



e3p

Phase II Geoenvironmental Site Assessment
Lathbury Road, Manchester

Reference: 16-718-R1-1
Date: September 2023



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Lathbury Road
Moston
Manchester
M9 5GE

Prepared for:
Jigsaw Homes



Report Ref: 16-718-R1-1
Date Issued: 4th September 2023

Lathbury Road, Manchester

Phase II Geoenvironmental Site Assessment

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EXECUTIVE SUMMARY

Site Address	Lathbury Road, Manchester, M9 5GE	
Grid Reference	E 385908, N 400897	
Site Area	Approximately 0.12 Ha	
Proposed Development	E3P understands that Jigsaw Homes propose to redevelop a parcel of land off Lathbury Road in Harpurhey, Manchester for low-rise residential housing with soft landscaping, associated adopted estate roads and utility infrastructure. The development layout is yet to be finalised.	
Current Site Use	The site is rectangular in shape and is located to the northeast of Lathbury Road. There are no current site uses and the site is predominantly soft standing with overgrown vegetation/shrubs. Localised areas of hardstanding are present. There is little topographic variance.	
Site History	Review of historical mapping from 1848 to present shows the site to comprise undeveloped land circa 1848. By 1890 the site was redeveloped with three rows of terrace housing present. Curtins report states that <i>"Post- WWII mapping shows the majority of buildings have been demolished on site, with the exception of Nos. 31, 33 and 35 Sutherland St in the north-eastern corner. WWII Luftwaffe bomb damage mapping for Manchester records a High Explosive bomb impacting just outside of the site's western boundary."</i> By 1968, the three remaining terraced properties are demolished, and the site redeveloped as a Welfare Centre. This building is demolished in recent years with the site then forming the grassed surface covering it has today.	
Environmental Setting	Drift Geology	Glacial Till – CLAY, SAND, GRAVEL
	Bedrock Geology	Chester Formation – SANDSTONE
	Faults	Nearest fault located 10 m south.
	Hydrogeology	Secondary Undifferentiated drift aquifer overlying principal bedrock aquifer. However, the site is not located within a Source Protection Zone and there are no active groundwater abstraction points within 1km.
	Hydrology	The nearest surface water feature is Moston Brook, located circa 140 m south of the site, flowing south-westward.
	Flood Risk	The site is not located in an area affected by river flooding (Flood Risk Zone 1).
Previous Reports	The following report has previously been completed for the site:  Curtins - Blencarn Walk Phase 1 Preliminary Risk Assessment (Ref 077873-CUR-00-XX-RP-GE-017). Dated May 2021. A full summary of findings is provided in Section 1.7.	



Utility Locations	A review of statutory utility plans has indicated the following services on site: ✿ A comms water pipe enters the site in the southwestern corner. ✿ Underground BT cables enter the site in the southwestern corner.
Landfill Sites and Ground Gases	There is one historical landfill located within 250 m, located 238 m east off Northampton Road. Type of waste included inert, industrial, commercial, household and special waste, and liquid sludge. Input dates between May 1974 to December 1977. A number of infilled reservoirs are recorded on historical mapping within 250 m.
Radon	The site is located in a low probability radon area where <1% of homes are estimated to be at or above the radon Action Level.
Coal Mining/Land Stability	The site is located within a coal mining reporting area, however, is not located within a Coal Authority deemed High-Risk Development Area. Additionally, there are no mine entries within 1 km of the site, or probable/recorded workings in the site boundary or immediate surrounding area. The risk to of shallow coal mining is considered to be Low.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.
Initial Conceptual Site Model	The contaminant sources, pathways and receptors discussed in the conceptual site model in the Curtins Audrey Street Phase 1 Preliminary Risk Assessment (Ref 077873-CUR-00-XX-RP-GE-017) are listed below for reference: Contaminant Sources ✿ On site: - <i>Made Ground of unknown composition from uncontrolled deposition of material onsite during the construction and demolition of properties on site.</i> ✿ Off-Site: - <i>Uncontrolled deposition of Made Ground during the construction of roads and structures and demolition near and adjacent to the site's boundaries.</i> Pathways ✿ <i>Direct contact, ingestion, inhalation (dust and vapours)</i> ✿ <i>Vertical migration through superficial deposits</i> ✿ <i>Horizontal migration over and through the superficial deposits</i> ✿ <i>Vertical and horizontal migration through existing service corridors and underlying superficial deposits</i>



Initial Conceptual Site Model	Receptors ✿ End-user of site (residents) and Construction Workers ✿ Controlled Waters (Principal bedrock aquifer) ✿ Controlled Waters (Surface water- Moston Brook)
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GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: ✿ 5 x mechanically excavated trial pits, ✿ 6 x window sample probeholes with 3 x environmental monitoring installations.
Ground Conditions	MADE GROUND – 0.00 m bgl to 3.70 m bgl Made Ground deposits were encountered in all exploratory hole locations across the site from ground level to a maximum proven depth of 3.70 m bgl (WS106). The following sequence of Made Ground Strata was generally encountered: ✿ Dark brown clayey silty sand (Topsoil) 0.20–0.50 m thick ✿ Brick and concrete fill 0.20–0.60 m thick (present across approximately 50% of the site). ✿ Very soft to soft greyish black to brown gravelly clay or clayey sand with frequent brick, concrete, slag, metal, clinker, ceramic and shells, and occasional wood, glass, ash and plastic. Hydrocarbon odours were noted in the Made Ground in TP102, TP103, WS102, WS103. Organic inclusions were also noted in a number of locations. Intact bricks and relict foundations were also encountered in TP103. DRIFT – 1.50 m bgl to 5.45 m bgl Drift deposits were encountered within all the exploratory hole locations and generally comprised stiff grey/brown mottled slightly sandy or silty CLAY. A yellowish brown SILT was encountered between 2.40 m and 2.60 m bgl within TP104 and a brown SILT was encountered between 2.10 m and 2.90 m bgl, within WS104. SOLID The solid geology was not encountered during the intrusive ground investigation. GROUNDWATER – Groundwater strikes were recorded in several locations as slow seepages between 1.50 m and 4.00 m bgl. Strikes were predominantly at the interface of the Made Ground and underlying CLAY, indicating the water to be perched in the Made Ground. Monitoring recorded groundwater between 1.37 m bgl and 2.90 m bgl.



CONTAMINATED LAND ASSESSMENT

Human Health

E3P has undertaken a Tier 2 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable risk to the identified receptors.

Results have been compared to residential end use with plant uptake GAC values (S4UL and C4SL) with 1% soil organic matter in the first instance.

This comparison indicates that the data exceeds the GAC values for the following:

- ✳ Heavy metals (lead, arsenic and total mercury)
- ✳ Elemental mercury and inorganic mercury
- ✳ Naphthalene
- ✳ Non-volatile PAHs (Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene)
- ✳ TPH Aromatic C16-C21
- ✳ Asbestos (Amosite fibres 0.002% wt/wt)

Heavy metals and non-volatile PAH compounds have primary exposure pathways related to dermal contact and ingestion of soils. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping, and public open space to remove any potential for direct exposure to impacted soils.

Elemental mercury can pose a vapour risk to site end users. Five samples have been found to contain total mercury in exceedance of the most conservative screening value (1.2 mg/kg). Mercury is composed of inorganic mercury, organo-mercury species and elemental mercury. Elemental mercury is the volatile fraction. To determine the elemental proportion, speciation has been carried out on two samples (TP102 3.2 mg/kg and TP105 53 mg/kg).

Made Ground in TP102 was found to contain 0.786 mg/kg elemental mercury and TP105 was found to contain 10.71 mg/kg elemental mercury (volatile). No mercury exceedances were identified in TP102. In respect of the marginally elevated mercury at TP101, in the absence of further speciation, the total mercury may be assumed to be non-volatile.

The soils at TP103 and WS102 (total mercury concentration of 6.9 mg/kg) should be assumed to be volatile and exceedances of other semi-volatile compounds have been identified in these locations. During remediation and enabling works, further speciated mercury analysis should be completed on samples of the Made Ground to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation.



Human Health <i>Continued</i>	Naphthalene was found to be in exceedance of the GAC value (residential end use with plant uptake and 1% SOM) in Made Ground in TP101, TP103, TP105 and WS102. Naphthalene also presents a vapour risk. However, on review of the organic content of the soils, comparison to GAC values for 2.5 % SOM is more appropriate. When the higher GAC values are applied, the naphthalene in TP101 and TP105 is no longer in exceedance. A clean cover system will be sufficient to mitigate the risk in TP101, however, the Made Ground in TP105 is still considered a vapour risk due to the presence of elemental mercury. A hydrocarbon odour was also noted in the Made Ground in TP102, TP103, WS102 and WS103. With regards to the elevated naphthalene, mercury and SVOCs, these present a potential volatilisation to indoor air risk. These elevated concentrations have been identified within several areas of the site. As the impact is attributed to the deposited Made Ground and no specific source has been identified, it may not be possible to classify these areas as hotspots for delineation and excavation. Instead, a vapour membrane may be required for all proposed plots to mitigate the volatilisation risk. In due consideration of the potential for naphthalene, mercury and SVOC impact to represent a vapour intrusion risk, a Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential. Asbestos was detected within one sample submitted for chemical analysis. Amosite fibres were detected at 0.002% wt/wt in TP101 at 1.00 m bgl. Impacted soil should be managed according to the asbestos risk mitigation conceptual site model. Chemical analysis of the natural clay drift deposits has not been undertaken. Validation testing will be required to determine whether they are acceptable for use as subsoil within the proposed garden areas. There are no suitable sources of topsoil available on the site. It is recommended that allowance be made for import of topsoil and subsoil for all gardens and soft landscaped areas.
Controlled Waters	The Tier 2 controlled waters risk assessment identified exceedances of the DWS for chromium (III), chromium (VI), total cyanide and zinc. Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation. The groundwater analysis only identified a marginal exceedance for total cyanide. There are no drinking water standards for chromium (VI) and zinc, therefore, to be conservative the data has been compared to the environmental quality standards. The nearest surface water feature is Moston Brook, however, this is located circa 140 m south of the site, therefore the brook is not considered to be a potential receptor and therefore the use of EQS values for thresholds is not considered appropriate.



Controlled Waters <i>Continued</i>	The underlying principal aquifer is considered to be the primary receptor, however the overall risk is reduced given the absence of any active potable groundwater abstraction within 1 km, which suggests the aquifer is not utilised as a strategic water resource. Furthermore, the aquifer is overlain by cohesive deposits which will serve to form an aquitard to limit the downward migration of any mobile contaminants. Given the general low solubility nature of the identified contaminants of concern, in addition to the relatively low sensitivity of the site with respect to controlled waters, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environ.
Ground Gas	Based on the peak flow rates and gas concentrations, the monitoring data to date indicates that the majority of visits classify as CS1/Green. In the vicinity of WS102, carbon dioxide has been identified above the 5 % v/v threshold on two occasions, however the GSV is noted to be within a CS1 classification. During Visit 5, carbon dioxide was recorded at 5.3 % v/v in WS104. This is likely to be a result of high groundwater levels causing compression in the well. It is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the full ground gas monitoring. Furthermore, with regards to the elevated volatile contaminants (naphthalene, elemental mercury and SVOCs), vapour resistant membranes may be required to be installed during the build phase. A Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.
Potable Water Infrastructure	Based on the assessment of current site conditions it is likely that Barrier pipe will be required for the proposed development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

GEOTECHNICAL ASSESSMENT

Underground Obstructions	Concrete and brick obstructions have been encountered within the Made Ground, consisting of a demolition 'crush' layer of brick fill and relict foundations in TP103. Other obstructions may be encountered at intervening locations. During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.
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Allowable Bearing Pressure	The underlying natural clay drift deposits have been assessed as being firm medium strength to very stiff very high strength. ✿ Firm medium strength (silty) CLAY encountered between 2.00–2.45 m bgl has an ABP of between 131–141 kN/m². ✿ Firm medium strength CLAY from c. 3.00 bgl has an ABP of between 100–150 kN/m². ✿ At depths of between 2.00 – 5.45 m bgl, stiff high strength to very stiff very high strength CLAY has an ABP of between 165–437 kN/m².
Foundation Options	Dependent on development levels, it is considered that the optimum foundation solution would be a combination of the following: ✿ Ground improvement using bottom feed vibro stone column (VSC) to support a shallow reinforced concrete strip foundation. ✿ Piled foundation in areas unsuitable for Ground Improvement by Vibro. Foundation depths within the conjectured influence of former, existing or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content.
Building Floor Slabs	Ground-bearing floor slabs are unlikely to be viable given the anticipated depths of reworked Made Ground > 600 mm and shallow cohesive soils.
Heave Precautions	As the clay is deemed to be medium volume change potential heave precautions will be required to the internal face of the external load-bearing walls (outside or within tree influence). If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams. Voids will be required beneath any precast or suspended floor slabs.
Soakaway Drainage	The presence of substantial depths of Made Ground across the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement. Due to the presence of low-permeability clay beneath the Made Ground, soakaway drainage is unlikely to be viable on-site. If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.
Sulphate Assessment	Concrete classification will be DS-1 AC-1s.
CBR Design %	Granular soils can be re-engineered to ensure 5% within the subgrade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.



Cut/Fill	Development levels unknown at this time; however, significant cut-and-fill works are unlikely to be required to prepare the development platform. The MDD/OMC relationship has been assessed for one sample of Made Ground to understand the soil properties in respect of re-engineering the material. The PSD grading indicates the material to comprise a gravelly sandy clay. The material in its current state is 11% wet of the optimum. Engineering of the material would need to be undertaken during dry weather periods only and consideration should be made for stabilisation of the soils.
Civil Engineering Excavations	Due to the depth and variability of the Made Ground and the likelihood of trench collapse in some areas of the site, it is recommended that excavations are supported or battered back in accordance with guidance contained in CIRIA R97. If local pumping of groundwater is required during the advancement of excavations for the proposed foundations, then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures near the site.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: <i>Waste Classification – Guidance on the classification and assessment of waste</i>.

RECOMMENDATIONS

Based on the findings of the geoenvironmental site assessment, the following additional works are recommended to be completed in due course:

- ✿ Tier 3 vapour risk assessment.
- ✿ Plot-specific foundation schedule (upon receipt of the final development levels).
- ✿ Arboricultural survey.
- ✿ Remediation and enabling works strategy.



Table of Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	11
1.1. Background	11
1.2. Proposed Development.....	11
1.3. Objectives	11
1.4. Scope of Works.....	12
1.5. Limitations	12
1.6. Confidentiality.....	12
1.7. Previous Reports	13
2. GROUND INVESTIGATION.....	15
2.1. General Overview	15
2.2. Scope of Investigation.....	15
2.3. In-Situ Standard Penetration Testing (SPT).....	15
2.4. Laboratory Analysis.....	16
3. GROUND AND GROUNDWATER CONDITIONS	17
3.1. Summary of Ground Conditions	17
3.2. Made Ground	17
3.3. Drift Deposits	18
3.4. Solid Geology.....	18
3.5. Groundwater	18
3.6. Visual and Olfactory Evidence of Contamination	18
3.7. Soil Consistency	19
3.8. Side Stability and Ease of Excavation	19
3.9. Particle Size Distribution	24
3.10. Soil Density/Moisture Content Relationship	24
3.11. Soil Plasticity	24
3.12. pH and Sulphate	25
4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	26
4.1. Deviating Samples.....	26
4.2. Human Health Risk Assessment.....	26
4.2.1. Summary of Results.....	29
4.3. Controlled Waters Risk Assessment.....	31
4.3.1. summary of results	36
4.3.2. Discussion of Controlled Waters Risk Assessment	36
4.4. Ground Gas Risk Assessment Methodology	37
4.5. Monitoring Methodology.....	38
4.6. Summary of Monitoring Results	41
4.6.1. Groundwater	41
4.6.2. Barometric pressure	41
4.6.3. Gas Flow	41
4.6.4. Gas Concentrations	41
4.6.5. Conclusion.....	41
4.7. Building Gas Risk Mitigation	43
4.7.1. British standard bs8485 (2015)+A1 (2019)	43
4.7.2. NHBC	47
4.8. Potable Water Supply	48
4.9. Conceptual Site Model	50
5. GEOTECHNICAL ASSESSMENT	55
5.1. Proposed Development.....	55



5.2.	Site Preparation	55
5.3.	Foundation Conditions and Assessment of Potential Bearing Capacities	55
5.4.	Ground Floor Slabs	58
5.5.	Heave Precautions	58
5.6.	Highways Construction	59
5.7.	Drainage	59
5.8.	Concrete Durability	59
5.9.	Excavations	60
5.10.	Construction Activity and Inspection	61
5.11.	Geotechnical Risk Register	62
5.12.	Further Works	64
6.	CONCLUSIONS AND RECOMMENDATIONS.....	65
6.1.	Contaminated Land Assessment	65
6.2.	Geotechnical Assessment	68
	APPENDIX I LIMITATIONS.....	69
	APPENDIX II GLOSSARY	71
	APPENDIX III DRAWINGS	74
	APPENDIX IV PHOTOGRAPHS	76
	APPENDIX V E3P EXPLORATORY HOLE LOGS	82
	APPENDIX VI CHEMICAL TESTING RESULTS	83
	APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA	84
	APPENDIX VIII GEOTECHNICAL TESTING RESULTS.....	86
	APPENDIX IX CROSS SECTIONS	87

DRAWING LIST

16-718-001 - Site Location Plan
16-718-003 - Historical Features Plan
16-718-004 - Site Features Plan
16-718-005 - Exploratory Hole Location Plan
16-718-006 - Depth of Made Ground Plan
16-718-008 - Depth to Founding Strata Plan
16-718-010 - Conceptual Site Model
16-718-018 - Contamination Exceedances Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been Jigsaw Homes to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of land off Lathbury Road in Harpurhey, Manchester.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed low-rise residential development.

1.2. PROPOSED DEVELOPMENT

E3P understands that Jigsaw Homes propose to redevelop a parcel of land off Lathbury Road in Harpurhey, Manchester for low-rise residential housing with soft landscaping, associated adopted estate roads and utility infrastructure. The development layout is yet to be finalised.

1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

- ✦ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document *Land Contamination: Risk Management (LCRM) (2023)*.
- ✦ Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- ✦ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✦ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✦ Provide recommendations regarding future works required.



1.4. SCOPE OF WORKS

The scope of work includes the following elements:

- ✦ Detailed review of historic information;
- ✦ Design of suitable intrusive ground investigation;
- ✦ Window sample probeholes with environmental monitoring installations;
- ✦ Mechanically excavated trial pits;
- ✦ In-situ geotechnical testing;
- ✦ Chemical and geotechnical laboratory analysis;
- ✦ Groundwater monitoring and sampling;
- ✦ Ground gas monitoring;
- ✦ Contamination risk assessment and conceptual site model;
- ✦ Geotechnical assessment and interpretation; and
- ✦ Factual and interpretive reporting.

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.6. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from E3P; a charge may be levied against such approval.



1.7. PREVIOUS REPORTS

E3P has been provided with the following previous report for the site:

- ✦ **Curtins** - Phase 1 Preliminary Risk Assessment, Blencarn Walk (REF; 077873-CUR-00-XX-RP-GE-017-V01, dated 10 May 2021). Prepared for Jigsaw Homes Group Ltd

A summary of the pertinent information from this report is provided below:

Site Setting

- ✦ The site is located west of Carisbrook Street and north of Lathbury Road. The site is currently occupied by unkept grass surface cover and trees along the site boundaries. A short metal fence surrounds the site with a gateway on the eastern boundary.

Site History

- ✦ Earliest mapping (1848) shows that the site was undeveloped, with possible water courses / features within 250 m. The site was developed by the 1890s with three rows of terraced residential dwellings, two of which are aligned northeast-southwest and one aligned east-west on the south-western boundary.
- ✦ Post-WWII mapping shows the majority of buildings have been demolished on site, with the exception of Nos. 31, 33 and 35 Sutherland St in the north-eastern corner. WWII Luftwaffe bomb damage mapping for Manchester records a High Explosive bomb impacting just outside of the site's western boundary.
- ✦ By 1968, the three remaining terraced properties are demolished, and the site redeveloped as a Welfare Centre. This building is demolished in recent years with the site then forming the grassed surface covering it has today.
- ✦ Mapping from the 1890s shows reservoirs located from 30 m west and 40 m southwest. These are no longer reported by 1908 as the surrounding area is developed for terraced housing. Industries located 100-250 m have included a dye works, clay pit, brick works, Turkey Lane Works, chemical works, Tape Works and carpentry works.
- ✦ The surrounding area to the south, west and north was developed as terraced housing by 1908 and redeveloped as larger housing with new roadways and green areas by the late 1970s.
- ✦ Refuse heaps were mapped to the east in the 1970s. In later years, recreational grounds and schools are constructed on land to the east.

Environmental Setting

- ✦ There is one historical landfill located within 250 m, located 238 m east located off Northampton Road. Type of waste included inert, industrial, commercial, household and special waste, and liquid sludge. Input dates between May 1974 to December 1977.
- ✦ The nearest area of infilled land (non-water) is located 93 m northeast, which is an infilled pit, quarry etc. dated 1990.
- ✦ Six infilled water features (Pond, marsh, river, stream etc.) are located within 100 m of the site. The nearest is located 27 m northeast and all are dated between 1848 and 1894.
- ✦ BGS mapping indicates the site is underlain by Glacial Till superficial deposits and Chester Formation bedrock (principal aquifer). The site is not located within a source protection zone.



