxic 3: |                          |     |             |                         |  |  |                                   |             |
| H2S                            | 1500          | 1502                      |     | 0        |                           |          |                          |     |             |                         |  |  |                                   |             |
| CO                             | 1000          | 45                        |     | 1002     |                           |          |                          |     |             |                         |  |  |                                   |             |
| Pressure Checks                |               |                           |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
| Atmospheric Pressure [AP] (mB) |               |                           |     |          | Static Pressure [SP] (mB) |          |                          |     |             |                         |  |  |                                   |             |
| Current Atmospheric            |               | Instrument Atmospheric    |     |          | Applied Pressure (mB)     |          | Instrument Pressure (mB) |     |             |                         |  |  |                                   |             |
| Pressure (mB)                  |               | Pressure Reading (mB)     |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
| All Ports                      |               | Open Ports                |     | 982      | Accept ±2.0               | 0.0mB    |                          | N/A | Accept ±0.0 |                         |  |  |                                   |             |
| AP Port (Internal)             |               | +800 mB                   |     | 800      | Accept ±5.0               | +50mB    |                          | N/A | Accept ±2.0 |                         |  |  |                                   |             |
| AP Port (Internal)             |               | +1200mb                   |     | 1200     | Accept ±5.0               | -100mB   |                          | N/A | Accept ±2.0 |                         |  |  |                                   |             |
| Flow Checks                    |               |                           |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
| Borehole Flow                  |               |                           |     |          | Differential Pressure     |          |                          |     |             |                         |  |  |                                   |             |
| Applied Reading (l/h)          |               | Instrument Reading (l/h)  |     |          | Applied Pressure (Pa)     |          | Instrument Reading (Pa)  |     |             |                         |  |  |                                   |             |
| -30                            | -30.7         | Accept ±3.0               |     |          | -251                      | -269     | Accept ±50               |     |             |                         |  |  |                                   |             |
| -3                             | -2.8          | Accept ±1.0               |     |          | -12                       | -11      | Accept ±6.0              |     |             |                         |  |  |                                   |             |
| 0                              | 0.0           | Accept ±0.0               |     |          | 0                         | 0        | Accept ±0.5              |     |             |                         |  |  |                                   |             |
| 3                              | 2.9           | Accept ±0.5               |     |          | 13                        | 12       | Accept ±3.0              |     |             |                         |  |  |                                   |             |
| 30                             | 29.4          | Accept ±3.0               |     |          | 269                       | 264      | Accept ±50               |     |             |                         |  |  |                                   |             |
| 60                             | 59.4          | Accept ±6.0               |     |          | 799                       | 796      | Accept ±130              |     |             |                         |  |  |                                   |             |
| 90                             | 89.1          | Accept ±9.0               |     |          | 1560                      | 1572     | Accept ±250              |     |             |                         |  |  |                                   |             |
|                                |               |                           |     |          |                           |          |                          |     |             |                         |  |  |                                   |             |
|                                |               |                           |     |          |                           |          |                          |     |             | Temperature Checks      |  |  |                                   |             |
|                                |               |                           |     |          |                           |          |                          |     |             | Calibration Temperature |  |  | Instrument Temperature Reading °C |             |
|                                |               |                           |     |          |                           |          |                          |     |             | Applied Temperature °C  |  |  |                                   |             |
|                                |               |                           |     |          |                           |          |                          |     |             | -10                     |  |  | -10.0                             | Accept ±2.0 |
|                                |               |                           |     |          |                           |          |                          |     |             | 0                       |  |  | 0.0                               | Accept ±1.0 |
|                                |               |                           |     |          |                           |          |                          |     |             | 30                      |  |  | 30.0                              | Accept ±1.0 |
|                                |               |                           |     |          |                           |          |                          |     |             | 60                      |  |  | 60.0                              | Accept ±1.0 |
|                                |               |                           |     |          |                           |          |                          |     |             | 100                     |  |  | 100.0                             | Accept ±1.0 |

Technician:  
**Jack Rutland**

Date Tested:  
**26/09/2022**

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

Gas Data Ltd is certified to BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018.

| TEST DATE AND CONDITIONS |         |    |  |
|--------------------------|---------|----|--|
| Date                     | 26.9.22 |    |  |
| Atmospheric Pressure     | 982     | mB |  |
| Ambient Temperature      | 20.2    | °C |  |
| EnviroNics Serial No.    | 5089    |    |  |

|                                                                                                                            |                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GAS DATA LTD</b><br>Unit 4<br>Fairfield Court<br>Seven Stars Estate<br>Coventry<br>CV3 4LJ<br>UK<br>+44 (0)24 7630 3311 | <br><b>GAS DATA</b><br><small>LISTEN - ANALYSE - INFORM</small> |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|

### GFM430 -1 OUTWARD INSPECTION & QUALITY CHECK SHEET

| INSTRUMENT DETAILS |                 |                                       |               |
|--------------------|-----------------|---------------------------------------|---------------|
| SO Number          | Instrument Type | Instrument Serial Number + SW Version | Job Number(s) |
| 332793             | GFM430          | 10227 G430-24/13                      | 123319        |

