Phase II Geoenvironmental Site Assessment
Audrey Street, Moston

Reference:16-219-R2-1
Date: July 2023

PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Audrey Street,
Moston,
Manchester,
M9 4PF

Prepared for:

AJP est. 1978

Report Ref: 16-219-R2-1
Date Issued: 25 July 2023

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EXECUTIVE SUMMARY

Site Address	Audrey Street, Moston, Manchester, M9 4PF	
Grid Reference	E 386994 , N 401492	
Site Area	0.27 Ha	
Proposed Development	Alan Johnston Partnership (AJP) is assisting their client with the proposed acquisition and future redevelopment of two parcels of land off Audrey Street and Benton Street in Moston, Greater Manchester for low-rise residential housing with associated adopted estate roads and utility infrastructure.	
Current Site Use	The site is split into two distinct areas, the northern section is a rectangular plot of land off Audrey Street and the south portion is a roughly square plot off Benton Street. Both areas are currently grassed open land surrounded by residential properties.	
Site History	The earliest mapping (1848) shows that the site was undeveloped and surrounded by farmland. By 1908 the site is surrounded by residential properties with industrial activity within the wider surrounding area. refuse heaps are shown to exist on the Audrey Street part of the development site with numerous other refuse heaps in the surrounding area shown on maps from 1950s onwards. Further residential development is shown to take place in the surrounding area with the former refuse heaps marked as playing fields.	
Environmental Setting	**Drift Geology**	Glacial Till, Devensian
	Bedrock Geology	Collyhurst Sandstone Formation
	Faults	A fault (geological boundary) is present running southeast to northwest between the two parcels of land.
	Hydrogeology	Principal Aquifer (solid) overlain by a Secondary Undifferentiated Aquifer (drift). The site is not located within a Source Protection Zone (SPZ). There are no potable groundwater abstraction points within 500 m.
	Hydrology	The nearest surface water feature is Moston Brook approximately 500 m south of the site. There are no surface water abstractions within 1 km. There is one discharge consent within 500 m previously held by United Utilities Water limited but revoked since October 1995.
	Flood Risk	Unaffected by flooding from rivers.
Previous Reports	The following previous reports have been completed for the site: - Curtins, Audrey Street Phase 1 Preliminary Risk Assessment (Ref 077873-CUR-00-XX-RP-GE-028). Dated April 2021 A full summary of findings is provided in Section 2.1.	
Utility Locations	A review of online services has not identified any services present within the site boundary. An overhead telephone cable runs from the south west corner of Audrey Street in a northerly direction.	

Landfill Sites and Ground Gases	Given historic development on site, primarily for residential use, it is possible that Made Ground soils may be present on site. These soils may act as a source of ground gas generation. There is one recorded landfill site within the site boundary of both parcels, with records showing commercial and household waste was deposited until 1977. A number of other historic landfill sites are located within 1 km of the site; 16 m northwest, 316 m southwest, 560 m northeast, 640 m southeast, 94 2m east and 971 m northeast.
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 but not within a Development High Risk Area. The nearest Development High-Risk Areas are associated with coal outcrops approximately 1 km to the north and south of the site. There are no shafts or mine entries loc ated within 500 m. The risk from shallow coal mining is therefore 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-028) are listed below for reference: **Contaminant Sources** On-site: • Made Ground of unknown composition from uncontrolled deposition of material onsite during the construction of properties on site • Uncontrolled deposition of Made Ground associated with the former waste site and infilled ground on site Off-Site: • Uncontrolled deposition of Made Ground during the construction of roads and structures and demolition near and adjacent to the site's boundaries • Uncontrolled deposition of Made Ground associated with the former waste site and infilled ground within close proximity **Pathways** • Direct contact, ingestion, inhalation (dust and vapours) • Vertical migration through superficial deposits • Horizontal migration over and through the superficial deposits • Vertical and horizontal migration through existing service corridors and underlying superficial deposits **Receptors** • End-user of the site (residents) and Construction Workers • Controlled Waters (Principal bedrock aquifer) • Controlled Waters (Surface water drain located 500 m south)

GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: - 14 x mechanically excavated trial pits, - 12 x window sample boreholes, - 12 x Environmental monitoring installations, - 2 x Cable Percussion Borehole.
Ground Conditions	**Made Ground – 0.0 m bgl to in excess of 5.45 m bgl** Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.00 m and in excess of 5.45 m bgl (WS104) in the Audrey Street parcel and 3.60 m bgl in the Benton Street parcel (WS108). A reworked topsoil of dark brown slightly sandy, slightly gravelly clay with frequent rootlets was encountered in all locations with gravel generally comprising plastic, brick, metal, ceramic and sandstone. Made Ground deposits underlying the reworked topsoil are varied across both parcels and generally comprised either a greyish brown/black gravel, a reddish/greyish brown fine to medium sand or a reworked sandy gravelly clay. Gravel comprised brick, metal, clinker, ceramic, glass, sandstone, coal, concrete, slag and plastic across both parcels. Made Ground deposits within the Audrey Street parcel are generally deeper than the Benton Street parcel. The depth of Made Ground was unproven within TP107, TP108a, TP108b, TP114 and WS101 due to concrete or brick obstructions. Within WS104, Made Ground was encountered to the maximum depth of the window sample probehole. In both parcels, a coal fill was identified in thin bands at 0.30 m and 2.75 m bgl.
	DRIFT – 0.20 m bgl to 11.19 m bgl Drift deposits were encountered within the majority of exploratory locations except for six locations where the full depth of Made Ground could not be proven. Drift deposits were encountered between 0.20 m and 11.19 m bgl. The drift deposits within the Audrey Street parcel comprised a stiff to very stiff, medium to very high strength reddish brown/ brown slightly gravelly CLAY with gravel of mudstone and sandstone. The deeper soil horizons (>5.45 m bgl) encountered within CP101 and CP102, advanced on the Audrey Street parcel, comprised a brown slightly gravelly clay to 6.90 m and 7.50 m bgl, respectively. Underlying the clay within both locations, was a dense orangish brown slightly gravelly fine to medium SAND. The drift deposits within the Benton Street parcel generally comprised a loose reddish/orangish brown gravelly fine to coarse SAND with gravel of sandstone and quartz and occasional cobbles of sandstone. Clay deposits were encountered underlying the sand to the southwest of the Benton Street parcel from circa 2.75 m bgl within WS111 and from 5.00 m bgl within WS112.
	SOLID – The solid bedrock geology was not encountered during the site investigation. The underlying bedrock is the Collyhurst Sandstone Formation, and nearby BGS boreholes indicate that bedrock is in excess of 25 m bgl.

	GROUNDWATER – Groundwater was not encountered during the site investigation.

CONTAMINATED LAND ASSESSMENT

Human Health	A Tier 2 human health risk assessment has been undertaken using the chemical analysis results of 20 soil samples and comparing to the relevant thresholds for a residential end use with plant uptake. The Tier 2 human health risk assessment identified elevated concentrations of heavy metals and hydrocarbon compounds across both parcels that would present an unacceptable theoretical risk to the identified receptors associated with direct exposure pathways. As such, it will be necessary to design and construct the proposed development in a manner that will ensure suitably validated cover systems for all areas of private gardens, soft landscaping and public open space. Localised areas of volatile/semi-volatile hydrocarbon impact and elevated naphthalene have been identified within discreet locations on the Benton Street parcel; these compounds pose a theoretical risk associated with volatilisation and subsequent ingress into the proposed dwellings (indoor air). As such it will be necessary to delineate the extent of impact and ensure all material is excavated, analysed, and treated for either reuse within an area of no sensitivity (post-treatment) or removed from the site. Asbestos was not detected in any of the nine samples tested. Chemical analysis of the natural clay and granular drift deposits has identified the majority of these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Exceedances of heavy metals and non-volatile PAH have been encountered within natural granular deposits within TP106 at 1.20 m bgl. There are no suitable sources of topsoil available on the site.
Controlled Waters	The critical receptors have been identified as the underlying principal aquifer (bedrock), with no surface water receptors identified within the influencing distance of the site. Nearby BGS boreholes have indicated that bedrock is likely in excess of 25 m bgl. No groundwater has been recorded within the monitoring wells constructed on-site. Leachate analysis has not identified any volatile contaminants, however, lead exceedances have been identified above the DWS and zinc above the EQS (DWS thresholds are not available for zinc). The presence of cohesive deposits (Audrey Street) will provide some protection to the underlying principal bedrock aquifer (primary receptor), however granular deposits have been identified underlying the Benton Street parcel. Leachate analysis can overstate the mobility of determinands and provides only a guide as to the potential risk to controlled waters. Given the marginal exceedances recorded and the absence of a groundwater abstraction point or surface watercourse within 500 m of the site, there is not considered to be a complete pollutant linkage.
Ground Gas	Given the presence of the recorded landfilling of the Audrey Street parcel and the recorded historical landfills within 500 m of the site, it is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the gas monitoring programme.

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, indicative of relict foundations from the former buildings. During a phase of cut-and-fill enabling works to create a development platform, all below-ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.
Allowable Bearing Pressure	The underlying natural clay drift deposits, where encountered, have been assessed as being stiff medium strength stiff, high strength with a net allowable bearing pressure (ABP) in the order of 100 kN/m^2 at circa 1 m bgl increasing to 150–200 kN/m^2 at circa 2 m bgl. Across the Benton Street parcel of the site, the underlying natural granular deposits have been assessed as being loose with an allowable bearing capacity of between 61 and 91 kN/m^2. Deep Made Ground deposits in excess of 3.00 m bgl have been encountered across both sectors of the site.
Foundation Options	Due to the significant depths of Made Ground across both parcels of the site and 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 Made Ground > 600 mm and shallow cohesive soils.
Heave Precautions	Given that the underlying clay is of medium volume change potential, heave precautions will be required to the internal face of a foundation less than 1.5 m in depth. Heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) and pile ground beams are required within the modelled influencing distance of trees.
Soakaway Drainage	Falling head permeability tests undertaken within WS105, on the Audrey Street parcel, did not record a sufficient fall in water level to calculate an infiltration rate. Given that the Audrey Street parcel is underlain by low permeability CLAY, soakaway drainage is unlikely to be viable for this parcel. However, the results of the remaining falling head permeability tests indicate soakaway drainage will likely be viable on the Benton Street parcel. 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 DS1 AC1s.
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, cut-and-fill works will be required to prepare the development platform.
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 the 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.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: *Waste Classification – Guidance on the classification and assessment of waste*.

RECOMMENDATIONS

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

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

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DRAWING LIST

16-219-001 - Site Location Plan
16-219-004 - Site Features Plan
16-219-003 - Historical Features Plan
16-219-005 - Exploratory Hole Location Plan
16-219-006 - Depth of Made Ground Plan
16-219-008 - Depth to Founding Strata Plan
16-219-010 - Conceptual Site Model
15-059-018 - Contamination Exceedances Plan

1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by Alan Johnston Partnership (AJP) to undertake a detailed Phase II Geoenvironmental Site Assessment for two parcels of land off Audrey Street and Benton Street in Moston, Greater 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 development for a proposed low-rise residential development.

1.2. PROPOSED DEVELOPMENT

E3P understands that Alan Johnston Partnership (AJP) are assisting their client with the proposed acquisition and future redevelopment of two parcels of land off Audrey Street and Benton Street in Moston, Greater Manchester for low-rise residential housing with associated adopted estate roads and utility infrastructure.

A proposed development layout has not been provided at the time of writing.

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) (2019).*
- 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;
- 6 x Window sample probeholes with environmental monitoring installations;
- 10 x Mechanically excavated trial pits;
- 2 x Deep cable percussive boreholes;
- 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 the following reports for the site:

- **Curtins** - Phase 1 Preliminary Risk Assessment, Audrey Street (REF; 077873-CUR-00-XX-RP-GE-028-V01, dated 28 April 2021). Prepared for One Manchester Housing.

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

Site Setting

- The site is split into two distinct areas, the northern section is a rectangular plot of land off Audrey Street and the south portion is a roughly square plot off Benton Street. Both areas are currently grassed open land surrounded by residential properties. Several mature trees are present across the Audrey Street parcel.

Site History

- Earliest mapping (1848) shows that the site was undeveloped and surrounded by farmland. By 1908 the site was surrounded by residential properties with industrial land uses in the wider surrounding area. Earthworks/excavations are shown on historical mapping on the Audrey Street site with numerous other refuse heaps in the surrounding area shown on maps from 1950s onwards.

Environmental Setting

- A recorded landfill site (receiving commercial and household waste until 1977) is located immediately south of Benton Street and Audrey Street. The Curtins' Phase I surmises that the Audrey Street earthworks excavation was later infilled and forms part of the historical landfill, however, a review of landfill records indicates that the landfill identified as being on-site in the Envirocheck report actually appears to encroach the southern boundary of the Benton Street parcel. The excavations on the Audrey Street parcel are recorded as extractive industries (not landfill), however, a recent topographical survey indicates the Audrey Street parcel to be relatively level, suggesting that the mapped excavation may have been infilled at some point.

- A number of other historic landfill sites are located within 500 m of the site. The nearest area of infilled land (unknown pit, quarry etc) is located 11 m northwest with a number of other infilled land areas shown in the surrounding area.

- BGS mapping indicates the site is underlain by Glacial Till superficial deposits and Collyhurst Sandstone Formation bedrock (principal aquifer). The site is not located within a source protection zone.

- One BGS borehole record located 400 m southeast of the site was advanced to depth of 8.45m bgl and encountered clay with sand.

- 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. A Stage I Preliminary UXO Risk Assessment is recommended.

Initial Conceptual Model

- The previous Curtins Phase I concluded the following: The risk from Made Ground posed to the site's end-users and groundwater is considered to be **Moderate** due to the anticipated contamination in the Made Ground associated with the former landfills on site and previous neighbouring development. The risk posed to surface water is considered to be **Low** due to the distance to the nearest surface water feature. The risk posed to groundwater is considered to be **Moderate/Low**. The risk posed to site end-users from ground generating gases arising from organic/putrescible soils near the site is considered to be **High**.

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-028-V01, dated 28 April 2021) is 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. The nearest Development High-Risk Areas are associated with coal outcrops to the north and south of the site.

- There are no recorded mine entries within 1 km of the site.

- There are no recorded coal workings and no probable coal workings within 500 m 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 site is located 41m southeast of the site at Silton Street, an opencast site for common clay and shale. Tulketh Street Brickworks which extracted common clay and shale from superficial soils (Till) is shown to lie 173 m north west of the site.

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 target specific potential contaminant sources identified within the previous site investigations. 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 between 24th April 2023 and 15th May 2023. The works are summarised in Table 2.1.

2.2. LIMITATIONS OF THE INVESTIGATION

Dense tree cover in the north of the Audrey Street parcel prevented the advancement of cable percussion boreholes in that area.

2.3. 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)
Audrey Street				
Ground Conditions in the centre of the Audrey Street parcel Including the presence/nature of obstructions	TP101	Mechanically Excavated Trial Pit	3.40	N/A
	TP102		2.40	
Ground conditions from north to south (WS101 to WS106) including the installation of monitoring wells	WS101	Window Sample Probehole	3.42	0.50–2.50
	WS102		5.45	3.00–5.00
	WS103		4.92	1.00–2.00
	WS104		5.45	2.00–4.00
	WS105		5.45	1.50–4.00
Former CLAY Pit	WS106		5.45	1.00–3.00
Deeper horizons of soils across the site to aid foundation design	CP101	Cable Percussive Borehole	11.19	N/A
	CP102		11.18	
Benton Street				
Ground Conditions of the Benton Street parcel from east to west (WS107 to WS112) Including the installation of monitoring wells	WS107	Window Sample Probehole	5.45	2.00–4.00
	WS108		5.45	0.50–2.00
	WS109		5.45	4.00–5.00
	WS110		5.45	1.50–3.00
	WS111		5.45	4.00–5.00
	WS112		5.45	3.00–5.00
Ground conditions to the east of the site Including the Presence/Nature of Obstructions	TP103	Mechanically Excavated Trial Pit	2.20	N/A
	TP104		2.40	
	TP105		2.40	
Former CLAY Pit	TP106		2.80	
General Ground conditions Including the Presence/Nature of Obstructions	TP107		2.00	
	TP108a		0.25	
	TP108b		0.25	
	TP109		2.60	
	TP110		2.00	
	TP111		1.90	
	TP112		2.00	
	TP113		2.00	
	TP114		1.45	

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.

Cable percussive boreholes were advanced to undertake in-situ detailed geotechnical testing and to investigate the deeper soil horizons.

The exploratory hole locations are illustrated in Drawing 16-219-005 (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.

2.4. 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 IV and presented in Table 3.5 and discussed in Section 6.

2.5. PERMEABILITY TESTS

Nine falling head permeability tests were undertaken within environmental monitoring wells (WS101, WS102, WS105, WS107, WS108, WS109, WS110, WS111 and WS112) in order to assess the likely permeability of the underlying strata to determine the potential suitability for soakaway drainage within the proposed development. The results are presented in Table 3.8 and the test certificates are included within Appendix IX.

2.6. 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 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).

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:

- Liquid and plastic limit (Atterberg).
- Natural moisture content.
- Single-stage triaxial.
- 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. Where an * is noted, the exploratory hole was terminated due to a refusal at the top of this strata, with the full depth not proven.

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)			
	MADE GROUND	MADE GROUND: COAL	CLAY	SAND
TP101	0.00–3.20	–	3.20–3.40	–
TP102	0.00–1.60	–	1.60–2.40	–
TP103	0.00–0.50	–	2.00–2.20	0.50–2.00
TP104	0.00–0.50	0.50–0.60	2.35–2.40	0.60–2.35
TP105	0.00–1.40	–	–	1.40–2.40
TP106	0.00–0.90	0.90–1.00	–	1.00–2.80
TP107	0.00–2.00*	–	–	–
TP108a	0.00–0.25*	–	–	–
TP108b	0.00–0.25*	–	–	–
TP109	0.00–0.80	–	–	0.80–2.60
TP110	0.00–0.80	–	–	0.80–2.00
TP111	0.00–0.50	–	–	0.50–1.90
TP112	0.00–1.10	–	–	1.10–2.00
TP113	0.00–0.55	–	–	0.55–2.00
TP114	0.00–1.45*	–	–	–
WS101	0.00–0.30 0.40–3.42*	0.30–0.40	–	–
WS102	0.00–2.70	2.70–2.75	2.75–5.45	–
WS103	0.00–0.25	–	0.25–4.92	–
WS104	0.00–5.45*	–	–	–
WS105	0.00–0.20	–	0.20–5.45	–
WS106	0.00–4.00	–	4.00–5.45	–
WS107	0.00–2.30	–	–	2.30–5.45
WS108	0.00–3.60	–	–	3.60–5.45
WS109	0.00–2.50	–	–	2.50–5.45
WS110	0.00–1.00 1.00–1.20	1.20–1.30	–	1.30–5.45
WS111	0.00–0.40 0.40–1.50	1.50–1.55	2.75–5.45	1.55–2.75

HOLE	DEPTH TO STRATUM (m bgl)			
	MADE GROUND	MADE GROUND: COAL	CLAY	SAND
WS112	0.00–1.00	–	5.00–5.45	1.00–5.00
CP101	0.00–4.00	–	4.00–6.90	6.90–11.19
CP102	0.00–2.50	–	2.50–7.50	7.50–11.18

*Depth of Made Ground unproven

3.2. MADE GROUND

Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.00 m and in excess of 5.45 m bgl (WS104) in the Audrey Street parcel and 3.60 m bgl in the Benton Street parcel (WS108).

A reworked topsoil of dark brown slightly sandy, slightly gravelly clay with frequent rootlets was encountered in all locations with gravel generally comprising plastic, brick, metal, ceramic and sandstone.

Made Ground deposits underlying the reworked topsoil are varied across both parcels and generally comprised either a greyish brown/black gravel, a reddish/greyish brown fine to medium sand or a reworked sandy gravelly clay. Gravel comprised brick, metal, clinker, ceramic, glass, sandstone, coal, concrete, slag and plastic across both parcels.

Made Ground deposits within the Audrey Street parcel are generally deeper than the Benton Street parcel.

The depth of Made Ground was unproven within six of the locations due to concrete or brick obstructions within TP107, TP108a, TP108b, TP114 and WS101. Within WS104, Made Ground was encountered to the maximum depth of the window sample probehole.

In both parcels, a coal fill was identified in thin bands between 0.30 m and 2.75 m bgl.

A Depth of Made Ground Plan is presented as Drawing 16-219-003 in Appendix III.

3.3. DRIFT DEPOSITS

Drift deposits were encountered within the majority of exploratory locations with the exception of six locations where the full depth of Made Ground could not be proven. Drift deposits were encountered between 0.20 m and 11.19 m bgl.

The drift deposits within the Audrey Street parcel comprised a stiff to very stiff, medium to very high strength reddish brown/ brown slightly gravelly CLAY with gravel of mudstone and sandstone.

The deeper soil horizons (>5.45 m bgl) encountered within CP101 and CP102, advanced on the Audrey Street parcel, comprised a brown slightly gravelly clay to 6.90 m and 7.50 m bgl, respectively. Underlying the clay within both locations, was a dense orangish brown slightly gravelly fine to medium SAND.

The drift deposits within the Benton Street parcel generally comprised a loose reddish/orangish brown gravelly fine to coarse SAND with gravel of sandstone and quartz and occasional cobbles of sandstone. Clay deposits were encountered underlying the sand to the southwest of the Benton Street parcel from circa 2.75 m bgl within WS111 and from 5.00 m bgl within WS112.

3.4. SOLID GEOLOGY

The solid bedrock geology was not encountered during the site investigation. The underlying bedrock is the Collyhurst Sandstone Formation, and nearby BGS boreholes indicate that bedrock is in excess of 25 m bgl.

3.5. GROUNDWATER

Groundwater was not encountered during the site investigation.

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual evidence of potential contamination has been identified during the site investigation and these are summarised in Table 3.2. No olfactory evidence of potential contamination was identified.

TABLE 3.2 SUMMARY OF VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
TP106	0.30–0.80	Made Ground	Clinker
WS102	2.40–2.70	Made Ground	Clinker
WS104	0.10–5.45	Made Ground	Clinker and slag
WS105	0.00–0.20	Made Ground	Clinker
WS106	0.10–4.00	Made Ground	Clinker
WS108	0.25–2.80	Made Ground	Clinker and slag
WS109	0.15–2.50	Made Ground	Clinker
WS110	0.20–1.00	Made Ground	Clinker
WS112	0.00–1.00	Made Ground	Clinker and slag
CP102	0.00–2.50	Made Ground	Clinker

3.7. SOIL CONSISTENCY

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained triaxial tests. Results of the tests are presented in Table 3.3 and Table 3.4, which indicate the clay soils vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

TABLE 3.3 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m^2)
TP101	3.30	106	250.06
TP102	1.70	134	315.98
TP102	2.10	112	263.70
TP102	2.40	172	403.50
TP103	2.10	97	227.32
TP104	2.37	59	138.67

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.

