



e3p

Phase II Geoenvironmental Site Assessment
Land to the West of New Street, Littleborough

Reference: 15-075-R2-2

Date: June 2023



PHASE II GEOENVIRONMENTAL SITE ASSESSMENT

Land to the West of New Street
Littleborough
OL15 8HW

Prepared for:



Report Ref: 15-075-R2-2

Date Issued: June 2023

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QUALITY ASSURANCE

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EXECUTIVE SUMMARY

Site Address	Land off New Street, Littleborough, OL15 8HW
Grid Reference	E 392610, N 415790
Site Area	~3.39 Ha
Proposed Development	Russell Homes intend to construct a low-rise residential development comprising 62 dwellings with associated access, gardens, public open space, attenuation basin, estate roads and ancillary infrastructure. The site is located west of the current Russell Homes development, accessed off New Road.
Current Site Use	The site comprises an undeveloped parcel of land located west of New Street in Littleborough. The site is variable in topography with undulating land. Generally, the site topographically falls from 150 m AOD in the north to 140 m AOD in the south. A steep slope is present in the northwest. The central-southern sector has been subject to overland flooding attributed to the accumulation of surface water in recent years. It is understood this occurred due to blockages within failing surface water drainage. A narrow drainage channel/stream runs from the northern site boundary where the woodland is present, in a southeast direction towards New Street. The drainage channel was full during the site investigation, with water flowing in a south-easterly direction. A pond decommission was undertaken by E3P in March 2022; however, a large volume of surface water is still present within the central and eastern site. A spring is also located at the western site boundary. The site is surfaced by soft standing ground comprising short grassland and self-seeding vegetation. An area of dense woodland is present in the far north of the site. E3P undertook a badger walkover, identifying four setts within the dense woodland. Invasive species including Himalayan Balsam have been identified within the northern section of the site. Sporadic semi-mature and mature trees are present in the central portion and along the site boundaries. Reeds and rushes are present at the edge of the pond located on site. Services have been identified on site including overhead telecommunication cables within the eastern site, and manholes associated with waste water from the northwest site boundary, running south across the site.
Site History	Historical mapping suggests that the southeast sector of the site was developed circa 1910 as part of Lower Mill Cottage to the east. The structures were no longer recorded by 1960. Tanks have been identified adjacent to the northwest boundary, located off site pre 1910 until c. 1960. An area of surface water is located in the central sector of the site, this appears to have gradually increased in size since circa 2000 when two small ponds were recorded, with it now indicated to encompass a notable portion of the development site area.



Site History <i>Continued...</i>	A watercourse flows from northwest to southeast from the earliest available mapping dated 1851. Wells were recorded in the west of the site from 1851; however, these are no longer shown by 1893. A spring is recorded at the western boundary from circa 1930. A sandpit and clay pit is recorded in the far north of the site from circa 1930, these features were subsequently backfilled. Between circa 1930 and 1960, allotment gardens were located in the east of the site.	
Environmental Setting	Drift Geology	Glacial Till – CLAY, SAND, GRAVEL; and Alluvium (South, Centre) – CLAY, SILT, SAND, GRAVEL.
	Bedrock Geology	Pennine Lower Coal Measures Formation – MUDSTONE, SILTSTONE AND SANDSTONE.
	Faults	There are no faults recorded within 250 m.
	Hydrogeology	The Glacial Till deposits are classified as Secondary Undifferentiated, and the Alluvium is a Secondary A Aquifer. The solid geology is classified as a Secondary A Aquifer.
	Hydrology	A spring is recorded in the west of the site. A narrow drainage channel/stream runs from the northern site boundary where the woodland is present, in a southeast direction towards New Street. A pond is located in the central / eastern sector of the site. The River Roch (main river) is located 52 m south.
	Flood Risk	The central site has been identified as a Flood Zone 2 associated with the site pond. The remaining site is unaffected by flooding from rivers.
Natural Landform and Geomorphology	The site is variable in topography. Generally, the site topographically falls from 150 m AOD in the north to 140 m AOD in the south. A steep slope is present in the northwest. Historical mapping suggests the site has not been subject to significant anthropogenic developments indicating the site broadly represents its natural landform. It is considered the natural landform slopes southward towards the River Roch located circa 52 m south of the site. The exception to this is the far north of the site which has undergone ground workings. During the intrusive investigation, the southern section of the site appeared to be topographically level with limited undulations in comparison to the northern and eastern site. It is considered likely the southern site has been subject to artificial levelling associated with the historical landfill.	
Previous Reports	E3P completed a Phase I and II Geoenvironmental Assessment Report (Ref: 10-423-r1-rev 4, May 2020) for the adjacent Russell Homes development site to the east. A number of exploratory holes were located in the northern area of the subject site.	