Calibration Technician ..... *[Signature]*

Date ..... 26.9.22

Inspection Technician ..... *[Signature]*

Date ..... 27.9.22

| INSTRUMENT CHECKS |                                   |     | Pass (P), Fail (F) or not applicable (NA) | INSTRUMENT PACKING LIST        |  | Tick if included |   |
|-------------------|-----------------------------------|-----|-------------------------------------------|--------------------------------|--|------------------|---|
| Function Tests    | Dust Caps Fitted                  |     | P                                         | Instrument                     |  | ✓                |   |
|                   | Keyboard Test (All Keys)          |     | P                                         | Leather Case                   |  | X                |   |
|                   | Backlight                         |     | P                                         | Instrument Strap               |  | ✓                |   |
|                   | Clock Set / Running               |     | P                                         | AC Battery Charger (UK)        |  | ✓                |   |
|                   | Comms Test                        |     | P                                         | AC Battery Charger (EURO)      |  | X                |   |
|                   | Pump Flow Test (In & Out)         |     | P                                         | AC Battery Charger (US)        |  | X                |   |
|                   | Overall Leak Test (30mB)          |     | n/a                                       | AC Battery Charger (AUS)       |  | X                |   |
|                   | Battery Charge Test               |     | P                                         | Hard Carry Case                |  | ✓                |   |
|                   | Service Date set to?              |     | 26.9.23                                   | Gas Sample Tube – (new issue)  |  | X                |   |
| Channel Test      | Data Logging Enabled?             |     | P                                         | Flow Sample Tube – (new issue) |  | X                |   |
|                   | Verify CH4/LEL                    |     | P                                         | Spares Pot                     |  | ✓                |   |
|                   | Verify CO2                        |     | P                                         | Allen Key                      |  | X                |   |
|                   | Verify O2                         |     | P                                         | Temperature Probe              |  | X                |   |
|                   | Verify LEL                        |     | P                                         | Vane Anemometer                |  | X                |   |
|                   | Verify 1 <sup>st</sup> Option Gas | H2S | P                                         | USB Cable                      |  | X                |   |
|                   | Verify 2 <sup>nd</sup> Option Gas | CO  | P                                         | USB Memory stick               |  | X                |   |
|                   | Verify 3 <sup>rd</sup> Option Gas |     | P                                         | SiteMan Software               |  | Ver 4.15         | X |
|                   | Verify 4 <sup>th</sup> Option Gas |     | P                                         | Internal Filter Pack           |  | Qty              | X |
|                   | Verify Atmospheric pressure       |     | P                                         | External Filter Pack           |  | Qty              | X |
|                   | Verify static pressure            |     | 0.14                                      | Field Guide                    |  |                  | X |
|                   | Verify differential pressure      |     | P                                         | Operation Manual (hard copy)   |  |                  | X |
|                   | Verify flow                       |     | P                                         | Extra Items:<br>Sample Tubes   |  |                  |   |
|                   | Verify temperature probe input    |     | P                                         |                                |  |                  |   |
|                   | Verify vane anemometer input      |     | P                                         |                                |  |                  |   |
| DataBase Checks   | Jobcard(s) completed and signed   |     | P                                         | Comments:                      |  |                  |   |
|                   | Jobcard(s) booked off database    |     | P                                         |                                |  |                  |   |
|                   | Calibration certificate completed |     | P                                         |                                |  |                  |   |
|                   | Complete & print QI record        |     | n/a                                       |                                |  |                  |   |
| Label Checks      | No. of Calibration label fitted   |     | GDC                                       | 11581                          |  |                  |   |
|                   | Warranty label fitted             |     |                                           |                                |  |                  |   |
| H2S Range         | H2S Range from Sales Order        |     | 2000                                      | ppm                            |  |                  |   |
|                   | H2S Range from Cal Cert           |     | 2000                                      | ppm                            |  |                  |   |
|                   | Over-range value correct?         |     | P                                         |                                |  |                  |   |

| TEST DATE AND CONDITIONS |  |            |    |
|--------------------------|--|------------|----|
| Date                     |  | 15/09/2021 |    |
| Atmospheric Pressure     |  | 996        | mB |
| Ambient Temperature      |  | 21.6       | °C |
| Envionics Serial No.     |  | 5089       |    |

**GFM430 Final Inspection & Calibration  
Check Certificate**

**GAS DATA LTD**

Unit 4, Fairfield Court  
Seven Stars Estate  
Wheler Rd  
Coventry  
CV3 4LJ



Tel 02476303311 Fax 02476307711

|                    |                          |
|--------------------|--------------------------|
| Customer           | Tweedie Evans Consulting |
| Certificate Number | 122710                   |
| Order Number       | 329180                   |

|                  |                   |
|------------------|-------------------|
| Serial Number    | 10220             |
| Software Version | G430-00.0024/0013 |

|                        |
|------------------------|
| Recalibration DUE Date |
| 15/09/22               |

| Instrument Checks   |                                   |                    |                                   |
|---------------------|-----------------------------------|--------------------|-----------------------------------|
| Keyboard            | ✓                                 | Display Contrast   | ✓                                 |
| Pump Flow In        | 400 <i>Accept &gt; 200 cc/min</i> | Pump Flow @ -200mB | 250 <i>Accept &gt; 200 cc/min</i> |
| Clock Set / Running | ✓                                 | Labels Fitted      | ✓                                 |

| Gas Checks           |                    |                  |                    |                  |                    |                  |
|----------------------|--------------------|------------------|--------------------|------------------|--------------------|------------------|
| Sensor               | CH <sub>4</sub>    |                  | CO <sub>2</sub>    |                  | O <sub>2</sub>     |                  |
|                      | Instrument Gas     | True Gas Value % | Instrument Gas     | True Gas Value % | Instrument Gas     | True Gas Value % |
|                      | Readings %         |                  | Readings %         |                  | Readings %         |                  |
|                      | 60.4               | 60               | 40                 | 40               | 20.9               | 20.9             |
|                      | <i>Accept ±3.0</i> |                  | <i>Accept ±3.0</i> |                  | <i>Accept ±0.5</i> |                  |
|                      | 5                  | 5                | 4.9                | 5                | 6                  | 6                |
|                      | <i>Accept ±0.3</i> |                  | <i>Accept ±0.3</i> |                  | <i>Accept ±0.3</i> |                  |
| Zero Reading 100% N2 | 0                  | 0                | 0                  | 0                | 0                  | 0                |
|                      | <i>Accept ±0.0</i> |                  | <i>Accept ±0.0</i> |                  | <i>Accept ±0.1</i> |                  |

