

National Breast Imaging Academy (NBIA), Wythenshawe Hospital

Phase 2 Ground Investigation Report

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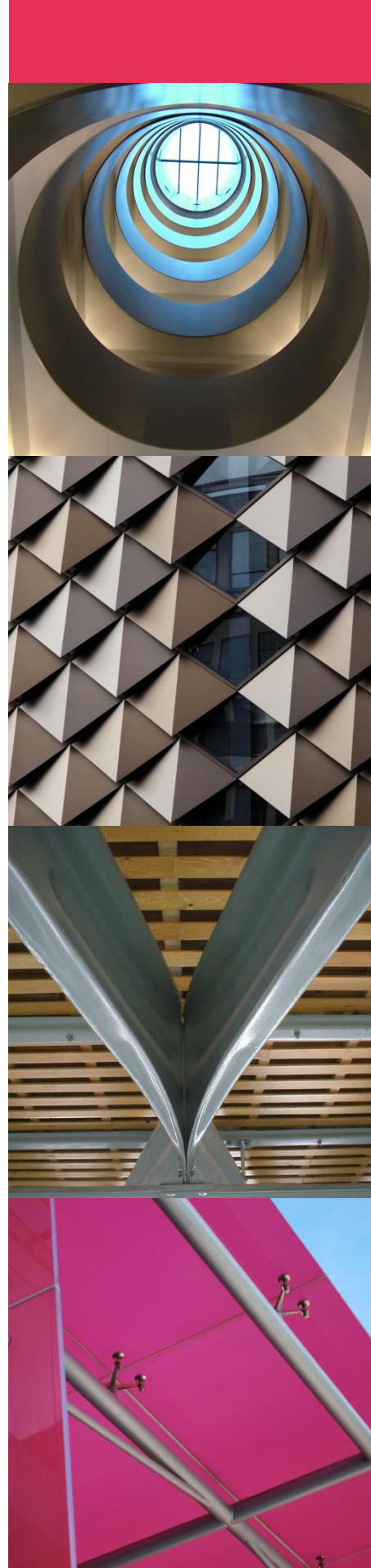
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Phase 2 Ground Investigation Report

Executive Summary

Appointment	<p>In February 2023, Curtins were instructed by Manchester University NHS Foundation Trust to undertake a Phase 2 Ground Investigation at the Nightingale overflow car park adjacent to the Nightingale Centre, Wythenshawe Hospital, Southmoor Road, Manchester, M23 9QZ.</p> <p>The aim of the ground investigation is to characterise the geo-environmental and geotechnical conditions prior to the development of the site for a commercial end-use comprising a single storey building with a corridor connecting the proposed National Breast Imaging Academy (NBIA) building to the existing Nightingale Centre located to the east and with the option to construct an additional storey in the future.</p>
Current Site Status	<p>The site is currently in use as an overflow carpark for the adjacent Nightingale Centre, with gravel hardstanding and a grass verge to the northern and eastern perimeter, further car parking along the western boundary and a small wooden fence and parking barrier on the southern boundary. Southmoor Road bounds the site to the south. The northern boundary comprises a grass verge which slopes downwards towards several industrial units located off Tilson Road. The eastern boundary comprises a grass verge which slopes downwards towards the Nightingale Centre. The western boundary is delineated by additional car-parking and The Langley Building (Clinical Research).</p>
Summary of Phase 1 Preliminary Risk Assessment	<p>The earliest available mapping (1876) shows the site as undeveloped agricultural land. The land surrounding the site was also generally undeveloped in early mapping. Mapping from 1910 records a Sewage Works 100m southwest of the site, along with the Baguley Sanatorium 230m south, occupying multiple buildings. From 1935 onwards, the Sewage Works is developed further to include settling tanks, filter and sludge beds and septic tanks. Baguley Sanatorium also underwent further development. By 1960 the Baguley Sanatorium is renamed the Baguley Hospital (later renamed Wythenshawe Hospital).</p> <p>Between 1960 and 1977 the Wythenshawe Hospital undergoes further development and contains a maternity unit, chest disease unit, a tennis court, and several car parks. By 1967 an industrial estate of unspecified works is recorded 250m north. Between 1977 and 2006, a mound appears on site and levels may have been built up, Wythenshawe Hospital continues expanding and occupied most of the area to the south and southeast of the site.</p> <p>Mapping from 2009 the site is now occupied by a hospital car park with large areas of hardstanding and gravel, there is a rectangular building occupying the majority of the site, which is no longer visible on mapping from 2019 onwards. The Nightingale Centre has been developed along the eastern boundary. There has also been continued expansion of the Wythenshawe Hospital to the south and west of the site.</p> <p>Published BGS data suggests that the site is underlain by Glacial Till superficial deposits and bedrock of the Bollin Mudstone Formation. The site is underlain by a Secondary B Aquifer within the bedrock and a Secondary Undifferentiated Aquifer within the Glacial Till. The nearest surface water feature is Mill Brook located approximately 182m east of the site, flowing to the north. According to an Envirocheck Report there are no surface water abstractions within 500m.</p>
Unexploded Ordnance	<p>The risk from UXO associated with WWII bombing to future intrusive investigation is considered to be Low.</p>
Fieldworks Undertaken	<p>Curtins 2023 ground investigation comprised of the following works; 3 no. cable percussion boreholes to a maximum depth of 6.00m below ground level (bgl), 4 no. hand pits to a maximum depth of 1.20m bgl, and 1 no. foundation pit to a maximum depth of 0.33m bgl.</p> <p>The three-cable percussion boreholes were installed with ground gas/water monitoring installations within the proposed building footprint area.</p>
Encountered Ground Conditions	<p>The ground conditions encountered in boreholes BH01, BH02 and BH03 suggest that upfilling may have taken place in the past to in order to construct a level plateau for the existing car park. Made Ground indicative of Reworked Glacial Till was present from between 1.70m and 3.00m bgl, with a maximum thickness of 2.80m recorded in BH02. This Reworked Glacial Till was overlain by more general cohesive Made Ground, which contained brick, concrete, limestone, fabric, plastic etc. In boreholes BH02 and BH03 this was finished at the surface by a 300mm thick layer of concrete and limestone gravel (hardcore). In BH01 concrete was encountered between 0.15m and 0.40m bgl, underlain by sub-base and overlain by the same hardcore as BH02 and BH03.</p> <p>Mudstone bedrock was encountered in the boreholes between 4.30m and 4.60m bgl.</p> <p>Groundwater strikes were encountered in BH01 at 0.80m bgl in the Made Ground and in BH02 at 4.80m bgl at the top of the bedrock. Groundwater was also observed in the base of HP04 at 1.20m bgl.</p>

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	<p>Pockets of wood and other organic material were noted within BH01 between 4.00m and 4.30m bgl. In BH03, a band of dark brown/black organic material with a strong organic odour was noted within Made Ground (Reworked Glacial Till) between 3.40m and 3.90m bgl and this may be indicative of former ground level.</p> <p>HP02 was terminated early at 1.10m bgl due to a large boulder at the base of the hand pit. Cobbles of brick and concrete were also encountered.</p>
Environmental Laboratory Testing and Ground Gas Monitoring Results	<p>With respect to the proposed 'Commercial' end-use, no exceedances were identified when compared with Tier 1 thresholds for human health. Asbestos was identified, at <0.001% concentrations, within HP01 and HP02.</p> <p>A maximum carbon dioxide concentration of 41.3% v/v and maximum methane concentration of 80.4% v/v and, a maximum flow rate of -68.9 l/hr have been recorded through the monitoring period.</p> <p>Maximum steady state carbon dioxide concentration of 37.5% v/v, a maximum steady state methane concentration of 46.6% v/v and, a maximum steady state gas flow of 2.5 l/hr was recorded through the monitoring period.</p> <p>A 'representative' scenario site characteristic GSV of 2.020 l/hr for methane and 0.928 l/hr for carbon dioxide has been calculated, corresponding to a CS3 gas regime requiring gas protection measures.</p>
Ground Contamination and Ground Gas Assessment	<p>A Moderate-Low-risk rating is identified to end-users from direct contact, inhalation, and ingestion of contaminants within Made Ground soils on site.</p> <p>A Very Low risk is identified to the underlying Aquifers and to the surface waters. This accounts for low sensitivity of controlled waters, lack of migration pathways and contaminant sources.</p> <p>A High/Moderate risk is identified to site end-users and construction/maintenance workers from ground gas migration and inhalation from soils respectively, with the site corresponding to BS8485 CS3 gas regime requiring gas protection measures.</p>
Geotechnical Assessment	<p>Due to the depth of the Made Ground on-Site and presence of shallow perched groundwater, shallow foundations are not considered suitable. Consideration may be given to ground improvement techniques to facilitate shallow foundations and a ground bearing floor slab (such as Vibro Stone Columns).</p> <p>Alternatively, a piled foundation solution in conjunction with a suspended floor slab could be considered to transfer the building loads to more competent ground at depth (i.e. the mudstone bedrock).</p> <p>A ground bearing floor slab founding on the Made Ground in its existing condition is not considered suitable without some form of ground improvement due to the risk of excessive total and differential settlement.</p> <p>A suspended floor slab should be used in conjunction with a piled foundation solution.</p> <p>The shallow ground conditions at the site (Made Ground) classify as DS-1 and AC-1 in accordance with the BRE Special Digest 1, Concrete in aggressive ground.</p>
Recommendations	<p>Based on the findings of the ground investigation, the following recommendations are made:</p> <ul style="list-style-type: none"> The engineering recommendations contained within the report should be reviewed once the proposed loads and elevations are available and upon completion of a cut and fill assessment. It is recommended that ground improvement and piling specialists are consulted with regards to suitable techniques at the site. It is recommended that an Earthworks Specification is produced to ensure fill placed is acceptable and compacted appropriately in accordance with the SHW. It is recommended that post earthworks, additional laboratory testing (Atterberg Limits) are undertaken on shallow cohesive soils in order to assess volume change potential. If a piled foundation solution is adopted, additional site investigation may be required for pile design purposes. This is likely to comprise rock coring and rock strength testing. Additional chemical testing is required to assess the concrete classification in accordance with BRE SD1. Remediation Strategy, to include information on further delineation of asbestos or capping within proposed soft landscaping areas. Asbestos management plan during construction works. It is recommended that construction workers are provided with appropriate PPE and sanitary facilities, with reference to the environmental testing results. Should unexpected contamination be observed during the enabling works or construction advice should be obtained from a Geo-environmental Engineer. <p>The Principal Contractor should undertake their own UXO Risk Assessment.</p>

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- Appendix B - Exploratory Hole Logs
- Appendix C - Chemical Laboratory Testing Results
- Appendix D - Geotechnical Laboratory Testing Results
- Appendix E - GAC Screening Thresholds
- Appendix F - Ground Gas Monitoring Results
- Appendix G - Risk Assessment Methodology

1.0 Introduction

1.1 Project Background

In February 2023, Curtins were instructed by Manchester University NHS Foundation Trust to undertake a Phase 2 Ground Investigation at the Nightingale overflow car park adjacent to the Nightingale Centre, Wythenshawe Hospital, Southmoor Road, Manchester, M23 9QZ.

The location and extent of the site is shown in *Figure 2.1* overleaf. It is understood that the current proposals are a National Breast Imaging Academy (NBIA) comprising the construction of a single storey building adjacent to the existing Nightingale Centre located to the east. A link corridor will provide access to both buildings and there is the option to construct an additional storey in the future.

Current Proposed Site Plans are available for review within *Appendix A*.

1.2 Project Aim

This aim of the investigation is to characterise the geo-environmental and geotechnical conditions for the proposed development.

1.3 Scope of Services

The Phase 2 Ground Investigation Report is intended to assess:

- a) If there is a risk of the proposed end-user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;
- c) If there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide; and
- d) The geotechnical issues impacting the site and to provide recommendations for substructure design.

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

2.0 Phase 1 Preliminary Risk Assessment (PRA) Summary

This section presents a summary of the current site setting, history, geology, and hydrogeology/hydrology, as presented in the Curtins Phase 1 PRA (1).

2.1 Current Setting

The site is located to the north of Southmoor Road, to the south of industrial units off Tilson Road, to the west of the Nightingale Centre and to the east of the Langley Building (Clinical Research).

The site is currently in use as an overflow carpark for the adjacent Nightingale Centre, with gravel hardstanding and a grass verge around the northern and eastern perimeter. Further carparking is along the western boundary and there is a small wooden fence and a parking barrier along the southern boundary. The southern boundary is delineated by Southmoor Road, the primary access road. The northern boundary comprises a grass verge which slopes downwards towards several industrial units located off Tilson Road. The eastern boundary comprises a grass verge which slopes downwards towards the Nightingale Centre and the western boundary comprises further car-parking spaces and The Langley Building (Clinical Research).

The surface cover is predominantly gravel hardcore associated with the car park. The site is approximately level.

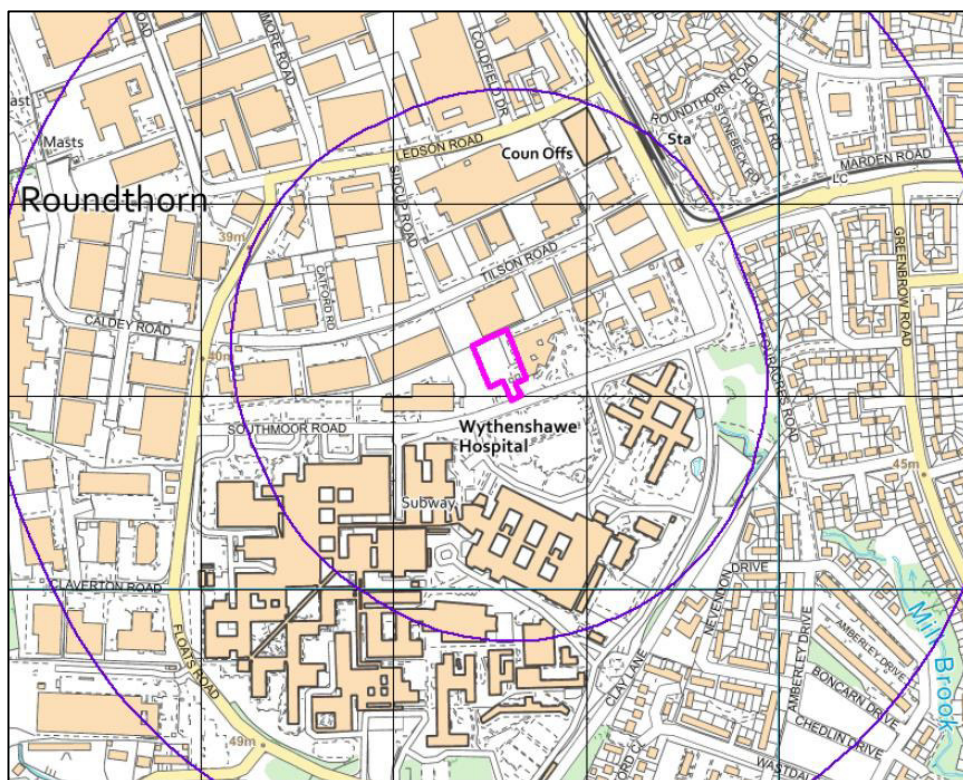


Figure 2.1 – Site Location Plan (site boundary shown in pink and 250m and 500m buffer in purple).
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2.2 Previous Site Use

The earliest available mapping (1876) shows the site as undeveloped agricultural land, with a hedgerow crossing from the northwest corner to the southeast. The land surrounding the site was generally undeveloped in early mapping, with agricultural fields. Towards 1910 the area became more developed with public and residential properties constructed within the surrounding area. Four ponds were located within 250m of the site; 70m south, 80m west, 110m southeast and 200m south.

Mapping from 1910 records a Sewage Works 100m southwest of the site, along with the Baguley Sanatorium 230m south, occupying multiple buildings with associated tennis courts and a bowling green. From 1935 onwards, the Sewage Works is developed further to include settling tanks, filter and sludge beds and septic tanks. Baguley Sanatorium underwent further development, and the ponds located 80m west and 110m southeast appear to have been infilled.

In 1954, Wythenshawe Hospital is recorded 50m south and Wythenshawe Housing Estate is developed 250m east of the site. By 1960 the Baguley Sanatorium is renamed the Baguley Hospital (later renamed Wythenshawe Hospital), and the ponds recorded 70m south and 200m south appear to have been infilled.

Between 1960 and 1977 the Wythenshawe Hospital undergoes further development and contains a maternity unit, chest disease unit, a tennis court, and several car parks. An unspecified pit can be recorded 90m north of the site, and by 1967 an industrial estate of unspecified works is recorded 250m north.

From 1977 a grassed mound/stockpile is recorded on the site extending to the east and the west, with a possible drain crossing the site. The warehouses immediately north of the site are identified as Roundthorne Industrial Estate. Between 1977 and 2006, Wythenshawe Hospital continues expanding and occupied most of the area to the south and southeast of the site, the Wythenshawe Housing Estate Villages to the east of the site continues development.

Mapping from 2009 onwards shows that the grassed mound/stockpile is no longer recorded, and the site is now occupied by a hospital car park with large areas of hardstanding and gravel, there is a rectangular building occupying the majority of the site, which is no longer visible on mapping from 2019 onwards. The Nightingale Centre has been developed along the eastern boundary. There has also been continued expansion of the Wythenshawe Hospital to the south and west of the site.

2.3 Published Geology

A review of the Envirocheck Report obtained for the Curtins Phase 1 PRA (1) and the British Geological Survey (BGS) map for Stockport (Sheet 098) (2) indicates the following geological and hydrogeological succession at the site:

- Superficial – Glacial Till, Devensian; and

- Bedrock – Bollin Mudstone Member, Anisian.

BGS mapping does not indicate the presence of Made Ground, however, given the historical development of the site it is considered likely that Made Ground will be present.

The BGS mapping suggests that there are no faults recorded on site. Two BGS boreholes are located within 250m of the site. Details of these boreholes are presented in *Table 2.3*.

Table 2.3 – Historical Borehole Record from Surrounding Area

Borehole Reference	Location (Easting, Northing)	Details (depth to top of strata/lithology/thickness)
SJ88NW1369	232m northeast (380872, 388441)	<ul style="list-style-type: none"> – 0.00m, MADE GROUND: Brown sandy slightly gravelly topsoil with rootlets (0.20m) – 0.20m, MADE GROUND: Stiff reddish brown and bluish grey slightly silty slightly gravelly clay with rootlets (0.30m) – 0.50m, Stiff brown slightly gravelly sandy CLAY with rootlets (0.30m) – 0.80m, Firm to stiff brown mottled bluish grey fissured slightly gravelly CLAY with rootlets (0.60m) – 1.40m, Firm reddish brown slightly sandy gravelly CLAY (0.70m) – 2.10m, Extremely weak to very weak reddish brown and bluish grey thinly bedded fine grained SANDSTONE (0.20m) <p>Borehole terminated at 2.30m bgl</p>
SJ88NW1305	240m northeast (380859, 388461)	<ul style="list-style-type: none"> – 0.00m, TOPSOIL dark brown sandy silt with rootlets (0.30m) – 0.30m, MADE GROUND: Firm brown slightly sandy slightly gravelly clay (0.40m) – 0.70m, Soft to firm brown mottled black and orange slightly sandy slightly gravelly CLAY (1.10m) – 1.80m, Extremely weak reddish-brown SILTSTONE with thin laminations of sandstone and mudstone (0.48m) <p>Borehole terminated at 2.28m bgl</p>

2.3.1 Made Ground

BGS mapping does not indicate Made Ground on site, however, given the historical land use an unknown thickness of Made Ground is anticipated to be present.

2.3.2 Superficial Deposits

BGS mapping indicates Glacial Till deposits within the site comprising sandy, silty clay with gravels and pebbles and sand layers.

2.3.3 Bedrock

Bedrock is recorded to be the Bollin Mudstone Member of Middle Triassic Age, comprising dominantly laminated reddish-brown and greenish-grey mudstone with siltstones.