- ✦ One BGS borehole record located within 50 m of the site recorded Made Ground underlain by clay, with bedrock deeper than 12.19 m bgl.
- ✦ The site is located within a Coal Mining Reporting Area but not within a Development High Risk area. Curtins conclude the risk from coal mining to be low.
- ✦ The site is not located within the Cheshire Brine compensation district.
- ✦ The site is located within an area assessed as being within at moderate risk from UXO.

Initial Conceptual Model

- ✦ The previous Curtins Phase I concluded the following: The risk from Made Ground soils posed to the site's end-users and construction workers is considered to be **Moderate / Low** due to the anticipated lack of contamination in potential Made Ground soils on site. The risk presented to groundwater and surface water receptors is considered to be Low and Very Low, taking into account the lack of historical industrial land use on site. The risk posed to site end-users from ground generating gases arising from organic / putrescible soils on or near the site is considered to be **Moderate**.

Coal Mining Geology

The relevant information associated with coal mining from the Curtins Phase 1 Preliminary risk assessment (Ref; 077873-CUR-00-XX-RP-GE-017-V01, dated 10 May 2021) are summarised below:

- ✦ *A review of the Coal Authority interactive mapping (Ref. 4) for the area indicates that the site is located within a Coal Mining Reporting Area, however it is not located within a Development High-Risk Area.*
- ✦ *There are no recorded mine entries within 1 km of the site.*
- ✦ *There are no recorded coal workings and no probable coal workings within 850 km of the site.*
- ✦ *Consequently, the risk to development from historic coal mining is considered to be **Low**. No further actions are required to further assess the risk to development from historic coal mining.*
- ✦ *The closest recorded BGS mineral sites is located 208m southeast of the site at Silton Street, an opencast site known as Harphurey Brick Works which extracted common clay and shale from superficial soils (Till) and is recorded to have ceased works.*



2. GROUND INVESTIGATION

2.1. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to provide general site coverage. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed on the 20th of June 2023. The works are summarised in Table 2.1.

2.2. SCOPE OF INVESTIGATION

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground conditions including the Presence/Nature of Obstructions	WS101	Window Sample Probehole	5.45	N/A
	WS102		5.45	1.00–3.00
	WS103		5.45	N/A
	WS104		5.45	1.50–5.00
	WS105		5.45	N/A
	WS106		5.45	1.00–3.00
General Ground conditions including the Presence/Nature of Obstructions	TP101	Mechanically Excavated Trial Pit	3.20	N/A
	TP102		3.20	
	TP103		3.20	
	TP104		3.00	
	TP105		3.10	

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The exploratory hole locations are illustrated in Drawing 16-718-005 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix V.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged and samples of groundwater recovered for chemical analysis.

2.3. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in Appendix V and presented in Table 3.5 and discussed in Section 5.



2.4. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis comprising:

- ✦ Metals.
- ✦ pH, total sulphate, water-soluble sulphate (2:1 extract).
- ✦ Sulphide.
- ✦ Cyanide.
- ✦ Phenols.
- ✦ Total Organic Carbon (TOC).
- ✦ Total and speciated polycyclic aromatic hydrocarbons (PAHs).
- ✦ Semi Volatile Organic Compounds (SVOC).
- ✦ Volatile Organic Compounds (VOC).
- ✦ Asbestos identification and quantification.
- ✦ Speciated and banded total petroleum hydrocarbon (TPH).
- ✦ Total Organic Carbon (TOC).
- ✦ Leachate Analysis.

i2 Analytical undertook the analytical work and the testing results are included in Appendix VI and discussed in Section 4.

Selected samples were submitted to PSL Laboratory where the following geotechnical tests were undertaken:

- ✦ Atterberg limit determinations.
- ✦ Natural moisture content.
- ✦ Particle size distribution.
- ✦ 2.5 kg compaction.

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 3.



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 3.1.

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)			
	MADE GROUND (TOPSOIL)	MADE GROUND	CLAY	SILT
TP101	0.00–0.45	0.45–1.90	1.90–3.20	–
TP102	0.00–0.50	0.50–2.80	2.80–3.20	–
TP103	0.00–0.30	0.30–2.80	2.80–3.20	–
TP104	0.00–0.40	0.40–2.40	2.60–3.00	2.40–2.60
TP105	0.00–0.35	0.35–2.80	2.80–3.10	–
WS101	0.00–0.40	0.40–1.50	1.50–5.45	–
WS102	0.00–0.45	0.45–2.90	2.90–5.45	–
WS103	0.00–0.30	0.30–2.90	2.90–5.45	–
WS104	0.00–0.40	0.40–1.50	1.50–2.10 2.80–5.45	2.10–2.80
WS105	0.00–0.30	0.30–2.70	2.70–5.45	–
WS106	0.00–0.20	0.20–3.70	3.70–5.45	–

3.2. MADE GROUND

Made Ground deposits were encountered in all exploratory hole locations across the site from ground level to a maximum proven depth of 3.70 m bgl (WS106).

A reworked topsoil comprising a dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots was encountered in all locations to a maximum depth of 0.50 m bgl.

The following sequence of Made Ground Strata was generally encountered:

- ✿ Dark brown clayey silty sand (Topsoil) 0.20–0.50 m thick
- ✿ Brick and concrete fill 0.20–0.60 m thick (present across approximately 50% of the site).
- ✿ Very soft to soft greyish black to brown gravelly clay or clayey sand with frequent brick, concrete, slag, metal, clinker, ceramic and shells, and occasional wood, glass, ash and plastic.

Hydrocarbon odours were noted in the Made Ground in TP102, TP103, WS102, WS103. Organic inclusions were also noted in a number of locations.

Intact bricks and relict foundations were also encountered in TP103.

A Depth of Made Ground Plan is presented as Drawing 16-718-006 in Appendix III.

3.3. DRIFT DEPOSITS

Drift deposits were encountered within all the exploratory hole locations and generally comprised stiff grey/brown mottled slightly sandy or silty CLAY.

A yellowish brown SILT was encountered between 2.40 m and 2.60 m bgl within TP104 and a brown SILT was encountered between 2.10 m and 2.90 m bgl, within WS104.

3.4. SOLID GEOLOGY

The solid bedrock geology was not encountered during the site investigation. Local BGS boreholes within 50m of the site, also did not record depth of bedrock.

3.5. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages are shown on the exploratory hole records in Appendix V and are summarised in Table 3.2.

TABLE 3.2 SUMMARY GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
TP102	2.80	Slow seepage.
TP103	2.80	Slow seepage.
TP105	2.70	Slow seepage.
WS103	4.00	Strike in borehole core.
WS105	1.50	Strike in borehole core.
WS106	3.60	Strike in borehole core.

Monitoring was undertaken using an electronic dip meter and interface probe to record the depth to groundwater and the thickness of any free-phase hydrocarbon product, if present. These results are summarised in Table 4.6.

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation and these are summarised in Table 3.3.

TABLE 3.3 SUMMARY VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
TP101	0.90–1.90	Made Ground	Slag, clinker and pockets of black organic clay
TP102	0.80–1.00 1.00–2.80	Made Ground	Slag and bitumen Strong hydrocarbon odour
TP103	1.70–2.80	Made Ground	Strong hydrocarbon odour
WS102	2.50–2.90	Made Ground	Strong hydrocarbon odour
WS103	2.20–2.90	Made Ground	Strong hydrocarbon odour



3.7. SOIL CONSISTENCY

Undrained shear strength values were measured using field hand shear vane tests. Results of the tests are presented in Table 3.4, which indicate the clay soils to be very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

TABLE 3.4 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP101	2.00	184	432.40
TP103	3.00	186	437.10

Notes

ABP Calculated using Stroud and Butler et al 1974.

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.5.

3.8. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation in the Made Ground and cohesive materials.

The presence of brick and concrete cobbles within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground. The natural strata was excavated with relative ease.



TABLE 3.5 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS101	1.00	MADE GROUND: Black gravel.	5	5.04	Loose	N/A	N/A	N/A	50.41
WS101	2.00	Greyish brown slightly silty CLAY.	15	13.70	N/A	Medium strength	Stiff	68.52	140.87
WS101	3.00	Greyish brown slightly silty CLAY.	14	12.18	N/A	Medium strength	Stiff	60.88	125.16
WS101	4.00	Greyish brown slightly silty CLAY.	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS101	5.00	Greyish brown slightly silty CLAY.	22	18.25	N/A	High strength	Very Stiff	91.26	187.63
WS102	1.00	MADE GROUND: Black clayey gravelly fine to medium sand.	4	4.03	Loose	N/A	N/A	N/A	40.33
WS102	2.00	MADE GROUND: Black clayey gravelly fine to medium sand.	4	3.65	Very Loose	N/A	N/A	N/A	36.54



BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS102	3.00	Greyish brown CLAY.	13	11.31	N/A	Medium strength	Stiff	56.53	116.22
WS102	4.00	Greyish brown CLAY.	16	13.52	N/A	Medium strength	Stiff	67.59	138.96
WS102	5.00	Greyish brown CLAY.	16	13.27	N/A	Medium strength	Stiff	66.37	136.46
WS103	3.00	Brown CLAY.	16	13.91	N/A	Medium strength	Stiff	69.57	143.04
WS103	4.00	Brown CLAY.	14	11.83	N/A	Medium strength	Stiff	59.14	121.59
WS103	5.00	Brown CLAY.	14	11.61	N/A	Medium strength	Stiff	58.07	119.40
WS104	1.00	MADE GROUND: Black gravelly clay.	0	0.00	N/A	Extremely low strength	Very Soft	<5.04	<10.36
WS104	2.00	Greyish brown silty CLAY.	14	12.79	N/A	Medium strength	Stiff	63.95	131.48
WS104	3.00	Greyish brown slightly gravelly CLAY.	20	17.39	N/A	High strength	Very Stiff	86.97	178.80
WS104	4.00	Greyish brown slightly gravelly CLAY.	19	16.05	N/A	High strength	Very Stiff	80.26	165.02



BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS104	5.00	Greyish brown slightly gravelly CLAY.	25	20.74	N/A	High strength	Very Stiff	103.70	213.21
WS105	1.00	MADE GROUND: Blackish brown gravelly sandy clay.	1	1.01	N/A	Extremely low strength	Very Soft	5.04	10.36
WS105	2.00	MADE GROUND: Greyish black gravelly clay.	9	8.22	N/A	Medium strength	Stiff	41.11	84.52
WS105	3.00	Greyish brown CLAY.	12	10.44	N/A	Medium strength	Stiff	52.18	107.28
WS105	4.00	Greyish brown CLAY.	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS105	5.00	Greyish brown CLAY.	21	17.42	N/A	High strength	Very Stiff	87.11	179.10
WS106	1.00	MADE GROUND: Blackish brown silty gravelly clay.	4	4.03	N/A	Low strength	Firm	20.16	41.46
WS106	3.00	MADE GROUND: Brown clayey gravel.	7	6.09	Loose	N/A	N/A	N/A	60.88



BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS106	4.00	Greyish brown CLAY.	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS106	5.00	Greyish brown CLAY.	12	9.96	N/A	Medium strength	Stiff	49.78	102.34

NOTES

* The Allowable Bearing Pressure (ABP) should be considered indicative.

The interpretation of in situ mass undrained shear strength (cu) data from SPT Blow Count (N) results and the influence of the Plasticity Index (PI) was reported in Standard Penetration Test in Insensitive Clays and Soft Rocks. Stroud (1974). The standard penetration test and the engineering properties of glacial materials subsequently. Stroud and Butler (1975) and (1989).

Allowable bearing pressure on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996.



3.9. PARTICLE SIZE DISTRIBUTION

Particle Size Distribution Tests have been undertaken on selected samples of material via wet sieve to obtain information on the soil fractions. The results are included in Table 3.6. The laboratory test certificates are included in Appendix VIII.

TABLE 3.6 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP105	1.50 (Made Ground)	2	21	31	46

3.10. SOIL DENSITY/MOISTURE CONTENT RELATIONSHIP

Dry density/moisture content relationship analysis has been conducted on soils using via utilising proctor compaction tests a 2.5 kg rammer. The results of the tests have been summarised in Table 3.7. The laboratory test certificates are included in Appendix VIII.

TABLE 3.7 SUMMARY DRY DENSITY AND MOISTURE CONTENT

LOCATION	LABORATORY DESCRIPTION	TOP DEPTH (m)	METHOD OF COMPACTION	INITIAL MOISTURE CONTENT (%)	OPTIMUM MOISTURE CONTENT (%)	MATERIAL RETAINED ON 37.5 mm SIEVE (%)	MAX DRY DENSITY (mg/m ³)	MATERIAL RETAINED ON 20.0 mm TEST SIEVE (%)
TP105	MADE GROUND: Brown very gravelly very sandy clay with cobbles.	1.50	2.5kg	37	26	6	1.45	6

The proctor compaction test has indicated the material in TP105 to be wet of the optimum. It should be noted that if this material is excavated for use in a cut/fill operation careful consideration should be taken in the stabilisation of this material.

Engineering of this type of material will need to be completed during dry weather periods only.

3.11. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.8, show the clay to be of low to moderate plasticity.



TABLE 3.8 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS102	3.00	24	22	44	22	100	22.00	Medium
WS104	2.00	13	16	33	17	96	16.32	Low
WS105	3.00	17	18	39	21	98	20.58	Medium

The results of the Atterberg limits testing confirmed that the soils would be deemed to be “Low to Medium Volume Change Potential” in accordance with the classification system utilised by the LABC/NHBC industry guidance.

3.12. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix VI (summarised in Table 3.9), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

TABLE 3.9 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	1.00	0.037	8.1	DS-1, AC-1s
TP102	0.30	0.0042	7.1	DS-1, AC-1s
TP102	2.50	0.15	7.8	DS-1, AC-1s
TP103	1.80	0.40	7.5	DS-1, AC-1s
TP104	0.35	0.033	8.2	DS-1, AC-1s
TP105	1.00	0.056	7.8	DS-1, AC-1s
WS102	2.80	0.42	7.3	DS-1, AC-1s



4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 2 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. DEVIATING SAMPLES

Deviating samples were to be avoided during the ground investigation by using best practice sampling procedures including use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis undertaken. No deviations were noted in the soil samples.

One deviation is identified in the groundwater sample from WS104. The deviation relates to exceeding the maximum holding time for pH analysis. The identified deviation is not considered to have impacted the overall risk assessment.

4.2. HUMAN HEALTH RISK ASSESSMENT

At Tier 2 stage, the long-term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

Where Tier 2 screening values are not provided by LQM, other screening values have been used and these are referenced in Table 4.1.

The results of this comparison have been summarised within Table 4.1.



TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A RESIDENTIAL END USE WITH PLANT UPTAKE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	8	62 47 41	TP105 1.00m TP102 2.50m TP101 1.00m	1	Further Action
Cadmium	mg/kg	11	8	0.5	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	8	2.3	N/A	1	No Further Action
Lead**	mg/kg	200	8	1500 660 540 450 300 210	TP105 1.00m TP102 2.50m WS102 2.80m TP101 1.00m TP103 1.80m TP102 0.30m	1	Further Action
Total Mercury	mg/kg	1.2	8	53 6.9 6.9 3.2 1.8	TP105 1.00m TP103 1.80m WS102 2.80m TP102 2.50m TP101 1.00m	4	Further Action
Inorganic Mercury	mg/kg	40	2	46.4	TP105 1.00m	1	Further Action
Methyl Mercury	mg/kg	11	2	2.203	N/A	1	No Further Action
Elemental Mercury	mg/kg	1.2	2	10.71	TP105 1.00m	4	Further Action
Nickel	mg/kg	130	8	35	N/A	1	No Further Action
Selenium	mg/kg	250	8	1	N/A	1	No Further Action
Copper	mg/kg	2400	8	400	N/A	1	No Further Action
Zinc	mg/kg	3700	8	390	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	8	21	N/A	1	No Further Action
Phenols – Total	mg/kg	120	7	1.4	N/A	1	No Further Action
Asbestos	Fibres	NFD	7	0.002%	TP101 1.00 m	3	Further Action
Naphthalene	mg/kg	2.3	7	130 63 4 3.7	WS102 2.80m TP103 1.80m TP101 0.30m TP105 0.30m	4	Further Action
Acenaphthylene	mg/kg	170	7	35	N/A	2	No Further Action
Acenaphthene	mg/kg	210	7	49	N/A	1	No Further Action
Fluorene	mg/kg	170	7	87	N/A	1	No Further Action
Phenanthrene	mg/kg	95	7	420 270	WS102 2.80m TP103 1.80m	2	Further Action
Anthracene	mg/kg	2400	7	120	N/A	2	No Further Action
Fluoranthene	mg/kg	280	7	340	WS102 2.80m	2	Further Action
Pyrene	mg/kg	620	7	350	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	7	150 100 23	WS102 2.80m TP103 1.80m TP101 1.00m	2	Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
				15	TP105 1.00m		
Chrysene	mg/kg	15	7	150 100 22 15	WS102 2.80m TP103 1.80m TP101 1.00m TP105 1.00m	2	Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	7	130 99 22 16 5.2 3.8 3.0	WS102 2.80m TP103 1.80m TP101 1.00m TP105 1.00m WS101 1.50m TP102 0.30m TP104 0.35m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	7	57	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	7	130 89 20 13 4.0 3.4 2.5	WS102 2.80m TP103 1.80m TP101 1.00m TP105 1.00m WS101 1.50m TP102 0.30m TP104 0.35m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	7	59 41	WS102 2.80m TP103 1.80m	2	Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	7	18 13 3.2 1.8 0.6 0.43 0.4	WS102 2.80m TP103 1.80m TP101 1.00m TP105 1.00m TP102 0.30m TP104 0.35m WS101 1.50m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	7	73	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	8	1	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	8	0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	8	0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	8	13	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	8	83	N/A	4	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	8	330 290	TP102 2.50m TP103 1.80m	1	Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	8	460	N/A	1	No Further Action

Notes

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; NFD = no fibres detected.



* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 1 values for aliphatic compounds for the volatile and semi-volatile fractions (C5-C12) and the Tier 1 values for aromatic compound for the non-volatile fractions (C12-C35). The comparison of total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

**CL:AIRE C4SL

4.2.1. SUMMARY OF RESULTS

E3P has undertaken a Tier 2 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable risk to the identified receptors.

Results have been compared to residential end use with plant uptake GAC values (S4UL and C4SL) with 1% soil organic matter in the first instance.

This comparison indicates that the data exceeds the GAC values for the following:

- ✳ Heavy metals (lead, arsenic and total mercury)
- ✳ Elemental mercury and inorganic mercury
- ✳ Naphthalene
- ✳ Non-volatile PAHs (Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene)
- ✳ TPH Aromatic C16-C21
- ✳ Asbestos (Amosite fibres 0.002% wt/wt)

SVOCs (including aniline, 2-methylnaphthalene, dibenzofuran and carbazole) have been recorded above the limit of detection in the Made Ground in TP103 and WS102, however no screening criteria is available.

Concentrations of VOCs are less than the limit of detection in samples from TP103 and WS102.

HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

Heavy metals and non-volatile PAH compounds have primary exposure pathways related to dermal contact and ingestion of soils. The risk to chronic human health associated with the elevated concentrations on inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils.

Elemental mercury can pose a vapour risk to site end users. Five samples have been found to contain total mercury in exceedance of the most conservative screening value (1.2 mg/kg). Mercury is composed of inorganic mercury, organo-mercury species and elemental mercury. Elemental mercury is the volatile fraction. To determine the elemental proportion, speciation has been carried out on two samples (TP102 3.2 mg/kg and TP105 53 mg/kg).

Made Ground in TP102 was found to contain 0.786 mg/kg elemental mercury and TP105 was found to contain 10.71 mg/kg elemental mercury (volatile). No mercury exceedances were identified in TP102. In respect of the marginally elevated mercury at TP101, in the absence of further speciation, the total mercury may be assumed to be non-volatile. The soils at TP103 and WS102 (total mercury concentration of 6.9 mg/kg) should be assumed to be volatile and exceedances of other semi-volatile compounds have been identified in these locations. During remediation and enabling works, further speciated mercury analysis should be completed on samples of the Made Ground to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation.



Naphthalene was found to be in exceedance of the GAC value (residential end use with plant uptake and 1% SOM) in Made Ground in TP101, TP103, TP105 and WS102. Naphthalene also presents a vapour risk. However, on review of the organic content of the soils, comparison to GAC values for 2.5 % SOM is more appropriate. When the higher GAC values are applied, the naphthalene in TP101 and TP105 is no longer in exceedance. A clean cover system will be sufficient to mitigate the risk in TP101, however, the Made Ground in TP105 is still considered a vapour risk due to the presence of elemental mercury.

A hydrocarbon odour was also noted in the Made Ground in TP102, TP103, WS102 and WS103.

With regards to the elevated naphthalene, mercury and SVOCs, these present a potential volatilisation to indoor air risk. These elevated concentrations have been identified within several areas of the site. As the impact is attributed to the deposited Made Ground and no specific source has been identified, it may not be possible to classify these areas as hotspots for delineation and excavation. Instead, a vapour membrane may be required for all plots to mitigate the volatilisation risk.

