Phase II Geoenvironmental Site Assessment
Burnage Sports Club

Reference:16-953-R2-1
Date: August 2023

PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Burnage Sports Club
Mauldeth Road,
Burnage
Manchester
M19 1AB

Prepared for:

KELLEN HOMES

Report Ref: 16-953-R2-1
Date Issued: August 2023

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	16-953		
VERSION	Version 1		
REMARKS			
DATE	August 2023		
PREPARED BY	I Diack		
QUALIFICATIONS	BSc (Hons), FGS		
CHECKED BY	M. Dee		
QUALIFICATIONS	MESci (Hons), FGS		
AUTHORISED BY	S. Cox		
QUALIFICATIONS	BSc (Hons), FGS, PIEMA, MIEnvSci, CEnv		

EXECUTIVE SUMMARY

Site Address	Burnage Sports Club, Manchester, M19 2WB.	
Grid Reference	E 386369, N 392896.	
Site Area	1.01 Ha.	
Proposed Development	E3P understands that Kellen Homes intends to construct a mixed residential development comprising low-rise dwellings and apartment blocks totalling 85 dwellings with associated gardens, estate roads, and infrastructure.	
Current Site Use	The site comprises a roughly rectangular shaped parcel of land located to the north of Mauldeth Road, Burnage. Burnage Sports Club occupies the site, however, presently, the site remains inactive, with the majority of surface cover comprising self-seeding scrub vegetation and overgrown grassland. An area of gravel hard standing is noted at the eastern boundary, with a small gravel path lining the southern boundary with the former associated with an informal car parking area. Two structures remain on site, including a semi-enclosed outdoor bar and adjacent outdoor covered seating areas with concrete hard standing at the base. Additionally, a three storey residential apartment building is present in the west. Localised areas of fly-tipped material were noted, including abandoned vehicles situated at the eastern boundary, with areas of fly-tipped material across site – most noticeably present in the north east.	
Site History	A review of the pertinent Ordnance Survey mapping suggests that the site comprised agricultural land with two ponds present circa 1849. The smaller of the ponds, located in the southwest, was infilled circa 1892 with the larger pond, located in the east, infilled circa 1934 when the site was made into a cricket ground. No changes were recorded on site until circa 1988 where a small structure was built in the southwest corner of site. The site remained in this state until circa 2016 when the sports club expanded in the east, with the construction of hardstanding and a timber outbuilding in the west. Additionally, a three-storey apartment building was constructed in the west at the same time. Further development in these two areas of the site has occurred to the present day, with the hardstanding in the east increasing in area and a small structure in the southwest being built.	
Environmental Setting	**Drift Geology**	Till, Devensian – SAND, GRAVEL, and CLAY.
	Bedrock Geology	Chester Pebble Beds Formation – SANDSTONE
	Faults	The nearest geological fault is located circa 226 m West of the site trending roughly north to south.
	Hydrogeology	Secondary Undifferentiated Superficial Aquifer overlying a Principal Bedrock Aquifer. One groundwater abstraction license is recorded 282 m east of the site with a general laundry use.
	Hydrology	The closest surface water feature is Shaw Brook, located 140 m east of the site.
	Flood Risk	Unaffected by flooding from rivers.

Natural Landform and Geomorphology	The subject site is located immediately north of a stream and in its current configuration is largely level, which is unlikely to be the natural landform. The site generally comprises even terrain with no significant topographical variances noted. However, a bund in the northeastern corner of the site was noted. The exact topographical difference between the site was unable to be determined due to densely packed vegetation preventing investigation.
Previous Reports	No previous reports for the site have been made available to E3P.
Utility Locations	A formal utility survey identifies no services are present through the site. A telecommunications mast is noted adjacent to the northwestern boundary. However, no services enter the site. A Vodafone substation box was noted within the site boundary at the southwestern boundary, however, given the recent installation of the substation (circa 2020), this is not considered to be a source of PCBs.
Landfill Sites and Ground Gases	No landfill sites (current or historic) are located within 250 m of the site. Two infilled historical ponds have been identified located towards the southeast of site. The Made Ground associated with these infilled ponds may produce hazardous ground gases such as methane and carbon dioxide.
Radon	Less than 1% of houses above the 'Action Level' – no special precautions required.
Coal Mining/Land Stability	The site is not situated within a Coal Authority Reporting Area, thus is not anticipated to be at risk from any coal mining-associated hazards.
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.
Initial Conceptual Site Model	Contaminant Sources - Agricultural land use (localised spillages of fuel and leaks from agricultural machinery, pesticides) – Heavy metals/inorganics, Polycyclic Aromatic Hydrocarbons (PAH), Total Petroleum Hydrocarbons (TPH). - Former small structure (southwest of site) – Asbestos. - Infilled pond (south and east of site) – Heavy metals/inorganics, PAH, TPH, asbestos and ground gas (CO2/CH4). Pathways - Direct contact and ingestion - Volatilisation/indoor explosion - Vapour inhalation - Dust inhalation - Vertical and lateral migration - Direct uptake by flora and fauna

Initial Conceptual Site Model	Receptors • Future site users (end-users and construction workers) • Buildings (proposed development, adjacent residential units) • Underlying aquifer (Principal Bedrock Aquifer)

GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: • 12 x Mechanically excavated trial pits • 6 x Window sample boreholes. • 2 x Cable percussion boreholes. • 6 x Environmental monitoring installations.
Ground Conditions	**Made Ground – 0.0mbgl to 1.40mbgl** Made Ground was encountered within eight of twenty exploratory hole locations, encountered along the eastern and western site boundaries and within the location of historically infilled ponds. Generally Made Ground was encountered at proven depths < 1.0 metres below ground level (m bgl), with localised exceptions in areas of infilled ponds where Made Ground was encountered to a maximum proven depth of 3.10 m bgl (TP105a). Made Ground comprised reworked topsoil superimposed upon blackish brown sandy gravel with frequent cobbles. Gravel consisted of angular to subrounded constituents of brick, concrete, timber, tile, ceramic, plastic, mudstone and sandstone, with cobbles comprising angular brick. Within areas of gravel surface coating along the eastern and northwestern sectors of the site, grey sandy gravel of concrete was encountered at ground level in replacement of reworked topsoil. Within areas of former ponds in the south of the site (TP102, TP105a, and WS104), soft highly organic Made Ground material (SILT and PEAT) were noted beneath the blackish sandy gravel, representative of the base of the former ponds and encountered to maximum depths ranging between 2.00 m – 3.10 m bgl.
Ground Conditions	**DRIFT – 0.20 m bgl to 5.40 m bgl** Drift deposits were encountered within all of the exploratory locations and generally comprised uniform strata of an orange, brown slightly gravelly CLAY, with subangular to subrounded gravel of MUDSTONE. CLAY deposits were generally noted as strengths of a firm to very stiff. Soft CLAY was encountered between 0.80 m – 1.50 m within TP101 in the south east and 0.20 m – 0.60 m bgl within TP106 in the south west of the site.

Ground Conditions	**SOLID – Top of Bedrock – 4.70 m bgl to 5.30 m bgl** Weathered sandstone bedrock geology was encountered between 4.70 m and 6.45 m bgl, with the top of solid bedrock generally encountered between 5.45 m bgl (CP101) and 6.45 m bgl (CP102). The solid geology comprises red SANDSTONE of the Chester Pebble Beds Formation.
	GROUNDWATER A groundwater strike was encountered within TP102 at 1.40 m bgl as a steady ingress. The groundwater strike contained a hydrocarbon sheen and is interpreted as being associated with the former ponds situated within the south east of the site.

CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing them to the relevant Tier I criteria (residential end-use with plant uptake), as this is the worst-case scenario. The results of this direct comparison indicate that the data exceeds the screening criteria for a residential end-use for heavy metals (lead and arsenic), non-volatile PAHs (Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, dibenzo[a,h]anthracene and long chain aromatic TPH (C21-C35). In relation to heavy metals, non-volatile PAHs and TPH C21-35, these contaminants have primary exposure pathways related to dermal contact, ingestion of soils, and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations of heavy inorganic metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils. Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. There are suitable sources of topsoil available on the site across the majority of the site, with the exception of the southeastern sector of the site within the vicinity of the former ponds, and the gravel hardstanding at the western boundary.

Controlled Waters	The results of the data review and Tier 2 qualitative risk assessment has allowed E3P to draw the following conclusions in respect to the risk to controlled waters: • The primary controlled water receptor has been identified as the underlying principal aquifer; • No surface water features are present within influencing distance of the site; • The site has undergone little historical development, with no on-site industrial processes recorded. As such, no significant contamination sources have been identified on site. • Localised infilling of former ponds in the south and development of structures in the west has resulted in isolated areas of Made Ground across the site. • Chemical analysis of Made Ground soils identified the Made Ground to be a potential source of PAH and TPH C10 – C16 (Table 4.3), however, upon receipt of leachate testing no exceedances of PAH or TPH were noted above EQS or DWS and therefore no risk to controlled waters is deemed to be present in relation to these contaminants. • Leachate analysis of Made Ground soils identified minor heavy metal (copper, total cyanide, lead and zinc) exceedances against EQS values, no exceedances of DWS were noted. • Made Ground is discontinuous, and therefore not hydraulically connected, given the presence of site wide stiff low permeability clay, no viable pathway for the lateral migration of mobile phase contamination through perched groundwater is considered to be present. • During the E3P investigation, a consistent water table was not identified, and since all locations advanced were underlain by low permeability CLAY, it is unlikely that vertical migration towards the underlying principal aquifer will occur. • Given the absence of significant contamination sources on site, lack of surface water features within influencing distance to the site, lack of consistent water table and presence of site wide low permeability clay that will serve to remove viable contamination pathways between Made Ground soils and the principal aquifer; the risk to controlled waters is considered to be low.
Ground Gas	The gas monitoring program is currently on going, visits undertaken to date record the site to be CS1. However, presently gas monitoring data during varying atmospheric conditions has not been completed. Upon completion of the full gas monitoring program a ground gas addendum will be issued under a separate cover that will outline any mitigation measures required.
Potable Water Infrastructure	PE pipeline could be used across the development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

GEOTECHNICAL ASSESSMENT

Underground Obstructions	No significant below-ground obstructions have been identified during the ground investigation. However, shallow bedrock has been identified across the site with the top of bedrock encountered at 4.70 m bgl within CP101 towards the southwest of the site and 5.30 m bgl within CP102 in the north. Where encountered, shallow bedrock is likely to impede excavations with standard machinery. Additionally, due to the presence of dense vegetation, including mature trees at the southern boundary, extensive root networks are anticipated across the site. Potential underground obstructions are likely to be present beneath structures in the west of the site and may be present within the bund located to the northeast of the site, however, it remained inaccessible due to dense vegetation. During a phase of enabling works to create a development platform, below-ground obstructions, if encountered, will require removal to the base of the Made Ground. Additionally, to enable the construction of the proposed development a site-wide vegetation clearance will be required, with all root systems grubbed out, with the exception of trees remaining within the proposed development.
Allowable Bearing Pressure	Across the majority of the site the suitable target founding stratum has been identified as the underlying firm to very stiff CLAY with an allowable bearing capacity (ABP) of 79 – 326 kN/m² between 1.00 – 2.00 m bgl, 91 – 415 kN/m² between 2.00 – 3.00 m and 69 – 418 kN/m² between 3.00 – 3.45 m bgl. Shallow bedrock encountered between 4.70 m bgl and 5.30 m bgl has a ABP of > 400 kN/m².
Foundation Options	Due to the strength of CLAY deposits recorded across the site, it is anticipated the foundation design required will likely comprise strip/mass trench for the low-rise dwellings and mass trench/piled foundation design for proposed apartment blocks dependent on final loadings. Foundation depths within the conjectured influence of former, existing, or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content. Furthermore, plots proposed within the location of former ponds where extraction of softer organic deposits is required, are likely to require specialist foundation designs likely to comprise a piled foundation design. The final foundation solution will be dependent on the loadings required, final levels and location of structures in relation to former or existing trees across the site.
Building Floor Slabs	Given the presence of potentially shrinking/swelling clays beneath the site and large tree influence noted, ground bearing floor slabs will not be suitable for the proposed development. Suspended floor slabs should be designed with a sufficient sub floor void dependant on the plasticity of the clays beneath the site.

Heave Precautions	The site has been proven to be underlain by clay soils, which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within the influencing distance of trees as per the NHBC/LABC conjectured zones of influence. Given that the underlying clay is of low volume change potential, heave precautions will not be required to the internal face of a foundation less than 1.5 m in depth. Heave precautions will be required to the underside of floor slabs (where there is no 200 mm void) and pile ground beams are required within the modelled influencing distance of trees.
Soakaway Drainage	Given the presence of low permeability clays across the site soakaway drainage is unlikely to be suitable. During return monitoring visits falling head tests were undertaken in three locations (WS101, WS105 and WS106), tests in all locations failed to fall during the duration of the test. As such, it is not recommended that soakaways are utilised for disposal of surface water runoff. Should soakaway drainage be proposed, soakaway testing in line with the methodology outlined in BRE365 may be required in later investigations to inform soakaway drainage design.
Sulphate Assessment	The concrete classification will be DS1 AC1s.
CBR Design %	Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.
Cut/Fill	Development levels are unknown at this time; however, significant cut-and-fill works are unlikely to be required to prepare the development platform given the current nature of the site.
Civil Engineering Excavations	Excavations in the near surface were completed with relative ease, with trial pits remaining stable in the short-term sitewide. The E3P intrusive ground investigation has identified the presence of shallow bedrock beneath the site, with the top of bedrock encountered between 4.70 m bgl and 5.30 m bgl. Where encountered, the presence of shallow bedrock may impede excavations with standard machinery. Additionally, the drainage and infrastructure design should account for the shallow bedrock as necessary. Due to the presence of low permeability cohesive deposits across the majority of the site, 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 upon with the relevant regulatory body and be undertaken under a trade effluent discharge consent, 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.
Waste Characterisation	Any material that is to be disposed of 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:

- Further investigation of inaccessible areas (including beneath current structures, north eastern bund and infilled pond delineation).
- Plot-specific foundation schedule (upon receipt of the final development levels).
- Arboricultural survey.
- Geotechnical earthworks strategy (infrastructure).
- Remediation and enabling works strategy.

Table of Contents

EXECUTIVE SUMMARY 1

1. INTRODUCTION 11
   1.1. Background 11
   1.2. Proposed Development 11
   1.3. Objectives 11
   1.4. Scope of Works 12
   1.5. Limitations 12
   1.6. Confidentiality 12

2. GROUND INVESTIGATION 13
   2.1. General Overview 13
   2.2. Limitations of the Investigation 13
   2.3. Scope of Investigation 13
   2.4. In-Situ Standard Penetration Testing (SPT) 14
   2.5. Laboratory Analysis 15

3. GROUND AND GROUNDWATER CONDITIONS 16
   3.1. Summary of Ground Conditions 16
   3.2. Made Ground 16
   3.3. Drift Deposits 17
   3.4. Solid Geology 17
   3.5. Groundwater 17
   3.6. Visual and Olfactory Evidence of Contamination 17
   3.7. Soil Consistency 17
   3.8. Side Stability and Ease of Excavation 23
   3.9. Consolidation 23
   3.10. Particle Size Distribution 23
   3.11. Soil Density/Moisture Content Relationship 24
   3.12. Soil Plasticity 24
   3.13. pH and Sulphate 24
   3.14. Soil Infiltration 25

4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT 26
   4.1. Human Health Risk Assessment 26
   4.2. Controlled Waters Risk Assessment 29
      4.2.1. Controlled Water Risk Assessment and Mitigation 34
      4.2.2. Discussion of Controlled Waters Risk Assessment 34
   4.3. Ground Gas Risk Assessment Methodology 35
   4.4. Monitoring Methodology 37
   4.5. Summary of Monitoring Results 40
      4.5.1. Groundwater 40
      4.5.2. Barometric pressure 40
      4.5.3. Gas Flow 40
      4.5.4. Gas Concentrations 40
   4.6. Conclusion 40
   4.7. Potable Water Supply 41
   4.8. Conceptual Site Model 43

5. GEOTECHNICAL ASSESSMENT 47
   5.1. Proposed Development 47
   5.2. Summary of Ground Conditions 47
   5.3. Site Preparation 48
   5.4. Foundation Conditions and Assessment of Potential Bearing Capacities 48

5.5. Ground Floor Slabs 50
5.6. Heave Precautions 50
5.7. Highways Construction 51
5.8. Drainage 51
5.9. Concrete Durability 52
5.10. Excavations 52
5.11. Construction Activity and Inspection 52
5.12. Geotechnical Risk Register 54
5.13. Further Works 57

6. CONCLUSIONS AND RECOMMENDATIONS 58
6.1. Contaminated Land Assessment 58
6.2. Geotechnical Assessment 59

APPENDIX I LIMITATIONS 61

APPENDIX II GLOSSARY 63

APPENDIX III DRAWINGS 66

APPENDIX IV PHOTOGRAPHS 68

APPENDIX V E3P EXPLORATORY HOLE LOGS 74

APPENDIX VI CHEMICAL TESTING RESULTS 75

APPENDIX VII ORIGIN OF TIER 2 GENERIC ASSESSMENT CRITERIA 76

APPENDIX VIII GEOTECHNICAL TESTING RESULTS 78

DRAWING LIST

16-953-001 - Site Location Plan
16-953-002 - Proposed Development Plan
16-953-003 - Historical Features Plan
16-953-004 - Site Features Plan
16-953-005 - Exploratory Hole Location Plan
16-953-006 - Depth of Made Ground Plan
16-953-007 - Depth of Topsoil Plan
16-953-010 - Conceptual Site Model
16-953-012 - Depth of Bedrock Plan
16-953-015 - Development Constraints Plan

1. INTRODUCTION

1.1. BACKGROUND

E3P Ltd has been commissioned by Kellen Homes to undertake a Phase II Geoenvironmental Site Assessment at Burnage Sports Club, Manchester, M19 2WB.

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

1.2. PROPOSED DEVELOPMENT

Kellen Homes intends to construct a residential development comprising low-rise dwellings and three apartment blocks totalling circa 85 dwellings with associated gardens, estate roads and infrastructure.

A snapshot of the proposed development layout is indicated in Figure 1.1 and E3P Drawing 16-953-002 in Appendix III.

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) (July 2023).*

- Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of work includes the following elements:

- Detailed review of historic information;
- Design of suitable intrusive ground investigation;
- Window sample probeholes with, and construction of, environmental monitoring installations;
- Deep cable percussive boreholes;
- 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 9th June 2023 and 12th June 2023. The works are summarised in Table 2.1.

2.2. LIMITATIONS OF THE INVESTIGATION

A bund is present in the north east of the site, due to dense vegetation across the bund and surrounding area no access to investigate the bund was present. As such, the contents of the bund and underlying ground conditions in this area are unknown at this time.

Structures were noted at the south western sector of the site associated with the former Burnage Sports Club including hardstanding surface cover, therefore limiting investigations within these areas.

A draft site constraints plan is appended to this letter as E3P Drawing 16-953-015.

2.3. SCOPE OF INVESTIGATION

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
Investigation of Historically Infilled Ponds	TP101	Mechanically Excavated Trial Pits	3.00	N/A
	TP102		2.70	
	TP105		0.60	
	TP105a		3.20	
	WS104	Window Sample Probehole	4.40	1.00 – 2.00

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	TP103	Mechanically Excavated Trial Pits	2.90	N/A
	TP104		3.00	
	TP106		2.80	
	TP107		2.70	
	TP108		2.80	
	TP109		2.80	
	TP110		2.60	
	TP111		3.10	
	TP112		2.40	
	WS101	Window Sample Probehole	4.30	1.00 – 4.00
	WS102		4.40	1.00 – 4.00
	WS103		4.25	1.00 – 4.00
	WS105		4.30	1.00 – 4.00
	WS106		4.20	1.00 – 4.00
	CP101	Cable Percussive Borehole	5.45	N/A
	CP102		6.45	

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

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

Two cable percussive boreholes were advanced to greater depths in areas of proposed apartment blocks to undertake in-situ detailed geotechnical testing to aid in foundation design and confirm depth to bedrock.

The sampling locations are illustrated in Drawing 16-953-005 (Appendix III). The ground conditions encountered are indicated on the logs, which are provided in Appendix V.

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

2.4. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in Appendix V and presented in Table 3.4 and discussed in Section 5.

2.5. LABORATORY ANALYSIS

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

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

I2 Analytical undertook the analytical work and the testing results are included in Appendix VI and discussed in Section 4.

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

- Atterberg limits determinations; and
- Single-stage triaxial tests.

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

3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

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

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)				
	MADE GROUND	TOPSOIL	SOFT CLAY	VERY STIFF CLAY	BED ROCK
TP101	0.00 – 0.80	-	0.80 – 1.50	1.50 – 3.00	-
TP102	0.00 – 2.70	-	-	-	-
TP103	-	0.00 – 0.30	-	0.30 – 2.90	-
TP104	-	0.00 – 0.30	-	0.30 – 3.00	-
TP105	0.00 – 0.60	-	-	-	-
TP105a	0.00 – 3.10	-	-	3.10 – 3.20	-
TP106	-	0.00 – 0.20	0.20 – 0.60	0.60 – 2.80	-
TP107	-	0.00 – 0.30	-	0.30 – 2.70	-
TP108	-	0.00 – 0.20	-	0.60 – 2.80	-
TP109	-	0.00 – 0.20	-	0.20 – 2.80	-
TP110	0.00 – 0.50	-	-	0.50 – 2.60	-
TP111	-	0.00 – 0.30	-	0.30 – 3.10	-
TP112	0.00 – 1.20	-	-	1.20 – 2.40	-
WS101	-	0.00 – 0.20	-	0.20 – 4.30	-
WS102	-	0.00 – 0.30	-	0.30 – 4.40	-
WS103	-	0.00 – 0.70	-	0.70 – 4.25	-
WS104	0.00 – 2.50	-	-	2.50 – 4.40	-
WS105	-	0.00 – 0.20	-	0.20 – 4.30	-
WS106	-	0.00 – 0.20	-	0.20 – 4.20	-
CP101	-	0.00 – 0.30	-	0.30 – 4.70	4.70 – 5.45
CP102	-	0.00 – 0.30	-	0.30 – 5.30	5.30 – 6.45

3.2. MADE GROUND

Made Ground was encountered within eight of twenty exploratory hole locations, encountered along the eastern and western site boundaries and within the location of historically infilled ponds. Generally Made Ground was encountered to proven depths < 1.0 metres below ground level (m bgl), with localised exceptions in areas of infilled ponds where Made Ground was encountered to a maximum proven depth of 3.10 m bgl (TP105a).