2.3.4 Mining and Quarrying

According to The Coal Authority (3), the site is not located within a Coal Mining Reporting Area.

There are no recorded mine entries, coal outcrops or probable shallow coal workings within 1km of the site.

Consequently, the risk to development from historic coal mining is **Very Low**. No further actions are required to further assess the risk to the development from historic coal mining.

There are no recorded mineral sites within 1km of the site.

2.3.5 Other Pertinent Existing Geological Issues

The Phase 1 PRA Report (1) states that there is a 'no hazard to very low risk' from the following ground stability hazards on site: collapsible ground, compressible ground, ground dissolution, landslide ground, running sands and shrinking or swelling clay.

2.4 Hydrogeology and Hydrology

Environment Agency (EA) data indicates that the geological sequence underlying the site has the following hydrogeological characteristics:

Table 2.4 – Geological/Hydrogeological Succession

Geology	Associated Hydrogeological Classification
Glacial Till, Devensian ¹	Secondary Undifferentiated Aquifer ³
Bollin Mudstone Member, Anisian ²	Secondary B Aquifer ⁴

Notes:

1. A heterogeneous mixture of clay, sand, gravel, and boulders varying widely in size and shape.
2. The upper part is a dominantly laminated reddish-brown and greenish-grey mudstone with siltstones. The lower part is structureless and laminated, dominantly reddish-brown mudstone. Within the lower part of the member, a unit termed the 'Lower Keuper Sandstone' has been recognised in the Stockport area. This unit closely resembles the Tarporley Siltstone Formation of adjacent areas.
3. This is assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
4. Layers of rock or drift deposits with lower permeability layers that may store or yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers.

The nearest surface water feature is Mill Brook located approximately 182m east of the site, flowing to the north. No information is available on the GQA Grade of River Quality.

Three pollution incidents to controlled waters have occurred within 500m of the site in the last 10 years. All incidents are classified as a Category 3 (minor) incident. The nearest entry is recorded 133m north relating to inorganic chemicals (sodium hydroxide) entering a freshwater stream/river.

There are no active discharge consents within 500m of the site.

There are no surface water abstractions within 500m of the site.

2.5 Ground Gas

There are no historical landfills located within 1000m of the site.

There are no BGS recorded landfill sites located within 1000m of the site.

There are no licensed waste management facilities within 1000m of the site.

There are fifteen recorded areas of infilled land (water) within 500m of the site, with two recorded within 100m associated with the former ponds recorded on earlier mapping, referred to in *Section 2.2*. The nearest of which is located approximately 70m to the southeast and therefore a potential source of ground gas within the site.

The Envirocheck Report (Curtins Phase 1 PRA, (1)) and BGS Radon Mapping (1) confirms that the site is situated in an area where less than 1% of homes are above the radon action level. Radon protection measures are therefore not considered necessary within the proposed development. The advice of a specialist radon assessor should be sought where the development incorporates a basement.

2.6 Unexploded Ordnance (UXO) Risk Assessment

Risk mapping for UXOs contained in the Curtins Phase 1 PRA (1) places the site in a moderate risk area. Moderate risk areas are those that show a density of bombing hits of 11-50 bombs per 1000 acres and may contain potential WWII targets. The area in and around Manchester generally escaped the worst of Britain's WWII bombing, particularly when compared with other major UK cities, such as Liverpool or London. Furthermore, the peripheries of Manchester were only bombed sporadically, with the major targets in the city consisting of the port, city centre and industry in Stretford.

A review of the available historic mapping did not identify the presence of any ruins or features indicative of bomb damage following WWII within 1000m of the site boundary.

Based on the foregoing commentary, the likelihood of encountering UXO on site as part of the ground investigation or development works is considered to be **Low**, and on this basis no further action is considered to be required.

If unexploded ordnance is discovered during any works, stop immediately, prevent access to the area and inform the police. If the site boundary or location changes then the UXO risk should be reassessed.

2.7 Summary of Phase 1 Preliminary Conceptual Site Model (CSM)

A summary of potential pollutant linkages identified in the Curtins Phase 1 PRA (1) requiring further investigation to enable the safe development of the site are presented in *Table 2.7*.

Table 2.7 – Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk
Significant sources of on-site contamination: <ul style="list-style-type: none"> Made Ground of unknown composition from uncontrolled deposition of materials on site associated with the hospital car parks/access roads Significant sources of off-site contamination: <ul style="list-style-type: none"> Made Ground of unknown composition from uncontrolled deposition during construction of the hospital to the south and west, industrial estate to the north and residences to the east. Potential contamination associated with the unknown composition from the demolition of the Sewage Works. Potential contamination associated with the Septic Tank previously located east of the site. Potential contamination from the unknown infill material of the ponds within 500m of the site. 	Direct contact, ingestion, and inhalation (dust and vapours)	End-user of site	Moderate/Low
	Vertical migration through the superficial deposits (soils)	Controlled Waters (Groundwater) Secondary Undifferentiated Aquifer (superficial deposits) and Secondary B Aquifer (bedrock). No groundwater abstraction points within 1km of the site Not within a designated Source Protection Zone.	Low
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Surface Water) The nearest surface water feature is Mill Brook located 182m east of the site. No surface water abstraction points within 1km.	Very Low
Significant sources of ground gas: <ul style="list-style-type: none"> Potential organic matter from Made Ground deposits containing organic/putrescible content and infilled ponds to the southeast and southwest. 	Vertical and horizontal migration through existing service corridors and the underlying superficial deposits	End-user of site	Moderate/Low

Potential contaminants of concern associated with the sources identified within the preliminary CSM include but are not limited to: broad range aliphatic and aromatic hydrocarbons present within any fuel oils; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals; and, asbestos present in any discarded building materials.

Potential contaminants associated with the airborne dust/particulates include but are not limited to: polycyclic aromatic hydrocarbons and inorganic compounds including toxic metals that are also accounted for by potential on-site contaminants of concern.

3.0 Phase 2 Ground Investigation Scope of Works

Intrusive ground investigation works were undertaken by Curtins between the 3rd and 4th April 2023.

The scope of the ground investigation was designed in general accordance with current UK guidance including:

- Land Contamination Risk Management (LCRM) (4);
- British Standard (BS) 10175:2011+A2:2017 Investigation of potentially contaminated sites – Code of practice (5);
- BS5930:2015+A1:2020 Code of practice for ground investigations (6); and
- BS EN1997: Part 2:2007 Eurocode 7 (7).

The scope and rationale of the ground investigation are summarised in *Table 3.0*.

Table 3.0 – Scope and Rationale of Fieldwork Undertaken

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Cable Percussion Boreholes	BH01 BH02 BH03	6.00 6.00 6.00	Characterise shallow ground and groundwater conditions; Collect soil samples for chemical analysis; Collect samples for geotechnical soil testing; and, Gas and groundwater level monitoring.
Hand Pits	HP01 HP02 HP03 HP04	1.20 1.10 1.20 1.20	Characterise shallow ground conditions; Collect soil samples for chemical analysis.
Foundation Pit	HP05	0.33	Investigate the type and depth of the existing foundations at the adjacent Nightingale Centre.

For information regarding the location of the exploratory holes, refer to Curtins drawing Ref. 072094-CUR-00-XX-DR-GE-001-P01 within *Appendix A*.

3.1 Soil Logging and Sampling

Exploratory hole arisings were logged onsite by a qualified geo-environmental engineer in general accordance with the requirements of BS5930:2015+A1:2020 (6), including recording observed visual and olfactory indicators of contamination.

Exploratory hole logs are provided in *Appendix B*.

3.2 Monitoring Well Installations

Ground gas and groundwater monitoring wells (50 mm diameter) were installed in 3 No. Cable Percussion Boreholes.

A bentonite seal was placed above and below the screened section of the borehole to minimise potential for downward migration of contaminants and the creation of a preferential migratory pathway. A gravel aggregate surround was installed in the annulus between the sides of the borehole and the slotted sections of pipe.

The monitoring wells were primarily designed to assess the potential presence of ground gas as well as providing information on any groundwater levels. The screened sections therefore focused on the Made Ground and Made Ground (Reworked Glacial Till), which represent a potential ground gas source, and where groundwater was most likely to be encountered.

The installed response zones are summarised in *Table 3.2* below.

Table 3.2 – Monitoring Well Response Zones

Borehole Ref.	Response Zone(s) m bgl (m AOD)	Strata Description(s)
BH01	1.00 – 4.00	Made Ground and Made Ground (Reworked Glacial Till)
BH02	2.00 – 5.00	Made Ground (Reworked Glacial Till)
BH03	1.00 – 4.00	Made Ground and Made Ground (Reworked Glacial Till)

The borehole logs are included in *Appendix B*.

3.3 Post-Investigation Monitoring

3.3.1 Ground Gas and Groundwater Monitoring

Five ground gas and groundwater monitoring visits were completed between 20th April and 2nd June 2023.

Groundwater levels were measured with an interface probe and ground gas concentrations were monitored using a gas monitor (GFM430).

4.0 Laboratory Analysis

Representative soil samples were selected for laboratory geotechnical and chemical testing, based on field observations, to inform the proposed works.

Selected environmental soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for soil chemical analysis was Envirolab, a UKAS and MCERTS accredited laboratory, and geotechnical analysis was contracted to i2 Analytical (UKAS and MCERTS accredited).

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

The Preliminary CSM carried out as part of the Phase 1 PRA (1) has shown a very low/low risk to controlled waters, therefore no groundwater samples were obtained as part of this investigation.

4.1 Environmental Soil Analysis

Soil testing comprised the analytical suites outlined in *Table 4.1*.

Table 4.1 – *Environmental Chemistry Analysis Suite: Soils*

Suite Reference	Analyte	LOD
Soils Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	0.1%
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	5 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.1 mg/kg
	Cyanide (total)	10 mg/kg
	Sulphate (total)	200 mg/kg
	Sulphide	2 mg/kg
	Sulphur (elemental)	20 mg/kg
	Phenols (screen)	1 mg/kg
	PAHs (USEPA 16)	0.1 mg/kg
	TPH (Aro/Ali Split)	0.01 to 0.1 mg/kg

During ground investigation, 9 No. environmental samples were taken from the Made Ground soils. The soil samples were tested for Soils Suite A, as detailed in *Table 4.1*.

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

4.2 Groundwater Analysis

Sample collection was undertaken by a Curtins geo-environmental engineer on the fourth groundwater and ground gas monitoring visit on 24th May 2023.

A bailer was used to abstract water from the wells, BH03 did not contain sufficient water to obtain a sample. Groundwater from BH01 and BH02 was collected and secured within sterile laboratory provided vials, labelled, and then placed in a bubble wrap protected cool box.

The samples were sent to an accredited laboratory, Envirolab, and scheduled for VPH and Dissolved Methane testing to the elevated methane encountered during gas monitoring. The testing suite undertaken is summarised in *Table 4.2*.

Table 4.2 – Groundwater Testing

Analyte	LOD
Dissolved Methane	1 µg/l
Ali >C5-C6 (w)	1 µg/l
Ali >C6-C8 (w)	1 µg/l
Aro >C5-C7 (w)	1 µg/l
Aro >C7-C8 (w)	1 µg/l
BTEX – Benzene (w)	1 µg/l
BTEX – Toluene (w)	1 µg/l
BTEX – Ethyl Benzene (w)	1 µg/l
BTEX – m & p Xylene (w)	1 µg/l
MTBE (w)	1 µg/l

4.3 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (8). The geotechnical testing undertaken is summarised in *Table 4.3*.

Table 4.3 – Geotechnical Testing

Test Type	Quantity	Standard
In Situ Testing		
Standard Penetration Testing (SPT)	12	BS 5930:2015+A1:2020, Clause 41
Laboratory Testing (General Testing - Foundation Design)		
Moisture Content	4	BS1377 1990, Part 2 (clause 3.2)

Test Type	Quantity	Standard
pH	4	BS1377 1990, Part 3 (clause 9.4 & 9.5)
Water Soluble Sulphate 2:1 SO ₄	4	BS1377 1990, Part 3 (clause 5.3 & 5.5)
Water Content and Atterberg Limits (4 point)	4	BS 1377-2:1990
BRE Suite (non-pyrite) Brownfield C	4	BS 1377-2:1990
Particle Size Distribution (wet sieve)	3 (See Appendix C)	BS1377 1990, Part 2 (clause 9.2)

The results of the geotechnical testing are summarised in *Section 6.0* of this report. Copies of the geotechnical testing certificates are presented in *Appendix D*.

4.4 Quality Assurance and Quality Control

Soil chemical analysis and soil geotechnical testing was conducted by Envirolab and i2 Analytical respectively, both UKAS and MCERTS accredited laboratories. All samples were delivered in appropriate containers for the suites tested and analysed within the recommended holding times. No deviations were recorded at the time of analysis.

5.0 Encountered Ground Conditions

5.1 General

At the hand pit locations, the ground conditions generally comprised grass over Made Ground (Topsoil) with the exception of HP05 where tarmac hardstanding was present at the surface. In HP05 tarmac was present at ground level, underlain by hardcore and a concrete foundation at a depth of 0.32m bgl.

At the borehole locations, hardcore comprising grey gravel of concrete and limestone was underlain by cohesive Made Ground in BH02 and BH03. At BH01, below the hardcore, buried concrete was encountered at a depth of 0.15m below ground level (bgl) with a thickness of 250mm. This was underlain by a 100mm thick layer of sub-base. Cohesive Made Ground was present below the sub-base.

Bedrock was encountered in all three cable percussion boreholes at depths ranging between 4.30m and 4.60m bgl.

A summary of the ground conditions encountered during the Curtins site investigation works is presented below in Table 5.1, with detailed information presented on the exploratory hole logs which can be referred to in *Appendix B*.

Table 5.1 – Summary of Ground Conditions Encountered

Stratum	Depth to top of strata, m bgl	Recorded Thickness (m)		Description
		Min	Max	
Made Ground	0.00	0.50	2.80	MADE GROUND of grass or gravel over concrete, granular and cohesive material, one location including an upper tarmacadam layer. Composition varies position to position, see <i>Section 5.2</i> for details.
Bollin Mudstone Member	4.30 – 4.60	-	-	Thickness not proven. Recovered as completely weathered bedrock in BH02 between 4.60 – 4.80m bgl and grey MUDSTONE in BH01, BH02 and BH03.

1 – Thickness not proven

5.2 Made Ground

Made Ground was encountered in all exploratory borehole locations from ground level to depths of between 0.85m and 4.60m bgl. The Made Ground varied between Cable Percussion Boreholes, Hand Pits, and the Foundation Pit.

Within the Cable Percussion borehole locations, the Made Ground typically comprised a light grey concrete and limestone gravel underlain by cohesive silty, sandy, gravelly clay with gravel consisting of man-made materials such as concrete, brick, plastic, fabric, glass underlain by dark greyish brown

slightly silty, slightly sandy, brown mottled grey slightly gravelly clay, identified as a reworked Glacial Till.

Within the Hand Pit locations, the Made Ground typically comprised grass over dark brown/black very clayey, gravelly sand (topsoil) underlain by greyish brown slightly sandy, very gravelly, cobbly clay, with gravel and cobbles consisting of man-made materials such as concrete, plastic, glass and, brick.

Within the Foundation Pit, the Made Ground comprised dark grey tarmac underlain by yellowish brown sandy gravel, at the base of which was the buildings foundation (0.32m bgl).

A breakdown summary of the Made Ground conditions encountered during the Curtins site investigation works is presented below in Table 5.2.

Table 5.2 – Summary of Made Ground Conditions Encountered

Stratum	Depth to top of strata, m bgl	Recorded Thickness (m)		Description
		Min	Max	
Tarmac Hardstanding HP05 only.	Ground Level	-	0.10	Tarmac
Made Ground (Topsoil) HP01, HP02, HP03 and HP04:	Ground Level	0.35	1.20 ¹	Dark brown and black slightly gravelly very clayey SAND or sandy very gravelly CLAY. The gravel fraction comprised angular to subrounded fine to coarse brick, concrete, glass, coal, and mudstone. Twigs and plastic were also recorded.
Made Ground (Hardcore) BH01, BH02 and BH03:	Ground Level	0.15	0.30	Grey angular to subangular medium to coarse GRAVEL of concrete and limestone.
Concrete (buried) BH01 and HP05 only.	0.15 – 0.32	0.25	-	BH01 concrete between 0.15 – 0.40m bgl (250mm thick) HP05 concrete between 0.32m – 0.33m bgl (thickness not proven)
Made Ground (Sub-base) BH01 and HP05 only.	0.10 – 0.40	0.10	0.22	BH01 Limestone GRAVEL recorded between 0.40 – 0.50m bgl (100mm thick) HP05 Limestone GRAVEL recorded between 0.10 – 0.32m bgl (220mm thick)
Made Ground BH01, BH02, BH03, HP03 and HP04	0.30 – 0.50	0.42	2.70	Encountered as greyish brown slightly gravelly to very gravelly, occasionally cobbly CLAY. The gravel fraction comprised angular to subrounded fine to coarse brick, concrete, mudstone, siltstone, limestone and coal. Woven fabric, plastic and glass were also recorded and cobbles of brick and concrete.
Made Ground (Reworked Glacial Till) BH01, BH02, BH03	0.85 – 3.00	0.42 ¹	2.70	Generally encountered as brown mottled grey and grey slightly silty slightly sandy slightly gravelly CLAY with gravel comprising fine to medium subangular siltstone, sandstone, mudstone, and coal.
Possible Relic Topsoil BH01	4.00 (BH01 only)	-	0.30	Possible relic Topsoil which may be indicative of a previous ground level was encountered in BH01 between 4.00m – 4.30m bgl.

Stratum	Depth to top of strata, m bgl	Recorded Thickness (m)		Description
		Min	Max	
				It is described as a dark brown slightly silty slightly sandy gravelly CLAY with pockets of wood and organic material. Organic material was also noted in BH03 within Reworked Glacial Till between 3.40 and 3.90m bgl.

5.3 Bollin Mudstone Member

Bedrock deposits of the Bollin Mudstone were encountered in all Cable Percussion borehole locations from beneath the Made Ground from depths of between 4.30m and 4.60m bgl. The bedrock deposits generally comprised dark greyish brown to light grey competent mudstone bedrock. In BH02, weathered bedrock was encountered at 4.60m – 4.80m bgl, recovered as brown/orange very clayey, gravelly sand.

5.4 Observed Potential Contamination

Pockets of wood and other organic material was noted within BH01 between 4.00m and 4.30m bgl.

In BH03 a band of dark brown/black organic material containing hay/relic plant matter with a strong organic odour was noted within Made Ground (Reworked Glacial Till) between 3.40m and 3.90m bgl and this may be indicative of former ground level.

5.5 Obstructions Encountered

HP02 was terminated early at 1.10m bgl due to a large boulder at the base of the hand pit.

No other obstructions were encountered during the intrusive investigation works.

5.6 Groundwater

Groundwater was encountered within BH01 at 0.80m bgl, within BH02 at 4.80m bgl and, within BH03 at the base of the borehole during well installation. Groundwater levels were monitored during the gas monitoring visits. Table 5.7 summarises the groundwater levels and the borehole response zones.

Table 5.7 – Groundwater Monitoring Results

Borehole Ref.	Installation Strata	Response Zone (m bgl)	Depth to water level m bgl (m bgl)				
			20/04/23	03/05/23	18/05/23	24/05/23	02/06/23
BH01	Made Ground/ Reworked Natural	1.00 – 4.00	- ¹	1.96	2.23	2.56	3.59
BH02	Reworked Natural	2.00 – 5.00	4.16	3.78	4.10	4.18	4.00
BH03	Made Ground/ Reworked Natural	1.00 – 4.00	3.81	4.04	3.96	4.00	4.07

¹ – Unable to monitor due to obstruction (vehicle)

6.0 Ground Model

6.1 Made Ground

Made Ground was encountered in exploratory hole locations BH01, BH02, BH03, HP03 and HP04 at depths ranging between 0.42m and 2.70m bgl. It generally comprised dark grey/greyish brown slightly sandy, very gravelly, cobbly CLAY. The gravel and anthropogenic material consisted of subrounded to angular, fine to coarse mudstone, siltstone, sandstone, coal, glass, plastic, wood, brick, concrete, and fabric. The cobbles encountered were subrounded to subangular of brick, concrete, limestone, and mudstone.