| Optional Gas Checks |             |                              |                           |                    |                        |                    |
|---------------------|-------------|------------------------------|---------------------------|--------------------|------------------------|--------------------|
| Applied Gas & Range |             | Concentration Tested @ (ppm) | Instrument Readings (ppm) |                    |                        |                    |
| Toxic Gas           | Range (ppm) |                              | Zero Reading              |                    | Instrument Gas Reading |                    |
| H2S                 | 2000        | 1500                         | 0                         | <i>Accept ±0.0</i> | 1500                   | <i>Accept ±5.0</i> |
| CO                  | 2000        | 1000                         | 0                         | <i>Accept ±0.0</i> | 1003                   | <i>Accept ±5.0</i> |

| Cross Gas Effects |               |                           |     |          |    |          |  |  |  |
|-------------------|---------------|---------------------------|-----|----------|----|----------|--|--|--|
| Applied Gas (ppm) |               | Instrument Readings (ppm) |     |          |    |          |  |  |  |
| Toxic Gas         | Concentration | Toxic 1:                  | H2S | Toxic 2: | CO | Toxic 3: |  |  |  |
| H2S               | 1500          | 1500                      |     | 0        |    |          |  |  |  |
| CO                | 1000          | 54                        |     | 1003     |    |          |  |  |  |

| Pressure Checks                |                        |      |                  |                           |                          |                  |
|--------------------------------|------------------------|------|------------------|---------------------------|--------------------------|------------------|
| Atmospheric Pressure [AP] (mB) |                        |      |                  | Static Pressure [SP] (mB) |                          |                  |
| Current Atmospheric            | Instrument Atmospheric |      |                  | Applied Pressure (mB)     | Instrument Pressure (mB) |                  |
| Pressure (mB)                  | Pressure Reading (mB)  |      |                  |                           |                          |                  |
| All Ports                      | Open Ports             | 996  | Accept $\pm 2.0$ | 0.0mB                     | 0                        | Accept $\pm 0.0$ |
| AP Port (Internal)             | +800 mB                | 800  | Accept $\pm 5.0$ | +50mB                     | 0                        | Accept $\pm 2.0$ |
| AP Port (Internal)             | +1200mb                | 1200 | Accept $\pm 5.0$ | -100mB                    | 0                        | Accept $\pm 2.0$ |

| Flow Checks           |                          |                  |                       |                         |                  |
|-----------------------|--------------------------|------------------|-----------------------|-------------------------|------------------|
| Borehole Flow         |                          |                  | Differential Pressure |                         |                  |
| Applied Reading (l/h) | Instrument Reading (l/h) |                  | Applied Pressure (Pa) | Instrument Reading (Pa) |                  |
| -30                   | -33                      | Accept $\pm 3.0$ | -260                  | -288                    | Accept $\pm 50$  |
| -3                    | -3                       | Accept $\pm 1.0$ | -13                   | -13                     | Accept $\pm 6.0$ |
| 0                     | 0                        | Accept $\pm 0.0$ | 0                     | 0                       | Accept $\pm 0.5$ |
| 3                     | 3                        | Accept $\pm 0.5$ | 13                    | 13                      | Accept $\pm 3.0$ |
| 30                    | 33                       | Accept $\pm 3.0$ | 264                   | 293                     | Accept $\pm 50$  |
| 60                    | 66                       | Accept $\pm 6.0$ | 790                   | 869                     | Accept $\pm 130$ |
| 90                    | 94.4                     | Accept $\pm 9.0$ | 1554                  | 1586                    | Accept $\pm 250$ |

| Temperature Checks                     |                                                   |                  |
|----------------------------------------|---------------------------------------------------|------------------|
| Calibration Temperature                | Instrument Temperature Reading $^{\circ}\text{C}$ |                  |
| Applied Temperature $^{\circ}\text{C}$ |                                                   |                  |
| -10                                    | -10                                               | Accept $\pm 2.0$ |
| 0                                      | 0                                                 | Accept $\pm 1.0$ |
| 30                                     | 30                                                | Accept $\pm 1.0$ |
| 60                                     | 60                                                | Accept $\pm 1.0$ |
| 100                                    | 100                                               | Accept $\pm 1.0$ |

|                     |
|---------------------|
| Technician:         |
| <i>Jack Rutland</i> |

|                   |
|-------------------|
| Date Tested:      |
| <i>16/09/2021</i> |

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

**TEST DATE AND CONDITIONS**

|                       |         |
|-----------------------|---------|
| Date                  | 15.9.21 |
| Atmospheric Pressure  | 996 mB  |
| Ambient Temp          | 21.6°C  |
| EnviroNics Serial No. | 5029    |

**GAS DATA LTD**

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

**GFM430 -1 OUTWARD INSPECTION & QUALITY CHECK SHEET**

| INSTRUMENT DETAILS |                 |                                       |               |
|--------------------|-----------------|---------------------------------------|---------------|
| SO Number          | Instrument Type | Instrument Serial Number + SW Version | Job Number(s) |
| 329180             | GFM430          | 10220 G430-24/13                      | 122710        |

Calibration Technician ..... J. [Signature]

Date ..... 15.9.21.....

Inspection Technician ..... [Signature]

Date ..... 16.9.21.....