Made Ground comprised reworked topsoil superimposed upon blackish brown sandy gravel with frequent cobbles. Gravel consisted of angular to subrounded constituents of brick, concrete, timber, tile, ceramic, plastic, mudstone and sandstone, with cobbles comprising angular brick. Within areas of gravel surface coating along the eastern and north western sectors of the site, grey sandy gravel of concrete was encountered at ground level in replacement of reworked topsoil.

Within areas of former ponds in the south of the site (TP102, TP105a, and WS104), soft highly organic Made Ground material (SILT and PEAT) were noted beneath the blackish sandy gravel, representative of the base of the former ponds and encountered to maximum depths ranging between 2.00 m – 3.10 m bgl. Given the highly organic nature of these soils they are susceptible to settlement and deemed geotechnical unsuitable.

A Depth of Made Ground Plan is presented as Drawing 16-953-006 in Appendix III.

3.3. DRIFT DEPOSITS

Drift deposits were encountered within all of the exploratory locations and generally comprised uniform strata of an orange, brown slightly gravelly CLAY, with subangular to subrounded gravel of MUDSTONE.

CLAY deposits were generally noted as strengths of firm to very stiff from below topsoil or Made Ground deposits.

Soft CLAYS were encountered between 0.80 m – 1.50 m within TP101 in the south east and 0.20 m – 0.60 m bgl within TP106 in the south west of the site.

3.4. SOLID GEOLOGY

Weathered sandstone bedrock geology was encountered between 4.70 m and 6.45 m bgl, with the top of solid bedrock generally encountered between 5.45 m bgl (CP101) and 6.45 m bgl (CP102).

The solid geology comprises red SANDSTONE of Chester Pebble Bed Formation.

3.5. GROUNDWATER

A single groundwater strike was encountered as a steady ingress within TP102 at 1.40 m bgl associated with one of the former infilled ponds in the south of the site. The water was recorded to pool at the base of the pit on the very stiff low permeability CLAY.

3.6. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

A hydrocarbon sheen and strong organic odour was noted within TP102 between 0.20 m and 1.40 m bgl, associated with the historically infilled pond in the south of the site.

No further visual or olfactory evidence was noted across the site.

3.7. SOIL CONSISTENCY

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained triaxial tests. Results of the tests are presented in Table 3.2 and Table 3.3, which indicate the clay soils to vary between stiff and very stiff. Strength test data is generally consistent with the field descriptions of the aforementioned soils.

TABLE 3.2 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m^2)
TP101	1.2	34	79.9
TP101	1.6	59	138.65
TP101	2	96	225.6
TP102	1.6	34	79.9
TP102	2.4	39	91.65
TP103	1.4	97	227.95
TP103	2.5	130	305.5
TP103	2.8	140	329
TP104	2.1	133	312.55
TP104	2.8	174	408.9
TP105	1.9	59	138.65
TP106	1.2	116	272.6
TP106	2.3	116	272.6
TP107	1.8	139	326.65
TP107	2.4	99	232.65
TP108	1.6	100	235
TP108	2	117	274.95
TP109	0.8	77	180.95
TP109	2.5	177	415.95
TP110	1.3	90	211.5
TP110	2.1	141	331.35
TP111	2.4	152	357.2
TP111	3	178	418.3
TP112	1.7	93	218.55
TP112	1.9	105	246.75

Notes
ABP Calculated using Stroud and Butler et al 1974.

TABLE 3.3 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m^2)	CONSISTENCY
WS101	1.50 – 2.00	Brown silty slightly sandy gravelly CLAY.	131	Stiff
WS102	0.50 – 1.00	Brown silty slightly sandy slightly gravelly CLAY.	123	Stiff
WS105	2.50-3.00	Brown silty slightly sandy slightly gravelly CLAY.	107	Stiff

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.4.

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	Orangeish brown mottled grey slightly gravelly CLAY.	12	12.10	N/A	Medium strength	Stiff	60.49	124.37
WS101	2	Orangeish brown mottled grey slightly gravelly CLAY.	22	20.10	N/A	High strength	Very Stiff	100.49	206.61
WS101	3	Orangeish brown mottled grey slightly gravelly CLAY.	28	24.35	N/A	High strength	Very Stiff	121.75	250.32
WS101	4	Orangeish brown mottled grey slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS102	1	Orangeish brown mottled grey slightly gravelly CLAY.	13	13.11	N/A	Medium strength	Stiff	65.53	134.73
WS102	2	Orangeish brown mottled grey slightly gravelly CLAY.	24	21.92	N/A	High strength	Very Stiff	109.62	225.39
WS102	3	Orangeish brown mottled grey slightly gravelly CLAY.	28	24.35	N/A	High strength	Very Stiff	121.75	250.32

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/m²)	ALLOWABLE BEARING PRESSURE (kN/m²)*
WS102	4	Orangeish brown mottled grey slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS103	1	Orangeish brown mottled grey slightly gravelly CLAY.	12	12.10	N/A	Medium strength	Stiff	60.49	124.37
WS103	2	Orangeish brown mottled grey slightly gravelly CLAY.	25	22.84	N/A	High strength	Very Stiff	114.19	234.78
WS103	3	Orangeish brown mottled grey slightly gravelly CLAY.	37	32.18	N/A	Very high strength	Very Stiff	160.89	330.78
WS103	4	Orangeish brown mottled grey slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS104	1	Organic MADE GROUND	1	1.01	N/A	Extremely low strength	Very Soft	5.04	10.36
WS104	2	Organic MADE GROUND	4	3.65	N/A	Very low strength	Soft	18.27	37.56
WS104	3	Orangeish brown slightly gravelly CLAY.	24	20.87	N/A	High strength	Very Stiff	104.36	214.56
WS104	4	Orangeish brown slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25



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	Orangeish brown slightly gravelly CLAY.	13	13.11	N/A	Medium strength	Stiff	65.53	134.73
WS105	2	Orangeish brown slightly gravelly CLAY.	26	23.75	N/A	High strength	Very Stiff	118.76	244.17
WS105	3	Orangeish brown slightly gravelly CLAY.	30	26.09	N/A	High strength	Very Stiff	130.45	268.20
WS105	4	Orangeish brown slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS106	1	Orangeish brown slightly gravelly CLAY.	13	13.11	N/A	Medium strength	Stiff	65.53	134.73
WS106	2	Orangeish brown slightly gravelly CLAY.	23	21.01	N/A	High strength	Very Stiff	105.06	216.00
WS106	3	Orangeish brown slightly gravelly CLAY.	27	23.48	N/A	High strength	Very Stiff	117.40	241.38
WS106	4	Orangeish brown slightly gravelly CLAY.	50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25

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.



3.8. SIDE STABILITY AND EASE OF EXCAVATION

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

The presence of brick and concrete cobbles within the Made Ground deposits meant that towards the south west, excavation was slow through the Made Ground.

The natural strata was excavated with relative ease, however, depths in excess of 2.50 m bgl within the very stiff very high strength CLAY, resulted in slower excavation speed and reduced efficiency.

3.9. CONSOLIDATION

An undisturbed sample of Glacial till from WS101 was submitted for oedometer analysis. The results are provided in Table 3.5.

TABLE 3.5 OEDOMETER CONSOLIDATION RESULTS

LOCATION	DEPTH (m)	SAMPLE TYPE	MOISTURE CONTENT (%)	OEDOMETER CONSOLIDATION		
				PRESSURE RANGE (kPa)	Mv (m^2/MN)	Cv (m^2/year)
WS101	1.50 – 2.00	U100	17.1	0 – 35	0.16	17.91
				35 – 70	0.16	9.14
				70 – 140	0.17	7.57
				140 – 280	0.12	8.77
				280 - 35	0.06	3.04

When considered at over-burden pressure with an additional load of 280 kPa the coefficient of volume compressibility (Mv) ranged from 0.06 m^2/MN up to 0.17 m^2/MN. The material is considered to be low to medium compressibility.

The rate at which settlement is likely to occur is determined by the coefficient of consolidation (Cv). As shown in Table 3.5, the coefficient ranges from 3.04 m^2/yr to 17.91 m^2/yr. The rate at which settlement will occur is increased by the presence of sand within the Glacial Till and it is likely that settlement will occur over a period of months to years.

3.10. PARTICLE SIZE DISTRIBUTION

Particle Size Distribution Tests have been undertaken on selected samples of granular material via wet sieve to obtain information on the soil fractions. The results are included in Table 3.6. The full results can be found in Appendix VIII.

TABLE 3.6 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP105a	2.00 (Made Ground)	29	52	14	5
TP112	1.00 (Made Ground)	33	48	14	5

3.11. SOIL DENSITY/MOISTURE CONTENT RELATIONSHIP

Dry density / moisture content relationship analysis has been conducted on soils using proctor compaction tests by a 4.5kg rammer. The results of the tests have been summarised in Table 3.7. The full test results can be found in Appendix VIII.

TABLE 3.7 SUMMARY DRY DENSITY AND MOISTURE CONTENT

LOCATION	LABORATORY DESCRIPTION	TOP DEPTH (m)	METHOD OF COMPACTION	INITIAL MOISTURE CONTENT (%)	OPTIMUM MOISTURE CONTENT (%)	MATERIAL RETAINED ON 37.5 mm SIEVE (%)	MAX DRY DENSITY (mg/m³)	MATERIAL RETAINED ON 20.0 mm TEST SIEVE (%)
TP105a	Made Ground (Reworked CLAY)	2.00	4.5kg	10.7	14	9	1.77	20

The proctor compaction tests have indicated that the materials on site are variable with the material in TP105a being dry of the optimum. It should be noted that if this material is excavated for use in a cut/fill operation careful consideration should be taken in the stabilisation of this material.

Engineering of this type of material may be completed during dry or wet weather periods.

3.12. SOIL PLASTICITY

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

TABLE 3.8 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS101	2.00 – 2.45	11.8	12	29	17	65	11.05	Low
WS102	2.00 – 2.45	11	12	30	18	71	12.78	Low
WS103	2.00 – 2.45	13.8	11	33	22	85	18.70	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.

3.13. pH AND SULPHATE

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

TABLE 3.9 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO_4 IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	0.60	0.330	7.7	DS-1 AC-1s
TP101	2.60	0.200	7.6	DS-1 AC-1s
TP102	1.00	0.170	7.3	DS-1 AC-1s
TP103	0.20	0.095	7.3	DS-1 AC-1s
TP110	0.30	0.019	6.5	DS-1 AC-1s
TP112	0.40	0.043	4.9	DS-1 AC-1s
WS104	0.70	0.037	8.2	DS-1 AC-1s

3.14. SOIL INFILTRATION

In-situ variable (falling) head permeability tests were undertaken within the monitoring well installations located in four probeholes (WS101, WS105 and WS106). Tests in all locations were undertaken within a response zone located within natural stiff cohesive deposits.

The results are presented in Table 3.10.

TABLE 3.10 SOIL INFILTRATION RESULTS

LOCATION	DEPTH (m)	MATERIAL	TEST No.	SOIL INFILTRATION RATE (m/s)
WS101	1.00–3.00	Stiff CLAY	1	N/A
WS105	0.50–3.00	Stiff CLAY	1	N/A
WS106	1.00–3.00	Stiff CLAY	1	N/A

Soil infiltration rates are based on the effective depth to water over the time of the test, however, as the water level failed to fall in any locations, no infiltration rate could be calculated. All tests showed natural drift deposits to have poor soakage potential, likely associated with the presence of clay drift deposits significantly reducing the soakage potential.

It should be noted that falling head tests are indicative only and therefore not for design purposes, however, based on the findings and presence of low permeability stiff clay across the majority of the site it is unlikely that soakaway drainage (SUDS) would be suitable in the future drainage design for the proposed development.

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

4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

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

4.1. HUMAN HEALTH RISK ASSESSMENT

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

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

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

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

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Arsenic	mg/kg	37	13	120	TP101 0.6 m TP110 0.3 m	1	Further Action
Cadmium	mg/kg	11	13	0.6	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	13	< 1.8	N/A	1	No Further Action
Lead	mg/kg	200	13	450	TP101 0.6 m	1	Further Action
Mercury	mg/kg	1.2	13	1.1	N/A	4	No Further Action
Nickel	mg/kg	130	13	52	N/A	1	No Further Action
Selenium	mg/kg	250	13	< 1.0	N/A	1	No Further Action
Copper	mg/kg	2400	13	270	N/A	1	No Further Action
Zinc	mg/kg	3700	13	150	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	13	53	N/A	1	No Further Action
Phenols – Total	mg/kg	120	7	< 1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	8	NFD	N/A	3	No Further Action
Naphthalene	mg/kg	2.3	12	0.64	N/A	4	No Further Action
Acenaphthylene	mg/kg	170	12	0.26	N/A	2	No Further Action
Acenaphthene	mg/kg	210	12	2.7	N/A	1	No Further Action
Fluorene	mg/kg	170	12	0.85	N/A	1	No Further Action
Phenanthrene	mg/kg	95	12	24	N/A	2	No Further Action
Anthracene	mg/kg	2400	12	36	N/A	2	No Further Action
Fluoranthene	mg/kg	280	12	31	N/A	2	No Further Action
Pyrene	mg/kg	620	12	35	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	12	16	TP101 0.6 m TP112 0.4 m	2	Further Action
Chrysene	mg/kg	15	12	15	N/A	2	No Further Action

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Benzo(b)Fluoranthene	mg/kg	2.6	12	16	TP101 0.6 m TP112 0.4 m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	12	5.8	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	12	12	TP101 0.6 m TP112 0.4 m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	12	7	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	12	2.0	TP101 0.6 m TP110 0.3 m TP112 0.4 m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	12	8.1	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	13	< 1.0	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	13	< 0.1	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	13	< 0.1	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	13	23	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	13	60	N/A	4	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	13	180	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	13	1100	TP112 (0.40m)	1	Further Action

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

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

* The Tier 2 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 2 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 2 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.
** Atkins ATRISK
*** USEPA Risk Management Levels

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(a)Anthracene;
- Benzo(b)Fluoranthene;
- Benzo(a)Pyrene;
- Dibenzo(a,h)Anthracene; and
- TPH C21 – C35 (Aromatic).

No significant concentrations of VOCs were identified in the soils submitted for chemical analysis.

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

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

- The main exposure pathways based on the Tier 2 exceedances are:
  - Dermal contact and ingestion; and
  - Consumption of homegrown vegetables.
- The exceedances for all determinands are associated with shallow Made Ground deposits < 0.7 m.
- The exceedances are not recorded within the location of historically infilled ponds.

HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

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

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

Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this.

There are suitable sources of topsoil available on the site across the majority of the site, with the exception of the southeastern sector of the site within the vicinity of the former ponds, and the gravel hardstanding at the western boundary.

4.2. 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 (Historical development and infilled ponds) Heavy metal, PAH and long chain TPH contamination has been identified within Made Ground deposits ranging from 0.60 – 1.00 m bgl.		**High**
Pathway		
Vertical Migration Due to the site wide presence of low permeability cohesive CLAY deposits, the risk presented by vertical migration of contaminants from Made Ground sources reaching the underlying aquifer is significantly reduced, as migration through this stratum will be limited.		**Low**
Lateral migration There is potential for lateral migration of mobile phase contaminants through the granular Made Ground deposits. However, due to the localised and discontinuous nature of Made Ground deposits, separated by low permeability CLAY deposits of which will serve to limit the contamination pathway, this is greatly reduced.		**Low**
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated aquifer	**Medium**
Aquifer Classification in Bedrock	Principal aquifer	**High**
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected	**Low**
Distance to the Closest Groundwater Abstraction Point	A groundwater abstraction point is noted 282 m E of the site.	**Medium**
Is the Site Located Within 50 m of a Surface Watercourse?	The closest surface watercourse is located 140 m E.	**Low**
The ICSM developed within the context of the site setting has not identified any potentially significant viable pollutant pathways. Therefore, the overall risk to controlled waters is considered low.		

TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of VOCs above 1mg/kg or TPH C5 to C6 that might otherwise be indicative of VOC impact.	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	SVOC analysis recorded concentrations below the laboratory limit of detection (LOD) throughout the site.	None
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	Concentrations of C10-C12 have been recorded above 10 mg/kg at TP110 (0.40 m), at 23 mg/kg.	**Further discussion**
C12-C16 > 50 mg/kg	Concentrations of C12-C16 have been recorded above 50 mg/kg within TP110, at 60 mg/kg at a depth of 0.40 m.	**Further discussion**
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	All concentrations of Naphthalene have been recorded below 2 mg/kg.	None
Total PAH > 10 mg/kg	Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected within four locations of the site (TP101, TP103, TP110, TP112), with a maximum concentration recorded in TP101 at 187 mg/kg.	**Further discussion**
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	No concentrations of heavy metals have been recorded above 500 mg/kg within any samples.	None

The Tier 2 assessment has included a comparison of leachate analysis from samples of the Made Ground to drinking water standards (DWS) and environmental quality standards (EQS). During the ground investigation a consistent water table was not recorded. Additionally, during return monitoring visits the groundwater was not encountered in adequate quantities to obtain a groundwater sample.

These are presented in Table 4.4.

TABLE 4.4 COMPARISON OF GROUNDWATER AND LEACHATE ANALYSIS WITH TIER 2 SCREENING LEVELS

DETERMINAND	UNIT	EQS [1, 2] AA	DWS [3,4]	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
Arsenic	µg/l	50	10	2	3.8	-	No Further Action
Cadmium	µg/l	0.08-0.25	5	2	< 0.08	-	No Further Action
Chromium (VI)	µg/l	3.4	–	2	< 5.0	-	No Further Action
Chromium (III)	µg/l	4.7	50	2	2.3	-	No Further Action
Copper	µg/l	1	2000	2	26	TP102 2.00m (EQS) TP112 0.40m (EQS)	Further Action
Total Cyanide	µg/l	1	50	2	1.3	TP102 1.00m (EQS)	Further Action
Lead	µg/l	1.2	10	2	6.9	TP102 1.00m (EQS) TP112 0.40m (EQS)	Further Action
Mercury	µg/l	–	1.0	2	< 0.5	-	No Further Action
Nickel	µg/l	4	20	2	3.8	-	No Further Action
Selenium	µg/l	–	10	2	< 4.0	-	No Further Action
Zinc	µg/l	10.9	–	2	19	TP102 1.00m (EQS) TP112 0.40m (EQS)	Further Action
pH	6–9			2	8.1	-	No Further Action
Polycyclic Aromatic Hydrocarbons							
Naphthalene	µg/l	2	10*	2	< 0.01	-	No Further Action
Anthracene	µg/l	0.1	10*	2	< 0.01	-	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	2	< 0.01	-	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	2	< 0.01	-	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	2	< 0.01	-	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	2	< 0.01	-	No Further Action

DETERMINAND	UNIT	EQS [1, 2] AA	DWS [3,4]	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
Fluoranthene	µg/l	0.0063	10*	2	< 0.01	-	No Further Assessment
Benzo(ghi)perylene	µg/l	1.7–4	10*	2	< 0.01	-	No Further Assessment
Aromatic Hydrocarbon							
TPH C5-C7 (benzene)	µg/l	10	1	2	< 3.0	-	No Further Assessment
TPH C7-C8 (toluene)	µg/l	74	700	2	< 3.0	-	No Further Assessment
TPH C8-C10 (xylene)	µg/l	30	300	2	< 3.0	-	No Further Assessment
TPH C10-C12 (naphthalene)	µg/l	2	90	2	< 3.0	-	No Further Assessment
TPH C12-C16	µg/l	–	90	2	< 3.0	-	No Further Assessment
TPH C16-C35	µg/l	–	90	2	< 3.0	-	No Further Assessment
Aliphatic Hydrocarbon							
TPH C5-C6	µg/l	–	1000[5]	2	<1.0	-	No Further Assessment
TPH C6-C8	µg/l	–	1000[5]	2	<1.0	-	No Further Assessment
TPH C8-C10	µg/l	–	300	2	<1.0	-	No Further Assessment
TPH C10-C12	µg/l	–	300	2	<10	-	No Further Assessment
TPH C12-C16	µg/l	–	300	2	<10	-	No Further Assessment
TPH C16-C21	µg/l	–	300**	2	<10	-	No Further Assessment
TPH C21-C35	µg/l	–	300**	2	<10	-	No Further Assessment

Notes

Solubility <0.01µg/l
AA – Annual Average
* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water
** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

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

4.2.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

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

- Copper;
- Total Cyanide;
- Lead; and
- Zinc.

No exceedances of DWS values were recorded.

4.2.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

Historically, the site has undergone limited development with no industrial processes recorded across the site's history, as such, limited contamination sources have been identified on site. However, localised infilling of former ponds in the south and development of structures in the west has resulted in isolated areas of Made Ground across the site. Chemical analysis of Made Ground soils identified the Made Ground to be a potential source of PAH and TPH C10 – C16 (Table 4.3), however, upon receipt of leachate testing no exceedances of PAH or TPH were noted above EQS or DWS and therefore no risk to controlled waters is deemed to be present in relation to these contaminants.

Leachate analysis of Made Ground soils identified minor heavy metal (copper, total cyanide, lead and zinc) exceedances against EQS values, no exceedances of DWS were noted. During the ground investigation a consistent water table was not recorded and during return monitoring visits the groundwater was not encountered in adequate quantities to obtain a groundwater sample. As such, the assessment has been undertaken on leachate samples only. Where leachate analysis has been undertaken, this can overstate the risk and is not wholly representative of the site characterisation, as the contaminants present in the soils are required to be mobilised by water in order to cause a potential risk to the aquifer. As such, this assessment is considered to be conservative.

The wider site comprises a uniform geology of circa five metres of low permeability stiff cohesive clay that will serve to limit migration. During the E3P investigation, a consistent water table was not identified, and since all locations advanced were underlain by low permeability CLAY, it is unlikely that vertical migration towards the underlying principal aquifer will occur. Additionally, the Made Ground is discontinuous, and therefore not hydraulically connected, given the presence of site wide stiff low permeability clay, no viable pathway for the lateral migration of mobile phase contamination through perched groundwater is considered to be present.

Given the absence of significant contamination sources on site, lack of surface water features within influencing distance to the site, lack of consistent water table and presence of site wide low permeability clay that will serve to remove viable contamination pathways between Made Ground soils and the principal aquifer; the risk to controlled waters is considered to be low.

As the site is currently open, public space, with little hardstanding surface cover, rainfall is not being intercepted and subsequently infiltrates freely into the underlying Made Ground, potentially mobilising the identified contaminants. However, the proposed development will create hardstanding cover across the site, thus reducing the amount of infiltration generated. This will in turn, reduce the amount of contaminants present in leachate off the site and reduce the risk further to the underlying aquifer. Given that the majority of the site is underlain by low permeability clay, the leaching of contaminants will be significantly reduced as the Made Ground will be contained beneath the impermeable surface covering, with the exception of garden areas, and above the natural clay aquitard.