Four Standard Penetration Tests were conducted in the Made Ground in boreholes BH01, BH02 and BH03. The results ranged between N = 2 and N = 5. A plot of SPT N versus Depth is provided as Figure 6.1a.

6.2 Made Ground (Reworked Glacial Till)

This was encountered beneath more typical Made Ground deposits in exploratory holes BH01, BH02, BH03, HP03 and HP04 at depths ranging between 0.85m and 3.00m bgl.

It is generally described as firm brown mottled grey and grey slightly silty slightly sandy slightly gravelly CLAY with gravel comprising fine to medium subangular siltstone, sandstone, mudstone, and coal.

The geotechnical test results recorded within the Made Ground (Reworked Glacial Till) are summarised in Table 6.1

Table 6.2 – Summary of Made Ground (Reworked Glacial Till) Test Results

Parameter		No. of Tests	Results
Laboratory Test Results			
Water Content (%)		1	23
Atterberg 4 Point	Liquid Limit (%)	1	43
	Plastic Limit (%)	1	22
	Plasticity Index (%)	1	21
	Modified Plasticity Index (%) ¹	1	17 (16.8)
In Situ Test Results			
Standard Penetration Test (SPT)		8	Min: 6 Max: 35

1. Modified plasticity index in accordance with the NHBC Technical Standards 2023 Chapter 4.2.

A total of eight SPT 'N' Values were recorded within the Made Ground (Reworked Glacial Till), with 'N' Values ranging from 6 to 35. A plot of SPT N versus Depth is provided as Figure 6.1a.

The Undrained Shear Strength (s_u) of the cohesive Made Ground (Reworked Glacial Till) has been determined using a relationship between SPT 'N₆₀' Values and Plasticity Indices after Stroud, 1975 (9) using Equation 1.

$$s_u = \text{SPT } N_{60} \times f_1 \quad \text{[Equation 1]}$$

Where:

SPT N₆₀ is the corrected SPT Result

f₁ is the Stroud factor

A Stroud factor f_1 value of 5.0 was chosen based on an I_P of 21%. Therefore, for SPT N values between 6 and 25, estimated s_u values range between 30kPa and 175kPa suggesting a low to very high strength clay. S_u versus depth is presented in Figure 6.1b.

The Coefficient of Compressibility (M_v) of the cohesive Made Ground (Reworked Glacial Till) has been determined from the relationship between SPT N₆₀ values and I_P after Stroud, 1975 (9) as presented in Equation 2:

$$M_v = 1 / (f_2 \cdot \text{SPT } N_{60}) \quad \text{[Equation 2]}$$

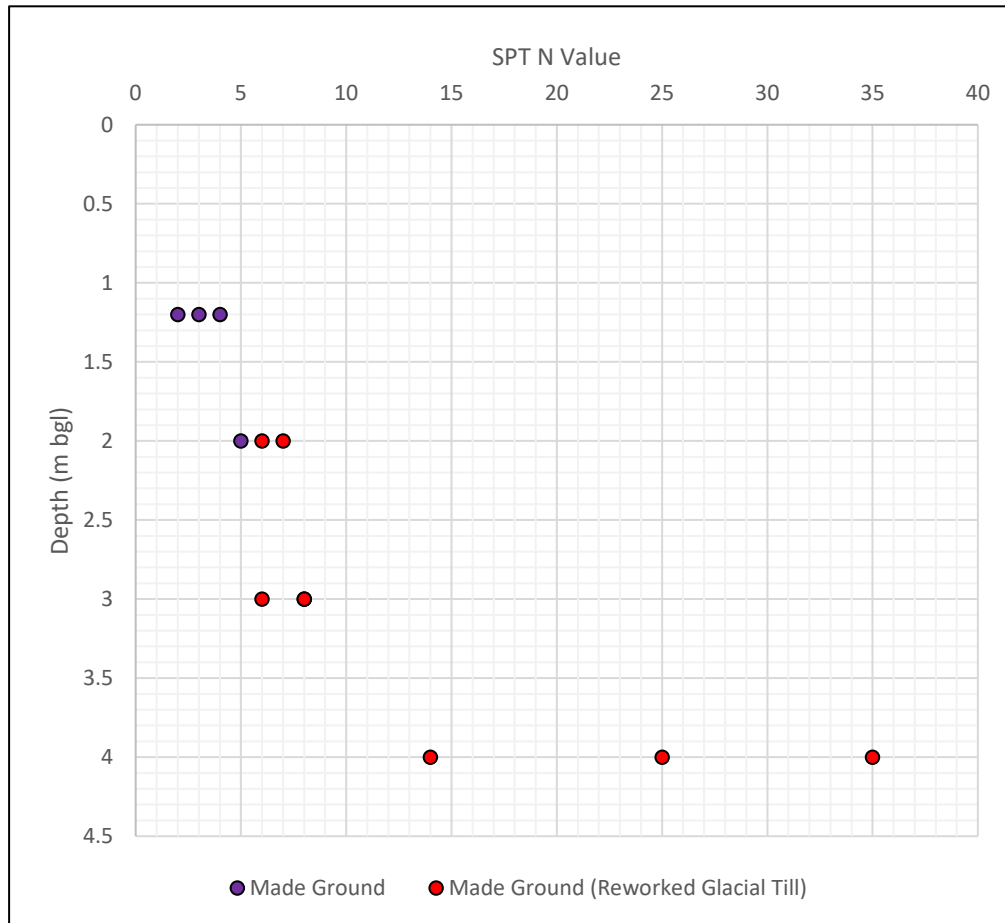
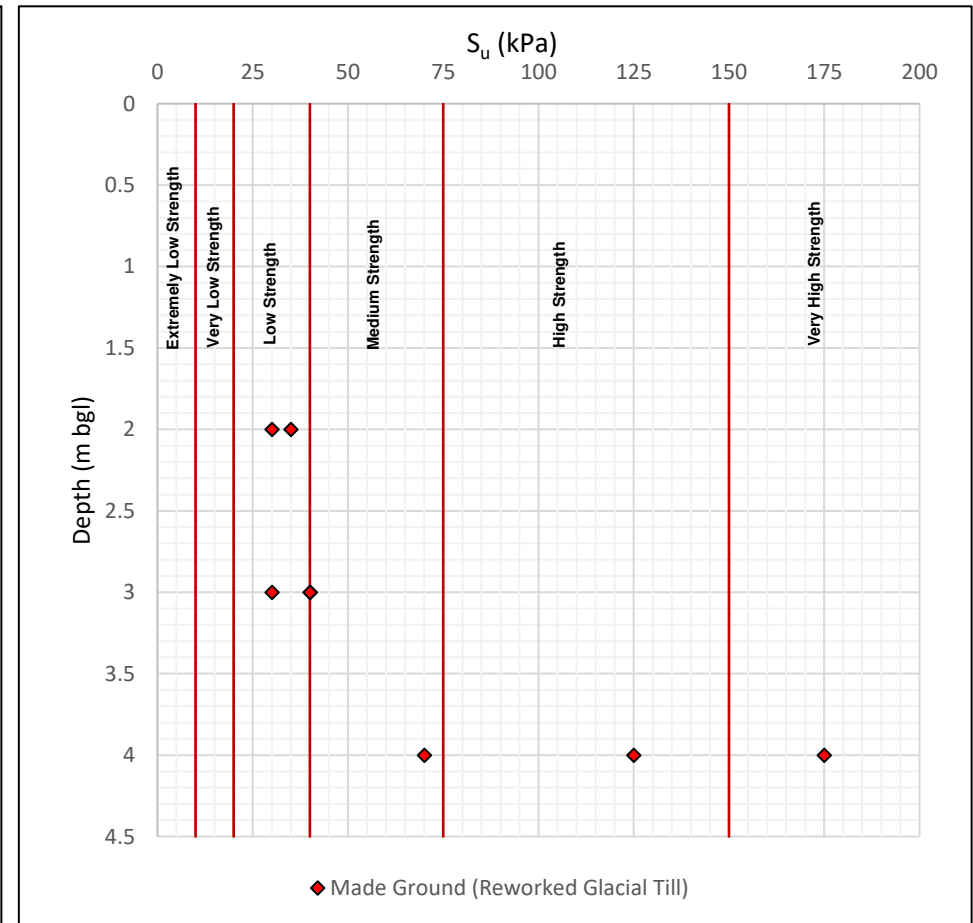
Where:

f₂ is the Stroud Factor determined from Figure 1.5 of Tomlinson, 2001 (9)

SPT N is Characteristic Standard Penetration Test Result

From Stroud a f_2 value of 0.50 was chosen for an I_P of 21%. Therefore, estimated M_v values range between 0.3 and 0.05m²/MN (firm to very stiff over consolidated clay).

Two samples were sent for Particle Size Distribution (PSD), results for BH02 indicate a very sandy, slightly gravelly CLAY and results for BH03 indicate a very sandy clay - the full results of which can be found in Appendix C.

**Figure 6.1a – SPT 'N' Value versus Depth****Figure 6.1b – S_u versus Depth Plot (Made Ground Reworked Glacial Till)**

6.3 Made Ground (Possible Relic Topsoil)

This was encountered in BH01 and BH03 at depths of 4.00m (0.30m thick) and 3.40m bgl (0.50m thick) respectively as pockets of wood and other organic material and a band of a band of dark brown/black organic material with a strong organic odour.

No SPTs were undertaken in this material, due to its limited thickness.

One Water Content and one Atterberg Limit test was undertaken on a soil sample from BH01 at 4.00m bgl. The results are summarised below.

Table 6.3 – Summary of Made Ground (Possible Relic Topsoil) Test Results

Parameter		No. of Tests	Results
Laboratory Test Results			
Water Content (%)		1	19
Atterberg 4 Point	Liquid Limit (%)	1	36
	Plastic Limit (%)	1	18
	Plasticity Index (%)	1	18
	Modified Plasticity Index (%) ¹	1	18

1. Modified plasticity index in accordance with the NHBC Technical Standards 2023 Chapter 4.2.

One PSD was undertaken on a soil sample from BH01 between 4.00 – 4.50m bgl. The results were 88% clay/silt, 11% sand and 1% gravel.

6.4 Bollin Mudstone Member

Mudstone bedrock was encountered in all Cable Percussion borehole locations, the top of the strata was encountered at depths of between 4.30m and 4.60m bgl. In borehole BH02 completely weathered bedrock is present between 4.60m and 4.80m bgl as brown/orange very clayey, gravelly sand, with the gravels consisting of angular to subangular sandstone. This was underlain by intact mudstone bedrock. The mudstone is described as dark greyish brown to light grey mudstone recovered as gravel of angular to subangular mudstone.

Six SPT tests were undertaken within the bedrock, none of the tests achieved full penetration. The SPT test values were recorded as >50 (refusal).

One Water Content and one Atterberg Limit test was undertaken on a soil sample from BH01 at 4.00m bgl. The results are summarised in Table 6.3.

Table 6.4 – Summary of Bollin Mudstone Member Test Results

Parameter		No. of Tests	Results
Laboratory Test Results			
Water Content (%)		2	9.8 - 10
Atterberg 4 Point	Liquid Limit (%)	2	35 – 37
	Plastic Limit (%)	2	17 – 18
	Plasticity Index (%)	2	18 – 19
	Modified Plasticity Index (%) ¹	2	18 – 19

1. Modified plasticity index in accordance with the NHBC Technical Standards 2023 Chapter 4.2.

6.5 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, Concrete in aggressive ground (10). A summary of the thirteen results obtained is summarised in *Table 6.4a*, and *Table 6.4b* details the classification.

Table 6.5 – Chemical Testing Results

Test Type	Range
pH	5.52 – 8.60
Water Soluble Sulphate (mg/l)	<10 - 260

In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils at the site would therefore be classified as Design Sulphate Class DS-1 and ACEC Class AC-1, when considering the most appropriate type of concrete to be used at the site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

7.0 Ground Contamination Assessment

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

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (11).

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

The subsections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Curtins Phase 1 PRA (1) in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in *Section 9.0* of this report.

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

7.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model (12), Report SC050021/SR2: Human Health Toxicological Assessment of Contaminants in Soil (13) and Report SC059921/SR3: Updated Technical Background to the CLEA Model (14).

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

- i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks

are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;

- ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third-party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds;
- iii) **Category 4 Screening Levels (C4SLs):** In March 2014, Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (15) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

7.1.1 Adopted Soil Human Health GACs Screening Methodology

The proposed development (NBIA) including areas of associated car parking and soft landscaping surrounding the building is most analogous with a *Commercial* end-use scenario and so the assessment has been undertaken against the following GACs, in order of preference for the development:

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

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e., the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the Made Ground at the site ranged from 0.46% to 4.06%.

With consideration for a calculated geometric average, the Made Ground soils determine an SOM of 1.53%. As such, soil data has been compared against Tier 1 Thresholds based on a SOM of 1% for a *Commercial* end-use.

The adopted GACs are listed in *Appendix E*.

7.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*, with testing undertaken on 9 No. samples of Made Ground obtained from across the site. A band of dark brown/black organic material with a strong organic odour was noted within the Made Ground between 3.40m and 3.90m bgl within BH03. No other visual and olfactory evidence of contamination was observed.

With respect to the *Commercial* end-use of the site, no exceedances were recorded.

Two samples had a positive result for asbestos containing materials (ACMs) which was identified as Chrysotile and Amosite as loose fibres and board in HP01, and loose fibres in HP02. Asbestos quantification was undertaken on the positive identifications, and both samples contained <0.001% asbestos as summarised in Table 7.1.2 below.

Table 7.1.2 – Positive Asbestos Identification Results

Hole ID	Sample Depth	Strata	Type	Quantification (% w/w)
HP01	0.60m bgl	Made Ground	Chrysotile & Amosite – Loose Fibres & Board	<0.001
HP02	1.00m bgl	Made Ground	Chrysotile & Amosite – Loose Fibres	<0.001

8.0 Ground Gas Assessment

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA (Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (16), BSI Publication Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015 (17) and other broadly accepted references such as the Ground Gas Handbook 2009 (18).

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

8.1 Ground Gas Monitoring Results

To characterise the site's ground gas regime and validate the qualitative assessment of ground gas risk standpipe installations were incorporated within three Cable Percussion borehole locations within the Made Ground deposits as part of the ground investigation. The details of the response zone of each monitoring installation are outlined in *Section 3.2*.

The Curtins Phase 1 PRA (1) highlighted a **Moderate/Low** risk from ground gases potentially arising from organic/ putrescible content in Made Ground soils.

The ground investigation proposed a programme of four monitoring visits over two months. Five monitoring visits were completed in order to collect water samples, as described in *Section 4.2*. These visits were undertaken between 20th April and 2nd June 2023, with barometric pressure recorded between 1017mb and 1023mb. Monitoring visits were undertaken during falling (visits 1, 2 and 5) and rising (visits 3 and 4) atmospheric pressure conditions.

The results are contained within *Appendix F* and summarised in *Table 8.1*.

Table 8.1 – Summary of Ground Gas Monitoring Results

Exploratory Hole Reference	Maximum Methane Concentration (% v/v)	Maximum Carbon Dioxide Concentration (% v/v)	Minimum Steady Oxygen Concentration (% v/v)	Maximum Gas Flow (l/hr)	Steady State Gas Flow (l/hr)
BH01	25.0	7.5	5.5	-68.9	-0.1
BH02	80.4	37.1	7.1	25.1	2.5
BH03	51.4	41.3	0.0	3.5	<0.1

Maximum methane (CH₄) concentrations were recorded of 80.4% within BH02 on the third monitoring visit.

Maximum carbon dioxide (CO₂) concentrations were recorded of 41.3% in BH03 on the fifth monitoring visit.

High methane and carbon dioxide concentrations decreased slightly through long monitoring periods (up to 40 minutes) however they remained significantly elevated.

A maximum Carbon monoxide (CO) was recorded at a maximum steady state concentration of 10ppm within BH02 on the fourth monitoring visit and was not recorded above the instrument's detection limit across every other monitoring visit.

Hydrogen sulphide (H₂S) was not recorded above the instrument's detection limit across the monitoring visits.

The greatest peak air flow rate was recorded in BH01 at -68.9 l/hr on the third monitoring visit.

Peak flow rates recorded within BH01 returned to a steady state of -0.1 l/hr during the third monitoring visit. Peak flow rates recorded within BH02 returned to a steady state of 2.5 l/hr during the first monitoring visit, and a steady state of 1.2 l/hr during the third monitoring visit. All other peak air flow rates recorded during the monitoring period returned to a steady state of <0.1 l/hr.

8.1.1 Dissolved Methane

During gas monitoring visits, it became apparent that there were significantly elevated concentrations of methane and carbon dioxide within the monitoring wells. In order to assess whether the groundwater contained within the monitoring wells was a source of methane production, two water samples were collected and sent for laboratory analysis.

The sample from BH02 returned a reading of 409 µg/l for Dissolved Methane (CH₄), whereas BH01 was not recorded above the detection limit. VPH testing on both samples did not return any results above the detection limit. The full table of results is contained within Appendix C.

8.2 Ground Gas Assessment

The Conceptual Site Model presented within the Phase 1 PRA (1) identified Made Ground deposits as a potential source of Ground Gas generation both on-site and off-site resulting from historical developments. The report suggests that there are no records of organic rich drift deposits (e.g., peat) being present and coal deposits are not indicated to underlie the site. Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane, and hydrogen sulphide. The consequence was evaluated as a **Moderate/Low** risk.

Made Ground soils were encountered in all boreholes across the site to proven depths of between 4.30m and 4.60m bgl. Organic inclusions were identified in BH01 and BH03 close to the base of the made ground which may comprise relic topsoil and represents a potential gassing source, albeit with relatively limited gas generation potential. Monitoring wells were installed in 3 No. borehole locations within Made Ground and Made Ground (Reworked Glacial Till), to assess the gassing potential and associated risk in these materials.

Phase 2 Ground Investigation Report

Current development plans indicate the construction of a NBIA and therefore gas assessments in accordance with BS8485:2019 (17) have been undertaken.

8.2.1 BS8485:2019 Classification

Using the available data set including air flow rates and gas concentrations, the hazardous gas flow rates (Q_{hg}) can be evaluated. Q_{hg} can be derived for both individual 'borehole' and 'worst case check' scenarios and a comparison made in support of an appropriate assessment of ground gas risk. For a 'borehole' scenario (highest hazardous gas flow rate that is realistically possible, i.e. in a single borehole) steady state flow rates and peak gas concentrations are adopted, whilst for a 'worst case check' scenario (highest Q_{hg} across the entire dataset for well screens in the same strata irrespective of location and discrete monitoring events) peak flows and gas concentrations are adopted (discounting any deemed to be unrepresentative such as peak flows in flooded boreholes discussed above).

See Table 8.2.1a and Table 8.2.1b below for calculated Q_{hg} values for the site.

Table 8.2.1a – Calculated Q_{hg} Values (Borehole Scenario)

Borehole	Steady State Flow	Peak CH ₄	Peak CO ₂	Q_{hg}	
				CH ₄	CO ₂
BH01	-0.1	25.0	7.5	0.025	0.008
BH02	2.5	80.4	37.1	2.010	0.928
BH03	<0.1	51.4	41.3	0.051	0.041

Table 8.2.1a – Calculated Q_{hg} Values (Worst Case Scenario)

Worst Case	Maximum Gas Flow	Peak CH ₄	Peak CO ₂	Q_{hg}	
				CH ₄	CO ₂
-	-68.9	80.4	41.3	55.396	28.456

Five ground gas monitoring visits have been completed. Consideration of the quantity of monitoring data, range of barometric states, and weather conditions, it is deemed that the available dataset is representative of the gas regime pertaining to the development site. As such, the maximum steady state flow rates are deemed suitable for use when deriving the Q_{hg} and Gas Screening Value (GSV) for the site.