In due consideration of the potential for naphthalene, mercury and SVOC impact to represent a vapour intrusion risk, a Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.

Asbestos was detected within one sample submitted for chemical analysis. Amosite fibres were detected at 0.002 % wt/wt in TP101 at 1.00 m bgl. Impacted soil should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1.

Chemical analysis of the natural clay drift deposits has not been undertaken. Validation testing will be required to determine whether they are acceptable for use as subsoil within the proposed garden areas. There are no suitable sources of topsoil available on the site.

It is recommended that allowance be made for import of topsoil and subsoil for all gardens and soft landscaped areas.

FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



4.3. CONTROLLED WATERS RISK ASSESSMENT

E3P has undertaken a controlled waters risk assessment for the site based on the consideration of the conceptual site model and the sensitive receptors which are summarised in Table 4.2.

TABLE 4.2 CONTROLLED WATERS CONCEPTUAL MODEL AND SENSITIVITY PROFILE

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground Elevated volatile concentrations have been found in the soils, which may leach to underlying shallow groundwater.		Moderate
Pathway		
Clay deposits are present beneath Made Ground to depths in excess of 5.00 m bgl. The presence of this low permeability drift will offer protection to the underlying aquifer.		Moderate
Lateral migration Lateral migration of contaminants is considered unlikely due to the presence of low permeability deposits underlying the Made Ground on site.		Low
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary undifferentiated	Low
Aquifer Classification in Bedrock	Principal aquifer	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected.	Low
Distance to the Closest Groundwater Abstraction Point	There are no active groundwater abstractions within 1km.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	None identified within 50 m.	Low
The ICSM developed within the context of the site setting has identified a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer. The sensitivity of the aquifer is reduced given there are no active groundwater abstractions within 1km.		



To ensure a robust appraisal of the identified risk to controlled waters, E3P has identified the sources of potential contamination that represent a risk to controlled waters from the initial CSM, we have then assessed the availability of ground investigation data in the form of analysis of the solid phase (soil) and dissolved phase within the perched groundwater or aquifer. The results of this assessment are presented in Table 4.3.

TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of VOCs above 1mg/kg or TPH C5 to C6 that might otherwise be indicative of VOC impact.	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	SVOCs are above 1.0 mg/kg in TP103 and WS102.	Further discussion
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	Concentrations of C10-C12 have been recorded above 10 mg/kg at one location; TP102 at 2.50 m (13 mg/kg).	Further discussion
C12-C16 > 50 mg/kg	Concentrations of C12-C16 have been recorded above 50 mg/kg at three locations; TP102 at 2.50 m bgl, TP103 at 1.80 m bgl and WS102 at 2.80 m bgl, at 83 mg/kg, 59 mg/kg and 59 mg/kg, respectively.	Further discussion
Phenols > 2 mg/kg	All concentrations are below 2 mg/kg.	None
Naphthalene > 2 mg/kg	Concentrations of naphthalene above 2 mg/kg have been recorded in TP101 at 1.00 m bgl (4.0 mg/kg), TP105 at 1.00 m bgl (3.7 mg/kg), TP103 at 1.80 m (63 mg/kg) and WS102 at 2.80 m bgl (130 mg/kg).	Further discussion
Total PAH > 10 mg/kg	Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected throughout the site, with a maximum concentration recorded in TP101 at 1.00 m bgl at 303 mg/kg.	Further discussion
PCB > 1 mg/kg	No potential sources of PCB have been identified.	None
Heavy metals > 500 mg/kg	Concentrations of heavy metals above 500 mg/kg have been recorded in three locations; TP102 at 2.50 m bgl, TP105 at 1.00 m bgl and WS102 at 2.80 m bgl.	Further discussion

The Tier 2 assessment has included a comparison of leachate analysis from samples of the Made Ground and groundwater samples to drinking water standards (DWS) due to the presence of a principal bedrock aquifer underlying the site. In the absence of drinking water standards, the data has been compared to the Environmental Quality Standards (EQS).

These are presented in Table 4.4.



TABLE 4.4 COMPARISON OF GROUNDWATER AND LEACHATE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Arsenic	µg/l	50	10	1	0.73	N/A	2	7.4	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	1	0.06	N/A	2	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	1	< 5.0	N/A	2	66	TP105 1.00m (EQS)	Further Discussion
Chromium (III)	µg/l	4.7	50	1	< 0.2	N/A	2	64	TP105 1.00m (DWS)	Further Discussion
Copper	µg/l	1	2000	1	3.3	N/A	2	19	N/A	No Further Action
Total Cyanide	µg/l	1	50	1	59	WS104 (DWS)	2	17	N/A	Further Discussion
Lead	µg/l	1.2	10	1	< 0.2	N/A	2	4.9	N/A	No Further Action
Mercury	µg/l	–	1.0	1	< 0.05	N/A	2	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	1	6	N/A	2	19	N/A	No Further Action
Selenium	µg/l	–	10	1	<0.6	N/A	2	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	1	10	N/A	2	89	TP103 1.80m (EQS) TP105 1.00m (EQS)	Further Discussion
pH	6–9			1	7.2	N/A	2	8.2	7.3–8.2	No Further Action
Polycyclic Aromatic Hydrocarbons										
Naphthalene	µg/l	2	10*	1	<0.01	N/A	2	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	1	<0.01	N/A	2	0.95	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	1	<0.01	N/A	2	0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	1	<0.01	N/A	2	<0.01	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Benzo(a)pyrene	µg/l	0.00017*	10*	1	<0.01	N/A	2	0.23	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	1	<0.01	N/A	2	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	1	<0.01	N/A	2	2.9	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	1	<0.01	N/A	2	<0.01	N/A	No Further Action
Aromatic Hydrocarbon										
TPH C5-C7 (benzene)	µg/l	10	1	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C8-C10 (xylene)	µg/l	30	300	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C10-C12 (naphthalene)	µg/l	2	90	1	<10	N/A	2	15	N/A	No Further Action
TPH C12-C16	µg/l	–	90	1	<10	N/A	2	30	N/A	No Further Action
TPH C16-C35	µg/l	–	90	1	<20	N/A	2	<20	N/A	No Further Action
Aliphatic Hydrocarbon										
TPH C5-C6	µg/l	–	1000 ⁵	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	1	<1.0	N/A	2	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	1	<10	N/A	2	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	1	<10	N/A	2	<10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	1	<10	N/A	2	<10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	1	<10	N/A	2	<10	N/A	No Further Action
Volatile Organic Compounds										
Tetrachloroethylene	µg/l	0.4	10	1	<3.0	N/A	2	–	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Trichloroethylene	µg/l	10	10	1	<3.0	N/A	2	–	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	1	<3.0	N/A	2	–	N/A	No Further Action
Trichloromethane	µg/l	2.5	–	1	<3.0	N/A	2	–	N/A	No Further Action
Dichloromethane	µg/l	20	200	1	<3.0	N/A	2	–	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	3	1	<3.0	N/A	2	–	N/A	No Further Action
Vinyl Chloride	µg/l	–	0.3	1	<3.0	N/A	2	–	N/A	No Further Action

Notes

Solubility <0.01µg/l

AA – Annual Average

* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. [The Water Framework Directive \(Standards and Classification\) Directions \(England and Wales\) 2015 \(legislation.gov.uk\)](#)
2. [The Water Supply \(Water Quality\) Regulations 2018 \(legislation.gov.uk\)](#)
3. [Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum \(who.int\)](#)
4. [CL:AIRE publishes Petroleum Hydrocarbons in Groundwater guidance \(claire.co.uk\)](#)
5. A total TPH criteria of 1000 mg/kg will act as a surrogate criterion for remaining aliphatic and aromatic TPH fractions.



4.3.1. SUMMARY OF RESULTS

This comparison indicates that the data exceeds the DWS values for the following inorganic compounds:

- ✿ Chromium (III) – Leachate
- ✿ Chromium (VI) – Leachate
- ✿ Total Cyanide – Groundwater
- ✿ Zinc – Leachate

Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation. The groundwater analysis only identified a marginal exceedance for total cyanide.

There are no drinking water standards for chromium (VI) and zinc, therefore, to be conservative the data has been compared to the environmental quality standards.

4.3.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

During the site works, groundwater strikes were recorded in several locations as slow seepages between 1.50 and 4.00 m bgl. Strikes were predominantly at the interface of the Made Ground and underlying CLAY, indicating the water to be perched in the Made Ground.

The nearest surface water feature is Moston Brook, however, this is located circa 140 m south of the site, therefore the brook is not considered to be a potential receptor and therefore the use of EQS values for thresholds is not considered appropriate.

The underlying principal aquifer is considered to be the primary receptor, however the overall risk is reduced given the absence of any active potable groundwater abstraction within 1km, which suggests the aquifer is not utilised as a strategic water resource. Furthermore, the aquifer is overlain by cohesive deposits which will serve to form an aquitard to limit the downward migration of any mobile contaminants.

Given the general low soluble nature of the identified contaminants of concern, in addition to the relatively low sensitivity of the site with respect to controlled waters, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environ.



4.4. GROUND GAS RISK ASSESSMENT METHODOLOGY

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in:

- ✳ CIRIA Report 665 – Assessing risks posed by hazardous ground gases to buildings (2007)
- ✳ BS8485:2015+A1:2019 – Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation (CS) and the proposed development based on building type.

Therefore, in accordance with BS8485, based on the measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) shall be derived for each monitoring point, from which the site characteristic hazardous gas flow rate (Q_{hgs}), and then the Characteristic Situation (CS) can be determined.

The following equation should be utilised:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where:

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

The subsequent derived gas screening value (GSV) should be the maximum Q_{hg} (flow rate x concentration as a percentage volume) for all the monitoring events.

A 'worst case check' may be carried out using the maximum recorded flow in any hole with the maximum concentration in any hole to present the plausible worst-case conditions. Adoption of the worst-case Q_{hg} requires thorough justification and reference to the CSM.

The final derived GSV can then be used to characterise the site as summarised in Table 4.5.

TABLE 4.5 SITE CHARACTERISATION BY GSV (BS8485:2015)

CS	HAZARD POTENTIAL	GSV (l/hr) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS1	Very Low	< 0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	< 0.70	Typical measured flow rate <70 l/h (otherwise consider an increase to CS3)
CS3	Moderate	< 3.5	N/A
CS4	Moderate to High	< 15	N/A
CS5	High	< 70	N/A
CS6	Very High	> 70	N/A



Notes

1. The CS is equivalent to the characteristic GSV in CIRIA C665.
2. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter should be considered.
3. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, multiplied by the concentration in the air stream of the particular gas being considered.
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

4.5. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) were measured using a calibrated infrared gas analyser (GFM435) with gas flow rates measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 500 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 4.6.

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485:2015+A1:2019. Based on the initial peak measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) have been derived for each monitoring point, from which an individual Characteristic Situation (CS) can ultimately be determined.



TABLE 4.6 SUMMARY OF GROUND GAS MONITORING RESULTS

WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS102	Made Ground	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1000	Steady	0.1	0.1	1.00–3.00	3.20	2.90
		25/07/2023	0.1	0.1	0.0001	7.0	7.0	0.0070	12.2	1000	Falling	0.1	0.1		2.70	Dry
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	998	Rising	0.1	0.1		2.88	2.31
		08/08/2023	0.1	0.1	0.0001	4.4	4.4	0.0044	15.4	1003	Steady	0.1	0.1		2.88	2.12
		15/08/2023	0.1	0.1	0.0001	8.2	8.2	0.0082	11.4	1005	Rising	0.1	0.1		2.88	2.40
		23/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1010	Falling	0.1	0.1		2.88	2.44
WS104	CLAY	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1000	Steady	0.1	0.1	1.50–5.00	5.20	2.10
		25/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	1000	Falling	0.1	0.1		4.90	1.70
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	998	Rising	0.1	0.1		4.9	1.53
		08/08/2023	0.1	0.1	0.0001	4.2	4.1	0.0042	12.6	1002	Steady	0.1	0.1		4.9	1.37
		15/08/2023	0.1	0.1	0.0001	5.3	5.2	0.0053	12.4	1004	Rising	0.1	0.1		4.9	1.65
		23/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1011	Falling	0.1	0.1		4.98	1.55
WS106	Made Ground	05/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1000	Steady	0.1	0.1	1.00–3.00	3.30	Dry
		25/07/2023	0.1	0.1	0.0001	3.7	3.7	0.0037	14.6	1002	Falling	0.1	0.1		2.95	Dry
		02/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	998	Rising	0.1	0.1		2.93	2.58
		08/08/2023	0.1	0.1	0.0001	3.1	3.0	0.0031	15.6	1003	Steady	0.1	0.1		2.93	2.43
		15/08/2023	0.1	0.1	0.0001	4.6	4.6	0.0046	13.4	1004	Rising	0.1	0.1		2.93	2.80
		23/08/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1011	Falling	0.1	0.1		2.93	2.70

Notes

CIRIA Characteristic Situation

Q_{hg}

CS1

<0.07

Typical Max CO₂ <5 % Typical Max CH₄ <1 %

Values in **BOLD** exceed CS1 Thresholds

CS2

<0.7

Flow rate not to exceed 70 l/hr otherwise consider increase to CS3

Values in **BLUE** denote water above level of response zone (flooded)



	CS3	<3.5	
	CS4	<15	Quantitative Risk Assessment required to evaluate scope of protective measures



4.6. SUMMARY OF MONITORING RESULTS

4.6.1. GROUNDWATER

Groundwater was recorded between 1.37 m bgl and 2.90 m bgl.

WS104 was noted to be flooded during the fourth monitoring visit.

4.6.2. BAROMETRIC PRESSURE

Visits 2 and 6 were undertaken during periods of falling pressure.

Visit 3 was undertaken during a period of relatively low pressure, with pressure recorded to be 998 mbar. Visit 6 was undertaken during a period of relatively high pressure, with pressure recorded to be 1011 mbar.

It is therefore considered that the visits have been undertaken over representative conditions.

4.6.3. GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.1 l/hr (limit of detection of the analyser).

4.6.4. GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 0.1% v/v (limit of detection of the analyser).

Carbon dioxide concentrations were recorded at concentrations ranging from 0.1% v/v to 8.2% v/v (WS102).

4.6.5. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is presented in Table 4.7. This indicates that based on the peak flow rates the majority of the monitoring visits classify as Characteristic Situation (CS)1 – Very Low Gas Risk.

TABLE 4.7 GAS RISK PROFILE AND LOCATION

WELL	DATE	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH ₄ (%V/V)	MAX CH ₄ Q _{hg} (l/hr)	MAX CO ₂ (%V/V)	MAX CO ₂ Q _{hg} (l/hr)	CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT
WS102	05/07/2023	2.90	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	25/07/2023	Dry	0.10	0.10	0.0001	7.0	0.0070	CS2	Amber 1
	02/08/2023	2.31	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	08/08/2023	2.12	0.10	0.10	0.0001	4.4	0.0044	CS1	Green
	15/08/2023	2.40	0.10	0.10	0.0001	8.2	0.0082	CS2	Amber 1
	23/08/2023	2.44	0.10	0.10	0.0001	0.1	0.0001	CS1	Green



WELL	DATE	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH ₄ (%V/V)	MAX CH ₄ Q _{hg} (l/hr)	MAX CO ₂ (%V/V)	MAX CO ₂ Q _{hg} (l/hr)	CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT
WS104	05/07/2023	2.10	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	25/07/2023	1.70	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	02/08/2023	1.53	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	08/08/2023	1.37	0.10	0.10	0.0001	4.2	0.0042	CS1	Green
	15/08/2023	1.65	0.10	0.10	0.0001	5.3	0.0053	CS2	Amber 1
	23/08/2023	1.55	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS106	05/07/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	25/07/2023	Dry	0.10	0.10	0.0001	3.7	0.0037	CS1	Green
	02/08/2023	2.58	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	08/08/2023	2.43	0.10	0.10	0.0001	3.1	0.0031	CS1	Green
	15/08/2023	2.80	0.10	0.10	0.0001	4.6	0.0046	CS1	Green
	23/08/2023	2.70	0.10	0.10	0.0001	0.1	0.0001	CS1	Green

E3P has assessed the previous variables and come to the following conclusions:

- Based on the peak flow rates and gas concentrations, the monitoring data to date indicates that the majority of visits classify as CS1/Green.
- In the vicinity of WS102, carbon dioxide has been identified above the 5 % v/v threshold on two occasions, however the GSV is noted to be within a CS1 classification.
- During Visit 5, carbon dioxide was recorded at 5.3 % v/v in WS104. This is likely to be a result of high groundwater levels causing compression in the well.
- The main sources of ground gases has been identified as the deep Made Ground Deposits, which due to their inherent variability may contain putrescible materials and volatiles that produce ground gases.
- It is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the full ground gas monitoring.
- Furthermore, with regards to the elevated volatile contaminants (naphthalene, elemental mercury and SVOCs), vapour resistant membranes may be required to be installed during the build phase. A Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.

It is recommended that the full ground gas assessment and recommended protection measures (if applicable) are agreed with the local authority prior to their adoption on-site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.



4.7. BUILDING GAS RISK MITIGATION

4.7.1. BRITISH STANDARD BS8485 (2015)+A1 (2019)

British Standard BS8485:2015+A1(2019) provides different types of property that require assessment. These building types are:

Type A Building – Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms are present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.

Type B Building – Private or commercial property with central building management control of any alterations to the building or its uses but limited or no central building management control of the maintenance of the building, including the gas protection measures. Multiple occupancy. Small to medium sized rooms with passive ventilation of rooms and other internal spaces throughout ground floor and basement areas. May be conventional building or civil engineering construction. Examples include managed apartments, multiple occupancy offices, some retail premises and parts of some public buildings (such as schools, hospitals, leisure centres) and parts of hotels.

Based on the ground gas risk assessment and the proposed Type A Building, it is envisaged that a point score of 3.5 will be required for affected properties, as summarised in Table 4.8.

TABLE 4.8 BS8485 (2015)+A1(2019) POINTS REQUIRED FOR TYPE A AND TYPE B BUILDINGS

Characteristic Situation	Minimum gas protection score (points)	
	HIGH SENSITIVITY	
	TYPE A BUILDING	TYPE B BUILDING
1	0	0
2	3.5	3.5
3	4.5	4
4	6.5 ^{A)}	5.5 ^{A)}
5	— ^{B)}	6
6	— ^{B)}	— ^{B)}

BS8485 (2015)+A1(2019) Notes

A) Residential buildings should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.

B) The gas hazard is too high for this empirical method to be used to define the gas protection measures.



CHARACTERISTIC SITUATION	MINIMUM GAS PROTECTION SCORE (POINTS)			
	HIGH RISK		MEDIUM RISK	LOW RISK
	TYPE A BUILDING	TYPE B BUILDING	TYPE C BUILDING	TYPE D BUILDING
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 ^{A)}	5.5 ^{A)}	4.5	3.5
5	— ^{B)}	6	5.5	4.5
6	— ^{B)}	— ^{B)}	— ^{B)}	6

TABLE 4.9 SUMMARY OF GROUND GAS MITIGATION MEASURES – BS8485 (2015)+A1(2019)

GAS PROTECTION SCORES FOR THE STRUCTURAL BARRIER	SCORE ^A
Floor and Substructure Design	
Precast Suspended Segmental Subfloor (Beam and Block)	0
Cast in Situ Ground Bearing Floor Slab (With Only Nominal Mesh Reinforcement)	0.5
Cast in Situ Monolithic Reinforced Ground Bearing Raft or Reinforced Cast in Situ Suspended Floor Slab With Minimal Penetrations	1 or 1.5 ^B
Basement Floor and Walls Conforming to BS 8102:2009, Grade 2 Waterproofing ^{C D}	2
Basement Floor and Walls Conforming to BS 8102:2009, Grade 3 Waterproofing ^{C D}	2.5
Notes A) The scores are conditional on breaches of floor slabs, etc., being effectively sealed. B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see A.2.2.2). C) The score is conditional on the waterproofing being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall). D) If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas resistant membrane in that table. When practical, utilities should enter the building above floor level with any conduit or meter housing being properly vented outside of the building.	

PROTECTION ELEMENT SYSTEM	SCORE	COMMENTS
Gas protection scores for ventilation protection measures		
(a) Pressure Relief Pathway – Usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building.	0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is 0.
Very good performance	2.5	



PROTECTION ELEMENT SYSTEM		SCORE	COMMENTS
(b) Passive Subfloor Dispersal Layer – Media used to provide the dispersal layer are: ✳ Clear void; ✳ Polystyrene void former blanket; ✳ Geocomposite void former blanket; ✳ No fines gravel layer with gas drains; and ✳ No fines gravel layer.	Good performance	1.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS 8485 (2015). Passive ventilation should be designed to meet at least “good performance”.
(c) Active Dispersal Layer – Usually comprising fans with active abstraction (suction) from a subfloor dilution layer with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.		1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least “good performance”.
(d) Active Positive Pressurisation – Provided by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.		1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient “coverage” of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least “good performance”.
(e) Ventilated Car Park – Floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park.		4	Assumes that the car park is vented to deal with car exhaust fumes, designed to Buildings Regulations 2000, Approved Document F [9].
Gas Protection Score for the Gas Resistant Membrane			



PROTECTION ELEMENT SYSTEM	SCORE	COMMENTS
Gas resistant membrane meeting all of the following criteria: ✳ Sufficiently impervious to the gases with a methane gas transmission rate < 40 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 151051 manometric method); ✳ Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; ✳ Sufficiently strong to withstand in service stresses (e.g. settlement if placed below a floor slab); ✳ Sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools); ✳ Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and ✳ Verified in accordance with CIRIA C735.	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet all the criteria opposite then the score is zero.
A) Membrane with a methane gas transmission rate < 40.0 ml/day/m²/atm (average) for sheets and joints (tested in accordance with BS ISO 151051:2007 manometric method) is regarded as sufficiently impervious. B) For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m² and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 98631:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast in situ floor slabs.		