The results of the data review and Tier 2 qualitative risk assessment has allowed E3P to draw the following conclusions in respect to the risk to controlled waters:

- The primary controlled water receptor has been identified as the underlying principal aquifer;
- No surface water features are present within influencing distance of the site;
- The site has undergone little historical development, with no on site industrial processes recorded. As such, no significant contamination sources have been identified on site.
- Localised infilling of former ponds in the south and development of structures in the west has resulted in isolated areas of Made Ground across the site.
- Chemical analysis of Made Ground soils identified the Made Ground to be a potential source of PAH and TPH C10 – C16 (Table 4.3), however, upon receipt of leachate testing no exceedances of PAH or TPH were noted above EQS or DWS and therefore no risk to controlled waters is deemed to be present in relation to these contaminants.
- Leachate analysis of Made Ground soils identified minor heavy metal (copper, total cyanide, lead and zinc) exceedances against EQS values, no exceedances of DWS were noted.
- Made Ground is discontinuous, and therefore not hydraulically connected, given the presence of site wide stiff low permeability clay, no viable pathway for the lateral migration of mobile phase contamination through perched groundwater is considered to be present.
- During the E3P investigation, a consistent water table was not identified, and since all locations advanced were underlain by low permeability CLAY, it is unlikely that vertical migration towards the underlying principal aquifer will occur.
- Given the absence of significant contamination sources on site, lack of surface water features within influencing distance to the site, lack of consistent water table and presence of site wide low permeability clay that will serve to remove viable contamination pathways between Made Ground soils and the principal aquifer; the risk to controlled waters is considered to be low.

4.3. 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.

4.4. MONITORING METHODOLOGY

Concentrations of methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) (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 CH_4 and CO_2, together with the lowest concentration of O_2 were recorded.

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

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485:2015. 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 CLAY Drift	20/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	1000	Falling	0.1	0.1	1.00-4.00	4.20	Dry
		10/07/2023	0.1	0.1	0.0001	0.8	0.7	0.0008	20.2	1011	Falling	0.1	0.1		3.97	3.04
		26/07/2023	0.1	0.1	0.0001	1.3	0.9	0.0013	19.8	1001	Falling	0.1	0.1		4	3.80
WS102	Natural CLAY Drift	20/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	999	Falling	0.1	0.1	1.00-4.00	4.30	Dry
		10/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	1012	Falling	0.1	0.1		4.06	Dry
		26/07/2023	0.1	0.1	0.0001	0.5	0.5	0.0005	18.3	1001	Falling	0.1	0.1		4	Dry
WS103	Natural CLAY Drift	20/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	999	Falling	0.1	0.1	1.00-4.00	4.20	4.10
		10/07/2023	0.1	0.1	0.0001	0.2	0.1	0.0002	20.8	1010	Falling	0.1	0.1		3.77	0.5
		26/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	21.0	1000	Falling	0.1	0.1		3.70	0.5
WS104	Made Ground (Pond Infill)	20/06/2023	0.1	0.1	0.0025	0.1	0.1	0.0025	20.4	999	Falling	2.5	0.1	1.00-2.00	2.2	1.9
		10/07/2023	0.3	0.1	0.0003	0.5	0.2	0.0005	20.8	1010	Falling	0.1	0.1		2.05	1.25
		26/07/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	21.1	1000	Falling	0.1	0.1		1.95	1.10
WS105	Natural CLAY Drift	20/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	999	Falling	0.1	0.1	1.00-4.00	4.3	Dry
		10/07/2023	0.1	0.1	0.0001	1	0.8	0.001	20.4	1011	Falling	0.1	0.1		4.04	3.97
		26/07/2023	0.1	0.1	0.0001	0.8	0.6	0.0008	20.1	1000	Falling	0.1	0.1		4	Dry
WS106	Natural CLAY Drift	20/06/2023	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	999	Falling	0.1	0.1	1.00-4.00	4.20	Dry
		10/07/2023	0.1	0.1	0.0001	1.2	1.5	0.0015	20.4	1011	Falling	0.1	0.1		4.07	Dry
		26/07/2023	0.1	0.1	0.0001	0.9	0.6	0.0009	20.2	1000	Falling	0.1	0.1		4	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	

4.5. SUMMARY OF MONITORING RESULTS

4.5.1. GROUNDWATER

Generally, the water level within the monitoring wells was recorded to be below the top of the response zone, however, following heavy rainfall WS103 response zone was flooded on two occasions, with the well purged between visits.

Within remaining monitoring wells, groundwater levels were observed to rise over the monitoring period, however, due to the predominantly low permeability cohesive drift stratum and heavy rainfall during the monitoring period to date, it is likely that water levels are representative of surface water collecting within the standpipes and not a true representation of groundwater.

4.5.2. BAROMETRIC PRESSURE

Visits 1 to 3 have been undertaken during periods of falling pressure with pressure recorded to be between 999 and 10121 mbar.

It is therefore considered that future visits need been undertaken during rising and steady pressure conditions to be considered fully representative conditions.

4.5.3. GAS FLOW

Throughout the monitoring period, the majority of flow rates were recorded to be 0.1 l/hr (limit of detection of the analyser). A peak flow rate of 2.5 l/hr was recorded within WS104 during the first visit, however steady flow was recorded to be 0.1 l/hr.

4.5.4. GAS CONCENTRATIONS

The maximum peak methane value recorded within the monitoring wells was 0.3% v/v (WS104), however, this fell to a steady rate of 0.1 % (limit of detection of the analyser).

4.6. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is presented in Table 4.10. 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 4.6 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	20/06/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	10/07/2023	3.04	0.1	0.1	0.0001	0.8	0.0008	CS1	Green
	26/07/2023	3.80	0.1	0.1	0.0001	1.3	0.0013	CS1	Green
WS102	20/06/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	10/07/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	26/07/2023	Dry	0.1	0.1	0.0001	0.5	0.0005	CS1	Green

WELL	DATE	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH_4 (%V/V)	MAX CH_4 Q_{hg} (l/hr)	MAX CO_2 (%V/V)	MAX CO_2 Q_{hg} (l/hr)	CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT
WS103	20/06/2023	4.10	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS104	20/06/2023	1.9	2.5	0.1	0.0025	0.1	0.0025	CS1	Green
	10/07/2023	1.25	0.1	0.3	0.0003	0.5	0.0005	CS1	Green
	26/07/2023	1.10	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS105	20/06/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	10/07/2023	3.97	0.1	0.1	0.0001	1	0.001	CS1	Green
	26/07/2023	Dry	0.1	0.1	0.0001	0.8	0.0008	CS1	Green
WS106	20/06/2023	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
	10/07/2023	Dry	0.1	0.1	0.0001	1.2	0.0015	CS1	Green
	26/07/2023	Dry	0.1	0.1	0.0001	0.9	0.0009	CS1	Green

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

- Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1, and in these areas it is considered that gas protection measures will not be required.
- In the vicinity of WS104, elevated flow rates were recorded, however the CO_2 and CH_4 GSV is noted to be within a CS1 classification.
- The site is predominantly glacial till of CLAY at depths of 0.10 m bgl to 5.45 m bgl.
- Made Ground has been encountered in localised areas at a maximum depth of 3.10 m bgl but more generally was encountered at a depth less than 1.00m bgl.
- The only monitoring installation with methane above the limit of detection has been encountered in the area of the infilled pond (WS104). However, no carbon dioxide or methane has been recorded above the CS1 threshold. Furthermore, it is understood that the onsite organic Made Ground material will be removed and backfilled with inert material, therefore, it is unlikely that this will cause any ongoing gas risk and it is considered that gas protection measures will not be required.
- With due consideration to the Conceptual Site Model and the absence of any persistent gas source and gas generation potential, it is considered by E3P that the site can be classified as CS1, and therefore no gas protection measures are required. However, this will need to be confirmed upon completion of the full gas monitoring program that is currently ongoing.

4.7. POTABLE WATER SUPPLY

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

TABLE 4.7 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at Current pipeline depth (mg/kg)
Total VOC	0.5	<1.0
Total BTEX And MTBE	0.1	< 5.0
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	< 4.0
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	28
Phenols (From SVOC Analysis)*	2	< 1.0
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	< 1.0
Ethers*	0.5	< 0.5
Nitrobenzene*	0.5	< 0.3
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	N/A
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	Yes – Minor exceedances of EC10-EC16 hydrocarbons at depths between 0.20 m to 0.60 m bgl.	
Is free product present in soil and groundwater?	None	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	No – heavy end hydrocarbon impact and low solubility PAH has been identified within Made Ground. Groundwater levels are generally significantly deeper than pipeline depth.	
Will soils impacted with above determinands likely be utilised elsewhere on site?	No	
Will soils be imported to site as part of any future earth works	Currently unknown, however it is unlikely soils will be required to be imported to site.	

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

Based on the assessment of current site conditions it is likely that PE pipe will be suitable at the proposed development. This will need to be confirmed with a suitable UKWIR pipeline assessment prior to the installation of any water pipeline on site.

4.8. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.8 has been prepared for the site.

TABLE 4.8 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	High	LOW
Discussion: Heavy metals (arsenic and lead), non-volatile PAHs (Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, dibenzo[a,h]anthracene and long chain aromatic TPH (C21-C35) have been recorded above the GAC in Made Ground soils between depths of 0.3 m and 0.60 m. **Recommendation:** Cover system to garden and landscaped areas will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Unlikely	Low	LOW
Assessment: No asbestos has been identified within any samples. **Recommendation:** No further action is required. Should asbestos be identified during enabling works, soils will require placement in accordance with the asbestos CSM. Construction works completed with PPE and provision of welfare.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons, solvents, antifreeze (Made Ground)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Unlikely	Low	LOW
Assessment: No VOC's, SVOCs or volatile phase TPHs have been recorded. Additionally, given the lack of industrial history on site, the presence of these contaminations is unlikely. **Recommendation:** No further action.						
PL4	Methane, carbon dioxide (peat, infilled pond)	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Off-site land users.	Likely	Moderate	LOW
Assessment: Deeper Made Ground and organic Made Ground deposits associated with historically infilled ponds have been identified as potential sources of hazardous ground gas. **Recommendation:** Initial monitoring suggests that the site can be classified as CS1/Green, however this will be confirmed on completion of the monitoring. Precautionary CS2/Amber 1 measures required. Putrescible material from the base of historic ponds should be removed during enabling works to remove source.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL5	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground)	Surface runoff. Migration through permeable strata and preferential pathways. Perched waters migration.	Groundwater (Principal bedrock aquifer). Surface water (Shaw Brook).	Likely	Low	LOW
Assessment: Leachate has identified heavy metals (lead, copper, cyanide and zinc) above EQS in Made Ground soils. Granular Made Ground is not isolated areas and not hydraulically connected. Due to the presence of low permeability stiff clay across the entirety of the site no viable lateral or vertical migration pathways are deemed to be present. Additionally, no surface water features are in influencing distance to the site and the site is not located within a source protection zone. As such the risk to controlled waters is low. **Recommendation:** No further action.						
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Unlikely	Low	LOW
Assessment: The soils at the site meet class DS-1, AC-1s. **Recommendation:** Concrete should be designed in accordance with the chemical testing results.						

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL7	Organic contaminants such as hydrocarbons, solvents (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Unlikely	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 PE pipe could be utilised. This will need to be confirmed with a UKWIR risk assessment post remediation.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Low	
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 where made Ground is present to prevent plant uptake of contaminants.						

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

5. GEOTECHNICAL ASSESSMENT

5.1. PROPOSED DEVELOPMENT

Kellen Homes intend to construct a residential development comprising low-rise dwellings and 3 apartment blocks totalling circa 85 dwellings with associated gardens, estate roads and infrastructure. Drawing 16-953-002 (Appendix III) identifies the proposed development layout.

5.2. SUMMARY OF GROUND CONDITIONS

MADE GROUND

- Made Ground deposits were encountered within eight exploratory hole locations, predominantly towards the southeast of the site to depths of between 0.50 m and in excess of 3.10 m bgl associated with historically infilled ponds.
- In general, Made Ground was encountered to a depth of less than 1.00 m bgl.
- Made Ground deposits comprise a dark brown/black sandy gravel with brick, concrete, plastic, timber, tile, mudstone, and sandstone in the majority of locations.
- A reworked dark brown mottled grey gravelly CLAY was encountered to a maximum proven depth of 2.70 m bgl.
- A Depth of Made Ground Plan is presented as Drawing 16-953-006 in Appendix III.

DRIFT

- Drift deposits were encountered within all exploratory locations generally comprising a stiff to very stiff, high to very high strength, orange-brown mottled CLAY with gravel of mudstone.
- CLAY deposits were encountered at depths of 0.20 – 5.30 m bgl, generally below a dark brown SAND with frequent roots and rootlets (topsoil)
- A small deposit of very clayey fine to medium SAND was recorded within TP108 from depths of 0.20 – 0.80 m bgl.

SOLID

- Weathered sandstone bedrock geology was encountered between 4.70 m and 6.45 m bgl, with the top of solid bedrock generally encountered between 5.45 m bgl (CP101) and 6.45 m bgl (CP102).
- The solid geology comprises red SANDSTONE of Chester Pebble Bed Formation.
- Bedrock was encountered within the northeast and southwest of the site, therefore it is considered likely to be present across the whole site at depths in excess of 5.00 m bgl.

GROUNDWATER

- Groundwater strike was only encountered within TP102, within the former pond area. The water strike was encountered as a steady ingress pooling at the base of exploratory locations.
- No consistent groundwater table was recorded across the wider site.

5.3. SITE PREPARATION

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

- Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- Demolition of all existing buildings and removal of all concrete hardstanding.
- Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- Buried structures and old foundations are anticipated below structures in the west of the site. These should be excavated from below the proposed development footprint with the resulting void backfilled.

5.4. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

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

TABLE 5.1 SUMMARY OF ABP

COHESIVE SOILS			
Description	**Depth (range m bgl)**	**Undrained Shear Strength (Cu) (kN/m^2)**	**Allowable Bearing Pressure (kN/m^2)**
Stiff to Very Stiff, Gravelly CLAY	1.00–4.45	60.49–211.21	124.37 – 434.25
Very Soft to Soft Gravelly CLAY (2 Locations)	0.2 – 1.50	34.00	79.9

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

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

- Shallow strip foundations bearing on firm to very stiff gravelly CLAY at circa 1 m bgl;
- Trench fill to support reinforced strip foundations in areas of softer ground and/or potential tree influence; and
- Piled foundation in location of former ponds.

A summary of anticipated foundations is presented in Table 5.2. Given no arboriculture report has been produced to date, Table 5.2 is based upon a worst case scenario of fully mature high water demand tree, as such, foundation depths are likely to change. Upon receipt of proposed development levels and arboriculture report, an updated foundation zoning plan should be produced.

TABLE 5.2 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	1.65	N/A	Stiff CLAY	Y	Shallow Strip/Mass Trench	DS-1 AC-1s
WS102	1.65	N/A	Very Stiff CLAY	Y	Shallow Strip/Mass Trench	DS-1 AC-1s
WS103	1.15	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS104	3.00	N/A	Very Stiff CLAY	N	VSC/Piled Foundation	DS-1 AC-1s
WS105	1.68	N/A	Stiff CLAY	Y	Shallow Strip/Mass Trench	DS-1 AC-1s
WS106	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
CP101	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
CP102	1.83	N/A	Stiff CLAY	Y	Mass Trench	DS-1 AC-1s
TP101	2.05	N/A	Firm CLAY	Y	Mass Trench	DS-1 AC-1s
TP102	>3	1.40	TBC	N	VSC/Piled Foundation	DS-1 AC-1s
TP103	2.10	N/A	Stiff CLAY	Y	Mass Trench/Vibro	DS-1 AC-1s
TP104	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
TP105a	>3.5	N/A	TBC	Y	VSC/Piled Foundation	DS-1 AC-1s
TP106	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
TP107	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
TP108	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (M BGL)	GROUND WATER (M BGL)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
TP109	2.10	N/A	Stiff CLAY	Y	Shallow Strip	DS-1 AC-1s
TP110	0.95	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
TP111	0.90	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
TP112	1.65	N/A	Stiff CLAY	N	Shallow Strip/Mass Trench	DS-1 AC-1s

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

5.5. GROUND FLOOR SLABS

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

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

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

5.6. HEAVE PRECAUTIONS

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

As the clay is deemed to be low plasticity, heave precautions are not required to the internal face of the external load-bearing walls (outside or within tree influence).

If a ground beam is to be constructed within the zone of tree influence, heave precautions are required to the underside of this and edge beams.

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

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

A summary of heave precautions is presented in Table 5.3.



TABLE 5.3 SUMMARY OF HEAVE PRECAUTIONS

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

5.7. HIGHWAYS CONSTRUCTION

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

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

5.8. DRAINAGE

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

Furthermore, the site is predominantly underlain by > 5 m of likely low-permeability gravelly CLAY. Therefore, the use of soakaway drainage will be limited. Falling head tests within the monitoring wells were attempted, however, tests in all locations failed to fall during the duration of the test. As such, it is not recommended that soakaways are utilised for disposal of surface water runoff.

If soakaway drainage is to be considered, full BRE 365 testing must be completed to inform the detailed design.



5.9. CONCRETE DURABILITY

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

5.10. EXCAVATIONS

Trial pits were generally stable in both granular Made Ground and natural strata; as such, it is considered that near-surface excavations will be feasible. In areas where Made Ground exceeded 2 m, excavations were generally less stable.

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

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

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

TABLE 5.4 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	No	Water ingress was only encountered within TP102, as a steady ingress flow.
Shallow Bedrock	No	Bedrock has been identified at depths > 5 m bgl beneath stiff to very stiff CLAY deposits within two exploratory hole locations.

5.11. CONSTRUCTION ACTIVITY AND INSPECTION

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

- Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.

- It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.

- Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.

- The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).

5.12. GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils	South of site/infilled ponds	15	Made Ground soils have been shown to be impacted by heavy metals, long chain hydrocarbons and non volatile PAH which will require mitigation measures during build phase. Additionally, where historic ponds have been infilled in the south of the site, organic Made Ground soils have been identified that will require subsequent delineation and removal.
Bedrock	N/A	0	Bedrock has been identified at depths > 5 m bgl beneath stiff to very stiff CLAY deposits within two exploratory hole locations. As required, piles can extend to the bedrock.
Cohesive Stratum overlying shallow Bedrock (<3.00m)	N/A	0	Bedrock has been identified at depths in excess of 3.00 m bgl, with cohesive stratum noted overlying the site. Therefore, it is considered significant cohesive deposits are present in excess of 4.00 m across the site.
Obstructions	Beneath Current Structures	20	The site has been subject to historical development and above-ground structures have not yet been removed. Therefore, it is considered likely that potential subsurface obstruction from relict foundations and slabs remain.
Artificially levelled and filled platforms	West	25	The site appears to have been levelled and artificially backfilled with areas of hardstanding noted across site. A bund/mound is noted at the north eastern boundary may be artificially filled, however due to constraints no exploratory holes could be conducted to confirm the presence of Made Ground.
Mature trees	Southern and Northern Boundaries	30	Arboriculture survey required to determine areas of potential tree influence. The site is predominantly surfaced by soft cover with localised areas of gravel and hardstanding, however a number of semi-mature and mature trees are present at the boundaries of the site.

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Volume change potential clay	Site Wide	100	The site is underlain by cohesive soils. The volume change potential of the clay deposits across site have been deemed as 'Low' in accordance with NHBC/LBC guidance, therefore it is deemed heave precautions are unlikely to be required at the site.
Peat/Organic Material	Infilled ponds	15	Localised stratum of highly organic material derived from the former on-site ponds towards the south east of the site. Further delineation of pond and organic deposits are required to determine the extent of area at risk and to remove unsuitable material.
Running sands	N/A	N/A	Data searches indicate low risk.
Ground dissolution	N/A	N/A	Data searches indicate no hazard.
Concrete design	On site	100	All tested 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).
Low-permeability ground	On site	100	Soakaways are unlikely to be effective in areas where low permeability cohesive deposits are present or where areas of potentially contaminated soil and groundwater are present. Further testing may be required to confirm the permeability of the ground material.
Services/sensitive structures	TBC	30	A Vodafone box has been identified within the site boundary at the southeast of the site, with a potential cable traversing east to west, and a telecommunications mast is noted adjacent to the northwestern boundary, with small overhead cables connecting off-site at the northwest of the site. Additionally, the buildings in the west are likely to have active services present.
Abnormal foundation solutions	Infilled ponds	15	Significant Made Ground and soft clay deposits have been identified, predominantly in areas of former infilled ponds. Therefore, an abnormal foundation solution (MTF, VSC, Pile) may be required within these areas, it is assumed that a piled foundation will be required due to the development load.



POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Areas not investigated	Below Current Structure / bund in north east	30	A small area at the northeastern site boundary was not investigated due to the extent of overgrown vegetation making it inaccessible. Further works within the vicinity may be required to confirm the material within the bund/mound and potential slope. Additionally, above ground structures were not removed prior to the intrusive site investigation, once demolished additional investigation will be required in these areas.
Historically infilled ponds	On Site (South East)	15	Two historically infilled ponds have been identified on site at the southeastern boundary. Multiple exploratory holes were placed within the vicinity of the former ponds with organic materials with strong organic odours encountered within TP105a and WS104, and soft clays and extensive Made Ground (>1.50 m bgl) deposits recorded within the former ponds in TP101 and TP102.
Slope	On Site	0	A slope is potentially present within the mound/bund noted at the northeastern boundary, however, this bund is likely to be removed as part of the proposed development and therefore no future risk will be present.



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:

- Further investigation of inaccessible areas (including beneath current structures, north eastern bund and infilled pond delineation).
- Plot-specific foundation schedule (upon receipt of the final development levels).
- Arboricultural survey.
- Geotechnical earthworks strategy (infrastructure).
- Remediation and enabling works strategy.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONTAMINATED LAND ASSESSMENT

Human Health	A Tier I human health risk assessment has been undertaken using the chemical analysis results of the soils and comparing them to the relevant Tier I criteria (residential end-use with plant uptake), as this is the worst-case scenario. The results of this direct comparison indicate that the data exceeds the screening criteria for a residential end-use for heavy metals (lead and arsenic), non-volatile PAHs (Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[a]pyrene, dibenzo[a,h]anthracene and long chain aromatic TPH (C21-C35). In relation to heavy metals, non-volatile PAHs and TPH C21-35, these contaminants have primary exposure pathways related to dermal contact, ingestion of soils, and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations of heavy inorganic metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping and public open space to remove any potential for direct exposure to impacted soils. Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas; however, further chemical validation samples will be required to confirm this. There are suitable sources of topsoil available on the site across the majority of the site, with the exception of the southeastern sector of the site within the vicinity of the former ponds, and the gravel hardstanding at the western boundary.
Controlled Waters	The results of the data review and Tier 2 qualitative risk assessment has allowed E3P to draw the following conclusions in respect to the risk to controlled waters: - The primary controlled water receptor has been identified as the underlying principal aquifer; - No surface water features are present within influencing distance of the site; - The site has undergone little historical development, with no on site industrial processes recorded. As such, no significant contamination sources have been identified on site. - Localised infilling of former ponds in the south and development of structures in the west has resulted in isolated areas of Made Ground across the site.