As the dataset has been considered representative, a decision has been made to use the maximum steady state readings over the peak readings for flow rates, as flow rates generally reduced to <0.1 during monitoring periods, while peak concentrations of CH₄ and CO₂ have

been used. In this case, a representative GSV of 2.010 l/h for methane, and 0.928 l/h for carbon dioxide. These GSV's indicate a CS3 classification and considering the high methane readings, a CS3 classification has been applied to the site, requiring protection measures.

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

8.2.2 Dissolved Methane

Dissolved methane may be present in perched water within monitoring wells causing elevated concentration of methane to be recorded during soil gas monitoring. Methane concentrations in groundwater can typically be recorded at concentrations of up to 1500 µg/l in uncontaminated sites (19). Elevated concentrations may be recorded where anaerobic degradation of organic material (relic topsoil etc.) has occurred.

Localised organic rich soils were recorded during the ground investigation in BH01 and BH03 at depths of 4.00m to 4.30m bgl and 3.40m to 3.90m respectively described as pockets of wood/organic material (BH01) and bands of dark brown/black organic material containing hay with an organic odour (BH03). However, dissolved methane concentrations in perched water from BH01 were recorded below the limit of detection of the analysis methodology. It was not possible to obtain a perched water sample from BH03, as there was insufficient water within the monitoring well.

Low concentrations (409µg/l) were recorded in a perched water sample from BH02, where no organic material was recorded in the exploratory hole log.

The low concentrations of Dissolved Methane found in BH01 and BH02 do not indicate that dissolved methane within shallow perched water is a likely source of ground gas generation, or the cause of elevated methane and carbon dioxide concentrations recorded during the ground gas monitoring program.

It is therefore recommended that, in accordance with the ground gas risk assessment (*Section 8.2.1*), CS3 gas protection measures are installed for the proposed development.

9.0 Revised Conceptual Site Model

The Preliminary CSM presented in the Phase 1 PRA (1) and discussed in *Section 2.7* of this report has been revised following the GQRA in *Section 7.0* above. The revised CSM is summarised in the table overleaf.

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

The CSM follows the framework outlined within CIRIA C552 (20) which is summarised within *Appendix G*.

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

Risks presented by Mining are discussed and assessed within *Section 2.3.4*.

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

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors, and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (21) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model.

Reference should be given to the environmental testing results discussed within *Section 7.0* and presented within *Appendix C*.

Qualitative Risk
AssessmentGeneric
Quantitative Risk
AssessmentDetailed
Quantitative Risk
Assessment or;
Remedial Action

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

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Significant sources of on-site contamination: <ul style="list-style-type: none"> Made Ground of unknown composition from uncontrolled deposition of materials on site associated with the hospital/ car parks/access roads. Site also known to have been built up historically. Significant sources of off-site contamination: <ul style="list-style-type: none"> Made Ground of unknown composition from uncontrolled deposition during construction of the hospital to the south and west, industrial estate to the north and residences to the east. Potential contamination associated with the unknown composition from the demolition of the Sewage Works. Potential contamination associated with the Septic Tank previously located east of the site. Potential contamination from the unknown infill material of the ponds within 500m of the site. 	Direct contact, ingestion, and inhalation (dust and vapours)	Site end-users	Medium	Low	Moderate/Low	Environmental chemical analysis recorded no exceedances compared against 'Commercial' end use scenario GACs. Two instances asbestos containing materials or fibres have been identified, however, at low concentrations of <0.001%. Some limited evidence of contamination was noted in shallow site soils.	Asbestos was positively identified in two locations. Allow for provision of a suitable thickness of clean and inert cover in all areas of soft landscaping as part of future development works, detailed in a Remediation Strategy. Asbestos control measures during construction works. Construction and maintenance works should be provided with suitable PPE with respect to environmental chemical results presented herein. Standard Health & Safety precautions likely to be used by workers. Should unexpected contamination be observed during demolition/construction, works should be stopped with advice obtained from an appropriate specialist.
		Construction and maintenance workers					
	Vertical migration through the superficial deposits (soils)	Controlled Waters (Surface Water) The nearest surface water feature is Mill Brook located 182m east of the site. No surface water abstraction points within 1km.	Mild	Unlikely	Very Low	Considering the distance from the site to the nearest surface water and groundwater receptor and the limited potential for significant contamination within the Made Ground, this pathway is considered unlikely.	No further action required.
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Groundwater) Secondary Undifferentiated Aquifer (superficial deposits) and Secondary B Aquifer (bedrock) No groundwater abstraction points within 1km of the site Not within a designated Source Protection Zone	Mild	Unlikely	Very Low		
Significant sources of ground gas: <ul style="list-style-type: none"> Potential organic matter from Made Ground deposits containing organic/putrescible content and infilled ponds to the southeast and southwest. 	Vertical and horizontal migration through existing service corridors and the underlying superficial deposits	Site end-users	Medium	Highly Likely	High	Significant concentrations of Methane and Carbon Dioxide. Flow has been noted within monitoring locations. Dissolved methane in perched water is not a likely source of ground gas generation.	Continued ground gas monitoring. Gas protection measures required.
		Construction and maintenance workers	Mild Standard Health & Safety precautions likely to be used by workers)	Highly Likely	Moderate	The BS8485:2019 Classification indicates the site is classified as CS3. Gas protection measures are required.	The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction.

10.1 Introduction

This section will assess the relevant geotechnical issues for the current development proposals which are a single storey NBIA building adjacent to the existing Nightingale Centre at Wythenshawe Hospital, with a corridor connecting the two buildings. An extract from the Proposed Site Plan is provided as Figure 10.1. It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 Report and the Construction Designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the ground investigation information, and their own examination of the site.

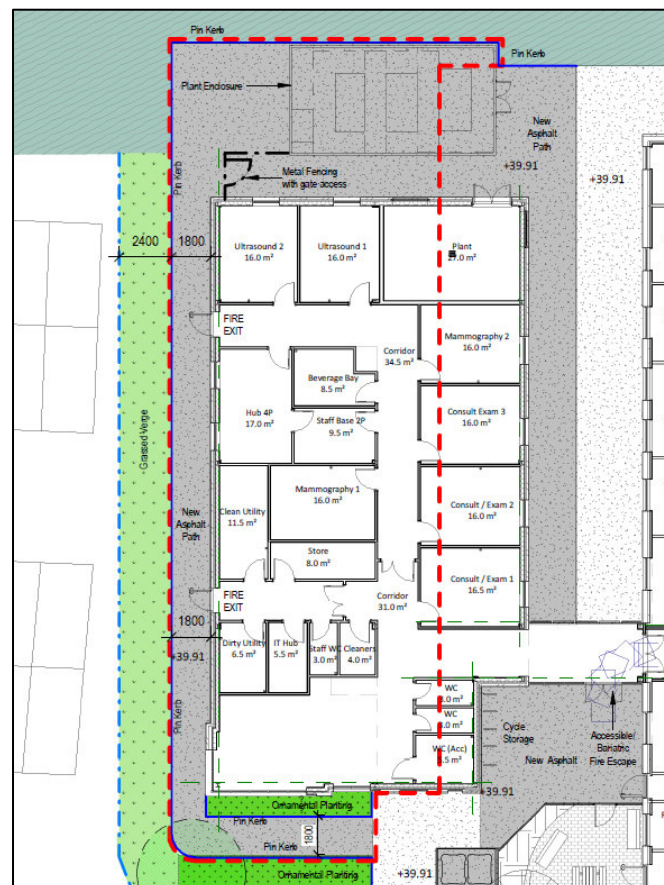


Figure 10.1 – Extract from Proposed Site Plan

The site is currently in use as an overflow carpark for the adjacent Nightingale Centre, with gravel hardstanding and a grass verge to the northern and eastern perimeter. Additional

An extract from the Existing Site Plan is provided as Figure 10.2.

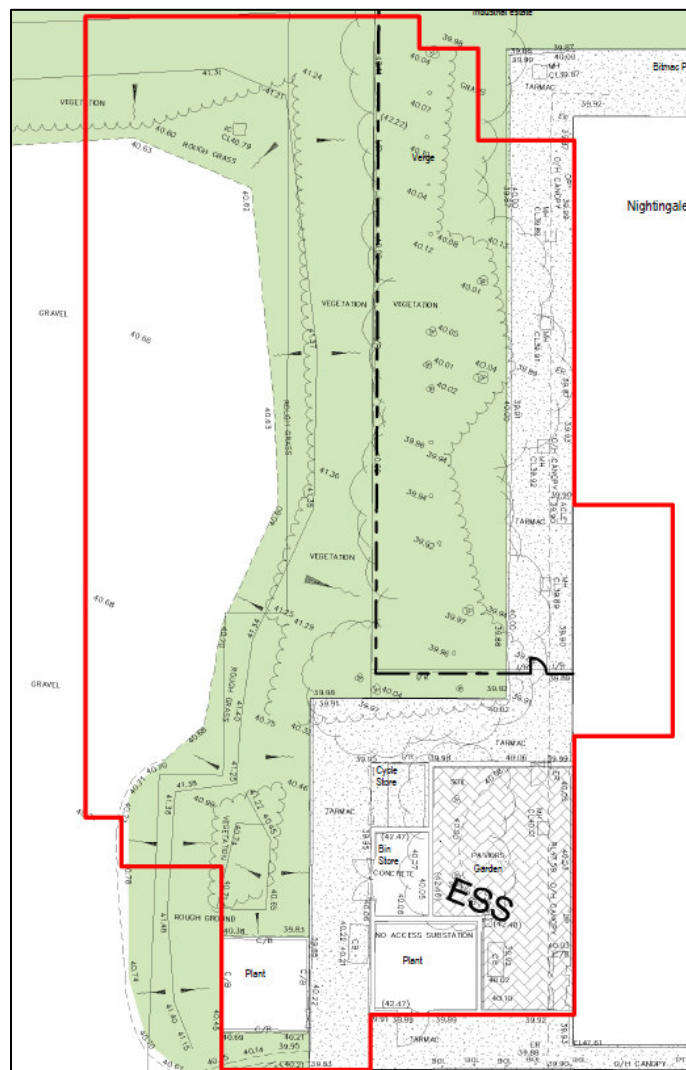


Figure 10.2 – Extract from Existing Site Plan

10.2 Summary of Ground Conditions

The ground conditions encountered in boreholes BH01, BH02 and BH03 suggest that upfilling may have taken place in the past to in order to construct a level plateau for the existing car park. Made Ground indicative of Reworked Glacial Till was present from between 1.70m and

3.00m bgl, with a maximum thickness of 2.80m recorded in BH02 to a depth of 4.60m bgl. This Reworked Glacial Till was overlain by more general cohesive Made Ground, which contained brick, concrete, limestone, fabric, plastic etc. In boreholes BH02 and BH03 this was finished at the surface by a 300mm thick layer of concrete and limestone gravel (hardcore). In BH01 concrete was encountered between 0.15m and 0.40m bgl, underlain by sub-base and overlain by the same hardcore as BH02 and BH03.

Mudstone bedrock was encountered in the boreholes between 4.30m and 4.60m bgl.

Groundwater strikes were encountered in BH01 at 0.80m bgl in the Made Ground and in BH02 at 4.80m bgl at the top of the bedrock. Groundwater was also observed in the base of HP04 at 1.20m bgl.

Pockets of wood and other organic material were noted within BH01 between 4.00m and 4.30m bgl. In BH03, a band of dark brown/black organic material with a strong organic odour was noted within Made Ground (Reworked Glacial Till) between 3.40m and 3.90m bgl and this may be indicative of former ground level.

HP02 was terminated early at 1.10m bgl due to a large boulder at the base of the hand pit. Cobbles of brick and concrete were also encountered.

10.3 Geotechnical Considerations

10.3.1 Presence of Existing Utilities

The presence of existing utilities which may require capping and/or diversion associated with the development. This should be managed through the appropriate utility suppliers during the construction phase. The Principal Contractor should ensure that appropriate mitigation measures are put in place during the construction phase (i.e., during excavation of foundations).

10.3.2 Deep Made Ground

Made Ground and Made Ground (Reworked Glacial Till) is present to proven depths of between 4.30m and 4.60m bgl. It is generally two cohesive layers, the upper layer is general Made Ground containing concrete brick and other anthropogenic material and the lower layer comprises Reworked Glacial Till which contains mudstone, coal, sandstone and siltstone gravel and rare anthropogenic material.

10.3.3 Earthworks

Given the existing topography of the site, earthworks are likely to be required to create a level development platform. A cut and fill assessment is not available at the time of writing this report, however it may be possible to re-use cut materials as Engineered Fill subject to acceptability testing in accordance with the Specification for Highways Works, Series 600.

10.3.4 Obstructions

Given the site history, obstructions within the Made Ground cannot be discounted in areas of the site that have not been investigated as part of this ground investigation.

HP02 was terminated early at 1.10m bgl due to a large boulder at the base of the hand pit. Cobbles of brick and concrete were also encountered.

It is recommended that oversized material and other obstructions are grubbed out as part of the enabling works/earthworks.

10.3.5 Shallow Groundwater

Groundwater strikes were encountered in BH01 at 0.80m bgl in the Made Ground and in BH02 at 4.80m bgl at the top of the bedrock. Groundwater was also observed in the base of HP04 at 1.20m bgl.

During gas monitoring groundwater levels were recorded within standpipes with response zones in the Made Ground. The shallowest groundwater level monitored was 1.96m bgl in BH01.

The Volume Change Potential of the shallow cohesive Made Ground should be considered with any solution and additional laboratory testing should be undertaken post earthworks to ascertain the risk of heave or subsidence associated with shrinking or swelling clay.

10.3.6 Volume Change Potential

The Volume Change Potential of the shallow cohesive Made Ground should be considered with any foundation or ground improvement solution. Additional laboratory testing (Atterberg Limits) should be undertaken post earthworks to assess the risk of heave or subsidence associated with shrinking or swelling clay in accordance with the NHBC Technical Standards 2023, Chapter 4.2.

10.4 Foundation Options

10.4.1 Shallow Foundations

At the time of writing this report proposed loads are not available.

Due to the depth of the Made Ground on-Site and presence of shallow perched groundwater, shallow foundations are not considered suitable.

Consideration may be given to ground improvement techniques to facilitate shallow foundations and a ground bearing floor slab. With respect to suitable ground improvement techniques, advice from specialist contractors should be sought, whose design should be warranted.

The ground gas risk assessment classifies the site as CS3 and ground gas protection measures are required. This needs to be considered in the foundation solution design.

10.4.2 Piling

Alternatively, a piled foundation solution in conjunction with a suspended floor slab could be considered to transfer the building loads to more competent ground at depth (i.e. the mudstone bedrock).

It is recommended that specialist contractors are consulted with regards to the type of piling solution suitable at the site and with consideration of the proposed loads, the proximity of the existing Nightingale Centre, and the ground conditions. They should be responsible for the selection of an appropriate piling technique and their design should be warranted.

Additional ground investigation may be required to obtain samples of bedrock for rock strength testing and design in accordance with current standards.

10.4.3 Vibro Stone Columns (VSC)

Vibro Stone Columns (VSC) may be a suitable ground improvement technique at the site.

The technique is generally used to improve a wide range of fill and weak natural soils to provide an economic foundation solution such as strip and pad foundations (where the arrangement of the columns has been designed in relation to a specific building layout or vice versa) and a ground bearing floor slab.

The technique comprises a vibrating 'poker' penetrating the ground and displacing the soils to produce a cavity to a design depth through loose or weak ground onto a competent bearing stratum, in this case the Bollin Mudstone Member. The poker is then withdrawn and at the same time the cavity filled with hard inert graded stone. The stone is introduced in successive layers compacted by the vibrating poker at each layer forming a column of stone that is tightly interlocked with the surrounding ground.

The reinforcing action of the stone columns serves to significantly improve the load bearing characteristics of the ground. A specialist contractor normally undertakes the design of the stone columns, but generally a bearing pressure of 120kN/m² can be achieved.

The advice of a specialist contractor should be sought to discuss the scheme with respect to the suitability of this solution particularly considering the presence of cobbles and localised pockets of organic material at the site.

The vibro replacement stone column contractor may wish to excavate additional trial pits at the site to inspect the Made Ground in order to confirm its suitability for improvement.

10.5 Floor Slabs

A ground bearing floor slab founding on the Made Ground in its existing condition is not considered suitable without some form of ground improvement due to the risk of excessive total and differential settlement.

A suspended floor slab should be used in conjunction with a piled foundation solution.

10.6 Excavations

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to <1.20m bgl should stand unsupported in the short term. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those >1.20m deep, in accordance with Health and Safety Regulations.

Suitable side slope angles must be checked and provided by a suitably qualified temporary works contractor for any excavations.

Shallow perched groundwater may be encountered as seepages in shallow excavations. If encountered dewatering by sump and pump may be required.

Excavation through layers of Made Ground encountered across the site should be feasible using conventional site plant however a breaker may be required if buried concrete is encountered.

10.7 Chemical Attack on Buried Concrete

The shallow ground conditions at the site (Made Ground) classify as DS-1 and AC-1 in accordance with the BRE Special Digest 1, Concrete in aggressive ground.

Should a piling solution be adopted additional chemical testing is recommended to classify the mudstone bedrock, which has the potential to be pyritic, and therefore the concrete classification may need to change.

11.0 Conclusions & Recommendations

11.1 Conclusions

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in *Section 9.0*.

11.1.1 Ground and Groundwater Contamination

With respect to the proposed Commercial end-use of the site, no exceedances of potential contaminants of concern were identified. All soil samples were screened for asbestos, with two instances of asbestos being detected, however at very low concentrations of <0.001%. Limited visual and olfactory evidence was encountered.

A **Moderate-Low**-risk rating is therefore identified to proposed site end-users and construction workers from direct contact, inhalation, and ingestion of contaminants within Made Ground soils.

A **Low**-risk rating is identified to construction workers, from soils across the site though inhalation and ingestion of soil or dust, accounting for appropriate PPE and sanitary facilities are utilised during groundworks and construction works.

Considering the distance from the site to the nearest surface water and groundwater receptor and the limited potential for significant contamination within the Made Ground, this pathway is considered unlikely. The Secondary B Aquifer within the bedrock are considered very low sensitivity and the pathway to surface water receptors around the site are limited.

A **Very Low** risk rating is currently identified to controlled waters in relation to groundwater and surface water receptors respectively, accounting for the limited sources of contamination encountered within site soils and limited pathways for migration.

11.1.2 Ground Gas Assessment

A **High/Moderate** risk rating is therefore identified to proposed site end users from inhalation of hazardous ground gases corresponding to a CS3 for which ground gas protection measures are required.

The Curtins Phase 1 PRA (1) confirms the site is situated in a lower probability radon area where <1% of homes are above the radon action level. On this basis radon

protection measures are not considered necessary in the construction of new dwellings or extensions.

If the new development incorporates a basement the advice of a specialist Radon assessor must be obtained.

11.2 Geotechnical

Due to the depth of the Made Ground On-Site and presence of shallow perched groundwater, shallow foundations are not considered suitable. Consideration may be given to ground improvement techniques to facilitate shallow foundations and a ground bearing floor slab (such as Vibro Stone Columns).

Alternatively, a piled foundation solution in conjunction with a suspended floor slab could be considered to transfer the building loads to more competent ground at depth (i.e. the mudstone bedrock). Additional ground investigation may be required to obtain samples of bedrock for rock strength testing and design in accordance with current standards.

A ground bearing floor slab founding on the Made Ground in its existing condition is not considered suitable without some form of ground improvement due to the risk of excessive total and differential settlement.

A suspended floor slab should be used in conjunction with a piled foundation solution.