4.7.2. NHBC

The NHBC Traffic Light guidance can still be used where the development proposals are based on the 'typical house' used in the modelling for the traffic light classification system.

A typical house is defined as a house (up to three storeys) with <100 m² footprint and minimum 150 mm depth clear ventilated void achieving sub-slab ventilation of one complete air exchange per day.

NHBC expectations for verification to satisfy the Traffic Light gas regime classifications are as detailed in Table 4.10.

TABLE 4.10 TYPICAL NHBC EXPECTATION AND VERIFICATION REQUIREMENTS

GAS REGIME	MINIMUM GAS PROTECTION EXPECTATIONS	VERIFICATION OR INFORMATION REQUIREMENTS
Green	N/A – but need to comply with BR211 radon requirements, where applicable	
Amber 1	Ventilation – subfloor venting to achieve at least one air exchange per day (minimum 150 mm void height; 1500 mm² /m air vent opening or 500 mm² /m² floor area spaced at not more than 2 m centres on at least two opposing sides). Membrane – must be suitable for purpose. Membrane installation/design - to achieve complete integrity across entire building footprint. Penetrations and joints sealed.	Construction drawings – showing position of membrane; sealing details and ventilation points to be provided. Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – photographic evidence of installed membrane may be requested.
Amber 2	Ventilation – subfloor venting to achieve at least one air exchange per day. Membrane – must be suitable for purpose (criterion detailed in BS8485 clause 7.2.4). Membrane installation and design to achieve complete integrity across entire building footprint. Penetrations and joints sealed. Installer – installers must be experienced and appropriately trained and/or qualified.	Construction drawings showing position of membrane, sealing details and ventilation points to be provided. Membrane specification – technical data sheet(s) for gas membrane (including gas permeability data) to be provided. Installation – third-party verification report with supporting evidence to be included (i.e. photographic evidence and certificates of conformity, observations relating to sealing, location of ventilators and standards of installation). Integrity testing – may be requested; testing plan to be agreed in advance.
Red	Standard residential housing is not generally acceptable without further ground gas risk assessment and/or possible remedial mitigation measures to reduce or remove the source of the ground gases.	



4.8. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework. The assessment is made with reference to the UK Water Industry Research (UKWIR) publication "Guidance on the selection of Water Supply Pipes to be used in Brownfield Sites"

TABLE 4.11 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.2
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	24.9 (TP101 at 1.00m) 16.4 (TP105 at 1.00m)
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<290
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	N/A
Ethers*	0.5	N/A
Nitrobenzene*	0.5	N/A
Ketones*	0.5	N/A
Aldehydes*	0.5	N/A
Amines	Fail	N/A
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	EC10-EC16 Aliphatic and Aromatic Hydrocarbons: ✳ 96 (TP102 at 2.50m) ✳ 66.6 (TP103 at 1.80m) ✳ 10.8 (WS101 at 1.50m) ✳ 68.9 (WS102 at 2.80m) EC16-EC40 Aliphatic and Aromatic Hydrocarbons: ✳ 804 (TP102 at 2.50m) ✳ 809 (TP103 at 1.80m) ✳ 652 (WS102 at 2.80m)	



Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
	SVOCs:  (TP103 at 1.80m)  (WS102 at 2.80m)	
Is free product present in soil and groundwater?	None	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	Yes	
Will soils impacted with above determinands likely be utilised elsewhere on site?	No	
Will soils be imported to site as part of any future earth works	Currently unknown. The importation of materials may affect the WIR Risk Assessment which should be updated after completion.	

Notes - Pipe line depth normally between 0.75m–1.35m

Based on the assessment of current site conditions it is likely that barrier pipe will be required for the proposed development.



4.9. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.12 has been prepared for the site.

TABLE 4.12 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	Moderate	LOW
Assessment: Heavy metals (arsenic, lead and mercury [potentially volatile]) were identified throughout Made Ground between depths of 0.30 m and 2.80 m bgl. Non-volatile PAHs have been identified throughout Made Ground between depths of 0.20 m and 2.80 m bgl.						
Recommendation: Cover system to garden and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	Moderate	LOW
Assessment: Asbestos was detected within one sample submitted for chemical analysis. Amosite fibres were detected at 0.002 % wt/wt in TP105 at 1.00m bgl.						
Recommendation: The soils will require placement in accordance with the asbestos CSM. Construction works completed with PPE and provision of welfare.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons (Made Ground)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Likely	Moderate	To be determined
Assessment: Elevated concentrations of naphthalene, SVOCs and elemental mercury (volatile) have been identified in the Made Ground. A hydrocarbon odour was also noted in the Made Ground in TP102, TP103, WS102 and WS103. Recommendation: With regards to the elevated naphthalene, mercury and SVOCs, these present a potential volatilisation to indoor air risk. These elevated concentrations have been identified within several areas of the site. As the impact is attributed to the deposited Made Ground and no specific source has been identified, it may not be possible to classify these areas as hotspots for delineation and excavation. Instead, a vapour membrane may be required for all plots to mitigate the volatilisation risk. In due consideration of the potential for naphthalene, mercury and SVOC impact to represent a vapour intrusion risk, a Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.						
PL4	Methane, carbon dioxide (Made Ground, Off-site infilled reservoirs, historical landfill)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Moderate	LOW
Assessment: Based on the peak flow rates and gas concentrations, the monitoring data to date indicates that the majority of visits classify as CS1/Green.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
In the vicinity of WS102, carbon dioxide has been identified above the 5 % v/v threshold on two occasions, however the GSV is noted to be within a CS1 classification. During Visit 5, carbon dioxide was recorded at 5.3 % v/v in WS104. This is likely to be a result of high groundwater levels causing compression in the well. The main source of ground gases has been identified as the deep Made Ground deposits, which due to their inherent variability may contain putrescible materials and volatiles that produce ground gases. Recommendation: It is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the full ground gas monitoring.						
PL5	Mobile contaminants (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principal bedrock aquifer).	Low Likelihood	Low	LOW
Assessment: The Tier 2 controlled waters risk assessment identified exceedances of the DWS for chromium (III), chromium (VI), total cyanide and zinc. Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation. The groundwater analysis only identified a marginal exceedance for total cyanide. There are no drinking water standards for chromium (VI) and zinc, therefore, to be conservative the data has been compared to the environmental quality standards. The underlying principal aquifer is considered to be the primary receptor, however the overall risk is reduced given the absence of any potable water abstraction within the locality which suggests the aquifer is not utilised as a strategic water resource. Furthermore, the aquifer is overlain by cohesive deposits which will serve to form an aquitard to limit the downward migration of any mobile contaminants.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Given the general low soluble nature of the identified contaminants of concern, in addition to the relatively low sensitivity of the site with respect to controlled waters, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environ. Recommendation: No further assessment required.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Low Likelihood	Low	LOW
Assessment: The soils at the site meet class DS-1, AC-1s. Recommendation: Concrete should be designed in accordance with the chemical testing results.						
PL7	Organic contaminants such as hydrocarbons, SVOCs (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Likely	Moderate	LOW
Assessment: Elevated concentrations of TPH have been identified at the proposed pipeline depth (0.75 m – 1.35 m). Recommendation: Based on the assessment of current site conditions, it is likely that barrier pipe will be required. This will need to be confirmed with a UKWIR risk assessment post remediation.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
Assessment: Generally low concentrations of zinc, nickel and copper have been recorded in the soils at the site. Low risk to flora anticipated.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
Recommendation: Installation of a clean cover system within any areas of soft landscaping to prevent plant uptake of contaminants.						

Main exposure pathways:

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants;



5. GEOTECHNICAL ASSESSMENT

5.1. PROPOSED DEVELOPMENT

E3P understands that Jigsaw Homes propose to redevelop a parcel of land off Lathbury Road in Harpurhey, Manchester for low-rise residential housing with soft landscaping, associated adopted estate roads and utility infrastructure. The development layout is yet to be finalised..

5.2. SITE PREPARATION

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual of Contract Documents for Highway Works (MCHW)*. This should include the following:

- ✳ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✳ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✳ Buried structures have been encountered on site. These should be excavated from below the proposed development footprint with the resulting void backfilled.

5.3. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the net safe allowable bearing pressure (ABP) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The results of this assessment are summarised in Table 5.1.

TABLE 5.1 SUMMARY OF ABP

COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Firm medium strength (silty) CLAY	2.00–2.45	64–69	131–141
Firm medium strength CLAY	3.00–3.45	52–70	107–143
Firm medium strength CLAY	4.00–5.45	50–72	102–148
Stiff high strength CLAY	3.00–5.45	80–104	165–213
Very stiff very high strength CLAY	2.00–3.00	184–186	432–437



Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe net allowable bearing pressure, the suitable target founding stratum has been identified as the underlying firm to very stiff glacial clays.

Due to the significant depths of Made Ground, a programme of remediation and enabling works will be required to remove the extensive buried obstructions and cut/fill the site to provide suitable development platform levels.

Therefore, upon completion of these enabling works, it is likely that the most cost-effective option for the majority of the site would be to re-engineer the Made Ground using vibro stone columns (VSCs) to support a shallow strip or spread foundation. To determine if VSC is viable at the subject site, E3P has completed a Ground Improvement Design Risk Matrix that is summarised in Table 5.2.

TABLE 5.2 GROUND IMPROVEMENT DESIGN RISK MATRIX

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m ²	CLAY soils are generally firm to very stiff with Cu > 40 kN.	PASS
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200 mm, either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column	No peat deposits have been identified.	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground requires processing/re-engineering to render the site suitable for VSC.	Re-engineering of Made Ground required.
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	Loose fill has been encountered on site, however it is unlikely to have been subject to rising water levels as groundwater encountered was likely perched and not a true representation of groundwater levels.	Re-engineering of Made Ground required.
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	Fill has been identified containing organic material within TP101-TP103.	PASS – On completion of enabling works
Fill, containing degradable material where organic material forms more than 15% of fill by volume	Fill has been identified containing organic material within TP101-TP103.	PASS – On completion of enabling works
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS



RISK ITEM	COMMENT	PASS/FAIL
Cohesive soils with trees in influencing distance	Plots where tree influence has been modelled and will either be subject to a piled or mass trench-fill solution.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS

A summary of anticipated foundations is presented in Table 5.3.

TABLE 5.3 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	1.95	–	Stiff CLAY	Y	Trench Fill/Engineered	–
WS102	3.35	–	Stiff CLAY	Y	Engineered	DS-1, AC-1s
WS103	3.35	4.00	Stiff CLAY	N	Engineered	–
WS104	1.95	–	Stiff CLAY	Y	Trench Fill/Engineered	–
WS105	3.15	1.50	Stiff CLAY	Y	Engineered	–
WS106	4.15	3.60	Stiff CLAY	Y	Engineered	–
TP101	2.35	–	V Stiff CLAY	Y	Engineered	DS-1, AC-1s
TP102	3.25	2.80	Stiff CLAY	N	Engineered	DS-1, AC-1s
TP103	3.25	2.80	V Stiff CLAY	N	Engineered	DS-1, AC-1s
TP104	3.05	–	Stiff CLAY	Y	Engineered	DS-1, AC-1s
TP105	3.25	2.70	Stiff CLAY	Y	Engineered	DS-1, AC-1s

Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

It is recommended that at working drawing stage a foundation schedule is prepared for the development, taking account of the physical change of natural clay soils and the current/proposed locations of trees.



At this time, it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience of similar sites, we would anticipate that the final foundation solution would be a combination of the following:

- ✳ Ground improvement using vibro stone column (VSC) to support a shallow reinforced concrete strip foundation where ground conditions are unsuitable for strip/trench.
- ✳ Piled foundations in areas unsuitable for Ground Improvement by Vibro.

5.4. GROUND FLOOR SLABS

Current building control regulations require that where infilled ground is present to depths in excess of 600 mm, or where the substratum is variable in terms of the structure and settlement potential, or where clay soils are present within the influence of existing or proposed trees, a suspended floor slab is required.

In this instance, it is considered that for the majority of substructures, the underlying stratum would have in excess of 600 mm of infill and, as such, a suspended floor slab will be required.

Where a cast in-situ suspended slab is utilised with no subfloor void, appropriate compressible material (heave precautions) will be required in the construction of the substructure.

5.5. HEAVE PRECAUTIONS

The site has been proven to be underlain by clay soils, which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within influencing distance of trees as per the NHBC/LABC conjectured zones of influence.

As the clay is deemed to be medium volume change potential heave precautions will be required to the internal face of the external load-bearing walls (outside or within tree influence).

If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams as well as a void included beneath precast concrete and suspended floors.

A summary of heave precautions is presented in Table 5.4.



TABLE 5.4 SUMMARY OF HEAVE PRECAUTIONS

		MINIMUM VOID DIMENSION FOR FOUNDATIONS, GROUND BEAMS AND SUSPENDED IN-SITU CONCRETE GROUND FLOORS		MINIMUM VOID DIMENSIONS UNDER PRECAST CONCRETE AND SUSPENDED TIMBER FLOORS
Plasticity Index of Soil	Required Foundation Depth (m)	Thickness of Void Former Against Side of Foundation or Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam and Floor Slab (mm)	Void Dimension (mm)
High Plasticity (> 40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	35	150	300
	1.5–2.0	25	75	
Moderate Plasticity (20–40)	> 2.5	Engineer Design		Engineer Design
	2.0–2.5	25	100	250
	1.5–2.0	25	50	
Low Plasticity (< 20)	2.0–2.5	N/A	50	200
	> 2.0	No Special Precautions		

5.6. HIGHWAYS CONSTRUCTION

A programme of remediation and enabling works will be required to remediate the proposed road subgrade in accordance with the requirements of the Manual of Contract Documents for Highway Works Volume 1 Specification For Highway Works (Series 600-Earthworks) for a method compaction.

It is considered that the material can be re-engineered using method compaction to achieve a CBR in excess of 5% if works are completed in favourable climatic conditions.

5.7. DRAINAGE

The presence of substantial depths of Made Ground across some areas of the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

Due to the presence of low-permeability clays beneath the Made Ground, soakaway drainage is unlikely to be viable on site. If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.

5.8. CONCRETE DURABILITY

Based upon the results of the chemical analyses it is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE *Special Digest 1* (2005).



5.9. EXCAVATIONS

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation in Made Ground and cohesive materials.

Site observations indicated that excavations should be feasible in the near surface with normal plant; however, obstructions were identified in the near surface, including former foundations. It is anticipated that any obstructions will be grubbed out during the reduced-level dig for the substructure works.

However, due to the depth and variability of the Made Ground and likelihood of trench collapse, it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations, then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures in close proximity to the site.

TABLE 5.5 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand have been identified.
Minor Water Ingress	Yes	Minor water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	Shallow bedrock has not been identified.



5.10. CONSTRUCTION ACTIVITY AND INSPECTION

The following activities and inspections should be incorporated into the site works:

- ✳ Due to the variability of the soils at the site, it is recommended that sufficient allowance is made for the inspection of formations and sub-formations to foundations and pavement construction.
- ✳ Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.
- ✳ It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.
- ✳ Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.
- ✳ The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).



5.11. GEOTECHNICAL RISK REGISTER

POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils		TBC	TBC	Material deemed to have a potential vapour risk may require hotspot removal, resulting in the requirement to backfill the resulting void. Should significant backfill be needed deeper or specialist foundations may be required in those areas.
Bedrock		N/A	N/A	Shallow bedrock has not been identified.
Obstructions		Central	40	Site has been subject to historical development and infilling and significant brick obstructions were encountered. Intact bricks and relict foundations were also encountered in TP103.
Trench collapse		All	100	Made Ground present beneath the site is likely to be loosely compacted and possibly prone to collapse.
Mature trees		Boundaries	55	Arboriculture survey is required to determine areas of potential tree influence.
Volume change potential clay		All	50	The clay soils are of medium volume change potential, therefore heave precautions may be required.
Peat		N/A	N/A	Peat has not been identified within the site investigation.
Running sands		N/A	N/A	Data searches indicate very low risk.
Ground dissolution		N/A	N/A	Data searches indicate no hazard.
Concrete design		All	100	The soils meet class DS-1, AC-1s.
Low-permeability ground		All	100	Due to the presence of low-permeability clays beneath the Made Ground, soakaway drainage is unlikely to be viable on site. If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.



POTENTIAL CONSTRAINT	ABNORMAL	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Services/sensitive structures		South west	5	A review of statutory utility plans has indicated the following services on site: ✳ A comms water pipe enters the site in the southwestern corner of the site. ✳ Underground BT cables enters the site in the southwestern corner of the site.
Abnormal foundation solutions		TBC	TBC	Dependent on development levels and in areas of tree influence an abnormal foundation solution (MTF, VSC, Pile) may be required due to the presence of deep Made Ground.



5.12. FURTHER WORKS

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

-  Tier 3 vapour risk assessment.
-  Plot-specific foundation schedule (upon receipt of the final development levels).
-  Arboricultural survey.
-  Remediation and enabling works strategy.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

Human Health	E3P has undertaken a Tier 2 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable risk to the identified receptors. Results have been compared to residential end use with plant uptake GAC values (S4UL and C4SL) with 1% soil organic matter in the first instance. This comparison indicates that the data exceeds the GAC values for the following: ✳ Heavy metals (lead, arsenic and total mercury) ✳ Elemental mercury and inorganic mercury ✳ Naphthalene ✳ Non-volatile PAHs (Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(a)Pyrene and Dibenzo(a,h)Anthracene) ✳ TPH Aromatic C16-C21 ✳ Asbestos (Amosite fibres 0.002% wt/wt) Heavy metals and non-volatile PAH compounds have primary exposure pathways related to dermal contact and ingestion of soils. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils. Elemental mercury can pose a vapour risk to site end users. Five samples have been found to contain total mercury in exceedance of the most conservative screening value (1.2 mg/kg). Mercury is composed of inorganic mercury, organo-mercury species and elemental mercury. Elemental mercury is the volatile fraction. To determine the elemental proportion, speciation has been carried out on two samples (TP102 3.2 mg/kg and TP105 53 mg/kg). Made Ground in TP102 was found to contain 0.786 mg/kg elemental mercury and TP105 was found to contain 10.71 mg/kg elemental mercury (volatile). No mercury exceedances were identified in TP102. In respect of the marginally elevated mercury at TP101, in the absence of further speciation, the total mercury may be assumed to be non-volatile.
----------------------------	--



Human Health

Continued

The soils at TP103 and WS102 (total mercury concentration of 6.9 mg/kg) should be assumed to be volatile and exceedances of other semi-volatile compounds have been identified in these locations. During remediation and enabling works, further speciated mercury analysis should be completed on samples of the Made Ground to assess whether elemental mercury is present which may pose a risk to future site users through vapour inhalation.

Naphthalene was found to be in exceedance of the GAC value (residential end use with plant uptake and 1% SOM) in Made Ground in TP101, TP103, TP105 and WS102. Naphthalene also presents a vapour risk. However, on review of the organic content of the soils, comparison to GAC values for 2.5 % SOM is more appropriate. When the higher GAC values are applied, the naphthalene in TP101 and TP105 is no longer in exceedance. A clean cover system will be sufficient to mitigate the risk in TP101, however, the Made Ground in TP105 is still considered a vapour risk due to the presence of elemental mercury.

A hydrocarbon odour was also noted in the Made Ground in TP102, TP103, WS102 and WS103.

With regards to the elevated naphthalene, mercury and SVOCs, these present a potential volatilisation to indoor air risk. These elevated concentrations have been identified within several areas of the site. As the impact is attributed to the deposited Made Ground and no specific source has been identified, it may not be possible to classify these areas as hotspots for delineation and excavation. Instead, a vapour membrane may be required for all plots to mitigate the volatilisation risk.

In due consideration of the potential for naphthalene, mercury and SVOC impact to represent a vapour intrusion risk, a Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.

Asbestos was detected within one sample submitted for chemical analysis. Amosite fibres were detected at 0.002% wt/wt in TP101 at 1.00m bgl. Impacted soil should be managed according to the asbestos risk mitigation conceptual site model.

Chemical analysis of the natural clay drift deposits has not been undertaken. Validation testing will be required to determine whether they are acceptable for use as subsoil within the proposed garden areas. There are no suitable sources of topsoil available on the site.

It is recommended that allowance be made for import of topsoil and subsoil for all gardens and soft landscaped areas.