| INSTRUMENT CHECKS |                                   |     | Pass (P), Fail (F) or not applicable (NA) | INSTRUMENT PACKING LIST        |          | Tick if included |
|-------------------|-----------------------------------|-----|-------------------------------------------|--------------------------------|----------|------------------|
| Function Tests    | Dust Caps Fitted                  |     | P                                         | Instrument                     |          | ✓                |
|                   | Keyboard Test (All Keys)          |     | P                                         | Leather Case                   |          | ✓                |
|                   | Backlight                         |     | P                                         | Instrument Strap               |          | ✓                |
|                   | Clock Set / Running               |     | P                                         | AC Battery Charger (UK)        |          | ✓                |
|                   | Comms Test                        |     | P                                         | AC Battery Charger (EURO)      |          | X                |
|                   | Pump Flow Test (In & Out)         |     | P                                         | AC Battery Charger (US)        |          | X                |
|                   | Overall Leak Test (30mB)          |     | n/a                                       | AC Battery Charger (AUS)       |          | X                |
|                   | Battery Charge Test               |     | P                                         | Hard Carry Case                |          | ✓                |
|                   | Service Date set to?              |     | 15.9.22                                   | Gas Sample Tube – (new issue)  |          | ✓                |
| Channel Test      | Data Logging Enabled?             |     | P                                         | Flow Sample Tube – (new issue) |          | ✓                |
|                   | Verify CH4/LEL                    |     | P                                         | Spares Pot                     |          | ✓                |
|                   | Verify CO2                        |     | P                                         | Allen Key                      |          | X                |
|                   | Verify O2                         |     | P                                         | Temperature Probe              |          | X                |
|                   | Verify LEL                        |     | P                                         | Vane Anemometer                |          | X                |
|                   | Verify 1 <sup>st</sup> Option Gas | H2S | P                                         | USB Cable                      |          | X                |
|                   | Verify 2 <sup>nd</sup> Option Gas | CO  | P                                         | USB Memory stick               |          | X                |
|                   | Verify 3 <sup>rd</sup> Option Gas |     | N/A                                       | SiteMan Software               | Ver 4.15 | X                |
|                   | Verify 4 <sup>th</sup> Option Gas |     | N/A                                       | Internal Filter Pack           | Qty      | X                |
|                   | Verify Atmospheric pressure       |     | P                                         | External Filter Pack           | Qty      | X                |
|                   | Verify static pressure            |     | N/A                                       | Field Guide                    |          | X                |
|                   | Verify differential pressure      |     | P                                         | Operation Manual (hard copy)   |          | X                |
|                   | Verify flow                       |     | P                                         | Extra Items:<br>Sample Tubes   |          |                  |
|                   | Verify temperature probe input    |     | P                                         |                                |          |                  |
|                   | Verify vane anemometer input      |     | P                                         |                                |          |                  |
| DataBase Checks   | Jobcard(s) completed and signed   |     | P                                         | Comments:                      |          |                  |
|                   | Jobcard(s) booked off database    |     | P                                         |                                |          |                  |
|                   | Calibration certificate completed |     | P                                         |                                |          |                  |
|                   | Complete & print QI record        |     | n/a                                       |                                |          |                  |
| Label Checks      | No. of Calibration label fitted   |     | GDC                                       | 11258                          |          |                  |
|                   | Warranty label fitted             |     | P                                         |                                |          |                  |
| H2S Range         | H2S Range from Sales Order        |     | 2000                                      | ppm                            |          |                  |
|                   | H2S Range from Cal Cert           |     | 2000                                      | ppm                            |          |                  |
|                   | Over-range value correct?         |     | P                                         |                                |          |                  |

| TEST DATE AND CONDITIONS |  |            |    |
|--------------------------|--|------------|----|
| Date                     |  | 16/09/2022 |    |
| Atmospheric Pressure     |  | 1001       | mB |
| Ambient Temperature      |  | 22.3       | °C |
| EnviroNics Serial No.    |  | 5089       |    |

**GFM436 Final Inspection & Calibration  
Check Certificate**

**GAS DATA LTD**

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311



Fax 02476307711

|                    |                          |
|--------------------|--------------------------|
| Customer           | Tweedie Evans Consulting |
| Certificate Number | 123507                   |
| Order Number       | 332079                   |

|                  |                   |
|------------------|-------------------|
| Serial Number    | 13072             |
| Software Version | G436-00.0027/0010 |

| Recalibration DUE Date |
|------------------------|
| 16/09/23               |

| Instrument Checks   |     |                     |                    |     |                     |
|---------------------|-----|---------------------|--------------------|-----|---------------------|
| Keyboard            | ✓   |                     | Display Contrast   | ✓   |                     |
| Pump Flow In        | 350 | Accept > 200 cc/min | Pump Flow @ -200mB | 250 | Accept > 200 cc/min |
| Clock Set / Running | ✓   |                     | Labels Fitted      | ✓   |                     |

| Gas Checks           |                 |                  |                 |                  |                |                  |
|----------------------|-----------------|------------------|-----------------|------------------|----------------|------------------|
| Sensor               | CH <sub>4</sub> |                  | CO <sub>2</sub> |                  | O <sub>2</sub> |                  |
|                      | Instrument Gas  | True Gas Value % | Instrument Gas  | True Gas Value % | Instrument Gas | True Gas Value % |
|                      | Readings %      |                  | Readings %      |                  | Readings %     |                  |
|                      | 60.4            | 60               | 39.5            | 40               | 20.9           | 20.9             |
|                      | Accept ±3.0     |                  | Accept ±3.0     |                  | Accept ±0.5    |                  |
|                      | 4.9             | 5                | 5.0             | 5                | 6.0            | 6                |
|                      | Accept ±0.3     |                  | Accept ±0.3     |                  | Accept ±0.3    |                  |
| Zero Reading 100% N2 | 0.0             | 0                | 0.0             | 0                | 0.0            | 0                |
|                      | Accept ±0.0     |                  | Accept ±0.0     |                  | Accept ±0.1    |                  |

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

| Cross Gas Effects |               |                           |     |          |    |          |     |  |  |
|-------------------|---------------|---------------------------|-----|----------|----|----------|-----|--|--|
| Applied Gas (ppm) |               | Instrument Readings (ppm) |     |          |    |          |     |  |  |
| Gas Type          | Concentration | Toxic 1:                  | H2S | Toxic 2: | CO | Toxic 3: | HEX |  |  |
| H2S               | 1500          | 1500                      |     | 0        |    | 0        |     |  |  |
| CO                | 1000          | 70                        |     | 1000     |    | 0        |     |  |  |
| Hexane            | 2.0%          | 0                         |     | 0        |    | 1.99     |     |  |  |

| Pressure Checks                   |         |                                              |                  |
|-----------------------------------|---------|----------------------------------------------|------------------|
| Atmospheric Pressure [AP] (mB)    |         |                                              |                  |
| Current Atmospheric Pressure (mB) |         | Instrument Atmospheric Pressure Reading (mB) |                  |
| AP Open Ports                     |         | 1001                                         | Accept $\pm 2.0$ |
| AP Port (Internal)                | +800 mB | 800                                          | Accept $\pm 5.0$ |
|                                   | +1200mb | 1200                                         | Accept $\pm 5.0$ |