The shallow ground conditions at the site (Made Ground) classify as DS-1 and AC-1 in accordance with the BRE Special Digest 1, Concrete in aggressive ground.

Should a piling solution be adopted additional chemical testing is recommended to classify the mudstone bedrock, which has the potential to be pyritic, and therefore the concrete classification may need to change.

11.3 Recommendations

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

- 1) The engineering recommendations contained within the report should be reviewed once the proposed loads and elevations are available and upon completion of a cut and fill assessment.
- 2) It is recommended that ground improvement and piling specialists are consulted with regards to suitable techniques at the site.
- 3) It is recommended that an Earthworks Specification is produced to ensure fill placed is acceptable and compacted appropriately in accordance with the SHW.
- 4) It is recommended that post earthworks, additional laboratory testing (Atterberg Limits) are undertaken on shallow cohesive soils in order to assess volume change potential.
- 5) If a piled foundation solution is adopted, additional site investigation may be required for pile design purposes. This is likely to comprise rock coring and rock strength testing. Additional chemical testing is required to assess the concrete classification in accordance with BRE SD1.
- 6) Remediation Strategy, to include information on further delineation of asbestos or capping within proposed soft landscaping areas.
- 7) Asbestos management plan during construction works.
- 8) It is recommended that construction workers are provided with appropriate PPE and sanitary facilities, with reference to the environmental testing results.
- 9) Should unexpected contamination be observed during the enabling works or construction advice should be obtained from a Geo-environmental Engineer.

The Principal Contractor should undertake their own UXO Risk Assessment.

12.0 References

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Appendix A – Drawings



Proposed Site Plan
1:200

KEY:

Note: Approx. areas are for overall external works

- Existing Asphalt Surface to be retained.
- Proposed New Asphalt Surface
Approx. 300m²
- Proposed New Paving Stones & Garden refresh
Approx. 45m²
- Proposed New Ornamental Planting Zone
Approx. 82.5m²
- Proposed Grass Verge
- Existing Planting/ Vegetation
- Proposed Trees
- Trellis Planting to Fence
- External Steps with retaining structure
- Area of Ground Excavation / Levelling
Approx. 450m²
- Proposed Standard Bullnosed Kerb
- Proposed Pin Kerb
- Proposed Metal Fencing
2100mm high
Metal posts with mesh panels.
Access Gate
- Proposed Diamond Wood Rail Fence
900mm High Posts
- Existing Control Box

NOTES
All dimensions and levels to be checked on site
Any discrepancies are to be reported to the Architect before any work commences
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P4	19.05.23	AS/JG	Stage 3 Issue
P3	10.05.23	AS	Draft Issue for Stage 3 co-ordination
P2	14.02.23	AS	Stage 2 initial Issue
P1	06.02.23	AS	First Issue. Draft

rev no.	rev date	rev by	description
project			

National Breast Imaging Academy

location
Wythenshawe Hospital
Employer

client
Manchester University NHS
Foundation Trust

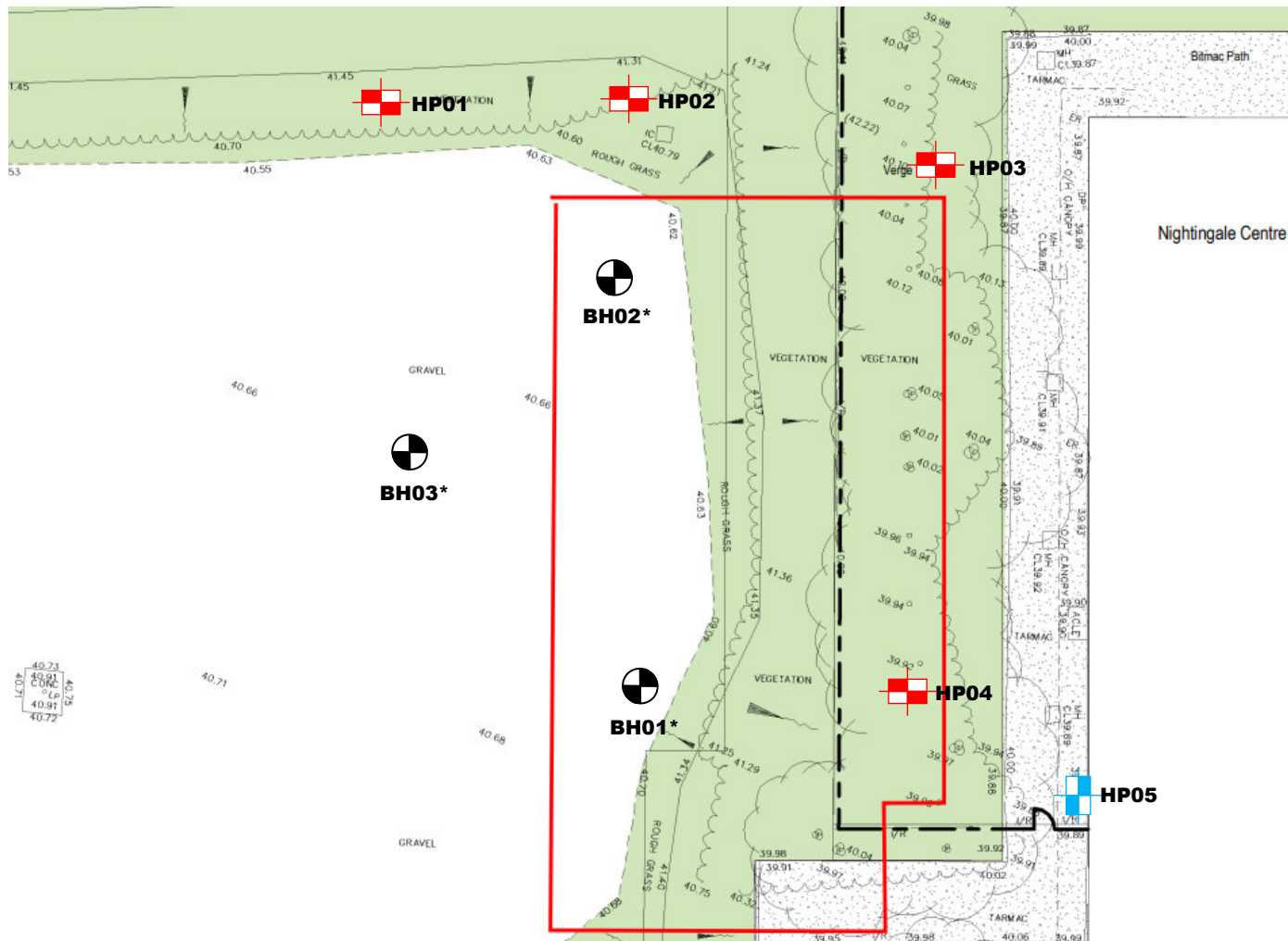
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key plan



drawing title
Proposed Site Plan

AFL job number	scale @ A1	drawn AS	checked JG
223196		rev date	19.05.23

draw purpose	status	rev
Information		P4
bim project	origin	zone level type role 5-digit no.
BIA-AFL-01-00-DR-A-90100		



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Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Project:
NBIA Wythenshawe Hospital

Status:
DRAFT

Drawing Title:
Exploratory Hole Location
Plan

Drawn By: LW	Checked By:
Designed By: LW	Date: 20/04/2023
Scale: NTS	

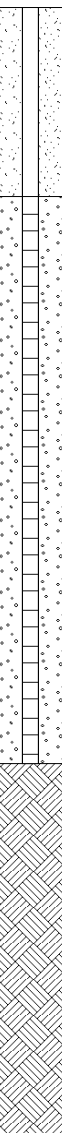
Project No: Originator: Zone: Level: Type: Discipline: Category/Number: Rev:

072094-CUR-00-XX-DR-GE-001-P01

GENERAL NOTES:

Rev:	Description:	Date:	By:
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Appendix B – Exploratory Hole Logs

					Borehole Log			Borehole No. BH01 Sheet 1 of 1		
Project Name: NBIA Wythenshawe Hospital					Project No. 072094		Co-ords: -		Hole Type CP	
Location: Wythenshawe Hospital					Level:		Scale 1:40			
Client: Manchester University NHS Foundation Trust (MFT)					Dates: 04/04/2023 - 04/04/2023		Logged By LW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.15			MADE GROUND: Light grey concrete and limestone gravel. Gravel is medium to coarse, subangular to angular of concrete, limestone and rare brick. Occasional cobble of subangular concrete and limestone.	1	
					0.40					MADE GROUND: Light grey concrete layer.
					0.50					MADE GROUND: Brownish grey gravel sub-base. Gravel is fine to coarse of subangular to angular limestone.
		0.90	ES						MADE GROUND: Brown silty, sandy, very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular of limestone, brick and concrete.	
		1.20	D	N=4 (1,1/1,1,1,1)	1.20			MADE GROUND: Reddish brown mottled grey slightly silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular of mudstone, siltstone, rare coal and brick.		
		1.20						MADE GROUND: Reddish brown mottled grey silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone and siltstone. (Reworked Glacial Till).		
		2.00		N=6 (1,1/1,1,2,2)	2.00			MADE GROUND: Dark greyish brown mottled brown and grey slightly silty, slightly sandy, gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular of brick fragments, mudstone, siltstone, with rare roots. (Reworked Glacial Till).		
		2.00 - 2.50	B					MADE GROUND: Dark brown mottled grey slightly silty, slightly sandy, slightly gravelly CLAY with pockets of wood/organic material. Sand is fine to coarse. Gravel is fine to coarse, subangular of mudstone, siltstone. Cobbles of subrounded mudstone. (Possible Relic Topsoil)		
		2.50	ES		2.60			Dark greyish brown MUDSTONE. (BOLLIN MUDSTONE MEMBER)		
		3.00	D	N=8 (1,1/2,2,1,3)				-		
		3.00						-		
		4.00	D	N=35 (2,3/4,9,10,12)	4.00			-		
		4.00	B		4.30			-		
		4.00 - 4.50						-		
		5.00	D	50 (10,14/50 for 80mm)				-		
		5.00						-		
		6.00	D	50 (8,15/50 for 90mm)	6.00			-		
		6.00						-		

Remarks

Service inspection pit hand excavated from GL to 0.15m, breaker used to break through 0.35m thickness of concrete, hand excavation resumed up to 1.20m. Groundwater struck at 0.80m, groundwater seepage encountered at the base of the borehole after drilling.

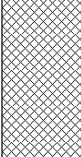


					Borehole Log		Borehole No. BH02 Sheet 1 of 1		
Project Name: NBIA Wythenshawe Hospital				Project No. 072094		Co-ords: -		Hole Type CP	
Location: Wythenshawe Hospital				Level:		Scale 1:40			
Client: Manchester University NHS Foundation Trust (MFT)				Dates: 03/04/2023 - 03/04/2023		Logged By JL			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.30		MADE GROUND: Grey aggregate gravel. Gravel is medium to coarse, subangular to angular of limestone.	1	
		1.20 1.20 1.50	D ES	N=2 (1,1/0,0,1,1)	1.30		MADE GROUND: Soft to firm brown slightly sandy, gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of brick, concrete, wood, plastic, sandstone, fabric, limestone.		
		2.00 2.00 2.00 - 2.50	D B	N=7 (1,1/2,1,1,3)	1.80		MADE GROUND: Soft to firm greyish brown slightly gravelly CLAY. Gravel is fine to coarse, subrounded to angular of brick, sandstone, mudstone and coal.	2	
		3.00 3.00	D	N=6 (1,1/1,1,2,2)			MADE GROUND: Firm brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subrounded to subangular of sandstone, mudstone, coal and siltstone. (Reworked Glacial Till)		
		4.00 4.00 4.00 - 4.50	D B	N=25 (3,4/5,6,7,7)				3	
		4.60 4.80							
		5.00 5.00	D	40 (6,10/40 for 220mm)			Brown/orange very clayey, gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, subangular to angular of sandstone. (Completely Weathered Bedrock). Dark greyish brown MUDSTONE. (BOLLIN MUDSTONE MEMBER)	4	
		6.00		50 (8,15/50 for 220mm)	6.00				
								End of borehole at 6.00 m	5
								6	
								7	
								8	

Remarks
Service inspection pit hand excavated from GL to 1.20m. Groundwater struck at 4.80m bgl, rose to 4.00m bgl after 20 minutes.

					Borehole Log		Borehole No. BH03 Sheet 1 of 1		
Project Name: NBIA Wythenshawe Hospital				Project No. 072094		Co-ords: -		Hole Type CP	
Location: Wythenshawe Hospital				Level:		Scale 1:40			
Client: Manchester University NHS Foundation Trust (MFT)				Dates: 04/04/2023 - 04/04/2023		Logged By LW			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30		MADE GROUND: Light grey concrete and limestone gravel. Gravel is medium to coarse, subangular to angular of concrete, limestone and rare brick. Occasional cobble of subangular concrete and limestone.		
		0.50	ES				MADE GROUND: Brown very sandy, very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of brick, concrete, limestone, plastic, woven material, rare glass and coal. Occasional cobbles of brick.	1	
		1.20 1.20 1.20 - 1.70	D B	N=3 (1,0/0,1,1,1)	1.20		MADE GROUND: Dark greyish brown silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular of brick.		
		2.00 2.00	D	N=5 (1,1/1,1,1,2)				2	
		3.00 3.00 3.00 - 3.50	D B	N=8 (1,1/2,1,2,3)	3.00		MADE GROUND: Dark greyish brown slightly silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is medium to coarse, rounded to subangular of mudstone and siltstone. Occasional cobble of subrounded mudstone. (Possible Reworked Glacial Till/Relic Topsoil). <i>Bands of dark brown/black organic material containing hay. Organic smell noted.</i>	3	
		4.00 4.00	D	N=14 (1,2/1,1,2,10)	4.40		Light grey MUDSTONE. (BOLLIN MUDSTONE MEMBER)	4	
		5.00 5.00	D	50 (9,10/50 for 170mm)				5	
		6.00 6.00	D	50 (8,17/50 for 125mm)	6.00		End of borehole at 6.00 m	6	
								7	
								8	
Remarks Service inspection pit hand excavated from GL to 1.20m. Groundwater seepage encountered at the base of the borehole after drilling.									



				<h1>Trial Pit Log</h1>			Trialpit No HP03 Sheet 1 of 1		
Project Name: NBIA Wythenshawe Hospital				Project No. 072094		Co-ords: - Level:		Date 03/04/2023	
Location: Wythenshawe Hospital				Dimensions (m):		0.5		Scale 1:20	
Client: Manchester University NHS Foundation Trust (MFT)				Depth 1.20		<div>0.5</div>		Logged LW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.50 - 0.60	ES		0.43			MADE GROUND: Grass over black/dark brown very clayey slightly gravelly SAND with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular of brick, concrete, mudstone and siltstone. (TOPSOIL).		
							MADE GROUND: Dark greyish brown slightly sandy, very gravelly CLAY with some cobbles. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular of brick, concrete, mudstone and siltstone.		
							Organic odour noted.		
							MADE GROUND: Soft brown mottled grey slightly silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular of siltstone and mudstone. (Reworked Glacial Till)		
				0.85					
				1.20			End of pit at 1.20 m		
Remarks: Hand pit excavated from GL to 1.20m.									
Stability: Stable									

				<h1>Trial Pit Log</h1>			Trialpit No HP04 Sheet 1 of 1		
Project Name: NBIA Wythenshawe Hospital				Project No. 072094		Co-ords: - Level:		Date 03/04/2023	
Location: Wythenshawe Hospital				Dimensions (m):		0.5		Scale 1:20	
Client: Manchester University NHS Foundation Trust (MFT)				Depth 1.20		<div>0.5</div>		Logged LW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
<div>▼</div>	0.45 - 0.55	ES		0.35		<div></div>	MADE GROUND: Grass over dark brown/black very clayey, slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, subangular of brick and rare plastic. (TOPSOIL).		
				0.85		<div></div>	MADE GROUND: Greyish brown slightly sandy, very gravelly, cobbly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular of concrete, brick, plastic. Cobbles of concrete, brick, plastic. Becoming less gravelly with depth.		
				1.20		<div></div>	MADE GROUND: Soft brown mottled grey slightly silty, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded to subangular of mudstone and siltstone. (Reworked Glacial Till)		
				End of pit at 1.20 m					
<div>1</div> <div>2</div> <div>3</div> <div>4</div>									
Remarks: Hand pit excavated from GL to 1.20m. Water at the base of the handpit.									
Stability: Stable									



				<h1>Trial Pit Log</h1>			Trialpit No HP05 Sheet 1 of 1			
Project Name: NBIA Wythenshawe Hospital				Project No. 072094		Co-ords: - Level:		Date 03/04/2023		
Location: Wythenshawe Hospital				Dimensions (m):		0.73		Scale 1:20		
Client: Manchester University NHS Foundation Trust (MFT)				Depth 0.33		<div>0.5</div>		Logged LW		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.10			Dark grey tarmac.			
				0.32			MADE GROUND: Yellowish brown sandy GRAVEL sub-base. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of limestone. Frequent cobbles of limestone.			
				0.33			<i>Large root extending from a tree towards the wall.</i>			
							MADE GROUND: Brownish red concrete foundation. End of pit at 0.33 m			
Remarks: Hand pit to inspect building foundations excavated from GL to 0.33m. Length of handpit restricted due to identified utilities.										
Stability: Stable										

Appendix C – Chemical Laboratory Testing Results

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 23/03371
Issue Number: 1

Date: 19 April, 2023

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

Project Manager: EBMA/Jonathan Lord/Lucy Woods
Project Name: NBIA, Wythenshawe MFT
Project Ref: 072094
Order No: 5312
Date Samples Received: 06/04/23
Date Instructions Received: 11/04/23
Date Analysis Completed: 19/04/23

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/1	23/03371/2	23/03371/3	23/03371/4	23/03371/5	23/03371/6	23/03371/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH02	BH02	BH03	HP01	HP02			
Depth to Top	0.90	2.50	0.50	1.50	0.50	0.60	1.00			
Depth To Bottom						0.70	1.10			
Date Sampled	04-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3	5A	5A	4AB	4AB	5AE			
% Stones >10mm _A	32.5	0.6	21.4	2.5	32.4	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	5.86	7.99	5.58	7.22	8.08	5.91	6.20	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.26	<0.01	0.07	0.03	0.17	0.01	<0.01	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	2.6	1.4	0.8	3.0	1.6	1.6	2.2	% w/w	0.1	A-T-032s
Arsenic _D ^{M#}	3	6	3	8	2	4	5	mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	2.2	<1.0	<1.0	1.2	1.1	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.5	0.6	0.6	0.8	<0.5	0.6	0.6	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	17	17	13	36	11	23	18	mg/kg	1	A-T-024s
Chromium _D ^{M#}	17	26	20	31	17	25	27	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	34	9	24	66	28	51	31	mg/kg	1	A-T-024s
Mercury _D	1.23	<0.17	0.97	<0.17	2.40	0.83	0.89	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	14	27	20	28	11	20	23	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	60	44	44	95	60	80	64	mg/kg	5	A-T-024s

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/1	23/03371/2	23/03371/3	23/03371/4	23/03371/5	23/03371/6	23/03371/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH02	BH02	BH03	HP01	HP02			
Depth to Top	0.90	2.50	0.50	1.50	0.50	0.60	1.00			
Depth To Bottom						0.70	1.10			
Date Sampled	04-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3	5A	5A	4AB	4AB	5AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD	NAD	NAD	NAD	Chrysotile & Amosite	Chrysotile & Amosite			A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-	-	Loose Fibres & Board	Loose Fibres			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	No	N/A			A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	-	-	-	-	-	<0.001	<0.001	% w/w	0.001	A-T-054