Controlled Waters	The Tier 2 controlled waters risk assessment identified exceedances of the DWS for chromium (III), chromium (VI), total cyanide and zinc. Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation. The groundwater analysis only identified a marginal exceedance for total cyanide. There are no drinking water standards for chromium (VI) and zinc, therefore, to be conservative the data has been compared to the environmental quality standards. The nearest surface water feature is Moston Brook, however, this is located circa 140 m south of the site, therefore the brook is not considered to be a potential receptor and therefore the use of EQS values for thresholds is not considered appropriate. The underlying principal aquifer is considered to be the primary receptor, however the overall risk is reduced given the absence of any active potable groundwater abstraction within 1km, which suggests the aquifer is not utilised as a strategic water resource. Furthermore, the aquifer is overlain by cohesive deposits which will serve to form an aquitard to limit the downward migration of any mobile contaminants. Given the general low soluble nature of the identified contaminants of concern, in addition to the relatively low sensitivity of the site with respect to controlled waters, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environ.
Ground Gas	Based on the peak flow rates and gas concentrations, the monitoring data to date indicates that the majority of visits classify as CS1/Green. In the vicinity of WS102, carbon dioxide has been identified above the 5 % v/v threshold on two occasions, however the GSV is noted to be within a CS1 classification. During Visit 5, carbon dioxide was recorded at 5.3 % v/v in WS104. This is likely to be a result of high groundwater levels causing compression in the well. It is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the full ground gas monitoring. Furthermore, with regards to the elevated volatile contaminants (naphthalene, elemental mercury and SVOCs), vapour resistant membranes may be required to be installed during the build phase. A Detailed Quantitative Risk Assessment (DQRA) is required to assess the actual vapour intrusion potential.
Potable Water	Based on the assessment of current site conditions it is likely that Barrier pipe will be required for the proposed development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.



6.2. GEOTECHNICAL ASSESSMENT

Significant concrete and brick obstructions have been encountered within the Made Ground, indicative of relic foundations from the former residential dwellings.

During a phase of cut-and-fill enabling works to create a developable platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.

Dependent on development levels, it is considered that the optimum foundation solution would be a combination of the following:

-  Ground improvement using vibro stone column (VSC) to support a shallow reinforced concrete strip foundation;
-  Piled foundation in areas unsuitable for Ground Improvement by Vibro.

Foundation depths within the conjectured influence of former, existing or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content.

END OF REPORT



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme

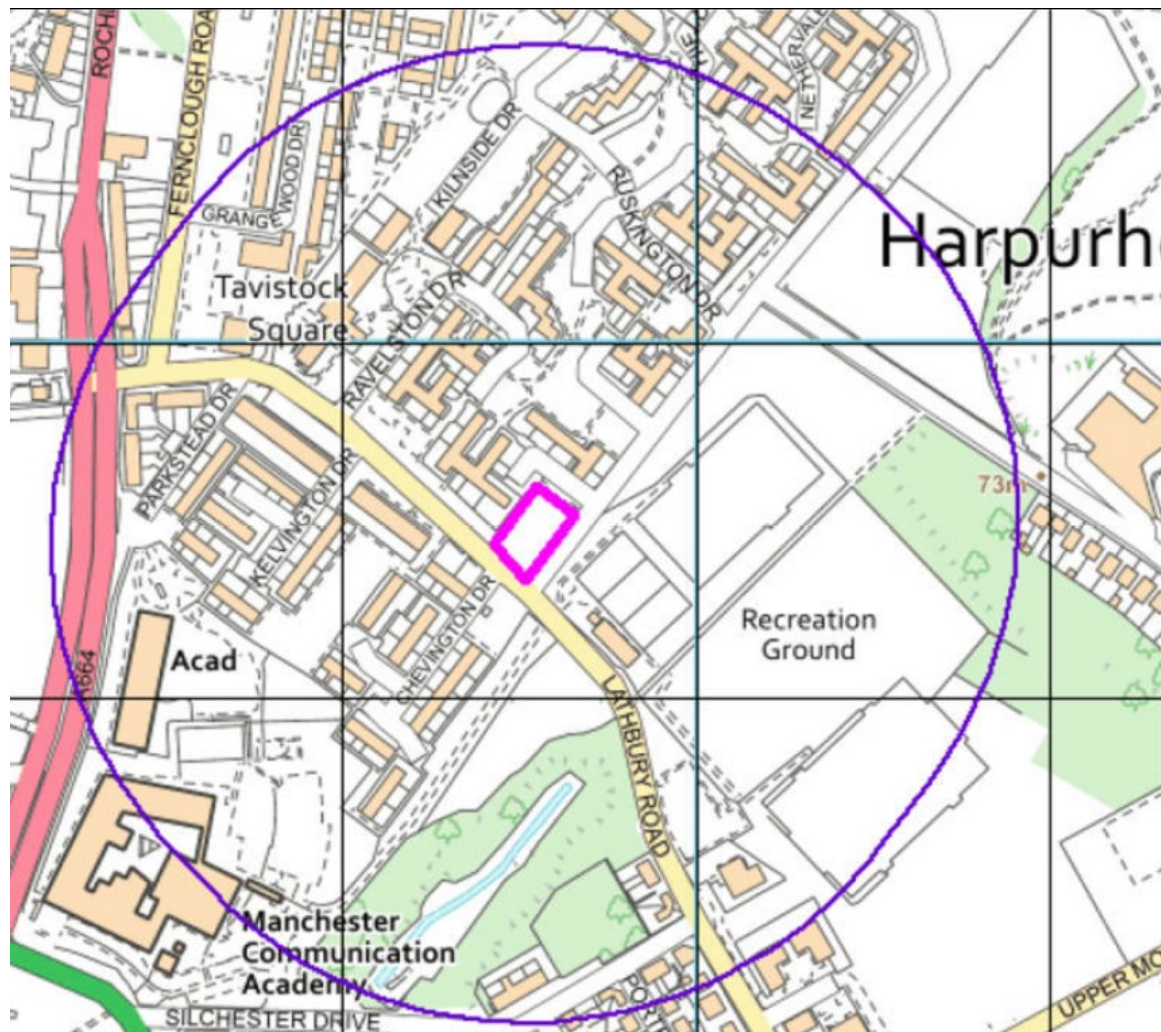


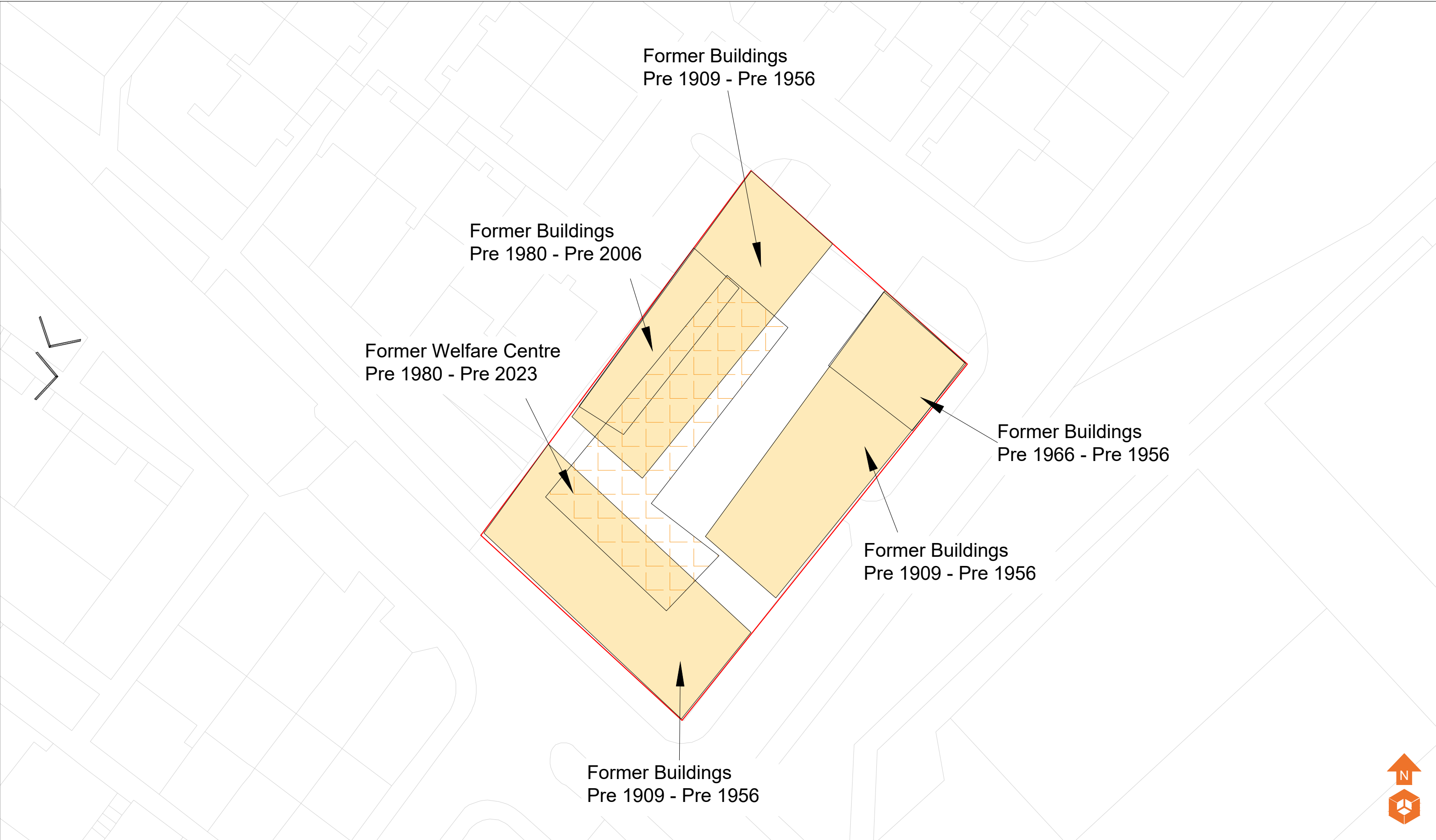
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III DRAWINGS

DRAWING 16-718-001 – SITE LOCATION PLAN

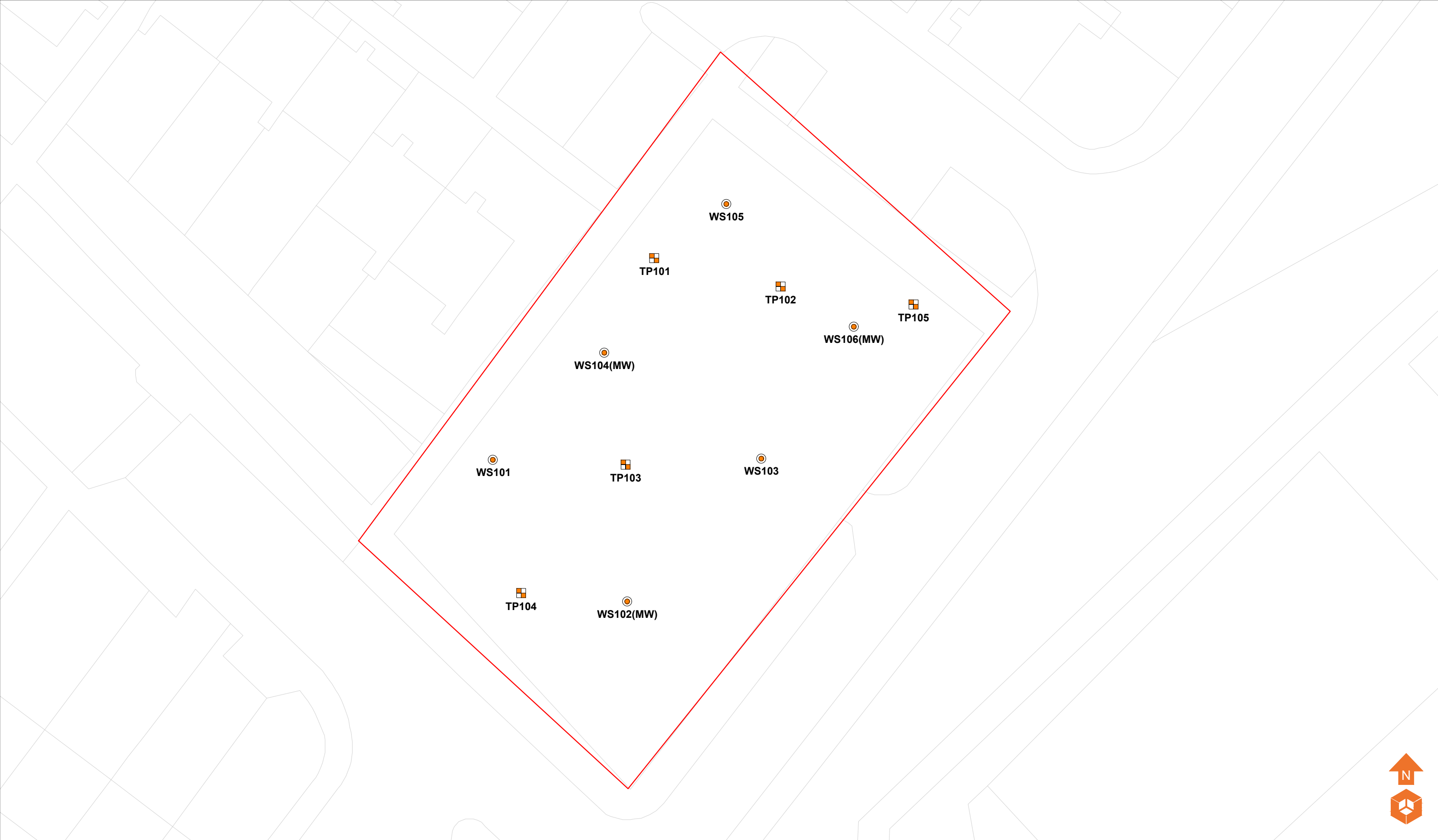




Historical Features Former Buildings Welfare Centre	Notes:					Client:	Jigsaw Homes	Job No:	16-718	Date:	10.08.2023	e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk															
								Drawing No:	003	Scale:	NTS@ A3																
	<table><tr><td>P1</td><td>REVB</td><td>10.08.2023</td><td>EB</td><td>EC</td></tr><tr><td>P1</td><td>REVA</td><td>31.07.2023</td><td>OW</td><td>EC</td></tr><tr><td>Phase</td><td>Issue</td><td>Date</td><td>Drawn</td><td>Checked</td></tr></table>					P1	REVB	10.08.2023	EB	EC	P1		REVA	31.07.2023	OW	EC	Phase	Issue	Date	Drawn	Checked	Job Title:		Lathbury Road, Manchester	Drawing Title:		Historical Features Plan
P1	REVB	10.08.2023	EB	EC																							
P1	REVA	31.07.2023	OW	EC																							
Phase	Issue	Date	Drawn	Checked																							



Site Features Mature Trees Overgrown Grasses Overgrown Hedgerow/ Gated Site Entrance Chain Link Fencing	Notes:	Client: Jigsaw Homes	Job No: 16-718	Date: 31.07.2023	Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk
P1 REVA 31.07.2023 OW EC Phase Issue Date Drawn Checked	Job Title: Lathbury Road, Manchester	Drawing No: 004	Scale: NTS @ A3	Drawing Title: Site Features Plan	The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Location Symbols

-  Approximate Window Sample Probehole Location
-  Approximate Window Sample Probehole Location with Install
-  Approximate Trial Pit Location

Notes:

P1	REVA	03.07.2023	RW	MD
Phase	Issue	Date	Drawn	Checked

Client:

Jigsaw Homes

Job Title:

Lathbury Road, Manchester

Job No:
16-718

Drawing No:
005

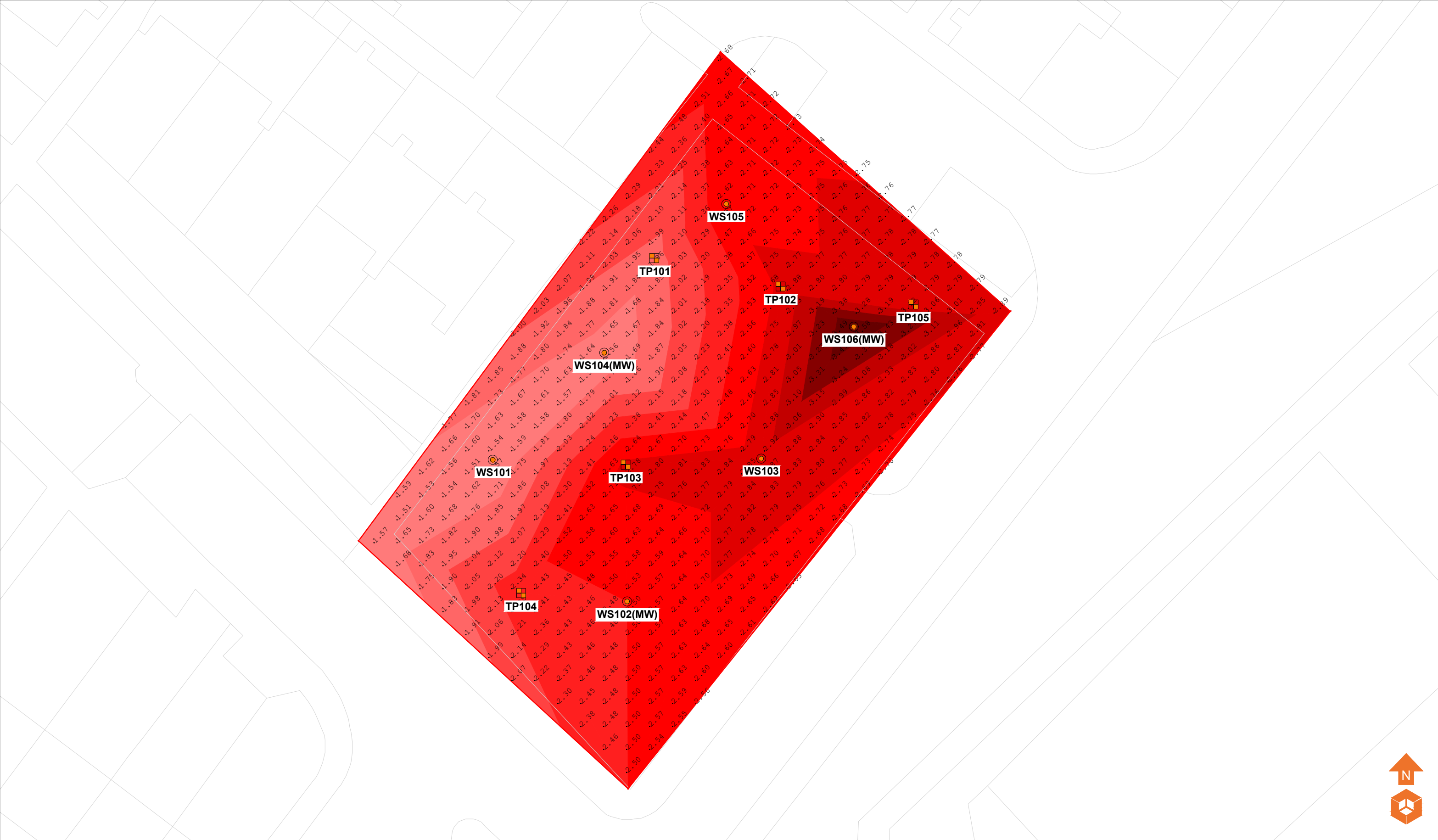
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03.07.2023

Scale:
1:1000 @ A3



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- Location Symbols**
-  Approximate Window Sample Probehole Location
 -  Approximate Window Sample Probehole Location with Install
 -  Approximate Trial Pit Location

Made Ground Depth (m)

	Depth of Made Ground 0.00 - 1.49m
	Depth of Made Ground 1.50 - 1.74m
	Depth of Made Ground 1.75 - 1.99m
	Depth of Made Ground 2.00 - 2.24m
	Depth of Made Ground 2.25 - 2.49m
	Depth of Made Ground 2.50 - 2.74m
	Depth of Made Ground 2.75 - 2.99m
	Depth of Made Ground 3.00 - 3.24m
	Depth of Made Ground >3.25m