Previous Reports <i>Continued...</i>	E3P has been provided with the URS Phase II Environmental Investigation report, which includes an investigation north of the subject site (Ref: 44320062, February 2007). A Phase I Geoenvironmental Site Assessment was completed by E3P for the subject site (Ref:15-075-R2-2, July 2022). A full summary of findings is provided in Section 2.
Utility Locations	A full Ground Penetrating Radar (GPR) survey has not been completed for the site; however, overhead BT cables are present in the east of the site and combined public sewers are present in the west/south. Manholes were noted in the west and south of the site during the intrusive investigation.
Landfill Sites and Ground Gases	A historic landfill and registered landfill is recorded in the south of the site. Inert waste was deposited between March 1988 and December 1990. The site has undergone some historic ground working; the Made Ground may produce hazardous ground gases such as methane and carbon dioxide.
Radon	Unaffected – No Special Precautions Required.
Hazardous Installations & Former Land Use	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. The south-central sector is a licensed historical landfill site, the material deposited in this sector is legally defined as waste material. To ensure safe and lawfully compliant recovery and reuse of this material, a suitable Environmental Permit will be required for the land remediation works.



GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising: ✿ 27 x Mechanically excavated trial pits, ✿ 12 x Window sample boreholes, ✿ 5 x Cable percussive boreholes; ✿ 8 x Rotary open holes and ✿ Construction of 12 environmental monitoring installations.
Ground Conditions	Made Ground – 0.00 m bgl to 4.70 m bgl Made Ground was encountered within thirty exploratory hole locations across the site. Generally, Made Ground identified within the southern section of the site comprised gravelly clay with angular mudstone, sandstone, and brick (reworked topsoil) with underlying brown and black very gravelly clay and clayey gravel with frequent cobbles and occasional boulders. Cobbles were encountered as brick, concrete, mudstone, and sandstone, with isolated areas containing asphalt, ceramic, plastic, and glass. Boulders were identified as concrete and mudstone particularly in the landfilled area. Slag was encountered within two locations (TP101 and TP103). Peat was encountered as pockets of spongy black fibrous peat within the Made Ground deposits of TP103 and TP105. Made Ground comprising similar material to the southern site was identified within the eastern site (TP123, TP124, and TP125 WEST). An isolated area of Made Ground was encountered in TP127 located within the northeast site in an area where historical ground workings have been identified. The Made Ground comprised sandy gravel of fine to coarse, angular glass, ash, and brick to a proven depth of 0.90 m bgl. Further isolated areas of Made Ground were identified across the site, identified within all cable percussive and rotary boreholes. Generally, Made Ground comprised gravelly clay, with gravel of fine to coarse, angular brick, ash, and concrete, and areas of reworked topsoil comprising gravelly, sandy clay with frequent rootlets. TOPSOIL – 0.00 m bgl to 0.40 m bgl. Topsoil was encountered within twenty exploratory hole locations between ground level and 0.40 m bgl. Topsoil comprised dark brown to brown sandy CLAY with frequent rootlets within the north and west site, with slightly gravelly, sandy CLAY in the eastern site. Gravel was noted to be subrounded to rounded of mudstone and sandstone. Light orangish brown, slightly gravelly very sandy CLAY with gravel of fine to coarse, subrounded mudstone and sandstone was identified within one location, TP126 in the northeast site.