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/1	23/03371/2	23/03371/3	23/03371/4	23/03371/5	23/03371/6	23/03371/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH02	BH02	BH03	HP01	HP02			
Depth to Top	0.90	2.50	0.50	1.50	0.50	0.60	1.00			
Depth To Bottom						0.70	1.10			
Date Sampled	04-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3	5A	5A	4AB	4AB	5AE			
PAH-16MS										
Acenaphthene _A ^{M#}	0.04	<0.01	0.04	0.01	0.07	0.05	0.10	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.05	<0.02	0.09	0.05	0.26	0.16	0.21	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.11	<0.04	0.28	0.17	0.75	0.41	0.50	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.11	<0.04	0.34	0.18	0.76	0.46	0.52	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.12	<0.05	0.33	0.22	0.78	0.48	0.54	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.06	<0.05	0.23	0.11	0.45	0.30	0.37	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	0.19	0.10	0.34	0.21	0.27	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.13	<0.06	0.31	0.23	0.77	0.41	0.50	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	0.09	0.05	0.07	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.29	<0.08	0.58	0.40	1.52	0.89	1.16	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.02	<0.01	0.03	0.01	0.06	0.03	0.08	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.07	<0.03	0.27	0.13	0.54	0.33	0.43	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.21	<0.03	0.29	0.19	0.94	0.42	0.74	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.25	<0.07	0.53	0.37	1.30	0.80	1.00	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	1.46	<0.08	3.51	2.17	8.68	5.01	6.51	mg/kg	0.01	A-T-019s

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/1	23/03371/2	23/03371/3	23/03371/4	23/03371/5	23/03371/6	23/03371/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH01	BH02	BH02	BH03	HP01	HP02			
Depth to Top	0.90	2.50	0.50	1.50	0.50	0.60	1.00			
Depth To Bottom						0.70	1.10			
Date Sampled	04-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23	04-Apr-23	03-Apr-23	03-Apr-23			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3	5A	5A	4AB	4AB	5AE			
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	<1	<1	1	<1	<1	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	2	<1	2	1	4	2	2	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	9	1	31	10	77	95	326	mg/kg	1	A-T-055s
Total Aliphatics _A	12	1	33	11	82	97	328	mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1	<1	<1	<1	1	1	mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	2	<1	2	2	3	3	2	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	2	<1	3	6	18	16	11	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	6	2	19	20	78	66	144	mg/kg	1	A-T-055s
Total Aromatics _A	10	2	23	29	101	87	159	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	22	3	56	40	183	184	487	mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/8	23/03371/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP03	HP04								
Depth to Top	0.50	0.45								
Depth To Bottom	0.60	0.55								
Date Sampled	03-Apr-23	03-Apr-23								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	5ABE	5AE								
% Stones >10mm _A	24.4	31.6						% w/w	0.1	A-T-044
pH _D ^{M#}	5.74	5.52						pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.06	0.04						g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1						mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2						mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	7.0	3.5						% w/w	0.1	A-T-032s
Arsenic _D ^{M#}	11	6						mg/kg	1	A-T-024s
Boron (water soluble) _D ^{M#}	<1.0	<1.0						mg/kg	1	A-T-027s
Cadmium _D ^{M#}	0.8	<0.5						mg/kg	0.5	A-T-024s
Copper _D ^{M#}	41	26						mg/kg	1	A-T-024s
Chromium _D ^{M#}	22	18						mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1						mg/kg	1	A-T-040s
Lead _D ^{M#}	96	76						mg/kg	1	A-T-024s
Mercury _D	<0.17	0.83						mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	23	15						mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1						mg/kg	1	A-T-024s
Zinc _D ^{M#}	81	64						mg/kg	5	A-T-024s

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/8	23/03371/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP03	HP04								
Depth to Top	0.50	0.45								
Depth To Bottom	0.60	0.55								
Date Sampled	03-Apr-23	03-Apr-23								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	5ABE	5AE								
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD								A-T-045
Asbestos Matrix (visual) _D	-	-								A-T-045
Asbestos Matrix (microscope) _D	-	-								A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A								A-T-045

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/8	23/03371/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	HP03	HP04								
Depth to Top	0.50	0.45								
Depth To Bottom	0.60	0.55								
Date Sampled	03-Apr-23	03-Apr-23								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	5ABE	5AE								
PAH-16MS										
Acenaphthene _A ^{M#}	0.04	0.07						mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.03	0.02						mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.10	0.14						mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.35	0.45						mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.37	0.48						mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.40	0.49						mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.20	0.33						mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.19	0.24						mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.41	0.46						mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	0.05						mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.81	0.97						mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.04	0.04						mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.24	0.37						mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03						mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.41	0.56						mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.77	0.88						mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	4.36	5.55						mg/kg	0.01	A-T-019s

Envirolab Job Number: 23/03371

Client Project Name: NBIA, Wythenshawe MFT

Client Project Ref: 072094

Lab Sample ID	23/03371/8	23/03371/9								
Client Sample No										
Client Sample ID	HP03	HP04								
Depth to Top	0.50	0.45								
Depth To Bottom	0.60	0.55								
Date Sampled	03-Apr-23	03-Apr-23								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	5ABE	5AE								
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1						mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1						mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1						mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	2	2						mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	16	43						mg/kg	1	A-T-055s
Total Aliphatics _A	19	45						mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1						mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1						mg/kg	1	A-T-055s
Aro >C12-C16 _A	3	2						mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	13	7						mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	52	32						mg/kg	1	A-T-055s
Total Aromatics _A	68	42						mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	87	87						mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

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

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	23/03371
Project:	NBIA, Wythenshawe MFT	Date Received:	11/04/2023 (am)
Clients Project No:	072094	Cool Box Temperatures (°C):	11.9

NO DEVIATIONS IDENTIFIED

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

Envirolab Analysis Dates

Lab Sample ID	23/03371/1	23/03371/2	23/03371/3	23/03371/4	23/03371/5	23/03371/6	23/03371/7	23/03371/8	23/03371/9
Client Sample No									
Client Sample ID/Depth	BH01 0.90m	BH01 2.50m	BH02 0.50m	BH02 1.50m	BH03 0.50m	HP01 0.60-0.70m	HP02 1.00-1.10m	HP03 0.50-0.60m	HP04 0.45-0.55m
Date Sampled	04/04/23	04/04/23	03/04/23	03/04/23	04/04/23	03/04/23	03/04/23	03/04/23	03/04/23
A-T-004s	18/04/2023		18/04/2023			18/04/2023	18/04/2023	18/04/2023	18/04/2023
A-T-007s	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-019s	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-022s	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-024s	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023
A-T-025w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-026s	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023
A-T-026w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-026w (F)	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-027s	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023
A-T-030s	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-031s	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-031w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-032s	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	18/04/2023	18/04/2023	17/04/2023	17/04/2023
A-T-032w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-037w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-040s	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023	18/04/2023
A-T-042sTCN	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023
A-T-044	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-045	12/04/2023	12/04/2023	12/04/2023	12/04/2023	12/04/2023	12/04/2023	12/04/2023	12/04/2023	12/04/2023
A-T-050s	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023
A-T-050w	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
A-T-054						17/04/2023	17/04/2023		
A-T-055s	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023	14/04/2023
A-T-ANCs	19/04/2023		19/04/2023			19/04/2023	19/04/2023	19/04/2023	19/04/2023
Calc-As Recd	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023	17/04/2023
Calc-no stones	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023
Probe (w)	17/04/2023		17/04/2023			17/04/2023	17/04/2023	17/04/2023	17/04/2023

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Final Test Report

Envirolab Job Number: 23/03371
Issue Number: 1

Date: 19-Apr-23

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

Project Manager: EBMA/Jonathan Lord/Lucy Woods
Project Name: NBIA, Wythenshawe MFT
Project Ref: 72094
Order No: 5312

Date Samples Received: 6-Apr-23
Date Instructions Received: 11-Apr-23
Date Analysis Completed: 19-Apr-23

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

HWOL TPH Code: EH_CU_1D_AL: Extractable hydrocarbons - i.e. everything extracted by the solvent(s), Clean-up - e.g. by florisil, silica gel, GC - Single coil gas chromatography, Aliphatics only

Approved by:



Richard Wong
Client Manager

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	23/03371/1				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				BH01				
Depth to Top				0.9				
Depth to Bottom								
Date Sampled				04/04/2023				
Sample Type				Soil - ES				
Sample Matrix Code				4AB				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	N	N	5.86	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.59	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.05	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	2.4	-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	1.51	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	1.58	100	-	-	
Mineral Oil (mg/kg) _{A EH_CU_1D_AL}	A-T-007	N	N	46	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.007	0.070	0.5	2	25
Barium	A-T-025	N	N	0.030	0.300	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.001	0.010	0.5	10	70
Copper	A-T-025	N	N	<0.004	<0.04	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.008	0.080	0.5	10	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	10	40
Lead	A-T-025	N	N	<0.001	<0.01	0.5	10	50
Antimony	A-T-025	N	N	0.006	0.060	0.06	0.7	5
Selenium	A-T-025	N	N	0.001	0.010	0.1	0.5	7
Zinc	A-T-025	N	N	<0.002	<0.02	4	50	200
Chloride	A-T-026	N	N	8	84	800	15000	25000
Fluoride	A-T-026	N	N	0.4	4.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	44	438	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	155	1550	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	10.6				
Conductivity (µS/cm)	A-T-037	N	N	310				
Mass Sample (kg)				0.219				
Dry Matter (%)	A-T-044	N	N	80				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits		
Lab Sample ID	Method	ISO17025	MCERTS	23/03371/3	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Client Sample Number							
Client Sample ID				BH02			
Depth to Top				0.5			
Depth to Bottom							
Date Sampled				03/04/2023			
Sample Type				Soil - ES			
Sample Matrix Code				5A			
Solid Waste Analysis							
pH (pH Units) _D	A-T-031	N	N	5.58	-	>6	-
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.38	-	to be evaluated	to be evaluated
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.11	-	to be evaluated	to be evaluated
Loss on Ignition (%) _D	A-T-030	N	N	2	-	-	10
Total Organic Carbon (%) _D	A-T-032	N	N	0.45	3	5	6
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	3.67	100	-	-
Mineral Oil (mg/kg) _{A EH CU 1D AL}	A-T-007	N	N	32	500	-	-
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-
Eluate Analysis					Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
				10:1 mg/l	mg/kg		
Arsenic	A-T-025	N	N	0.005	0.050	0.5	25
Barium	A-T-025	N	N	0.074	0.740	20	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	5
Chromium	A-T-025	N	N	0.001	0.010	0.5	70
Copper	A-T-025	N	N	0.006	0.060	2	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	2
Molybdenum	A-T-025	N	N	0.004	0.040	0.5	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	40
Lead	A-T-025	N	N	0.032	0.320	0.5	50
Antimony	A-T-025	N	N	0.001	0.010	0.06	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	7
Zinc	A-T-025	N	N	0.015	0.150	4	200
Chloride	A-T-026	N	N	9	91	800	25000
Fluoride	A-T-026	N	N	0.5	5.0	10	500
Sulphate as SO ₄	A-T-026	N	N	<1.00	<10	1000	50000
Total Dissolved Solids	A-T-035	N	N	60	600	4000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	1000
Leach Test Information							
pH (pH Units)	A-T-031	N	N	8.6			
Conductivity (µS/cm)	A-T-037	N	N	121			
Mass Sample (kg)				0.204			
Dry Matter (%)	A-T-044	N	N	85.6			
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation							

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	23/03371/6				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				HP01				
Depth to Top				0.6				
Depth to Bottom				0.70				
Date Sampled				03/04/2023				
Sample Type				Soil - ES				
Sample Matrix Code				4AB				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	N	N	5.91	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.35	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.11	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N		-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	0.95	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	5.08	100	-	-	
Mineral Oil (mg/kg) _{A EH_CU_1D_AL}	A-T-007	N	N	69	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.006	0.060	0.5	2	25
Barium	A-T-025	N	N	0.065	0.650	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.007	0.070	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.006	0.060	0.5	10	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	10	40
Lead	A-T-025	N	N	0.020	0.200	0.5	10	50
Antimony	A-T-025	N	N	0.001	0.010	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.012	0.120	4	50	200
Chloride	A-T-026	N	N	5	50	800	15000	25000
Fluoride	A-T-026	N	N	0.7	7.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	15	152	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	52	520	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	8.2				
Conductivity (µS/cm)	A-T-037	N	N	103				
Mass Sample (kg)				0.213				
Dry Matter (%)	A-T-044	N	N	82				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details				Landfill Waste Acceptance Criteria Limits				
Lab Sample ID	Method	ISO17025	MCERTS					
				23/03371/7				
Client Sample Number				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill		
Client Sample ID								
Depth to Top								
Depth to Bottom								
Date Sampled								
Sample Type								
Sample Matrix Code								
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	N	N	6.20	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.73	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.21	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N		-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	1.3	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	6.63	100	-	-	
Mineral Oil (mg/kg) _A EH_CU_1D_AL	A-T-007	N	N	<10	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.006	0.060	0.5	2	25
Barium	A-T-025	N	N	0.061	0.610	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	0.006	0.060	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	<0.001	<0.01	0.5	10	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	10	40
Lead	A-T-025	N	N	0.024	0.240	0.5	10	50
Antimony	A-T-025	N	N	<0.001	<0.01	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.016	0.160	4	50	200
Chloride	A-T-026	N	N	3	27	800	15000	25000
Fluoride	A-T-026	N	N	0.3	3.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	4	40	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	41	410	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	8.6				
Conductivity (µS/cm)	A-T-037	N	N	82				
Mass Sample (kg)				0.204				
Dry Matter (%)	A-T-044	N	N	85.9				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	23/03371/8				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				HP03				
Depth to Top				0.5				
Depth to Bottom				0.60				
Date Sampled				03/04/2023				
Sample Type				Soil - ES				
Sample Matrix Code				5ABE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	N	N	5.74	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.15	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.04	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	8.3	-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	4.02	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	4.45	100	-	-	
Mineral Oil (mg/kg) _{A EH_CU_1D_AL}	A-T-007	N	N	20	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.002	0.020	0.5	2	25
Barium	A-T-025	N	N	0.065	0.650	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	<0.001	<0.01	0.5	10	70
Copper	A-T-025	N	N	<0.004	<0.04	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.014	0.140	0.5	10	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	10	40
Lead	A-T-025	N	N	0.002	0.020	0.5	10	50
Antimony	A-T-025	N	N	0.002	0.020	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	<0.002	<0.02	4	50	200
Chloride	A-T-026	N	N	<1.00	<10	800	15000	25000
Fluoride	A-T-026	N	N	0.7	7.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	16	162	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	110	1100	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.9				
Conductivity (µS/cm)	A-T-037	N	N	220				
Mass Sample (kg)				0.225				
Dry Matter (%)	A-T-044	N	N	77.7				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

Sample Details					Landfill Waste Acceptance Criteria Limits			
Lab Sample ID	Method	ISO17025	MCERTS	23/03371/9				
Client Sample Number					Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Client Sample ID				HP04				
Depth to Top				0.45				
Depth to Bottom				0.55				
Date Sampled				03/04/2023				
Sample Type				Soil - ES				
Sample Matrix Code				5AE				
Solid Waste Analysis								
pH (pH Units) _D	A-T-031	N	N	5.52	-	>6	-	
ANC to pH 4 (mol/kg) _D	A-T-ANC	N	N	0.4	-	to be evaluated	to be evaluated	
ANC to pH 6 (mol/kg) _D	A-T-ANC	N	N	0.1	-	to be evaluated	to be evaluated	
Loss on Ignition (%) _D	A-T-030	N	N	5.4	-	-	10	
Total Organic Carbon (%) _D	A-T-032	N	N	2.04	3	5	6	
PAH Sum of 17 (mg/kg) _A	A-T-019	N	N	5.69	100	-	-	
Mineral Oil (mg/kg) _A EH_CU_1D_AL	A-T-007	N	N	28	500	-	-	
Sum of 7 PCBs (mg/kg) _A	A-T-004	N	N	<0.007	1	-	-	
Sum of BTEX (mg/kg) _A	A-T-022	N	N	<0.01	6	-	-	
Eluate Analysis				10:1 mg/l	10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic	A-T-025	N	N	0.005	0.050	0.5	2	25
Barium	A-T-025	N	N	0.069	0.690	20	100	300
Cadmium	A-T-025	N	N	<0.001	<0.01	0.04	1	5
Chromium	A-T-025	N	N	0.001	0.010	0.5	10	70
Copper	A-T-025	N	N	0.014	0.140	2	50	100
Mercury	A-T-025	N	N	<0.0005	<0.005	0.01	0.2	2
Molybdenum	A-T-025	N	N	0.004	0.040	0.5	10	30
Nickel	A-T-025	N	N	<0.002	<0.02	0.4	10	40
Lead	A-T-025	N	N	0.038	0.380	0.5	10	50
Antimony	A-T-025	N	N	0.002	0.020	0.06	0.7	5
Selenium	A-T-025	N	N	<0.001	<0.01	0.1	0.5	7
Zinc	A-T-025	N	N	0.013	0.130	4	50	200
Chloride	A-T-026	N	N	2	24	800	15000	25000
Fluoride	A-T-026	N	N	0.9	9.0	10	150	500
Sulphate as SO ₄	A-T-026	N	N	18	183	1000	20000	50000
Total Dissolved Solids	A-T-035	N	N	68	680	4000	60000	100000
Phenol Index	A-T-050	N	N	<0.01	<0.1	1	-	-
Dissolved Organic Carbon	A-T-032	N	N	<2.0	<200	500	800	1000
Leach Test Information								
pH (pH Units)	A-T-031	N	N	7.6				
Conductivity (µS/cm)	A-T-037	N	N	135				
Mass Sample (kg)				0.202				
Dry Matter (%)	A-T-044	N	N	86.6				
Stated acceptance limits are for guidance only and Envirolab cannot be held responsible for any discrepancies with current legislation								

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 23/05149
Issue Number: 1
Date: 06 June, 2023

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

Project Manager: EBMA/Jonathan Lord/Lucy Woods
Project Name: NBIA- Wythenshawe Hospital
Project Ref: 072094
Order No: 6537
Date Samples Received: 26/05/23
Date Instructions Received: 26/05/23
Date Analysis Completed: 06/06/23

Approved by:



Richard Wong
Client Manager

Envirolab Job Number: 23/05149

Client Project Name: NBIA- Wythenshawe Hospital

Client Project Ref: 072094

Lab Sample ID	23/05149/1	23/05149/2						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	BH01	BH02								
Depth to Top	2.56	4.18								
Depth To Bottom	4.14	5.07								
Date Sampled	24-May-23	24-May-23								
Sample Type	WATER - EW	WATER - EW								
Sample Matrix Code	N/A	N/A								
Ali >C5-C6 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Ali >C6-C8 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Aro >C5-C7 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Aro >C7-C8 (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - Benzene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - Toluene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - Ethyl Benzene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - m & p Xylene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
BTEX - o Xylene (w) _A [#]	<1	<1						µg/l	1	A-T-022w
MTBE (w) _A [#]	<1	<1						µg/l	1	A-T-022w
Dissolved Methane (CH ₄) (w) _A	<1	409						µg/l	1	A-T-058w

Report Notes

General

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

Key

Superscript "#"	Accredited to ISO 17025
Superscript "M"	Accredited to MCertS
Superscript "U"	Individual result not accredited
None of the above symbols	Analysis unaccredited
Subscript "A"	Analysis performed on as-received Sample
Subscript "D"	Analysis performed on the dried sample, crushed to pass 2mm sieve.
Subscript "A"	Analysis has dependant options against results. Details appear in the comments of your Sample receipt
IS	Insufficient Sample for analysis
US	Unsuitable Sample for analysis
NDP	No Determination Possible
NAD	No Asbestos Detected
N/A	Not applicable

Asbestos

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

Assigned Matrix Codes

1	SAND	6	CLAY/LOAM	A	Contains Stones
2	LOAM	7	OTHER	B	Contains Construction Rubble
3	CLAY	8	Asbestos Bulk (Only Asbestos ID accredited)	C	Contains visible hydrocarbons
4	LOAM/SAND	9	Incinerator Ash (some Metals accredited)	D	Contains glass / metal
5	SAND/CLAY			E	Contains roots / twigs

Note: 7,8,9 matrices are not covered by our ISO 17025 or MCertS accreditation, unless stated above.