| Flow Checks           |                          |                  |                       |                         |                  |
|-----------------------|--------------------------|------------------|-----------------------|-------------------------|------------------|
| Borehole Flow         |                          |                  | Differential Pressure |                         |                  |
| Applied Reading (l/h) | Instrument Reading (l/h) |                  | Applied Pressure (Pa) | Instrument Reading (Pa) |                  |
| -30                   | -30.1                    | Accept $\pm 3.0$ | -401                  | -407                    | Accept $\pm 50$  |
| -3                    | -3.0                     | Accept $\pm 1.0$ | -18                   | -18                     | Accept $\pm 6.0$ |
| 0                     | 0.0                      | Accept $\pm 0.0$ | 0                     | 0                       | Accept $\pm 0.5$ |
| 3                     | 3.0                      | Accept $\pm 0.5$ | 16                    | 15                      | Accept $\pm 3.0$ |
| 30                    | 29.7                     | Accept $\pm 3.0$ | 308                   | 301                     | Accept $\pm 50$  |
| 60                    | 59.5                     | Accept $\pm 6.0$ | 915                   | 898                     | Accept $\pm 130$ |
| 90                    | 90.5                     | Accept $\pm 9.0$ | 1777                  | 1812                    | Accept $\pm 250$ |

| Temperature Checks                     |                                                   |                  |
|----------------------------------------|---------------------------------------------------|------------------|
| Calibration Temperature                | Instrument Temperature Reading $^{\circ}\text{C}$ |                  |
| Applied Temperature $^{\circ}\text{C}$ |                                                   |                  |
| -10                                    | -10.0                                             | Accept $\pm 2.0$ |
| 0                                      | 0.0                                               | Accept $\pm 1.0$ |
| 30                                     | 30.0                                              | Accept $\pm 1.0$ |
| 60                                     | 60.0                                              | Accept $\pm 1.0$ |
| 100                                    | 100.0                                             | Accept $\pm 1.0$ |

| Technician:         |
|---------------------|
| <i>Jack Rutland</i> |

| Date Tested:      |
|-------------------|
| <i>16/09/2022</i> |

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015, BS EN ISO14001:2015, BS EN ISO45001:2018 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

| TEST DATE AND CONDITIONS |         |    |  |
|--------------------------|---------|----|--|
| Date                     | 16.9.22 |    |  |
| Atmospheric Pressure     | 1001    | mB |  |
| Ambient Temperature      | 22.3    | °C |  |
| EnviroNics Serial No.    | 5029    |    |  |

|                                                                                                                            |                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GAS DATA LTD</b><br>Unit 4<br>Fairfield Court<br>Seven Stars Estate<br>Coventry<br>CV3 4LJ<br>UK<br>+44 (0)24 7630 3311 | <br><b>GAS DATA</b><br><small>LISTEN · ANALYSE · INFORM</small> |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|

### GFM436-1 OUTWARD INSPECTION & QUALITY CHECK SHEET

| INSTRUMENT DETAILS |                 |                                       |               |
|--------------------|-----------------|---------------------------------------|---------------|
| SO Number          | Instrument Type | Instrument Serial Number + SW Version | Job Number(s) |
| 332079             | GFM436          | 13072 9436-27/10                      | 123507        |

Calibration Technician ..... *[Signature]* .....

Date ..... 16.9.22 .....

Inspection Technician ..... *[Signature]* .....

Date ..... 20.9.22 .....

| INSTRUMENT CHECKS |                                   |  | Pass (P), Fail (F) or not applicable (NA) | INSTRUMENT PACKING LIST        |          | Tick if included |
|-------------------|-----------------------------------|--|-------------------------------------------|--------------------------------|----------|------------------|
| Function Tests    | Dust Caps Fitted                  |  | P                                         | Instrument                     |          | ✓                |
|                   | Keyboard Test (All Keys)          |  | P                                         | Leather Case                   |          | X                |
|                   | Backlight                         |  | P                                         | Instrument Strap               |          | ✓                |
|                   | Clock Set / Running               |  | P                                         | AC Battery Charger (UK)        |          | ✓                |
|                   | Comms Test                        |  | P                                         | AC Battery Charger (EURO)      |          | X                |
|                   | Pump Flow Test (In & Out)         |  | P                                         | AC Battery Charger (US)        |          | X                |
|                   | Overall Leak Test (30mB)          |  | n/a                                       | AC Battery Charger (AUS)       |          | X                |
|                   | Battery Charge Test               |  | P                                         | Gas Sample Pipe - (new issue)  |          | ✓                |
|                   | Service Date set to?              |  | 16.9.23                                   | Flow Sample Pipe - (new issue) |          | ✓                |
| Channel Tests     | Data Logging Enabled?             |  | P                                         | Hard Carry Case                |          | ✓                |
|                   | Verify CH4/LEL/Hexane/PID         |  | P                                         | Spares Pot                     |          | X                |
|                   | Verify CO2                        |  | P                                         | Allen Key                      |          | X                |
|                   | Verify O2                         |  | P                                         | Temperature Probe              |          | X                |
|                   | Verify H2S                        |  | P                                         | Vane Anemometer                |          | X                |
|                   | Verify CO                         |  | P                                         | USB Cable                      |          | X                |
|                   | Verify LEL                        |  | P                                         | USB Memory stick               |          | X                |
|                   | Verify 1 <sup>st</sup> Option Gas |  | N/A                                       | SM V5 Software                 | Ver 6.05 | X                |
|                   | Verify Atmospheric pressure       |  | P                                         | Internal Filter Pack           | Qty      | X                |
|                   | Verify differential pressure      |  | P                                         | External Filter Pack           | Qty      | X                |
|                   | Verify flow                       |  | P                                         | Field Guide                    |          | X                |
|                   | Verify temperature probe input    |  | P                                         | Extra Items:<br>Sample Tube    |          |                  |
|                   | Verify vane anemometer input      |  | P                                         |                                |          |                  |
|                   |                                   |  |                                           |                                |          |                  |
| DataBase Checks   | Jobcard(s) completed and signed   |  | P                                         | Comments:                      |          |                  |
|                   | Jobcard(s) booked off database    |  | P                                         |                                |          |                  |
|                   | Calibration certificate completed |  | P                                         |                                |          |                  |
|                   | Complete & print QI record        |  | n/a                                       |                                |          |                  |
| Label Checks      | No. of Calibration label fitted   |  | GDC                                       | 11568                          |          |                  |
|                   | MCERTS label displayed            |  | N/A                                       |                                |          |                  |
|                   | Warranty label fitted             |  | P                                         |                                |          |                  |
| H2S Range         | H2S Range from Sales Order        |  | 5000                                      | ppm                            |          |                  |
|                   | H2S Range from Cal Cert           |  | 5000                                      | ppm                            |          |                  |
|                   | Over-range value correct?         |  | P                                         |                                |          |                  |