DRIFT – 0.10 m bgl to 33.10 m bgl.

The natural drift geology was identified within forty-six of the fifty-two exploratory hole locations. Drift deposits were not encountered within six locations where the depth of Made Ground was unproven.

Generally, cohesive deposits comprised firm to stiff gravelly, sandy CLAY was encountered within the southern site, underlying Made Ground deposits, with interbedded medium dense SAND and GRAVEL. Isolated areas of soft CLAY and loose SAND and GRAVEL were noted within the southern site.

Exploratory holes within the northwest section of the site identified granular deposits comprising reddish brown clayey, gravelly fine to coarse SAND with underlying SAND and GRAVEL to circa 13.30 m bgl, before encountering CLAY (RB105).

Generally, soft low strength very silty CLAY and sandy CLAY with areas of PEAT was identified within the northern section of the site. Rotary boreholes identified interbedded SAND, GRAVEL and CLAY deposits underlying sandy CLAY. Peat was identified as pockets of spongy brown fibrous PEAT within TP115 and WS108 between 0.50 m bgl and 1.70 m bgl. Layers of PEAT were identified within the northern section of the site in exploratory hole TP115 between 2.65 – 2.80 m bgl.

Spongy brown fibrous PEAT with a slight organic odour was identified within the eastern section of the site, in close proximity to the pond. The maximum recorded thickness of the PEAT is 0.20 m, recorded at 1.10 m bgl (WS110). Surrounding exploratory holes within the eastern site identified underlying granular deposits of medium dense to dense SAND and GRAVEL, with isolated areas of very soft very low strength, to soft low strength silty, sandy CLAY (TP119). Silt was identified within CP104 between 3.00 – 12.20 m bgl, and RB109 between 1.40 – 12.30 m bgl, with underlying cohesive and interbedded granular deposits.

In areas surrounding the site pond, particularly within the northern and eastern section of the site, significant depths of SILT were identified with areas of PEAT and isolated areas of very soft CLAY. Further potential for peat deposits to extend out from these areas should be considered. Water strikes were identified within shallow drift deposits.

SOLID – 33.10 m bgl to 56.00 m bgl.

Bedrock was encountered within all rotary borehole locations at a depth of between 33.10 m bgl to 36.30 m bgl, to a proven depth of 56.00m bgl.

The bedrock comprised MUDSTONE with interbedded SANDSTONE.

GROUNDWATER –

Groundwater was identified within twenty-eight exploratory hole locations during the intrusive investigations. Water strikes were encountered as slow to fast seepages through silty, sandy, or gravelly CLAY, granular deposits, and Made Ground. One exploratory hole location, TP116 identified a water strike within PEAT deposits at 1.00 m bgl. Running sands was identified within TP 118 and TP121 at 1.00 m bgl.

Subsequent groundwater monitoring recorded groundwater at depths of between 1.35m and 6.80m bgl. Two monitoring wells were flooded during the monitoring visits to date (CP103 and WS110).