Soil Chemical Analysis:

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

TPH by method A-T-007:

For waters, free and visible oils are excluded from the sample used for analysis, so the reported result represents the dissolved phase only.
 Results "with Clean up" indicates samples cleaned up with Silica during extraction.

EPH CWG (method A-T-055) from TPH CWG:

EPH CWG results have humics mathematically subtracted through instrument calculation.
 Where these humic substances have been identified in any IDs from "TPH CWG with clean up" please note that the concentration is **NOT** included in the quantified results but present in the ID for information.

Electrical Conductivity of water by method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the accreditation range and as such are unaccredited.

Please contact your client manager if you require any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	23/05149
Project:	NBIA- Wythenshawe Hospital	Date Received:	26/05/2023 (am)
Clients Project No:	072094	Cool Box Temperatures (°C):	15.6

NO DEVIATIONS IDENTIFIED

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

Envirolab Analysis Dates

Lab Sample ID	23/05149/1	23/05149/2
Client Sample No		
Client Sample ID/Depth	BH01 2.56-4.14m	BH02 4.18-5.07m
Date Sampled	24/05/23	24/05/23
A-T-022w	31/05/2023	31/05/2023
A-T-058w	06/06/2023	06/06/2023

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix D – Geotechnical Laboratory Testing Results

Jonathan Lord
Curtins
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Manchester
M1 5WG

i2 Analytical Ltd.
7 Woodshots Meadow,
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Herts,
WD18 8YS

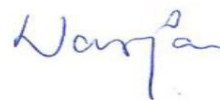
e: jonathan.lord@curtins.com

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

Analytical Report Number : 23-27193

Project / Site name:	NBIA - Wythenshawe - MFT	Samples received on:	06/04/2023
Your job number:	B072094	Samples instructed on/ Analysis started on:	06/04/2023
Your order number:	5313	Analysis completed by:	20/04/2023
Report Issue Number:	1	Report issued on:	21/04/2023
Samples Analysed:	4 soil 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: 23-27193

Project / Site name: NBIA - Wythenshawe - MFT

Your Order No: 5313

Lab Sample Number				2641360	2641361	2641362	2641363
Sample Reference				BH01	BH01	BH02	BH03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				3.00	5.00	4.00	2.00
Date Sampled				04/04/2023	04/04/2023	03/04/2023	04/04/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	8.2	13	19
Total mass of sample received	kg	0.001	NONE	0.5	0.5	0.5	0.5

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7	8.6	8.2	7.3
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.027	0.042	0.026	0.2
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	26.7	41.8	25.9	205
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	11	5.3	7.8	17
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	21	23	22	24
Magnesium (leachate equivalent)	mg/l	2.5	NONE	11	11	11	12

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

Analytical Report Number : 23-27193

Project / Site name: NBIA - Wythenshawe - MFT

* 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 *
2641360	BH01	None Supplied	3	Brown clay and sand.
2641361	BH01	None Supplied	5	Brown clay and sand.
2641362	BH02	None Supplied	4	Brown clay and sand.
2641363	BH03	None Supplied	2	Brown clay and sand.

Analytical Report Number : 23-27193

Project / Site name: NBIA - Wythenshawe - MFT

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
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
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
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

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

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

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

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 04/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

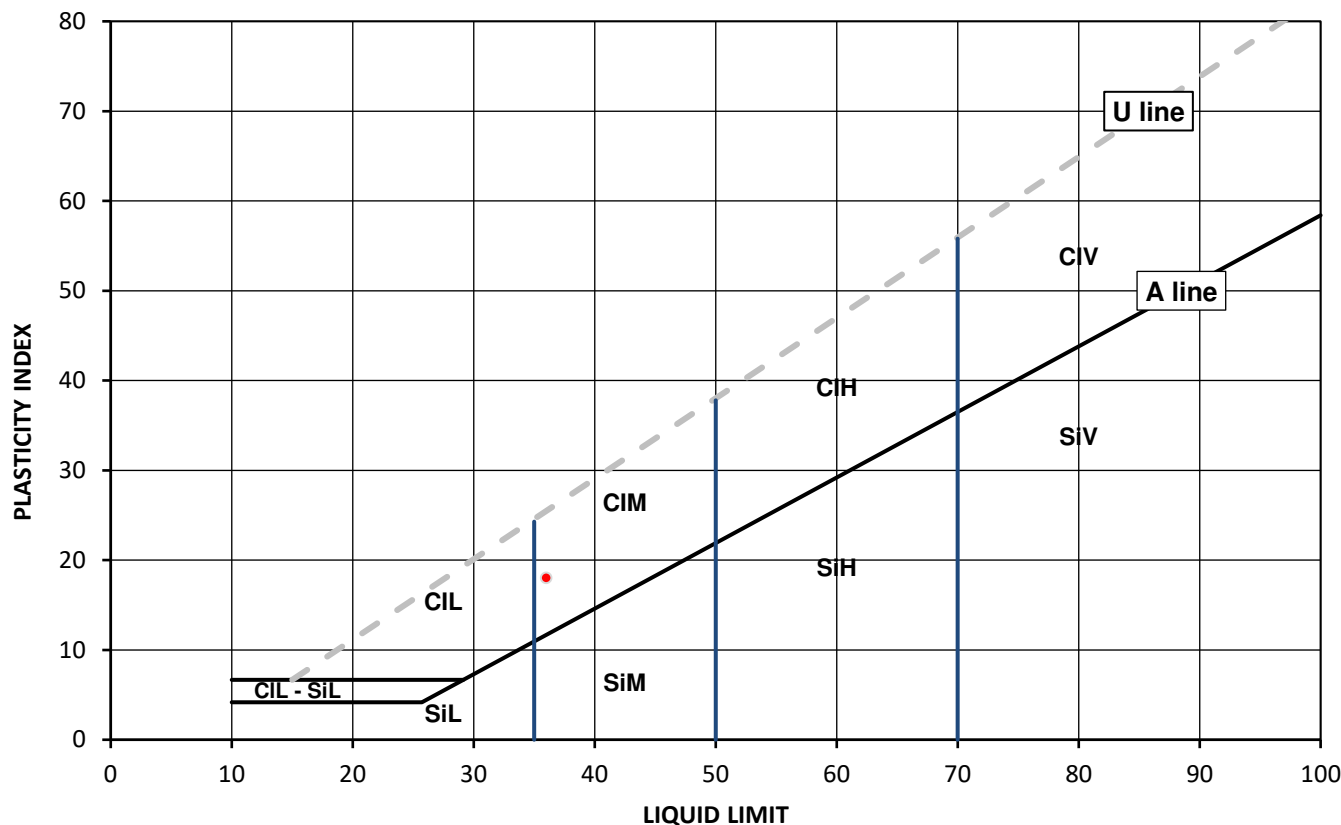
Test Results:

Laboratory Reference: 2641353
Hole No.: BH01
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 4.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
19	36	18	18	100



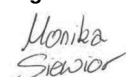
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:



Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

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i2 Analytical Ltd
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Brackmills Industrial Estate
Northampton NN4 7EB

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 03/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

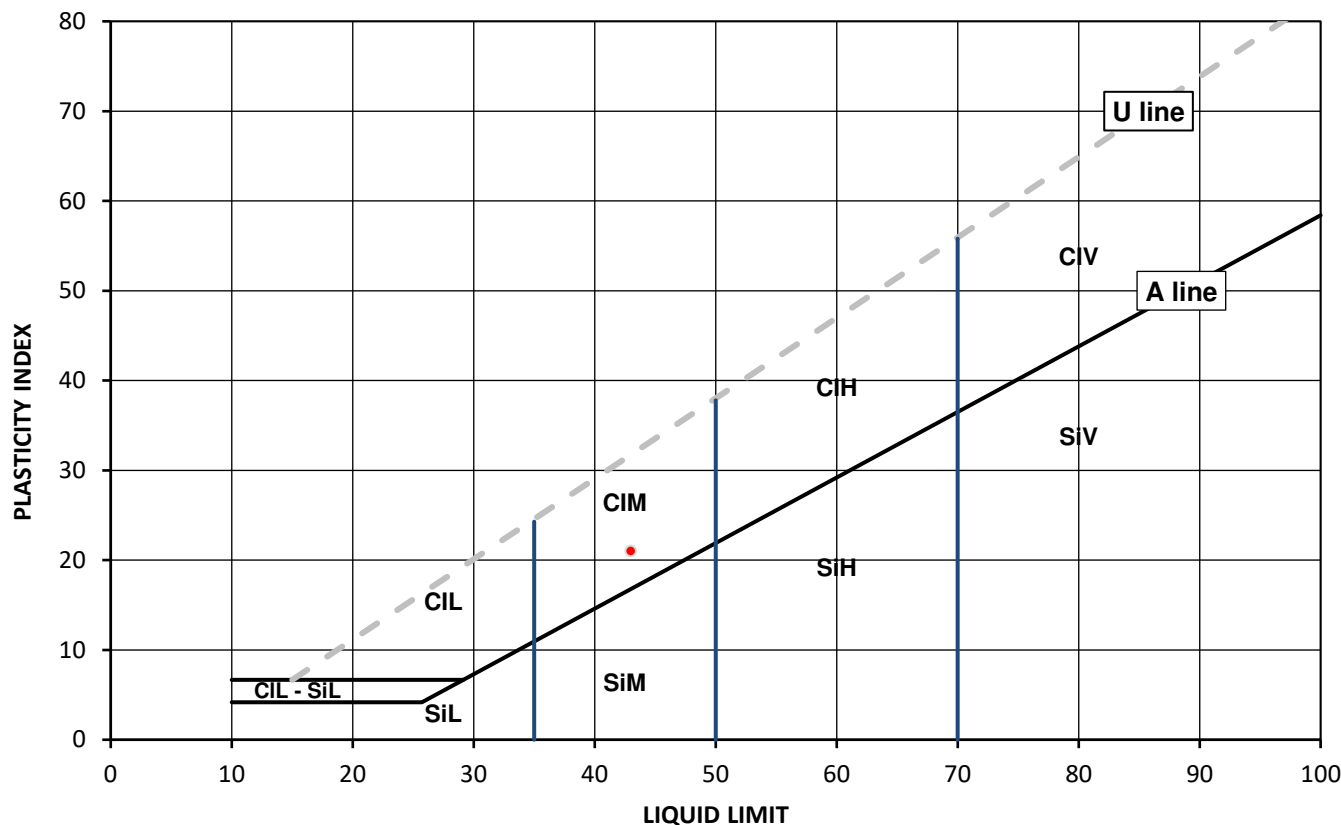
Test Results:

Laboratory Reference: 2641355
Hole No.: BH02
Sample Reference: Not Given
Sample Description: Greyish brown slightly gravelly sandy CLAY

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
23	43	22	21	80



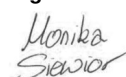
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:



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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 03/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

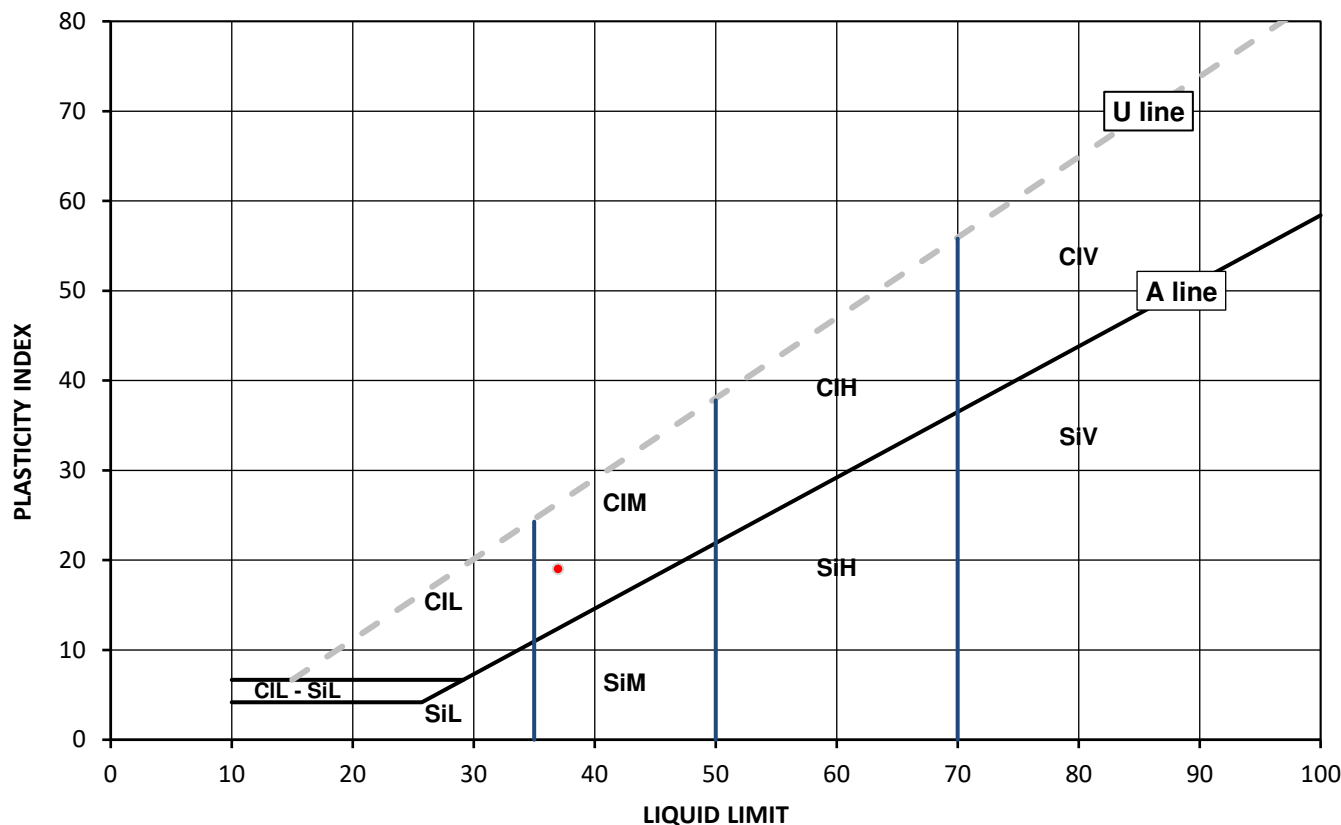
Test Results:

Laboratory Reference: 2641357
Hole No.: BH02
Sample Reference: Not Given
Sample Description: Brownish grey sandy CLAY

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
10	37	18	19	100



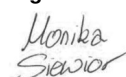
Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl	Clay	L Low below 35
Si	Silt	M Medium 35 to 50
	H High 50 to 70	V Very high exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:



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TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS
Tested in Accordance with: BS 1377-2:1990: Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 04/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

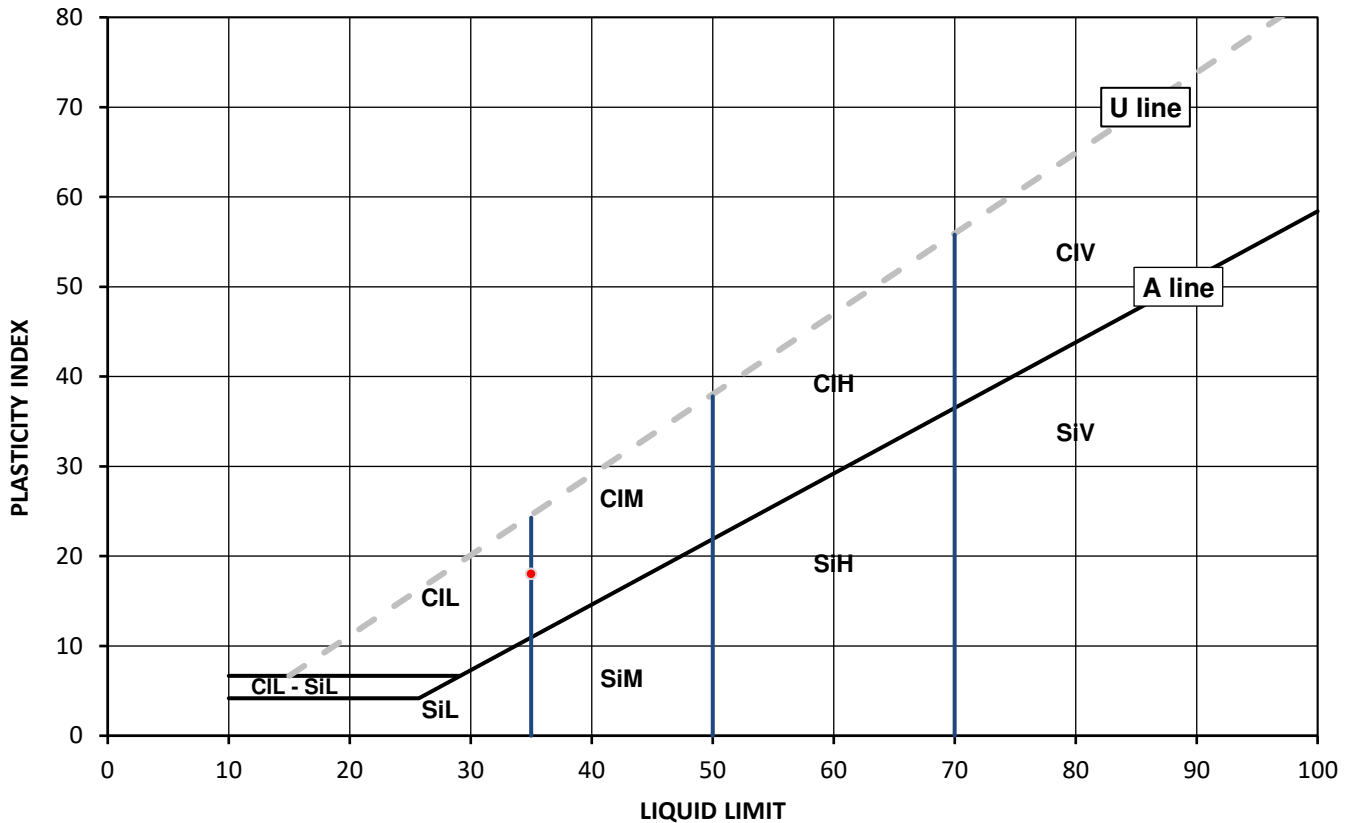
Test Results:

Laboratory Reference: 2641359
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Brown sandy CLAY

Depth Top [m]: 5.00
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested in natural condition

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
9.8	35	17	18	100



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Clay	Plasticity	Liquid Limit
Cl	Clay	L Low	below 35
Si	Silt	M Medium	35 to 50
		H High	50 to 70
		V Very high	exceeding 70
		O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

4041

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Water Content by BS 1377-2:1990: Clause 3.2 Atterberg by BS 1377-2: 1990:
Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 03/04 - 04/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Water Content BS 1377-2 [W] %	Water Content BS EN ISO 17892-2 [W] %	Atterberg				Density			Total Porosity# %		
		Reference	Depth Top	Depth Base	Type					% Passing 425um	WL	Wp	Ip	bulk	dry	PD			
			m	m						%	%	%	%	Mg/m3	Mg/m3	Mg/m3			
2641353	BH01	Not Given	4.00	Not Given	D	Brown sandy CLAY	Atterberg 4 Point	19		100	36	18	18						
2641355	BH02	Not Given	2.00	Not Given	D	Greyish brown slightly gravelly sandy CLAY	Atterberg 4 Point	23		80	43	22	21						
2641357	BH02	Not Given	5.00	Not Given	D	Brownish grey sandy CLAY	Atterberg 4 Point	10		100	37	18	19						
2641359	BH03	Not Given	5.00	Not Given	D	Brown sandy CLAY	Atterberg 4 Point	9.8		100	35	17	18						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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4041