	• Chemical analysis of Made Ground soils identified the Made Ground to be a potential source of PAH and TPH C10 – C16 (Table 4.3), however, upon receipt of leachate testing no exceedances of PAH or TPH were noted above EQS or DWS and therefore no risk to controlled waters is deemed to be present in relation to these contaminants. • Leachate analysis of Made Ground soils identified minor heavy metal (copper, total cyanide, lead and zinc) exceedances against EQS values, no exceedances of DWS were noted. • Made Ground is discontinuous, and therefore not hydraulically connected, given the presence of site wide stiff low permeability clay, no viable pathway for the lateral migration of mobile phase contamination through perched groundwater is considered to be present. • During the E3P investigation, a consistent water table was not identified, and since all locations advanced were underlain by low permeability CLAY, it is unlikely that vertical migration towards the underlying principal aquifer will occur. • Given the absence of significant contamination sources on site, lack of surface water features within influencing distance to the site, lack of consistent water table and presence of site wide low permeability clay that will serve to remove viable contamination pathways between Made Ground soils and the principal aquifer; the risk to controlled waters is considered to be low.
Ground Gas	The gas monitoring program is currently on going, visits undertaken to date record the site to be CS1. However, presently gas monitoring data during varying atmospheric conditions has not been completed. Upon completion of the full gas monitoring program a ground gas addendum will be issued under a separate cover that will outline any mitigation measures required.
Potable Water	PE pipeline could be used across the development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

6.2. GEOTECHNICAL ASSESSMENT

No significant below-ground obstructions have been identified during the ground investigation. However, potential underground obstructions are likely to be present beneath structures in the west of the site and may be present within the bund located to the northeast of the site, however, it remained inaccessible due to dense vegetation

Bedrock has been identified across the site with the top of bedrock encountered at 4.70 m bgl within CP101 towards the southwest of the site and 5.30 m bgl within CP102 in the north. Where encountered shallow bedrock is likely to impede excavations with standard machinery.

Due to the presence of dense vegetation, including mature trees at the northern and southern boundary, extensive root networks are anticipated across these areas of the site.

Geotechnically unsuitable material has been identified at the base of former ponds, therefore additional investigation into the extent of former ponds is required, with unsuitable material removed prior to the construction of the proposed development.

Across the majority of the site the suitable target founding stratum has been identified as the underlying firm to very stiff CLAY with an allowable bearing capacity (ABP) of 79 – 326 kN/m² between 1.00 – 2.00 m bgl, 91 – 415 kN/m² between 2.00 – 3.00 m and 69 – 418 kN/m² between 3.00 – 3.45 m bgl.

Shallow bedrock encountered between 4.70 m bgl and 5.30 m bgl has a ABP of > 400 kN/m².

Due to the strength of CLAY deposits recorded across the site, it is anticipated the foundation design required will likely comprise strip/mass trench for the low-rise dwellings and mass trench/piled foundation design for proposed apartment blocks dependent on final loadings.

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

Furthermore, within the location of former ponds and where softer clays are encountered to significant depth, a piled foundation is likely to be required.

The final foundation solution will be dependent on the loadings required, final levels and location of structures in relation to former or existing trees across the site.

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II
GLOSSARY

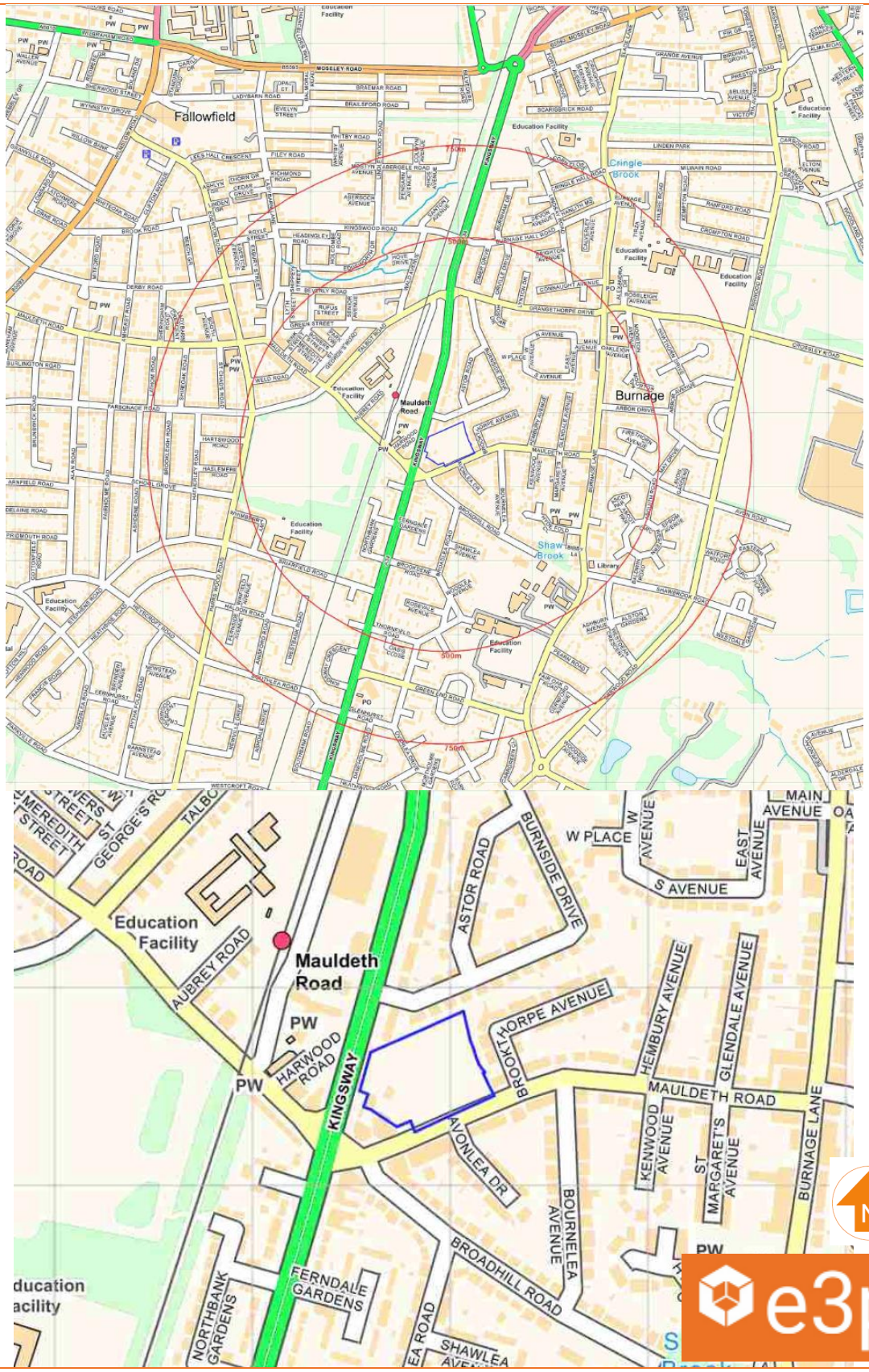
TERMS

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

MIBK	Methyl isobutyl ketone	**WTE**	Water table elevation
m	Metres	**ppm**	Parts per million
km	Kilometres	**mg/m^3**	Milligram per metre cubed
% v/v	Percent volume in air	**m bgl bgl**	Metres below ground level
mb	Millibars (atmospheric pressure)	**m bcl**	Metre below cover level
l/hr	Litres per hour	**mAOD**	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	**kN/m^2**	Kilonewtons per metre squared
ppb	Parts per billion	**µm**	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	**SSRT**	Site Specific Remediation Target
PSD	Particle Size Distribution	**DD**	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	**Mc**	Moisture Content
ρ	Bulk Density	**GPR**	Ground Penetrating Radar
NDP	Nuclear Density Probe	**FFL**	Finished Floor Level
LEL	Lower Explosive Limit	**UKWIR**	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	**LOD**	Limit of Detection

APPENDIX III
DRAWINGS

DRAWING 16-953-001 – SITE LOCATION PLAN





Site Features

- Former Building
- Hardstanding
- Former Cricket Club
- Former Pond

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVB	06.07.2023	EB	MD
P1	REVA	28.06.2023	OW	MD

Client: Kellen

Job No: 16-953

Date: 06.07.2023

Drawing No: 003

Scale: NTS@ A3

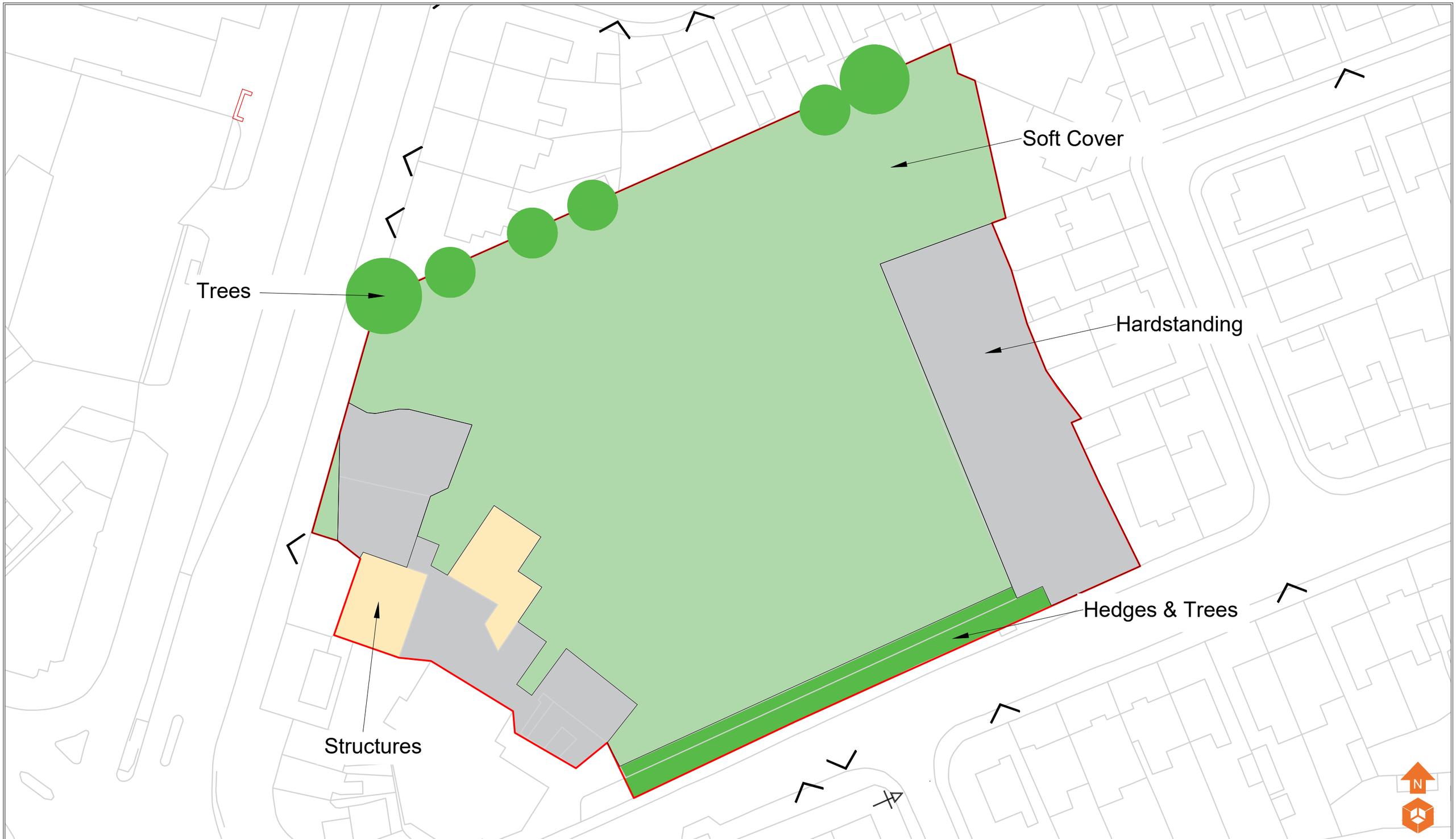
Job Title: Burnage Sports Club, Manchester

Drawing Title: Historical Features Plan

e3p

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

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.



Site Features

- Structures
- Hardstanding
- Soft Cover
- Hedges and Trees

Notes:

Client: Kellen

Job No: 16-953

Date: 12.06.2023

Drawing No: 004

Scale: NTS@ A3

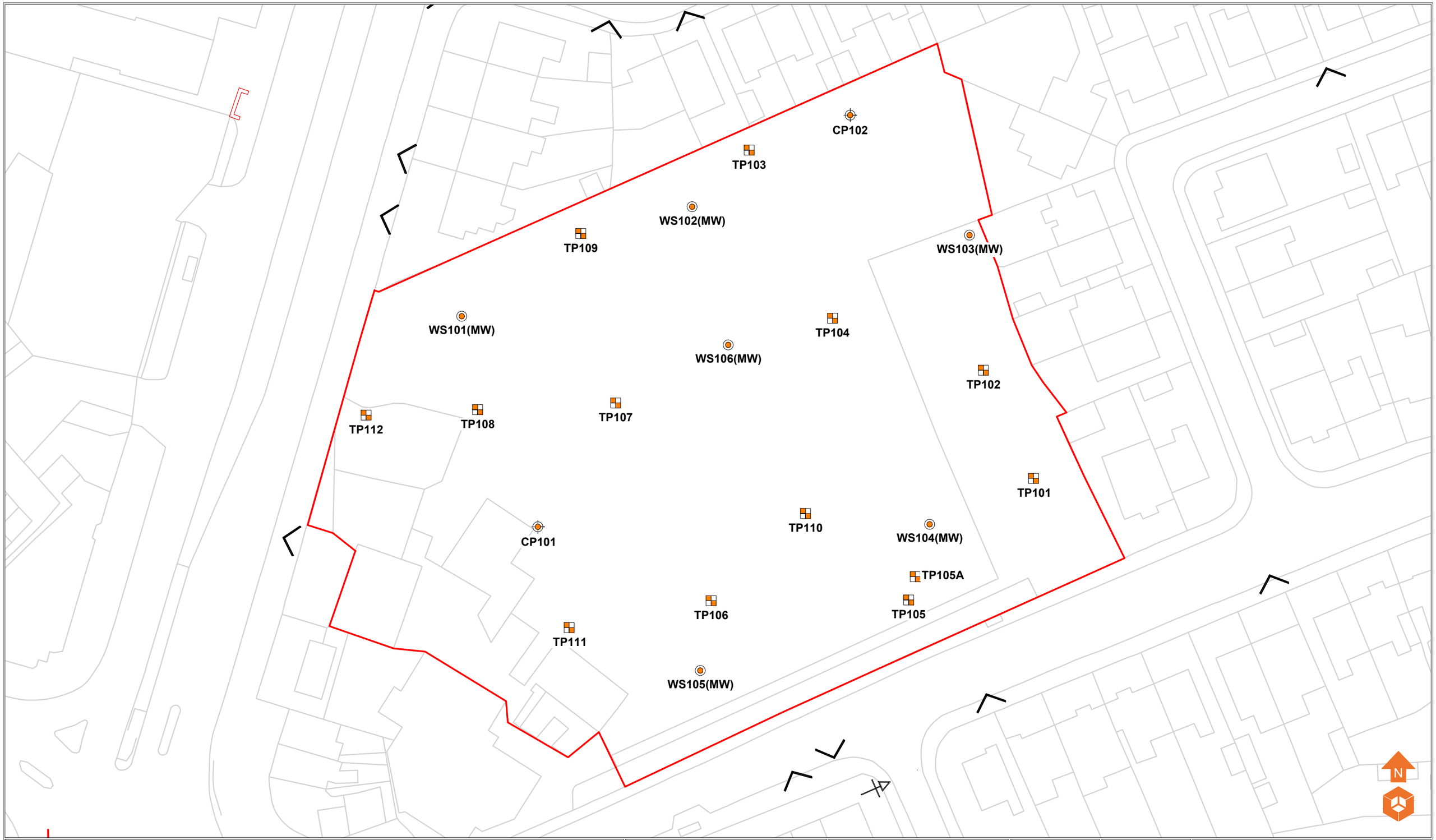
P1	REVA	12.06.2023	EB	MD
Phase	Issue	Date	Drawn	Checked

Job Title: Burnage Sports Club, Manchester

Drawing Title: Site Features Plan

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

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



Location Symbols

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

Notes:

P1	REVA	12.06.2023	EB	MD
Phase	Issue	Date	Drawn	Checked

Client: Kellen

Job No: 16-953

Date: 12.06.2023

Drawing No: 005

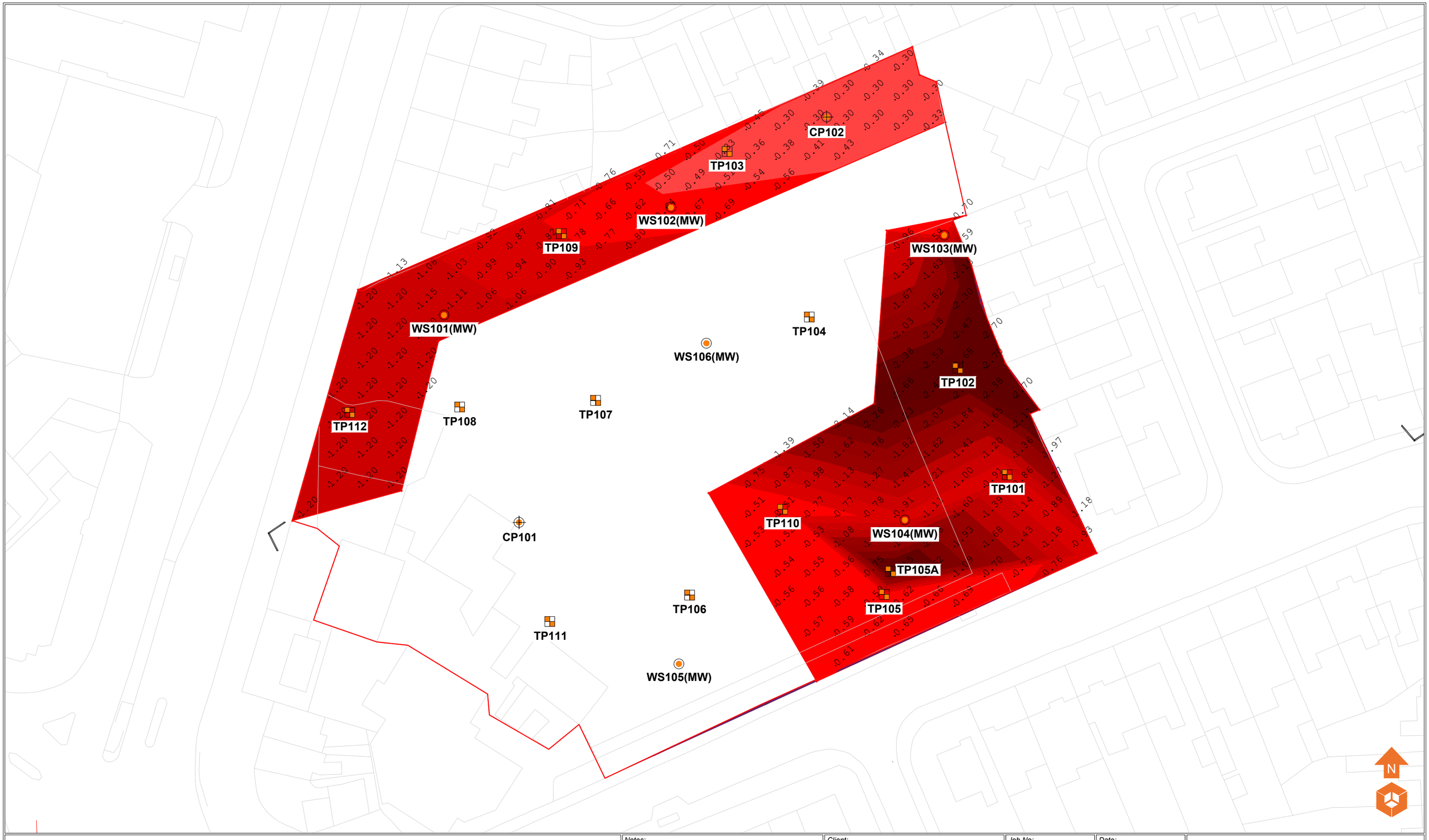
Scale: NTS@ A3

Job Title: Burnage Sports Club, Manchester

Drawing Title: Exploratory Hole Location 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

- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- CP101 — Approximate Cable Percussive Borehole Location

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.55m
- Depth of Made Ground 0.79 - 0.80m
- Depth of Made Ground 1.04 - 1.05m
- Depth of Made Ground > 1.30m

Notes:

Client: Kellen

Job No: 16-953

Date: 03.08.2023

Drawing No: 006

Scale: NTS@ A3

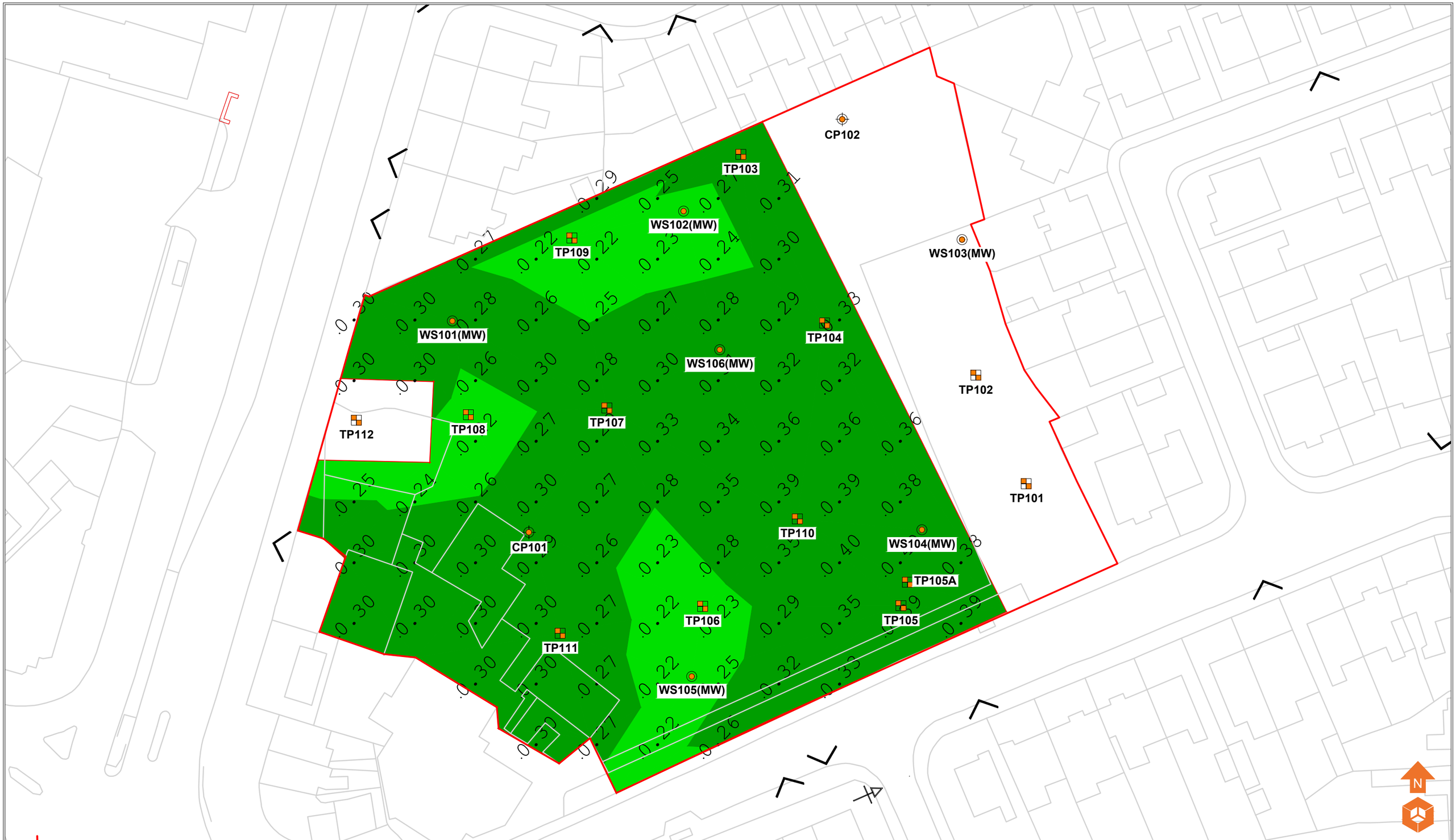
Phase	Issue	Date	Drawn	Checked
P1	REVB	03.08.2023	OW	MW
P1	REVA	15.06.2023	OW	ID

Job Title: Burnage Sports Club, Manchester

Drawing Title: Depth of Made Ground Plan

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

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



Location Symbols

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

Topsoil Depth (m)

- Depth of Topsoil 0.00 - 0.24m
- Depth of Topsoil > 0.49m

Notes:

Client: Kellen

Job No: 16-953

Date: 15.06.2023

Drawing No: 007

Scale: NTS@ A3

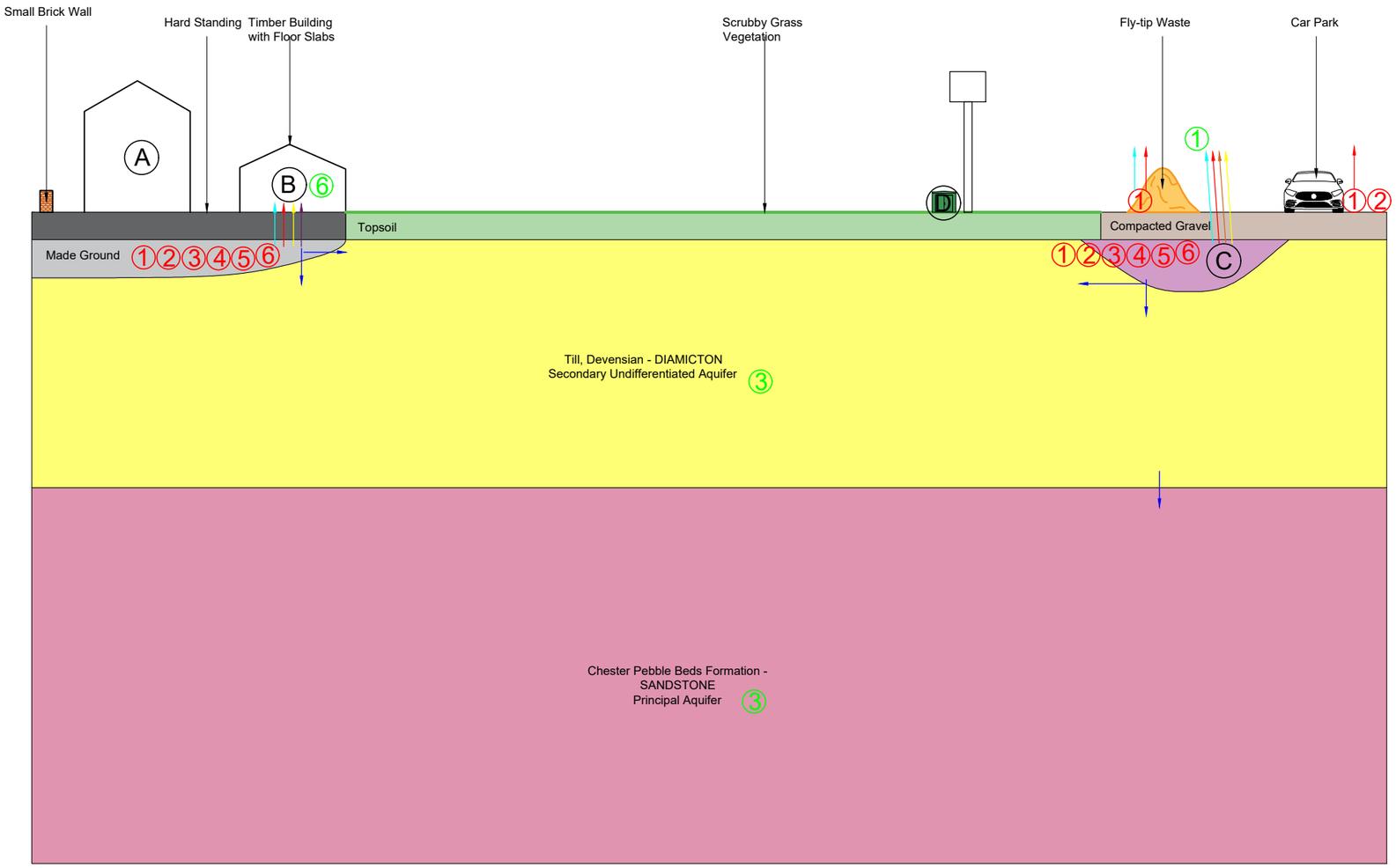
e3p
Environmental Engineering Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

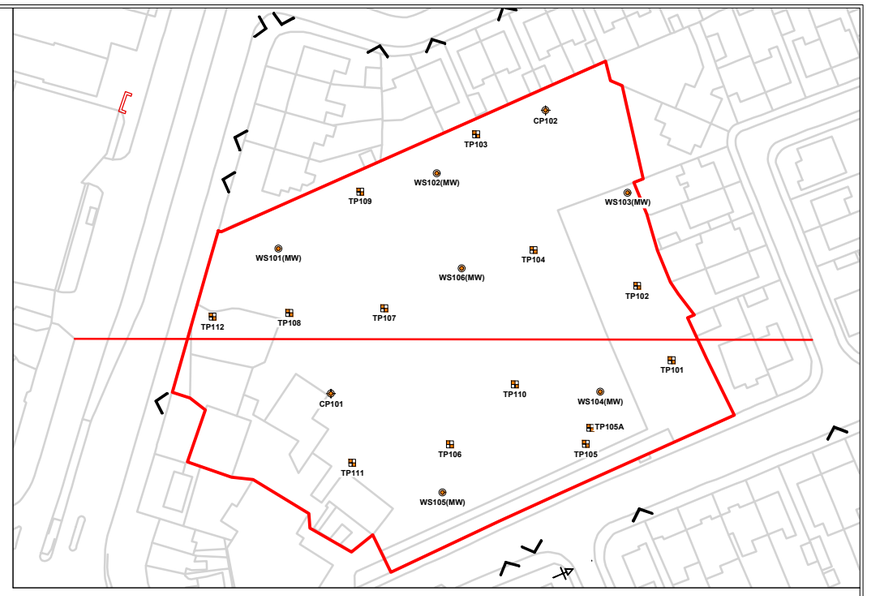
Phase	Issue	Date	Drawn	Checked
P1	REVA	15.06.2023	OW	ID

Job Title: Burnage Sports Club, Manchester

Drawing Title: Depth of Topsoil Plan

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





Geology Key

- Made Ground
- Sandstone (Wilmslow Sandstone Formation Principal Aquifer)
- Sand & Gravels (Glaciofluvial Sheet Deposits Secondary A Aquifer)
- Groundwater

Sources

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

Pathways

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

Receptors

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

Site Features

- A 3 Story Building (unfinished)
- B 1 Story Building
- C Infilled Pond
- D Electric Substation

Notes:

Phase	Issue	Date	Drawn	Checked
P1	REVA	14.06.2023	EB	MD

Client: Kellen

Job No: 16-953

Date: 14.06.2023

Drawing No: 010

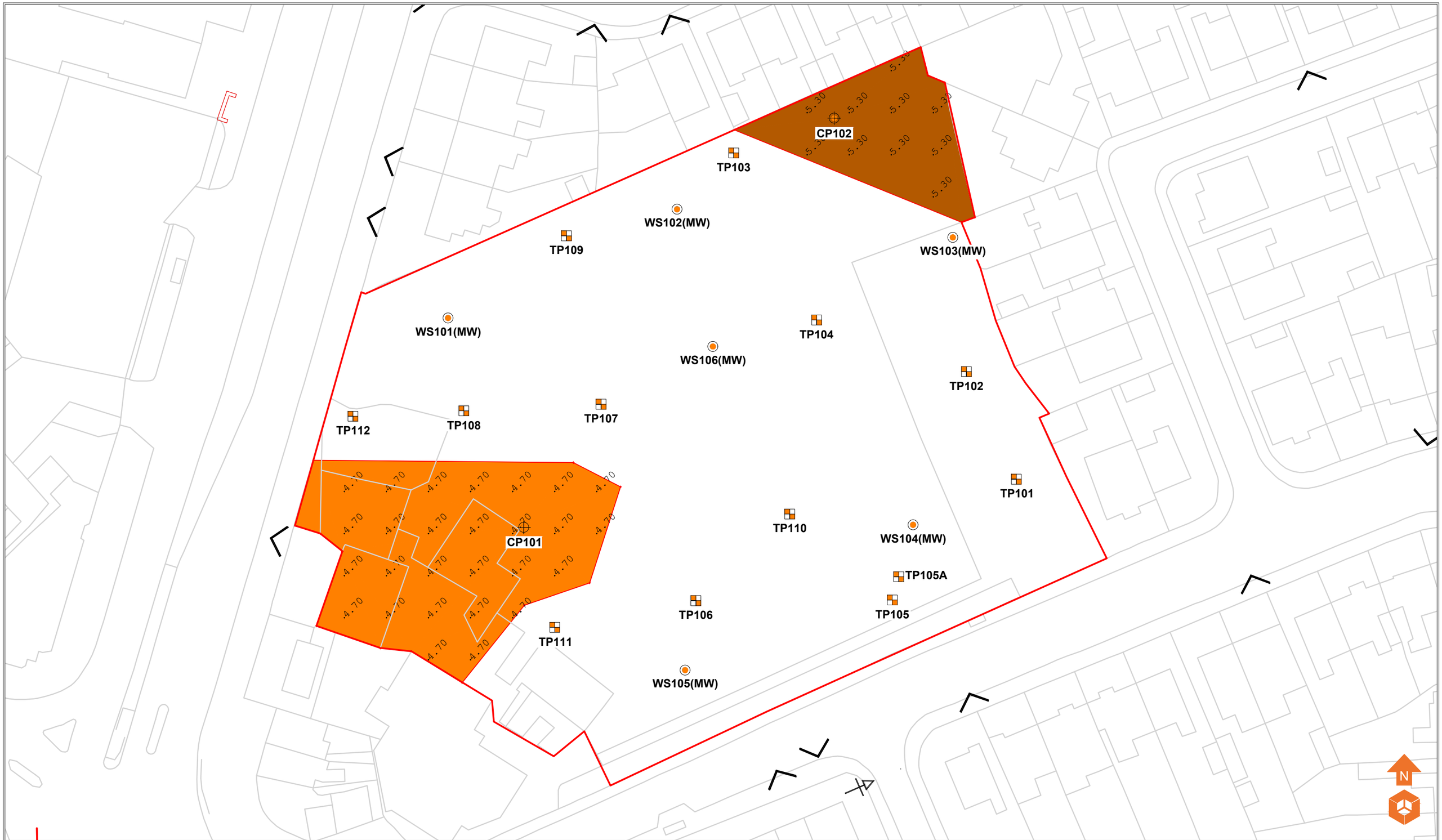
Scale: NTS

Job Title: Burnage Sports Club, Manchester

Drawing Title: Conceptual Site Model

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

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

Bedrock Depth (m)

- Depth of Bedrock 0.00m - 5.39m
- Depth of Bedrock > 5.40m

Notes:

Client: Kellen

Job No: 16-953

Date: 26.06.2023

Drawing No: 012

Scale: NTS@ A3

Phase	Issue	Date	Drawn	Checked
P1	REVB	26.06.2023	OW	ID
P1	REVA	15.06.2023	OW	ID

Job Title: Burnage Sports Club, Manchester

Drawing Title: Depth of Bedrock 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

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

Development Constraints

- Residential Dwelling (Assumed)
- Hardstanding
- Outdoor Bar
- Outdoor Seating
- Abandoned Cars
- Bund
- Telecoms Mast

Notes:

Client: Kellen

Job No: 16-953

Date: 15.06.2023

Drawing No: 015

Scale: NTS@ A3

P1	REVA	15.06.2023	OW	MD
Phase	Issue	Date	Drawn	Checked

Job Title: Burnage Sports Club, Manchester

Drawing Title: Development Constraints 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 VIEW OF SITE FACING SOUTH WEST



PLATE 2 VIEW OF SITE FACING NORTH



PLATE 3 VIEW OF SITE FACING EAST



PLATE 4 VIEW OF BUND AND OVERGROWN AREA IN NORTH EAST



PLATE 5 VODAFONE TELECOMMUNICATIONS BOX



PLATE 6 STRUCTURE IN SOUTH WEST



PLATE 7 STRUCTURE AT SOUTH WEST



PLATE 8 DENSE OVERGROWN VEGETATION AT NORTH WESTERN BOUNDARY



APPENDIX V
E3P EXPLORATORY HOLE LOGS

Borehole Log

Borehole No. **CP101**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386352.00 - 392900.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 10/06/2023 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=10 (1,1/2,2,3,3)				Very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=19 (2,3/4,4,5,6)				
		3.00 - 3.45	U100	Ublow=17				
		4.00		50 (6,10/50 for 290mm)				
					4.70			Red SANDSTONE (Chester Pebble Bed Formation)
		5.00		50 (6,12/50 for 175mm)				
					5.45			End of borehole at 5.45 m

Remarks
1. Complete.

Borehole Log

Borehole No. **CP102**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386393.00 - 392953.00	Hole Type CP
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 11/06/2023 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.30			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=11 (1,2/2,3,3,3)				Very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=15 (2,2/3,3,4,5)				
		3.00		N=20 (2,3/4,5,5,6)				
		4.00		N=50 (9,10/12,13,14,11)				
		5.00		50 (3,9/50 for 200mm)				
					5.30			Red SANDSTONE (Chester Pebble Bed Formation)
		6.00		50 (17,8/50 for 105mm)				
					6.45			End of borehole at 6.45 m

1 2 3 4 5 6 7 8 9 10

Remarks
1. Complete.

Trial Pit Log

TrialPit No: TP101
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386432.00 - 392904.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 3.00	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Grey sandy gravel. Gravel is fine to coarse, angular to subrounded of concrete, and mudstone.
	0.60	ES					MADE GROUND: Black sandy gravel with occasional cobbles. Gravel is fine to coarse, angular to subrounded of brick, concrete, plastic, tile, timber, sandstone and mudstone. Cobbles are angular to subangular of brick.
				0.80			Soft to firm low strength dark grey mottled black slightly sandy CLAY with pockets of orangeish brown silty fine to medium SAND.
	1.20	HVP	34				
	1.60	HVP	59	1.50			Firm medium strength brown mottled orangeish brown slightly gravelly sandy CLAY. Gravel is fine to coarse, subangular to rounded of mudstone. (Becoming stiff high strength from 2.00 m bgl)
	2.00	HVP	96				
	2.60	ES					
				3.00			End of Pit at 3.00m

1 2 3 4

Trial Pit Photographs



TP101 Excavation



TP101 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

TrialPit No: TP102
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386420.00 - 392916.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 2.70	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Grey sandy gravel. Gravel is fine to coarse, angular to subrounded of concrete, and mudstone.
	1.00	ES					MADE GROUND: Dark brown very sandy gravel with frequent cobbles. Gravel is fine to coarse, angular to subrounded of tile, ceramic, plastic, timber, brick, concrete, mudstone and sandstone. Cobbles are angular to subangular of plastic, timber and brick.
▼ 1.40				1.40			
	1.60	HVP	34				MADE GROUND: Soft low strength black mottled dark grey silty very sandy organic clay. (Hydrocarbon sheen noted). (Strong organic odour).
	1.80	ES					
	2.40	HVP	39				
				2.70			End of Pit at 2.70m

1
2
3
4

Trial Pit Photographs



TP102 Excavation



TP102 Arisings

Remarks: 1. Complete. 2. Stable. 3. Water strike at 1.40 m bgl encountered as steady ingress/pooling at base of excavation.

Stability: Stable

Trial Pit Log

TrialPit No: TP103
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386381.00 - 392952.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.90	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30			Brown SAND with frequent roots and rootlets (Topsoil).
	1.40	HVP	97				Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	2.50	HVP	130				
	2.80	HVP	140	2.90			End of Pit at 2.90m

1
2
3
4

Trial Pit Photographs



TP103 Excavation



TP103 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

			TrialPit No TP104 Sheet 1 of 1
Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386396.00 - 392922.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 3.00	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Brown SAND with frequent roots and rootlets (Topsoil).
	1.20	ES					Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone. (Becoming very stiff very high strength from 2.80 m bgl)
	2.10	HVP	133				
	2.80	HVP	174				
				3.00			End of Pit at 3.00m

1 2 3 4

Trial Pit Photographs



TP104 Excavation



TP104 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

TrialPit No: TP105
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386408.00 - 392883.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 0.60	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Dark brown SAND with frequent roots and rootlets (Reworked topsoil).
				0.60			MADE GROUND: Dark brown sandy gravelly clay with occasional cobbles. Gravel is fine to coarse, angular to subrounded of brick, tile, ceramic, timber, concrete, mudstone, and sandstone. Cobbles are angular of brick.
							End of Pit at 0.60m
	1.90	HVP	59				
	3.00	ES					

1
2
3
4

Remarks: 1. Complete. 2. Stable. 3. Terminated due to pea gravel indicating potential service in south pit wall - relocated to TP105a.

Stability: Stable

Trial Pit Log

TrialPit No: TP105a
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386411.00 - 392886.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60, Depth 3.20	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20			MADE GROUND: Dark brown SAND with frequent roots and rootlets (Reworked topsoil).
				1.00			MADE GROUND: Dark brown sandy gravelly clay with occasional cobbles. Gravel is fine to coarse, angular to subrounded of brick, tile, ceramic, timber, concrete, mudstone, and sandstone. Cobbles are angular of brick.
				2.70			Made Ground: Firm dark brown mottled grey slightly gravelly very silty CLAY. Gravel is fine to coarse, subangular to rounded of mudstone. [Reworked]
				3.10			MADE GROUND: Dark brown fiborous peat interbedded with dark brown mottled grey very silty organic clay. (Infilled pond material)
				3.20			Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone. (Becoming very stiff very high strength from 2.80 m bgl) End of Pit at 3.20m

1
2
3
4

Trial Pit Photographs



TP105a Excavation



TP105a Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

TrialPit No: TP106
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386366.00 - 392886.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 2.80	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20			Brown SAND with frequent roots and rootlets (Topsoil).
				0.60			Dark brown sandy very gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	1.20	HVP	116				Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	1.60	ES					
	2.30	HVP	116				
				2.80			End of Pit at 2.80m

1
2
3
4

Trial Pit Photographs



TP106 Excavation



TP106 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

			TrialPit No TP107 Sheet 1 of 1
Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386363.00 - 392910.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.70	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30			Brown SAND with frequent roots and rootlets (Topsoil).
	0.80	ES					Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coars, subangular to rounded of mudstone.
	1.80	HVP	139				
	2.40	HVP	99				
				2.70			End of Pit at 2.70m

1
2
3
4

Trial Pit Photographs



TP107 Excavation



TP107 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

TrialPit No: TP108
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386339.00 - 392913.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.80	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Brown SAND with frequent roots and rootlets (Topsoil).
				0.60			Orangeish brown gravelly very clayey fine to medium SAND. Gravel is fine to coarse, subangular to subrounded of mudstone and sandstone.
	1.30	ES					Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	1.60	HVP	100				
	2.00	HVP	117				
				2.80			End of Pit at 2.80m

1
2
3
4

Trial Pit Photographs



TP108 Excavation



TP108 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

			TrialPit No TP109 Sheet 1 of 1
Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386351.00 - 392943.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.80	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Brown SAND with frequent roots and rootlets (Topsoil).
	0.80	HVP	77				Firm medium strength becoming stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	2.50 2.60	HVP ES	177				
				2.80			End of Pit at 2.80m

1 2 3 4

Trial Pit Photographs



TP109 Excavation



TP109 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

			TrialPit No TP110 Sheet 1 of 1
Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386396.00 - 392901.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): Depth 2.60 — 2.00 × 0.60	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	ES		0.40			MADE GROUND: Dark brown SAND with frequent roots and rootlets (Reworked topsoil).
				0.50			MADE GROUND: Brown sandy very gravelly clay with occasional cobbles. Gravel is fine to coarse angular to subrounded of brick, tile, ceramic, mudstone and sandstone. Cobbles are subangular of brick.
	1.30	HVP	90				Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	1.50	ES					
	2.10	HVP	141				
				2.60			End of Pit at 2.60m

1
2
3
4

Trial Pit Photographs



TP110 Excavation



TP110 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

TrialPit No: TP111
Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386360.00 - 392889.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 × 0.60 Depth 3.10	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30			Brown SAND with frequent roots and rootlets (Topsoil).
							Very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	2.40	HVP	152				
	3.00	HVP	178	3.10			End of Pit at 3.10m

1
2
3
4

Trial Pit Photographs



TP111 Excavation



TP111 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Trial Pit Log

			TrialPit No TP112 Sheet 1 of 1
Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386321.00 - 392925.00 Level:	Date 09/06/2023
Location: Manchester		Dimensions (m): 2.00 x 0.60 Depth 2.40	Scale 1:30
Client: Kellen Homes			Logged I.Diack

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40	ES		0.50			MADE GROUND: Grey sandy gravel. Gravel is fine to coarse, angular to subrounded of concrete, and mudstone.
				1.20			MADE GROUND: Black sandy gravel with occasional cobbles. Gravel is fine to coarse, angular to subrounded of brick, concrete, plastic, tile, timber, sandstone and mudstone. Cobbles are angular to subangular of brick.
	1.70	HVP	93				Stiff high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
	1.90	HVP	105				
				2.40			End of Pit at 2.40m

1
2
3
4

Trial Pit Photographs



TP112 Excavation



TP112 Arisings

Remarks: 1. Complete. 2. Stable.