| TEST DATE AND CONDITIONS                                             |  |            |    |
|----------------------------------------------------------------------|--|------------|----|
| Date                                                                 |  | 06/09/2021 |    |
| Atmospheric Pressure<br>Ambient Temperature<br>EnviroNics Serial No. |  | 1005       | mB |
|                                                                      |  | 22.3       | °C |
|                                                                      |  | 5089       |    |

**GFM436 Final Inspection & Calibration  
Check Certificate**

**GAS DATA LTD**

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311

Fax 02476307711



|                    |                          |
|--------------------|--------------------------|
| Customer           | Tweedie Evans Consulting |
| Certificate Number | 122677                   |
| Order Number       | 329181                   |

|                  |                   |
|------------------|-------------------|
| Serial Number    | 13072             |
| Software Version | G436-00.0027/0010 |

|                        |
|------------------------|
| Recalibration DUE Date |
| 06/09/22               |

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

| Gas Checks                       |                 |                  |                 |                  |                |                  |
|----------------------------------|-----------------|------------------|-----------------|------------------|----------------|------------------|
| Sensor                           | CH <sub>4</sub> |                  | CO <sub>2</sub> |                  | O <sub>2</sub> |                  |
|                                  | Instrument Gas  | True Gas Value % | Instrument Gas  | True Gas Value % | Instrument Gas | True Gas Value % |
|                                  | Readings %      |                  | Readings %      |                  | Readings %     |                  |
|                                  | 59.6            | 60               | 39.7            | 40               | 20.9           | 20.9             |
|                                  | Accept ±3.0     |                  | Accept ±3.0     |                  | Accept ±0.5    |                  |
|                                  | 5               | 5                | 5               | 5                | 6              | 6                |
|                                  | Accept ±0.3     |                  | Accept ±0.3     |                  | Accept ±0.3    |                  |
| Zero Reading 100% N <sub>2</sub> | 0               | 0                | 0               | 0                | 0              | 0                |
|                                  | Accept ±0.0     |                  | Accept ±0.0     |                  | Accept ±0.1    |                  |

| Optional Gas Checks |             |                              |                           |             |                        |              |
|---------------------|-------------|------------------------------|---------------------------|-------------|------------------------|--------------|
| Applied Gas & Range |             | Concentration Tested @ (ppm) | Instrument Readings (ppm) |             |                        |              |
| Gas Type            | Range (ppm) |                              | Zero Reading              |             | Instrument Gas Reading |              |
| H <sub>2</sub> S    | 5000        | 1500                         | 0                         | Accept ±0.0 | 1500                   | Accept ±5.0  |
| CO                  | 2000        | 1000                         | 0                         | Accept ±0.0 | 1000                   | Accept ±5.0  |
| Hexane              | 2.0%        | 2.0%                         | 0                         | Accept ±0.0 | 1.99                   | Accept ±10.0 |

| Cross Gas Effects |               |                           |     |          |    |          |     |  |  |
|-------------------|---------------|---------------------------|-----|----------|----|----------|-----|--|--|
| Applied Gas (ppm) |               | Instrument Readings (ppm) |     |          |    |          |     |  |  |
| Gas Type          | Concentration | Toxic 1:                  | H2S | Toxic 2: | CO | Toxic 3: | HEX |  |  |
| H2S               | 1500          | 1500                      |     | 0        |    | 0        |     |  |  |
| CO                | 1000          | 70                        |     | 1000     |    | 0        |     |  |  |
| Hexane            | 2.0%          | 0                         |     | 0        |    | 1.99     |     |  |  |

| Pressure Checks                   |         |                                              |                  |
|-----------------------------------|---------|----------------------------------------------|------------------|
| Atmospheric Pressure [AP] (mB)    |         |                                              |                  |
| Current Atmospheric Pressure (mB) |         | Instrument Atmospheric Pressure Reading (mB) |                  |
| AP Open Ports                     |         | 1005                                         | Accept $\pm 2.0$ |
| AP Port (Internal)                | +800 mB | 800                                          | Accept $\pm 5.0$ |
|                                   | +1200mb | 1200                                         | Accept $\pm 5.0$ |

| Flow Checks           |                          |                  |                       |                         |                  |
|-----------------------|--------------------------|------------------|-----------------------|-------------------------|------------------|
| Borehole Flow         |                          |                  | Differential Pressure |                         |                  |
| Applied Reading (l/h) | Instrument Reading (l/h) |                  | Applied Pressure (Pa) | Instrument Reading (Pa) |                  |
| -30                   | -30                      | Accept $\pm 3.0$ | -397                  | -399                    | Accept $\pm 50$  |
| -3                    | -3                       | Accept $\pm 1.0$ | -18                   | -18                     | Accept $\pm 6.0$ |
| 0                     | 0                        | Accept $\pm 0.0$ | 0                     | 0                       | Accept $\pm 0.5$ |
| 3                     | 3                        | Accept $\pm 0.5$ | 15                    | 15                      | Accept $\pm 3.0$ |
| 30                    | 29.8                     | Accept $\pm 3.0$ | 320                   | 316                     | Accept $\pm 50$  |
| 60                    | 60                       | Accept $\pm 6.0$ | 937                   | 930                     | Accept $\pm 130$ |
| 90                    | 91.3                     | Accept $\pm 9.0$ | 1820                  | 1866                    | Accept $\pm 250$ |