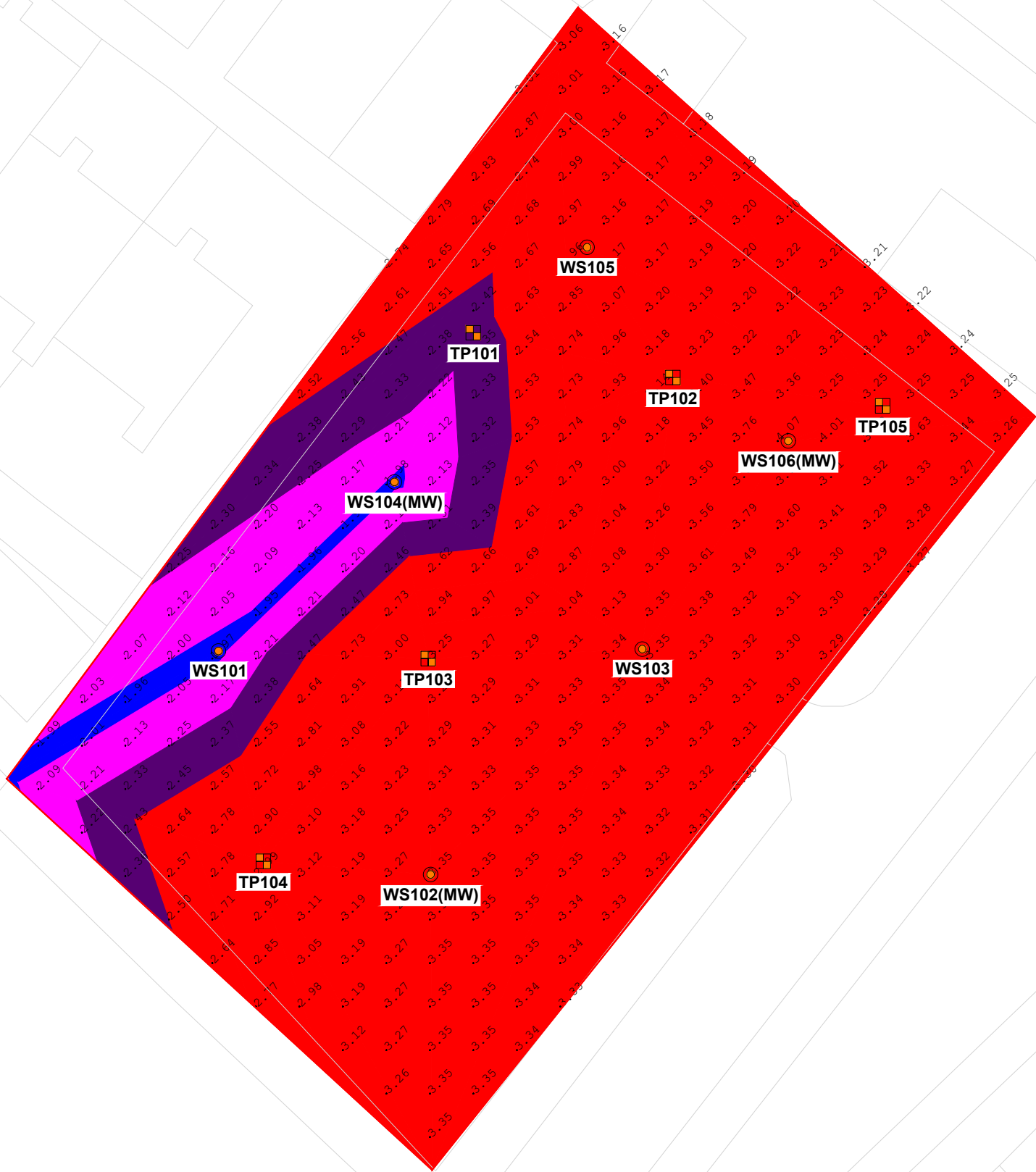
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Phase	Issue	Date	Drawn	Checked

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		Drawing No:	006	Scale:	NTS@ A3
Job Title:	Lathbury Road, Manchester	Drawing Title:	Depth of Made Ground Plan		



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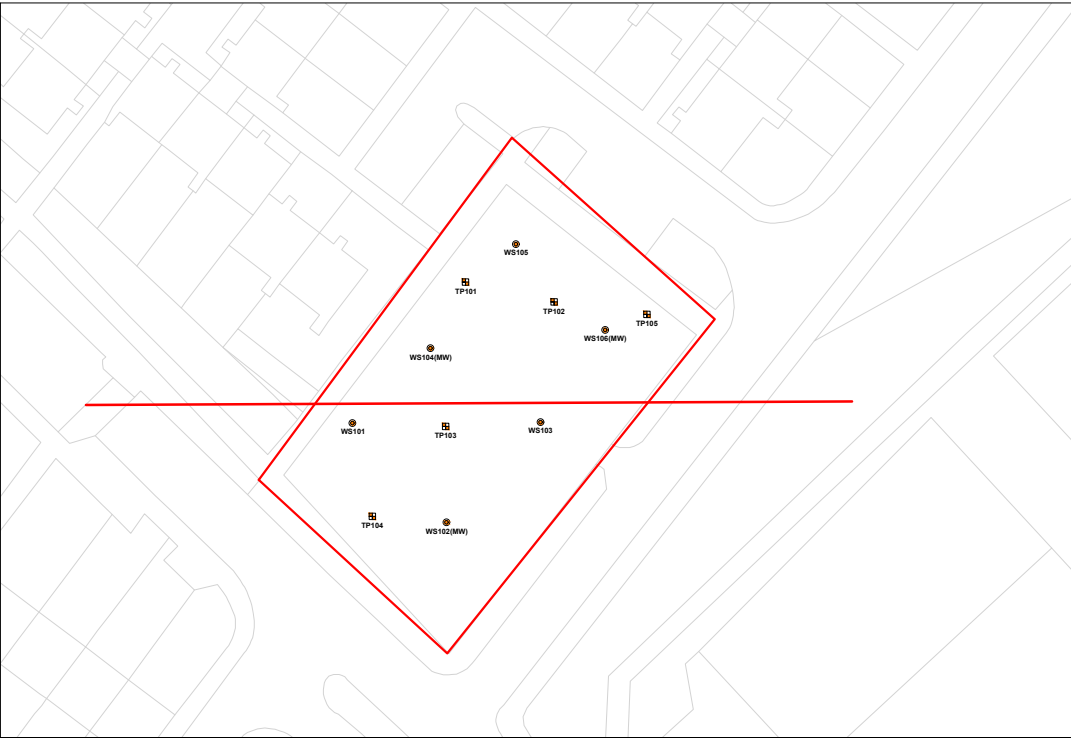
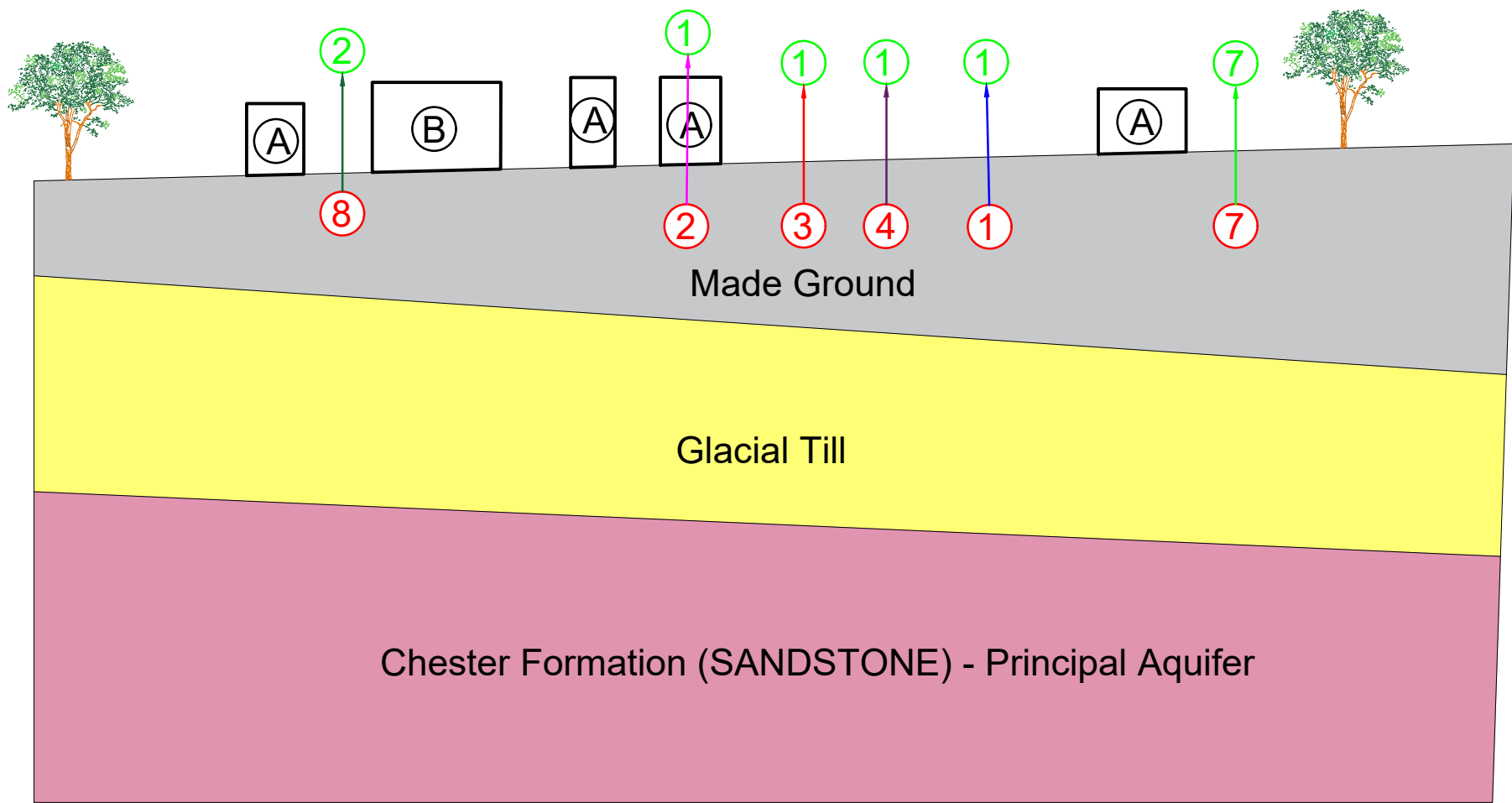
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Location Symbols WS101 WS102(MW) TP101 Approximate Window Sample Probehole Location Approximate Window Sample Probehole Location with Install Approximate Trial Pit Location					Shallow Spread Footings Depth to Founding Strata 0.00 - 1.24m Depth to Founding Strata 1.25 - 1.49m Mass Trench Fill Footings Depth to Founding Strata 1.50 - 1.74m Depth to Founding Strata 1.75 - 1.99m Depth to Founding Strata 2.00 - 2.24m Engineered Footings Depth to Founding Strata 2.25 - 2.49m Depth to Founding Strata >2.50m					Notes:					Client: Jigsaw Homes		Job No: 16-718		Date: 10.08.2023		e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
					Job Title: Lathbury Road, Manchester					Drawing No: 008				Scale: NTS@ A3		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.						
P1					REVA					Depth to Founding Strata Plan												
Phase					Issue					Date												
10.08.2023					EB					EC												
Drawn					Checked																	

E

W



Geology Key Made Ground Sandstone (Wilmslow Sandstone Formation Principal Aquifer) Sand & Gravels (Glaciofluvial Sheet Deposits Secondary A Aquifer) Groundwater	Sources 1 Heavy Metals, Non Volatile PAH's, Non Volatile TPH's (Made Ground) 2 Asbestos (Made Ground) 3 Volatile Contaminants (SVOC, Mercury, Napthalene) 4 Ground Gases (Made Ground) 5 Mobile Contaminants 6 Sulphate (Made Ground) 7 Phytotoxic Contaminants (Made Ground) 8 Organic Contaminants
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APPENDIX IV PHOTOGRAPHS

PLATE 1 SITE ENTRANCE



PLATE 2 VIEW OF SITE FACING NORTH EAST



PLATE 3 VIEW OF SITE FACING NORTH



PLATE 4 MATURE TREES IN SOUTHERN CORNER OF SITE



PLATE 5 **TP104 EXCAVATION AND ARISING**



PLATE 6 **TP103 EXCAVATION AND ARISING**



PLATE 7 BACKFILLED TP104



PLATE 8 WS105 ARISINGS



PLATE 9 WS102 ARISINGS



PLATE 10 WS104 MONITORING WELL



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Lathbury Road	Project No. 16718	Co-ords: 385907.00 - 400907.00 Level:	Date 20/06/2023
Location: Manchester	Dimensions (m): 2.50 Depth 3.20		Scale 1:30
Client: Jigsaw Homes			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.00	ES		0.45			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
				0.90			MADE GROUND: Brick fill.	
				1.10			MADE GROUND: Greyish black gravelly clay. Gravel is fine to coarse angular to sub-angular of slag, brick and metal.	1
							MADE GROUND: Brown slightly gravelly slightly sandy reworked clay with pockets of black organic clay. Gravel is fine to coarse angular to sub-angular of brick and clinker.	
	2.00 2.00 2.00	B ES HVP	184	1.90			Very stiff very high strength brown mottled grey slightly sandy CLAY.	2
				3.20			End of Pit at 3.20m	3
								4

Trial Pit Photographs



TP101



TP101 Arisings

Remarks: 1. Complete.

Stability: Stable.

Project Name: Lathbury Road	Project No. 16718	Co-ords: 385917.00 - 400905.00 Level:	Date 20/06/2023
Location: Manchester		Dimensions (m): 2.50 Depth 3.20	Scale 1:30
Client: Jigsaw Homes			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.50			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
				0.80			MADE GROUND: Brick and concrete fill.	
				1.00			MADE GROUND: Blackish brown clayey gravelly medium to coarse sand with band of white gravel at 0.80 m to 1.00 m bgl. Gravel is fine to coarse subangular to subrounded of shells, slag, brick, concrete and bitumen.	1
							MADE GROUND: Black slightly silty clay with wood/organic matter fragments. (Strong hydrocarbon odour)	
	2.50	ES		2.80			Stiff yellowish brown silty CLAY.	2
				3.00			Stiff brown mottled grey CLAY.	3
				3.20			End of Pit at 3.20m	4

Trial Pit Photographs



Remarks: 1. Complete. 2. Water strike encountered at 2.80 m bgl - slow seepage. 3. Strong hydrocarbon odour encountered from 1.00 m to 2.80 m bgl).

Stability: Stable.

Project Name: Lathbury Road	Project No. 16718	Co-ords: 385906.00 - 400891.00 Level:	Date 20/06/2023
Location: Manchester	Dimensions (m): Depth 3.20		Scale 1:30
Client: Jigsaw Homes	0.70 		Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.80				0.30			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
							MADE GROUND: Greyish brown clayey fine to medium sand with occasional pockets of black silty fine to medium sand. Frequent intact bricks and relict foundations encountered to 1.50 m bgl.	1
	1.80	ES		1.70			MADE GROUND: Black gravelly clay. Gravel is fine to coarse subangular to angular of shells, ceramic, mudstone and organic matter. (Strong hydrocarbon odour)	2
				2.80			Very stiff very high strength greyish brown CLAY.	3
	3.00 3.00	ES HVP	186	3.20			End of Pit at 3.20m	4

Trial Pit Photographs

	
TP103	TP103 Arisings

Remarks: 1. Complete. 2. Water strike encountered at 2.80 m bgl - slow seepage. 3. Strong hydrocarbon odour encountered from 1.70 m to 2.80 m bgl). 4. Relict brick foundations encountered to 1.50 m bgl.

Stability: Stable.

Project Name: Lathbury Road	Project No. 16718	Co-ords: 385899.00 - 400881.00 Level:	Date 20/06/2023
Location: Manchester		Dimensions (m): 2.00 0.70 Depth 3.00	Scale 1:30 Logged E. Canham
Client: Jigsaw Homes			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.35	ES		0.40			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
				0.60			MADE GROUND: Brick fill.	
	1.20	ES					MADE GROUND: Blackish brown slightly clayey gravelly fine to medium sand with occasional roots and cobbles. Gravel is fine to coarse subangular to subrounded of brick, concrete, shells and ceramic. Cobbles are angular to sub-angular of bricks.	1
	2.00	B						2
				2.40			Yellowish brown SILT.	
				2.60			Stiff grey mottled brown slightly sandy CLAY.	
				3.00			End of Pit at 3.00m	3
								4

Trial Pit Photographs



TP104



TP104 Arisings

Remarks: 1. Complete.

Stability: Stable.

Project Name: Lathbury Road	Project No. 16718	Co-ords: 385928.00 - 400904.00 Level:	Date 20/06/2023
Location: Manchester	Dimensions (m): 2.30 Depth 3.10		Scale 1:30
Client: Jigsaw Homes			Logged E. Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.70				0.35			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
				0.70			MADE GROUND: Blackish brown clayey gravelly medium to coarse sand. Gravel is fine to coarse angular to sub-angular of brick and plastic.	
	1.00	ES					MADE GROUND: Brown clayey gravelly medium to coarse sand. Gravel is fine to coarse subangular to subrounded of ceramic.	1
	1.50	B						
				1.80			MADE GROUND: Blackish brown clayey gravelly medium to coarse sand. Gravel is fine to coarse angular to sub-angular of brick and plastic.	2
				2.40			MADE GROUND: Greyish brown gravelly clay.	
				2.80			Stiff brown slightly sandy CLAY.	3
				3.10			End of Pit at 3.10m	4

Trial Pit Photographs



TP105



TP105 Arisings

Remarks: 1. Complete 2. Water strike encountered at 2.70 m bgl - slow seepage.

Stability: Stable.



Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Lathbury Road

Project No.
16718

Co-ords: 385896.00 - 400891.00

Hole Type
WS

Location: Manchester

Level:

Scale
1:50

Client: Jigsaw Homes

Dates: 20/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
		1.00		N=5 (1,1/1,1,2,1)	1.00				MADE GROUND: Loose black gravel. Gravel is fine to coarse angular to sub-angular of clinker.
		1.50	ES		1.50				Stiff medium strength greyish brown slightly silty CLAY. Becomes very stiff high strength from circa 5.00m bgl.
		2.00	SPT				2		
		2.00		N=15 (2,3/3,4,4,4)					
		2.50 - 3.00	U						
		3.00	SPT				3		
		3.00		N=14 (2,3/3,3,4,4)					
		4.00	SPT				4		
		4.00		N=17 (3,3/4,4,4,5)					
		5.00		N=22 (3,4/4,5,6,7)			5		
					5.45		End of borehole at 5.45 m		
								6	
								7	
								8	
								9	
								10	

Remarks

1. Complete.



Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Lathbury Road

Project No.
16718

Co-ords: 385906.00 - 400880.00

Hole Type
WS

Location: Manchester

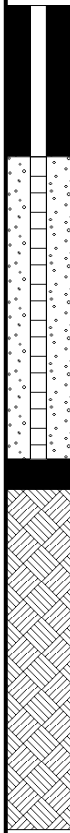
Level:

Scale
1:50

Client: Jigsaw Homes

Dates: 20/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.45 0.50			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
								MADE GROUND: Orangish brown sandy clay.	
		1.00		N=4 (2,2/1,1,1,1)				MADE GROUND: Loose to very loose black clayey gravelly fine to medium sand. Gravel is medium to coarse angular to sub-angular of brick, ceramic, sandstone and shells. (Strong hydrocarbon odour encountered from 2.50 m to 2.90 m bgl)	1
		2.00		N=4 (1,1/1,1,1,1)					2
		2.80	ES						
		3.00	SPT		2.90				
		3.00		N=13 (2,2/3,3,3,4)				Stiff medium strength greyish brown CLAY.	3
		3.50	ES						
		4.00	SPT						4
		4.00		N=16 (2,4/4,4,4,4)					
		5.00	SPT						5
		5.00		N=16 (3,3/3,3,5,5)	5.45				
								End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (1.00 m to 3.00 m bgl).

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Lathbury Road

Project No.
16718

Co-ords: 385916.00 - 400891.00

Hole Type
WS

Location: Manchester

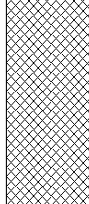
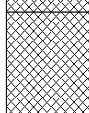
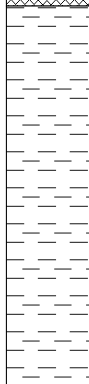
Level:

Scale
1:50

Client: Jigsaw Homes

Dates: 20/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.30 0.60			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	1
								MADE GROUND: Black gravel. Gravel is fine to medium subangular of ash and glass.	
								MADE GROUND: Very soft blackish brown gravelly clay with white gravel band of shell encountered from 1.80 m to 2.00 m bgl. Gravel is fine to medium subangular to angular of ash, glass, sandstone and ceramic.	2
					2.20				
		3.00 3.00	SPT	N=16 (2,2/4,4,4,4)	2.90			MADE GROUND: Very soft black slightly silty slightly gravelly clay. Gravel is fine to medium subangular to subrounded of shell, brick, ceramic, coal and organic matter. (Strong hydrocarbon odour)	3
		3.50 - 4.00	U					Stiff medium strength brown CLAY.	
		4.00 4.00	SPT	N=14 (2,2/3,3,4,4)					4
		5.00 5.00	SPT	N=14 (2,2/3,3,4,4)					5
					5.45				6
								End of borehole at 5.45 m	7

Remarks

1. Complete. 2. Water strike encountered at 4.00 m bgl - fast seepage. 3. Strong hydrocarbon odour encountered from 2.20 m to 2.90 m bgl).



Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Lathbury Road

Project No.
16718

Co-ords: 385913.00 - 400912.00

Hole Type
WS

Location: Manchester

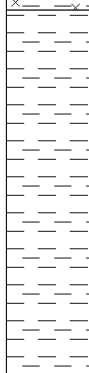
Level:

Scale
1:50

Client: Jigsaw Homes

Dates: 20/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30			0.30			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
		0.80	ES					MADE GROUND: Very soft blackish brown gravelly sandy clay. Gravel is fine to coarse angular to sub-angular of coal, brick, mudstone and ash.	1
		1.00		N=1 (1,1/1,0,0,0)					
					1.20				
					1.70			MADE GROUND: Brown clayey gravelly medium to coarse sand. Gravel is fine to medium angular to sub-angular of clinker and mudstone.	
		2.00		N=9 (2,2/2,2,2,3)				MADE GROUND: Stiff greyish black gravelly clay. Gravel is fine to coarse angular to sub-angular of brick, shell and ash.	2
					2.70				
		3.00	SPT		3.00			Stiff grey mottled brown slightly silty CLAY.	3
		3.00		N=12 (2,2/2,2,3,5)					
								Stiff medium strength greyish brown CLAY. Becomes very stiff high strength from circa 5.00 m bgl.	4
		4.00	SPT						
		4.00		N=17 (3,3/3,4,5,5)					
		5.00	SPT						5
		5.00		N=21 (3,4/4,5,5,7)					
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Water strike encountered at 1.50 m bgl - slow seepage.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Lathbury Road

Project No.
16718

Co-ords: 385923.00 - 400902.00

Hole Type
WS

Location: Manchester

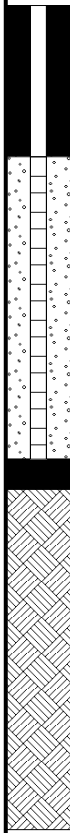
Level:

Scale
1:50

Client: Jigsaw Homes

Dates: 20/06/2023 -

Logged By
E. Canham

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20			MADE GROUND: Dark brown slightly silty clayey fine to medium sand with occasional rootlets and frequent roots. (Topsoil)	
		0.40			0.40			MADE GROUND: Black slightly clayey gravel. Gravel is fine to medium subangular to angular of ash, clinker, concrete and coal.	
		1.00	SPT	N=4 (1,1/1,1,1,1)				MADE GROUND: Soft blackish brown silty gravelly clay. Gravel is medium to coarse subangular to angular of shell, brick and mudstone.	1
		2.00	SPT						2
		3.00		N=7 (0,0/1,2,2,2)	3.00			MADE GROUND: Loose brown clayey gravel. Gravel is medium to coarse subangular to angular of clinker, shell, mudstone and brick.	3
		4.00		N=17 (2,3/4,4,4,5)	3.70			Stiff medium strength greyish brown CLAY.	4
		5.00		N=12 (2,2/2,2,4,4)	5.45			End of borehole at 5.45 m	5
									6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed- response zone (1.00 m to 3.00 m bgl) 3. Water strike encountered at 3.60 m bgl - slow seepage.

APPENDIX VI

CHEMICAL TESTING

RESULTS

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e: jsheridan@e3p.co.uk

Analytical Report Number : 23-40665

Replaces Analytical Report Number: 23-40665, issue no. 1
Client references/information amended.

P.O. Number amended as per client's request

Additional analysis undertaken. Speciated Mercury added for samples 2722311 and 2722314 as per client's request.

Changes to the VOC report template- change of the name of compound or change of the order of compound for selected parameters.

Project / Site name: Lathbury Road **Samples received on:** 21/06/2023

Your job number: 16-718 **Samples instructed on/ Analysis started on:** 21/06/2023

Your order number: 005352 **Analysis completed by:** 10/07/2023

Report Issue Number: 2 **Report issued on:** 13/07/2023

Samples Analysed: 2 leachate samples - 8 soil samples

Signed:

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

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

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

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

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

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

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

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722309	2722310	2722311	2722312	2722313
Sample Reference				TP101	TP102	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	2.50	1.80	0.35
Date Sampled				20/06/2023	20/06/2023	20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	21	22	36	44	25
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.8	0.3

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Amosite	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	0.002	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	0.002	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM	WEM	SCA	SCA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	7.1	7.8	7.5	8.2
Total Cyanide	mg/kg	1	MCERTS	8.5	1.1	7.3	21	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	580	590	1200	1600	550
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.037	0.0042	0.15	0.4	0.033
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	73	8.3	300	800	66
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	36.5	4.2	151	402	32.9
Sulphide	mg/kg	1	MCERTS	3.4	< 1.0	110	100	8.7
Total Sulphur	mg/kg	50	MCERTS	590	290	4400	8800	590
Organic Matter	%	0.1	MCERTS	-	-	-	13	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.9	4.1	6.8	-	2.2
Total Organic Carbon (TOC) - Manual	%	0.1	MCERTS	-	-	-	7.3	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	4	0.34	-	-	1.4
Acenaphthylene	mg/kg	0.05	MCERTS	3.8	0.6	-	-	0.45
Acenaphthene	mg/kg	0.05	MCERTS	4.3	0.57	-	-	0.82
Fluorene	mg/kg	0.05	MCERTS	6.1	0.82	-	-	1.1
Phenanthrene	mg/kg	0.05	MCERTS	52	6.8	-	-	6.3
Anthracene	mg/kg	0.05	MCERTS	11	1.6	-	-	1.6
Fluoranthene	mg/kg	0.05	MCERTS	51	9.7	-	-	7.3
Pyrene	mg/kg	0.05	MCERTS	50	9.7	-	-	7.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	23	4	-	-	2.9
Chrysene	mg/kg	0.05	MCERTS	22	3.9	-	-	2.9
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	22	3.8	-	-	3
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	7.5	1.8	-	-	1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	20	3.4	-	-	2.5
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	10	2	-	-	1.3
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	3.2	0.6	-	-	0.4
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	12	2.2	-	-	1.6

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	303	51.9	-	-	41.7
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Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722309	2722310	2722311	2722312	2722313
Sample Reference				TP101	TP102	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	2.50	1.80	0.35
Date Sampled				20/06/2023	20/06/2023	20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	41	20	47	32	11
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	0.5
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	9.2	22	12	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	400	83	420	100	46
Lead (aqua regia extractable)	mg/kg	1	MCERTS	450	210	660	300	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.8	0.7	3.2	6.9	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	28	13	27	19	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230	100	240	100	120

Speciated Mercury (Dry Weight)

Inorganic Mercury	mg/kg	0.005	NONE	-	-	2.703	-	-
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	-	-	0.069	-	-
Elemental Mercury	mg/kg	0.005	NONE	-	-	0.786	-	-

Speciated Mercury (Dry Weight)

F1 - Water soluble	mg/kg	0.005	NONE	-	-	0.039	-	-
F2 - Weak acid	mg/kg	0.005	NONE	-	-	0.134	-	-
F3 - Organo- complexed	mg/kg	0.005	NONE	-	-	0.069	-	-
F4 - Strongly complexed	mg/kg	0.005	NONE	-	-	0.786	-	-
F5 - Mineral bound	mg/kg	0.005	NONE	-	-	2.53	-	-

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	0.1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	2.9	< 2.0	13	7.2	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	22	< 4.0	83	59	4.4
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	110	16	330	290	15
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	170	38	430	460	61
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	44	59	17
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	300	63	900	870	99

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Chloroethane	µg/kg	5	NONE	-	-	-	< 5.0	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	< 5.0	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1-dichloroethene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	< 5.0	-
Trans 1,2-dichloroethylene	µg/kg	5	NONE	-	-	-	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1-dichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Chloroform##	µg/kg	5	NONE	-	-	-	< 5.0	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722309	2722310	2722311	2722312	2722313
Sample Reference				TP101	TP102	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	2.50	1.80	0.35
Date Sampled				20/06/2023	20/06/2023	20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,2-dichloroethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Benzene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
Carbontetrachloride	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-dichloropropane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Dibromomethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Bromodichloromethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Trans-1,3-dichloropropene##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Toluene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
1,1,2-Trichloroethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3-Dichloropropane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Dibromochloromethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1,1,2-Tetrachloroethane##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
Styrene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Bromoform	µg/kg	5	NONE	-	-	-	< 5.0	-
o-xylene	µg/kg	5	MCERTS	-	-	-	< 5.0	-
Isopropylbenzene#	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Bromobenzene	µg/kg	5	NONE	-	-	-	< 5.0	-
N-Propylbenzene#	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
2-Chlorotoluene##	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,3-dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
P-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,4-dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2-dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Butylbenzene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	< 5.0	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	< 5.0	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	18	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	< 0.2	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722309	2722310	2722311	2722312	2722313
Sample Reference				TP101	TP102	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	2.50	1.80	0.35
Date Sampled				20/06/2023	20/06/2023	20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	< 0.05	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	63	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	45	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	20	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	38	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	25	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	63	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	< 0.3	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	270	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	76	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	17	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	250	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	250	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	100	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	100	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	99	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	31	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	89	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	41	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	13	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	51	-

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

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722314	2722315	2722316
Sample Reference				TP105	WS101	WS102
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.50	2.80
Date Sampled				20/06/2023	20/06/2023	20/06/2023
Time Taken				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
Moisture Content	%	0.01	NONE	28	15	65
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	SCA	N/A	SCA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.8	-	7.3
Total Cyanide	mg/kg	1	MCERTS	5.6	< 1.0	21
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1500	-	1600
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.056	-	0.42
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	110	-	850
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	55.7	-	425
Sulphide	mg/kg	1	MCERTS	5.7	-	110
Total Sulphur	mg/kg	50	MCERTS	1200	-	3500
Organic Matter	%	0.1	MCERTS	-	-	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	4.2	1.1	5.5
Total Organic Carbon (TOC) - Manual	%	0.1	MCERTS	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	1.4
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	3.7	1.1	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.98	0.23	-
Acenaphthene	mg/kg	0.05	MCERTS	3.3	1.6	-
Fluorene	mg/kg	0.05	MCERTS	3.2	1.3	-
Phenanthrene	mg/kg	0.05	MCERTS	25	12	-
Anthracene	mg/kg	0.05	MCERTS	5.3	2.1	-
Fluoranthene	mg/kg	0.05	MCERTS	29	13	-
Pyrene	mg/kg	0.05	MCERTS	31	12	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	15	5.4	-
Chrysene	mg/kg	0.05	MCERTS	15	5	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	16	5.2	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	5.9	1.8	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	13	4	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	6.4	2	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.8	0.43	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	7.9	2.1	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	183	68.1	-
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Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722314	2722315	2722316
Sample Reference				TP105	WS101	WS102
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.50	2.80
Date Sampled				20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	62	11	31
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	160	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.1	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.6	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	2.3	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	-	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	290	41	100
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1500	52	540
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	53	< 0.3	6.9
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	35	29	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	28	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	390	74	120

Speciated Mercury (Dry Weight)

Inorganic Mercury	mg/kg	0.005	NONE	46.4	-	-
Organo-Mercury Species (including Methyl Hg)	mg/kg	0.005	NONE	2.203	-	-
Elemental Mercury	mg/kg	0.005	NONE	10.71	-	-

Speciated Mercury (Dry Weight)

F1 - Water soluble	mg/kg	0.005	NONE	0.097	-	-
F2 - Weak acid	mg/kg	0.005	NONE	0.347	-	-
F3 - Organo- complexed	mg/kg	0.005	NONE	2.203	-	-
F4 - Strongly complexed	mg/kg	0.005	NONE	10.71	-	-
F5 - Mineral bound	mg/kg	0.005	NONE	45.96	-	-

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	0.1	NONE	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	3.4	2.8	9.9
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	13	8	59
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	46	24	250
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	71	36	360
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	42
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	130	71	730

VOCs

Chloromethane	µg/kg	5	ISO 17025	-	-	< 5.0
Chloroethane	µg/kg	5	NONE	-	-	< 5.0
Bromomethane	µg/kg	5	ISO 17025	-	-	< 5.0
Vinyl Chloride	µg/kg	5	NONE	-	-	< 5.0
Trichlorofluoromethane	µg/kg	5	NONE	-	-	< 5.0
1,1-dichloroethene	µg/kg	5	NONE	-	-	< 5.0
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	< 5.0
Trans 1,2-dichloroethylene	µg/kg	5	NONE	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	< 5.0
1,1-dichloroethane	µg/kg	5	ISO 17025	-	-	< 5.0
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	< 5.0
Chloroform#	µg/kg	5	NONE	-	-	< 5.0
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	< 5.0

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722314	2722315	2722316
Sample Reference				TP105	WS101	WS102
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.50	2.80
Date Sampled				20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
1,2-dichloroethane##	µg/kg	5	ISO 17025	-	-	< 5.0
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	< 5.0
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	< 5.0
Benzene	µg/kg	5	MCERTS	-	-	< 5.0
Carbontetrachloride	µg/kg	5	NONE	-	-	< 5.0
1,2-dichloropropane##	µg/kg	5	ISO 17025	-	-	< 5.0
Trichloroethene	µg/kg	5	ISO 17025	-	-	< 5.0
Dibromomethane##	µg/kg	5	ISO 17025	-	-	< 5.0
Bromodichloromethane##	µg/kg	5	ISO 17025	-	-	< 5.0
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	< 5.0
Trans-1,3-dichloropropene##	µg/kg	5	ISO 17025	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	-	-	< 5.0
1,1,2-Trichloroethane##	µg/kg	5	ISO 17025	-	-	< 5.0
1,3-Dichloropropane##	µg/kg	5	ISO 17025	-	-	< 5.0
Dibromochloromethane##	µg/kg	5	ISO 17025	-	-	< 5.0
Tetrachloroethene	µg/kg	5	NONE	-	-	< 5.0
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	< 5.0
Chlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0
1,1,1,2-Tetrachloroethane##	µg/kg	5	ISO 17025	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	-	< 5.0
p & m-xylene	µg/kg	5	MCERTS	-	-	< 5.0
Styrene	µg/kg	5	ISO 17025	-	-	< 5.0
Bromoform	µg/kg	5	NONE	-	-	< 5.0
o-xylene	µg/kg	5	MCERTS	-	-	< 5.0
Isopropylbenzene#	µg/kg	5	ISO 17025	-	-	< 5.0
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	< 5.0
Bromobenzene	µg/kg	5	NONE	-	-	< 5.0
N-Propylbenzene#	µg/kg	5	ISO 17025	-	-	< 5.0
2-Chlorotoluene##	µg/kg	5	ISO 17025	-	-	< 5.0
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	< 5.0
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	< 5.0
Tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	< 5.0
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	< 5.0
Sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	< 5.0
1,3-dichlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0
P-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	< 5.0
1,4-dichlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0
1,2-dichlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0
Butylbenzene	µg/kg	5	NONE	-	-	< 5.0
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	< 5.0
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0
Hexachlorobutadiene	µg/kg	5	NONE	-	-	< 5.0
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	< 5.0

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	< 0.1
Phenol	mg/kg	0.2	ISO 17025	-	-	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	< 0.1

Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Lab Sample Number				2722314	2722315	2722316
Sample Reference				TP105	WS101	WS102
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.50	2.80
Date Sampled				20/06/2023	20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	< 0.3
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	-	-	< 0.2
Isophorone	mg/kg	0.2	MCERTS	-	-	< 0.2
2-Nitrophenol	mg/kg	0.3	NONE	-	-	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	-	-	130
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	-	-	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	66
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	35
Acenaphthene	mg/kg	0.05	MCERTS	-	-	49
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	40
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	< 0.2
4-Nitroaniline	mg/kg	0.2	NONE	-	-	< 0.2
Fluorene	mg/kg	0.05	MCERTS	-	-	87
Azobenzene	mg/kg	0.3	NONE	-	-	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	-	-	420
Anthracene	mg/kg	0.05	MCERTS	-	-	120
Carbazole	mg/kg	0.3	MCERTS	-	-	23
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	< 0.2
Anthraquinone	mg/kg	0.3	NONE	-	-	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	-	-	340
Pyrene	mg/kg	0.05	MCERTS	-	-	350
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	150
Chrysene	mg/kg	0.05	MCERTS	-	-	150
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	130
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	57
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	130
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	59
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	18
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	73

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



Analytical Report Number: 23-40665
Project / Site name: Lathbury Road
Your Order No: 005352

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

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

Quantitative Analysis

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

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

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

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2722309	TP101	1.00	137	Loose Fibrous Debris	Amosite	0.002	0.002

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



4041



Analytical Report Number: 23-40665

Project / Site name: Lathbury Road

Your Order No: 005352

Lab Sample Number				2722317	2722318
Sample Reference				TP103	TP105
Sample Number				None Supplied	None Supplied
Depth (m)				1.80	1.00
Date Sampled				20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.3	8.2
Total Cyanide	µg/l	10	ISO 17025	-	81
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	17	-

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	2.7	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	0.33	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	4.9	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	0.96	< 0.01
Anthracene	µg/l	0.01	ISO 17025	0.95	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	2.9	< 0.01
Pyrene	µg/l	0.01	ISO 17025	2.8	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	0.51	< 0.01
Chrysene	µg/l	0.01	ISO 17025	0.51	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	0.23	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	14	< 0.2
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Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	7.4	5.1
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	66
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.3	64
Copper (dissolved)	µg/l	0.7	ISO 17025	19	14
Lead (dissolved)	µg/l	1	ISO 17025	4.9	3.6
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	19	1.1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	89	12

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10



4041



Analytical Report Number: 23-40665

Project / Site name: Lathbury Road

Your Order No: 005352

Lab Sample Number				2722317	2722318
Sample Reference				TP103	TP105
Sample Number				None Supplied	None Supplied
Depth (m)				1.80	1.00
Date Sampled				20/06/2023	20/06/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	NONE	55	< 10
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TPH-CWG - Aliphatic >C5 - C6# HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8# HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10# HS_ID_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_ID_AL_MS	µg/l	10	NONE	< 10	< 10

TPH-CWG - Aromatic >C5 - C7 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 HS_ID_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 EH_ID_AR_MS	µg/l	10	NONE	15	< 10
TPH-CWG - Aromatic >C12 - C16 EH_ID_AR_MS	µg/l	10	NONE	30	< 10
TPH-CWG - Aromatic >C16 - C21 EH_ID_AR_MS	µg/l	10	NONE	10	< 10
TPH-CWG - Aromatic >C21 - C35 EH_ID_AR_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) HS+EH_ID_AR_MS	µg/l	10	NONE	55	< 10

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

Analytical Report Number : 23-40665

Project / Site name: Lathbury Road

* 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 *
2722309	TP101	None Supplied	1	Brown loam and sand with gravel.
2722310	TP102	None Supplied	0.3	Brown loam with gravel and vegetation.
2722311	TP102	None Supplied	2.5	Brown silt with peat and vegetation."
2722312	TP103	None Supplied	1.8	Brown silt with vegetation."
2722313	TP104	None Supplied	0.35	Brown silt with gravel and vegetation."
2722314	TP105	None Supplied	1	Brown loam and sand with gravel and vegetation.
2722315	WS101	None Supplied	1.5	Brown clay.
2722316	WS102	None Supplied	2.8	Brown loam with gravel and vegetation.

Analytical Report Number : 23-40665

Project / Site name: Lathbury Road

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS

Analytical Report Number : 23-40665

Project / Site name: Lathbury Road

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	ISO 17025
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Speciated Mercury in soil by Millennium Merlin Ana	Determination of Speciated Mercury in soil by Millennium Merlin Analyzer	In-house method	L085-PL	Dry	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

Analytical Report Number : 23-40665
Project / Site name: Lathbury Road

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
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	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 30°C. Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

"unaccredited sample matrix

- Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

- Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.