Stability: Stable

Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386339.00 - 392928.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.20			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=12 (2,2/3,3,3,3)				Stiff high strength becoming very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=22 (3,4/4,5,6,7)				
		3.00		N=28 (5,6/6,7,7,8)				
		4.00		50 (6,8/50 for 280mm)	4.30			End of borehole at 4.30 m

Remarks

1. Refusal at 4.30 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl.

Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386372.00 - 392943.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES		0.30			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=13 (2,2/3,3,3,4)				Stiff high strength becoming very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=24 (4,5/5,6,6,7)				
		3.00		N=28 (5,6/6,7,7,8)				
		4.00		50 (6,9/50 for 290mm)	4.40			End of borehole at 4.40 m

Remarks

1. Refusal at 4.40 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl.

Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386420.00 - 392937.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	ES		0.70			MADE GROUND: Dark grey slightly sandy gravel. Gravel is fine to coarse, angular to subrounded of brick, concrete, tile, ceramic, and mudstone.
		1.00		N=12 (1,2/3,2,3,4)				Stiff high strength becoming very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=25 (3,5/5,6,7,7)				
		3.00		N=37 (6,7/8,8,9,12)				
		4.00		50 (8,10/50 for 280mm)	4.25			End of borehole at 4.25 m

1 2 3 4 5 6 7 8 9 10

Remarks

1. Refusal at 4.25 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl.

Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386411.00 - 392901.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND: Dark brown SAND with frequent roots and rootlets (Reworked topsoil).
		0.70	ES					MADE GROUND: Dark brown sandy gravelly clay with occasional cobbles. Gravel is fine to coarse, angular to subrounded of brick, tile, ceramic, timber, concrete, mudstone, and sandstone. Cobbles are angular of brick.
		1.00		N=1 (0,0/0,0,1,0)	0.90			MADE GROUND: Very soft to soft dark brown slightly gravelly very silty organic clay with pockets of dark brown fibrous PEAT. Gravel is fine to coarse, subangular to rounded of mudstone and organic matter. (Infilled pond material)
		2.00		N=4 (0,0/0,1,1,2)				Dark brown slightly gravelly very silty CLAY with pockets of dark brown fiborous PEAT. Gravel is fine to coarse, subangular to rounded of mudstone and organic matter.
					2.50			Very stiff very high strength orangeish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		3.00		N=24 (3,4/4,6,7,7)				
		4.00		50 (7,9/50 for 290mm)				
					4.40			End of borehole at 4.40 m
					4.40			

Remarks

1. Refusal at 4.40 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 2.00 m bgl.

Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386375.00 - 392874.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.20			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=13 (1,3/3,3,3,4)				Stiff high strength becoming very stiff very high strength orangeish brown slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=26 (4,5/5,6,7,8)				
		3.00		N=30 (4,6/6,7,8,9)				
		4.00		50 (7,10/50 for 280mm)				
					4.30			End of borehole at 4.30 m

1 2 3 4 5 6 7 8 9 10

Remarks

1. Refusal at 4.30 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl.

Borehole Log

Borehole No. **WS106**

Sheet 1 of 1

Project Name: Burnage Sports Club	Project No. 16953	Co-ords: 386378.00 - 392916.00	Hole Type WS
Location: Manchester		Level:	Scale 1:50
Client: Kellen Homes		Dates: 09/06/2023 -	Logged By I.Diack

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			Brown SAND with frequent roots and rootlets (Topsoil).
		1.00		N=13 (2,2/3,3,3,4)				Stiff high strength becoming very stiff very high strength orangeish brown slightly gravelly CLAY. Gravel is fine to coarse, subangular to rounded of mudstone.
		2.00		N=23 (4,5/5,5,6,7)				
		3.00		N=27 (3,5/5,6,8,8)				
		4.00		50 (9,10/50 for 270mm)	4.20			End of borehole at 4.20 m

Remarks

1. Refusal at 4.20 m bgl. 2. Environmental monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl.

APPENDIX VI
CHEMICAL TESTING RESULTS

Iona Diack
e3p
Taylor Road
Urmston
Manchester
M41 7JQ

e: idiack@e3p.co.uk

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

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

Analytical Report Number : 23-38895

Project / Site name:	Burnage Sports Club	**Samples received on:**	12/06/2023
Your job number:	16-953	**Samples instructed on/ Analysis started on:**	12/06/2023
Your order number:	005145	**Analysis completed by:**	20/06/2023
Report Issue Number:	1	**Report issued on:**	20/06/2023
Samples Analysed:	2 leachate samples - 13 soil samples		

Signed: [redacted]

Anna Goc
PL Head of Reporting Team
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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711493	2711494	2711495	2711496	2711497
Sample Reference				TP101	TP101	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	2.60	1.00	0.20	1.20
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	21	19	34	14	15
Total mass of sample received	kg	0.001	NONE	0.9	0.3	0.9	0.3	0.9
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	N/A	WEM	WEM	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.7	7.6	7.3	6.5	-
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	53	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	1500	740	880	1200	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.33	0.2	0.17	0.095	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	670	400	350	190	-
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	334	198	174	95.2	-
Sulphide	mg/kg	1	MCERTS	2.6	21	79	4.2	-
Total Sulphur	mg/kg	50	MCERTS	1000	920	4500	870	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	4.2	1.4	3.2	5.6	0.3

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.64	-	0.11	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.26	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	2.7	-	0.15	0.11	< 0.05
Fluorene	mg/kg	0.05	MCERTS	2	-	0.21	0.09	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	24	-	1.2	1.2	< 0.05
Anthracene	mg/kg	0.05	MCERTS	5.7	-	0.26	0.23	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	36	-	1.2	2.9	< 0.05
Pyrene	mg/kg	0.05	MCERTS	35	-	1.3	2.7	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	16	-	0.57	1.5	< 0.05
Chrysene	mg/kg	0.05	MCERTS	15	-	0.64	1.6	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	16	-	0.58	2.1	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	5.8	-	0.22	0.71	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	12	-	0.54	1.6	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	6	-	0.23	0.84	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	1.5	-	0.08	0.23	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	7.2	-	0.31	0.95	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	187	-	7.61	16.6	< 0.80

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	66	9.9	12	23	7.5
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	75
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	0.3
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	4.2	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	18	17	21	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	270	21	41	50	19

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711493	2711494	2711495	2711496	2711497
Sample Reference				TP101	TP101	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	2.60	1.00	0.20	1.20
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Lead (aqua regia extractable)	mg/kg	1	MCERTS	450	39	130	140	11
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	< 0.3	1.1	0.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	52	13	15	13	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	27
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	36	110	76	35
Petroleum Hydrocarbons								
TPH (C5 - C6) HS_1D_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_1D_TOTAL	mg/kg	2	MCERTS	3.5	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) EH_CU_1D_TOTAL	mg/kg	4	MCERTS	15	< 4.0	< 4.0	12	< 4.0
TPH (C16 - C21) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	68	5.4	9.6	14	1.8
TPH (C21 - C35) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	100	14	24	22	5.8
TPH (C35 - C40) EH_CU_1D_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	190	29	38	52	11
VOCs								
Chloromethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Chloroethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
Bromomethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Vinyl Chloride	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Trichloromethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
Benzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	-	-
Tetrachloromethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Toluene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Tetrachloroethene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711493	2711494	2711495	2711496	2711497
Sample Reference				TP101	TP101	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	2.60	1.00	0.20	1.20
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Styrene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Tribromomethane	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
o-Xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Bromobenzene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Butylbenzene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	< 5.0	< 5.0	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	< 5.0	< 5.0	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	< 0.1	2.2	-	-
Phenol	mg/kg	0.2	ISO 17025	-	< 0.2	< 0.2	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	< 0.05	< 0.05	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	< 0.2	< 0.2	-	-
Isophorone	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	< 0.3	< 0.3	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	< 0.05	0.11	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	< 0.1	< 0.1	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	< 0.1	< 0.1	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	< 0.1	< 0.1	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	< 0.2	< 0.2	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	< 0.1	< 0.1	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	< 0.1	< 0.1	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	< 0.1	< 0.1	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	< 0.05	< 0.05	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711493	2711494	2711495	2711496	2711497
Sample Reference				TP101	TP101	TP102	TP103	TP104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	2.60	1.00	0.20	1.20
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Acenaphthene	mg/kg	0.05	MCERTS	-	< 0.05	0.15	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	< 0.2	< 0.2	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	< 0.2	< 0.2	-	-
Fluorene	mg/kg	0.05	MCERTS	-	< 0.05	0.21	-	-
Azobenzene	mg/kg	0.3	NONE	-	< 0.3	< 0.3	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	< 0.2	< 0.2	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	0.58	1.2	-	-
Anthracene	mg/kg	0.05	MCERTS	-	0.11	0.26	-	-
Carbazole	mg/kg	0.3	MCERTS	-	< 0.3	< 0.3	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	< 0.2	< 0.2	-	-
Anthraquinone	mg/kg	0.3	NONE	-	< 0.3	< 0.3	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	0.92	1.2	-	-
Pyrene	mg/kg	0.05	MCERTS	-	0.89	1.3	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	< 0.3	< 0.3	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	0.42	0.57	-	-
Chrysene	mg/kg	0.05	MCERTS	-	0.43	0.64	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	0.45	0.58	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	0.18	0.22	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	0.39	0.54	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	0.21	0.23	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	< 0.05	0.08	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	0.26	0.31	-	-

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711498	2711499	2711500	2711501	2711502
Sample Reference				TP106	TP107	TP108	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.80	1.30	2.60	0.30
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	12	11	12	6.2
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.9	0.3
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A	N/A	N/A	WEM
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	-	4.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	-	-	-	160
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	-	-	-	-	0.019
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	-	-	-	-	37
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	-	-	-	-	18.6
Sulphide	mg/kg	1	MCERTS	-	-	-	-	1.3
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-	1300
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.7	-	-	0.6	3.7
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.22
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.11
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.35
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.31
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.1	< 0.05	3.5
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.56
Fluoranthene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.21	0.09	5.1
Pyrene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.2	< 0.05	5.2
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.09	< 0.05	2.5
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.12	< 0.05	2.7
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	0.12	< 0.05	2.8
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	0.05	< 0.05	0.92
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.09	< 0.05	2.2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.3
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	1.3
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	0.98	< 0.80	29.1
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	7.2	7.7	8.3	7.8	120
Barium (aqua regia extractable)	mg/kg	1	MCERTS	59	120	66	130	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.72	1.1	0.64	1.1	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	0.2	0.2	0.2	-
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	-	-	-	-	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	20	20	16	21	42

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711498	2711499	2711500	2711501	2711502
Sample Reference				TP106	TP107	TP108	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.80	1.30	2.60	0.30
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Lead (aqua regia extractable)	mg/kg	1	MCERTS	16	12	25	11	90
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	28	12	29	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	25	26	21	26	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	43	52	36	51	54
Petroleum Hydrocarbons								
TPH (C5 - C6) $_{HS_1D_TOTAL}$	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) $_{HS_1D_TOTAL}$	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) $_{EH_CU_1D_TOTAL}$	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) $_{EH_CU_1D_TOTAL}$	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	4.4
TPH (C16 - C21) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	13
TPH (C21 - C35) $_{EH_CU_1D_TOTAL}$	mg/kg	1	MCERTS	< 1.0	< 1.0	6	< 1.0	33
TPH (C35 - C40) $_{EH_CU_1D_TOTAL}$	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40 $_{EH_CU+HS_1D_TOTAL}$	mg/kg	10	NONE	< 10	< 10	< 10	< 10	56
VOCs								
Chloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloromethane	µg/kg	5	NONE	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711498	2711499	2711500	2711501	2711502
Sample Reference				TP106	TP107	TP108	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.80	1.30	2.60	0.30
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Styrene	µg/kg	5	ISO 17025	-	-	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Bromobenzene	µg/kg	5	NONE	-	-	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711498	2711499	2711500	2711501	2711502
Sample Reference				TP106	TP107	TP108	TP109	TP110
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.80	1.30	2.60	0.30
Date Sampled				09/06/2023	09/06/2023	09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	-	-

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711503	2711504	2711505
Sample Reference				TP112	WS102	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.40	0.70
Date Sampled				09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.7	17	12
Total mass of sample received	kg	0.001	NONE	0.5	0.3	0.3
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	N/A	WEM
General Inorganics						
pH - Automated	pH Units	N/A	MCERTS	8.2	-	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	mg/kg	50	MCERTS	440	-	400
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.043	-	0.037
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	86	-	73
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	43.2	-	36.7
Sulphide	mg/kg	1	MCERTS	11	-	< 1.0
Total Sulphur	mg/kg	50	MCERTS	660	-	170
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	3.7	-	0.9
Total Phenols						
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	0.39	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.48	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	2.2	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	1.9	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	23	< 0.05	0.09
Anthracene	mg/kg	0.05	MCERTS	6.5	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	31	0.1	0.12
Pyrene	mg/kg	0.05	MCERTS	29	0.06	0.14
Benzo(a)anthracene	mg/kg	0.05	MCERTS	13	< 0.05	0.06
Chrysene	mg/kg	0.05	MCERTS	14	< 0.05	0.1
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	13	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	5.7	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	11	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	7	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	2	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	8.1	< 0.05	< 0.05
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	169	< 0.80	< 0.80
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	8.9	5.8
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	50	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.43	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	< 0.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	18	-	14
Copper (aqua regia extractable)	mg/kg	1	MCERTS	65	9.8	24

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711503	2711504	2711505
Sample Reference				TP112	WS102	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.40	0.70
Date Sampled				09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	66	10	28
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	10	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	31	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	72	19	41
Petroleum Hydrocarbons						
TPH (C5 - C6) HS_1D_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_1D_TOTAL	mg/kg	2	MCERTS	23	< 2.0	< 2.0
TPH (C12 - C16) EH_CU_1D_TOTAL	mg/kg	4	MCERTS	60	< 4.0	< 4.0
TPH (C16 - C21) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	180	< 1.0	< 1.0
TPH (C21 - C35) EH_CU_1D_TOTAL	mg/kg	1	MCERTS	1100	< 1.0	< 1.0
TPH (C35 - C40) EH_CU_1D_TOTAL	mg/kg	10	NONE	560	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	1900	< 10	< 10
VOCs						
Chloromethane	µg/kg	5	ISO 17025	-	-	-
Chloroethane	µg/kg	5	NONE	-	-	-
Bromomethane	µg/kg	5	ISO 17025	-	-	-
Vinyl Chloride	µg/kg	5	NONE	-	-	-
Trichlorofluoromethane	µg/kg	5	NONE	-	-	-
1,1-Dichloroethene	µg/kg	5	NONE	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	5	NONE	-	-	-
Cis-1,2-dichloroethene	µg/kg	5	ISO 17025	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-
1,1-Dichloroethane	µg/kg	5	ISO 17025	-	-	-
2,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Trichloromethane	µg/kg	5	NONE	-	-	-
1,1,1-Trichloroethane	µg/kg	5	ISO 17025	-	-	-
1,2-Dichloroethane	µg/kg	5	ISO 17025	-	-	-
1,1-Dichloropropene	µg/kg	5	ISO 17025	-	-	-
Trans-1,2-dichloroethene	µg/kg	5	NONE	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-
Tetrachloromethane	µg/kg	5	NONE	-	-	-
1,2-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Trichloroethene	µg/kg	5	ISO 17025	-	-	-
Dibromomethane	µg/kg	5	ISO 17025	-	-	-
Bromodichloromethane	µg/kg	5	ISO 17025	-	-	-
Cis-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-
Trans-1,3-dichloropropene	µg/kg	5	ISO 17025	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-
1,1,2-Trichloroethane	µg/kg	5	ISO 17025	-	-	-
1,3-Dichloropropane	µg/kg	5	ISO 17025	-	-	-
Dibromochloromethane	µg/kg	5	ISO 17025	-	-	-
Tetrachloroethene	µg/kg	5	NONE	-	-	-
1,2-Dibromoethane	µg/kg	5	ISO 17025	-	-	-
Chlorobenzene	µg/kg	5	ISO 17025	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711503	2711504	2711505
Sample Reference				TP112	WS102	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.40	0.70
Date Sampled				09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Styrene	µg/kg	5	ISO 17025	-	-	-
Tribromomethane	µg/kg	5	NONE	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	5	ISO 17025	-	-	-
Isopropylbenzene	µg/kg	5	ISO 17025	-	-	-
Bromobenzene	µg/kg	5	NONE	-	-	-
n-Propylbenzene	µg/kg	5	ISO 17025	-	-	-
2-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-
4-Chlorotoluene	µg/kg	5	ISO 17025	-	-	-
1,3,5-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-
tert-Butylbenzene	µg/kg	5	ISO 17025	-	-	-
1,2,4-Trimethylbenzene	µg/kg	5	ISO 17025	-	-	-
sec-Butylbenzene	µg/kg	5	ISO 17025	-	-	-
1,3-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
p-Isopropyltoluene	µg/kg	5	ISO 17025	-	-	-
1,2-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
1,4-Dichlorobenzene	µg/kg	5	ISO 17025	-	-	-
Butylbenzene	µg/kg	5	NONE	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	5	ISO 17025	-	-	-
1,2,4-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-
Hexachlorobutadiene	µg/kg	5	NONE	-	-	-
1,2,3-Trichlorobenzene	µg/kg	5	ISO 17025	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-
Phenol	mg/kg	0.2	ISO 17025	-	-	-
2-Chlorophenol	mg/kg	0.1	MCERTS	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	-	-	-
2-Methylphenol	mg/kg	0.3	MCERTS	-	-	-
Hexachloroethane	mg/kg	0.05	ISO 17025	-	-	-
Nitrobenzene	mg/kg	0.3	MCERTS	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-
Isophorone	mg/kg	0.2	MCERTS	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	-	-	-
Naphthalene	mg/kg	0.05	MCERTS	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-
Hexachlorobutadiene	mg/kg	0.1	MCERTS	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-
2-Chloronaphthalene	mg/kg	0.1	MCERTS	-	-	-
Dimethylphthalate	mg/kg	0.1	MCERTS	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club
Your Order No: 005145

Lab Sample Number				2711503	2711504	2711505
Sample Reference				TP112	WS102	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.40	0.70
Date Sampled				09/06/2023	09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-
Dibenzofuran	mg/kg	0.2	MCERTS	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	MCERTS	-	-	-
Diethyl phthalate	mg/kg	0.2	MCERTS	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	-	-	-
Hexachlorobenzene	mg/kg	0.3	MCERTS	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-
Carbazole	mg/kg	0.3	MCERTS	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club

Your Order No: 005145

Lab Sample Number				2711506	2711507
Sample Reference				TP102	TP112
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	0.40
Date Sampled				09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
General Inorganics					
pH (automated)	pH Units	N/A	ISO 17025	8.1	8
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	1.3	< 1.0
Total Phenols					
Total Phenols (monohydric)	µg/l	1	ISO 17025	3.2	< 1.0
Speciated PAHs					
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01
Total PAH					
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2
Heavy Metals / Metalloids					
Arsenic (dissolved)	µg/l	1	ISO 17025	3.8	3.8
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	U/S**
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4	2.3
Copper (dissolved)	µg/l	0.7	ISO 17025	20	26
Lead (dissolved)	µg/l	1	ISO 17025	1.6	6.9
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.7	3.8
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	15	19
Monoaromatics & Oxygenates					
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	NONE	< 10	< 10

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 23-38895
Project / Site name: Burnage Sports Club

Your Order No: 005145

Lab Sample Number				2711506	2711507
Sample Reference				TP102	TP112
Sample Number				None Supplied	None Supplied
Depth (m)				1.00	0.40
Date Sampled				09/06/2023	09/06/2023
Time Taken				None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Petroleum Hydrocarbons					
TPH1 (C10 - C40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic## >C5 - C6 HS_1D_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic## >C6 - C8 HS_1D_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic## >C8 - C10 HS_1D_AL	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic## (C5 - C35) HS+EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) HS+EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 23-38895
Project / Site name: Burnage Sports Club

* 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 *
2711493	TP101	None Supplied	0.6	Brown sand with gravel.
2711494	TP101	None Supplied	2.6	Brown clay.
2711495	TP102	None Supplied	1	Brown clay.
2711496	TP103	None Supplied	0.2	Brown loam and sand with gravel and vegetation.
2711497	TP104	None Supplied	1.2	Brown clay.
2711498	TP106	None Supplied	1.6	Brown clay and sand with gravel and vegetation.
2711499	TP107	None Supplied	0.8	Brown clay with gravel.
2711500	TP108	None Supplied	1.3	Brown loam and sand with gravel and vegetation.
2711501	TP109	None Supplied	2.6	Brown clay with gravel.
2711502	TP110	None Supplied	0.3	Brown loam with gravel and vegetation.
2711503	TP112	None Supplied	0.4	Brown loam and sand with gravel.
2711504	WS102	None Supplied	0.4	Brown loam and clay with gravel and vegetation.
2711505	WS104	None Supplied	0.7	Brown clay and sand with gravel.

Analytical Report Number : 23-38895
Project / Site name: Burnage Sports Club

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate - LOW LEVEL 1 ug/l	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

Analytical Report Number : 23-38895
Project / Site name: Burnage Sports Club

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	NONE
TPHCWG (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate by GC-MS.	In-house method	L070-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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

Analytical Report Number : 23-38895
Project / Site name: Burnage Sports Club

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

**U/S - Unsuitable for analysis due to high colour intensity.

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

APPENDIX VII
ORIGIN OF TIER 2 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

MURRAY RIX
CONSULTANCY, SITE INVESTIGATION
CONSTRUCTION MATERIALS TESTING

TEST REPORT

Client e3p

Address Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ

Contract Burnage Sports Club

Job Number MRN 4588/70
Date of Issue 12 July 2023

Approved Signatories

S J Hutchings, O P Davies

Notes

1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.