TABLE 3.4 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m^2)	CONSISTENCY
WS103	1.50–2.00	Firm brown slightly gravelly very sandy CLAY.	42	Firm
WS111	3.50–4.00	Firm brown slightly gravelly very sandy CLAY.	54	Firm
CP101	5.50–5.95	Stiff brown slightly gravelly sandy CLAY.	108	Stiff
CP102	6.50–6.95	Firm brown slightly gravelly sandy CLAY.	62	Firm

3.8. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation in cohesive materials, however, in exploratory trial pit excavations where the Made Ground was underlain by sand, excavations were unstable as sand collapsed from circa 0.70 m bgl.

The presence of brick and concrete cobbles within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground and in some places, Made Ground could not be fully penetrated. 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: gravelly clay.	8	8.07	N/A	Medium strength	Stiff	40.33	82.91
WS101	2.00	MADE GROUND: slightly clayey very sandy gravel.	11	10.05	Medium Dense	N/A	N/A	N/A	100.49
WS101	3.00	MADE GROUND: slightly clayey very sandy gravel.	50	43.48	Dense	N/A	N/A	N/A	434.83
WS101	3.42	MADE GROUND: gravel.	50	42.88	Dense	N/A	N/A	N/A	428.83
WS102	1.00	MADE GROUND: very sandy gravel.	6	6.05	Loose	N/A	N/A	N/A	60.49
WS102	2.00	slightly gravelly CLAY.	9	8.22	Loose	N/A	N/A	N/A	82.22
WS102	3.00	slightly gravelly CLAY.	13	11.31	N/A	Medium strength	Stiff	56.53	116.22
WS102	4.00	slightly gravelly CLAY.	16	13.52	N/A	Medium strength	Stiff	67.59	138.96
WS102	5.00	slightly gravelly CLAY.	24	19.91	N/A	High strength	Very Stiff	99.55	204.68

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)*
WS103	1.00	slightly gravelly CLAY.	12	12.10	N/A	Medium strength	Stiff	60.49	124.37
WS103	2.00	slightly gravelly CLAY.	16	14.62	N/A	Medium strength	Stiff	73.08	150.26
WS103	3.00	slightly gravelly CLAY.	15	13.04	N/A	Medium strength	Stiff	65.22	134.10
WS103	4.00	slightly gravelly CLAY.	18	15.21	N/A	High strength	Very Stiff	76.04	156.33
WS103	4.50	slightly gravelly CLAY.	50	41.82	N/A	Very high strength	Very Stiff	209.09	429.89
WS104	1.00	MADE GROUND: gravel.	8	8.07	Loose	N/A	N/A	N/A	80.65
WS104	2.00	MADE GROUND: slightly clayey sandy gravel.	8	7.31	Loose	N/A	N/A	N/A	73.08
WS104	3.00	MADE GROUND: slightly clayey sandy gravel.	9	7.83	Loose	N/A	N/A	N/A	78.27
WS104	4.00	MADE GROUND: slightly clayey sandy gravel.	8	6.76	Loose	N/A	N/A	N/A	67.59

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	MADE GROUND: slightly clayey sandy gravel.	9	7.47	Loose	N/A	N/A	N/A	74.67
WS105	1.00	slightly gravelly CLAY.	12	12.10	N/A	Medium strength	Stiff	60.49	124.37
WS105	2.00	slightly gravelly CLAY.	19	17.36	N/A	High strength	Very Stiff	86.79	178.43
WS105	3.00	slightly gravelly CLAY.	14	12.18	N/A	Medium strength	Stiff	60.88	125.16
WS105	4.00	slightly gravelly CLAY.	17	14.36	N/A	Medium strength	Stiff	71.81	147.65
WS105	5.00	slightly gravelly CLAY.	20	16.59	N/A	High strength	Very Stiff	82.96	170.57
WS106	1.00	MADE GROUND: gravelly clay.	8	8.07	Loose	N/A	N/A	N/A	80.65
WS106	2.00	MADE GROUND: slightly clayey sandy gravel.	13	11.88	Medium Dense	N/A	N/A	N/A	118.76
WS106	3.00	MADE GROUND: slightly clayey sandy gravel.	10	8.70	Loose	N/A	N/A	N/A	86.97
WS106	4.00	slightly gravelly CLAY.	14	11.83	N/A	Medium strength	Stiff	59.14	121.59

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	5.00	slightly gravelly CLAY.	14	11.61	N/A	Medium strength	Stiff	58.07	119.40
WS107	1.00	MADE GROUND: slightly clayey very gravelly sand.	8	8.07	Loose	N/A	N/A	N/A	80.65
WS107	2.00	MADE GROUND: slightly clayey very gravelly sand.	8	7.31	Loose	N/A	N/A	N/A	73.08
WS107	3.00	gravelly SAND.	10	8.70	Loose	N/A	N/A	N/A	86.97
WS107	4.00	gravelly SAND.	11	9.29	Loose	N/A	N/A	N/A	92.93
WS107	5.00	gravelly SAND.	9	7.47	Loose	N/A	N/A	N/A	74.67
WS108	1.00	MADE GROUND: sandy gravel.	7	7.06	Loose	N/A	N/A	N/A	70.57
WS108	2.00	MADE GROUND: sandy gravel.	8	7.31	Loose	N/A	N/A	N/A	73.08
WS108	3.00	MADE GROUND: very sandy gravelly clay.	8	6.96	Loose	N/A	N/A	N/A	69.57
WS108	4.00	gravelly SAND.	11	9.29	Loose	N/A	N/A	N/A	92.93
WS108	5.00	gravelly SAND.	11	9.13	Loose	N/A	N/A	N/A	91.26

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)*
WS109	1.00	MADE GROUND: slightly clayey sandy gravel.	8	8.07	Loose	N/A	N/A	N/A	80.65
WS109	2.00	MADE GROUND: slightly clayey sandy gravel.	10	9.14	Loose	N/A	N/A	N/A	91.35
WS109	3.00	gravelly SAND.	7	6.09	Loose	N/A	N/A	N/A	60.88
WS109	4.00	gravelly SAND.	9	7.60	Loose	N/A	N/A	N/A	76.04
WS109	5.00	gravelly SAND.	10	8.30	Loose	N/A	N/A	N/A	82.96
WS110	1.00	gravelly SAND.	9	9.07	Loose	N/A	N/A	N/A	90.73
WS110	2.00	gravelly SAND.	9	8.22	Loose	N/A	N/A	N/A	82.22
WS110	3.00	gravelly SAND.	8	6.96	Loose	N/A	N/A	N/A	69.57
WS110	4.00	gravelly SAND.	9	7.60	Loose	N/A	N/A	N/A	76.04
WS110	5.00	gravelly SAND.	10	8.30	Loose	N/A	N/A	N/A	82.96
WS111	1.00	gravelly SAND.	7	7.06	Loose	N/A	N/A	N/A	70.57
WS111	2.00	gravelly SAND.	8	7.31	Loose	N/A	N/A	N/A	73.08
WS111	3.00	slightly gravelly CLAY.	14	12.18	N/A	Medium strength	Stiff	60.88	125.16
WS111	4.00	gravelly SAND.	15	12.67	N/A	Medium strength	Stiff	63.36	130.28

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)*
WS111	5.00	slightly gravelly CLAY.	18	14.93	N/A	Medium strength	Stiff	74.67	153.51
WS112	1.00	gravelly SAND.	6	6.05	Loose	N/A	N/A	N/A	60.49
WS112	2.00	gravelly SAND.	9	8.22	Loose	N/A	N/A	N/A	82.22
WS112	3.00	gravelly SAND.	9	7.83	Loose	N/A	N/A	N/A	78.27
WS112	4.00	gravelly SAND.	12	10.14	Medium Dense	N/A	N/A	N/A	101.38
WS112	5.00	slightly sandy slightly gravelly CLAY.	13	10.79	N/A	Medium strength	Stiff	53.93	110.87
CP101	1.00	MADE GROUND: slightly clayey sandy gravelly clay.	8	8.07	N/A	Medium strength	Stiff	40.33	82.91
CP101	2.00	MADE GROUND: slightly clayey sandy gravelly clay.	9	8.22	N/A	Medium strength	Stiff	41.11	84.52
CP101	3.00	MADE GROUND: slightly clayey sandy gravelly clay.	10	8.70	N/A	Medium strength	Stiff	43.48	89.40

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)*
CP101	4.00	slightly gravelly CLAY.	16	13.52	N/A	Medium strength	Stiff	67.59	138.96
CP101	5.00	slightly gravelly CLAY.	18	14.93	N/A	Medium strength	Stiff	74.67	153.51
CP101	6.50	slightly gravelly CLAY.	19	15.51	N/A	High strength	Very Stiff	77.56	159.46
CP101	8.00	gravelly SAND.	50	40.47	Dense	N/A	N/A	N/A	404.73
CP101	9.50	gravelly SAND.	50	40.30	Dense	N/A	N/A	N/A	402.97
CP101	11.00	gravelly SAND.	50	38.67	Dense	N/A	N/A	N/A	386.68
CP102	1.00	MADE GROUND: sandy gravelly clay.	8	8.07	N/A	Medium strength	Stiff	40.33	82.91
CP102	2.00	MADE GROUND: sandy gravelly clay.	9	8.22	N/A	Medium strength	Stiff	41.11	84.52
CP102	3.00	slightly gravelly CLAY.	10	8.70	N/A	Medium strength	Stiff	43.48	89.40
CP102	4.00	slightly gravelly CLAY.	16	13.52	N/A	Medium strength	Stiff	67.59	138.96
CP102	5.00	slightly gravelly CLAY.	16	13.27	N/A	Medium strength	Stiff	66.37	136.46
CP102	8.00	gravelly SAND.	50	40.47	Dense	N/A	N/A	N/A	404.73

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)*
CP102	9.50	gravelly SAND.	50	40.30	Dense	N/A	N/A	N/A	402.97
CP102	11.00	gravelly SAND.	50	38.67	Dense	N/A	N/A	N/A	386.68

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 granular material via wet sieve to obtain information on the soil fractions. The results are included in Table 3.6. The full results can be found in Appendix VIII.

TABLE 3.6 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP102	1.70 (Natural)	0	1	14	85
TP111	0.80 (Natural)	17	30	51	2
TP114	1.00 (Made Ground)	79	12	7	2

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 full test results can be found 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/m³)	MATERIAL RETAINED ON 20.0 mm TEST SIEVE (%)
TP111	Brown very gravelly slightly silty SAND with cobbles.	0.80	2.5kg	6.3	10	25	1.93	8
TP114	MADE GROUND: Dark brown slightly sandy slightly silty gravel of cobbles.	1.00	2.5kg	15	13	81	1.83	3

The proctor compaction tests have indicated that the materials on site are variable with the material in TP114 being 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 INFILTRATION

In-situ variable (falling) head permeability tests were undertaken within the monitoring well installations located in nine out of the twelve probeholes (WS101, WS102, WS105, WS107, WS108, WS109, WS110, WS111 and WS112). Tests could not be performed within WS103, WS104 and WS106 as monitoring wells could not be located or the monitoring well bung was stuck within the pipe.

All of the installations were noted to be dry prior to the test being undertaken, therefore the tests were undertaken in the unsaturated zone. Tests in WS107, WS109, WS110 and WS112 were undertaken within monitoring wells with response zones located in the natural granular drift stratum. Tests in WS102, WS105, WS110 and WS111 were undertaken within monitoring wells with response zones located in the natural cohesive drift stratum and tests in WS101 and WS108 were undertaken within monitoring wells with response zones located in Made Ground.

The results are presented in Table 3.8 and the test certificate for WS105 is included within Appendix IX.

TABLE 3.8 SOIL INFILTRATION RESULTS

LOCATION	DEPTH (m)	MATERIAL	TEST No.	SOIL INFILTRATION RATE (m/s)
WS101	0.50-2.50	MADE GROUND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS102	3.00-5.00	Slightly gravelly CLAY	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS105	1.50-4.00	Slightly gravelly CLAY	1	N/A
WS107	2.00-4.00	Gravelly SAND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS108	0.50-2.00	MADE GROUND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS109	4.00-5.00	Gravelly SAND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS110	1.50-3.00	Gravelly SAND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS111	4.00-5.00	Slightly gravelly CLAY	1	Water drained rapidly within 30 seconds of filling - unable to monitor.
WS112	3.00-5.00	Gravelly SAND	1	Water drained rapidly within 30 seconds of filling - unable to monitor.

Within all monitoring wells except WS105, water drained rapidly within 30 seconds of filling with water, therefore a test could not be undertaken to calculate soil infiltration rate.

Within WS105, the water level remained at 4.20 m bgl throughout the test period, therefor a soil infiltration could not be calculated.

Falling head permeability tests undertaken within WS105, on the Audrey Street parcel, did not record a sufficient fall in water level to calculate an infiltration rate. Given that the Audrey Street parcel is underlain by low permeability CLAY, soakaway drainage is unlikely to be viable for this parcel.

However, the results of the remaining falling head permeability tests and given that the Benton Street Parcel is underlain by high permeability SAND beneath the Made Ground, indicate soakaway drainage will likely be viable on the Benton Street parcel however, if soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.

3.12. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.9, show the clay to be of predominantly moderate plasticity.

TABLE 3.9 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
WS101	1.00	19	22	48	26	85	22.10	Medium
WS103	2.00	15	20	41	21	97	20.37	Medium
WS105	1.00	15	21	45	24	94	22.56	Medium

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

3.13. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.10), 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 3.10 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO_4 IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
WS101	0.10	0.0035	5.4	DS-1, AC-1s
WS101	1.20	0.0240	8.0	DS-1, AC-1s
WS104	1.20	0.3700	8.0	DS-1, AC-1s
WS105	0.10	0.0270	7.1	DS-1, AC-1s
WS106	0.80	0.0190	8.2	DS-1, AC-1s
WS108	0.90	0.0300	8.7	DS-1, AC-1s
WS111	1.30	0.0077	8.0	DS-1, AC-1s
TP101	0.10	0.0059	6.4	DS-1, AC-1s
TP103	0.10	0.0045	6.0	DS-1, AC-1s
TP105	0.10	0.0045	7.1	DS-1, AC-1s
TP108b	0.10	0.0028	5.7	DS-1, AC-1s
TP111	0.10	0.0074	5.8	DS-1, AC-1s
TP114	0.10	0.0082	5.3	DS-1, AC-1s
TP114	0.70	0.0770	8.5	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 the 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.

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).

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

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	20	45 49 37	WS101 0.10 m bgl WS105 0.10 m bgl TP106 1.20 m bgl	1	**Further Action**
Cadmium	mg/kg	11	20	2.5	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	20	2.4	N/A	1	No Further Action
Lead	mg/kg	200	20	310 460 380 290 240 590 200 220	WS104 1.20 m bgl WS105 0.10 m bgl WS108 0.90 m bgl TP101 0.10 m bgl TP105 0.10 m bgl TP106 1.20 m bgl TP108b 0.10 m bgl TP111 0.10 m bgl	1	**Further Action**
Mercury	mg/kg	1.2	20	1.1	N/A	4	No Further Action
Nickel	mg/kg	130	20	44	N/A	1	No Further Action
Selenium	mg/kg	250	20	1	N/A	1	No Further Action
Copper	mg/kg	2400	20	250	N/A	1	No Further Action
Zinc	mg/kg	3700	20	560	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	20	5.8	N/A	1	No Further Action
Phenols – Total	mg/kg	120	14	1	N/A	1	No Further Action
Asbestos	Fibres	NFD	20	ND	N/A	3	No Further Action
Naphthalene	mg/kg	2.3	20	4.6 16	WS108 0.90 m bgl TP114 0.70 m bgl	4	**Further Action**
Acenaphthylene	mg/kg	170	20	0.51	N/A	2	No Further Action
Acenaphthene	mg/kg	210	20	65	N/A	1	No Further Action
Fluorene	mg/kg	170	20	58	N/A	1	No Further Action
Phenanthrene	mg/kg	95	20	370	TP114 0.70 m bgl	2	**Further Action**
Anthracene	mg/kg	2400	20	92	N/A	2	No Further Action
Fluoranthene	mg/kg	280	20	330	TP114 0.70 m bgl	2	**Further Action**
Pyrene	mg/kg	620	20	280	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	20	7.4 13 23 110	WS104 1.20 m bgl WS105 0.10 m bgl WS108 0.90 m bgl TP114 0.70 m bgl	2	**Further Action**
Chrysene	mg/kg	15	20	21 110	WS108 0.90 m bgl TP114 0.70 m bgl	2	**Further Action**
Benzo(b)Fluoranthene	mg/kg	2.6	20	5.1 7.3 16 5.2 27	WS101 1.20 m bgl WS104 1.20 m bgl WS105 0.10 m bgl WS106 0.80 m bgl WS108 0.90 m bgl	2	**Further Action**

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
				3.0 3.8 2.7 120	TP101 0.10 m bgl TP106 1.20 m bgl TP111 0.10 m bgl TP114 0.70 m bgl		
Benzo(k)Fluoranthene	mg/kg	77	20	40	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	20	4.9 6.1 12 3.8 19 2.9 96	WS101 1.20 m bgl WS104 1.20 m bgl WS105 0.10 m bgl WS106 0.80 m bgl WS108 0.90 m bgl TP106 1.20 m bgl TP114 0.70 m bgl	2	**Further Action**
Indeno(123-cd)Pyrene	mg/kg	27	20	52	TP114 0.70 m bgl	2	**Further Action**
Dibenzo(a,h) Anthracene	mg/kg	0.24	20	0.62 0.83 1.7 2.8 0.35 0.41 0.34 13	WS101 1.20 m bgl WS104 1.20 m bgl WS105 0.10 m bgl WS108 0.90 m bgl TP101 0.10 m bgl TP106 1.20 m bgl TP111 0.10 m bgl TP114 0.70 m bgl	2	**Further Action**
Benzo(ghi)Perylene	mg/kg	320	20	60	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	20	1	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	20	0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	20	0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	20	82	TP114 0.70 m bgl	4	**Further Action**
TPH C12-C16 (aromatic)*	mg/kg	140	20	160 190	TP111 0.10 m bgl TP114 0.70 m bgl	4	**Further Action**
TPH C16-C21 (aromatic)*	mg/kg	260	20	500 510	TP111 0.10 m bgl TP114 0.70 m bgl	1	**Further Action**
TPH C21-C35 (aromatic)*	mg/kg	1100	20	490	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.

4.2.1. SUMMARY OF RESULTS

Referring to Table 4.1, the results of this direct comparison indicate that the following contaminants have been found at concentrations in exceedance of chosen GAC values:

- Heavy metals including lead and arsenic.
- Non-volatile PAHs including phenanthrene, fluoranthene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(123-cd)pyrene and dibenzo(a,h)anthracene.
- Volatile contaminants including naphthalene, TPH C10-C12 (aromatic), TPH C12-C16 (aromatic) and TPH C16-C21 (aromatic).

Asbestos was not detected in the ten samples analysed.

In relation to these exceedances, the following can be determined:

- The main exposure pathways based on the Tier I exceedances are:
  - Soil ingestion.
  - Vapour inhalation (indoor).
  - Consumption of homegrown vegetables.

HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

The majority of the identified elevated concentrations across both sectors of the site have primary exposure pathways related to dermal contact, ingestion of soils, inhalation of particulate; inhalation of vapour and consumption of homegrown vegetables.

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. The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy.

With regards to the elevated naphthalene and TPHs, these present potential volatilisation to indoor air risk. Napthalene exceedances against the GAC were recorded in WS108 at 0.90 m bgl and TP114 at 0.70 m bgl. Hydrocarbon fractions (C10-C12, C12-C16 & C16-C21) were noted within TP111 at 0.10 m bgl and TP114 at 0.70 m bgl within the Made Ground deposits. These elevated concentrations have been identified within three areas of the site all within the Benton Street sector (WS108, TP111 and TP114) and are therefore considered to be localised hotspots. As such it will be necessary to delineate the extent of impact and ensure all material is excavated, analysed, and treated for either reuse within an area of no sensitivity (post-treatment) or removed from the site.

Chemical analysis of the natural clay and granular drift deposits has identified the majority of these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Exceedances of heavy metals and non-volatile PAH have been encountered within natural granular deposits within TP106 at 1.20 m bgl.

There are no suitable sources of topsoil available on the site.

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 heavy metals, PAH and volatile contaminants have been found in the soils, which may leach to underlying shallow groundwater and migrate towards nearby watercourses and waterbodies.		**Moderate**
Pathway		
Vertical Migration Due to the Benton Street parcel being underlain by granular alluvium deposits, vertical migration of contaminants is likely to occur as a result of the high permeability of the drift deposits. Clay deposits are present beneath Made Ground at the Audrey Street parcel to depths in excess of 5.00 m (CP101 and CP102). The presence of this low permeability drift will offer some protection to the underlying aquifer, however, limited clay deposits have been identified on the Benton Street parcel, therefore the risk of vertical migration is considered to be high for the Benton Street Parcel.		**High**
Lateral migration Lateral migration of contaminants is considered possible due to the presence of granular alluvium deposits across the site.		**Moderate**
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	None identified within 500m radius.	**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 a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying principal aquifer.		

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 1 mg/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	PAH analysis has identified levels above the laboratory LOD throughout the site.	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; TP114 at 0.10 m and 0.70 m bgl, at 13 mg/kg and 82 mg/kg, respectively.	Further discussion
C12-C16 > 50 mg/kg	Concentrations of C12-C16 have been recorded above 50 mg/kg at one location; TP114 at 0.10 m and 0.70 m bgl, at 160 mg/kg and 190 mg/kg, respectively.	Further discussion
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	Concentrations of naphthalene above 2 mg/kg have been recorded in WS108 at 0.90 m bgl (4.6 mg/kg) and TP114 at 0.70 m bgl (16 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 TP114 at 0.70 m bgl at 1810 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 one location TP106 at 1.20 m bgl.	Further discussion

The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground to drinking water standards (DWS) due to the presence of a principal bedrock aquifer underlying the site. There are no surface watercourses within influencing distance, therefore samples have not been compared to Environmental Quality Standards (EQS).

These are presented in Table 4.4.

On initial return monitoring visits, all monitoring wells were recorded as dry, therefore groundwater samples could not be retrieved. If sufficient groundwater is recorded in monitoring wells on subsequent monitoring visits, groundwater samples will be collected and analysed.

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

DETERMINAND	UNIT	EQS [1, 2] AA	DWS [3,4]	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
Arsenic	µg/l	50	10	3	2.6	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	3	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	3	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	3	4.7	N/A	No Further Action
Copper	µg/l	1	2000	3	30	N/A	No Further Action
Total Cyanide	µg/l	1	50	3	6.8	N/A	No Further Action
Lead	µg/l	1.2	10	3	14	TP101 1.40 m (DWS)	Further Action
Mercury	µg/l	–	1.0	3	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	3	12	N/A	No Further Action
Selenium	µg/l	–	10	3	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	3	30	TP101 1.40 m (EQS) TP105 0.20 m (EQS) TP114 0.80 m (EQS)	Further Action
pH	6–9			3	7.3–7.9	N/A	No Further Action
Polycyclic Aromatic Hydrocarbons							
Naphthalene	µg/l	2	10*	3	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	3	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	3	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	3	<0.01	N/A	No Further Action

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

DETERMINAND	UNIT	EQS [1, 2] AA	DWS [3,4]	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
Trichloroethylene	µg/l	10	10	3	N/A	N/A	No Further Action
Trichlorobenzene	µg/l	0.4	–	3	N/A	N/A	No Further Action
Trichloromethane	µg/l	2.5	–	3	N/A	N/A	No Further Action
Dichloromethane	µg/l	20	200	3	N/A	N/A	No Further Action
Carbon Tetrachloride	µg/l	12	3	3	N/A	N/A	No Further Action
Vinyl Chloride	µg/l	–	0.3	3	N/A	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.
The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (legislation.gov.uk)
The Water Supply (Water Quality) Regulations 2018 (legislation.gov.uk)
Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum (who.int)
CL:AIRE publishes Petroleum Hydrocarbons in Groundwater guidance (claire.co.uk)
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

During the site works and initial return monitoring visits, shallow groundwater was not encountered across the site.

During the intrusive site investigation, three leachate samples were taken of the Made Ground soils. Leachate analysis identified heavy metal exceedances (lead) when compared to Drinking Water Standard (DWS) within TP101 at 1.40 m bgl.

Exceedances of zinc were identified within all three leachate samples when compared to EQS values, as there are no DWS screening values for zinc.

4.3.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

The critical receptors have been identified as the underlying principal aquifer (bedrock), with no surface water receptors identified within the influencing distance of the site. Nearby BGS boreholes have indicated that bedrock is likely in excess of 25 m bgl.No groundwater has been recorded within the monitoring wells constructed on-site.

Leachate analysis has not identified any volatile contaminants, however, lead exceedances have been identified above the DWS and zinc above the EQS (DWS thresholds are not available for zinc).

Soil analysis has identified volatile contaminants within localised areas all within the Benton Street sector (WS108, TP111 and TP114). Leachate analysis has not identified any volatile contaminants, however, heavy metal exceedances have been identified above the DWS for Lead and above the EQS for Zinc (there is DWS thresholds for zinc).

Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation, as the contaminants present in the soils are required to be mobilised by water in order to cause a potential risk to the aquifer.

The presence of cohesive deposits (Audrey Street) will provide some protection to the underlying Principal bedrock aquifer (primary receptor), however considerable granular deposits have been identified underlying the Benton Street Parcel. Given the absence of a groundwater abstraction point within 500m of the site, there is not considered to be a complete pollutant linkage on-site which could pose risk to the underlying principal bedrock aquifer.

On initial return monitoring visits, all monitoring wells were recorded as dry, therefore groundwater samples could not be retrieved. Groundwater has not been encountered within the investigation and therefore it is likely that groundwater is encountered at significant depth. Due to the lack of groundwater encountered within the investigation, it is unlikely that water will mobilise any contaminants within the MAde Ground deposits, and therefore the risk to the underlying aquifer is reduced.

Based on the lack of groundwater across the majority of the site, alongside the significant depth of underlying bedrock, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environment. However, should groundwater be encountered within any return visits, groundwater samples for chemical analysis should be undertaken.

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+A1:2019)

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 (CH_4), carbon dioxide (CO_2) and oxygen (O_2) 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 CH_4 and CO_2, together with the lowest concentration of O_2 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. 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)
WS101	Made Ground	18/05/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	1016	Steady	0.1	0.1	0.50-2.50	3.00	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1015	Falling	0.1	0.1		2.90	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1011	Rising	0.1	0.1		2.90	Dry
WS102	Natural CLAY	18/05/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.9	1016	Steady	0.1	0.1	3.00-5.00	3.55	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1014	Falling	0.1	0.1		3.50	3.13
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1014	Rising	0.1	0.1		3.50	3.27
WS103	Natural CLAY	18/05/2023	Monitoring well not located											1.00-2.00		
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1013	Falling	0.1	0.1		1.82	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1011	Rising	0.1	0.1		2.00	Dry
WS104	Made Ground	18/05/2023	0.1	0.1	0.0001	2.7	2.7	0.0027	17.1	1015	Steady	0.1	0.1	2.00-4.00	Bung stuck in well	
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1013	Falling	0.1	0.1		Bung Stuck in well	
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1010	Rising	0.1	0.1		Bung Stuck in well	
WS105	Natural CLAY	18/05/2023	0.1	0.1	0.0001	2.6	2.6	0.0026	18.2	1014	Steady	0.1	0.1	1.50-4.00	4.20	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1013	Falling	0.1	0.1		1.75	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1010	Rising	0.1	0.1		1.00	Dry
WS106	Made Ground	18/05/2023	Monitoring well not located											1.00-3.00		
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1013	Falling	0.1	0.1		2.68	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1010	Rising	0.1	0.1		2.68	Dry
WS107	Natural	18/05/2023	0.1	0.1	0.0001	4.0	4.0	0.0040	13.6	1015	Steady	0.1	0.1	2.00-4.00	4.00	Dry

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)
	SAND	06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1013	Falling	0.1	0.1		3.88	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1011	Rising	0.1	0.1		3.90	Dry
WS108	Made Ground	18/05/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	1015	Steady	0.1	0.1	0.50-2.00	2.00	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1013	Falling	0.1	0.1		1.95	Dry
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.7	1011	Rising	0.1	0.1		1.95	Dry
WS109	Natural SAND	18/05/2023	0.1	0.1	0.0001	2.5	2.5	0.0025	17.0	1016	Steady	0.1	0.1	4.00-5.00	4.90	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1013	Falling	0.1	0.1		4.85	4.79
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.7	1010	Rising	0.1	0.1		4.89	4.81
WS110	Natural SAND	18/05/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	20.7	1015	Steady	0.1	0.1	1.50-3.00	2.24	Dry
		06/06/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	20.5	1014	Falling	0.1	0.1		2.13	Dry
		23/06/2023	0.1	0.1	0.0001	0.3	0.3	0.0003	20.8	1011	Rising	0.1	0.1		2.13	Dry
WS111	Natural CLAY	18/05/2023	0.1	0.1	0.0001	3.1	3.1	0.0031	15.4	1014	Steady	0.1	0.1	4.00-5.00	4.82	Dry
		06/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1014	Falling	0.1	0.1		4.75	4.70
		23/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	1010	Rising	0.1	0.1		4.77	4.71
WS112	Natural SAND	18/05/2023	0.1	0.1	0.0001	2.0	2.0	0.0020	18.4	1014	Steady	0.1	0.1	3.00-5.00	4.60	Dry
		06/06/2023	0.1	0.1	0.0000	0.1	0.1	0.0001	20.5	1013	Falling	0.1	0.1		4.53	Dry
		23/06/2023	0.1	0.1	0.0000	0.1	0.1	0.0001	20.8	1010	Rising	0.1	0.1		4.53	Dry

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

The majority of the monitoring wells were recorded as dry throughout the initial monitoring visits. Groundwater was recorded within WS102, WS109 and WS111 between 3.13 m and 4.79 m bgl.

4.6.2. BAROMETRIC PRESSURE

Visit 1 was undertaken during a period of relatively high steady pressure, with pressure recorded to be 1014 mbar. Visit 2 was undertaken during a period of falling pressure and visit 3 was undertaken during a period of rising pressure. An additional twenty one visits are required and it is therefore considered that all atmospheric pressure dynamic scenarios will be encountered during the further ground gas monitoring.

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 4.0% v/v (WS107).

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
WS101	18/05/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS102	18/05/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	06/06/2023	3.13	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	3.27	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS103	18/05/2023	Monitoring well not located							
	06/06/2023	Dry	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
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS104	18/05/2023	Bung Stuck in well	0.10	0.10	0.0001	2.7	0.0027	CS1	Green
	06/06/2023		0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023		0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS105	18/05/2023	Dry	0.10	0.10	0.0001	2.6	0.0026	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS106	18/05/2023	Monitoring well not located							
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS107	18/05/2023	Dry	0.10	0.10	0.0001	4.0	0.0040	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS108	18/05/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS109	18/05/2023	Dry	0.10	0.10	0.0001	2.5	0.0025	CS1	Green
	06/06/2023	4.79	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	4.81	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS110	18/05/2023	Dry	0.10	0.10	0.0001	0.3	0.0003	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.3	0.0003	CS1	Green
	23/06/2023	Dry	0.10	0.10	0.0001	0.3	0.0003	CS1	Green
WS111	18/05/2023	Dry	0.10	0.10	0.0001	3.1	0.0031	CS1	Green
	06/06/2023	4.70	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	4.71	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
WS112	18/05/2023	Dry	0.10	0.10	0.0001	2.0	0.0020	CS1	Green
	06/06/2023	Dry	0.10	0.10	0.0001	0.1	0.0001	CS1	Green
	23/06/2023	Dry	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 Characteristic Situation (CS)1 – Very Low Gas Risk. It should be noted however that the gas monitoring programme is incomplete, and no visits have yet been undertaken during low or falling pressure weather events.

- The main sources of ground gas have been identified as the deep Made Ground, which due to their inherent variability may contain putrescible materials and volatiles that produce ground gases. Despite this, no putrescible materials have been identified within the Made Ground to date.

- Given the presence of the recorded landfilling of the Audrey Street parcel and the recorded historical landfills within 500 m of the site, 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.

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. 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 4.8 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at Current 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	<15.0 (WS104) 40 (WS108)
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	625 (WS108)
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	NA
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		

Contaminant Group	PE-threshold (mg/kg)	Concentrations at Current pipeline depth (mg/kg)
Are there any exceedances of the PE threshold outside of the pipeline depth?	Yes; EC10-EC16 Aliphatic and Aromatic Hydrocarbons: • 173 mg/kg (TP114 at 0.10 m) • 272 mg/kg (TP114 at 0.70 m) EC16-EC40 Aliphatic and Aromatic Hydrocarbons: • 992 mg/kg (TP114 at 0.10 m) • 1033 mg/kg (TP114 at 0.70 m)	
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?	No hydrocarbon impact has been identified.	
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.

4.8. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.9 has been prepared for the site.

TABLE 4.9 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	High	LOW
Discussion: Heavy metals (arsenic and lead) were identified throughout Made Ground between depths of 0.10 m and 1.20 m bgl. Non-volatile PAHs have been identified throughout Made Ground of both parcels between depths of 0.10 m and 1.20 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.						
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 TPH C10-C12, TPH C12-C16 and naphthalene have been identified in the Made Ground in WS108, TP111 and TP114 at 0.10 m and 0.90 m bgl. **Recommendation:** During a process of cut/fill enabling works, a hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on-site in an area of no future sensitivity.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Methane, carbon dioxide (Localised Made Ground)	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: The monitoring data to date indicates Characteristic Situation (CS)1 – Very Low Gas Risk. Given the presence of the recorded landfilling of the Audrey Street parcel and the recorded historical landfills within 500 m of the site, it is recommended that precautionary allowances be made for CS2 gas protection measures. **Recommendation:** Initial monitoring suggests that the site can be classified as CS1/Green, however this will be confirmed on completion of the monitoring. Precautionary CS2/Amber 1 measures required.						
PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principal bedrock aquifer).	Likely	Moderate	LOW
Assessment: The critical receptors have been identified as the underlying principal aquifer (bedrock), with no surface water receptors identified within the influencing distance of the site. Nearby BGS boreholes have indicated that bedrock is likely in excess of 25 m bgl. No groundwater has been recorded within the monitoring wells constructed on-site. Leachate analysis has not identified any volatile contaminants, however, lead exceedances have been identified above the DWS and zinc above the EQS (DWS thresholds are not available for zinc).						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
The presence of cohesive deposits (Audrey Street) will provide some protection to the underlying principal bedrock aquifer (primary receptor), however granular deposits have been identified underlying the Benton Street parcel. Leachate analysis can overstate the mobility of determinands and provides only a guide as to the potential risk to controlled waters. Given the marginal exceedances recorded and the absence of a groundwater abstraction point or surface watercourse within 500 m of the site, there is not considered to be a complete pollutant linkage. **Recommendation:** Obtain groundwater samples for chemical analysis if present within monitoring wells on return monitoring visits to confirm the above conclusions.						
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, solvents (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.						

Notes:
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

Alan Johnston Partnership (AJP) are assisting their client with the proposed acquisition and future redevelopment of two parcels of land off Audrey Street and Benton Street in Moston, Greater Manchester for low rise residential housing with associated adopted estate roads and utility infrastructure.

5.2. SUMMARY OF GROUND CONDITIONS

Made Ground

- Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.00 m and in excess of 5.45 m bgl (WS104) in the Audrey Street Parcel and 3.60 mbgl in the Benton Street Parcel (WS108).
- A reworked topsoil of dark brown slightly sandy, slightly gravelly clay with frequent rootlets was encountered in all locations with gravel generally comprising plastic, brick, metal, ceramic and sandstone.
- Made Ground deposits underlying the reworked topsoil are varied across both parcels and generally comprised either a greyish brown/black gravel, a reddish/greyish brown fine to medium sand or a reworked sandy gravelly clay. Gravel comprised of brick, metal, clinker, ceramic, glass, sandstone, coal, concrete, slag and plastic across both parcels.
- Made Ground deposits within the Audrey Street parcel are generally deeper than the Benton Street parcel.
- The depth of Made Ground was unproven within six of the locations due to concrete or brick obstructions within TP107, TP108a, TP108b, TP114 and WS101. Within WS104, Made Ground was encountered to the maximum depth of the window sample probehole.
- In both parcels, a coal fill was identified in thin bands between 0.30 m and 2.75 m bgl.

Drift Deposits

- Drift deposits were encountered within the majority of exploratory locations with the exception of six locations where the full depth of Made Ground could not be proven. Drift deposits were encountered between 0.20 m and 11.19 m bgl.
- The drift deposits within the Audrey Street parcel comprised a stiff to very stiff, medium to very high strength reddish brown/ brown slightly gravelly CLAY with gravel of mudstone and sandstone.
- The deeper soil horizons (>5.45 m bgl) encountered within CP101 and CP102, advanced on the Audrey Street parcel, comprised a brown slightly gravelly clay to 6.90 m and 7.50 m bgl, respectively. Underlying the clay within both locations, was a dense orangish brown slightly gravelly fine to medium SAND.
- The drift deposits within the Benton Street parcel generally comprised a loose reddish/orangish

brown gravelly fine to coarse SAND with gravel of sandstone and quartz and occasional cobbles of sandstone. Clay deposits were encountered underlying the sand to the southwest of the Benton Street parcel from circa 2.75 m bgl within WS111 and from 5.00m bgl within WS112.

Solid

- The solid bedrock geology was not encountered during the site investigation. The underlying bedrock is the Collyhurst Sandstone Formation, and nearby BGS boreholes indicate that bedrock is in excess of 25 m bgl.

Groundwater

- Groundwater was not encountered during the site investigation or during any of the return monitoring visits to date.

5.3. 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.

5.4. 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 6.1.

TABLE 6.1 SUMMARY OF ABP

GRANULAR SOILS			
Description	**Depth (Range m bgl)**	**Relative Density**	**Allowable Bearing Pressure (kN/m^2)**
Gravelly SAND	1.00–5.45	Loose	61–91
Gravelly SAND (1 location)	4.00–4.45	Medium Dense	101
Slightly gravelly SAND	8.00–11.45	Dense	387–404
COHESIVE SOILS			
Description	**Depth (range m bgl)**	**Undrained Shear Strength (Cu) (kN/m^2)**	**Allowable Bearing Pressure (kN/m^2)**
Stiff slightly gravelly CLAY	1.00–2.45	60–73	124–150
Stiff slightly gravelly CLAY	3.00–5.45	43–75	89–154
Very stiff slightly gravelly CLAY (1 location-WS105)	2.00–2.45	87	178
Very stiff slightly gravelly CLAY	4.00–6.95	76–209	156–430

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 stiff to very stiff glacial clay.

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 6.2.

TABLE 6.2 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 stiff 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 require 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 both parcels, however it is unlikely to have been subject to rising water levels as groundwater was not encountered during the site investigation.	**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	None identified – the site was historically filled circa 50 years ago with a mixture of clayey SAND and sandy CLAY. It is considered that the material has consolidated under self-weight settlement.	**PASS**
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None identified.	**PASS**
Clays with a plasticity index greater than 40%	None identified.	**PASS**
Highly sensitive soils liable to collapse or remoulding	None identified.	**PASS**
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 6.3.

TABLE 6.3 ANTICIPATED FOUNDATIONS

SECTOR	LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
Audrey Street	WS101	>3.40	–	*TBC Anticipated: Stiff CLAY*	Y	VSC/Pile	DS-1, AC-1s
	WS102	3.25	–	Stiff CLAY	Y	VSC/Pile	–
	WS103	0.90	–	Stiff CLAY	Y	Traditional Strip	–
	WS104	>5.45	–	*TBC*	Y	VSC/Pile	DS-1, AC-1s
	WS105	0.90	–	Stiff CLAY	Y	Traditional Strip	DS-1, AC-1s
	WS106	4.45	–	Stiff CLAY	Y	VSC/Pile	DS-1, AC-1s
	CP101	4.45	–	Stiff CLAY	Y	VSC/Pile	–
	CP102	2.95	–	Stiff CLAY	Y	VSC/Pile	–
Benton Street	WS107	>5.45	–	*TBC Anticipated: gravelly SAND*	N	VSC/Pile	–
	WS108	>5.45	–	*TBC Anticipated: gravelly SAND*	N	VSC/Pile	DS-1, AC-1s
	WS109	>5.45	–	*TBC Anticipated: gravelly SAND*	N	VSC/Pile	–
	WS110	>5.45	–	*TBC Anticipated: gravelly SAND*	N	VSC/Pile	–
	WS111	3.15	–	Stiff CLAY	N	VSC/Pile	DS-1, AC-1s
	WS112	5.45	–	V Stiff CLAY	N	VSC/Pile	–

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 foundation in areas unsuitable for Ground Improvement by Vibro.

5.5. 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.

5.6. 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.

If the ground floor slab is to be constructed with a beam and block floor, a minimum subfloor void of 200 mm is required within any structures located in the zone of conjectured tree influence.

If the ground floor slab is constructed with a cast in-situ suspended floor slab, then heave precautions that can tolerate 50 mm of clay swelling are required within any part of the floor slab to be located within the zone of influence of a tree.

A summary of heave precautions is presented in Table 6.4.

TABLE 6.4 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		

5.7. 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.

5.8. 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.

Falling head permeability tests undertaken within WS105, on the Audrey Street Parcel, did not record a sufficient fall in water level to calculate an infiltration rate. Given that the Audrey Street Parcel is underlain by low permeability CLAY, soakaway drainage is unlikely to be viable for this parcel.

However, the results of the remaining falling head permeability tests and given that the Benton Street Parcel is underlain by high permeability SAND beneath the Made Ground, indicate soakaway drainage will likely be viable on the Benton Street parcel however, if soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.

5.9. 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).

5.10. EXCAVATIONS

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation in cohesive materials, however, in exploratory trial pit excavations where the Made Ground was underlain by sand, excavations were unstable as sand collapsed from circa 0.70 m bgl.

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 and former floor slabs. 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 6.5 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	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.

5.11. 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).

5.12. GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	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. A clean cover system will be required in gardens and soft landscaped areas.
Bedrock	N/A	N/A	Shallow bedrock has not been identified.
Obstructions	All	100	Site has been subject to historical development and infilling. Concrete slab and brick obstructions have been encountered within both parcels.
Artificially levelled and filled platforms	Audrey Street	50	The excavations on the Audrey Street parcel are recorded as extractive industries (not landfill), however, a recent topographical survey indicates the Audrey Street parcel to be relatively level, suggesting that the mapped excavation may have been infilled at some point.
Trench collapse	All	100	Made Ground present beneath the site is likely to be loosely compacted and possibly prone to collapse.
Mature trees	Audrey Street Parcel	50	Arboriculture survey is required to determine areas of potential tree influence.
Volume change potential clay	On-site	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 low risk.
Ground dissolution	N/A	N/A	Data searches indicate no hazard.

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON-SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Concrete design	All	100	The soils meet class DS-1, AC-1s.
Low-permeability ground	On site	50	Falling head permeability tests undertaken within WS105, on the Audrey Street parcel, did not record a sufficient fall in water level to calculate an infiltration rate. Given that the Audrey Street parcel is underlain by low permeability CLAY, soakaway drainage is unlikely to be viable for this parcel. However, the results of the remaining falling head permeability tests and given that the Benton Street parcel is underlain by high permeability SAND beneath the Made Ground, indicate soakaway drainage will likely be viable on the Benton Street parcel however, if soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.
Services/sensitive structures	N/A	N/A	A review of online services has not identified any services present within the site boundary. An overhead telephone cable runs from the southwest corner of Audrey Street in a northerly direction.
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. Where a foundation spans two different soil matrices, additional reinforcement will be required to mitigate the risk of any potential differential settlement.
Areas not investigated	North (Audrey Street)	N/A	Dense tree cover in the north of the Audrey Street parcel prevented the advancement of cable percussion boreholes in that area, however, window samples probeholes were advanced in this area.

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON-SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Historically infilled features	Periphery	10	A recorded landfill site (receiving commercial and household waste until 1977) is located immediately south of Benton Street and Audrey Street. The Curtin's Phase I surmises that the Audrey Street earthworks excavation was later infilled and forms part of the historical landfill, however, a review of landfill records indicates that the landfill identified as being on-site in the Envirocheck report actually appears to encroach the southern boundary of the Benton Street parcel. The excavations on the Audrey Street parcel are recorded as extractive industries (not landfill), however, a recent topographical survey indicates the Audrey Street parcel to be relatively level, suggesting that the mapped excavation may have been infilled at some point. A number of other historic landfill sites are located within 500 m of the site. The nearest area of infilled land (unknown pit, quarry etc) is located 11 m northwest with a number of other infilled land areas shown in the surrounding area.
Surface water features	N/A	N/A	None identified within influencing distance of the site.

5.13. FURTHER WORKS

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

- 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	A Tier 2 human health risk assessment has been undertaken using the chemical analysis results of 20 soil samples and comparing to the relevant thresholds for a residential end use with plant uptake. The Tier 2 human health risk assessment identified site-wide concentrations across both parcels of non-volatile, insoluble heavy metals and hydrocarbon compounds that would present unacceptable degrees of theoretical risk to the identified receptors associated with direct exposure pathways. As such, it will be necessary to design and construct the proposed development in a manner that will ensure suitably validated cover systems to all areas of private garden, soft landscaping and public open space. Localised areas of volatile/semi-volatile hydrocarbon impact and elevated naphthalene have been identified within discreet locations on the Benton Street Parcel (hotspots); these compounds pose a theoretical risk associated with volatilisation and subsequent ingress into the proposed dwellings (indoor air). As such it will be necessary to delineate the extent of impact and ensure all material is excavated, analysed, and treated for either reuse within an area of no sensitivity (post-treatment) or, alternatively, removed from site. Asbestos was not detected in any of the nine samples tested. A clean cover system will be required in gardens and soft landscaped areas. Chemical analysis of the natural clay and granular drift deposits has identified the majority of these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. Exceedances of heavy metals and non-volatile PAH have been encountered within natural granular deposits within TP106 at 1.20 m bgl. There are no suitable sources of topsoil available on the site.
Controlled Waters	The critical receptors have been identified as the underlying principal aquifer (bedrock), with no surface water receptors identified within the influencing distance of the site. Nearby BGS boreholes have indicated that bedrock is likely in excess of 25 m bgl. Leachate analysis has not identified any volatile contaminants, however, heavy metal exceedances have been identified above the DWS in Lead and above the EQS in Zinc (where DWS thresholds aren't available). Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation, as the contaminants present in the soils are required to be mobilised by water in order to cause a potential risk to the aquifer.

	The presence of cohesive deposits (Audrey Street) will provide some protection to the underlying Principal bedrock aquifer (primary receptor), however considerable granular deposits have been identified underlying the Benton Street Parcel. Given the absence of a groundwater abstraction point within 500m of the site, there is not considered to be a complete pollutant linkage on-site which could pose risk to the underlying principal bedrock aquifer. On initial return monitoring visits, all monitoring wells were recorded as dry, therefore groundwater samples could not be retrieved. Groundwater has not been encountered within the investigation and therefore it is likely that groundwater is encountered at significant depth. Due to the lack of groundwater encountered within the investigation, it is unlikely that water will mobilise any contaminants within the MAde Ground deposits, and therefore the risk to the underlying aquifer is reduced. Based on the lack of groundwater across the majority of the site, alongside the significant depth of underlying bedrock, it is considered there is unlikely to be any degree of unacceptable risk to the controlled water receptors and the wider environment. However, should groundwater be encountered within any return visits, groundwater samples for chemical analysis should be undertaken.
Ground Gas	Given the presence of the recorded landfilling of the Audrey Street parcel and the recorded historical landfills within 500m of the site, it is recommended that precautionary allowances be made for CS2 gas protection measures. This will be confirmed on completion of the gas monitoring programme.
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 buildings, road/footpaths and infilled areas.

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 where ground conditions are unsuitable for strip/trench.
- 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

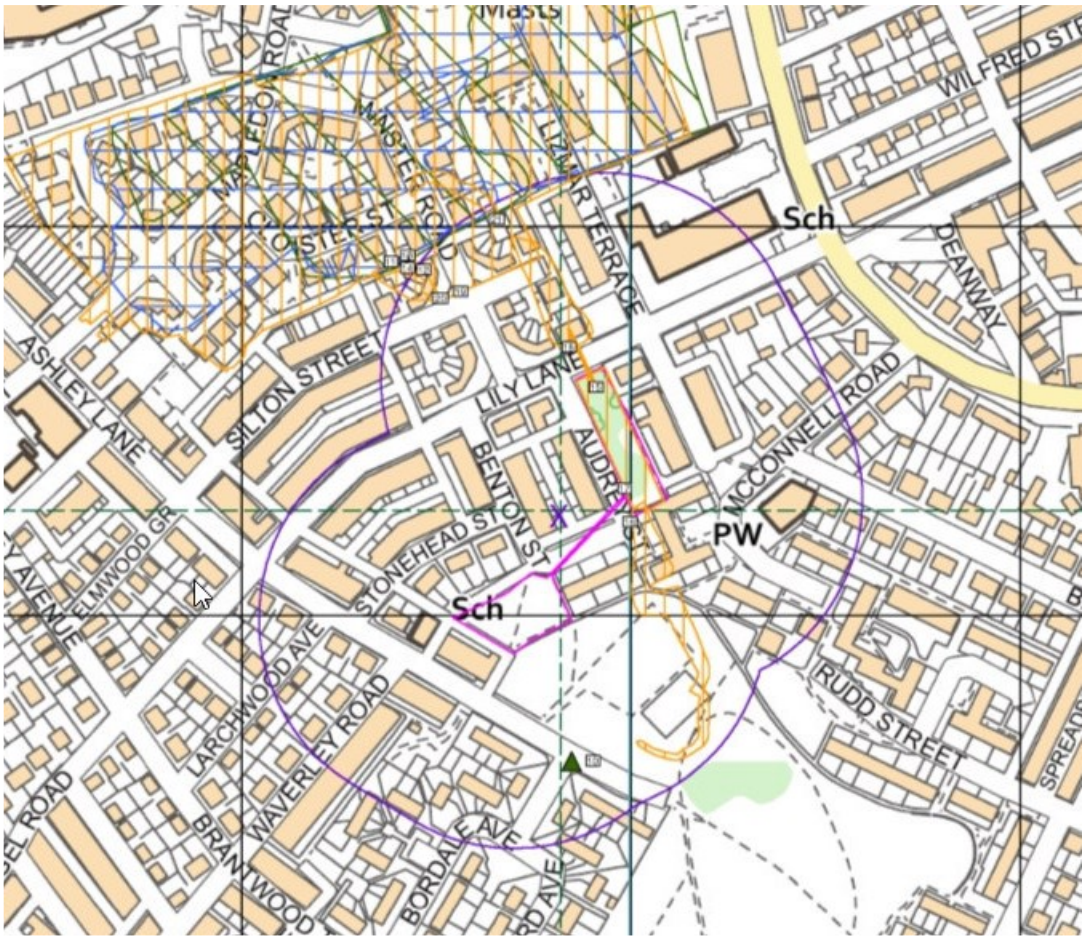
TERMS

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

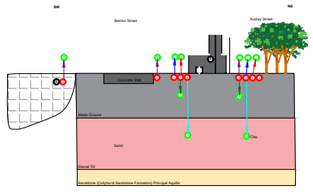
MIBK	Methyl isobutyl ketone	**WTE**	Water table elevation
m	Metres	**ppm**	Parts per million
km	Kilometres	**mg/m^3**	Milligram per metre cubed
% v/v	Percent volume in air	**m bgl bgl**	Metres below ground level
mb	Millibars (atmospheric pressure)	**m bcl**	Metre below cover level
l/hr	Litres per hour	**mAOD**	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	**kN/m^2**	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 16-219-001 – SITE LOCATION PLAN







N

Site Features

- Grass
- Old Cloth
- Rough Ground
- Track Marks
- Mature Trees
- Low Wooden Fence
- Gate Site Entrance
- Metal Fencing

Notes:

Client: AJP

Job No: 16-219

Date: 18.07.2023

Drawing No: 004

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked
P1	REVA	18.07.2023	EB	EC

Job Title: Audrey Street, Moston

Drawing Title: Site Features Plan

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Location Symbols

WS101(MW) Approximate Window Sample Probehole Location with Install

TP101 Approximate Trial Pit Location

Notes:

Client: AJP

Job No: 16-219

Date: 16-219

Drawing No: 005

Scale: NTS@ A3

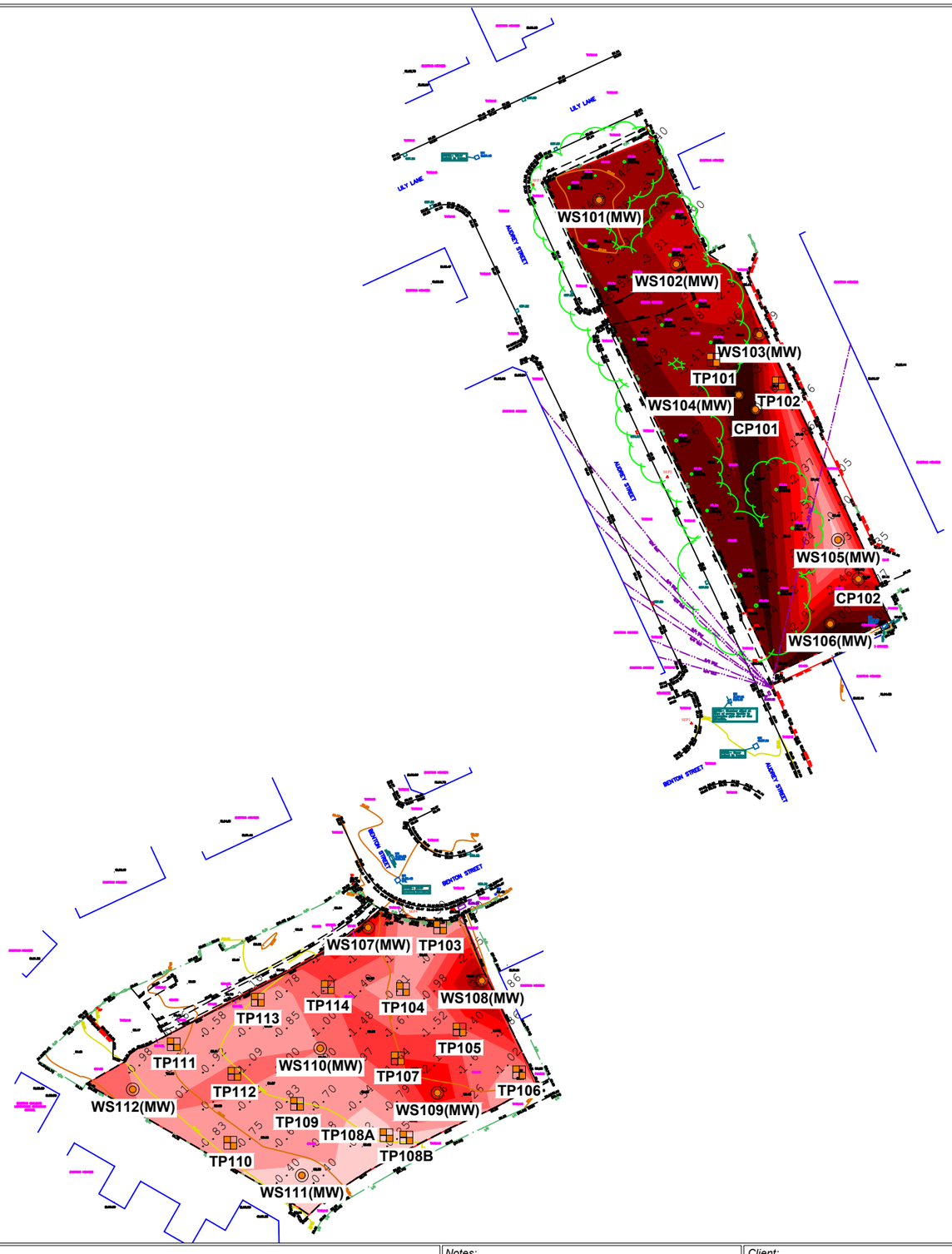
P1	REVA	03.07.2023	EB	JS
Phase	Issue	Date	Drawn	Checked

Job Title: Audrey Street, Moston

Drawing Title: Exploratory Hole Location Plan

e3p
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Location Symbols

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

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.49m
- Depth of Made Ground 0.50 - 0.99m
- Depth of Made Ground 1.00 - 1.49m
- Depth of Made Ground 1.50 - 1.99m
- Depth of Made Ground 2.00 - 2.49m
- Depth of Made Ground 2.50 - 2.99m
- Depth of Made Ground 3.00 - 3.49m
- Depth of Made Ground 3.50 - 3.99m
- Depth of Made Ground >4.00m

Notes:

Client: AJP

Job No: 16-219

Date: 16-219

Drawing No: 006

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked
P1	REVA	03.07.2023	EB	JS

Job Title: Audrey Street, Moston

Drawing Title: Depth of Made Ground Plan

e3p
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Location Symbols

- 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: AJP

Job No: 16-219

Date: 16-219

Drawing No: 008

Scale: NTS@ A3

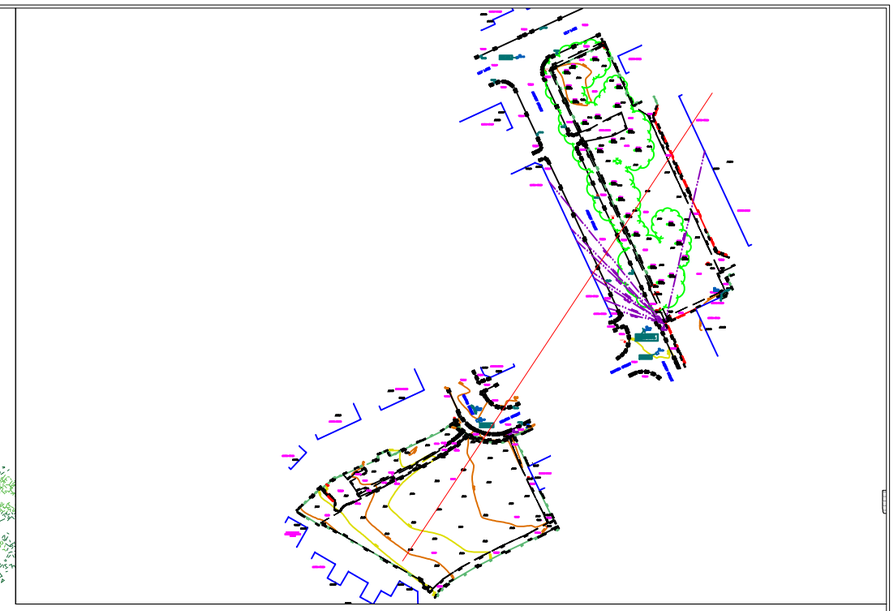
P1	REVA	03.07.2023	EB	JS
Phase	Issue	Date	Drawn	Checked

Job Title: Audrey Street, Moston

Drawing Title: Depth to Founding Strata Plan

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SW

NE

Benton Street

Audrey Street

Concrete Slab

A

B

Made Ground

Sand

Glacial Till

Clay

Sandstone (Collyhurst Sandstone Formation) Principal Aquifer

Geology Key

- Made Ground
- Glacial Till
- Sandstone

Sources

1. Heavy Metals, Non Volatile PAH's, Non Volatile TPH's (Made Ground)
2. Asbestos (Made Ground, Infilled Pond)
3. Volatile Contaminants (UST-TPH, VOC)
4. Ground Gases (Infilled Pond)
5. Mobile Contaminants (UST-TPH, VOC)
6. Sulphate (Made Ground)
7. Phytotoxic Contaminants (Made Ground)

Pathways

- Dermal Contact / Ingestion
- Vapour Inhalation
- Inhalation / Accumulation
- Tainting of Water Supplies
- Dust Inhalation
- Vertical / Lateral Migration
- Sulphate Attack on Concrete
- Plant Uptake

Receptors

1. Future End Users
2. Water Pipes
3. Groundwater (Secondary B Aquifer)
4. Surface Water Features
5. Off-site Receptors
6. Building Structure
7. Flora

Site Features

- A Historical Residential Building
- B Current Industrial Unit
- C Infilled Pond
- D Off-site Pond

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVA	18.07.2023	OW	NS

Client: AJP

Job No: 16-219

Date: 18.07.2023

Drawing No: 010

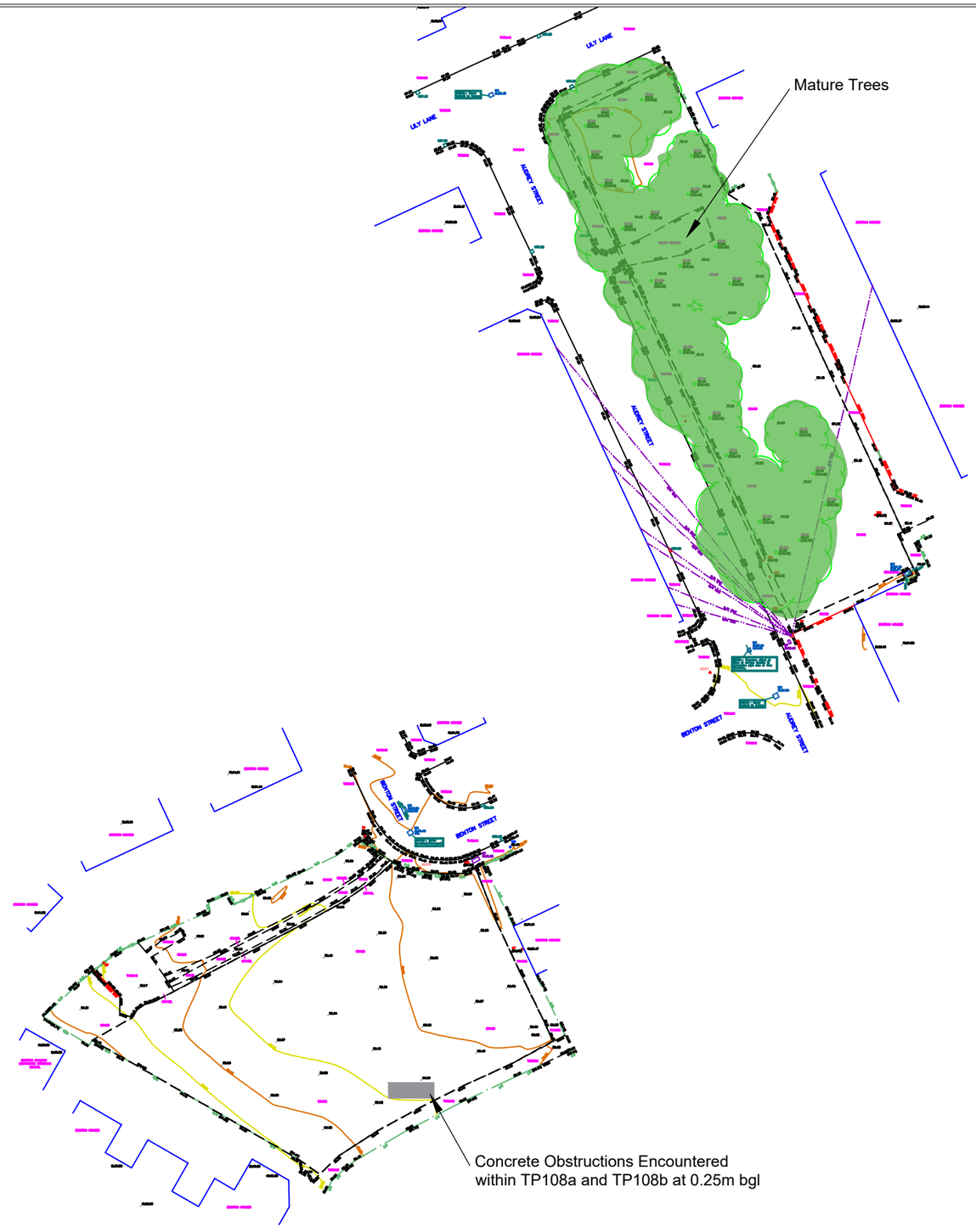
Scale: NTS

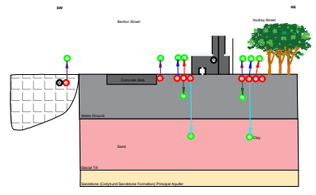
Job Title: Audrey Street, Moston

Drawing Title: Conceptual Site Model Plan

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Development Constraints

- Mature Trees
- Concrete

P1	REVA	18.07.2023	OW	NS
Phase	Issue	Date	Drawn	Checked

Notes:

Client: AJP

Job No: 16-219

Date: 18.07.2023

Drawing No: 015

Scale: NTS@ A3

Job Title: Audrey Street, Moston

Drawing Title: Development Constraints Plan

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Location Symbols

- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location

Contamination issues

- Lead
- Arsenic
- Napthalene
- Non-volatile PAH
- TPH C10-C12
- TPH C12-C16 TPHC16-C21

Notes:

Client: AJP

Job No: 16-219

Date: 16-219

Drawing No: 018

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked
P1	REVA	03.07.2023	EB	JS

Job Title: Audrey Street, Moston

Drawing Title: Contamination Issues Plan

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APPENDIX IV
PHOTOGRAPHS

PLATE 1 AUDREY STREET PARCEL FACING NORTH



PLATE 2 VIEW OF BENTON STREET PARCEL FACING SOUTH EAST



PLATE 3 TP101 EXCAVATION AND ARISINGS





PLATE 4 TP101 BACKILLED AREA



PLATE 5 TP108A EXCAVATION AND ARISINGS



PLATE 6 BACKFILLED TRIAL PITS - BENTON STREET PARCEL



PLATE 7 WS102 ARISINGS



PLATE 8 WS105 ARISINGS



PLATE 9 WS107 ARISINGS



PLATE 10 WS102 MONITORING WELL



APPENDIX V
E3P EXPLORATORY HOLE LOGS

Borehole Log

Borehole No. **CP101**

Sheet 1 of 2

Project Name: Audrey Street	Project No. 16219	Co-ords: 387000.00 - 401490.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 15/05/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent roots. Gravel is fine to medium subangular to subrounded of plastic, brick, fabric, and metal. (Reworked topsoil)
		1.00 1.00 1.00	B D	N=8 (1,2/2,1,2,3)				MADE GROUND: Stiff medium strength dark grey slightly clayey sandy gravelly clay with occasional roots. Gravel is fine to coarse angular to subrounded of brick, metal, plastic, ceramic, slate, fabric, glass, and sandstone.
		2.00 2.00	D	N=9 (1,2/2,2,2,3)				
		3.00 3.00	D	N=10 (2,2/3,2,2,3)				
		4.00 4.00 4.00	B D	N=16 (2,2/3,4,4,5)	4.00			Stiff medium strength becoming very stiff high strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.
		5.00 5.00	D	N=18 (2,2/3,4,5,6)				
		5.50	U					
		6.50 6.50	D	N=19 (2,3/4,5,5,5)				
					6.90			Brown silty slightly gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded.
		8.00 8.00	D	50 (25 for 95mm/50 for 105mm)	7.90			Dense orangish brown slightly gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
		9.50 9.50	D	50 (25 for 85mm/50 for 95mm)				
								Continued on next sheet

Remarks

1. Two refusals on dense sandsa at 11.00 m bgl.

Borehole Log

Borehole No. **CP101**
Sheet 2 of 2

Project Name: Audrey Street	Project No. 16219	Co-ords: 387000.00 - 401490.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 15/05/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		11.00 11.00	B	50 (25 for 80mm/50 for 110mm)	11.19			End of borehole at 11.19 m

Remarks
1. Two refusals on dense sandsa at 11.00 m bgl.

Borehole Log

Borehole No. **CP102**

Sheet 1 of 2

Project Name: Audrey Street	Project No. 16219	Co-ords: 387014.00 - 401467.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 16/05/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Dark brown to black sandy gravelly clay. Gravel is fine to medium angular to subrounded of sandstone, clinker, and brick. (Reworked Topsoil)
		1.00 1.00 1.00	B D	N=8 (2,2/1,2,2,3)				MADE GROUND: Stiff medium strength black sandy gravelly clay. Gravel is fine to medium angular to subrounded of sandstone, brick, and clinker
		2.00 2.00	D	N=9 (2,2/3,2,2,2)				
					2.50			Stiff medium strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.
		3.00 3.00	D	N=10 (1,2/2,2,3,3)				
		4.00 4.00	D	N=16 (2,2/3,4,4,5)				
		5.00 5.00 5.00	B D	N=16 (2,3/4,4,4,4)				
		6.50	U					
					7.50			Dense orangish brown slightly gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
		8.00 8.00	D	50 (8,12/50 for 115mm)				
		9.50 9.50 9.50	B D	50 (25 for 105mm/50 for 105mm)				

Continued on next sheet

Remarks

1. Two refusals on dense sandsa at 11.00 m bgl.

Borehole Log

Borehole No. **CP102**
Sheet 2 of 2

Project Name: Audrey Street	Project No. 16219	Co-ords: 387014.00 - 401467.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 16/05/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		11.00 11.00	D	50 (25 for 85mm/50 for 100mm)	11.18			End of borehole at 11.18 m

Remarks
1. Two refusals on dense sandsa at 11.00 m bgl.

Trial Pit Log

TrialPit No: TP101
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386998.00 - 401493.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 3.40	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent roots. Gravel is fine to medium subangular to subrounded of plastic, brick, fabric, and metal. (Reworked topsoil)
	1.40	L					MADE GROUND: Dark grey slightly clayey very gravelly fine to coarse sand with occasional roots and occasional cobbles. Gravel is fine to coarse angular to subrounded of brick, metal, plastic, ceramic, slate, fabric, glass, and sandstone. Cobbles are angular to subrounded of brick and sandstone.
	1.70	B					
	3.30 3.30	ES HVP	106	3.20 3.40			Stiff high strength greyish brown slightly gravelly CLAY. Gravel is fine subangular to subrounded of sandstone. End of Pit at 3.40m

1
2
3
4

Trial Pit Photographs



Trial Pit 101



Trial Pit 101 Spoil

Remarks: 1.Complete.

Stability: Stable

Trial Pit Log

			TrialPit No TP102 Sheet 1 of 1
Project Name: Audrey Street	Project No. 16219	Co-ords: 387004.00 - 401490.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.40	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent roots. Gravel is fine to coarse angular to subrounded of plastic, brick, ceramic, and metal. (Reworked topsoil)
				0.30			MADE GROUND: Dark brown slightly clayey very gravelly fine to coarse sand with occasional roots. Gravel is fine to coarse angular to subrounded of metal, brick, ceramic, slate, plastic, and sandstone.
	1.00	L					
	1.10	ES					
				1.60			
	1.70	B					Stiff high strength becoming very stiff very high strength greyish brown slightly sandy CLAY.
	1.70	HVP	134				
	2.10	HVP	112				
	2.40	HVP	172	2.40			End of Pit at 2.40m

1 2 3 4

Trial Pit Photographs



Trial Pit 102



Trial Pit 102 Spoil

Remarks: 1.Complete 2. metal obstruction at 1.20 m bgl.

Stability: Stable

Trial Pit Log

			TrialPit No TP103 Sheet 1 of 1
Project Name: Audrey Street	Project No. 16219	Co-ords: 386957.00 - 401420.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.20	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, ceramic, and sandstone. (Reworked topsoil)
				0.50			Reddish brown gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
	1.00 1.00	B ES					
	2.10	HVP	97	2.00 2.20			Stiff high strength greyish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium of sandstone.
							End of Pit at 2.20m

1
2
3
4

Trial Pit Photographs



Trial Pit 103



Trial Pit 103 Spoil

Remarks: 1.Terminated at 2.20 m bgl due to collapsing sands from 0.70 m bgl

Stability: Collapsing sides at 0.70 m bgl.

Trial Pit Log

TrialPit No: TP104
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386952.00 - 401411.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.40	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.50			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, and sandstone. (Reworked topsoil)
	0.75	ES		0.60			MADE GROUND: Black sandy angular to subangular GRAVEL of coal.
							Reddish brown gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
	2.30 2.37	ES HVP	59	2.35 2.40			Firm medium strength greyish brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium of sandstone.
							End of Pit at 2.40m

1
2
3
4

Trial Pit Photographs



Trial Pit 104



Trial Pit 104 Spoil

Remarks: 1.Terminated at 2.40 m bgl due to collapsing sands from 0.70 m bgl

Stability: Collapsing sides at 0.70 m bgl.

Trial Pit Log

TrialPit No TP105 Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386959.00 - 401406.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.40	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.20	ES L		0.40			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, and sandstone. (Reworked topsoil)
	0.80	B		1.00			MADE GROUND: Dark reddish brown slightly sandy very gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded of brick, metal, plastic, coal, and sandstone.
				1.40			MADE GROUND: Orangish brown fine to medium sand (Fill - surrounding a drain pipe).
	2.20	ES		2.40			Reddish brown gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
							End of Pit at 2.40m

1 2 3 4

Trial Pit Photographs



Trial Pit 105



Trial Pit 105 Spoil

Remarks: 1.Terminated at 2.40 m bgl due to collapsing sands from 1.50 m bgl. 2. No cohesive material for HSV

Stability: Collapsing sides at 1.50 m bgl.

Trial Pit Log

TrialPit No: TP106
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386966.00 - 401402.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 2.80	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, glass, and sandstone. (Reworked topsoil)
	0.50	ES		0.80			MADE GROUND: Grey to black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of sandstone, brick, metal, plastic, clinker, coal, and glass.
				0.90			MADE GROUND: Grey to black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of sandstone, brick, metal, plastic, clinker, coal, and glass.
				0.90			MADE GROUND: Reddish brown gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of brick, sandstone, and coal.
	1.20	ES		1.00			MADE GROUND: Black sandy angular to subangular GRAVEL of coal.
							Dark greyish brown very gravelly fine to medium SAND. Gravel is fine to coarse angular to subrounded of brick, sandstone, and coal.
				2.80			End of Pit at 2.80m

1
2
3
4

Trial Pit Photographs



Trial Pit 106



Trial Pit 106 Spoil

Remarks: 1.Terminated at 2.80 m bgl due to unidentidfied obstruction. 2. No cohesive material for HSV

Stability: Stable

Trial Pit Log

			TrialPit No TP107 Sheet 1 of 1
Project Name: Audrey Street	Project No. 16219	Co-ords: 386951.00 - 401402.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): Depth 2.00 — 2.00 × 0.60	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, glass, and sandstone. (Reworked topsoil)
				0.50			MADE GROUND: Blackish brown slightly clayey very gravelly fine to coarse sand with occasional cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, asphalt, metal, fabric, and sandstone. Cobbles are angular to subrounded of brick, asphalt, concrete, and sandstone.
	1.00	ES					
				2.00			End of Pit at 2.00m

1 2 3 4

Trial Pit Photographs



Trial Pit 107



Trial Pit 107 Spoil

Remarks: 1.Terminated at 2.00 m bgl due to unidentidfied obstruction. 2. No cohesive material for HSV

Stability: Stable

Trial Pit Log

TrialPit No: TP108a
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386948.00 - 401393.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): Depth 0.25 — 2.00 × 0.60	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20 0.25			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, glass, and sandstone. (Reworked topsoil) MADE GROUND: Concrete End of Pit at 0.25m

1
2
3
4

Trial Pit Photographs



Trial Pit 108



Trial Pit 108 Spoil

Remarks: 1.Terminated at 0.25 m bgl due to concrete obstruction. 2. No cohesive material for HSV

Stability: Stable

Trial Pit Log

TrialPit No: TP108b
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386947.00 - 401394.00 Level:	Date 24/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 0.25	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20 0.25			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, metal, ceramic, glass, and sandstone. (Reworked topsoil) MADE GROUND: Concrete End of Pit at 0.25m

Remarks: 1.Terminated at 0.25 m bgl due to concrete obstruction. 2. No cohesive material for HSV

Stability: Stable

Trial Pit Log

TrialPit No: TP109
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386938.00 - 401397.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 2.60	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10 0.10	ES L		0.25			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of plastic, brick, and sandstone. (Reworked topsoil)
				0.80			MADE GROUND: Firm dark brown gravelly slightly sandy clay with occasional cobbles. Gravel is fine to coarse subangular to subrounded of brick, concrete, and sandstone. Cobbles are subangular to subrounded of brick, concrete, and sandstone.
	1.20	ES					Reddish brown gravelly fine to coarse SAND with frequent cobbles and rare coal bands at 1.00 m bgl. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
	2.10	B					
				2.60			End of Pit at 2.60m

1
2
3
4

Trial Pit Photographs



Trial Pit 109



Trial Pit 109 Spoil

Remarks: 1.Terminated at 2.60 m bgl due to collapsing sands from 1.60 m bgl

Stability: Collapsing sides at 1.60 m bgl.

Trial Pit Log

TrialPit No: TP110
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386930.00 - 401393.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): Depth 2.00 — 0.60 × 2.00	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.35			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of brick and sandstone. (Reworked topsoil)
				0.60			MADE GROUND: Greyish brown slightly clayey gravelly fine to medium sand. Gravel is fine to coarse angular to subrounded of brick, concrete, metal, ceramic, timber, plastic, coal, and sandstone.
	0.75	ES		0.80			MADE GROUND: Reddish brown gravelly fine to medium sand. Gravel is fine to coarse angular to subrounded of brick, timber, coal, and sandstone.
	1.50	ES					Reddish brown very gravelly fine to medium SAND with rare coal bands at 1.00 m bgl. Gravel is fine to coarse subangular to rounded of sandstone.
				2.00			End of Pit at 2.00m

1
2
3
4

Trial Pit Photographs



Trial Pit 110



Trial Pit 110 Spoil

Remarks: 1.Terminated at 2.00 m bgl due to collapsing sands from 0.60 m bgl

Stability: Collapsing sides at 0.60 m bgl.

Trial Pit Log

TrialPit No: TP111
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386923.00 - 401405.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): Depth 1.90, 2.00 × 0.60	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.50			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to medium angular to subrounded of plastic, brick, glass, ceramic, and sandstone. (Reworked topsoil)
	0.80	B					Reddish brown very gravelly fine to medium SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
	1.80	ES		1.90			End of Pit at 1.90m

1
2
3
4

Trial Pit Photographs



Trial Pit 111



Trial Pit 111 Spoil

Remarks: 1.Terminated at 1.90 m bgl due to collapsing sands from 0.50 m bgl

Stability: Collapsing sides at 0.50 m bgl.

Trial Pit Log

TrialPit No: TP112
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386931.00 - 401401.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 2.00	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of plastic, brick, glass, ceramic, coal, and sandstone. (Reworked topsoil)
	0.80	ES		1.10			MADE GROUND: Dark reddish brown slightly clayey gravelly fine to medium sand with occasional cobbles. Gravel is fine to coarse angular to rounded of brick, plastic, ceramic, coal, and sandstone. Cobbles are angular to rounded of sandstone and brick.
				2.00			Reddish brown very gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to coarse subangular to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
							End of Pit at 2.00m

1 2 3 4

Trial Pit Photographs



Trial Pit 112



Trial Pit 112 Spoil

Remarks: 1.Terminated at 2.00 m bgl due to collapsing sands from 0.60 m bgl

Stability: Collapsing sides at 0.50 m bgl.

Trial Pit Log

TrialPit No: TP113
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386934.00 - 401410.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.00	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.25			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to medium angular to subrounded of plastic, brick, glass, metal, and sandstone. (Reworked topsoil)
				0.55			MADE GROUND: Greyish brown slightly clayey very gravelly fine to medium sand with occasional cobbles. Gravel is fine to coarse angular to rounded of brick, concrete, metal, plastic, coal, and sandstone. Cobbles are angular to rounded of sandstone and brick.
	0.75 0.75	ES L					Reddish brown very gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to coarse subrounded to rounded of sandstone and quartz. Cobbles are subrounded to rounded of sandstone.
	2.00 2.00	B ES		2.00			End of Pit at 2.00m

1
2
3
4

Trial Pit Photographs



Trial Pit 113



Trial Pit 113 Spoil

Remarks: 1.Terminated at 2.00 m bgl due to collapsing sands from 0.50 m bgl

Stability: Collapsing sides at 0.60 m bgl.

Trial Pit Log

TrialPit No TP114
Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386943.00 - 401412.00 Level:	Date 25/04/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 1.45	Scale 1:30
Client: R P Tyson Construction Ltd			Logged M.Dimes

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to medium angular to subrounded of plastic, brick, metal, and sandstone. (Reworked topsoil)
	0.70 0.80	ES L		0.75			MADE GROUND: Dark greyish brown very clayey gravelly fine to coarse sand with occasional cobbles. Gravel is fine to coarse angular to subrounded of brick, concrete, metal, plastic, ceramic, and sandstone. Cobbles are angular to subrounded of brick, metal, and sandstone.
	1.00	B		1.45			MADE GROUND: Dark brown very sandy slightly clayey gravel with frequent cobbles and boulders. Gravel is fine to coarse angular to subrounded of brick, concrete, metal, plastic, electrical cable, coal, and sandstone. Cobbles are angular to subrounded of brick, concrete, metal, and sandstone.
							End of Pit at 1.45m

1
2
3
4

Trial Pit Photographs



Trial Pit 114



Trial Pit 114 Spoil

Remarks: 1.Terminated at 1.45 m bgl due to collapsing sands from 0.30 m bgl. 2. Concrete obstructions at 1.20 m bgl.

Stability: Collapsing sides at 0.30 m bgl.

Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386982.00 - 401518.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.30			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of brick, glass, ceramic, sandstone, and plastic. (Reworked Topsoil)
		1.00	D		0.40			MADE GROUND: Black GRAVEL of coal.
		1.00		N=8 (1,2/2,2,2,2)	1.00			MADE GROUND: Black mottled grey slightly sandy clay. Gravel is fine to coarse angular to subrounded of brick, coal, concrete, ceramic, and metal.
		1.20	ES		1.50			MADE GROUND: Stiff medium strength dark brown gravelly clay. Gravel is fine to coarse angular to subrounded of brick, sandstone, coal, concrete, and limestone.
		2.00	D					MADE GROUND: Medium dense becoming dense black mottled orange slightly clayey very sandy gravel. Gravel is fine to coarse angular to subrounded of brick, concrete, and coal.
		2.00		N=11 (2,2/2,2,3,4)				
		3.00	D					
		3.00		50 (3,5/50 for 270mm)	3.42			End of borehole at 3.42 m

Remarks

1.Terminated on cobbles of brick at 3.42 m bgl.

Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386990.00 - 401510.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			MADE GROUND: Black mottled orange slightly sandy very gravelly clay. Gravel is fine to coarse angular to subrounded of brick, concrete, and sandstone.
					0.25			
					0.40			MADE GROUND: Reddish dark brown gravel. Gravel is fine to coarse angular to subrounded of brick, concrete, and sandstone.
		0.80	ES					
		1.00		N=6 (3,2/2,2,1,1)				MADE GROUND: Black mottled orange slightly sandy very gravelly clay. Gravel is fine to coarse angular to subrounded of brick, concrete, and sandstone.
					1.25			
		1.60	ES		1.55			MADE GROUND: Loose white gravel. Gravel is fine to coarse angular to subrounded of limestone, concrete, and brick.
					1.65			
		2.00		N=9 (1,2/2,2,2,3)				MADE GROUND: Black mottled orange slightly sandy very gravelly clay. Gravel is fine to coarse angular to subrounded of brick, concrete, and sandstone.
					2.40			
					2.70			MADE GROUND: Brown sawdust.
					2.75			MADE GROUND: Loose grey very sandy gravel. Gravel is fine to coarse angular to subrounded of brick, concrete, limestone, coal, and clinker.
		3.00	D					
		3.00		N=13 (3,2/3,3,3,4)				MADE GROUND: Brown slightly gravelly clay. Gravel is fine to coarse angular to subrounded of brick, sandstone, and clinker.
		3.50	U					
		4.00	D					MADE GROUND: Black sandy angular to subangular GRAVEL of coal.
		4.00		N=16 (4,4/4,4,4,4)				Stiff medium strength becoming very stiff very high strength brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone.
		5.00	D					
		5.00		N=24 (4,4/5,6,6,7)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 387001.00 - 401497.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.05 0.20 0.25			MADE GROUND: Dark brown sandy slightly gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of sandstone, brick, and plastic. (Reworked Topsoil)
		1.00	D					MADE GROUND: Grey mottled orange sandy gravel. Gravel is fine to coarse angular to subrounded of brick, concrete, and glass.
		1.00	ES					MADE GROUND: Brown gravelly clay. Gravel is fine to coarse angular to subrounded of brick and concrete.
		1.00		N=12 (3,3/3,3,3,3)				
		1.50	U					Stiff medium strength becoming very stiff very high strength reddish brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.
		2.00	D					
		2.00		N=16 (3,4/4,4,4,4)				
		3.00	D					
		3.00		N=15 (2,3/3,4,4,4)				
		4.00	D					
		4.00		N=18 (3,4/4,4,5,5)				
		4.50		50 (9,11/50 for 275mm)				
		5.00	D		4.92			End of borehole at 4.92 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386999.00 - 401485.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Dark brown very gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of sandstone, mudstone, brick , and clinker. (Reworked Topsoil)
		1.00 1.00	D	N=8 (3,2/2,2,2,2)	0.90			MADE GROUND: Black sandy gravel. Gravel is fine to coarse angular to subrounded of slag, clinker, brick, and sandstone.
		1.20	ES		1.20			MADE GROUND: Loose orange gravel. Gravel is fine to coarse angular to subrounded of brick.
		2.00 2.00	D	N=8 (2,2/2,2,2,2)				MADE GROUND: Loose light grey mottled brown slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of brick, concrete, clinker, sandstone, and limestone.
		3.00 3.00	D	N=9 (2,2/2,2,2,3)	3.00			MADE GROUND: Loose becoming dense black slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of brick, clinker, sandstone, and limestone.
		4.00 4.00	D	N=8 (1,1/2,2,2,2)				
		5.00		N=9 (1,2/2,2,2,3)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete. 2. No recovering between 1.20-2.00 m bgl.

Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 387013.00 - 401471.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.10 0.20			MADE GROUND: Dark brown to black sandy gravelly clay. Gravel is fine to medium angular to subrounded of sandstone, clinker, and brick. (Reworked Topsoil)
		1.00 1.00	D	N=12 (3,3/3,3,3,3)				MADE GROUND: Black sandy gravel. Gravel is fine to medium angular to subrounded of sandstone, brick, and clinker Stiff medium strength becoming very stiff high strength reddish brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.
		2.00 2.00 2.00	D ES	N=19 (3,3/4,5,5,5)				
		3.00 3.00	D	N=14 (3,3/3,3,4,4)	3.00			Stiff medium strength becoming very stiff very high strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.
		4.00 4.00	D	N=17 (3,3/4,4,4,5)				
		5.00 5.00	D	N=20 (4,4/4,6,5,5)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS106**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 387013.00 - 401463.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 24/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Dark brown gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick. (Reworked Topsoil)
		0.80	ES					MADE GROUND: Stiff medium strength dark brown gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone, brick, coal, concrete, and clinker
		1.00	D					
		1.00		N=8 (1,2/2,2,2,2)	1.20			
		2.00		N=13 (1,2/2,4,4,3)				MADE GROUND: Medium dense becoming loose greyish brown mottled black slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, brick, and clinker.
		3.00	D					
		3.00		N=10 (2,2/2,3,2,3)				
					3.80			
		4.00	D		4.00			MADE GROUND: Dark brown gravelly clay. Gravel is fine to coarse angular to subrounded of brick, sandstone, clinker.
		4.00		N=14 (2,3/3,4,4,3)				Stiff medium strength becoming very stiff very high strength reddish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone and mudstone.
		4.80	ES					
		5.00	D					
		5.00		N=14 (2,3/3,3,4,4)				
					5.45			End of borehole at 5.45 m

Remarks

1.Complete. 2. No recovering between 3.00-3.80 m bgl.

Borehole Log

Borehole No. **WS107**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386947.00 - 401419.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.25			MADE GROUND: Dark brown slightly sandy slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick and sandstone. (Reworked Topsoil)
					0.60			MADE GROUND: Greyish brown gravelly fine to medium sand. Gravel is fine to coarse angular to rounded of sandstone, quartz, and brick.
		1.00		N=8 (2,2/2,2,2,2)				MADE GROUND: Loose orangish brown slightly clayey very gravelly fine to medium sand. Gravel is fine to coarse angular to subrounded of sandstone and brick.
		2.00		N=8 (2,2/2,2,2,2)	2.10			
					2.30			MADE GROUND: Reddish brown sandy gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone and brick.
		3.00		N=10 (2,2/2,3,2,3)				Loose becoming dense orangish brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
		3.50	ES					
		4.00	D					
		4.00		N=11 (2,2/3,3,2,3)				
		5.00	D					
		5.00		N=9 (3,3/2,2,2,3)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS108**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386961.00 - 401412.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.25			MADE GROUND: Black very sandy gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of brick and sandstone. (Reworked Topsoil)
					0.40			
					0.55			MADE GROUND: Dark brown very gravelly fine to medium sand. Gravel is fine to coarse angular to subrounded of clinker and sandstone.
					0.65			
		0.90	ES					
		1.00		N=7 (1,1/2,2,2,1)				MADE GROUND: Orangish brown slightly clayey very gravelly fine to medium sand. Gravel is fine to coarse angular to subrounded of sandstone, brick, and limestone.
					1.60			MADE GROUND: Dark brown mottled grey gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone and brick.
		2.00		N=8 (2,2/2,2,2,2)				MADE GROUND: Loose dark grey mottled brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, brick, slag, clinker, and fabric.
					2.80			MADE GROUND: Loose dark grey mottled brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, brick, slag, clinker, and limestone.
		3.00	D					
		3.00		N=8 (2,2/2,2,2,2)				MADE GROUND: Firm low strength orangish brown mottled grey very sandy gravelly clay. Gravel is fine to coarse angular to subrounded of sandstone, brick, and coal.
					3.45			
					3.60			MADE GROUND: Dark grey mottled brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, brick, slag, and clinker.
		4.00		N=11 (2,2/2,3,3,3)				Loose becoming dense orangish brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
		4.90	ES					
		5.00	D					
		5.00		N=11 (2,3/3,2,3,3)				
					5.45			End of borehole at 5.45 m

Remarks

1.Complete. 2. No recovering between 1.45-1.60 m bgl.

Borehole Log

Borehole No. **WS109**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386956.00 - 401398.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.15			MADE GROUND: Black clayey gravelly fine to medium sand with frequent rootlets. Gravel is fine to medium angular to subrounded of sandstone and brick. (Reworked Topsoil)
		1.00	D		0.25			MADE GROUND: Dark brown slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded of brick and clinker.
		1.00		N=8 (1,2/2,2,2,2)				MADE GROUND: Loose grey mottled brown slightly clayey sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone, brick, clinker, wood, and limestone.
		2.00		N=10 (2,2/2,3,3,2)				
		2.30	ES					
					2.50			Loose becoming dense orangish brown gravelly fine to coarse SAND. Gravel is fine to coarse subangular to subrounded of sandstone.
		3.00		N=7 (1,1/2,2,2,1)				
		4.00	D					
		4.00		N=9 (1,2/2,2,2,3)				
		5.00	D					
		5.00		N=10 (3,2/2,2,3,3)				
					5.45			End of borehole at 5.45 m

Remarks

1.Complete. 2. No recovering between 1.45-1.80 m bgl.

Borehole Log

Borehole No. **WS110**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386942.00 - 401404.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND: Dark brown gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of brick and sandstone. (Reworked Topsoil)
		0.80	ES					
		1.00	D		1.00			MADE GROUND: Black gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of sandstone, clinker, and brick.
		1.00		N=9 (1,2/2,2,2,3)	1.20			MADE GROUND: Loose orangish brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to rounded of sandstone.
					1.30			MADE GROUND: Black GRAVEL of coal.
		1.80	ES					Loose becoming dense orangish brown gravelly fine to medium SAND. Gravel is fine to coarse subangular to rounded of sandstone.
		2.00	D					
		2.00		N=9 (2,2/2,2,2,3)				
		3.00	D					
		3.00		N=8 (1,2/2,2,2,2)				
		4.00		N=9 (2,2/2,2,2,3)				
		5.00		N=10 (2,2/2,2,3,3)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS111**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386938.00 - 401389.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15			MADE GROUND: Dark brown sandy gravelly clay with frequent rootlets. Gravel is fine to medium subangular to subrounded of brick and sandstone. (Reworked Topsoil)
					0.40			MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone and brick.
		1.00 1.00	D	N=7 (1,2/2,2,2,1)				MADE GROUND: Loose reddish brown gravelly fine to coarse SAND. Gravel is fine coarse subangular to subrounded of sandstone.
		1.20	ES		1.50			MADE GROUND: Black GRAVEL of coal.
					1.55			Loose reddish brown gravelly fine to coarse SAND. Gravel is fine coarse subangular to subrounded of sandstone.
		2.00 2.00	D	N=8 (2,2/2,2,2,2)				
					2.75			Stiff medium strength becoming very stiff very high strength reddish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone.
		2.90 3.00	ES	N=14 (2,3/3,3,4,4)				
		3.50	U					
		4.00 4.00	D	N=15 (2,3/3,4,4,4)				
		5.00 5.00	D	N=18 (3,4/4,4,5,5)				
					5.45			End of borehole at 5.45 m

Remarks
1.Complete.

Borehole Log

Borehole No. **WS112**

Sheet 1 of 1

Project Name: Audrey Street	Project No. 16219	Co-ords: 386918.00 - 401400.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: R P Tyson Construction Ltd		Dates: 25/04/2023 -	Logged By M.Dimes

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.20			MADE GROUND: Black sandy gravelly clay with frequent rootlets. Gravel is fine to coarse angular to subrounded of sandstone, clinker, and brick. (Reworked Topsoil)
		1.00		N=6 (2,2/2,2,1,1)	1.00			MADE GROUND: Black slightly clayey very gravelly fine to coarse sand. Gravel is fine to coarse angular to subrounded of sandstone, slag, clinker, and brick.
		1.30	ES					Loose becoming medium dense orangish brown gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded of sandstone.
		2.00 2.00	D	N=9 (1,2/2,2,3,2)				
		3.00 3.00	D	N=9 (2,3/3,2,2,2)				
		4.00		N=12 (2,3/3,3,3,3)				
		5.00 5.00	D	N=13 (2,3/3,3,3,4)	5.00			Very stiff very high strength reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone.
					5.45			End of borehole at 5.45 m

Remarks
1.Complete. 2. No recovering between 3.00-4.00 m bgl.

APPENDIX VI
CHEMICAL TESTING RESULTS

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Analytical Report Number : 23-30951

Project / Site name:	Audrey Street	**Samples received on:**	26/04/2023
Your job number:	16 219	**Samples instructed on/ Analysis started on:**	26/04/2023
Your order number:	004682	**Analysis completed by:**	09/05/2023
Report Issue Number:	1	**Report issued on:**	09/05/2023
Samples Analysed:	3 leachate samples - 20 soil samples		

Signed:

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

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

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

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

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

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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.

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662522	2662523	2662524	2662525	2662526
Sample Reference				WS101	WS101	WS104	WS105	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.20	0.10	2.00
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	14	13	14	15	11
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	SCA	SCA	N/A	SCA	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	5.4	8	8	7.1	-
Total Cyanide	mg/kg	1	MCERTS	5.8	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	390	420	1200	900	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0035	0.024	0.37	0.027	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	7	47	750	53	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	3.5	23.6	373	26.7	-
Sulphide	mg/kg	1	MCERTS	1.6	2.4	1.3	2.4	-
Total Sulphur	mg/kg	50	MCERTS	240	260	940	820	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.5	1.1	1.7	4.7	-

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.09	0.24	0.47	0.56	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.08	0.34	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.18	1.2	1.8	3.1	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.14	0.92	1.7	2.1	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.7	8.7	14	21	0.2
Anthracene	mg/kg	0.05	MCERTS	0.37	2.2	2.7	5.1	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	3.4	12	15	30	0.11
Pyrene	mg/kg	0.05	MCERTS	3.3	12	16	27	0.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.9	5.7	7.4	13	< 0.05
Chrysene	mg/kg	0.05	MCERTS	1.9	5.4	7	13	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	2.1	5.1	7.3	16	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.82	2.4	2.7	4.9	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	4.9	6.1	12	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1	2.4	2.7	7.3	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.23	0.62	0.83	1.7	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.99	2.6	3.1	8.2	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	19.9	66.2	88.8	166	< 0.80

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662522	2662523	2662524	2662525	2662526
Sample Reference				WS101	WS101	WS104	WS105	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.20	0.10	2.00
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	45	14	19	49	6.8
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	110
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	2.5	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	2.4	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	76	31	19	25	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	76	120	63	180	22
Lead (aqua regia extractable)	mg/kg	1	MCERTS	160	140	310	460	13
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.1	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	16	35	24	41	31
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	29
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	150	300	300	61
Petroleum Hydrocarbons								
TPH (C5 - C6) $_{HS_1D_TOTAL}$	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) $_{EH_CU_1D_TOTAL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) $_{EH_CU_1D_TOTAL}$	mg/kg	4	MCERTS	< 4.0	5	13	6.1	< 4.0
TPH (C16 - C21) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	16	26	65	44	< 1.0
TPH (C21 - C35) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	39	30	95	110	< 1.0
TPH (C35 - C40) $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	< 10	< 10	20	17	< 10
TPH Total C5 - C40 $_{EH_CU+HS_1D_TOTAL}$	mg/kg	10	NONE	65	62	190	170	< 10

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

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662527	2662528	2662529	2662530	2662531
Sample Reference				WS106	WS108	WS110	WS111	WS112
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.90	1.80	1.30	1.20
Date Sampled				24/04/2023	25/04/2023	25/04/2023	25/04/2023	25/04/2023
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	50	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	12	4	7	5.9
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.2	8.7	-	8	-
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	350	760	-	56	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.019	0.03	-	0.0077	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	38	59	-	15	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	19.2	29.7	-	7.7	-
Sulphide	mg/kg	1	MCERTS	1.1	12	-	< 1.0	-
Total Sulphur	mg/kg	50	MCERTS	370	600	-	< 50	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.1	2.5	-	0.5	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.15	4.6	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.39	11	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.3	7.9	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	3.6	53	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.8	12	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	8	53	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	7.4	48	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.8	23	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.6	21	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	5.2	27	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.6	8.7	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8	19	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.1	10	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	2.8	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.1	12	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	42.7	314	< 0.80	< 0.80	< 0.80

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662527	2662528	2662529	2662530	2662531
Sample Reference				WS106	WS108	WS110	WS111	WS112
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.90	1.80	1.30	1.20
Date Sampled				24/04/2023	25/04/2023	25/04/2023	25/04/2023	25/04/2023
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	17	25	6.8	5.9	6.2
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	62	-	45
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	0.61	-	0.41
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	0.2	-	0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.8	2	< 0.2	< 0.2	< 0.2
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	20	27	-	15	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	250	120	12	14	10
Lead (aqua regia extractable)	mg/kg	1	MCERTS	89	380	11	12	7.1
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	42	21	21	14
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	-	-	19	-	12
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	140	560	59	59	26
Petroleum Hydrocarbons								
TPH (C5 - C6) $_{HS_1D_TOTAL}$	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) $_{EH_CU_1D_TOTAL}$	mg/kg	2	MCERTS	< 2.0	4	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) $_{EH_CU_1D_TOTAL}$	mg/kg	4	MCERTS	< 4.0	36	< 4.0	< 4.0	< 4.0
TPH (C16 - C21) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	16	220	< 1.0	< 1.0	< 1.0
TPH (C21 - C35) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	64	360	< 1.0	< 1.0	< 1.0
TPH (C35 - C40) $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	33	45	< 10	< 10	< 10
TPH Total C5 - C40 $_{EH_CU+HS_1D_TOTAL}$	mg/kg	10	NONE	120	670	< 10	< 10	< 10

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

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662532	2662533	2662534	2662535	2662536
Sample Reference				TP101	TP101	TP103	TP103	TP105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	3.30	0.10	1.00	0.10
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	18	21	17	5.9	17
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SCA	N/A	SCA	N/A	MJN

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.4	-	6	-	7.1
Total Cyanide	mg/kg	1	MCERTS	1.9	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	670	-	380	-	390
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0059	-	0.0045	-	0.0045
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	12	-	9	-	9
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	5.9	-	4.5	-	4.5
Sulphide	mg/kg	1	MCERTS	< 1.0	-	2.2	-	1.1
Total Sulphur	mg/kg	50	MCERTS	510	-	320	-	340
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	3.6	-	2.8	-	2.9

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.15	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.23	< 0.05	< 0.05	< 0.05	0.13
Fluorene	mg/kg	0.05	MCERTS	0.16	< 0.05	< 0.05	< 0.05	0.08
Phenanthrene	mg/kg	0.05	MCERTS	2.1	0.27	0.38	0.21	0.99
Anthracene	mg/kg	0.05	MCERTS	0.54	< 0.05	0.11	0.05	0.25
Fluoranthene	mg/kg	0.05	MCERTS	4.9	0.17	0.91	0.32	1.6
Pyrene	mg/kg	0.05	MCERTS	4.7	0.15	0.92	0.3	1.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.1	0.08	0.41	0.18	0.62
Chrysene	mg/kg	0.05	MCERTS	2.4	0.11	0.47	0.15	0.67
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3	< 0.05	0.57	0.21	0.85
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.86	< 0.05	0.22	0.08	0.31
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.1	< 0.05	0.4	0.14	0.59
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.5	< 0.05	0.31	< 0.05	0.43
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.35	< 0.05	< 0.05	< 0.05	0.11
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.7	< 0.05	0.37	< 0.05	0.59

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	26.8	< 0.80	5.07	1.64	8.78

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662532	2662533	2662534	2662535	2662536
Sample Reference				TP101	TP101	TP103	TP103	TP105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	3.30	0.10	1.00	0.10
Date Sampled				24/04/2023	24/04/2023	24/04/2023	24/04/2023	24/04/2023
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	32	8.4	14	6.6	14
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	180	-	110	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.6	-	0.47	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	1.6	-	0.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.3	< 0.2
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	30	-	20	-	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	150	28	41	15	65
Lead (aqua regia extractable)	mg/kg	1	MCERTS	290	20	110	33	240
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	31	44	16	13	19
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	-	41	-	16	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	340	93	140	53	240
Petroleum Hydrocarbons								
TPH (C5 - C6) $_{HS_1D_TOTAL}$	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) $_{EH_CU_1D_TOTAL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) $_{EH_CU_1D_TOTAL}$	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	16	< 1.0	9.1	2	7.5
TPH (C21 - C35) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	53	< 1.0	25	7.9	21
TPH (C35 - C40) $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40 $_{EH_CU+HS_1D_TOTAL}$	mg/kg	10	NONE	78	< 10	37	< 10	30

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662537	2662538	2662539	2662540	2662541
Sample Reference				TP106	TP108b	TP111	TP114	TP114
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.10	0.10	0.10	0.70
Date Sampled				24/04/2023	24/04/2023	25/04/2023	25/04/2023	25/04/2023
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	50
Moisture Content	%	0.01	NONE	16	19	17	24	8.6
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	N/A	MJN	MJN	MJN	MJN

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	5.7	5.8	5.3	8.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	1
Total Sulphate as SO4	mg/kg	50	MCERTS	-	640	390	530	580
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	0.0028	0.0074	0.0082	0.077
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	5.6	15	16	150
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	2.8	7.4	8.2	76.9
Sulphide	mg/kg	1	MCERTS	-	1.6	< 1.0	1.6	2.4
Total Sulphur	mg/kg	50	MCERTS	-	620	430	450	450
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	4.8	2.9	3.5	2.3

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.26	< 0.05	0.7	0.38	16
Acenaphthylene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.51	0.13	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.26	< 0.05	0.24	0.22	65
Fluorene	mg/kg	0.05	MCERTS	0.17	< 0.05	0.65	0.24	58
Phenanthrene	mg/kg	0.05	MCERTS	2.7	0.22	3.8	1.9	370
Anthracene	mg/kg	0.05	MCERTS	0.59	0.06	0.87	0.44	92
Fluoranthene	mg/kg	0.05	MCERTS	6	0.51	4.8	3.1	330
Pyrene	mg/kg	0.05	MCERTS	5.5	0.51	4.3	3	280
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.1	0.22	2.2	1.3	110
Chrysene	mg/kg	0.05	MCERTS	2.5	0.24	2.1	1.3	110
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.8	0.31	2.7	1.6	120
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.5	0.11	0.93	0.54	40
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.9	0.23	2	1.2	96
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.7	0.16	1.1	0.82	52
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.41	0.05	0.34	0.2	13
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.7	0.2	1.2	0.93	60

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	33.1	2.82	28.6	17.3	1810

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street
Your Order No: 004682

Lab Sample Number				2662537	2662538	2662539	2662540	2662541
Sample Reference				TP106	TP108b	TP111	TP114	TP114
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.10	0.10	0.10	0.70
Date Sampled				24/04/2023	24/04/2023	25/04/2023	25/04/2023	25/04/2023
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	37	8.8	21	17	14
Barium (aqua regia extractable)	mg/kg	1	MCERTS	360	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.7	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.8	< 0.2	1.5
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	-	14	20	18	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	220	31	87	55	75
Lead (aqua regia extractable)	mg/kg	1	MCERTS	590	200	220	160	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.5	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	37	12	23	17	27
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	48	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	390	88	270	220	250
Petroleum Hydrocarbons								
TPH (C5 - C6) $_{HS_1D_TOTAL}$	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) $_{EH_CU_1D_TOTAL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	13	82
TPH (C12 - C16) $_{EH_CU_1D_TOTAL}$	mg/kg	4	MCERTS	6.5	6.2	< 4.0	160	190
TPH (C16 - C21) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	34	23	8.9	500	510
TPH (C21 - C35) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	89	50	26	460	490
TPH (C35 - C40) $_{EH_CU_1D_TOTAL}$	mg/kg	10	MCERTS	10	11	< 10	32	33
TPH Total C5 - C40 $_{EH_CU+HS_1D_TOTAL}$	mg/kg	10	NONE	140	90	42	1200	1300

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street

Your Order No: 004682

Lab Sample Number				2662542	2662543	2662544
Sample Reference				TP101	TP105	TP114
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.40	0.20	0.80
Date Sampled				24/04/2023	24/04/2023	25/04/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
General Inorganics						
pH (automated)	pH Units	N/A	ISO 17025	7.9	7.3	7.7
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	6.8	2.8	3.2
Total Phenols						
Total Phenols (monohydric)	µg/l	1	ISO 17025	1.9	2	2.1
Speciated PAHs						
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Total PAH						
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2
Heavy Metals / Metalloids						
Arsenic (dissolved)	µg/l	1	ISO 17025	2.6	< 1.0	< 1.0
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	4.7	0.9	3.4
Copper (dissolved)	µg/l	0.7	ISO 17025	19	30	18
Lead (dissolved)	µg/l	1	ISO 17025	14	< 1.0	8.8
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.6	12	12
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	30	16	25
Monoaromatics & Oxygenates						
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10
Petroleum Hydrocarbons						
TPH1 (C10 - C40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10

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Analytical Report Number: 23-30951
Project / Site name: Audrey Street

Your Order No: 004682

Lab Sample Number				2662542	2662543	2662544
Sample Reference				TP101	TP105	TP114
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.40	0.20	0.80
Date Sampled				24/04/2023	24/04/2023	25/04/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
TPH-CWG - Aliphatic >C5 - C6 $_{HS_1D_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8 $_{HS_1D_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 $_{HS_1D_AL}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 $_{EH_1D_AL_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 $_{EH_1D_AL_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 $_{EH_1D_AL_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 $_{EH_1D_AL_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH_1D_AL_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 $_{HS_1D_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 $_{HS_1D_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 $_{HS_1D_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 $_{EH_1D_AR_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 $_{EH_1D_AR_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 $_{EH_1D_AR_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 $_{EH_1D_AR_MS}$	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH_1D_AR_MS}$	µg/l	10	NONE	< 10	< 10	< 10

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* 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 *
2662522	WS101	None Supplied	0.1	Brown sandy clay with gravel and vegetation.
2662523	WS101	None Supplied	1.2	Brown loam and clay with gravel and vegetation.
2662524	WS104	None Supplied	1.2	Brown loam and clay with gravel and vegetation.
2662525	WS105	None Supplied	0.1	Brown sandy clay with gravel and vegetation.
2662526	WS105	None Supplied	2	Brown clay and loam.
2662527	WS106	None Supplied	0.8	Brown loam and clay with clinker and vegetation
2662528	WS108	None Supplied	0.9	Brown sandy clay with vegetation and stones.
2662529	WS110	None Supplied	1.8	Brown sand with gravel and vegetation.
2662530	WS111	None Supplied	1.3	Brown sandy clay with gravel.
2662531	WS112	None Supplied	1.2	Brown sand with gravel and vegetation.
2662532	TP101	None Supplied	0.1	Brown loam with gravel and vegetation.
2662533	TP101	None Supplied	3.3	Brown clay with vegetation.
2662534	TP103	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2662535	TP103	None Supplied	1	Brown sand with gravel and vegetation.
2662536	TP105	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2662537	TP106	None Supplied	1.2	Brown sandy clay with rubble and brick.
2662538	TP108b	None Supplied	0.1	Brown loam with gravel and vegetation.
2662539	TP111	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2662540	TP114	None Supplied	0.1	Brown loam and clay with gravel and vegetation.
2662541	TP114	None Supplied	0.7	Brown loam and clay with rubble and stones.

Analytical Report Number : 23-30951
Project / Site name: Audrey Street

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 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
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
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 - 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
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
Total sulphate (as SO4 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

Analytical Report Number : 23-30951
Project / Site name: Audrey Street

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 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
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 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
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
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
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 : 23-30951
Project / Site name: Audrey Street

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 30oC
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

APPENDIX VIII
GEOTECHNICAL TESTING RESULTS

LABORATORY REPORT

Contract Number: PSL23/3045

Report Date: 22 May 2023

Client's Reference: 16-219

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: M.Dimes/J Sheridan

Contract Title: Bolton Street

Date Received: 27/4/2023
Date Commenced: 27/4/2023
Date Completed: 22/5/2023

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)

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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS101		D	1.00		Brown gravelly sandy CLAY.
WS103		U	1.50	2.00	Firm brown slightly gravelly very sandy CLAY.
WS103		D	2.00		Brown slightly gravelly sandy CLAY.
WS105		D	1.00		Brown slightly gravelly sandy CLAY.
WS111		U	3.50	4.00	Firm brown slightly gravelly very sandy CLAY.
TP102		B	1.70		Brown slightly gravelly sandy CLAY.
TP111		B	0.80		Brown very gravelly slightly silty SAND with cobbles.
TP114		B	1.00		MADE GROUND dark brown slightly sandy slightly silty gravel of cobbles.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

Contract No:

PSL23/3045

Client Ref:

16-219

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS101		D	1.00		19			48	22	26	85	Intermediate Plasticity CI
WS103		D	2.00		15			41	20	21	97	Intermediate Plasticity CI
WS105		D	1.00		15			45	21	24	94	Intermediate Plasticity CI
TP102		B	1.70		22							
TP111		B	0.80		6.3							
TP114		B	1.00		15							

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

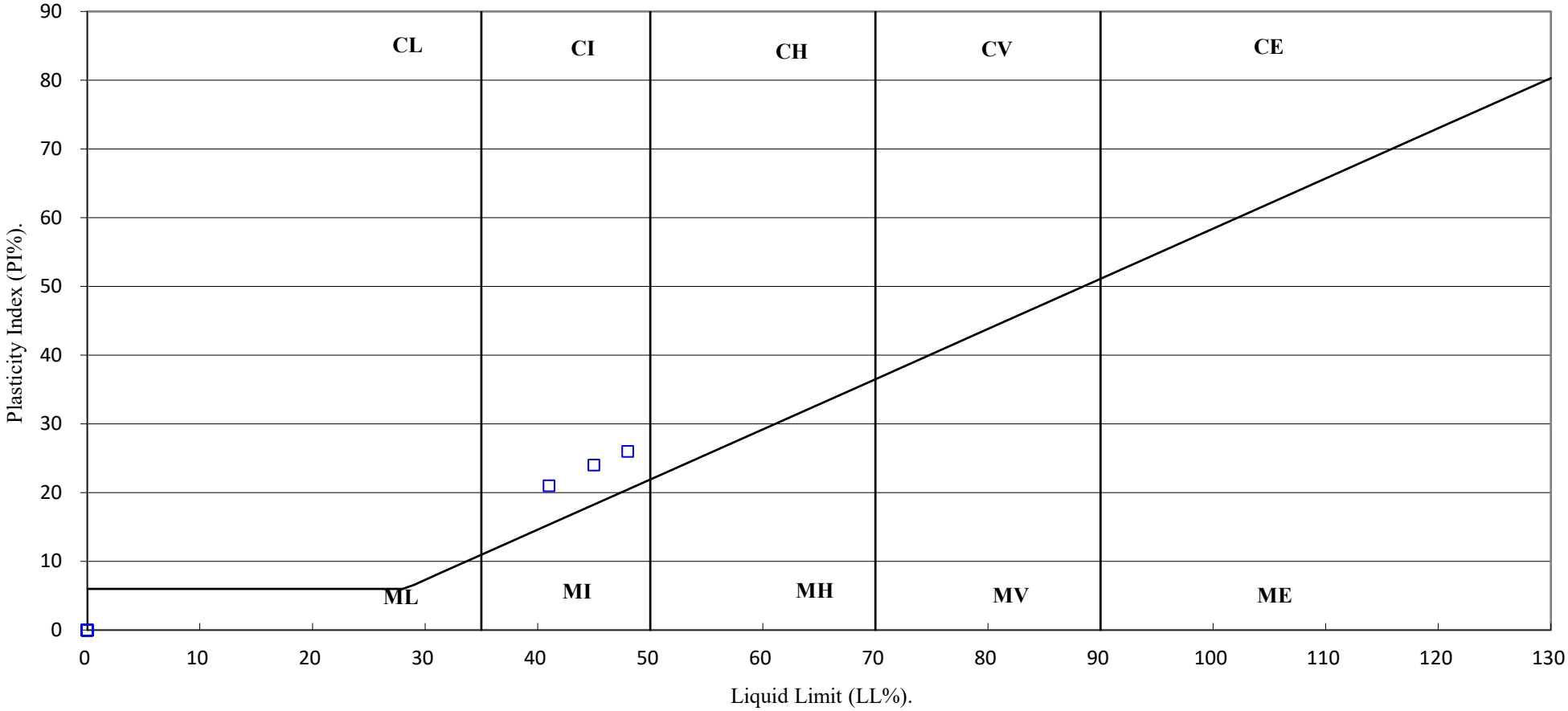
Contract No:

PSL23/3045

Client Ref:

16-219

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Bolton Street**	**Contract No:** PSL23/3045 **Client Ref:** 16-219

PARTICLE SIZE DISTRIBUTION TEST

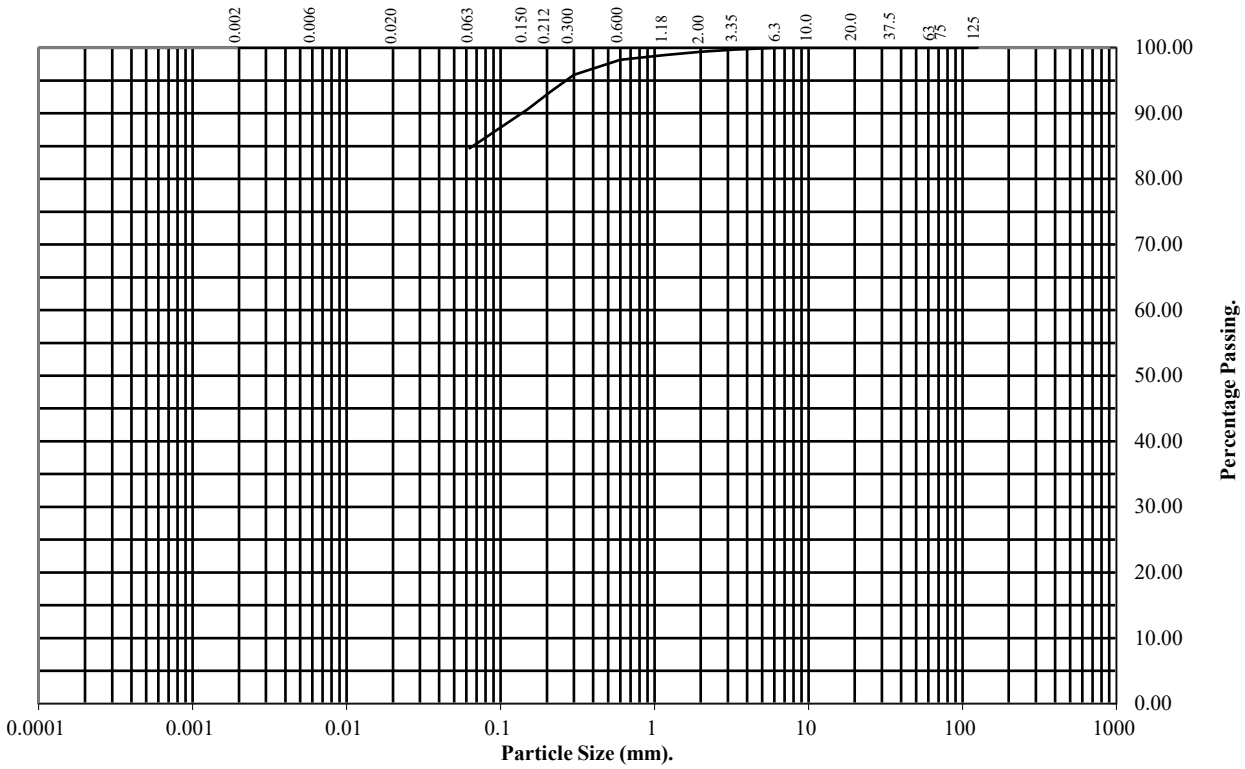
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP102 **Top Depth (m):** 1.70

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	100
2	99
1.18	99
0.6	98
0.3	96
0.212	93
0.15	91
0.063	85

Soil Fraction	Total Percentage
Cobbles	0
Gravel	1
Sand	14
Silt/Clay	85

Remarks:
See Summary of Soil Descriptions

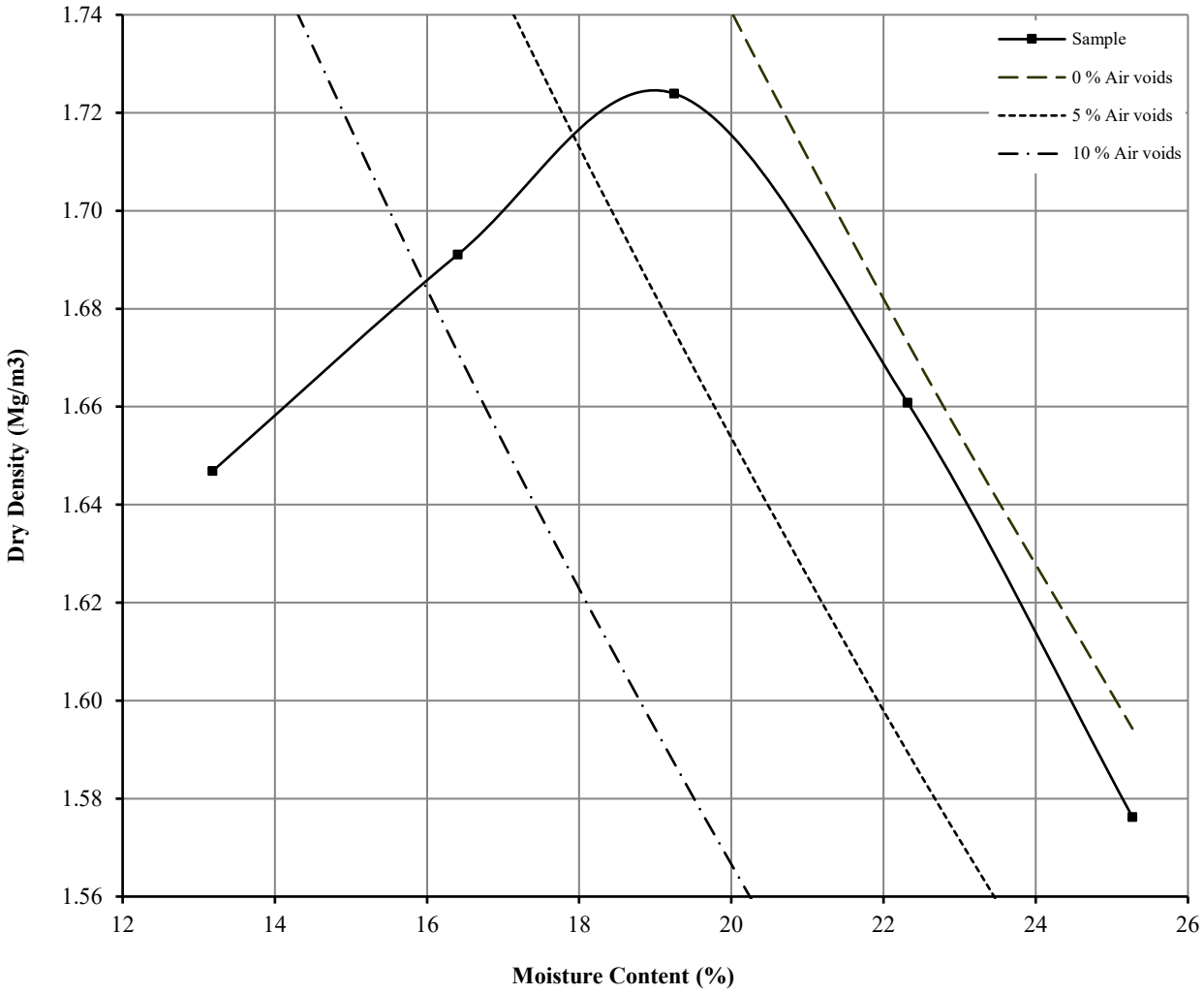
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

Hole Number: TP102 **Top Depth (m) :** 1.70

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		22	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.67	Assumed	Material Retained on 37.5 mm Test Sieve (%):		0
Maximum Dry Density (Mg/m3):		1.72	Material Retained on 20.0 mm Test Sieve (%):		0
Optimum Moisture Content (%):		19			
Remarks See summary of soil descriptions					

PARTICLE SIZE DISTRIBUTION TEST

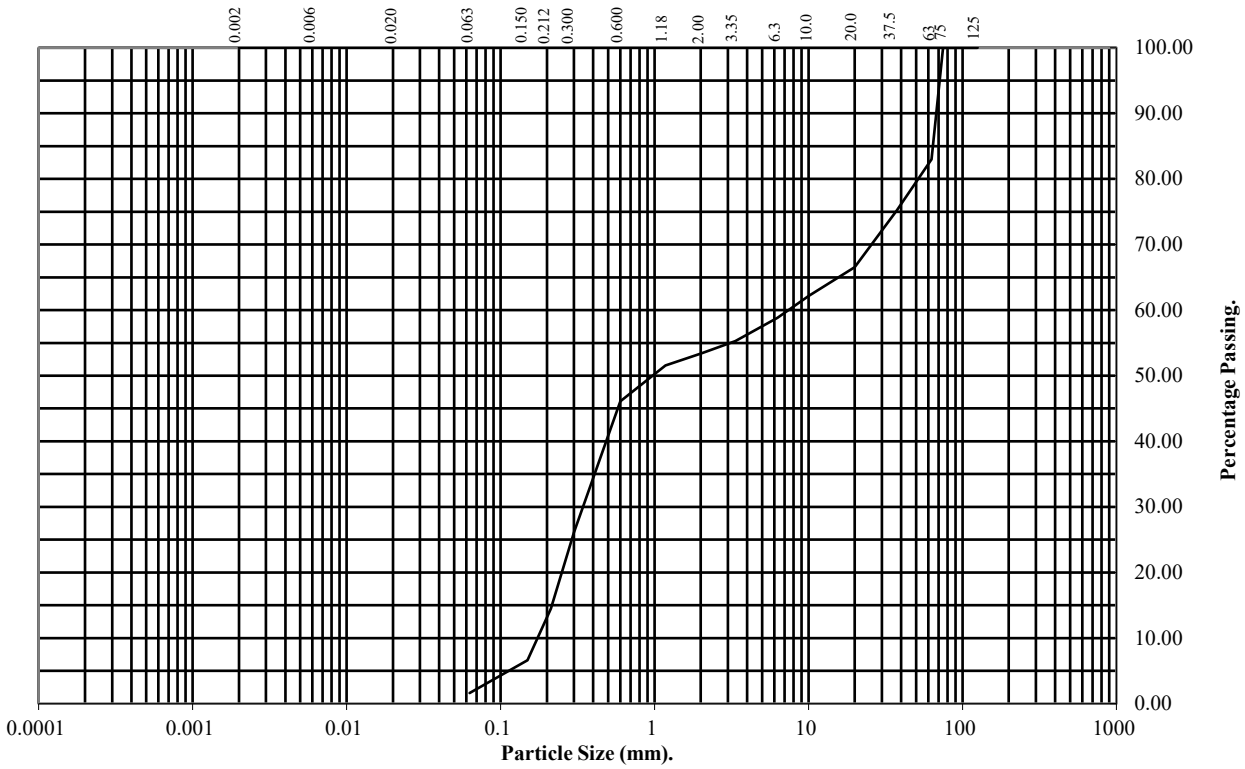
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP111 **Top Depth (m):** 0.80

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	83
37.5	75
20	67
10	62
6.3	59
3.35	55
2	53
1.18	52
0.6	46
0.3	26
0.212	14
0.15	7
0.063	2

Soil Fraction	Total Percentage
Cobbles	17
Gravel	30
Sand	51
Silt/Clay	2

Remarks:
See Summary of Soil Descriptions

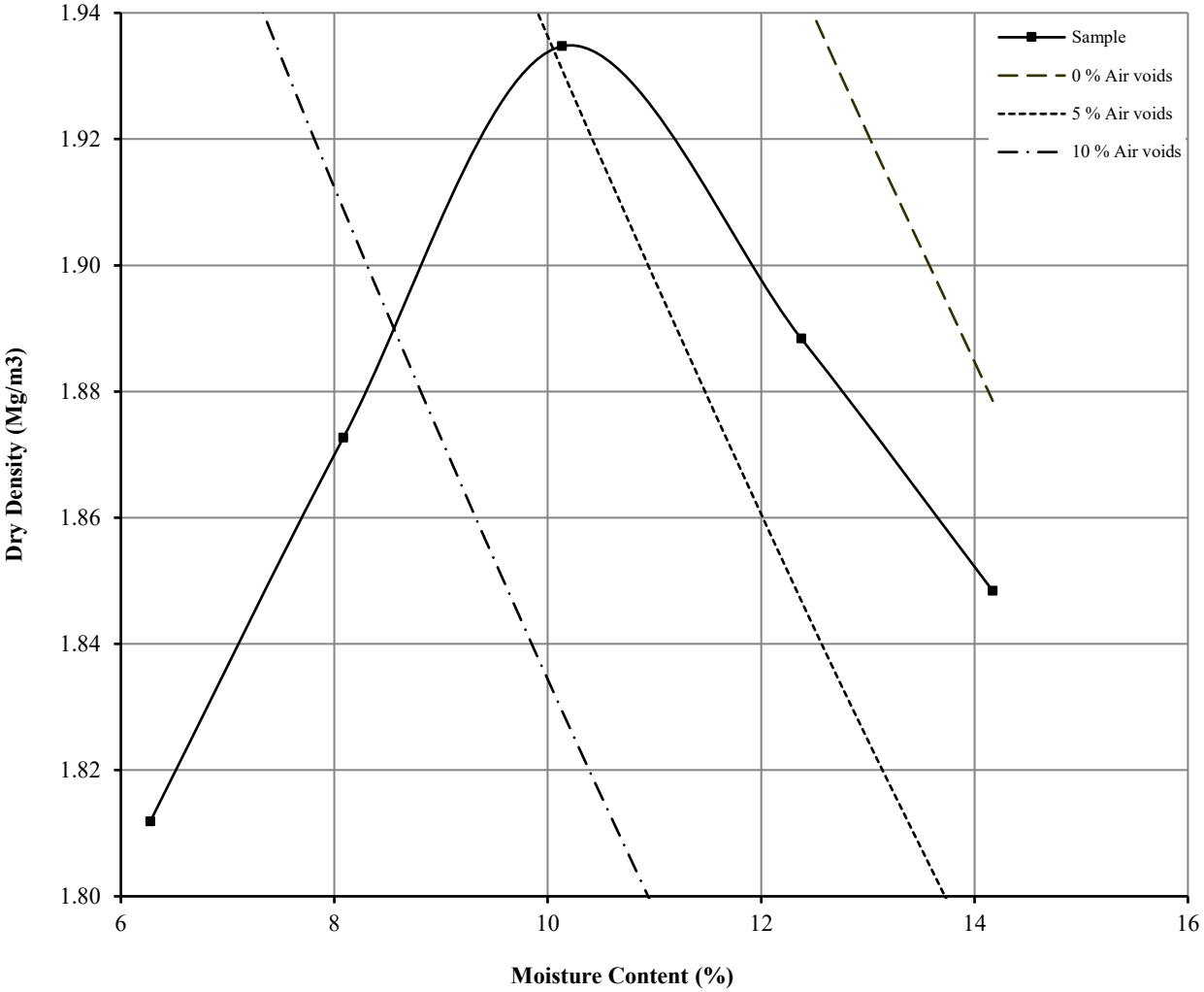
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP111 **Top Depth (m) :** 0.80

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		6.3	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.56	Assumed	Material Retained on 37.5 mm Test Sieve (%):		25
Maximum Dry Density (Mg/m3):		1.93	Material Retained on 20.0 mm Test Sieve (%):		8
Optimum Moisture Content (%):		10			
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

Contract
PSL23/3045
Client Ref
16-219

PARTICLE SIZE DISTRIBUTION TEST

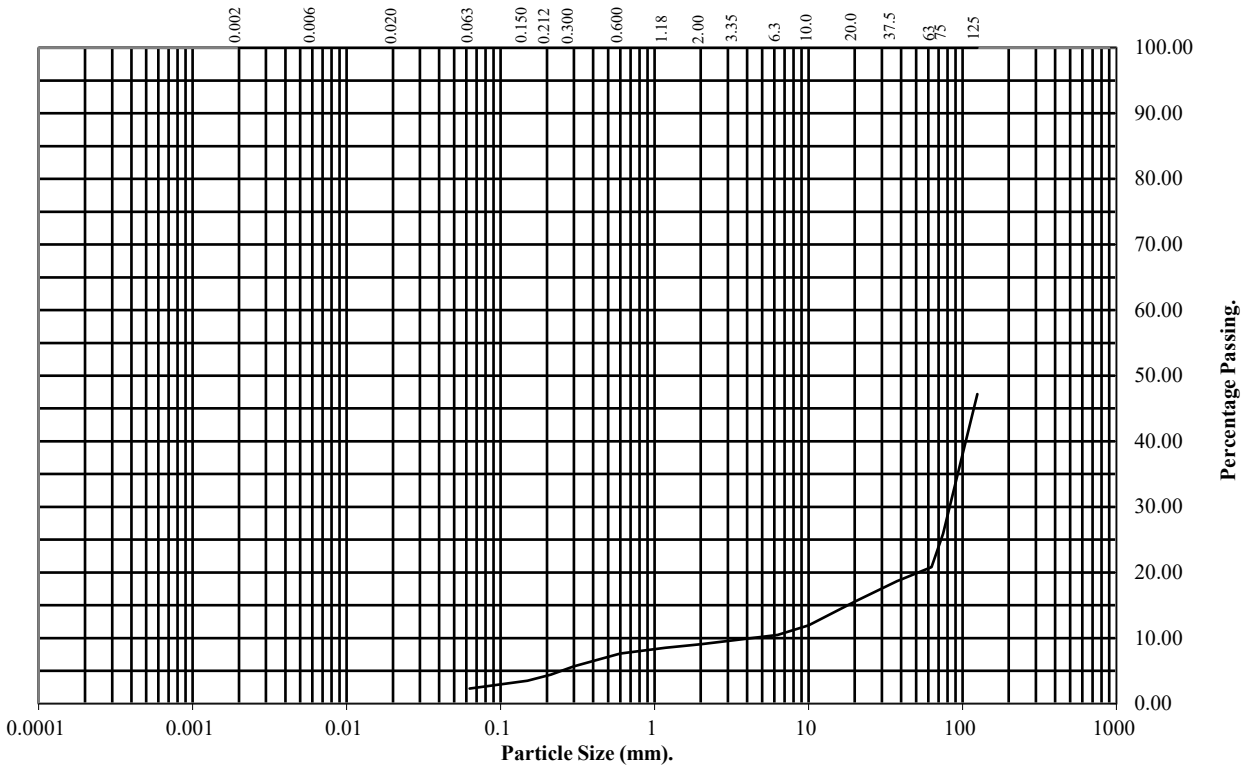
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP114 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	47
75	26
63	21
37.5	19
20	16
10	12
6.3	10
3.35	10
2	9
1.18	9
0.6	8
0.3	6
0.212	4
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	79
Gravel	12
Sand	7
Silt/Clay	2

Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

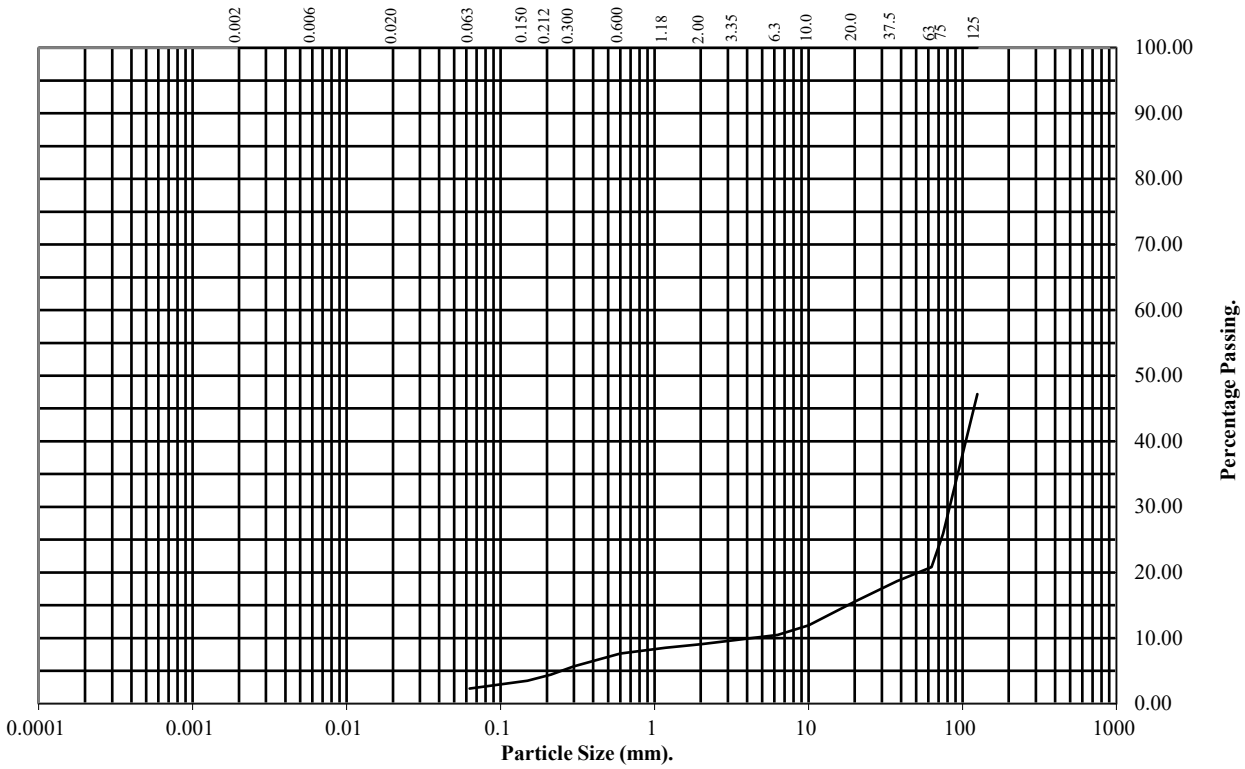
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP114 **Top Depth (m):** 1.00

Sample Number: **Base Depth(m):**

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	47
75	26
63	21
37.5	19
20	16
10	12
6.3	10
3.35	10
2	9
1.18	9
0.6	8
0.3	6
0.212	4
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	79
Gravel	12
Sand	7
Silt/Clay	2

Remarks:
See Summary of Soil Descriptions

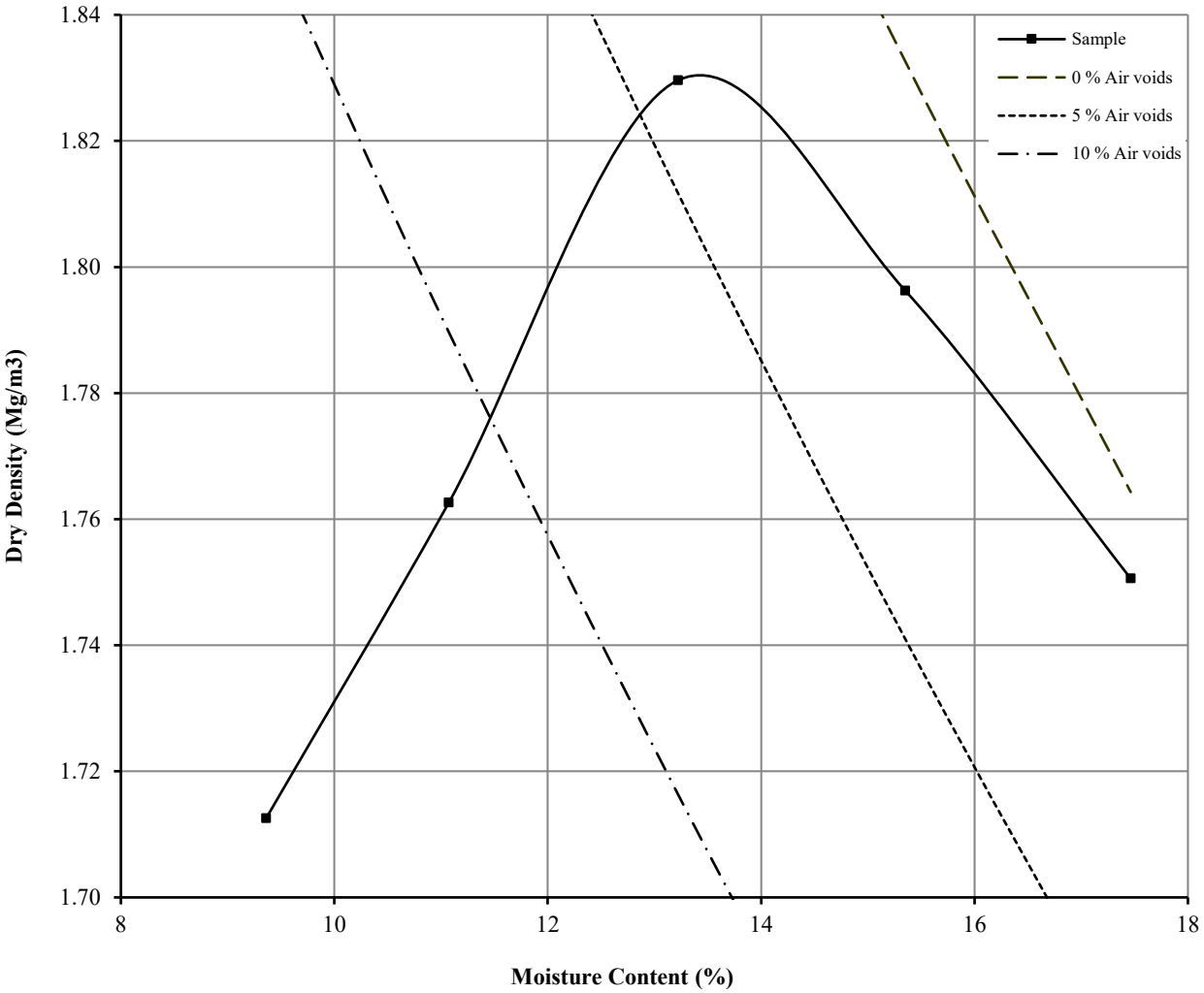
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Non compliance with BS 1377 : Part 4 : Clause 3.4 : 1990

Hole Number: TP114 **Top Depth (m) :** 1.00

Sample Number: **Base Depth (m) :**

Sample Type: B



Initial Moisture Content:		15	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.55	Assumed	Material Retained on 37.5 mm Test Sieve (%):		81
Maximum Dry Density (Mg/m3):		1.83	Material Retained on 20.0 mm Test Sieve (%):		3
Optimum Moisture Content (%):		13			
Remarks See summary of soil descriptions					

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

Contract
PSL23/3045
Client Ref
16-219

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

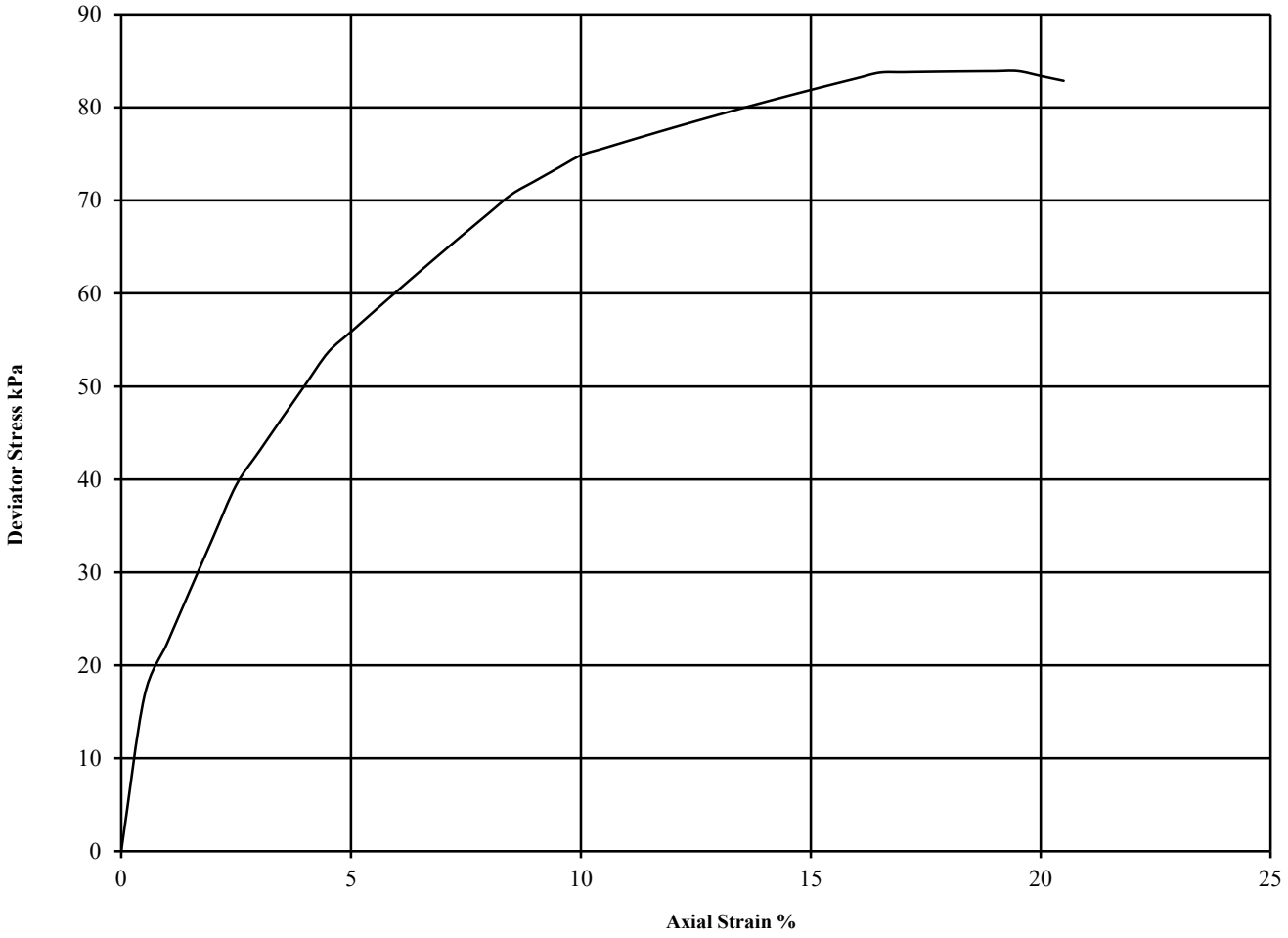
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: WS103 **Top Depth (m):** 1.50

Sample Number: **Base Depth (m):** 2.00

Sample Type U



Diameter (mm):		88	Height (mm):		176	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.38
1	18	2.05	1.73	35	84	42	19.5	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

Contract No: PSL23/3045

Client Ref: 16-219

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

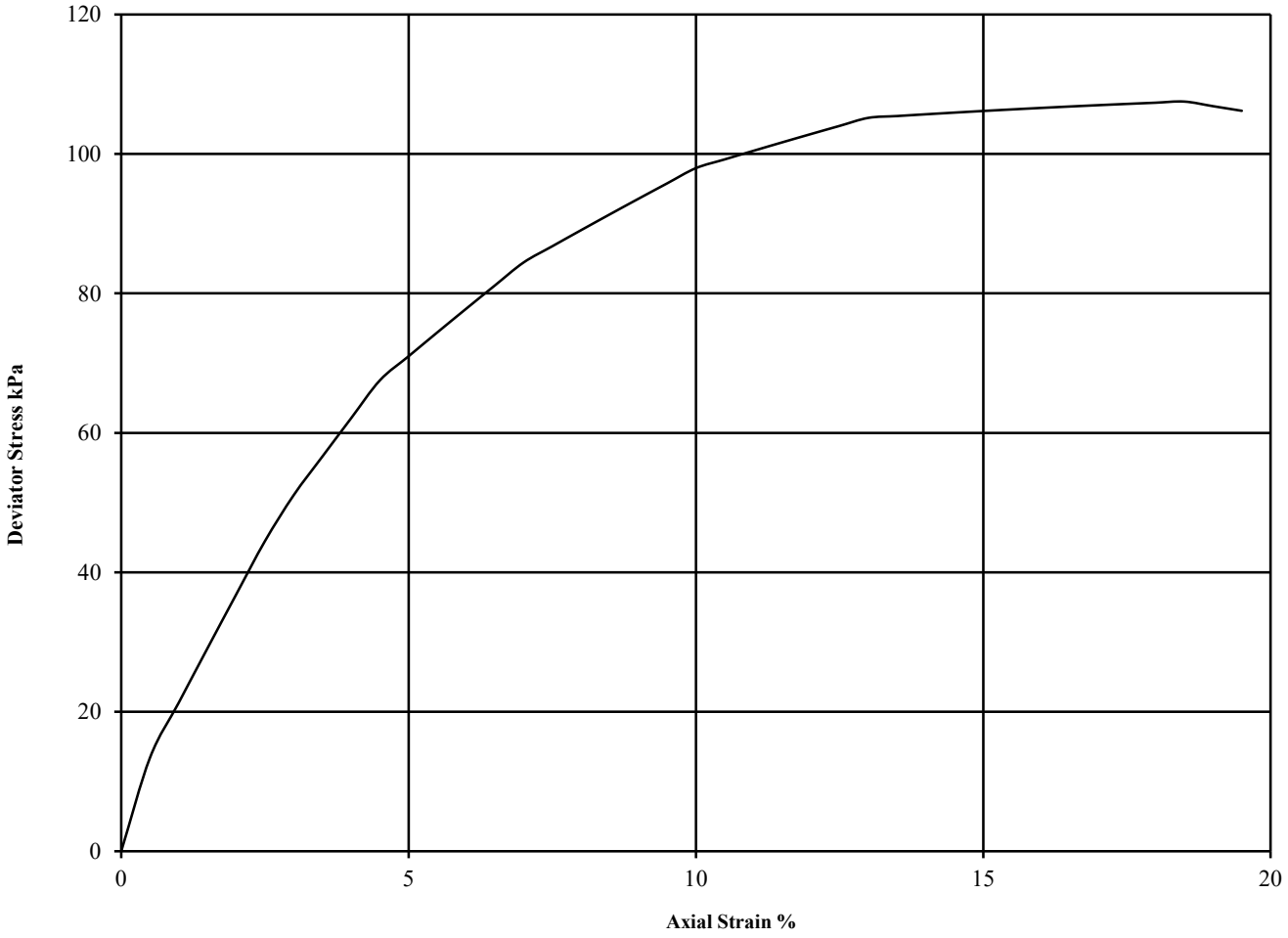
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: WS111 **Top Depth (m):** 3.50

Sample Number: **Base Depth (m):** 4.00

Sample Type U



Diameter (mm):		65	Height (mm):		130	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.49
1	13	2.23	1.98	75	108	54	18.5	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Bolton Street

Contract No: PSL23/3045

Client Ref: 16-219

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)	

LABORATORY REPORT

Contract Number: PSL23/3802

Report Date: 22 June 2023

Client's Reference: 16-219

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: M.Dimes/J Sheridan

Contract Title: Audrey Street

Date Received: 19/5/2023
Date Commenced: 19/5/2023
Date Completed: 21/6/2023

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:

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L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technical Coordinator)
T Watkins (Senior Technician)

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Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
CP101		U	5.50	5.95	Stiff brown slightly gravelly sandy CLAY.
CP102		U	6.50	6.95	Firm brown slightly gravelly sandy CLAY.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Audrey Street

Contract No:

PSL23/3802

Client Ref:

16-219

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

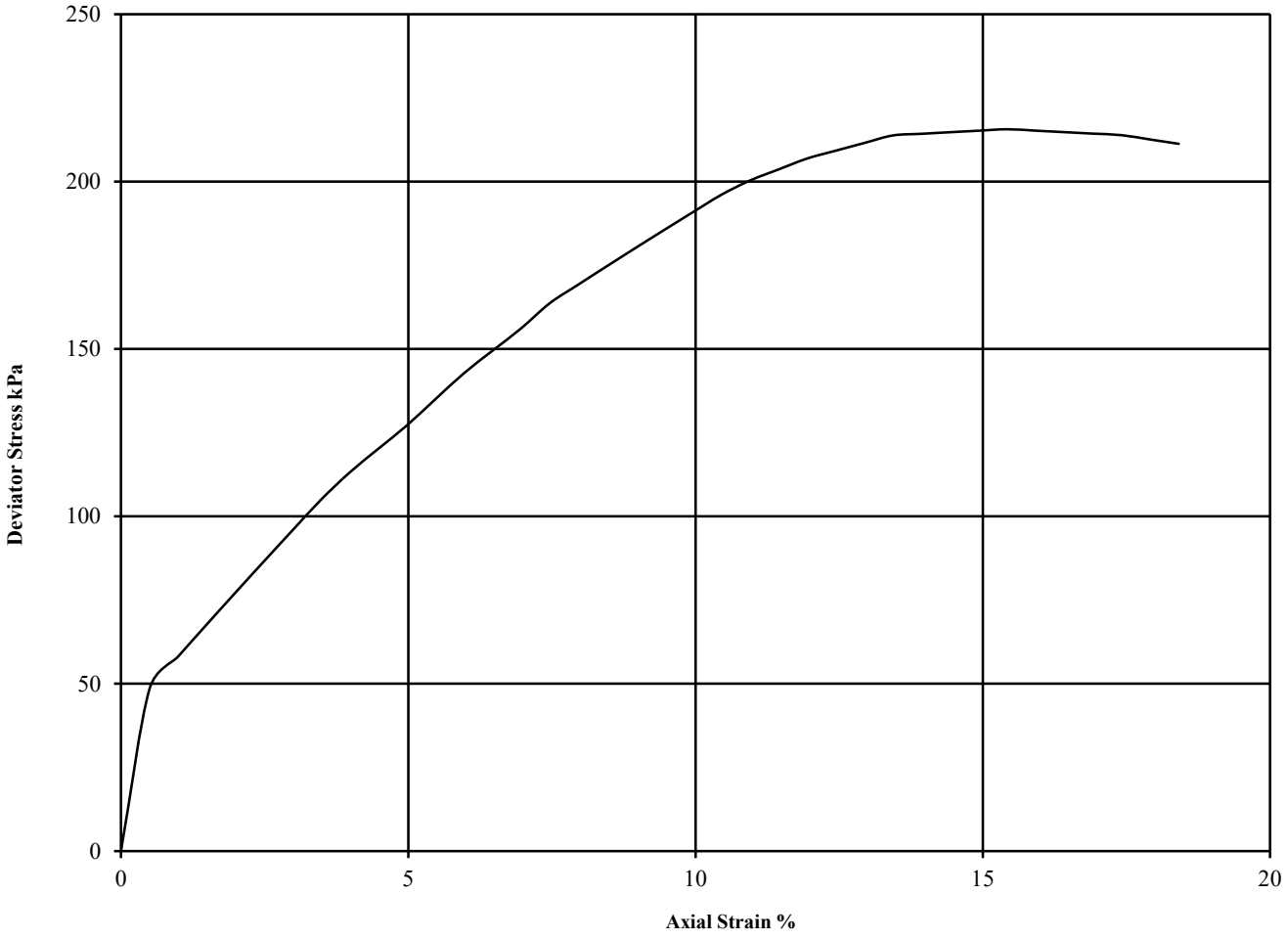
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: CP101 **Top Depth (m):** 5.50

Sample Number: **Base Depth (m):** 5.95

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	16	2.10	1.81	114.5	216	108	15.4	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Audrey Street

Contract No: PSL23/3802

Client Ref: 16-219

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

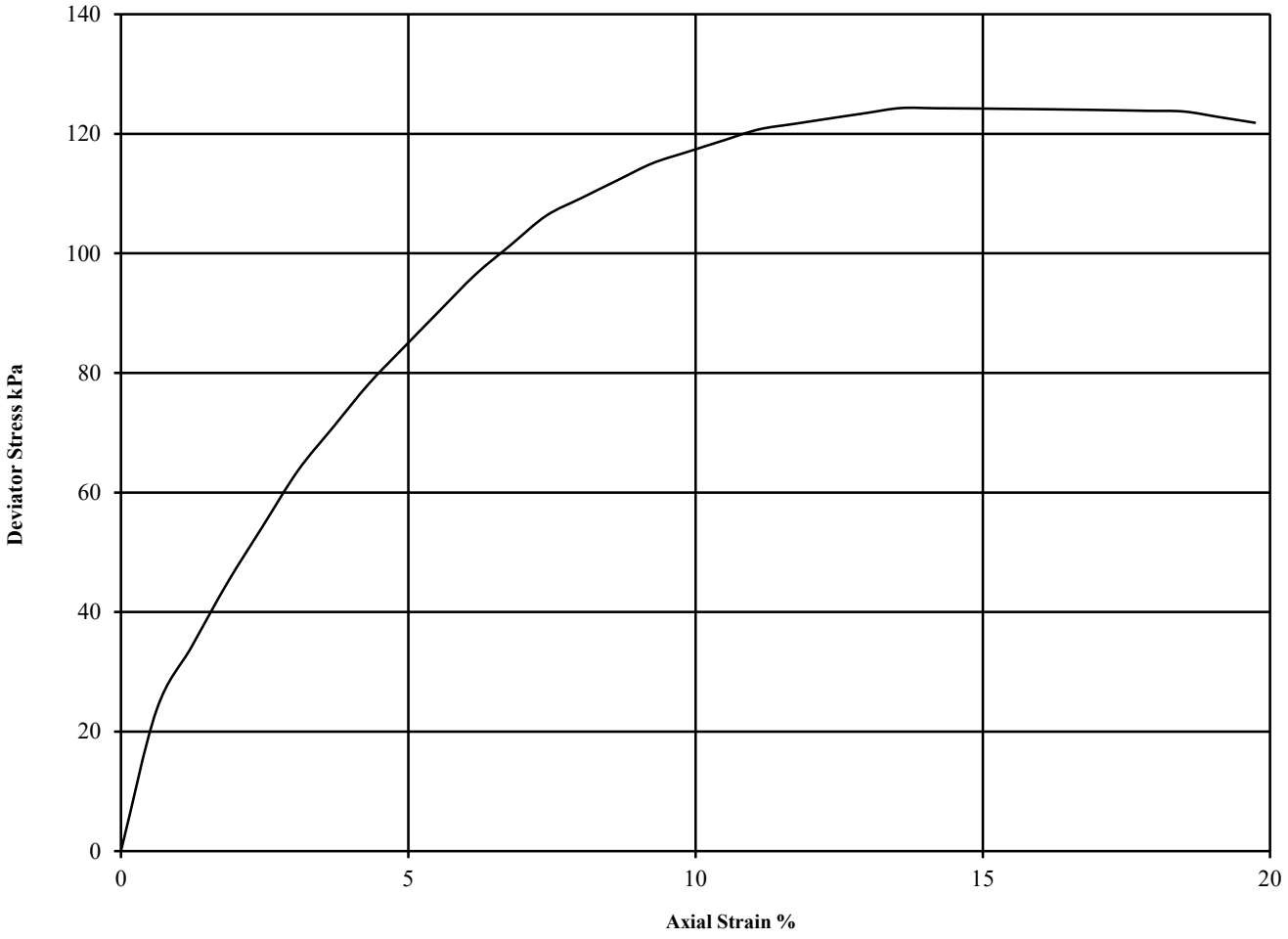
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: CP102 **Top Depth (m):** 6.50

Sample Number: **Base Depth (m):** 6.95

Sample Type U



Diameter (mm):		103	Height (mm):		167	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	17	2.07	1.76	134.5	124	62	13.6	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Audrey Street

Contract No: PSL23/3802

Client Ref: 16-219