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 03/04 - 04/04/2023
Date Received: 06/04/2023
Date Tested: 18/04/2023
Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2641353	BH01	Not Given	4.00	Not Given	D	Brown sandy CLAY		19	Sample was quartered, oven dried at 106.2 °C			
2641355	BH02	Not Given	2.00	Not Given	D	Greyish brown slightly gravelly sandy CLAY		23	Sample was quartered, oven dried at 106.2 °C			
2641357	BH02	Not Given	5.00	Not Given	D	Brownish grey sandy CLAY		10	Sample was quartered, oven dried at 106.2 °C			
2641359	BH03	Not Given	5.00	Not Given	D	Brown sandy CLAY		9.8	Sample was quartered, oven dried at 106.2 °C			

Comments:

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Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

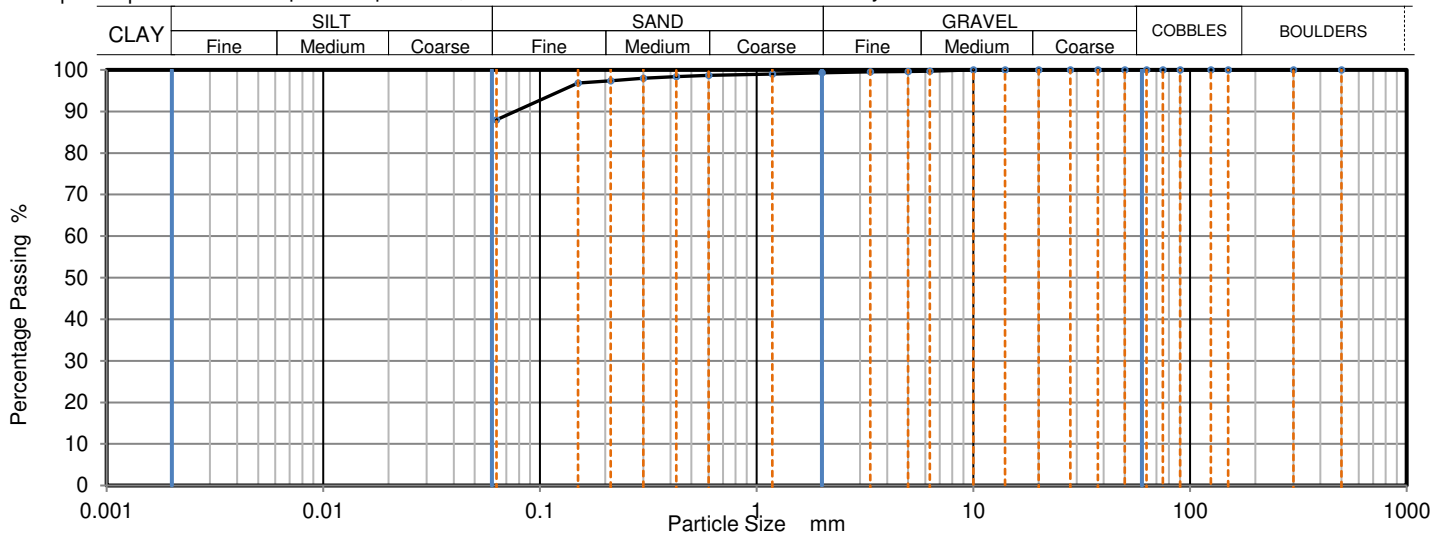
Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 04/04/2023
Date Received: 06/04/2023
Date Tested: 20/04/2023
Sampled By: Not Given

Test Results:

Laboratory Reference: 2641354
Hole No.: BH01
Sample Reference: Not Given
Sample Description: Brown slightly sandy clayey SILT
Sample Preparation: Sample was quartered, oven dried at 107.0 °C and broken down by hand.

Depth Top [m]: 4.00
Depth Base [m]: 4.50
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.6	99		
0.425	98		
0.3	98		
0.212	97		
0.15	97		
0.063	88		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	11
Fines <0.063mm	88

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	N/A
Curvature Coefficient	

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

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Client: Curtins
Client Address: 17-19 Whitworth Street West, Manchester,
M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

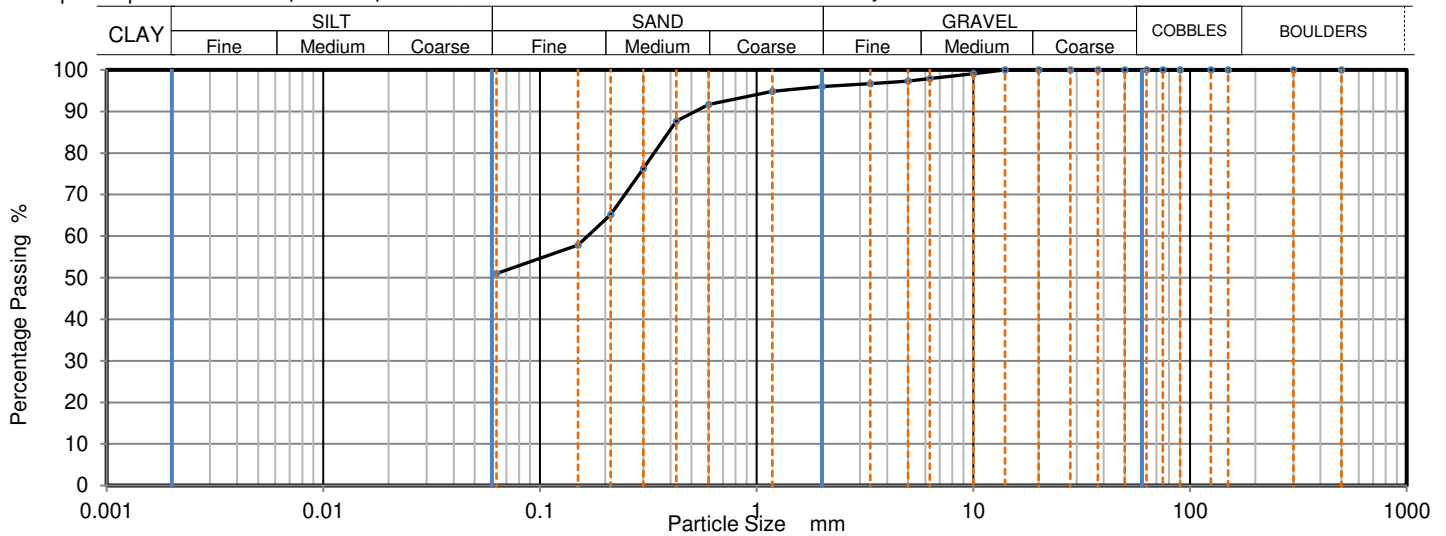
Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 03/04/2023
Date Received: 06/04/2023
Date Tested: 20/04/2023
Sampled By: Not Given

Test Results:

Laboratory Reference: 2641356
Hole No.: BH02
Sample Reference: Not Given
Sample Description: Dark brown slightly organic sandy clayey SILT with fragments of rootlets
Sample Preparation: Sample was quartered, oven dried at 107.0 °C and broken down by hand.

Depth Top [m]: 2.00
Depth Base [m]: 2.50
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	98		
5	97		
3.35	97		
2	96		
1.18	95		
0.6	92		
0.425	88		
0.3	76		
0.212	65		
0.15	58		
0.063	52		

Sample Proportions	% dry mass
Very coarse	0
Gravel	4
Sand	45
Fines <0.063mm	51

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 2.6
Curvature Coefficient	

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
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M1 5WG

Contact: Jonathan Lord
Site Address: NBIA - Wythenshawe - MFT

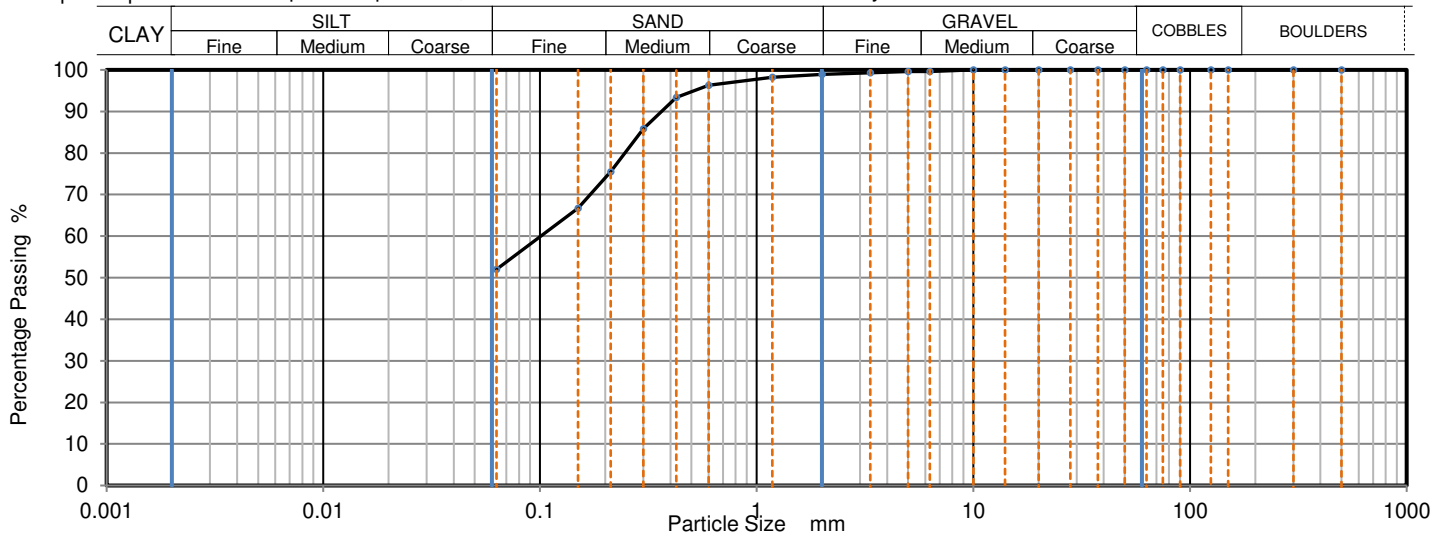
Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Client Reference: B072094
Job Number: 23-27192-1
Date Sampled: 04/04/2023
Date Received: 06/04/2023
Date Tested: 20/04/2023
Sampled By: Not Given

Test Results:

Laboratory Reference: 2641358
Hole No.: BH03
Sample Reference: Not Given
Sample Description: Dark brown slightly organic sandy clayey SILT with fragments of rootlets
Sample Preparation: Sample was quartered, oven dried at 107.0 °C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 3.50
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	98		
0.6	96		
0.425	93		
0.3	86		
0.212	76		
0.15	67		
0.063	52		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	46
Fines <0.063mm	52

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 1.6
Curvature Coefficient	

Uniformity and Curvature Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

Signed:

Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Appendix E – GAC Screening Thresholds

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130⁽¹⁰⁾	180⁽¹⁰⁾	53⁽¹¹⁾	980⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - EC ₄₄	1700	1900	1600	28000	3800	7900
Aliph + Arom EC >44-70	1900	1900	3000	28000	3800	7900
Aromatic						
Benzene	0.33 0.87	1.0 3.3	0.07 0.18	95 98	73 140	110 230
Ethyl benzene	350	840	90	2800⁽⁸⁾ [66000]	2800⁽⁸⁾ [25000]	2800⁽⁸⁾ [27000]
Toluene	610	2700	120	4400⁽⁸⁾ [190000]	4400⁽⁸⁾ [56000]	4400⁽⁸⁾ [100000]
Xylene ⁽⁹⁾	230	290	160	2600⁽⁸⁾ [32000]	2600⁽⁸⁾ [43000]	2600⁽⁸⁾ [31000]
Phenol	420	520	280	3200⁽¹⁴⁾ (38000)	3200⁽¹⁴⁾ (10000)	3200⁽¹⁴⁾ (9300)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	13	13	24	1100	4900	3000
Acenaphthylene	920	6000	160	100000	15000	30000
Acenaphthene	1100	6000	200	100000	15000	30000
Fluorene	860	4500	160	71000	9900	20000
Phenanthrene	440	1500	90	23000	3100	6300
Anthracene	11000	37000	2200	540000	74000	150000
Fluoranthene	890	1600	290	23000	3100	6400
Pyrene	2000	3800	620	54000	7400	15000
Benz(a)anthracene	13	15	13	180	29	62
Chrysene	27	32	19	350	57	120
Benzo(b)fluoranthene	3.7	4.0	3.9	45	7.2	16.0
Benzo(k)fluoranthene	100	110	130	1200	190	440
Benzo(a)pyrene	3.0 5.0	3.2 5.3	3.5 5.7	36 77	5.7 10	13 21
Indeno(123cd)pyrene	41	46	39	510	82	180
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4
Benzo(ghi)perylene	350	360	640	4000	640	1600
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0014	0.0015	0.0018	0.12	3.5	5.4
Trichloroethene (TCE)	0.075	0.08	0.21	5.7	120	120
1,1,1,2 Tetrachlorethane	6.4	8.2	4.4	560	1400	2100
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

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

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (elemental)	1	1	26	26	16	26 ⁽⁸⁾ [30]
Mercury (inorganic)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₆	78	78	1700	5900	590000	130000
EC ₆ - EC ₈	230	230	5600	17000	610000	220000
EC ₈ - EC ₁₀	65	65	770	4800	13000	18000
EC ₁₀ - EC ₁₂	330	330	4400	23000	13000	23000
EC ₁₂ - EC ₁₆	2400	2400	13000	82000	13000	25000
EC ₁₆ - EC ₃₅	92000	92000	270000	1700000	250000	480000
EC ₃₅ - EC ₄₄	92000	92000	270000	1700000	250000	480000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₇	140	690	27	46000	56000	84000
EC ₇ - EC ₈	290	1800	51	110000	56000	95000
EC ₈ - EC ₁₀	83	110	21	8100	5000	8500
EC ₁₀ - EC ₁₂	180	590	31	28000	5000	9700
EC ₁₂ - EC ₁₆	330	2300	57	37000	5100	10000
EC ₁₆ - EC ₂₁	540	1900	110	28000	3800	7700
EC ₂₁ - EC ₃₅	1500	1900	820	28000	3800	7800
EC ₃₅ - EC ₄₄	1500	1900	820	28000	3800	7800
Aliph + Arom EC >44-70	1800	1900	2100	28000	3800	7800
<i>Aromatic</i>						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200⁽⁸⁾ [35000]	1200⁽⁸⁾ [24000]	1200⁽⁸⁾ [22000]
Toluene	270	1300	51	1900⁽⁸⁾ [110000]	1900⁽⁸⁾ [56000]	1900⁽⁸⁾ [95000]
Xylene ⁽⁹⁾	98	120	70	1200⁽⁸⁾ [14000]	1200⁽⁸⁾ [42000]	1200⁽⁸⁾ [23000]
Phenol	290	420	140	1500⁽¹⁴⁾ (35000)	1500⁽¹⁴⁾ (10000)	1500⁽¹⁴⁾ (8300)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
Naphthalene	5.6	5.6	10	460	4900	1900
Acenaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4.0	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	2.7	3.2	2	35	5.7	12
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00087	0.001	0.001	0.077	3.5	5
Trichloroethene (TCE)	0.034	0.036	0.091	2.6	120	91
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



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

Notes

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

Appendix F – Ground Gas Monitoring Results

Curtins

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

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: NBIA Wythenshawe **Date:** 20/04/2023
Job Number: B072094 **Visit:** 1
Client: Manchester University NHS F **Weather:** Sunny
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	-	-	-	-	-	-	-	-	-	-	-	-	1
BH02	1018	17.8	2.5	68.3	42.1	26.2	16.7	8.5	0	0	4.16	5.11	2
BH03	1017	0.0	0.0	36.1	36.1	21.8	21.8	1.6	0	0	3.81	4.08	3

Notes**Logged by**

- 1 Van parked over monitoring position from 3:30pm to 5:15pm - unable to monitor
2 Steady State achieved after 6 minutes
3 Steady State achieved after 1.25 minutes

LW

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

Curtins

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

Tel: 0161 236 2394

Fax: 0161 228 7902

**GAS MONITORING LOG SHEET**

Project: NBIA Wythenshawe **Date:** 03/05/2023
Job Number: B072094 **Visit:** 2
Client: Manchester University NHS Fc **Weather:** Sunny
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	1022	-42.2	0.0	25.0	15.4	2.4	1.5	14.80	0	0	1.96	4.19	1,2,3
BH02	1020	25.1	0.0	62.5	46.6	30.8	23.4	7.10	0	0	3.78	5.09	4,5
BH03	1019	0.0	0.0	0.0	0.0	0.2	0.2	20.7	0	0	4.04	4.08	

Notes**Logged by**

- 1 Steady state gas flow rate achieved after 6.15 minutes
2 Test stopped after monitoring for an hour
3 Methane level fluctuated throughout monitoring at 52 minutes methane level reduced down to 9.8
4 Steady state gas flow rate achieved after 9.31 minutes
5 Test stopped after monitoring for 40 minutes

JP

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

Curtins

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

Tel: 0161 236 2394

Fax: 0161 228 7902



GAS MONITORING LOG SHEET

Project: NBIA Wythenshawe **Date:** 18.05.23
Job Number: B072094 **Visit:** 3
Client: Manchester University NHS Foundation **Weather:** Sunny, dry
Barometric State: Rising **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	1023	-68.9	-0.1	15.8	11.9	4.3	3.4	13.4	0	0	2.23	4.92	1, 2
BH02	1022	16.5	1.2	80.4	20.0	35.9	11.8	14.0	0	0	4.10	5.01	3, 4
BH03	1022	3.5	0.0	47.8	47.8	37.5	37.5	0.0	0	0	3.96	4.08	5, 6

Notes

- 1 Steady state gas flow reached after 5 minutes.
- 2 Steady state methane and carbon dioxide reached after 3 minutes.
- 3 Steady state gas flow reached after 5 minutes.
- 4 Steady state methane and carbon dioxide reached after 10 minutes.
- 5 Steady state gas flow reached immediately.
- 6 Steady state methane and carbon dioxide reached after 1.15 minutes.

Logged by

LW

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

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**GAS MONITORING LOG SHEET**

Project: NBIA Wythenshawe **Date:** 24.05.23
Job Number: B072094 **Visit:** 4
Client: Manchester University NHS F **Weather:** Sunny
Barometric State: Rising **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	1019	0.5	0.0	24.0	23.4	7.5	7.4	5.5	0	0	2.56	4.14	1, 2, 5
BH02	1020	7.6	0.0	38.9	14.2	21.0	7.5	16.1	0	10	4.18	5.07	3, 5
BH03	1017	0.1	0.0	45.7	45.2	36.4	36.4	1.2	0	0	4.00	4.07	4, 6

Notes

- 1 Hissed upon opening the well
- 2 Flow reached steady state after 60 seconds
- 3 Flow reached steady state after 2 minutes
- 4 Flow reached steady state after 30 seconds
- 5 Water samples taken - testing for dissolved oxygen and TPH
- 6 Water too shallow to obtain a sample.

Logged by

LW

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

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**GAS MONITORING LOG SHEET**

Project: NBIA Wythenshawe **Date:** 02/06/2023
Job Number: B072094 **Visit:** 5
Client: Manchester University NHS F **Weather:** Sunny
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	1024	0.0	0.0	9.1	2.5	7.3	2.5	15.9	0	0	3.59	4.15	1
BH02	1020	0.0	0.0	61.8	23.4	37.1	13.7	12.7	0	0	4.00	5.04	2
BH03	1020	0.0	0.0	51.4	33.7	41.3	30.0	6.0	0	0	4.07	4.09	2

Notes

- Monitoring of borehole was finished after 15 minutes
- Monitoring of borehole was finished after 25 minutes

Logged by

JP

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

Appendix G – Risk Assessment Methodology

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

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

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

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

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

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

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

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

Phase 2 Ground Investigation Report

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

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

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

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

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

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

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

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