| Temperature Checks                     |                                                   |                  |
|----------------------------------------|---------------------------------------------------|------------------|
| Calibration Temperature                | Instrument Temperature Reading $^{\circ}\text{C}$ |                  |
| Applied Temperature $^{\circ}\text{C}$ |                                                   |                  |
| -10                                    | -10                                               | Accept $\pm 2.0$ |
| 0                                      | 0                                                 | Accept $\pm 1.0$ |
| 30                                     | 30                                                | Accept $\pm 1.0$ |
| 60                                     | 60                                                | Accept $\pm 1.0$ |
| 100                                    | 100                                               | Accept $\pm 1.0$ |

| Technician:         |
|---------------------|
| <i>Jack Rutland</i> |

| Date Tested:      |
|-------------------|
| <i>07/09/2021</i> |

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

| TEST DATE AND CONDITIONS |         |
|--------------------------|---------|
| Date                     | 6.9.21  |
| Atmospheric Pressure     | 1005 mB |
| Ambient Temp             | 22.3 °C |
| EnviroNics Serial No.    | 508A    |

# GAS DATA LTD

Unit 4, Fairfield Court  
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## GFM436-1 OUTWARD INSPECTION & QUALITY CHECK SHEET

| INSTRUMENT DETAILS |                 |                                       |               |
|--------------------|-----------------|---------------------------------------|---------------|
| SO Number          | Instrument Type | Instrument Serial Number + SW Version | Job Number(s) |
| 329181             | GFM436          | 13072 9436-27/10                      | 122677        |

Calibration Technician ..... *[Signature]*

Date ..... 6.9.21

Inspection Technician ..... *[Signature]*

Date ..... 7.9.21

| INSTRUMENT CHECKS |                                   | Pass (P), Fail (F) or not applicable (NA) | INSTRUMENT PACKING LIST             |          | Tick if included |
|-------------------|-----------------------------------|-------------------------------------------|-------------------------------------|----------|------------------|
| Function Tests    | Dust Caps Fitted                  | P                                         | Instrument                          |          | ✓                |
|                   | Keyboard Test (All Keys)          | P                                         | Leather Case                        |          | ✓                |
|                   | Backlight                         | P                                         | Instrument Strap                    |          | ✓                |
|                   | Clock Set / Running               | P                                         | AC Battery Charger (UK)             |          | ✓                |
|                   | Comms Test                        | P                                         | AC Battery Charger (EURO)           |          | x                |
|                   | Pump Flow Test (In & Out)         | P                                         | AC Battery Charger (US)             |          | x                |
|                   | Overall Leak Test (30mB)          | n/a                                       | AC Battery Charger (AUS)            |          | x                |
|                   | Battery Charge Test               | P                                         | Gas Sample Pipe - (new issue)       |          | ✓                |
|                   | Service Date set to?              | 6.9.22                                    | Flow Sample Pipe - (new issue)      |          | ✓                |
| Channel Tests     | Data Logging Enabled?             | P                                         | Hard Carry Case                     |          | ✓                |
|                   | Verify CH4/LEL/Hexane/PID         | P                                         | Allen Key                           |          | x                |
|                   | Verify CO2                        | P                                         | Spares Pot                          |          | ✓                |
|                   | Verify O2                         | P                                         | Temperature Probe                   |          | x                |
|                   | Verify H2S                        | P                                         | Vane Anemometer                     |          | x                |
|                   | Verify CO                         | P                                         | USB Cable                           |          | x                |
|                   | Verify LEL                        | P                                         | USB Memory stick                    |          | ✓                |
|                   | Verify 1 <sup>st</sup> Option Gas | N/A                                       | SM V5 Software                      | Ver 6.03 | x                |
|                   | Verify Atmospheric pressure       | P                                         | Internal Filter Pack                | Qty      | x                |
|                   | Verify differential pressure      | P                                         | External Filter Pack                | Qty      | x                |
|                   | Verify flow                       | P                                         | Field Guide                         |          | ✓                |
|                   | Verify temperature probe input    | P                                         | Extra Items:<br><i>Sample Tubes</i> |          |                  |
|                   | Verify vane anemometer input      | P                                         |                                     |          |                  |
| DataBase Checks   | Jobcard(s) completed and signed   | P                                         | Comments:                           |          |                  |
|                   | Jobcard(s) booked off database    | P                                         |                                     |          |                  |
|                   | Calibration certificate completed | P                                         |                                     |          |                  |
|                   | Complete & print QI record        | n/a                                       |                                     |          |                  |
| Label Checks      | No. of Calibration label fitted   | GDC 11249                                 |                                     |          |                  |
|                   | MCERTS label displayed            | n/a                                       |                                     |          |                  |
|                   | Warranty label fitted             | P                                         |                                     |          |                  |
| H2S Range         | H2S Range from Sales Order        | 5000                                      | ppm                                 |          |                  |
|                   | H2S Range from Cal Cert           | 5000                                      | ppm                                 |          |                  |
|                   | Over-range value correct?         | P                                         |                                     |          |                  |



## **Certificate of Calibration**

Customer: Tweedie Evans Consulting Limited, t/a TEC

Instrument: MiniRAE Lite

Job: Service, Test & Calibration

Serial number: 595-000508

Fleet Number: N/A

Certificate no: 000508 / 150622

Next calibration due date: 15 Jun 2023

Tested on: 15 Jun 2022

Calibrated for: Isobutylene

| <u><b>Applied Gas<br/>Concentration:</b></u> | <u><b>Cylinder<br/>Reference:</b></u> | <u><b>Final Sensor<br/>Reading</b></u> | <u><b>Accuracy<br/>Limits</b></u> | <u><b>Pass / Fail</b></u> |
|----------------------------------------------|---------------------------------------|----------------------------------------|-----------------------------------|---------------------------|
| Isobutylene: 100 ppm                         | 6593-3-3                              | 100.2 ppm                              | ± 5%                              | Pass ✓                    |

The instrument has been calibrated after re-zeroing and introducing span calibration gas, using gas that is traceable to national standards and has been prepared in accordance with BS EN ISO 6145-6:2017

Calibration Engineer: LESLEY BAINBRIDGE

Sign: \_\_\_\_\_

|                                 |      |       |  |
|---------------------------------|------|-------|--|
| Quality Assessed by<br>(Print): | C.S. | Sign: |  |
|---------------------------------|------|-------|--|



## **Certificate of Calibration**

Customer: *Tweedie Evans*

Instrument: MiniRAE Lite

Job: Service, Test & Calibration

Serial number: 595-003323

Fleet Number: 000525

Certificate no: 003323/170921

Next calibration due date: 17.09.2022

Tested on: 17.09.2021

Calibrated for: Isobutylene

| <u><b>Applied Gas<br/>Concentration:</b></u> | <u><b>Cylinder<br/>Reference:</b></u> | <u><b>Initial Sensor<br/>Reading</b></u> | <u><b>Final Sensor<br/>Reading</b></u> | <u><b>Accuracy<br/>Limits</b></u> |
|----------------------------------------------|---------------------------------------|------------------------------------------|----------------------------------------|-----------------------------------|
| Isobutylene 100ppm                           | 1055/3021                             | 97.3ppm                                  | 100.9ppm                               | +/-5%                             |

The Instrument has been calibrated after Re-Zeroing & Introducing Span Calibration Gas, using gas that is traceable to national standards and has been prepared in accordance with BS EN ISO6145-6:2017

Calibration Engineer: *Daniel Jacques*

Sign:

|                                 |             |       |                    |
|---------------------------------|-------------|-------|--------------------|
| Quality Assessed by<br>(Print): | <i>C.S.</i> | Sign: | <i>[Signature]</i> |
|---------------------------------|-------------|-------|--------------------|

## Appendix M

### Risk Methodologies and Evaluation

## Risk Evaluation

The qualitative assessment methodology presented in CIRIA publication C552 (2001) titled '*Contaminated Land Risk Assessment: A Guide to Good Practice*' has been used by TEC for the basis of evaluating potential risk.

The method requires an assessment of the:

- magnitude of the probability or likelihood of the risk occurring (Table 1); and
- magnitude of the potential consequence or severity of the risk occurring (Table 2)

**Table 1. Classification of Probability**

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

**Table 2. Classification of Consequence**

| Classification | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Examples                                                                                                                                                                                                                                                                |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Severe         | Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. (Note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organisation forming part of such ecosystem (note: the definitions of ecological systems within the draft circular on Contaminated Land, DETR, 2000). | High concentrations of cyanide on the surface of an informal recreation area.<br>Major spillage of contaminants from site into controlled water.<br>Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied). |
| Medium         | Chronic damage to human health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources. (Note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within draft circular on Contaminated Land, DETR, 2000).                                                                                                                                | Concentration of a contaminant from site exceeding the generic or site-specific assessment criteria.<br>Leaching of contaminants from a site to a major or minor aquifer.<br>Death of a 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 the draft circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.                                                                                                                                                                                                                                                                       | Pollution of non-classified groundwater.<br>Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).                                                                                                                  |
| Minor          | Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc), easily repairable effects of damage to buildings, structures and services.                                                                                                                                                                                                                                 | The presence of contaminants at such concentrations that protective equipment is required during site works.<br>The loss of plants in a landscaping scheme.<br>Discolouration of concrete.                                                                              |

The combination of the two factors is determined using Table 3 and the resulting level of risk is described in Table 4. The evaluation can be applied to each of the scenarios identified in the risk model and the overall risk assessed.

**Table 3. Combination of Consequence with Probability**

|             |                 | Consequence              |                          |                          |                          |
|-------------|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
|             |                 | Severe                   | Medium                   | Mild                     | Minor                    |
| Probability | High Likelihood | <b>Very High Risk</b>    | <b>High Risk</b>         | <b>Moderate Risk</b>     | <b>Moderate/Low Risk</b> |
|             | Likely          | <b>High Risk</b>         | <b>Moderate Risk</b>     | <b>Moderate/Low Risk</b> | <b>Low Risk</b>          |
|             | Low Likelihood  | <b>Moderate Risk</b>     | <b>Moderate/Low Risk</b> | <b>Low Risk</b>          | <b>Very Low Risk</b>     |
|             | Unlikely        | <b>Moderate/Low Risk</b> | <b>Low Risk</b>          | <b>Very Low Risk</b>     | <b>Very Low Risk</b>     |

**Table 4. Description of risks and likely action required**

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Very High Risk</b> | 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 to a designated receptor is currently happening.<br>This risk, if realised, is likely to result in a substantial liability.<br>Urgent investigation (if not undertaken already) and remediation are likely to be required.                                                                          |
| <b>High Risk</b>      | Harm is likely to arise to a designated receptor from an identified hazard.<br>Realisation of the risk is likely to present a substantial liability.<br>Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.                                                                                                                                        |
| <b>Moderate Risk</b>  | 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 is more likely that the harm would be relatively mild.<br>Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability.<br>Some remedial works may be required in the long-term. |
| <b>Low Risk</b>       | 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.                                                                                                                                                                                                                                                                                |
| <b>Very Low Risk</b>  | 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.                                                                                                                                                                                                                                                                                                                |

Using the risk model the pollutant linkages are identified and a preliminary estimate of risk undertaken. If there is no pollutant linkage identified, then there is no risk. If the estimate of risk for all the linkages and exposure scenarios is very low at this stage then it is likely that no further assessment will be required.