2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.

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

4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted.

5 The results included within the report are representative of the samples submitted for analysis.

6 This certificate should not be reproduced, except in full, without the express permission of the laboratory.

M U R R A Y R I X
ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4:2016

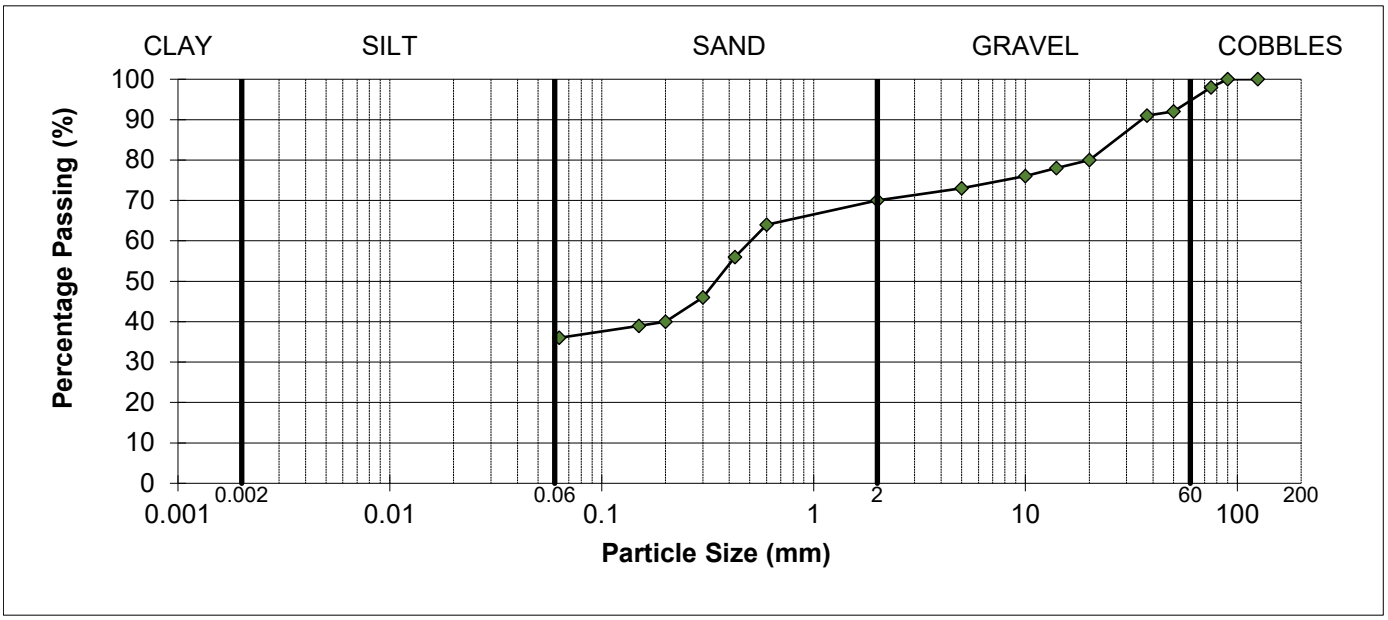
Determination of Water Content in accordance with BS EN ISO 17892-1:2014 (Oven Dry)

CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	TP105a	DATE SAMPLED	09-Jun-23
LAB SAMPLE No	127182	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	MADE GROUND
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100	100	5	73	
90	100		2	70	15-80
75	98		0.6	64	
50	92		0.425	56	
37.5	91		0.3	46	
20	80		0.2	40	
14	78		0.15	39	
10	76		0.063	36	15-80



REMARKS
Sample complies with the advised grading specification for a 2C material (SHW 2016)

SIGNED [redacted]

NAME [redacted] A (Hons) DATE 12-Jul-23
(Laboratory Manager)

M U R R A Y R I X
ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS EN ISO 17892-4:2016

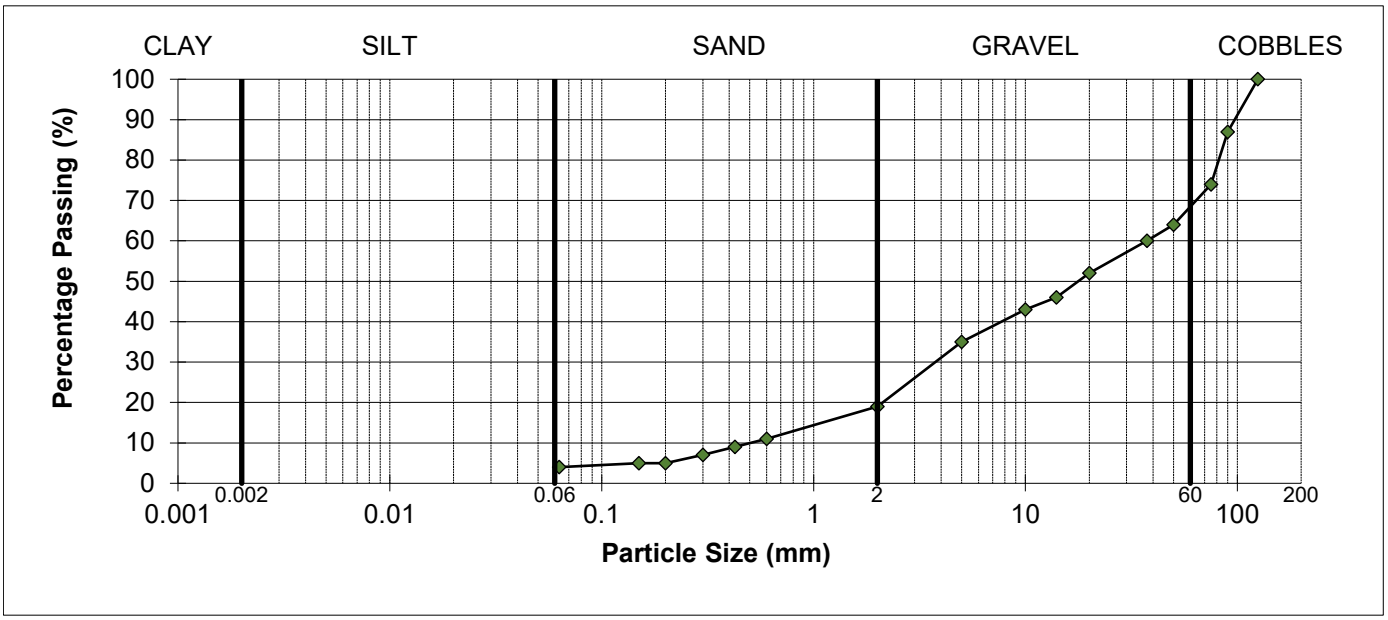
Determination of Water Content in accordance with BS EN ISO 17892-1:2014 (Oven Dry)

CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	TP112	DATE SAMPLED	09-Jun-23
LAB SAMPLE No	127173	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	MADE GROUND
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100	95-100	5	35	
90	87		2	19	
75	74		0.6	11	
50	64		0.425	9	
37.5	60		0.3	7	
20	52		0.2	5	
14	46		0.15	5	
10	43		0.063	4	<15



REMARKS

Sample complies with the advised grading specification for a 1A material (SHW 2016), Uniformity coefficient = >10

SIGNED [redacted]

NAME [redacted] A (Hons) DATE 12-Jul-23

(Laboratory Manager)

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

DRY DENSITY/WATER CONTENT RELATIONSHIP 4.5kg RAMMER
BS 1377-2:2022 Cl.11
PARTICLE DENSITY METHOD BS 1377-2:2022 Cl.9.2

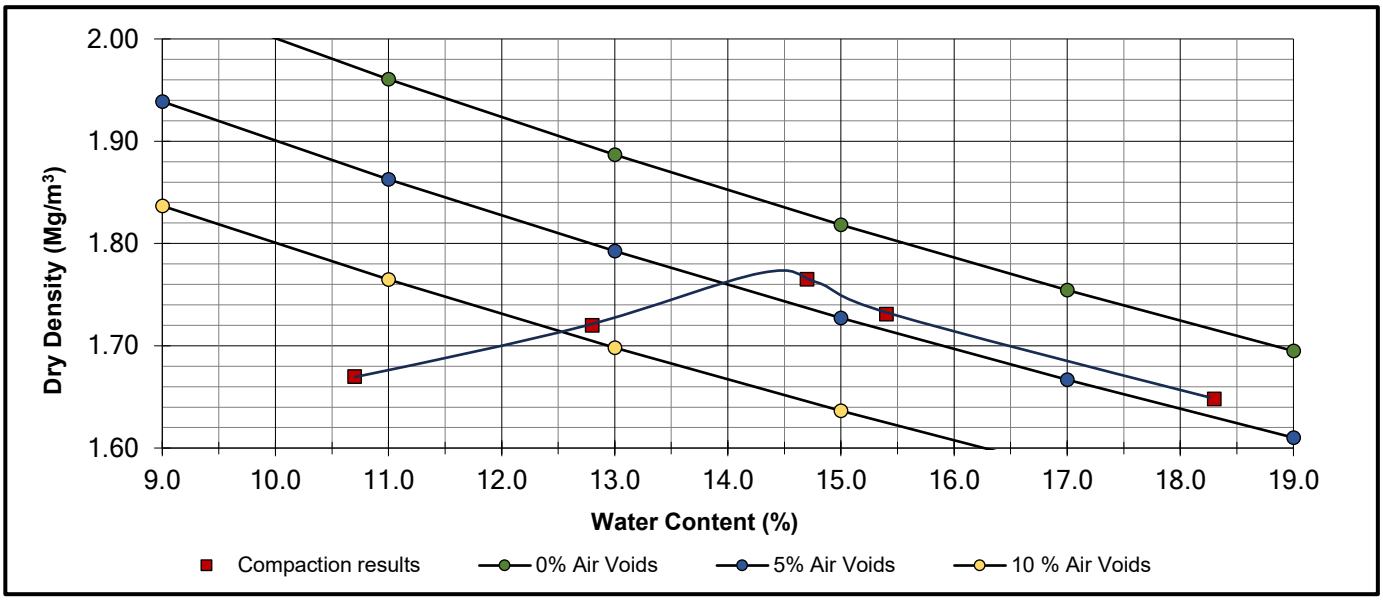
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	TP105a	DATE SAMPLED	09-Jun-23
SAMPLE NUMBER	127172	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	MADE GROUND
ADVISED SOURCE	Site Investigation Sample
PRE TREATMENT	Air Dried / Single Sample

RETAINED 37.5mm	9 %	GRADING ZONE	Zone 5
RETAINED 20mm	20 %	PARTICLE DENSITY	2.5 Mg/m3 (Assumed)

POINT NUMBER	WATER CONTENT (%)	DRY DENSITY (Mg/m^3)
1	10.7	1.670
2	12.8	1.720
3	14.7	1.765
4	15.4	1.731
5	18.3	1.648



OPTIMUM WATER CONTENT	**14**	(%)
MAXIMUM DRY DENSITY	**1.77**	(Mg/m^3)

REMARKS

NAME O.P. Davies BA (Hons) (Laboratory Manager) SIGNED [redacted] DATE 12-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

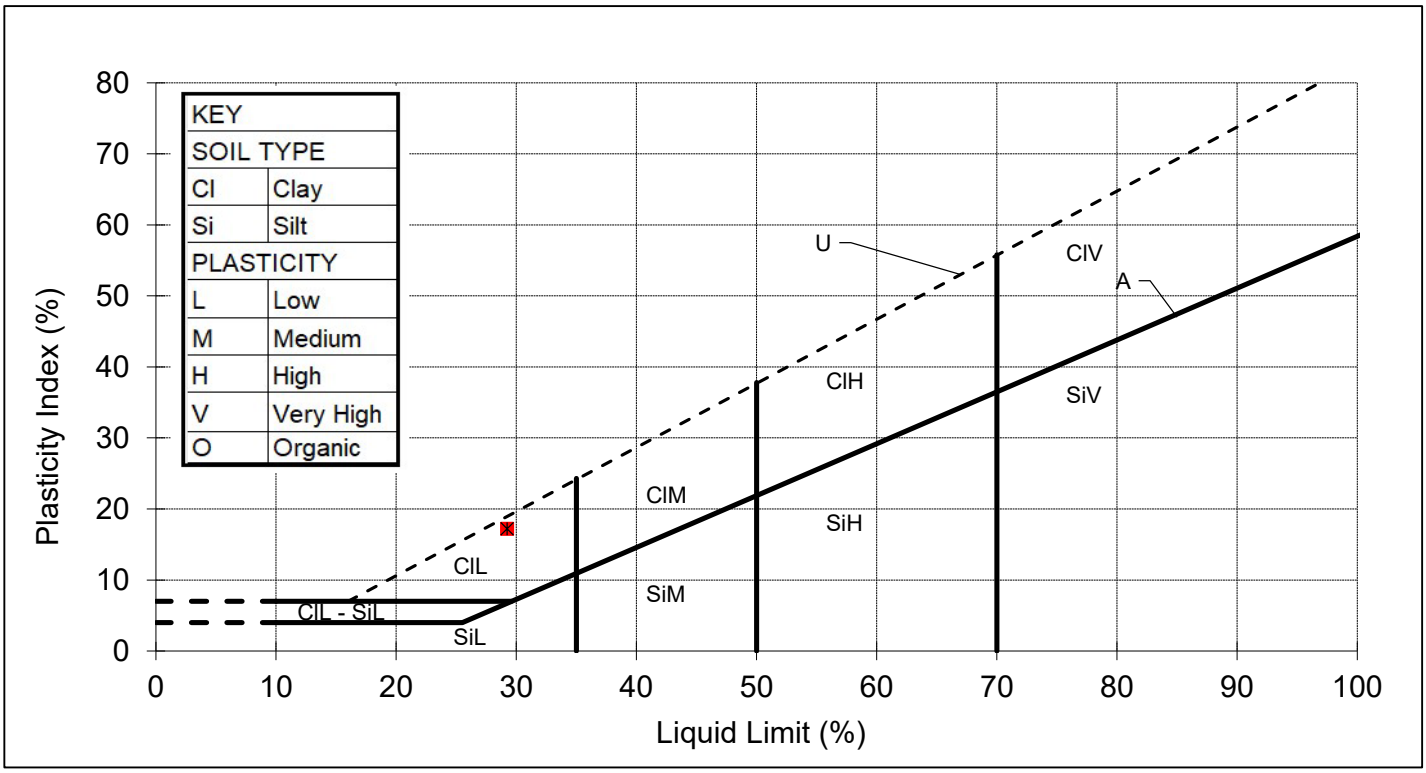
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS101 2.00-2.45	DATE SAMPLED	09-Jun-23
SAMPLE No.	127175	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	19.5	28.9	1.006	
Determination 2 (avg)	19.7	29.2		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
11.8	29	12	17	65



REMARKS

SIGNED [redacted]

NAME BA (Hons) DATE 12-Jul-23
(Laboratory Manager)

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

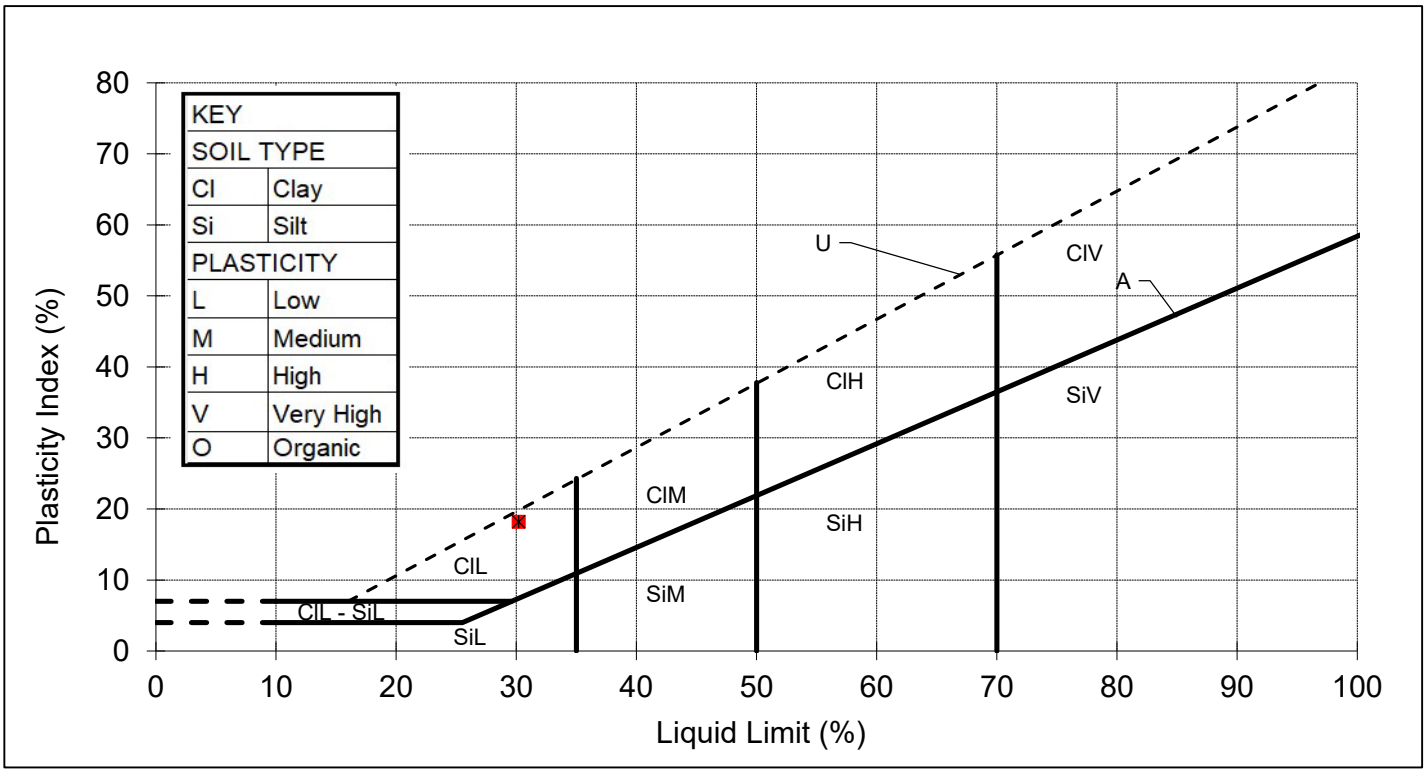
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS102 2.00-2.45	DATE SAMPLED	09-Jun-23
SAMPLE No.	127176	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	20.0	30.4	1.000	
Determination 2 (avg)	20.0	30.0		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
11.0	30	12	18	71



REMARKS

SIGNED [redacted]

NAME A (Hons) (Laboratory Manager) DATE 12-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

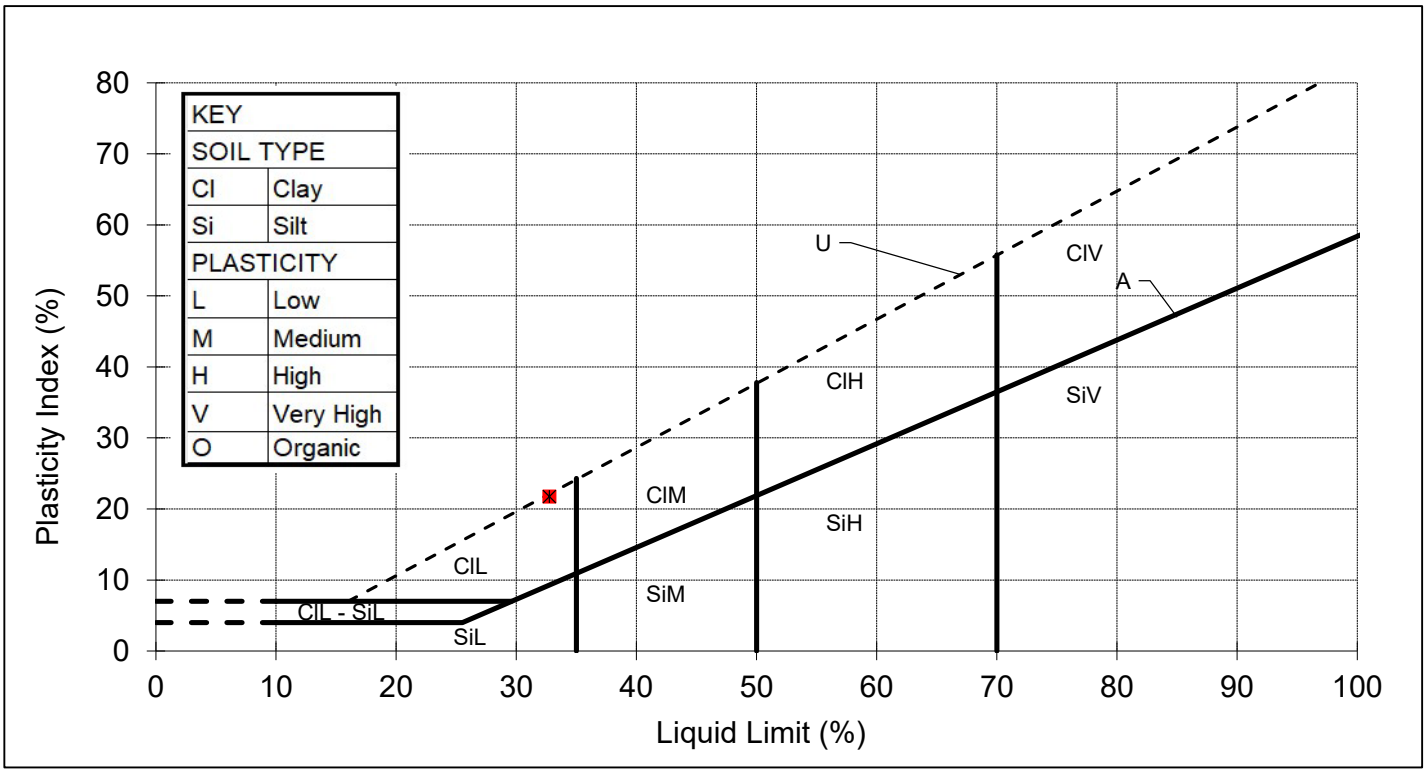
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS103 2.00-2.45	DATE SAMPLED	09-Jun-23
SAMPLE No.	127177	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	18.6	32.1	1.019	
Determination 2 (avg)	18.9	32.2		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
13.8	33	11	22	85



REMARKS

SIGNED [redacted]

NAME BA (Hons) DATE 12-Jul-23
(Laboratory Manager)

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

LIQUID LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.3 (30° FALL CONE) 1 POINT METHOD
PLASTIC LIMIT BS EN ISO 17892-12:2018+A2:2022 Clause 5.5
WATER CONTENT METHOD BS EN ISO 17892-1:2014+A1:2022

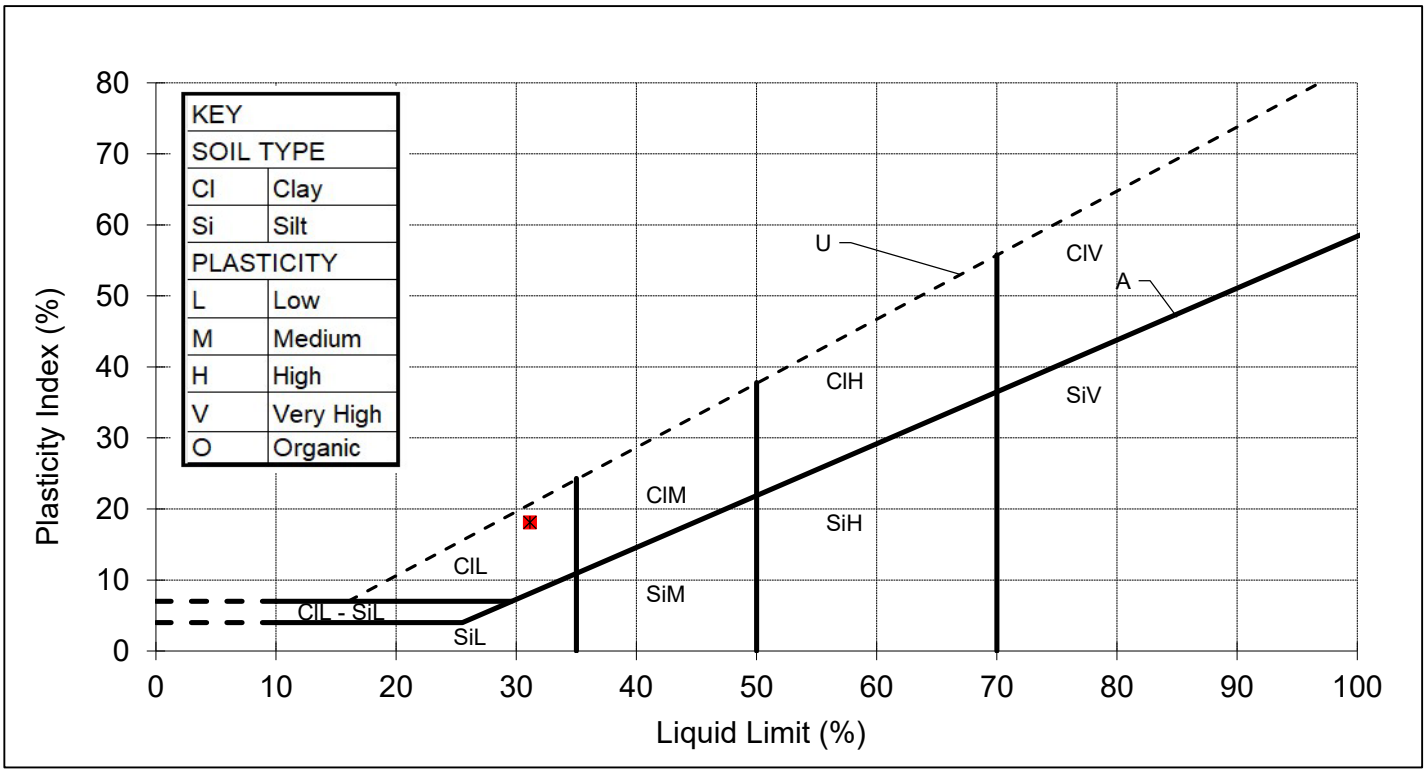
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS103 2.00-2.45	DATE SAMPLED	09-Jun-23
SAMPLE No.	127177	DATE RECEIVED	20-Jun-23
DATE TESTED	23-Jun-23	SAMPLED BY	Client

MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample	WATER CONTENT	Increasing
SAMPLE HISTORY	Natural State	% RET. 425um BY	Wet Sieved

Test Readings mm (average)		Moisture Content %	Correction Factor	Correction factor from Clayton and Jukes 1978
Determination 1 (avg)	19.2	31.0	1.012	
Determination 2 (avg)	19.2	30.5		

Natural Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
19.3	31	13	18	90



REMARKS

SIGNED [redacted]

NAME (Hons)
(Laboratory Manager)

DATE 12-Jul-23

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION
BS EN ISO 17892-8:2018

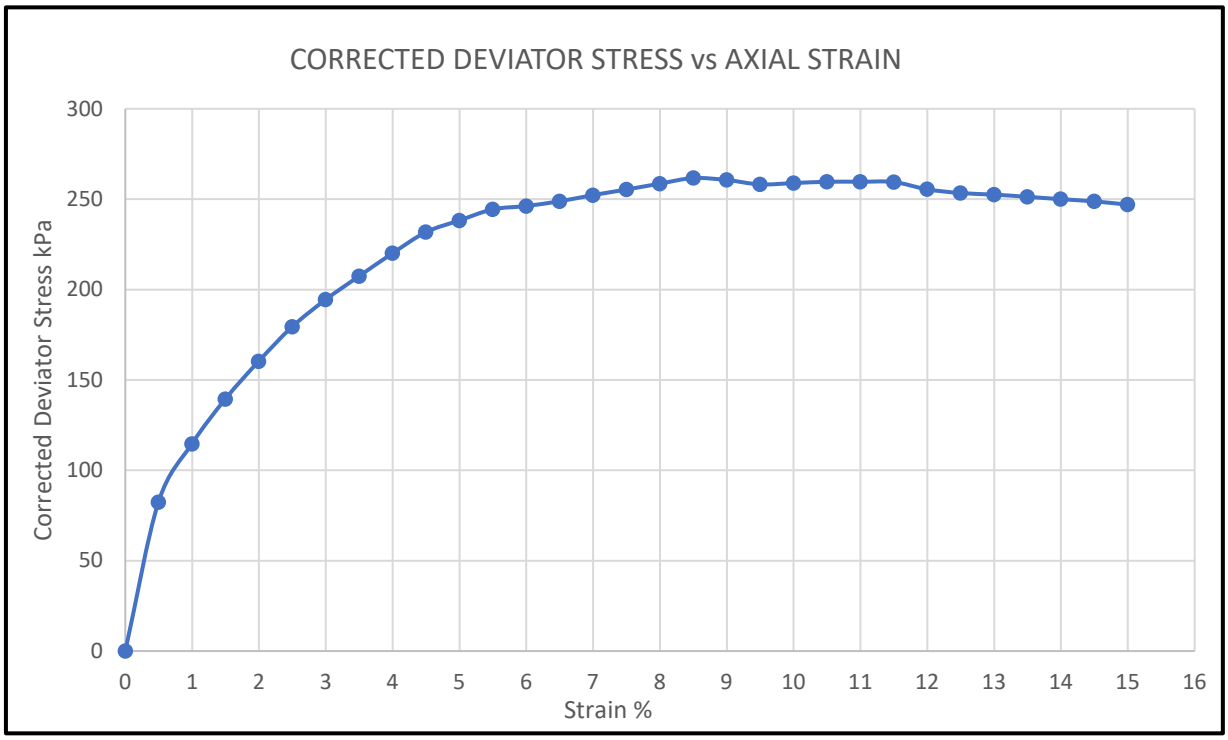
CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS101 1.50-2.00	**DATE SAMPLED**	09-Jun-23
LAB SAMPLE No.	127174	**DATE RECEIVED**	20-Jun-23
DATE TESTED	03-Jul-23	**SAMPLED BY**	Client
MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample		

INITIAL CONDITIONS

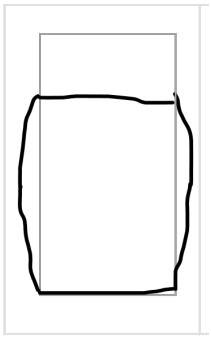
Specimen Location

Sample Length (mm)	360	Specimen depth from top of Sample (mm)	110
Sample Orientation	Vertical	Specimen Condition	Undisturbed
Specimen Length (mm)	145	Specimen Water Content (%)	17.1
Specimen Diameter (mm)	71	Specimen Bulk Density (Mg/m3)	2.13
Membrane Thickness (mm)	0.4	Specimen Dry Density (Mg/m3)	1.82
Membrane Correction	4.45		



TEST TYPE
SINGLE STAGE

SKETCH OF SPECIMEN AT FAILURE



PLASTIC

Cell Pressure (kPa)	Failure Strain (%)	Rate of Strain (%/min)	Corrected Deviator Stress (kPa)	Shear Strength Cu (kPa)
35	8.5	2.0	262	131

Remarks/Abnormalities

Name O.P Davies BA (Hons) (Laboratory Manager)

Signed [redacted]

Date 12 July 2023

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

BS EN ISO 17892-8:2018

CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

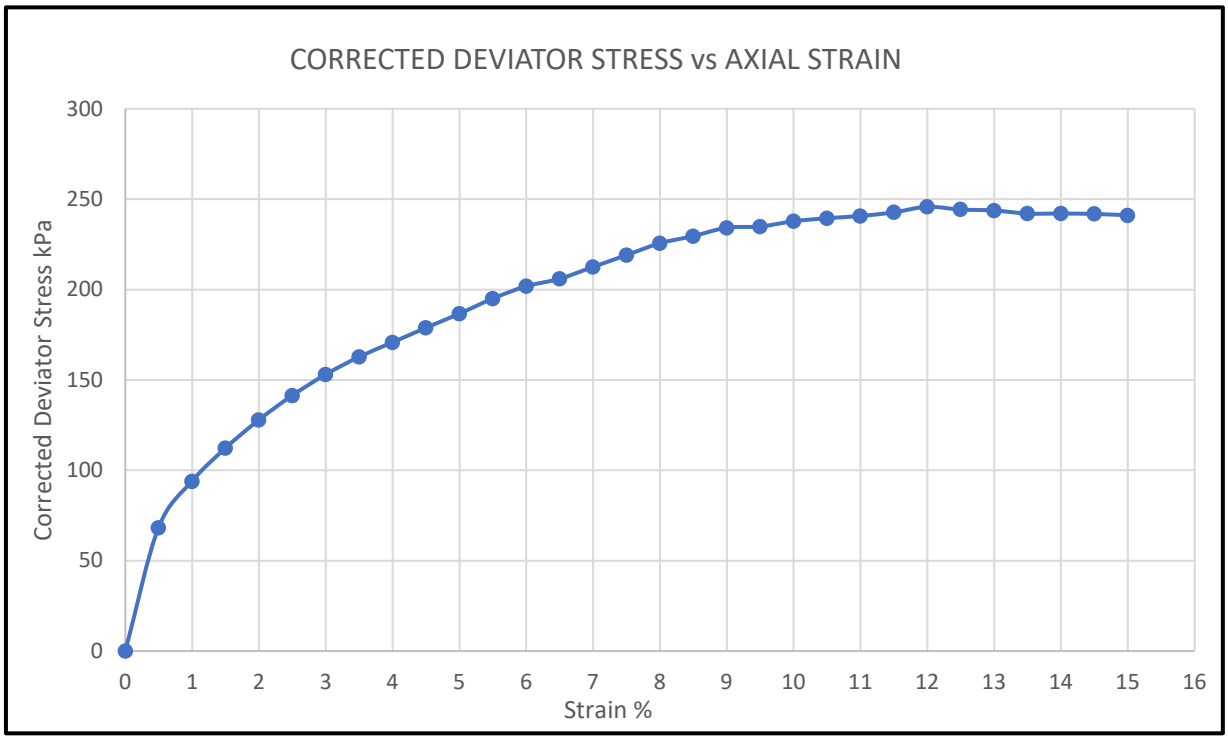
SAMPLE LABEL	WS102 0.50-1.00	**DATE SAMPLED**	09-Jun-23
LAB SAMPLE No.	127344	**DATE RECEIVED**	26-Jun-23
DATE TESTED	03-Jul-23	**SAMPLED BY**	Client
MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample		

INITIAL CONDITIONS

Specimen Location

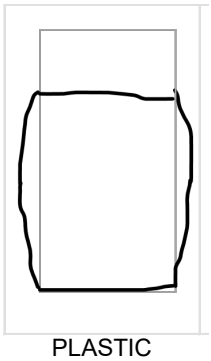


Sample Length (mm)	450	Specimen depth from top of Sample (mm)	100
Sample Orientation	Vertical	Specimen Condition	Undisturbed
Specimen Length (mm)	172	Specimen Water Content (%)	16.5
Specimen Diameter (mm)	72	Specimen Bulk Density (Mg/m3)	2.17
Membrane Thickness (mm)	0.4	Specimen Dry Density (Mg/m3)	1.86
Membrane Correction	4.52		



TEST TYPE
SINGLE STAGE

SKETCH OF SPECIMEN AT FAILURE



PLASTIC

Cell Pressure (kPa)	Failure Strain (%)	Rate of Strain (%/min)	Corrected Deviator Stress (kPa)	Shear Strength Cu (kPa)
15	12.0	2.0	246	123

Remarks/Abnormalities

Name O.P Davies BA (Hons) (Laboratory Manager)

Signed [redacted]

Date 12 July 2023

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION
BS EN ISO 17892-8:2018

CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

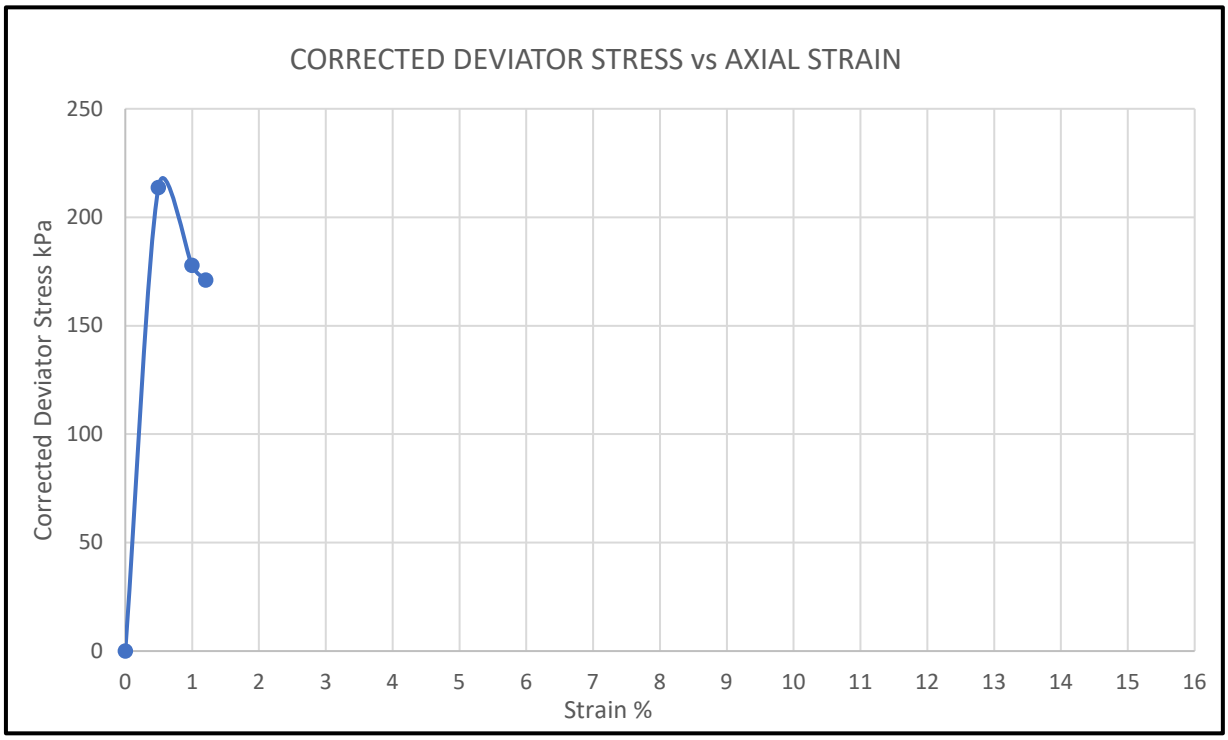
SAMPLE LABEL	WS105 2.50-3.00	**DATE SAMPLED**	09-Jun-23
LAB SAMPLE No.	127179	**DATE RECEIVED**	20-Jun-23
DATE TESTED	03-Jul-23	**SAMPLED BY**	Client
MATERIAL	Brown silty slightly sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample		

INITIAL CONDITIONS

Specimen Location

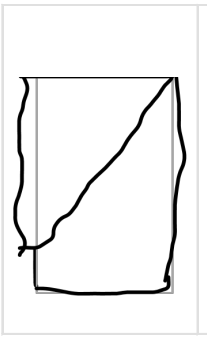


Sample Length (mm)	450	Specimen depth from top of Sample (mm)	200
Sample Orientation	Vertical	Specimen Condition	Undisturbed
Specimen Length (mm)	142	Specimen Water Content (%)	13.2
Specimen Diameter (mm)	72	Specimen Bulk Density (Mg/m3)	2.20
Membrane Thickness (mm)	0.4	Specimen Dry Density (Mg/m3)	1.94
Membrane Correction	0.27		



TEST TYPE
SINGLE STAGE

SKETCH OF SPECIMEN AT FAILURE



SIMPLE_SHEAR

Cell Pressure (kPa)	Failure Strain (%)	Rate of Strain (%/min)	Corrected Deviator Stress (kPa)	Shear Strength Cu (kPa)
55	0.5	2.0	214	107

Remarks/Abnormalities

Name O.P Davies BA (Hons) (Laboratory Manager) Signed Date 12 July 2023

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870

UKAS TESTING 1580

TEST CERTIFICATE

INCREMENTAL LOADING OEDOMETER TEST
BS EN ISO 17892-5:2017

CLIENT	e3p
SITE	Burnage Sports Club
JOB NUMBER	MRN 4588/70

SAMPLE LABEL	WS101 1.50-2.00	**DATE SAMPLED**	09-Jun-23
LAB SAMPLE No.	127174	**DATE RECEIVED**	20-Jun-23
DATE TESTED	26-Jun-23	**SAMPLED BY**	Client
MATERIAL	Brown silty sandy slightly gravelly CLAY		
ADVISED SOURCE	Site Investigation Sample		

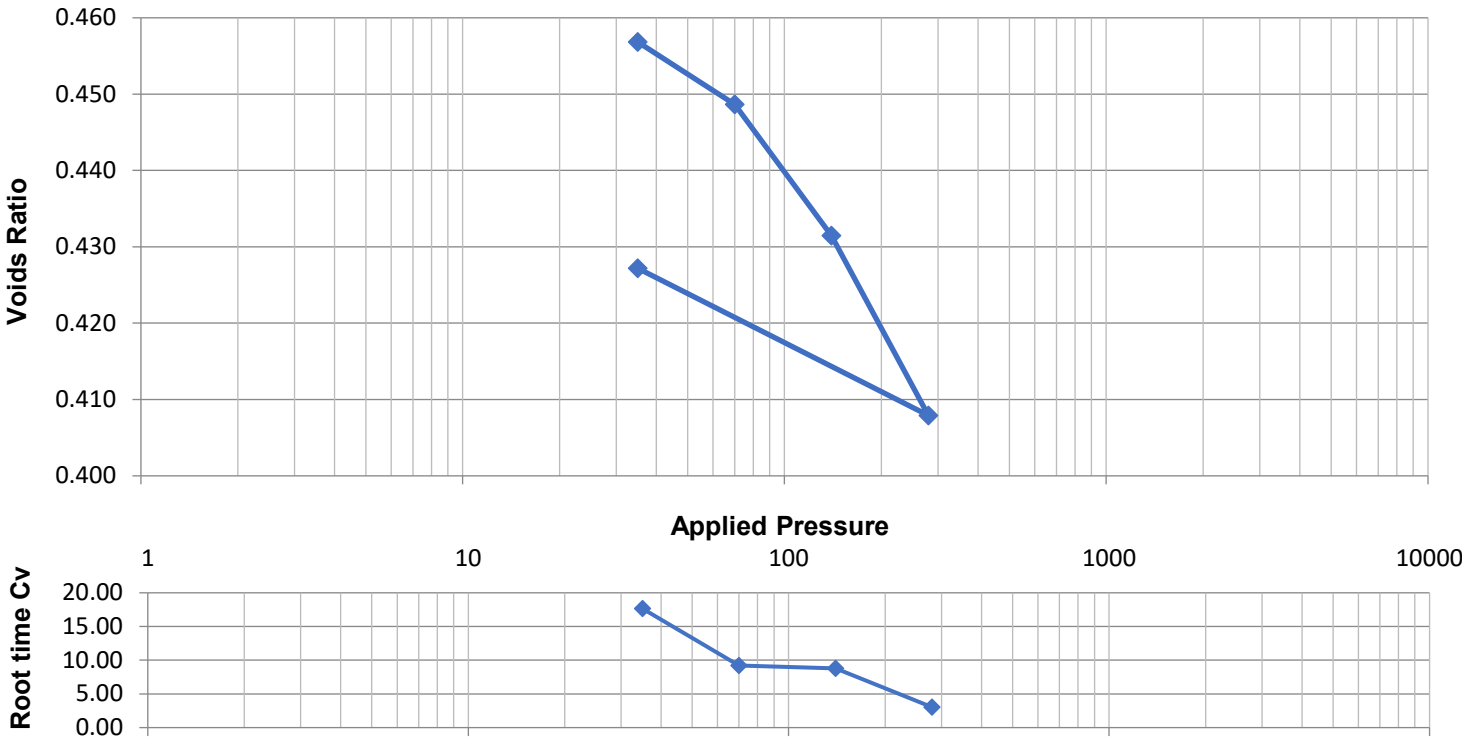
Specimen Location	Sample Length (mm)	450	Specimen depth from top of Sample (mm)		50
	Sample Orientation	Vertical	Specimen Condition		Undisturbed

INITIAL CONDITIONS

Height	20.1	mm	Particle density	2.65	Ass
Diameter	70.1	mm	Initial void ratio	0.47	
Weight wet	163.8	g	Deg. of sat.	97	%
Water cont.*	17.1	%	Swell. press.	0	kN/m^2
Bulk Density	2.12	Mg/m^3	Dry density	1.81	Mg/m^3

*determined from specimen trimmings

Load No.	Applied Pressure kPa	Sample Height mm	Void Ratio	Mv m^2/MN	Temp °C	Cv t90 root m^2/yr	Cv t50 log m^2/yr
1	35	19.95	0.457	0.16	20	17.65	17.91
2	70	19.84	0.449	0.16	20	9.22	9.14
3	140	19.60	0.431	0.17	20	8.77	7.57
4	280	19.28	0.408	0.12	20	3.04	2.73
5	35	19.54	0.427	0.06	20		
6							
7							



Remarks/Abnormalities

Name O.P Davies BA (Hons) (Laboratory Manager)

Signed [redacted]

Date 12 July 2023