4041

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Analytical Report Number : 23-43542

Project / Site name:	Cansbrook St Cathbury Road	Samples received on:	06/07/2023
Your job number:	16718	Samples instructed on/ Analysis started on:	06/07/2023
Your order number:		Analysis completed by:	13/07/2023
Report Issue Number:	1	Report issued on:	13/07/2023
Samples Analysed:	1 water sample		

Signed:

Elżbieta Suchy
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

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



4041



Analytical Report Number: 23-43542

Project / Site name: Cansbrook St Cathbury Road

Lab Sample Number				2739001
Sample Reference				WS104
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				03/07/2023
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L099)	pH Units	N/A	ISO 17025	7.2
Total Cyanide	µg/l	10	ISO 17025	59
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	4.22

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	210
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.73
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.06
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	3.3
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	1800
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	6
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6
Zinc (dissolved)	µg/l	0.5	ISO 17025	10

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	ISO 17025	< 10
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TPH-CWG - Aliphatic >C5 - C6## HS_ID_AL	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C6 - C8## HS_ID_AL	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C8 - C10## HS_ID_AL	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aliphatic >C10 - C12 EH_ID_AL_MS	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_ID_AL_MS	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_ID_AL_MS	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_ID_AL_MS	µg/l	10	NONE	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_ID_AL_MS	µg/l	10	NONE	< 10

TPH-CWG - Aromatic >C5 - C7 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C7 - C8 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C8 - C10 HS_ID_AR	µg/l	1	ISO 17025	< 1.0
TPH-CWG - Aromatic >C10 - C12 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C12 - C16 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C16 - C21 EH_ID_AR_MS	µg/l	10	NONE	< 10
TPH-CWG - Aromatic >C21 - C35 EH_ID_AR_MS	µg/l	10	NONE	< 10



4041



Environmental Science

Analytical Report Number: 23-43542

Project / Site name: Cansbrook St Cathbury Road

Lab Sample Number				2739001
Sample Reference				WS104
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				03/07/2023
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
TPH-CWG - Aromatic (C5 - C35) HS+EH_ID_AR_MS	µg/l	10	NONE	< 10

VOCs

Chloromethane	µg/l	3	ISO 17025	< 3.0
Chloroethane	µg/l	3	ISO 17025	< 3.0
Bromomethane	µg/l	3	ISO 17025	< 3.0
Vinyl Chloride	µg/l	3	NONE	< 3.0
Trichlorofluoromethane	µg/l	3	NONE	< 3.0
1,1-Dichloroethene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloro-1,2,2-trifluoroethane##	µg/l	3	ISO 17025	< 3.0
Trans 1,2-dichloroethylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0
1,1-Dichloroethane	µg/l	3	ISO 17025	< 3.0
2,2-Dichloropropane#	µg/l	3	NONE	< 3.0
Chloroform	µg/l	3	ISO 17025	< 3.0
1,1,1-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,2-Dichloroethane	µg/l	3	ISO 17025	< 3.0
1,1-Dichloropropene	µg/l	3	ISO 17025	< 3.0
Cis-1,2-dichloroethene#	µg/l	3	NONE	< 3.0
Benzene	µg/l	3	ISO 17025	< 3.0
Carbontetrachloride	µg/l	3	ISO 17025	< 3.0
1,2-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Trichloroethene	µg/l	3	ISO 17025	< 3.0
Dibromomethane	µg/l	3	ISO 17025	< 3.0
Bromodichloromethane	µg/l	3	ISO 17025	< 3.0
Cis-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Trans-1,3-dichloropropene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
1,1,2-Trichloroethane	µg/l	3	ISO 17025	< 3.0
1,3-Dichloropropane	µg/l	3	ISO 17025	< 3.0
Dibromochloromethane	µg/l	3	ISO 17025	< 3.0
Tetrachloroethene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromoethane	µg/l	3	ISO 17025	< 3.0
Chlorobenzene	µg/l	3	ISO 17025	< 3.0
1,1,1,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-Xylene	µg/l	3	ISO 17025	< 3.0
Styrene#	µg/l	3	NONE	< 3.0
Bromoform	µg/l	3	ISO 17025	< 3.0
o-Xylene	µg/l	3	ISO 17025	< 3.0
Isopropylbenzene#	µg/l	3	NONE	< 3.0
1,1,2,2-Tetrachloroethane	µg/l	3	ISO 17025	< 3.0
Bromobenzene	µg/l	3	ISO 17025	< 3.0
n-Propylbenzene#	µg/l	3	NONE	< 3.0
2-Chlorotoluene	µg/l	3	ISO 17025	< 3.0
4-Chlorotoluene#	µg/l	3	NONE	< 3.0
1,3,5-Trimethylbenzene	µg/l	3	ISO 17025	< 3.0
tert-Butylbenzene#	µg/l	3	NONE	< 3.0
1,2,4-Trimethylbenzene#	µg/l	3	NONE	< 3.0
sec-Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,3-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
p-Isopropyltoluene#	µg/l	3	NONE	< 3.0



4041



Environmental Science

Analytical Report Number: 23-43542

Project / Site name: Cansbrook St Cathbury Road

Lab Sample Number				2739001
Sample Reference				WS104
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				03/07/2023
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
1,4-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dichlorobenzene	µg/l	3	ISO 17025	< 3.0
Butylbenzene	µg/l	3	ISO 17025	< 3.0
1,2-Dibromo-3-chloropropane	µg/l	3	ISO 17025	< 3.0
1,2,4-Trichlorobenzene#	µg/l	3	NONE	< 3.0
Hexachlorobutadiene	µg/l	3	ISO 17025	< 3.0
1,2,3-Trichlorobenzene#	µg/l	3	NONE	< 3.0

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	0.26
1,2-Dichlorobenzene	µg/l	0.05	NONE	2.4
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05
Naphthalene	µg/l	0.01	ISO 17025	< 0.01
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	1.1
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	3.3
4-Nitroaniline	µg/l	0.05	NONE	< 0.05
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Azobenzene	µg/l	0.05	NONE	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Carbazole	µg/l	0.05	NONE	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	2.7



4041



Analytical Report Number: 23-43542

Project / Site name: Cansbrook St Cathbury Road

Lab Sample Number				2739001
Sample Reference				WS104
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				03/07/2023
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	
Anthraquinone	µg/l	0.05	NONE	< 0.05
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01
3&4-Methylphenol	µg/l	0.1	NONE	< 0.10

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



4041



Environmental Science

Analytical Report Number : 23-43542

Project / Site name: Cansbrook St Cathbury Road

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 *for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	ISO 17025

Analytical Report Number : 23-43542
Project / Site name: Cansbrook St Cathbury Road

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
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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 30°C.

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

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

- Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

- Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

Sample Deviation Report



Analytical Report Number : 23-43542

Project / Site name: Cansbrook St Cathbury Road

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

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

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS104	None Supplied	W	2739001	c	pH at 20oC in water (automated)	L099-PL	c

APPENDIX VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C ₅ -C ₆ (aliphatic)	
TPH C ₆ -C ₈ (aliphatic)	
TPH C ₈ -C ₁₀ (aliphatic)	
TPH C ₁₀ -C ₁₂ (aliphatic)	
TPH C ₁₂ -C ₁₆ (aromatic)	
TPH C ₁₆ -C ₂₁ (aromatic)	
TPH C ₂₁ -C ₃₅ (aromatic)	



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



Contract Number: PSL23/4879

Report Date: 27 July 2023

Client's Reference: 16-718

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Eleanor Canham

Contract Title: Lathbury Road

Date Received: 22/6/2023

Date Commenced: 22/6/2023

Date Completed: 27/7/2023

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)


T Watkins
(Senior Technician)

5 – 7 Hexthorpe Road,
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Lathbury Road

Contract No:

PSL23/4879

Client Ref:

16-718

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



Lathbury Road

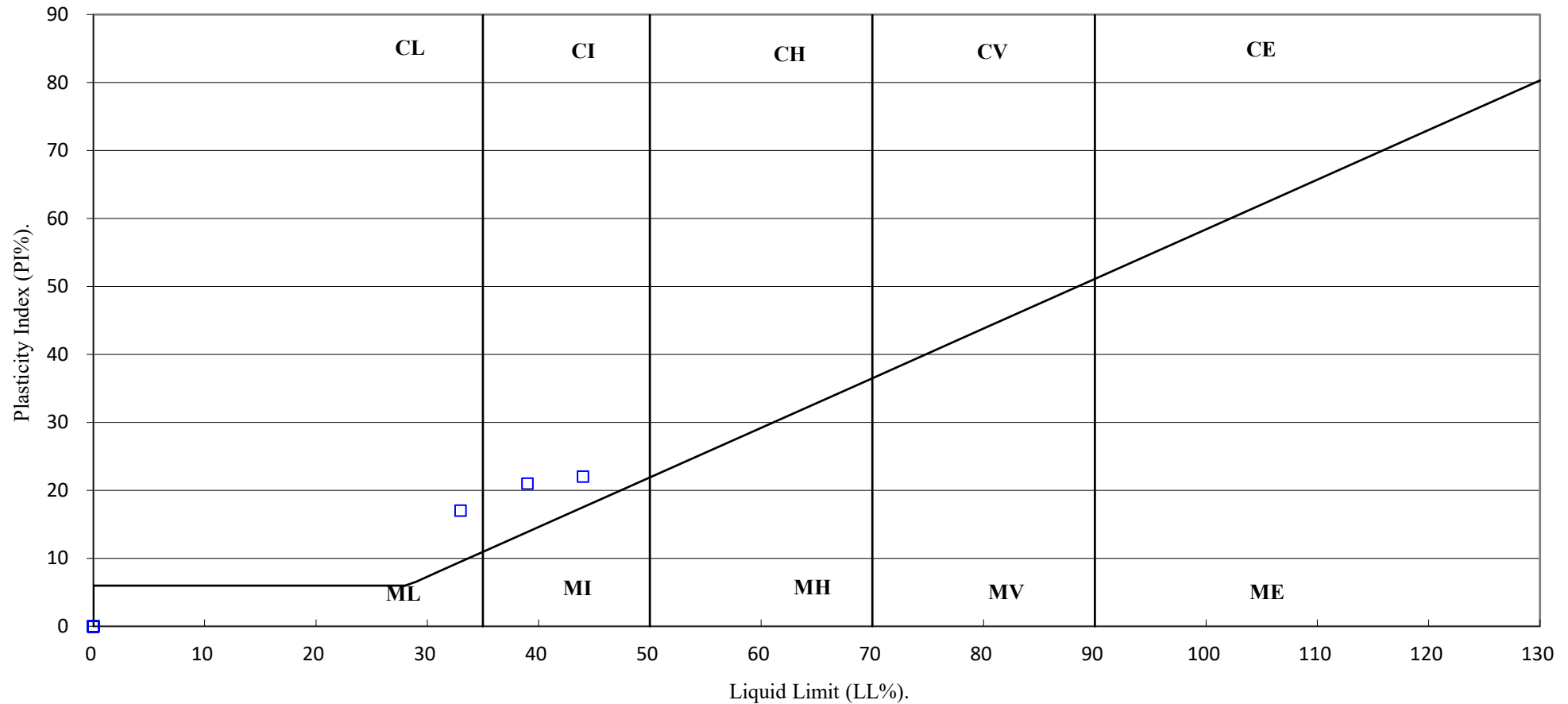
Contract No:

PSL23/4879

Client Ref:

16-718

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



Lathbury Road

Contract No:

PSL23/4879

Client Ref:

16-718

PARTICLE SIZE DISTRIBUTION TEST

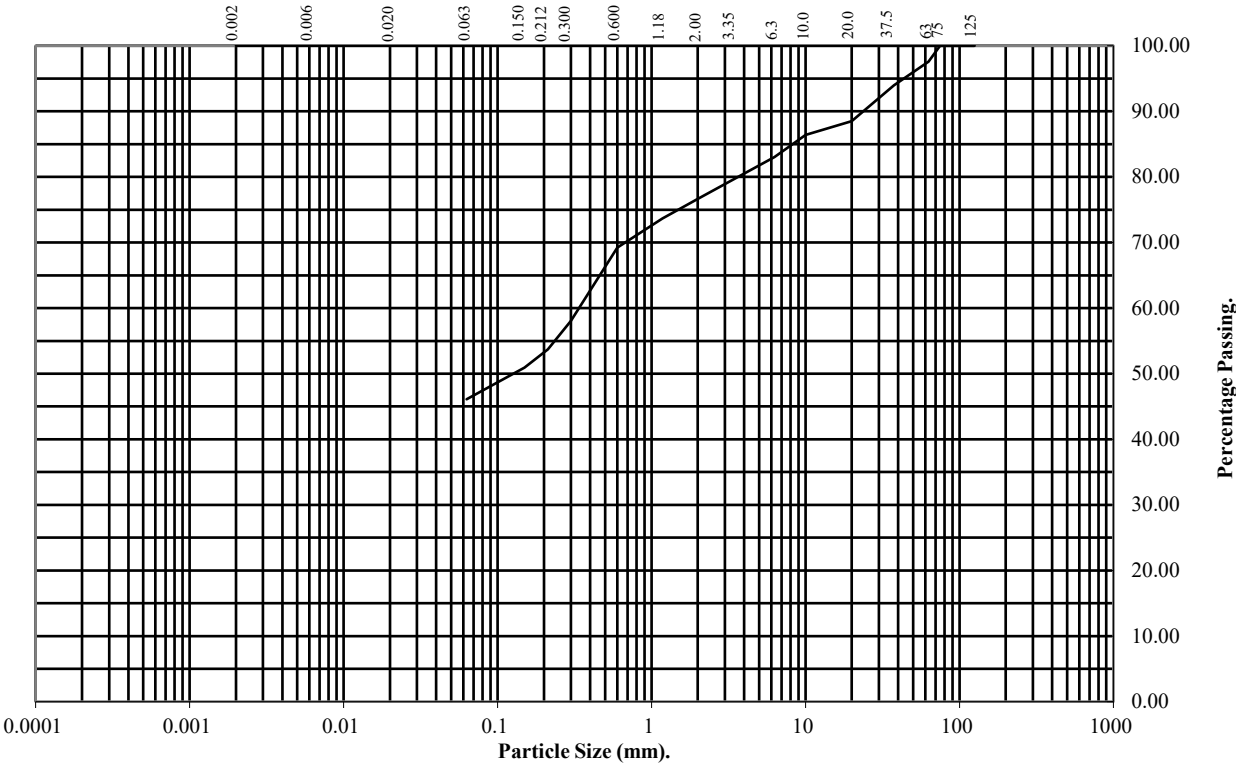
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP105 Top Depth (m): 1.50

Sample Number: Base Depth(m):

Sample Type: Bulk



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	98
37.5	94
20	88
10	86
6.3	83
3.35	80
2	77
1.18	74
0.6	69
0.3	58
0.212	54
0.15	51
0.063	46

Soil Fraction	Total Percentage
Cobbles	2
Gravel	21
Sand	31
Silt/Clay	46

Remarks:
See Summary of Soil Descriptions



Lathbury Road

Contract No:
PSL23/4879
Client Ref:
16-718

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.4 : 1990

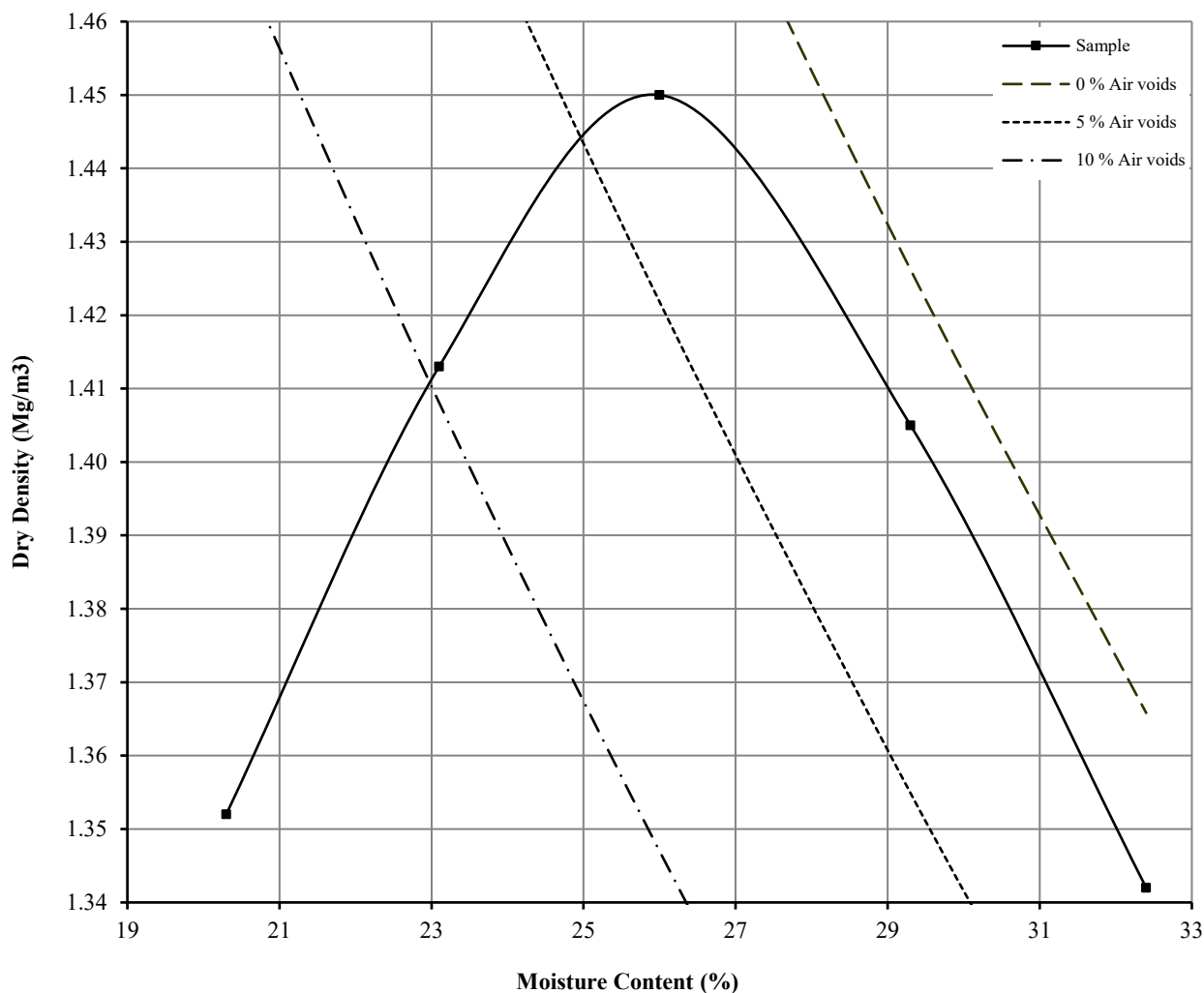
Hole Number: TP105

Top Depth (m) : 1.50

Sample Number:

Base Depth (m) :

Sample Type: Bulk



Initial Moisture Content:	37	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.45	Assumed	Material Retained on 37.5 mm Test Sieve (%):	6
Maximum Dry Density (Mg/m ³):	1.45		Material Retained on 20.0 mm Test Sieve (%):	6
Optimum Moisture Content (%):	26			
Remarks See summary of soil descriptions				

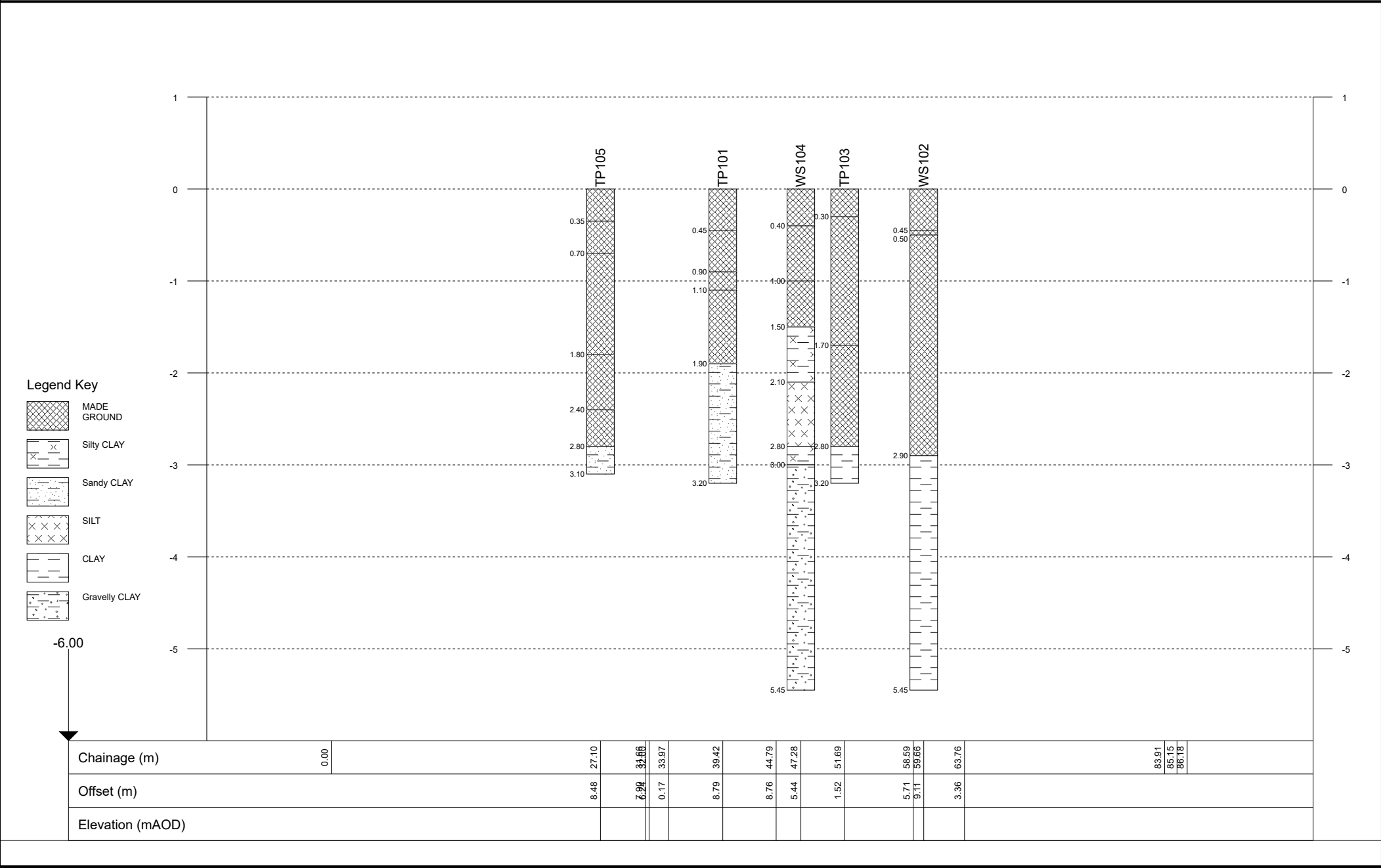
 4043	 A PHENNA GROUP COMPANY	Lathbury Road	Contract
			PSL23/4879
			Client Ref
			16-718

APPENDIX IX

CROSS SECTIONS

Project Id: 16718
Project Title: Lathbury Road
Location: Manchester
Client: btp Architects

Title: Section line 1
Vertical Scale: 1:54
Horizontal Scale: 1:500
Engineer:



Title: Section line 2
Vertical Scale: 1:54
Horizontal Scale: 1:473
Engineer:

