



e3p

Phase II Geoenvironmental Site Assessment
Green Lane, Heywood

Reference: 16-218-R1-1
Date: October 2022



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Green Lane
Heywood
OL10 2DY

Prepared for:

The Challenger Group

Report Ref: 16-218-R1-1
Date Issued: 4th October 2022

Green Lane, Heywood

Phase II Geoenvironmental Site Assessment

October 2022

E3P

Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

+ 44 (0) 161 707 9612
<https://e3p.co.uk>

Registered in England
CRN: 08725262

QUALITY ASSURANCE

PROJECT NUMBER	16-218		
VERSION	Version 1		
REMARKS	First Revision		
DATE	4 th October 2022		
PREPARED BY	N.Gregory		
QUALIFICATIONS	BSc, FGS		
CHECKED BY	E. Fearn		
QUALIFICATIONS	BSc (Hons), MSc, FGS		
AUTHORISED BY	A Edgar		
QUALIFICATIONS	BSc, MSc, PIEMA, MEnvSc, CEnv		



EXECUTIVE SUMMARY

Site Address	Green Lane, Heywood, Greater Manchester OL10 1PN	
Grid Reference	E386274, N410791	
Site Area	~0.155 Ha.	
Proposed Development	The proposed development comprises a 5-storey block of apartments with car parking at ground floor level and residential accommodation above including a mix of 1 and 2 bedroom apartments. The scheme will include soft landscaping and adopted utility infrastructure.	
Current Site Use	The land is rectangular in shape and level in topography, formerly used as a drive through car wash and is currently vacant. There is an Electricity Substation on the southeast corner of the site.	
Site History	The site was developed prior to 1851 with Eagle Mill and chimney being present on-site with Roeacre Mill to the west and sand pits to the east. There was a dam and reservoir to the southwest of the site serving Roeacre Mill. Eagle Mill was demolished in the early 1970s with the site being vacant until the late 1990s. By the early 2000s the drive through car wash was erected. The site is relatively level along the west but rises towards the electricity substation on the southeast corner. Road improvements were made in the late 1970s and part of the site was taken up by the re-alignment of Green Lane at the junction with Rochdale Road East.	
Environmental Setting	Drift Geology	Glaciofluvial Deposits – SAND.
	Bedrock Geology	Pennine Lower Coal Measures.
	Faults	There are no recorded faults shown to exist within the site or its immediate vicinity (<50m).
	Hydrogeology	Coal Measures - Secondary Aquifer. There are no licensed potable groundwater abstractions in the vicinity of the site.
	Hydrology	There are no surface watercourses within influencing distance of the site.
	Flood Risk	Unaffected by flooding from rivers.
Previous Reports	The following previous reports have been completed for the site: STL Projects Ltd – Phase 1 Geo-Environmental Assessment –Land at Rochdale Road East (Ref: 19-3422), dated March 2019. The report was prepared for Maxstretti Homes (Heywood) Ltd.	
Utility Locations	A full utility survey has not been undertaken for the site, however, utility connections from the surrounding highways are understood to enter the site.	
Landfill Sites and Ground Gases	A historic landfill is recorded immediately to the south of the site boundary.	
Radon	Lower Probability Area (<1% affected) - No radon protection measures are required in the construction of units.	



Coal Mining/Land Stability	The site is not located within a Development High Risk Area and the site is considered to be at low risk from subsidence associated with historic coal mining.
Brine Workings	The site is not located within an area deemed to be at risk from ground instability due to historic brine pumping activities and/or salt extraction.
Hazardous Installations	No hazardous installations that could potentially prejudice the development of the site for residential end use have been identified within influencing distance of the subject site.

GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: ✳ 6 No. Window Sample Boreholes; ✳ 1 No. Cable Percussive Borehole; ✳ 8 No. Trial Pits; and ✳ Construction of 5 No. environmental monitoring installations.
Ground Conditions	Made Ground – Ground Level to >2.40m bgl Made Ground deposits were encountered within all exploratory hole locations to a proven depth of 2.39 m bgl although, in general, Made Ground was encountered to a depth of less than 1.00m bgl. Made Ground deposits comprise of dark grey very gravelly sand. Gravel is fine to coarse, angular to subrounded of brick in the majority of locations. A reworked topsoil of dark grey gravelly sand with frequent rootlets and gravel of concrete and brick was encountered in locations of soft standing in the eastern sector of the site. DRIFT Drift deposits were encountered within the majority of exploratory locations, with the exception of two locations where the full depth of Made Ground could not be proven. The drift deposits generally comprised a loose light brown slightly gravelly fine to medium sand, where gravel is fine, subrounded to rounded of sandstone. In CP101, a sandy GRAVEL was recorded between 9.40m and 11.20m bgl. SOLID The solid bedrock geology was not encountered during this phase of works. BGS records indicate bedrock is likely to be at ~15.00 to 20.00m bgl. GROUNDWATER No shallow groundwater (<2.50m bgl) has been recorded at the site. However, groundwater strikes were recorded at 4.00m bgl during the intrusive works.



CONTAMINATED LAND ASSESSMENT

Human Health	The Tier I assessment identified exceedances of heavy metals, non-volatile PAH compounds and asbestos in the Made Ground. Asbestos has been identified within the shallow Made Ground, and as such it will be necessary to carefully manage these impacted soils and place them in a legislatively compliant manner that will negate any possibility of future exposure. In respect to the non-volatile PAHs and heavy metals, external areas will be covered by hard-standing or a suitable cover system in all soft landscaped areas thereby removing the exposure pathway to future site users. It is possible that as yet unidentified contaminant impact is present within localised hotspots at the site. It is considered that any such contamination could be addressed by the delineation, excavation and treatment of impacted soils.
Controlled Waters	The site is not considered to pose an unacceptable level of risk to controlled waters.
Ground Gas	Characteristic Situation 1; as such gas protection measures are not required.
Potable Water Infrastructure	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	Underground obstructions have been identified. During the enabling works, any substructures should be grubbed out in their entirety to facilitate the installation of piled foundations.
Allowable Bearing Pressure	The loose to medium dense SAND deposits typically offer an ABP of less 70 to 100 kN/m ² at depths of 2.00-8.00 m bgl.
Foundation Options	The Made Ground is not considered a suitable founding stratum due to the unquantifiable potential for long-term and differential settlement. Deeper Made Ground (>2.00 m bgl) has been recorded locally, however, Made Ground deposits are typically recorded to a depth of c. 1.00 m bgl. 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 is likely at a depth beyond the termination depth of the boreholes completed to date. Due to local deeper areas of Made Ground and loose natural granular soils within the upper 5.00-8.00m of the site, consideration should be given to the use of piled foundations capable of transferring the structural loads to competent strata. However, a deeper borehole may be required to confirm this. The final foundation solution will be dependent on the structural loadings, elevation and should be designed by a suitably qualified structural engineer.
Building Floor Slabs	A ground bearing slab will be viable for the apartment building, but it will need to be constructed on a granular sub-base with the thickness designed by a structural engineer to ensure that settlement tolerances are taken into consideration.



Heave Precautions	The site is underlain by granular soils and therefore heave precautions directly overlying these areas are not required.
Soakaway Drainage	The presence of predominantly granular deposits across the site would indicate the potential for soakaway drainage. This would need to be confirmed through BRE365 soakaway testing
Sulphate Assessment	All samples indicate concrete classification DS-1 AC-1s.
CBR Design %	It is likely the underlying predominantly granular Made Ground deposits could be re-engineered to achieve a CBR of 5% under favourable climatic conditions Where any compressible ground is present beneath proposed roads, adopted drainage infrastructure and hard standing (car park) consideration must be given to the potential for consolidation which will induce unacceptable degrees of total and differential settlement at the surface.
Cut/Fill	The development levels for the proposed residential units are likely to remain close to present and therefore a significant cut-and-fill is not anticipated.
Civil Engineering Excavations	The intrusive ground investigation has identified the presence of relict substructures which may impede excavations for service corridors and foundations.
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:

- ✳ A deeper borehole may be required to inform the set depth for pile design;
- ✳ Foundations to be designed by suitably qualified Structural Engineer;
- ✳ Geotechnical Earthworks Strategy (Infrastructure); and
- ✳ Remediation and Enabling Works Strategy.



Table of Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	7
1.1. Background	7
1.2. Proposed Development	7
1.3. Objectives	8
1.4. Scope of Works	8
1.5. Limitations	8
1.6. Confidentiality	8
2. GROUND INVESTIGATION	9
2.1. General Overview	9
2.2. Scope of Investigation	9
2.3. In-Situ Standard Penetration Testing (SPT)	10
2.4. Laboratory Analysis	10
3. GROUND AND GROUNDWATER CONDITIONS	11
3.1. Summary of Ground Conditions	11
3.2. Made Ground	11
3.3. Drift Deposits	12
3.4. Solid Geology	12
3.5. Groundwater	12
3.6. Visual and Olfactory Evidence of Contamination	12
3.7. Soil Consistency	13
3.8. Side Stability and Ease of Excavation	13
3.9. Particle Size Distribution	17
3.10. Soil Plasticity	17
3.11. pH and Sulphate	17
4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	19
4.1. Deviating Samples	19
4.2. Human Health Risk Assessment	19
4.3. Controlled Waters Risk Assessment	23
4.3.1. Controlled Water Risk Assessment and Mitigation	27
4.3.2. Discussion of Controlled Waters Risk Assessment	27
4.4. Ground Gas Risk Assessment Methodology	27
4.5. Monitoring Methodology	28
4.6. Summary of Monitoring Results	32
4.6.1. Groundwater	32
4.6.2. Barometric pressure	32
4.6.3. Gas Flow	32
4.6.4. Gas Concentrations	32
4.7. Conclusion	32
4.8. Potable Water Supply	34
4.9. Conceptual Site Model	35
5. GEOTECHNICAL ASSESSMENT	38
5.1. Proposed Development	38
5.2. Site Preparation	38
5.3. Foundation Conditions and Assessment of Potential Bearing Capacities	38
5.4. Ground Floor Slabs	40
5.5. Heave Precautions	40
5.6. Highways Construction	40
5.7. Drainage	40



5.8.	Concrete Durability	41
5.9.	Excavations	41
5.10.	Slope Stability	41
5.11.	Construction Activity and Inspection	42
5.12.	Geotechnical Risk Register	43
5.13.	Further Works	44
6.	CONCLUSIONS AND RECOMMENDATIONS.....	45
6.1.	Contaminated Land Assessment	45
6.2.	Geotechnical Assessment	45
APPENDIX I LIMITATIONS.....		46
APPENDIX II GLOSSARY		48
APPENDIX III DRAWINGS		51
APPENDIX IV PHOTOGRAPHS		53
APPENDIX V E3P EXPLORATORY HOLE LOGS		56
APPENDIX VI CHEMICAL TESTING RESULTS		57
APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA		58
APPENDIX VIII GEOTECHNICAL TESTING RESULTS.....		60

DRAWING LIST

16-218-001 - Site Location Plan
16-218-002 - Proposed Development Plan
16-218-005 - Exploratory Hole Location Plan
16-218-006 - Depth of Made Ground Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P has been commissioned by The Challenger Group (the Client) to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of semi-derelict former industrial land to the west of Green Lane, Heywood.

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 residential development.

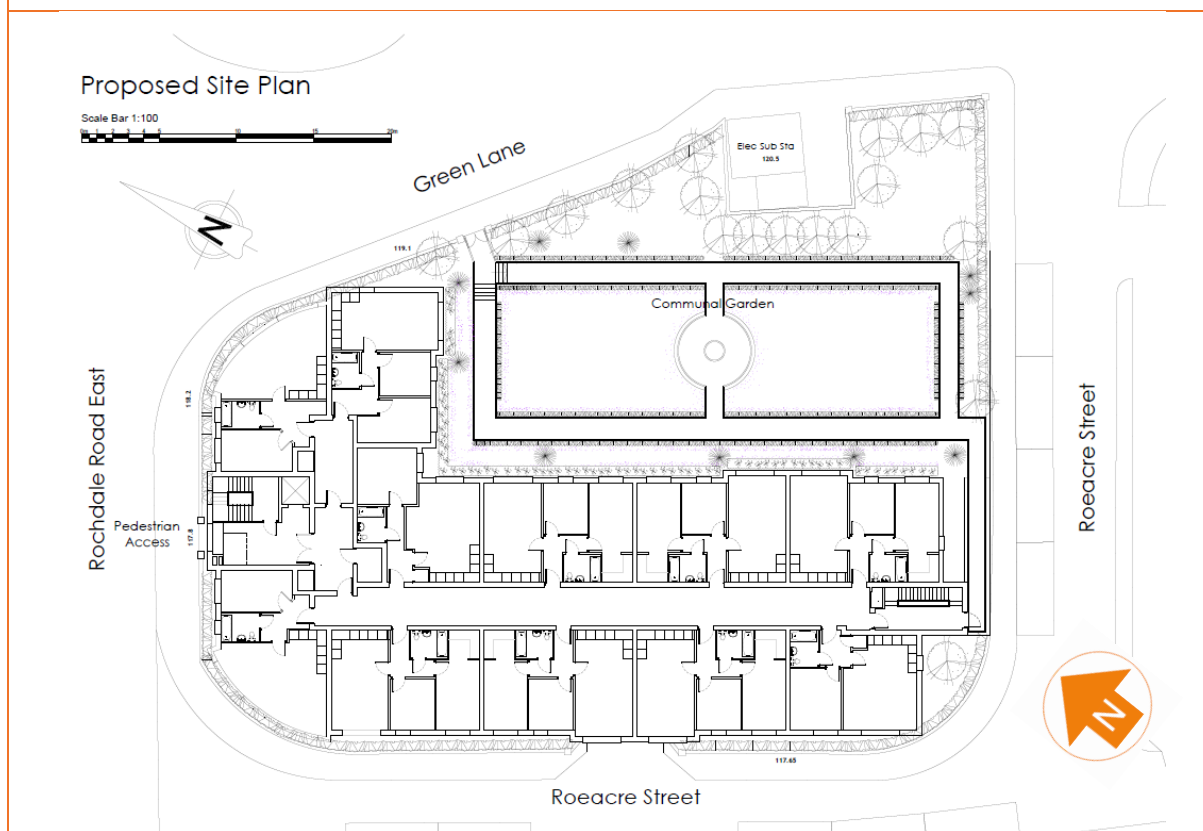
1.2. PROPOSED DEVELOPMENT

The Challenger Group intends to construct a 5-storey block of apartments with car parking at ground floor level and residential accommodation above including a mix of 1 and 2 bedroom apartments.

The scheme will include soft landscaping and adopted utility infrastructure.

A snapshot of the Proposed Development Layout is indicated in Figure 1.1.

FIGURE 1.1 SNAPSHOT OF PROPOSED DEVELOPMENT



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;
- ✿ Window sample probeholes with, and construction of, environmental monitoring installations;
- ✿ Deep cable percussive borehole
- ✿ Mechanically excavated trial pits;
- ✿ In-situ geotechnical testing;
- ✿ Chemical and geotechnical laboratory analysis;
- ✿ Groundwater monitoring and sampling;
- ✿ Ground gas monitoring;
- ✿ Contamination risk assessment and conceptual site model;
- ✿ Geotechnical assessment and interpretation; and
- ✿ Factual and interpretive reporting.

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.6. CONFIDENTIALITY

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



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 26th July 2022. The works are summarised in Table 2.1.

2.2. SCOPE OF INVESTIGATION

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General ground conditions including the presence/nature of obstructions	WS101	Window Sample Probehole	5.45	1.00–4.00
	WS102		2.39	1.00–2.00
	WS103		5.45	0.10–1.00
	WS104		5.45	N/A
	WS105		5.45	1.00–4.00
	WS106		5.45	1.00–4.00
	WS106A		1.05	N/A
	CP101	Cable Percussive Borehole	15.95	N/A
	TP101 – TP108	Mechanically Excavated Trial Pit	3.00	N/A

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples. The trial pits were spatially distributed to offer the maximum site coverage.

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 facilitate the investigation of deeper soil horizons (in excess of 5.00 m) with extensive in-situ geotechnical testing to determine the relative densities of granular soils and undrained strengths of clays.

The sampling locations are illustrated in Drawing 16-218-005 (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 levels and gas concentrations. In addition, selected wells were purged, and samples of groundwater were recovered for chemical analysis.



2.3. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube.

The results are shown in the probehole logs in Appendix V and presented in Table 3.4 and discussed in Section 5.

2.4. LABORATORY ANALYSIS

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

- ✦ Metals.
- ✦ pH, total sulphate, water-soluble sulphate (2:1 extract).
- ✦ Sulphide.
- ✦ Cyanide.
- ✦ Phenols.
- ✦ Total and speciated polycyclic aromatic hydrocarbons (PAHs).
- ✦ Semi Volatile Organic Compounds (SVOC).
- ✦ Volatile Organic Compounds (VOC).
- ✦ Total Organic Carbon (TOC).
- ✦ 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:

- ✦ Atterberg limits determinations; and
- ✦ Particle size distribution.

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 5.



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

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

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)			
	MADE GROUND	CLAY	GRAVELLY SAND	GRAVEL
TP101	0.00 – 1.00	–	1.00 – 3.00	–
TP102	0.00 – 0.20	–	0.20 – 2.80	–
TP103	0.00 – 1.50	–	–	–
TP104	0.00 – 2.05	–	2.05 – 3.00	–
TP105	0.00 – 1.30	–	1.30 – 3.00	–
TP106	0.00 – 1.40	–	1.40 – 2.80	–
TP107	0.00 – 0.40	–	0.40 – 3.00	–
TP108	0.00 – 0.30	–	0.30 – 2.80	–
WS101	0.00 – 0.25	–	0.25 – 5.45	–
WS102	0.00 – 2.39	–	–	–
WS103	0.00 – 1.10	–	1.10 – 5.45	–
WS104	0.00 – 0.90	–	0.90 – 5.45	–
WS105	0.00 – 0.35	–	0.35 – 5.45	–
WS106	0.00 – 0.25	–	0.25 – 5.45	–
WS106A	0.00 – 1.30	–	–	–
CP101	0.00 – 1.30	11.20 – 13.90	1.30 – 9.40 13.90 – 15.95	9.40 – 11.20

3.2. MADE GROUND

Made Ground deposits were encountered within all exploratory hole locations to depths of between 0.00 m and 2.39 m bgl. In three locations the full depth of Made Ground was not proven, although, in general, Made Ground was encountered to a depth of less than 1.00 m bgl.

Made Ground deposits comprise of dark grey very gravelly sand. Gravel is fine to coarse, angular to subrounded of brick in the majority of locations. A reworked topsoil of dark grey gravelly sand with frequent rootlets and gravel of concrete and brick was encountered in locations of soft standing in the eastern sector of the site.

A Depth of Made Ground Plan is presented as Drawing 16-218-006 in Appendix III.



3.3. DRIFT DEPOSITS

Drift deposits were encountered within the majority of exploratory locations, with the exception of two locations where the full depth of Made Ground could not be proven.

The drift deposits generally comprised a loose to medium dense light brown slightly gravelly fine to medium sand, where gravel is fine, subrounded to rounded sandstone.

In CP101, a sandy GRAVEL was recorded between 9.40 m and 11.20 m bgl.

3.4. SOLID GEOLOGY

The solid bedrock geology was not encountered in any exploratory locations.

3.5. GROUNDWATER

The depth of the groundwater strikes is shown on the exploratory hole records in Appendix V and is summarised in Table 3.2.

TABLE 3.2 SUMMARY OF GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS101	4.00	Strike in SAND
WS103	4.00	Strike in SAND
WS104	4.00	Strike in SAND
WS105	4.00	Strike in SAND
WS106	4.00	Strike in SAND
CP101	4.00	Strike in SAND

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

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

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

TABLE 3.3 SUMMARY OF VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
TP103	0.10	Made Ground	Clinker and ash
TP104	0.10	Made Ground	Clinker and ash
TP105	0.10	Made Ground	Clinker and ash
TP106	0.10	Made Ground	Clinker and ash
WS102	0.15	Made Ground	Clinker and ash
WS106A	0.10	Made Ground	Clinker and ash



3.7. SOIL CONSISTENCY

Due to ground conditions on site (granular) undrained shear strength values could not be measured using both field hand shear vane tests and laboratory undrained triaxial tests.

3.8. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations generally appeared to be stable during excavation.

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 were excavated with relative ease.



TABLE 3.4 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	Gravelly SAND	11	11.09	Medium Dense	N/A	N/A	N/A	110.89
	2.00	Gravelly SAND	10	9.14	Loose	N/A	N/A	N/A	91.35
	3.00	Gravelly SAND	8	6.96	Loose	N/A	N/A	N/A	69.57
	4.00	Gravelly SAND	9	7.60	Loose	N/A	N/A	N/A	76.03
	5.00	Gravelly SAND	10	8.30	Loose	N/A	N/A	N/A	82.96
WS102	1.00	MG: Gravelly Sand	8	8.07	Loose	N/A	N/A	N/A	80.65
	2.00	MG: Gravelly Sand	50	45.68	Dense	N/A	N/A	N/A	456.76
WS103	1.00	Gravelly SAND	9	9.07	Loose	N/A	N/A	N/A	90.73
	2.00	Gravelly SAND	10	9.14	Loose	N/A	N/A	N/A	91.35
	3.00	Gravelly SAND	9	7.83	Loose	N/A	N/A	N/A	78.26
	4.00	Gravelly SAND	10	8.45	Loose	N/A	N/A	N/A	84.48
	5.00	Gravelly SAND	11	9.13	Loose	N/A	N/A	N/A	91.25
WS104	1.00	Gravelly SAND	9	9.07	Loose	N/A	N/A	N/A	90.73
	2.00	Gravelly SAND	7	6.39	Loose	N/A	N/A	N/A	63.94
	3.00	Gravelly SAND	9	7.83	Loose	N/A	N/A	N/A	78.26
	4.00	Gravelly SAND	6	5.07	Loose	N/A	N/A	N/A	50.69
	5.00	Gravelly SAND	9	7.47	Loose	N/A	N/A	N/A	74.66



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)*
WS105	1.00	Gravelly SAND	10	10.08	Medium Dense	N/A	N/A	N/A	100.81
	2.00	Gravelly SAND	10	9.14	Loose	N/A	N/A	N/A	91.35
	3.00	Gravelly SAND	19	16.52	Medium Dense	N/A	N/A	N/A	165.23
	4.00	Gravelly SAND	13	10.98	Medium Dense	N/A	N/A	N/A	109.83
	5.00	Gravelly SAND	13	10.79	Medium Dense	N/A	N/A	N/A	107.85
WS106	1.00	Gravelly SAND	9	9.07	Loose	N/A	N/A	N/A	90.73
	2.00	Gravelly SAND	9	8.22	Loose	N/A	N/A	N/A	82.21
	3.00	Gravelly SAND	10	8.70	Loose	N/A	N/A	N/A	86.96
	4.00	Gravelly SAND	8	6.76	Loose	N/A	N/A	N/A	67.58
WS106	5.00	Gravelly SAND	9	7.47	Loose	N/A	N/A	N/A	74.66
WS106A	1.00	MG: Gravelly sand	50	50.41	Very Dense	N/A	N/A	N/A	504.07
CP101	1.00	MG: Gravelly sand	14	14.11	Medium Dense	N/A	N/A	N/A	141.14
	2.00	Gravelly SAND	9	8.22	Loose	N/A	N/A	N/A	82.21
	3.00	Gravelly SAND	10	8.70	Loose	N/A	N/A	N/A	86.96
	4.00	Gravelly SAND	11	9.29	Loose	N/A	N/A	N/A	92.93
	5.00	Gravelly SAND	9	7.47	Loose	N/A	N/A	N/A	74.66
	6.50	Gravelly SAND	8	6.53	Loose	N/A	N/A	N/A	65.31
	8.00	Gravelly SAND	8	6.48	Loose	N/A	N/A	N/A	64.75



Green Lane, Heywood

Phase II Geoenvironmental Site Assessment

October 2022

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	9.50	Sandy GRAVEL	28	22.57	Medium Dense	N/A	N/A	N/A	225.66
	11.00	Sandy GRAVEL	15	11.60	Medium Dense	N/A	N/A	N/A	116.00
	12.50	CLAY	12	8.77	N/A	Medium Strength	Stiff	43.84	90.13
	14.00	Gravelly SAND	13	9.01	Loose	N/A	N/A	N/A	90.05
	15.00	Gravelly SAND	18	11.86	Medium Dense	N/A	N/A	N/A	118.56

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 3.5. The full results can be found in Appendix VIII.

TABLE 3.5 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP101	0.80 (Made Ground)	0	1	3	96
TP104	0.60 (Made Ground)	32	28	5	35
TP105	0.70 (Made Ground)	34	23	5	38
TP107	1.00 (Natural)	0	2	2	96
TP108	1.20 (Natural)	0	1	2	97

3.10. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.6, show the clay to be of predominantly low plasticity with discrete areas of moderate plasticity clay.

TABLE 3.6 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
CP101	12.50	18	15	29	14	97	13.54	Low

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

3.11. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix V (summarised in Table 3.7), 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 3.7 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP103	0.80	0.022	9.2	DS-1, AC-1s
TP104	1.30	0.023	7.9	DS-1, AC-1s
TP105	0.80	0.03	7.3	DS-1, AC-1s
TP108	0.50	0.0063	8.2	DS-1, AC-1s
WS106	1.50	0.0041	8.4	DS-1, AC-1s
CP101	0.60	0.041	11.8	DS-1, AC-1s



4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. DEVIATING SAMPLES

Deviating samples were to be avoided during the ground investigation by using best practice sampling procedures including use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis undertaken.

No samples were noted to be deviating.

4.2. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 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).

In the absence of any private gardens, E3P has used the thresholds for Residential without homegrown produce (plant uptake).

Where Tier 1 screening values are not provided by LQM, other screening values have been used and these are referenced in Table 4.1.

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



TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A RESIDENTIAL END USE WITHOUT HOMEGROWN PRODUCE

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	40	6	61	TP105 0.80m	1	Further Action
Cadmium	mg/kg	85	6	0.3	N/A	1	No Further Action
Chromium (VI)	mg/kg	6	6	< 1.8	N/A	1	No Further Action
Lead	mg/kg	310	6	410	TP104 1.30m	1	Further Action
Mercury	mg/kg	1.2	6	0.6	N/A	4	No Further Action
Nickel	mg/kg	180	6	39	N/A	1	No Further Action
Selenium	mg/kg	430	6	< 1.0	N/A	1	No Further Action
Copper	mg/kg	7100	6	150	N/A	1	No Further Action
Zinc	mg/kg	40000	6	310	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	6	< 1.0	N/A	1	No Further Action
Phenols – Total	mg/kg	210	6	< 1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	6	0.096% 0.006%	TP103 0.80m TP104 1.30m	3	Further Action
Naphthalene	mg/kg	2.3	6	<0.05	N/A	4	No Further Action
Acenaphthylene	mg/kg	2900	6	<0.05	N/A	2	No Further Action
Acenaphthene	mg/kg	3000	6	0.94	N/A	1	No Further Action
Fluorene	mg/kg	2800	6	0.68	N/A	1	No Further Action
Phenanthrene	mg/kg	1300	6	7.3	N/A	2	No Further Action
Anthracene	mg/kg	31000	6	2.0	N/A	2	No Further Action
Fluoranthene	mg/kg	1500	6	12	N/A	2	No Further Action
Pyrene	mg/kg	3700	6	10	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	11	6	6.9	N/A	2	No Further Action
Chrysene	mg/kg	30	6	4.1	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	3.9	6	5.1	TP103 0.80m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	110	6	2.9	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	3.2	6	5.7 4.1	TP103 0.80m TP104 1.30m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	45	6	2.2	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.31	6	0.61 0.55	TP103 0.80m TP104 1.30m	2	Further Action
Benzo(ghi)Perylene	mg/kg	360	6	2.6	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	6	< 1.0	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	6	< 0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	6	< 0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	130	6	<2.0	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	1100	6	10	N/A	4	No Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
TPH C21-C35 (aromatic)*	mg/kg	65000	6	130	N/A	1	No Further Action

Notes

Main exposure pathways: 1 = soil ingestion, 2 = dermal contact and ingestion, 3 = dust inhalation, 4 = vapour inhalation (indoor).

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 a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

Referring to Table 4.1, the result of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

- ☛ Lead;
- ☛ Arsenic;
- ☛ Benzo(b)Fluoranthene;
- ☛ Benzo(a)Pyrene;
- ☛ Dibenzo(a,h)Anthracene; and
- ☛ Chrysotile and Amosite.

Asbestos in the form of loose chrysotile fibres has been identified in the granular Made Ground at TP103, and loose chrysotile and amosite fibres in the granular Made Ground at TP104.

The laboratory analysis confirms the assessment within the initial conceptual site model that the main constituents of concern were likely to be asbestos, PAHs, hydrocarbon compounds and heavy metals.

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);
 - Dermal contact and ingestion;
 - Consumption of homegrown vegetables; and
 - Fibre/dust inhalation.

The exceedances for all determinants are associated with shallow Made Ground deposits at depth of between 0.80 m to 1.30 m.



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 The historical construction and redevelopment activities (construction and demolition of former buildings and possible cut/fill earthworks) on-site have given rise to Made Ground which contains localised exceedances of inorganic heavy metals and polycyclic aromatic hydrocarbons (PAHs). The Made Ground has been identified across the majority of the site.		High
Pathway		
Vertical Migration The site has been noted to be underlain by high permeability SILT, SAND AND GRAVEL, which will facilitate the migration of any contaminants, if present.		High
Lateral migration Lateral migration of contaminants is considered possible due to the presence of granular alluvium deposits across the site.		Medium
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary A aquifer.	Medium
Aquifer Classification in Bedrock	Secondary A aquifer.	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected by a Groundwater Source Protection Zone.	Low
Distance to the Closest Groundwater Abstraction Point	None identified within a 1 km radius.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	None identified within a 50 m radius	Low
The ICSM developed within the context of the site setting has identified a viable pollutant pathway, which would be the downward migration of potentially mobile phase-soluble contaminants towards the underlying Secondary A 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 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 recorded concentrations either below or only slightly elevated above the laboratory LOD at the majority of locations, with concentrations of 48.9 mg/kg and 62.6 mg/kg at TP104 and TP103 respectively.	None
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	All concentrations are below the laboratory LOD.	None
C12-C16 > 50 mg/kg	All concentrations are below the laboratory LOD.	None
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	Naphthalene has been not identified at concentrations greater than 2 mg/kg.	None
Total PAH > 10 mg/kg	Concentrations of low-solubility PAH compounds greater than 10 mg/kg have not been detected in the soil analysis.	None
PCB > 1 mg/kg	A former electricity substation is located on the eastern boundary of the site. Further PCB analysis will be required in this area prior to development.	None
Heavy metals > 500 mg/kg	Concentrations of heavy metals are all below 500mg/kg.	None

The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground to drinking water standards (DWS), and where unavailable environmental quality standards (EQS), due to the primary controlled waters receptor being the underlying Secondary A Aquifer.

No shallow groundwater has been recorded at the site and no samples were able to be obtained for analysis.

These are presented in Table 4.4.



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

DETERMINAND	UNIT	EQS ^{1,2,3}	DWS ^{3,4,5}	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
Arsenic	µg/l	50	10	3	4.7	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	22	CP101 (EQS)	Further Action
Chromium (III)	µg/l	4.7	50	3	22	N/A	Further Action
Copper	µg/l	1	2000	3	13	N/A	Further Action
Total Cyanide	µg/l	1	50	3	<1.0	N/A	No Further Action
Lead	µg/l	1.2	10	3	3.3	N/A	Further Action
Mercury	µg/l	–	1.0	3	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	3	3.1	N/A	No Further Action
Selenium	µg/l	–	10	3	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	3	12	TP103 (EQS) TP105 (EQS)	Further Action
pH		6–9		3	12.5	CP101	Further Action
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
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
TPH C5-C6 (benzene)	µg/l	10	1	3	< 1.0	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1, 2, 3}	DWS _{3,4,5}	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA					
TPH C6-C8 (toluene)	µg/l	74	700	3	< 1.0	N/A	No Further Action
TPH C8-C10 (ethyl benzene)	µg/l	20	300	3	< 1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	500	3	< 10	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	500	3	< 10	N/A	No Further Action
TPH C12-C16	µg/l	2	90 ⁵	3	< 10	N/A	No Further Action
TPH C16-C35	µg/l	50#	90 ⁵	3	< 10	N/A	No Further Action
TPH C5-C6	µg/l	–	15000	3	< 1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	15000	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

Notes

Solubility <0.01µg/l

AA – Annual Average

MAC- Maximum Admissible Concentration

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

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

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
5. WHO Guidelines for Drinking Water Quality. Third edition (2004)



4.3.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that the leachate data exceeds the EQS values (where DWS values absent) for the following inorganic compounds:

-  Chromium (VI);
-  Zinc; and
-  pH.

Exceedances in heavy metals against EQS screening values have been identified in three locations across the site within leachate samples at TP103, TP105 and CP101.

No shallow groundwater samples were obtained from the environmental monitoring wells.

4.3.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

Marginally exceedances of the EQS values for heavy metals (chromium VI and zinc) were recorded within the leachate analysis completed on three Made Ground samples. However, there are no surface watercourses within influencing distance of the site.

The sensitive receptor is therefore the underlying Secondary A Aquifer. The site is typically underlain by granular soils which will offer little protection to the underlying Secondary A Aquifer. However, the overall risk to the aquifer is considered to be low as no exceedances of the DWS have been identified and the proposed development will create a wider area of hardstanding which will reduce infiltration.

E3P does not consider there to be a complete pollutant linkage, and therefore the site is not considered to pose an unacceptable level of risk to the underlying Secondary A Aquifer.

4.4. GROUND GAS RISK ASSESSMENT METHODOLOGY

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

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

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

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



The following equation should be utilised:

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

Where:

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

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

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

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

TABLE 4.5 SITE CHARACTERISATION BY GSV (BS8485:2015)

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

Notes

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

4.5. MONITORING METHODOLOGY

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

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



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

In addition to the raw data, the results for each standpipe have been assessed with reference to guidance provided in BS8485:2015. 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	Natural SAND Drift	29/07/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.5	1003	Falling	0.10	0.10	1.00 – 4.00	3.85	3.72
		18/08/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	996	Rising	0.10	0.10		3.85	3.75
		13/09/22	0.10	0.10	0.0001	0.10	0.10	0.0001	20.6	1001	Falling	0.10	0.10		3.85	3.50
WS102	Made Ground	29/07/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	1003	Falling	0.10	0.10	1.00 – 2.00	1.32	Dry
		18/08/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	997	Rising	0.10	0.10		1.32	Dry
		13/09/22	0.10	0.10	0.0001	0.10	0.10	0.0001	20.5	1001	Falling	0.10	0.10		1.35	Dry
WS103	Made Ground	29/07/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.5	1003	Falling	0.10	0.10	0.10 – 1.00	1.05	Dry
		18/08/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	996	Rising	0.10	0.10		1.05	Dry
		13/09/22	0.10	0.10	0.0001	0.10	0.10	0.0001	20.6	1001	Falling	0.10	0.10		1.05	Dry
WS105	Natural SAND Drift	29/07/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	1005	Falling	0.10	0.10	1.00 – 4.00	3.98	Dry
		18/08/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	997	Rising	0.10	0.10		3.98	Dry
		13/09/22	0.10	0.10	0.0001	0.10	0.10	0.0001	20.6	1001	Falling	0.10	0.10		3.98	Dry
WS106	Natural SAND Drift	29/07/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	1003	Falling	0.10	0.10	1.00 - 4.00	3.72	Dry
		18/08/22	0.10	0.10	0.0001	0.10	0.10	0.0001	18.6	996	Rising	0.10	0.10		3.79	Dry
		13/09/22	0.10	0.10	0.0001	0.10	0.10	0.0001	20.6	1001	Falling	0.10	0.10		3.79	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

During the monitoring visits to date, the wells have been noted as dry.

Water was recorded in the base of WS101, however, this is likely to be water which has collected in the well from runoff and is not representative of wider groundwater levels.

4.6.2. BAROMETRIC PRESSURE

To date, two visits have been completed during falling atmospheric.

Visit 2 was completed during a low but rising pressure episode.

4.6.3. GAS FLOW

Flow rates have been recorded to be less than 0.10 l/hr (limit of detection of the analyser) to date.

4.6.4. GAS CONCENTRATIONS

Methane has been recorded to be less than 0.10% v/v (limit of detection of the analyser) to date.

Carbon dioxide has been recorded to be less than 0.10% v/v (limit of detection of the analyser) to date.

4.7. 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	29/07/22	3.72	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	18/08/22	3.75	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	13/09/22	3.50	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
WS102	29/07/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	18/08/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	13/09/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
WS103	29/07/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	18/08/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	13/09/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
WS105	29/07/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	18/08/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	13/09/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
WS106	29/07/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	18/08/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A
	13/09/22	Dry	0.10	0.10	0.0001	0.10	0.0001	CS1	N/A

The following should also be considered:

- ✿ The site is underlain by predominantly natural granular deposits;
- ✿ Made Ground is typically recorded to depths of less than 1.50 m bgl;
- ✿ No alluvial or peat strata have been recorded at the site;
- ✿ No landfill sites have been identified within a 250 m radius of the site;
- ✿ The site does not require radon protection measures;
- ✿ Concentrations of methane are all below the 1% threshold; and
- ✿ Concentrations of carbon dioxide are typically below the 5% threshold.

In summary, the site currently has a low gas generation potential. Importantly there is no evidence of material that could cause surface emissions of gas out of the ground in large volumes.

In light of the above, the ground gas assessment confirms that the site can be classified as CS1, and E3P consider that gas protection measures will not be required.

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.



4.8. POTABLE WATER SUPPLY

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

TABLE 4.8 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	<1.0
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	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	12
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	208
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	N/A
Ethers*	0.5	N/A
Nitrobenzene*	0.5	N/A
Ketones*	0.5	N/A
Aldehydes*	0.5	N/A
Amines	Fail	N/A
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	None identified.	
Is free product present in soil and groundwater?	None identified.	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No hydrocarbon impact has been identified at depth.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	Currently unknown.	
Will soils be imported to site as part of any future earth works	Site levels will likely need to be raised as part of a phase of enabling works. 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 unlikely that barrier pipe will be required at the proposed development.



4.9. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.9 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: Elevated concentrations of heavy metals and non-volatile PAHs have been identified in Made Ground deposits between depths of 0.80 m and 1.30 m at TP103 and TP104. Further exceedances within the Made Ground cannot be discounted. Recommendation: To remove the pathway of direct contact for future site users, a suitable clean cover system to landscaped areas will prevent exposure. Construction works should be completed with PPE and the provision of welfare to ensure exposure and direct contact with impacted materials is at a minimum.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	High	LOW
Assessment: Asbestos in the form of loose chrysotile and amosite fibres has been identified in the granular Made Ground in TP103 at 0.80 m bgl, and TP104 at 1.30 m bgl quantified between 0.006% and 0.096%. Recommendation: As only fibres have been encountered, impacted soils and Made Ground will need to be placed in accordance with the asbestos conceptual site model with a suitable cover system placed in landscaped areas to prevent exposure to future site users.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
A hotspot removal should be completed in areas in which asbestos quantification is greater than 0.001%. Risks from ACM can be mitigated through the development of a detailed enabling works strategy following guidance and protocol specified within the Control of Asbestos Regulations (2012) and industry best practice as detailed in CIRIA733 (Asbestos in Soil and Made Ground: A guide to understanding risk). Construction works must be completed with appropriate PPE/RPE and the provision of adequate welfare facilities for site workers.						
PL4	Methane, carbon dioxide (Made Ground)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Low likelihood	Moderate	LOW
Assessment: Preliminary ground gas monitoring has characterised the site as CS1 with areas of Made Ground. Recommendation: Full ground gas protection measures are to be confirmed following completion of the monitoring regime.						
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 (Secondary A Aquifer)	Likely	Low	LOW
Assessment: Given the absence of exceedances of the DWS screening thresholds and a likely absence of complete pollutant linkages, the site is not considered to pose an unacceptable level of risk to the underlying Secondary A Aquifer..						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Likely	Moderate/Low	LOW
Assessment: The soil analysis indicates the materials 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	Low	LOW
Assessment: No 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 standard PE pipe will be suitable. This will need to be confirmed with a UKWIR risk assessment post remediation and enabling works.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	LOW
Assessment: Contamination has been encountered within shallow Made Ground across the site which may be taken up by flora in soft landscaping.						
Recommendation: Installation of a clean cover system within any areas of soft landscaping to prevent plant uptake of contaminants.						

Main exposure pathways:

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation; PL4/5 = Vertical / Lateral Migration; PL6 = Corrosion of concrete; PL7=Tainting of water supply; PL8 = Uptake by plants.



5. GEOTECHNICAL ASSESSMENT

5.1. PROPOSED DEVELOPMENT

The Challenger Group intends to construct a 5-storey block of apartments with car parking at ground floor level and residential accommodation above including a mix of 1 and 2 bedroom apartments. The scheme will include soft landscaping and adopted utility infrastructure.

5.2. SITE PREPARATION

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

- ✦ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill;
- ✦ Removal of all concrete hardstanding;
- ✦ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill;
- ✦ No invasive plant species have been identified on-site. If identified during future works, this material and the infested soils will require treatment/removal by a suitably qualified contractor;
- ✦ Buried structures and old foundations are anticipated. These should be excavated from below the proposed development footprint with the resulting void backfilled.

5.3. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

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

The results of this assessment are summarised in Table 5.1.



TABLE 5.1 SUMMARY OF ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
SAND	1.00 – 1.45	Loose to Medium Dense	90 – 100
	2.00 – 2.45		63 – 91
	3.00 – 3.45		70 – 165
	4.00 – 4.45		50 – 104
	5.00 – 5.45		74 – 107
SAND (CP101)	6.00 – 8.45	Loose	64 – 65
GRAVEL (CP101)	9.00 – 11.45	Medium Dense	116 – 225
SAND (CP101)	14.00 – 15.45	Loose to Medium Dense	90 – 118
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Stiff CLAY	12.5	43.84	90.13

The Made Ground is not considered a suitable founding stratum due to the unquantifiable potential for long term and differential settlement. Deeper Made Ground (>2.00 m bgl) has been recorded locally, however, Made Ground deposits are typically recorded to a depth of c. 1.00 m bgl.

The loose to medium dense SAND deposits typically offer an ABP of less 70 to 100 kN/m² at depths of 2.00-8.00 m bgl.

Furthermore, no shallow groundwater was encountered. However, if the sands at depth (>4.00m bgl) are saturated, this would further reduce the ABP of this material and should be considered.

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 medium dense SAND or GRAVEL.

It is not possible to accurately define the foundation types at this stage due to the absence of finished floor levels (FFLs). In addition, a phase of enabling works will be required to remove the existing hardstand, any relict foundations and substructures.

Due to local deeper areas of Made Ground and loose natural granular soils within the upper 5.00-8.00m of the site, consideration should be given to the use of piled foundations capable of transferring the structural loads to competent strata.

A deeper borehole may be required to confirm the set depth for a piled foundation.

The final foundation solution will be dependent on the structural loadings, and elevation and should be designed by a suitably qualified structural engineer.



5.4. GROUND FLOOR SLABS

Following enabling works, the site will likely have a variable thickness of Made Ground, that may extend to significant depth in places. Given the structure that is proposed, it is considered that a ground-bearing floor slab will require settlement analysis and detailed design in order to accommodate variability of the formation and account for differential settlement.

In order to accommodate for differential settlement and slab failure, it is recommended that further Plate Load Testing is undertaken on the natural sub-grade to understand settlement characteristics and inform a geotechnical design specification in order to engineer to the required level to support a proposed ground bearing slab.

Given the depth of Made Ground and its loose/variable nature, it will be necessary to undertake some form of Ground Improvement work to ensure the total and differential settlement is within tolerable limits for the Uniformly Distributed Load of the floor slab and any external hardstanding.

A traditional solution comprises the excavation of the upper stratum of Made Ground prior to re-engineering and compaction as a structural upfill be considered. Limitations with this approach would be attributed to the inherent variability of the material and issues arising from fluctuations in moisture content, which are exaggerated during periods of seasonal variance with increased precipitation and reduced evaporation.

It would also be possible to utilise soil stabilisation techniques that incorporate the addition of lime and OPC to construct a stiffened soil horizon with a CBR >15% to constitute a sub-base replacement layer that could then be capped with Type 1 MOT.

5.5. HEAVE PRECAUTIONS

The site is underlain by significant depths of granular soils and therefore heave precautions directly overlying these areas are not required.

5.6. HIGHWAYS CONSTRUCTION

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

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

Compressible Made Ground represents a significant risk associated with consolidation inducing unacceptable total and differential settlement to roads and infrastructure. This material, if encountered, will require removal in its entirety from beneath all proposed roads, car parks and external hardstanding.

5.7. DRAINAGE

Considering the significant volumes of permeable granular soils underlying the site, it is considered that soakaway drainage will likely be suitable for the proposed development.

Full BRE365 soakaway tests would be required to confirm this.



However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaway drainage should be designed in accordance with BRE Special Digest 365 – Soakaway Design.

5.8. CONCRETE DURABILITY

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

5.9. EXCAVATIONS

Window sample and cable percussive probeholes were advanced with ease through the natural strata and based on the ground conditions recorded within the boreholes, it is considered that near-surface excavations will be feasible.

TABLE 5.2 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	Groundwater strikes were noted at 4.00m bgl during the drilling process.
Shallow Bedrock	No	No shallow bedrock has been identified at the site.

5.10. SLOPE STABILITY

Due to the topography of the site and in consideration of the proposed development scheme, a slope stability assessment is not deemed necessary.



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 the 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	Site	20	Elevated concentrations for contaminants of concern have been recorded in the analysis to date. The site will be largely capped and require a cover system in any areas of soft cover.
Bedrock	N/A	N/A	No shallow bedrock encountered.
Obstructions	Site	50	Subsurface obstructions have been noted in the south of the site and further obstructions cannot be discounted. These will require removal in their entirety in order to create a suitable development platform.
Artificially Levelled and Filled Platforms	All	100	The site appears to have been levelled and artificially backfilled.
Retaining Walls	N/A	N/A	None identified on-site.
Trench Collapse	All	100	The shallow Made Ground and natural granular soils are likely to be loosely compacted and possibly prone to collapse. Furthermore, deeper excavation may be susceptible to trench collapse.
Mature trees	N/A	N/A	There are no mature trees present within the site boundary.
Volume Change Potential Clay	N/A	N/A	The site is proven to be underlain by granular soils.
Peat	N/A	N/A	None identified.
Running Sands	N/A	N/A	Data searches indicate Low Risk.
Ground Dissolution	N/A	N/A	Data searches indicate No Hazard.
Concrete Design	Site	All	Concrete classification determined as DS-1 AC1s
Low-Permeability Ground	N/A	N/A	The underlying natural sand and gravel are likely be to highly permeable.
Services / Sensitive structures	Site	All	Service infrastructure is noted within Green Lane, Roeacre Street and Rochdale Road East surrounding the site.
Abnormal Foundation Solutions	Site	All	Due to loosely compacted granular soils, a piled foundation will likely be required.
Areas not Investigated	N/A	N/A	N/A



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:

-  A deeper borehole may be required to inform the set depth for pile design;
-  Foundations to be designed by suitably qualified Structural Engineer;
-  Geotechnical Earthworks Strategy (Infrastructure); and
-  Remediation and Enabling Works Strategy.



6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

Human Health	The Tier I assessment identified exceedances of heavy metals, non-volatile PAH compounds and asbestos in the Made Ground. Asbestos has been identified within the shallow Made Ground, as such it will be necessary to carefully manage these impacted soils and place them in a legislatively compliant manner to negate any possibility of future exposure. In respect to the non-volatile PAHs and heavy metals, external areas will be covered by hard-standing or a chemically suitable cover system within all soft landscaped areas thereby removing the exposure pathway to future site users. It is possible that as yet unidentified contaminant impact is present within localised hotspots. It is considered that any such contamination could be addressed by the delineation, excavation and treatment of impacted soils.
Controlled Waters	The site is not considered to pose an unacceptable risk to controlled waters.
Ground Gas	Characteristic Situation 1; as such gas protection measures are not required.
Potable Water	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

The Made Ground is not considered a suitable founding stratum due to the unquantifiable potential for long-term and differential settlement. Deeper Made Ground (>2.00m bgl) has been recorded locally, however, Made Ground deposits are typically recorded to depth of c. 1.00m bgl.

The loose to medium dense SAND deposits typically offer an ABP of less 70 to 100 kN/m² at depths of 2.00-8.00 m bgl. Due to local deeper areas of Made Ground and loose natural granular soils within the upper 5.00-8.00m of the site, consideration should be given to the use of piled foundations capable of transferring the structural loads to competent strata. A deeper borehole may be required to confirm this.

The final foundation solution will be dependent on the structural loadings, elevation and should be designed by a suitably qualified structural engineer.

The site is not located in an area of historic mine workings or ground instability and the risk of future subsidence is considered to be very low.

The presence of significant depths of granular deposits underlying the site indicates that soakaway drainage will likely be suitable for the proposed development.

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



Green Lane, Heywood

Phase II Geoenvironmental Site Assessment

October 2022

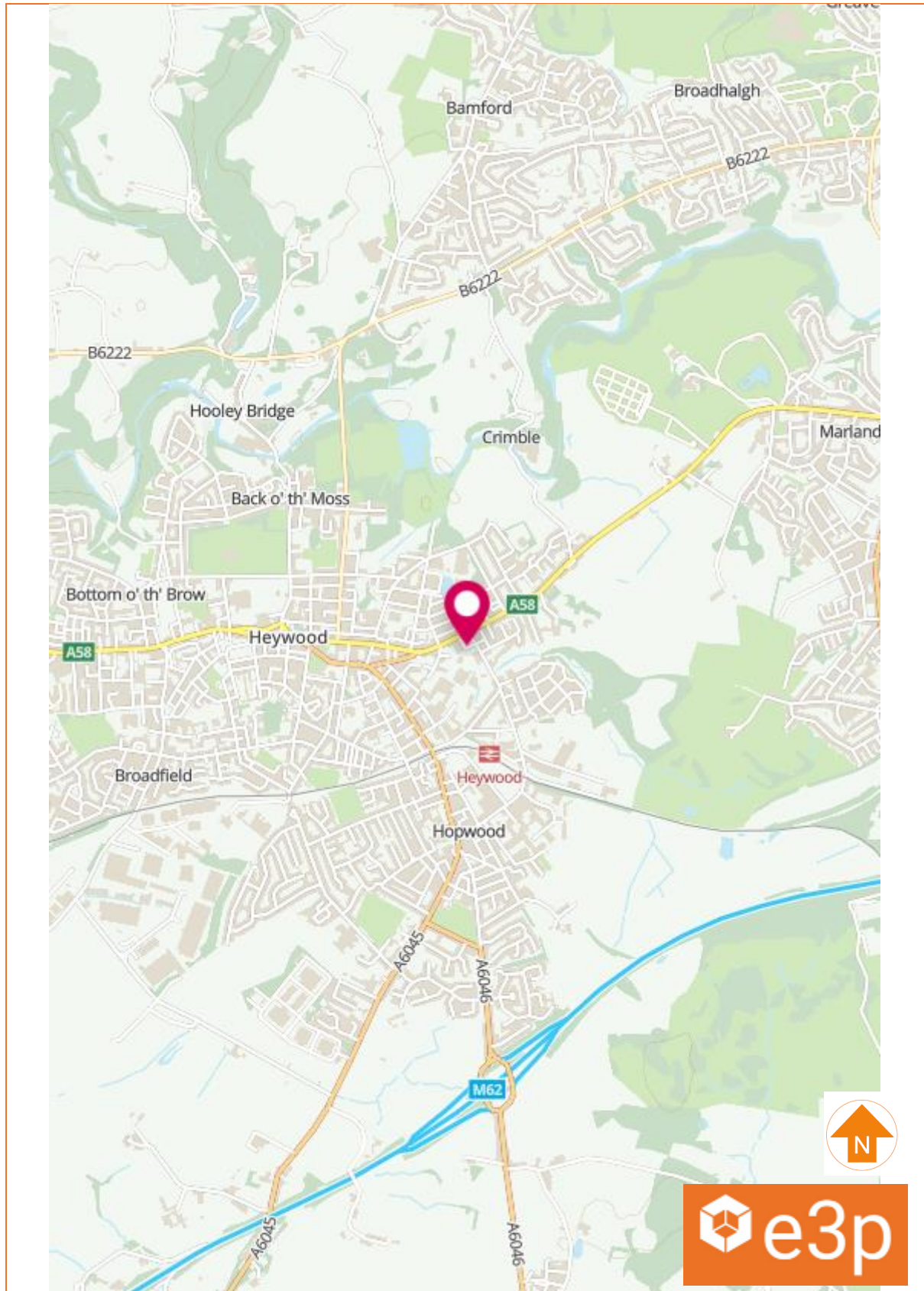
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance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

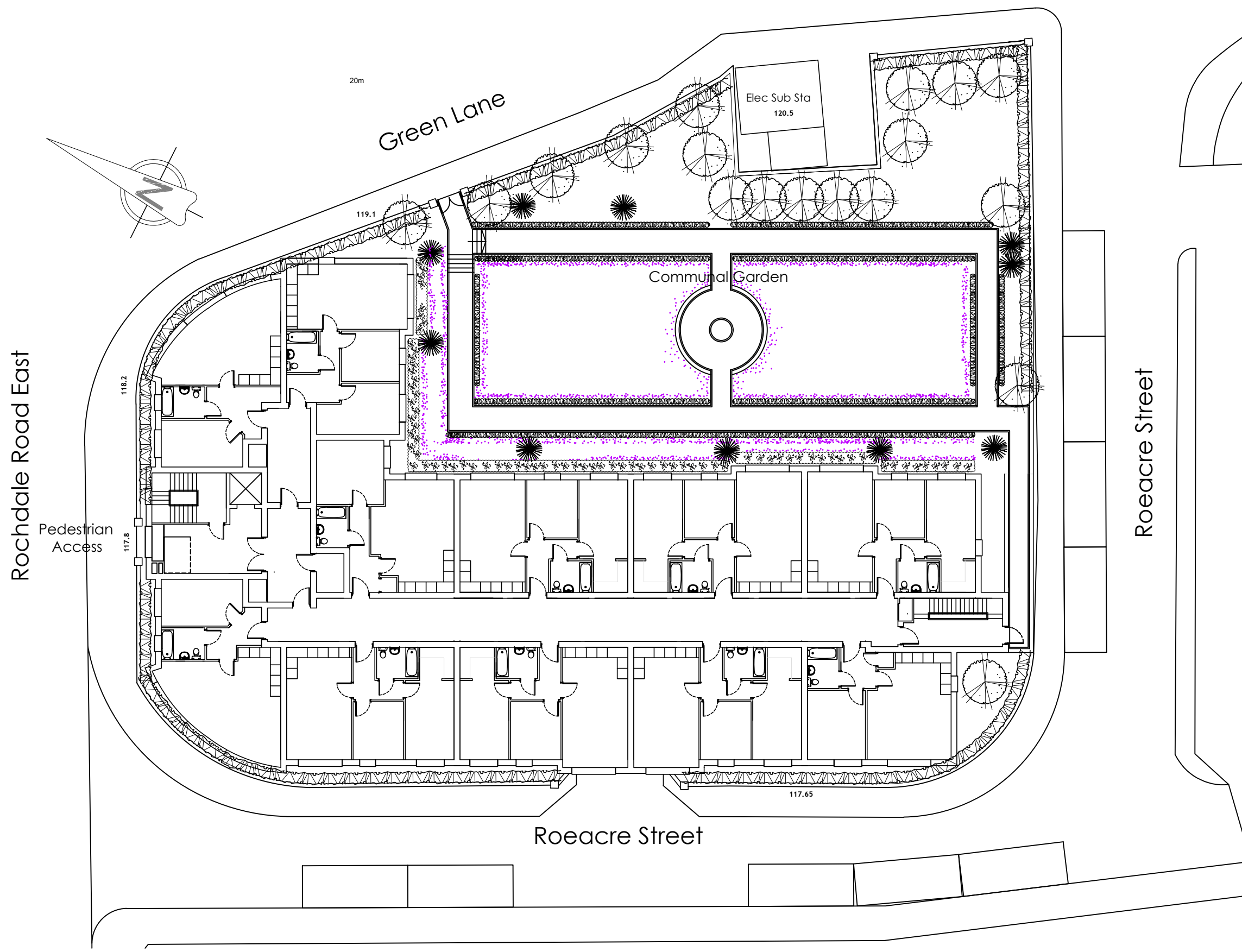


APPENDIX III

DRAWINGS

DRAWING 16-218-001 – SITE LOCATION PLAN





Notes:				
P1	REVA	20.09.2022	EB	NG
Phase	Issue	Date	Drawn	Checked

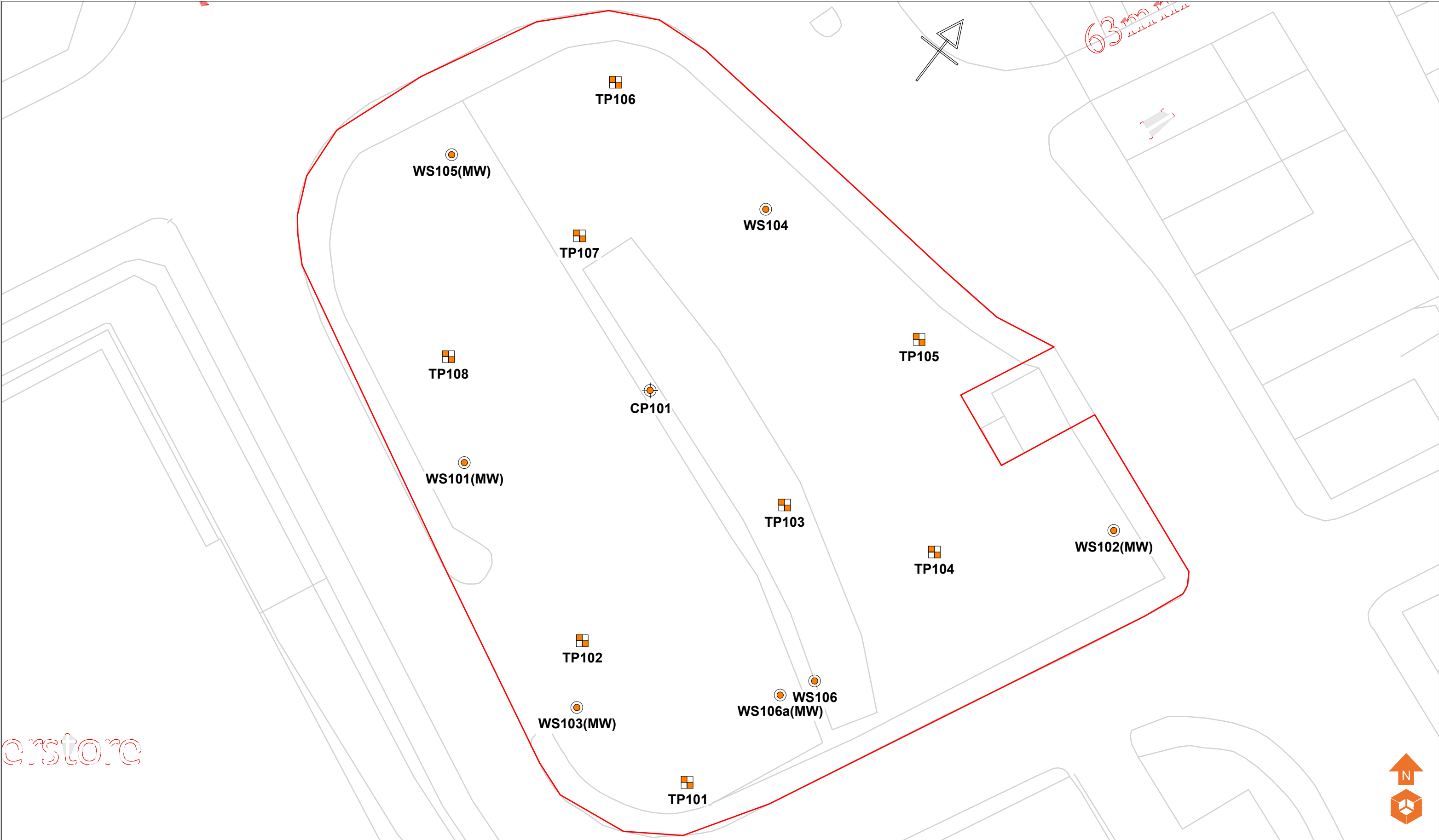
Client:	Challenger Building Serviced Ltd
Job Title:	Green Lane, Heywood

Job No:	16-218	Date:	20.09.2022
Drawing No:	002	Scale:	NTS@ A3
Drawing Title:	Proposed Development Plan		

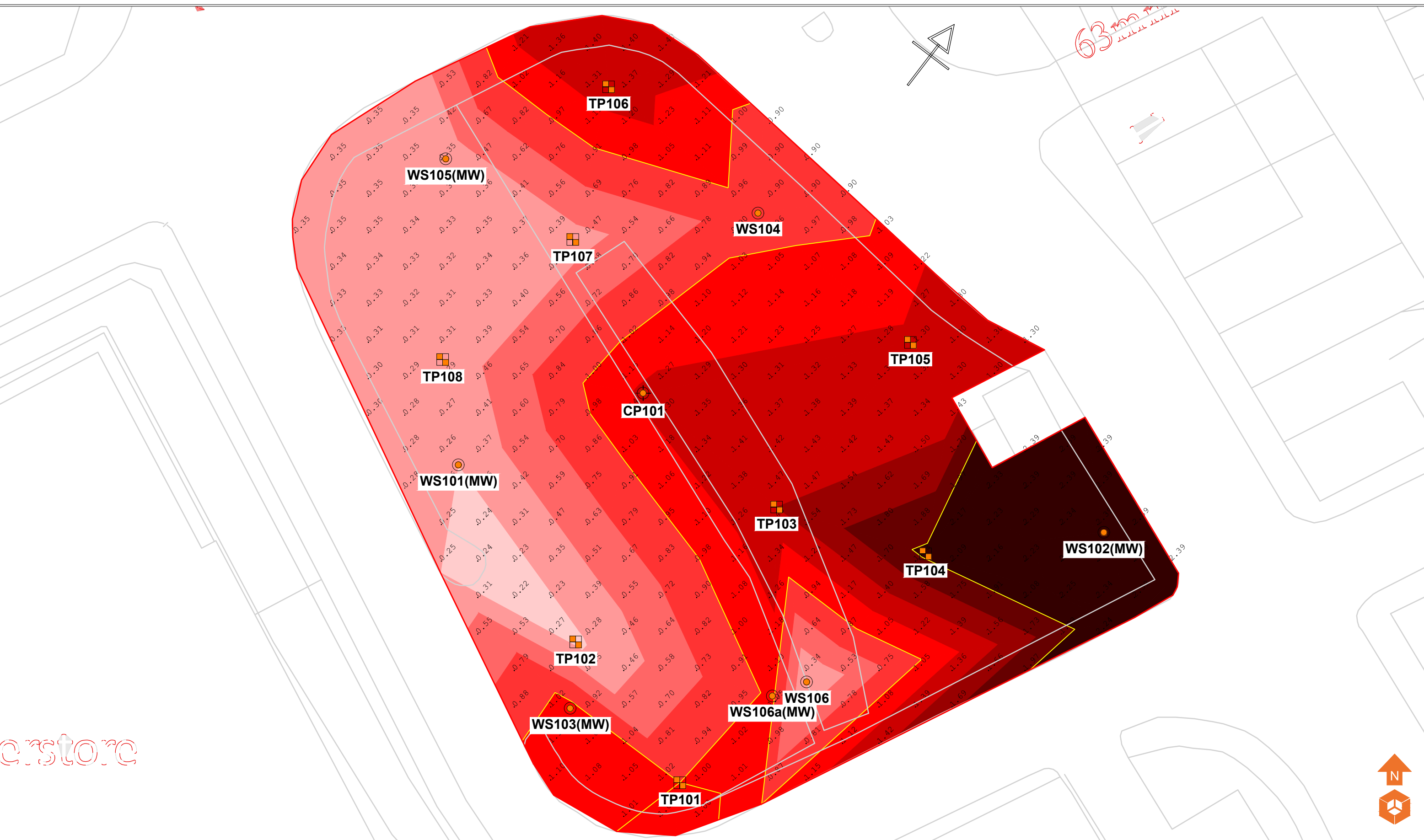


Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



Location Symbols  WSP101 Approximate Window Sample Probehole Location  WSP1000 Approximate Window Sample Probehole Location with Install  TP101 Approximate Trial Pit Location  CP101 Approximate Cable Percussive Borehole Location					Notes:					Client: Challenger Building Serviced Ltd		Job No: 16-218		Date: 20.09.2022		Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk												
										Drawing No: 005		Scale: NTS@ A3																
<table><tr><td>P1</td><td>REVB</td><td>20.09.2022</td><td>EB</td><td>NG</td></tr><tr><td>P1</td><td>REVA</td><td>25.07.2022</td><td>EB</td><td>AS</td></tr><tr><td>Phase</td><td>Issue</td><td>Date</td><td>Drawn</td><td>Checked</td></tr></table>					P1	REVB	20.09.2022	EB	NG	P1	REVA	25.07.2022	EB	AS	Phase			Issue	Date	Drawn	Checked	Job Title: Green Lane, Heywood					Drawing Title: Exploratory Hole Location Plan	
P1	REVB	20.09.2022	EB	NG																								
P1	REVA	25.07.2022	EB	AS																								
Phase	Issue	Date	Drawn	Checked																								



Location Symbols

- Approximate Window Sample Probehole Location
- Approximate Window Sample Probehole Location with Install
- Approximate Trial Pit Location
- Approximate Cable Percussive Borehole Location

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.24m
- Depth of Made Ground 0.25 - 0.49m
- Depth of Made Ground 0.50 - 0.74m
- Depth of Made Ground 0.75 - 0.99m
- Depth of Made Ground 1.00 - 1.24m
- Depth of Made Ground 1.25 - 1.49m
- Depth of Made Ground 1.50 - 1.74m
- Depth of Made Ground 1.75 - 1.99m
- Depth of Made Ground >2.00m

Notes:

P1	REVA	20.09.2022	EB	NG
Phase	Issue	Date	Drawn	Checked

Client:

Challenger Building
Serviced Ltd

Job Title:

Green Lane,
Heywood

Job No:	16-218	Date:	20.09.2022
Drawing No:	006	Scale:	NTS@ A3
Drawing Title:		Depth of Made Ground Plan	

Environmental Engineering
Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

APPENDIX IV

PHOTOGRAPHS

PLATE 1 HISTORIC FOUNDATIONS PRESENT WITHIN TP106



PLATE 2 SAND PRESENT UNDER HARDSTANDING - WESTERN SECTOR OF SITE



PLATE 3 MADE GROUND PRESENT WITHIN TP103



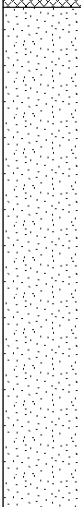
PLATE 4 SUBSTATION PRESENT ALONG THE EASTERN BOUNDARY OF THE SITE



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood	Dimensions (m): Depth 3.00		Scale 1:30
Client: Challenger Building Services Ltd	0.70 		Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.15	ES		0.07			MADE GROUND: Asphalt.	
				0.30			MADE GROUND: Dark brown gravelly sand. Gravel is fine to coarse angular to subrounded of brick and concrete.	
	0.80 0.80	B ES		1.00			MADE GROUND: Light brown gravelly sand with occasional cobbles. Gravel is fine to coarse angular to subrounded of brick. Cobbles are angular of brick.	
				3.00			Light brown slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	1
							End of Pit at 3.00m	3
								4

Trial Pit Photographs



Trial Pit 101



Trial Pit 101 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood		Dimensions (m): 2.00	Scale 1:30
Client: Challenger Building Services Ltd		Depth 1.55	Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.10			MADE GROUND: Dark grey very gravelly sand with frequent cobbles and boulders. Gravel is fine to coarse angular to subrounded of concrete and brick.	
	0.80	ES					MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete, slag, plastic, metal, clinker, ash and brick. Cobbles are angular of brick and concrete. Boulders are angular of brick and concrete.	1
				1.50 1.55			MADE GROUND: Concrete. End of Pit at 1.55m	2
								3
								4

Trial Pit Photographs



Trial Pit 103



Trial Pit 103 Spoil

Remarks: 1. Terminated. 2. Refusal on obstruction at 1.50m bgl.

Stability: Stable.

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood	Client: Challenger Building Services Ltd	Dimensions (m): Depth 3.00	Scale 1:30 Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10			0.10			MADE GROUND: Dark grey very gravelly sand with frequent cobbles and boulders. Gravel is fine to coarse angular to subrounded of concrete and brick.	
	0.40	ES		0.40			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete, slag, plastic, metal, clinker, ash and brick. Cobbles are angular of brick and concrete. Boulders are angular of brick and concrete.	
	0.60	B		0.60				
	0.90			0.90			MADE GROUND: Concrete and slag obstruction. Extracted as grey fine to coarse angular to subrounded gravel with frequent angular cobbles.	1
	1.30	ES		1.30				
	2.05			2.05			Dark grey brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	2
	3.00			3.00			End of Pit at 3.00m	3
								4

Trial Pit Photographs



Trial Pit 104



Trial Pit 104 Spoil

Remarks: 1. Complete. 2. Monitoring well installed.

Stability: Stable.

Project Name: Green Lane

Project No.
16218

Co-ords: -
Level:

Date
26/07/2022

Location: Heywood

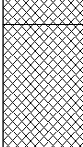
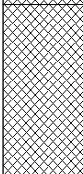
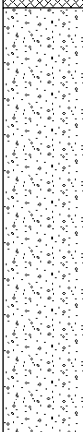
Dimensions (m): 2.20

Scale
1:30

Client: Challenger Building Services Ltd

Depth
3.00

Logged
N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.70 0.80	B ES		0.10			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete and brick. MADE GROUND: Dark grey gravelly sand with occasional rootlets. Gravel is fine to coarse angular to subrounded of concrete, ash and brick.
				0.60			MADE GROUND: Black very gravelly sand. Gravel is fine to coarse angular to subrounded of concrete, ash, clinker and brick.
				1.30			Light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.
				3.00			End of Pit at 3.00m

Trial Pit Photographs



Trial Pit 105



Trial Pit 105 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood	Client: Challenger Building Services Ltd	Dimensions (m): 2.30 Depth 2.80	Scale 1:30 Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10			0.10			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete and brick.	
	0.50	ES		0.50			MADE GROUND: Dark grey very gravelly sand. Gravel is fine to coarse angular to subrounded of concrete, slag, metal, plastic, clinker, ash and brick.	
	1.00			1.00			MADE GROUND: Red gravel with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick. Cobbles are angular to sub rounded of brick.	1
	1.40			1.40			Light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	2
	1.60	ES		1.60				
	2.80			2.80			End of Pit at 2.80m	3
								4

Trial Pit Photographs



Trial Pit 106



Trial Pit 106 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood	Client: Challenger Building Services Ltd	Dimensions (m): Depth 3.00	Scale 1:30 Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.10			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to medium angular to subrounded of concrete and brick.	
				0.40			MADE GROUND: Dark grey very gravelly sand. Gravel is fine to coarse angular to subrounded of concrete, metal and brick.	
	1.00 1.00	B ES					Light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	1
				3.00			End of Pit at 3.00m	3
								4

Trial Pit Photographs



Trial Pit 107



Trial Pit 107 Spoil

Remarks: 1. Complete.

Stability: Stable.

Project Name: Green Lane	Project No. 16218	Co-ords: - Level:	Date 26/07/2022
Location: Heywood		Dimensions (m): 2.20	Scale 1:30
Client: Challenger Building Services Ltd		Depth 2.80	Logged N.Gregory

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.15	ES		0.10			MADE GROUND: Asphalt.
				0.30			MADE GROUND: Grey sandy gravel. Gravel is fine to medium angular to subrounded of limestone [Sub base].
	0.50	ES					Light brown slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.
	1.20	B					
				2.80			End of Pit at 2.80m

Trial Pit Photographs



Trial Pit 108

Trial Pit 108 Spoil

Remarks: 1. Complete.

Stability: Stable.

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

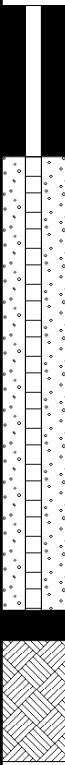
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.15 0.25			MADE GROUND: Asphalt.	
		1.00 1.00	ES	N=11 (2,2/3,2,3,3)				MADE GROUND: Dark grey gravelly sand. Gravel is fine to coarse angular to subrounded of brick and concrete. Loose light brown slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	1
		2.00		N=10 (1,2/3,2,3,2)					2
		3.00		N=8 (2,2/2,2,2,2)					3
		4.00		N=9 (1,2/2,2,2,3)					4
		5.00		N=10 (2,2/2,2,3,3)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed. Response zone 1.00 to 4.00m bgl. 3. Water strike at 4.00m bgl.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.15			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete and brick.	
		1.00 1.00	ES	N=8 (2,2/2,2,2,2)				MADE GROUND: Dark grey gravelly sand with occasional rootlets. Gravel is fine to coarse angular to subrounded of concrete, ash and brick.	1
		2.00		50 (15,10/50 for 245mm)	1.90			MADE GROUND: Red gravel with frequent cobbles. Gravel is fine to coarse angular to subrounded of brick. Cobbles are angular to sub rounded of brick.	2
					2.39			End of borehole at 2.39 m	3
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Terminated. 2. Refusal on obstruction at 2.31m bgl. 3. Monitoring well installed. Response zone 1.00 to 2.00m bgl.

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

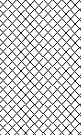
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15			MADE GROUND: Asphalt.	
		0.40	ES					MADE GROUND: Dark grey gravelly sand. Gravel is fine to coarse angular to subrounded of brick and concrete.	1
		1.00		N=9 (2,2/3,2,2,2)	1.10				
		1.50	ES					Loose light brown slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	2
		2.00		N=10 (1,2/2,3,2,3)					
		3.00		N=9 (2,2/2,2,2,3)					3
		4.00		N=10 (2,2/2,2,3,3)					4
		5.00		N=11 (2,2/3,2,3,3)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed. Response zone 0.10 to 1.00m bgl. 3. Water strike at 4.00m bgl.

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

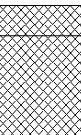
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

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: Dark grey gravelly sand with frequent rootlets. Gravel is fine to medium angular to subrounded of concrete and brick.	
		1.00		N=9 (2,2/2,2,2,3)	0.90			MADE GROUND: Dark grey very gravelly sand. Gravel is fine to coarse angular to subrounded of clinker, metal and brick.	1
		1.50	ES					Loose light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	
		2.00		N=7 (1,2/1,2,2,2)					2
		3.00		N=9 (2,2/3,2,2,2)					3
		4.00		N=6 (1,2/1,2,2,1)					4
		5.00		N=9 (2,2/2,2,3,2)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed. Response zone 1.00 to 4.00m bgl. 3. Water seepage at 4.00m bgl.

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

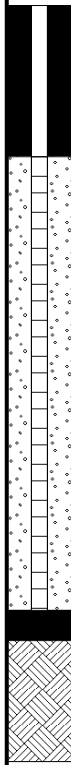
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15			MADE GROUND: Asphalt.	
		0.30	ES		0.35			MADE GROUND: Dark grey gravelly sand. Gravel is fine to coarse angular to subrounded of brick and concrete.	
		0.60	ES		0.70			Loose orange slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	1
		1.00		N=10 (2,2/2,3,2,3)				Medium dense light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone. Circa 2.00m bgl becomes loose. Circa 3.00m bgl becomes medium dense.	2
		2.00		N=10 (1,2/2,3,2,3)					3
		3.00		N=19 (3,4/5,5,4,5)					4
		4.00		N=13 (4,4/3,4,3,3)					5
		5.00		N=13 (2,3/2,3,4,4)					6
					5.45			End of borehole at 5.45 m	7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed. Response zone 1.00 to 4.00m bgl. 3. Water strike at 4.00m bgl.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

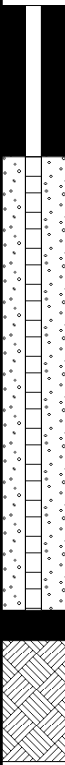
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.05 0.25			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to medium angular to subrounded of concrete and brick.	
		1.00		N=9 (2,2/2,2,2,3)				MADE GROUND: Dark grey very gravelly sand. Gravel is fine to coarse angular to subrounded of brick.	1
		1.50	ES					Loose light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	
		2.00		N=9 (1,2/1,3,2,3)					2
		3.00		N=10 (2,2/2,2,3,3)					3
		4.00		N=8 (1,2/1,2,2,3)					4
		5.00		N=9 (2,2/2,2,2,3)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. Monitoring well installed. Response zone 1.00 to 4.00m bgl. 3. Water strike at 4.00m bgl.



Borehole Log

Borehole No.

WS106A

Sheet 1 of 1

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
WS

Location: Heywood

Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		50 (25 for 30mm/50 for 20mm)	0.10 1.05 1.10			MADE GROUND: Dark grey gravelly sand with frequent rootlets. Gravel is fine to coarse angular to subrounded of concrete and brick. MADE GROUND: Dark grey gravelly sand with occasional rootlets. Gravel is fine to coarse angular to subrounded of concrete, ash and brick. MADE GROUND: Concrete. End of borehole at 1.10 m	1 2 3 4 5 6 7 8 9 10

Remarks

1. Terminated. 2. Refusal on obstruction at 1.05m bgl.



Borehole Log

Borehole No.

CP101

Sheet 1 of 2

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
CP

Location: Heywood

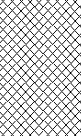
Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Concrete with rebar.	
		0.60	ES					MADE GROUND: Dark grey gravelly sand. Gravel is fine to coarse angular to subrounded of brick and concrete.	1
		1.00		N=14 (7,6/5,3,3,3)	1.30				
		2.00		N=9 (2,2/3,2,2,2)				Loose light brown slightly gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone.	2
		3.00		N=10 (2,2/2,3,2,3)					3
		4.00		N=11 (2,3/3,3,3,2)					4
		5.00		N=9 (2,3/2,2,3,2)					5
		6.50		N=8 (2,2/2,3,2,1)					6
		8.00		N=8 (2,1/2,2,2,2)					7
		9.50		N=28 (4,5/6,8,8,6)	9.40			Medium dense light brown sandy GRAVEL. Gravel is fine to coarse angular to subrounded of siltstone and sandstone.	8
									9
									10

Continued on next sheet

Remarks

1. Complete. 2. Water strike at 4.00m bgl.



Borehole Log

Borehole No.

CP101

Sheet 2 of 2

Project Name: Green Lane

Project No.
16218

Co-ords: -

Hole Type
CP

Location: Heywood

Level:

Scale
1:50

Client: Challenger Building Services Ltd

Dates: 26/07/2022 -

Logged By
N.Gregory

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00		N=15 (8,9/5,4,3,3)	11.20				11
		12.50		N=12 (3,3/4,3,3,2)				Stiff medium strength brown boulder CLAY.	12
		14.00		N=13 (3,4/3,4,3,3)	13.90			Loose light brown gravelly fine to medium SAND. Gravel is fine subrounded to rounded of sandstone. Circa 15.5.00m bgl becomes medium dense.	13
		15.50		N=18 (3,4/4,5,4,5)	15.95				14
								End of borehole at 15.95 m	15
									16
									17
									18
									19
									20

Remarks

1. Complete. 2. Water strike at 4.00m bgl.



APPENDIX VI

CHEMICAL TESTING

RESULTS



Nick Gregory
e3p
Taylor Road
Urmston
Manchester
M41 7JQ

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

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

e: ngregory@e3p.co.uk

Analytical Report Number : 22-74317

Project / Site name:	Green Lane	Samples received on:	27/07/2022
Your job number:	16 218	Samples instructed on/ Analysis started on:	28/07/2022
Your order number:	002356	Analysis completed by:	05/08/2022
Report Issue Number:	1	Report issued on:	30/08/2022
Samples Analysed:	3 leachate samples - 6 soil samples		

Signed:

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

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

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

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

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

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

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

Analytical Report Number: 22-74317
Project / Site name: Green Lane
Your Order No: 002356

Lab Sample Number				2367486	2367487	2367488	2367489	2367490
Sample Reference				TP103	TP104	TP105	TP108	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.30	0.80	0.50	1.50
Date Sampled				26/07/2022	26/07/2022	26/07/2022	26/07/2022	26/07/2022
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	9.2	8.6	4.4	2	4.7
Total mass of sample received	kg	0.001	NONE	1.2	0.6	0.6	0.6	0.6

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile & Amosite	Chrysotile	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	0.096	0.006	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	0.096	0.006	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	DSA	DSA	DSA	DSA	DSA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.2	7.9	7.3	8.2	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	910	880	3500	< 50	62
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.022	0.023	0.03	0.0063	0.0041
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	44	46	60	13	8.1
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	21.9	23	30.1	6.3	4.1
Sulphide	mg/kg	1	MCERTS	6.7	9	6	< 1.0	< 1.0
Total Sulphur	mg/kg	50	MCERTS	510	570	1900	< 50	52
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.7	1.9	3.9	0.2	0.6

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.94	0.63	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.68	0.5	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	7.3	4.7	0.41	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	2	1.2	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	12	8.8	0.45	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	10	7.7	0.46	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	6.9	5.2	0.3	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	3.8	4.1	0.36	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	5.1	3.8	0.29	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.9	2.8	0.2	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5.7	4.1	0.27	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.2	2.2	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.61	0.55	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.4	2.6	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	62.6	48.9	2.74	< 0.80	< 0.80
-----------------------------	-------	-----	--------	------	------	------	--------	--------

Analytical Report Number: 22-74317

Project / Site name: Green Lane

Your Order No: 002356

Lab Sample Number				2367486	2367487	2367488	2367489	2367490
Sample Reference				TP103	TP104	TP105	TP108	WS106
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.30	0.80	0.50	1.50
Date Sampled				26/07/2022	26/07/2022	26/07/2022	26/07/2022	26/07/2022
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	20	25	61	3.6	4.1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 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	25	26	22	7	8.4
Copper (aqua regia extractable)	mg/kg	1	MCERTS	140	150	140	11	13
Lead (aqua regia extractable)	mg/kg	1	MCERTS	230	410	92	15	6.2
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	0.4	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	28	39	6.2	9
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	190	310	110	27	23

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	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_1D_TOTAL	mg/kg	0.1	MCERTS	< 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	4.8	10	< 4.0	< 4.0	< 4.0
TPH (C16 - C21) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	40	41	9.8	< 1.0	< 1.0
TPH (C21 - C35) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	110	130	23	< 1.0	< 1.0
TPH (C35 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	10	37	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_1D_TOTAL	mg/kg	10	MCERTS	160	220	33	< 10	< 10

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

Analytical Report Number: 22-74317

Project / Site name: Green Lane

Your Order No: 002356

Lab Sample Number				2367491
Sample Reference				CP101
Sample Number				None Supplied
Depth (m)				0.60
Date Sampled				26/07/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	67
Moisture Content	%	0.01	NONE	4.2
Total mass of sample received	kg	0.001	NONE	1.2

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	11.8
Total Cyanide	mg/kg	1	MCERTS	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	1600
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.041
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	83
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	41.3
Sulphide	mg/kg	1	MCERTS	4.6
Total Sulphur	mg/kg	50	MCERTS	600
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.4

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.3
Anthracene	mg/kg	0.05	MCERTS	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.42
Pyrene	mg/kg	0.05	MCERTS	0.34
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.22
Chrysene	mg/kg	0.05	MCERTS	0.18
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	1.46
-----------------------------	-------	-----	--------	------

Analytical Report Number: 22-74317

Project / Site name: Green Lane

Your Order No: 002356

Lab Sample Number				2367491
Sample Reference				CP101
Sample Number				None Supplied
Depth (m)				0.60
Date Sampled				26/07/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	9.6
Lead (aqua regia extractable)	mg/kg	1	MCERTS	32
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	43

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	MCERTS	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	MCERTS	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	MCERTS	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	MCERTS	< 4.0
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	< 1.0
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	MCERTS	< 1.0
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	MCERTS	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	MCERTS	< 10

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



Analytical Report Number: 22-74317
Project / Site name: Green Lane
Your Order No: 002356

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

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

Quantitative Analysis

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

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

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

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2367486	TP103	0.80	190	Loose Fibrous Debris	Chrysotile & Amosite	0.096	0.096
2367487	TP104	1.30	157	Loose Fibrous Debris	Chrysotile	0.006	0.006

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



4041



Analytical Report Number: 22-74317

Project / Site name: Green Lane

Your Order No: 002356

Lab Sample Number				2367492	2367493	2367494
Sample Reference				TP103	TP105	CP101
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.80	0.60
Date Sampled				26/07/2022	26/07/2022	26/07/2022
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	8	7.8	12.6
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0	< 1.0	3.3
----------------------------	------	---	-----------	-------	-------	-----

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	4.7	4.3	< 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	22
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.9	2.1	22
Copper (dissolved)	µg/l	0.7	ISO 17025	11	13	8.1
Lead (dissolved)	µg/l	1	ISO 17025	1.9	3.3	2.1
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.6	2.6	3.1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	12	12	8.8

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10	< 10



4041



Analytical Report Number: 22-74317

Project / Site name: Green Lane

Your Order No: 002356

Lab Sample Number				2367492	2367493	2367494
Sample Reference				TP103	TP105	CP101
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.80	0.80	0.60
Date Sampled				26/07/2022	26/07/2022	26/07/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_1D_TOTAL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
---------------------------------------	------	----	------	------	------	------

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_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_1D_AL_#1_#2_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_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) HS+EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10	< 10

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

Analytical Report Number : 22-74317

Project / Site name: Green Lane

* 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 *
2367486	TP103	None Supplied	0.8	Brown loam and sand with gravel and vegetation.
2367487	TP104	None Supplied	1.3	Brown loam and sand with gravel and vegetation.
2367488	TP105	None Supplied	0.8	Brown loam and sand with gravel and rubble.
2367489	TP108	None Supplied	0.5	Brown sand.
2367490	WS106	None Supplied	1.5	Brown sand.
2367491	CP101	None Supplied	0.6	Brown sand with gravel and stones.

Analytical Report Number : 22-74317

Project / Site name: Green Lane

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
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine 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
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

Analytical Report Number : 22-74317

Project / Site name: Green Lane

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
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
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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' analysis have been carried out in our laboratory in the United Kingdom.

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

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

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

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography

Analytical Report Number : 22-74317

Project / Site name: Green Lane

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
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 VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

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



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



4043

Contract Number: PSL22/5014

Report Date: 30 August 2022

Client's Reference: 15-253

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: Nick Gregory

Contract Title: Green Lane, Heywood

Date Received: 29/7/2022

Date Commenced: 29/7/2022

Date Completed: 30/8/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Assistant Laboratory Manager)

S Eyre
(Senior Technician)

T Watkins
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Green Lane, Heywood

Contract No:

PSL22/5014

Client Ref:

15-253

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

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



4043

PSL
Professional Soils Laboratory

Green Lane, Heywood

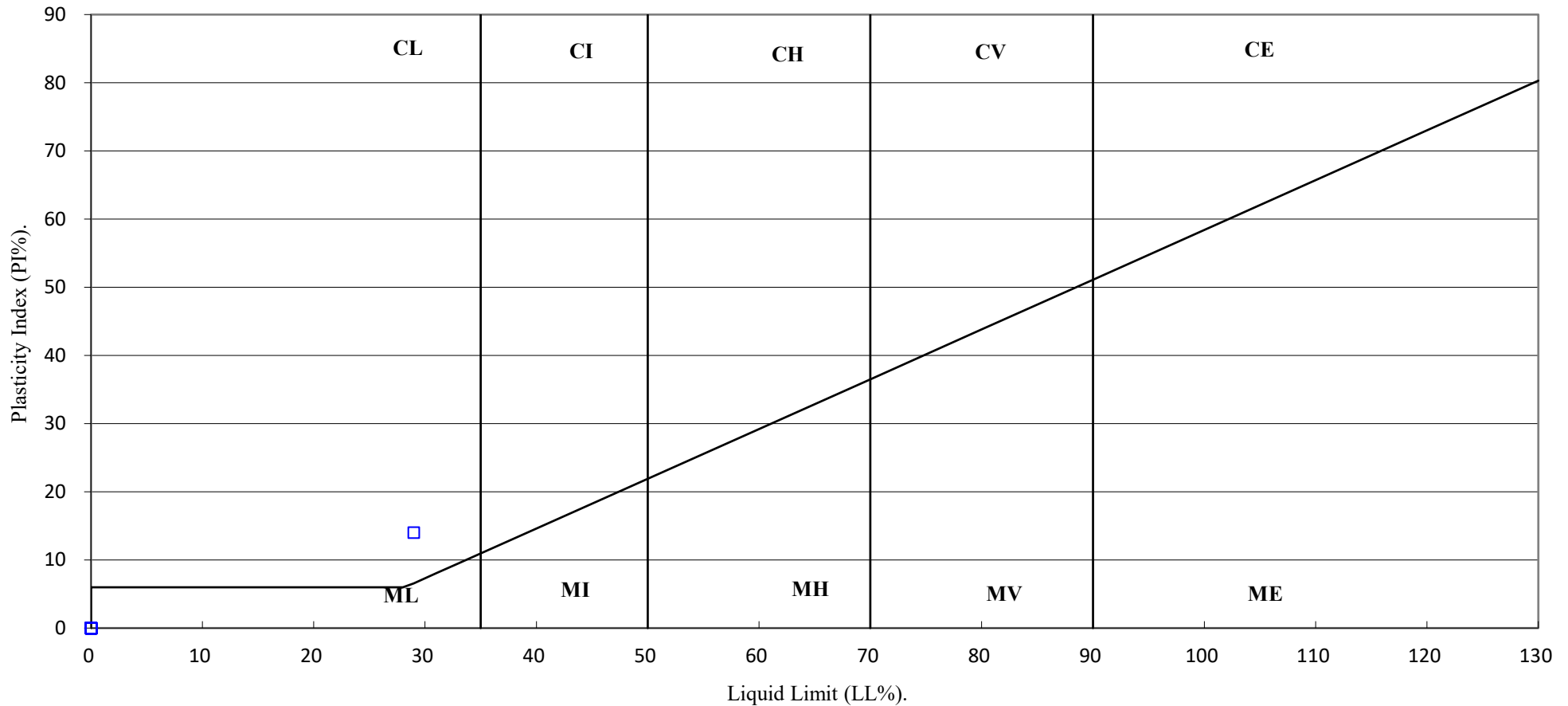
Contract No:

PSL22/5014

Client Ref:

15-253

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL

Professional Soils Laboratory

Green Lane, Heywood

Contract No:

PSL22/5014

Client Ref:

15-253

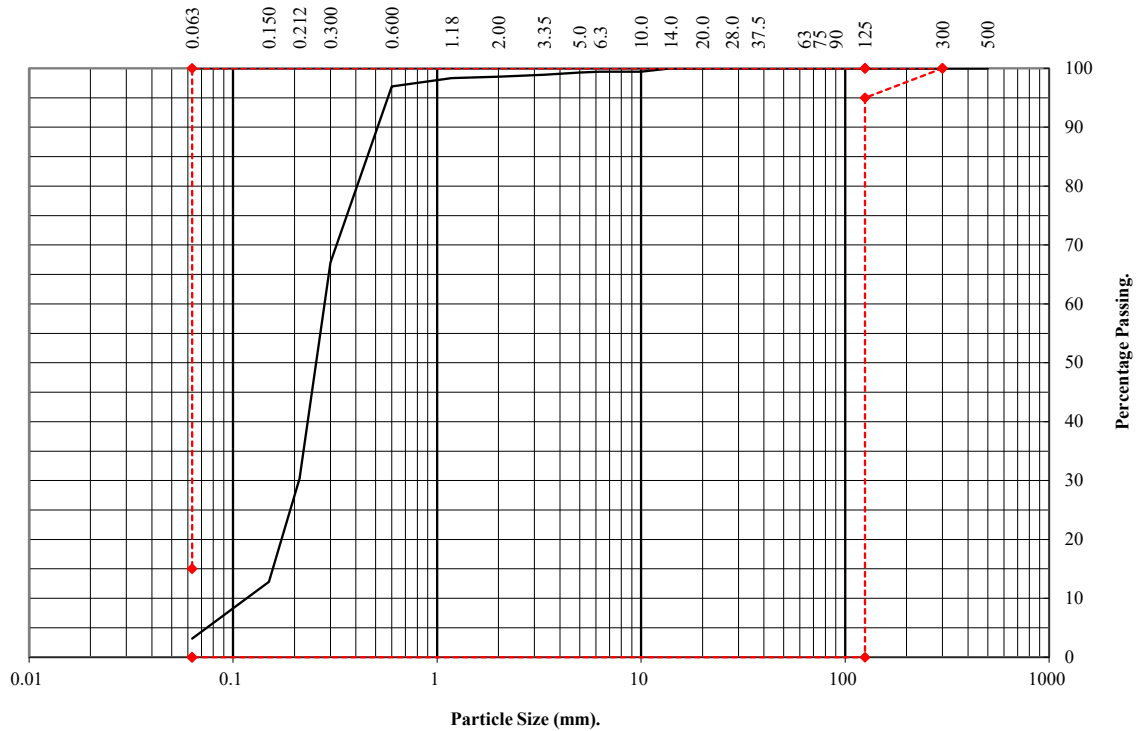
PARTICLE SIZE DISTRIBUTION TEST

BS1377:Part 2:1990

Wet Sieve: Clause 9.2

Classification for Acceptable Earthworks Materials

Sample Reference **TP101 @ 0.80m** Classification Type: **1A**



BS Test Sieve mm	Percentage Passing %	Table 6/2 Grading Requirements	
		Lower	Upper
500	100		
300	100	100	100
125	100	95	100
90	100		
75	100		
63	100		
37.5	100		
28	100		
20	100		
14	100		
10	99		
6.3	99		
5	99		
3.35	99		
2	99		
1.18	98		
0.6	97		
0.3	67		
0.212	30		
0.15	13		
0.063	3	0	15

Remarks:

SHW Series 600 Table 6/2 :
Class 1A



Green Lane, Heywood

Contract No.:

PSL22/5014

Client Ref:

15-253

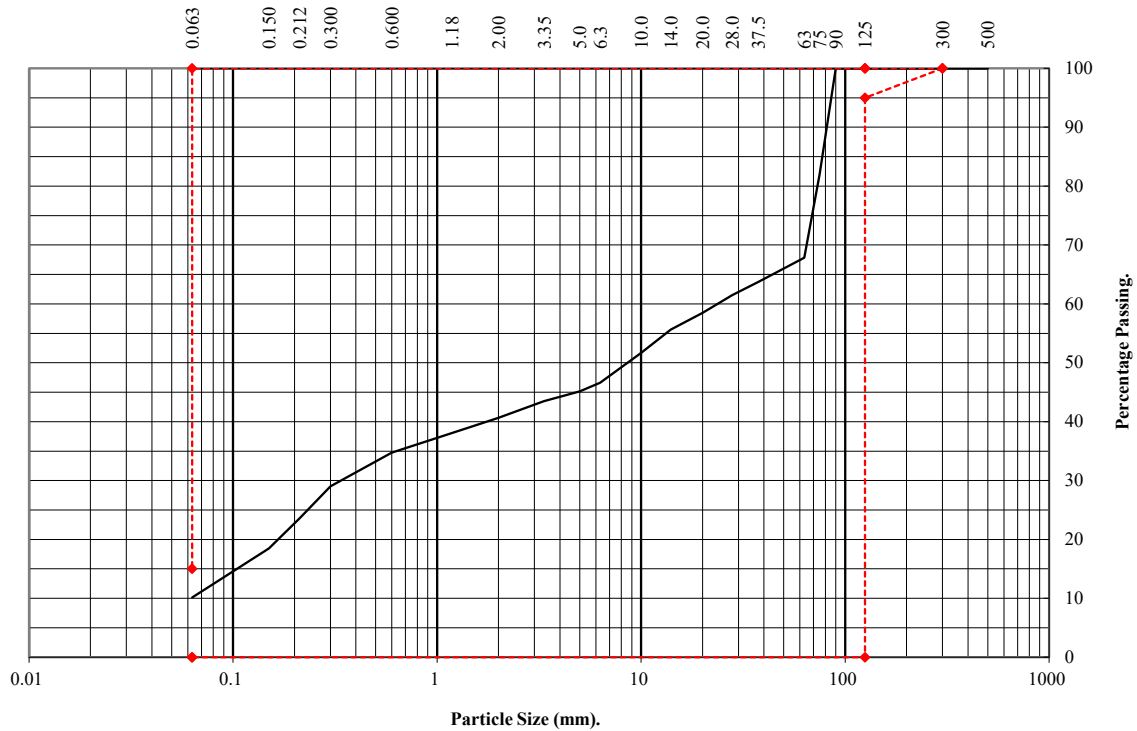
PARTICLE SIZE DISTRIBUTION TEST

BS1377:Part 2:1990

Wet Sieve: Clause 9.2

Classification for Acceptable Earthworks Materials

Sample Reference **TP104 @ 0.60m** Classification Type: **1A**



BS Test Sieve mm	Percentage Passing %	Table 6/2 Grading Requirements	
		Lower	Upper
500	100		
300	100	100	100
125	100	95	100
90	100		
75	82		
63	68		
37.5	64		
28	62		
20	58		
14	56		
10	52		
6.3	47		
5	45		
3.35	43		
2	41		
1.18	38		
0.6	35		
0.3	29		
0.212	24		
0.15	18		
0.063	10	0	15

Remarks:

SHW Series 600 Table 6/2 :
Class 1A



PSL
Professional Soils Laboratory

Green Lane, Heywood

Contract No.:

PSL22/5014

Client Ref:

15-253

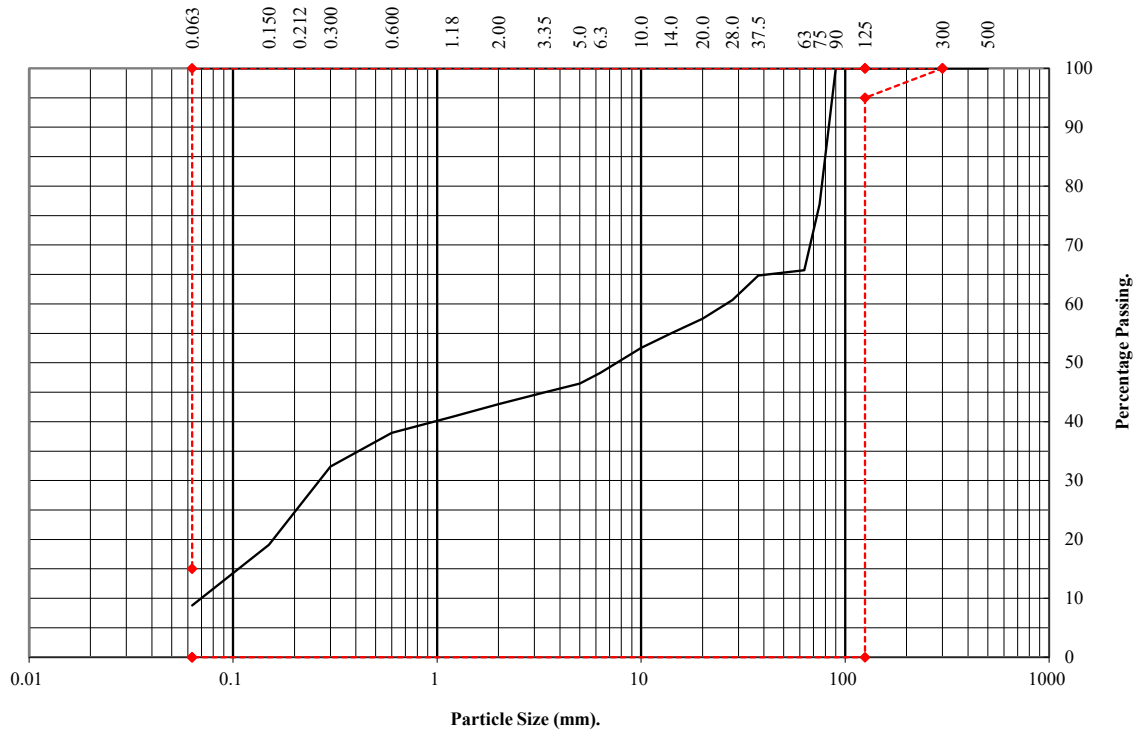
PARTICLE SIZE DISTRIBUTION TEST

BS1377:Part 2:1990

Wet Sieve: Clause 9.2

Classification for Acceptable Earthworks Materials

Sample Reference **TP105 @ 0.70m** Classification Type: **1A**



BS Test Sieve mm	Percentage Passing %	Table 6/2 Grading Requirements	
		Lower	Upper
500	100		
300	100	100	100
125	100	95	100
90	100		
75	77		
63	66		
37.5	65		
28	61		
20	57		
14	55		
10	53		
6.3	48		
5	46		
3.35	45		
2	43		
1.18	41		
0.6	38		
0.3	32		
0.212	26		
0.15	19		
0.063	9	0	15

Remarks:

SHW Series 600 Table 6/2 :
Class 1A



PSL
Professional Soils Laboratory

Green Lane, Heywood

Contract No.:

PSL22/5014

Client Ref:

15-253

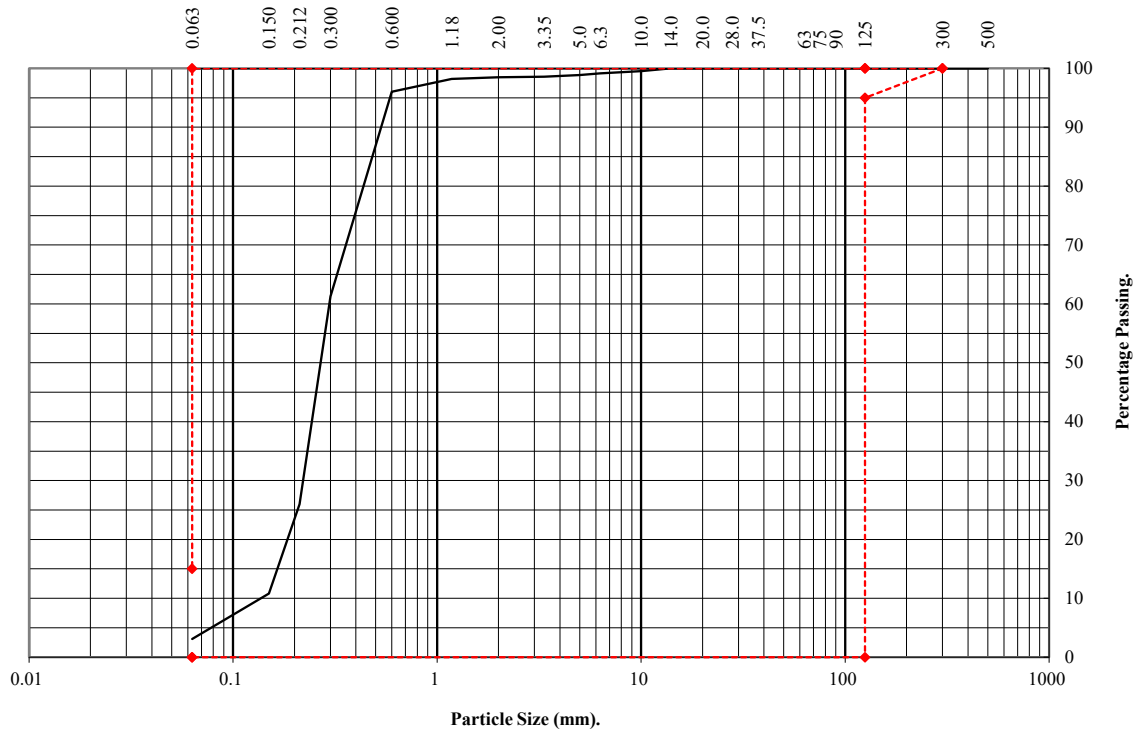
PARTICLE SIZE DISTRIBUTION TEST

BS1377:Part 2:1990

Wet Sieve: Clause 9.2

Classification for Acceptable Earthworks Materials

Sample Reference **TP107 @ 1.0m** Classification Type: **1A**



BS Test Sieve mm	Percentage Passing %	Table 6/2 Grading Requirements	
		Lower	Upper
500	100		
300	100	100	100
125	100	95	100
90	100		
75	100		
63	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	99		
5	99		
3.35	99		
2	98		
1.18	98		
0.6	96		
0.3	61		
0.212	26		
0.15	11		
0.063	3	0	15

Remarks:

SHW Series 600 Table 6/2 :
Class 1A



PSL
Professional Soils Laboratory

Green Lane, Heywood

Contract No.:

PSL22/5014

Client Ref:

15-253

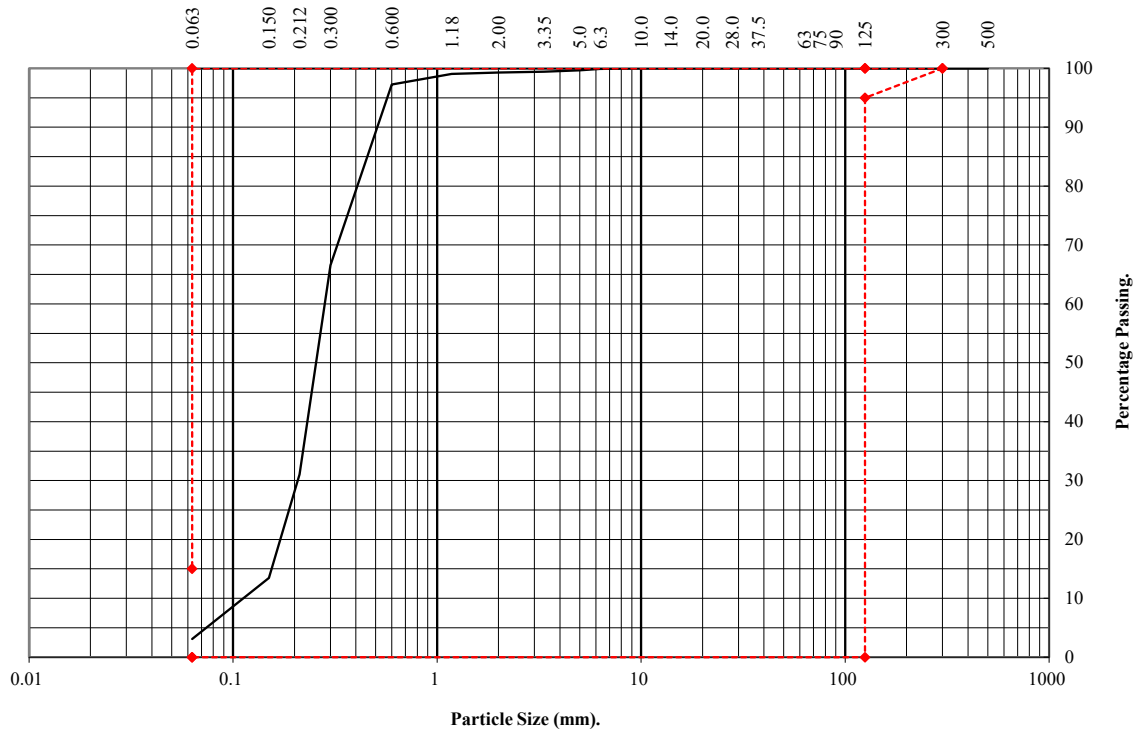
PARTICLE SIZE DISTRIBUTION TEST

BS1377:Part 2:1990

Wet Sieve: Clause 9.2

Classification for Acceptable Earthworks Materials

Sample Reference **TP108 @ 1.20m** Classification Type: **1A**



BS Test Sieve mm	Percentage Passing %	Table 6/2 Grading Requirements	
		Lower	Upper
500	100		
300	100	100	100
125	100	95	100
90	100		
75	100		
63	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	99		
0.6	97		
0.3	67		
0.212	31		
0.15	13		
0.063	3	0	15

Remarks:

SHW Series 600 Table 6/2 :
Class 1A



Green Lane, Heywood

Contract No.:

PSL22/5014

Client Ref:

15-253