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. This assessment has identified the presence of elevated asbestos, PAHs and TPHs compounds. The non-volatile contaminants within the Made Ground soils can be mitigated by the placement of a suitable cover system overlying any Made Ground soils left in situ after the cut and fill works. Where Made Ground soils are removed to expose natural soils, a full cover system may not be required. However, further analysis will be required in some areas to confirm this. Localised semi-volatile TPH hotspots will require delineation and removal. Asbestos trace fibres has been identified within the shallow Made Ground. As such, it will be necessary to carefully manage these impacted soils and place them in a legislatively compliant manner (in accordance with the asbestos CSM) that will negate any possibility of future exposure. It is possible that as yet unidentified contaminant impact is present within localised hotspots at the site. It is considered that any such contamination could be addressed by the delineation, excavation and treatment of impacted soils.
Controlled Waters	The site is not considered to pose an unacceptable level of risk to controlled waters.
Ground Gas	The northern portion of the site does not require any ground gas protection measures. However, for the southern portion, precautionary CS2 / Amber 1 ground protection measures are recommended.
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.
Waste Management	The southwest sector is occupied by a historical landfill where the material was deposited under a Waste Management License. Materials originating from a licensed waste management facility are regulated under the Waste Framework Directive (WFD). Furthermore, materials originating from future excavations (both during remediation or construction) cannot be recovered for re-use using the normal processes and protocols such as the CL:AIRE DoW CoP. The material deposited in this sector appears to be largely inert, comprising construction and demolition materials and soils. Remediation options for this sector of the site warrant robust consideration given that options for re-use would either be an application for a new Environmental Permit (Deposit for Recovery – DFR) or alternatively the on-site processing of material to recover the fractions that would no longer cease to be a waste with the off-site disposal of all non-recoverable portions. E3P would recommend that a waste management and recovery strategy be defined to facilitate the safe and economic re-use of material from landfill. A volume of 'waste' will require removal from site, this should be considered as part of a site viability assessment.



COAL MINING ASSESSMENT

Coal Mining

The site is located within a 'Development High Risk' area. The desk-based coal mining risk assessment identified coal seams recorded to sub-crop underlying the site boundary, with areas of recorded shallow workings underlying the western side of the site (CA mining report ref: 5103006852001). Mine workings are recorded in the Upper Mountain and Lower Mountain seams between 7.00 – 22.00 m. The Coal Authority also indicate probable shallow mine workings across the majority of the Site.

E3P completed eight >50m rotary boreholes to investigate shallow mine workings. The bedrock was recorded at depths of between 33.10m and 36.30m bgl to a proven termination depth of 56.00m bgl.

No evidence of coal seams or historic workings has been recorded in the eight rotary boreholes.

At this time, it is recommended that an allowance should be made for proof drilling beneath the development site with some pressure grouting to consolidate the proven mine workings. Due to the depth of superficial drift deposits, abnormal costs should be allowed for deep proof drilling works.

Due to the absence of any recorded seams within the upper 80m of the site, based on the Coal Authority abandonment plans for the site, it is critical to confirm the absence of unrecorded coal seams underlying each plot.

Therefore, the sequence for the proof drill and grouting works will be to advance a borehole beneath each residential plot, If a coal seam is encountered which does not have sufficient rock cover (10x seam thickness), the location will be subject to Drill and grouting on a 6m grid, reduced to 4.5m and 3.0m centres accordingly, subject to Grout takes. If sufficient rock cover is present, grouting will not be required.



GEOTECHNICAL ASSESSMENT

Underground Obstructions	Significant concrete and brick obstructions have been encountered within the southern section of the site in the form of concrete and mudstone boulders at depth. The former landfill has a layer of inert waste-type material with unsuitable elements, and this will require excavation and processing (in accordance with a suitable Environmental Permit) to construct a suitable development platform. During a phase of cut-and-fill enabling works to create a developable platform, any Made Ground will require grubbing out in its entirety to facilitate the installation of piled foundations, if required.
Allowable Bearing Pressure	The underlying natural clay drift deposits are generally firm to stiff with a net allowable bearing pressure (ABP) of 40.04 – 129.12 kN/m² between 0.60 m bgl and 2.50 m bgl, increasing to 72.53 – 143.36 kN/m² in excess of 6.50 m bgl. The underlying medium dense SAND and GRAVEL have an ABP of 101.38 – 299.76 kN/m² between 2.00 m bgl and 20.00 m bgl. However, areas of very soft CLAY and SILT were identified within eight locations across the site. Very soft to soft CLAY was encountered between 0.30 – 2.80 m bgl with an ABP of 10.66 – 38.33 kN/m², with very soft to soft SILT within CP104 between 3.00 – 6.50 m bgl (ABP of 17.39 – 36.74 kN/m²). Loose SAND and GRAVEL were identified within CP102 and CP103 between 3.00 – 5.00 m bgl with an ABP of 58.07 – 86.97 kN/m². In areas where the granular stratum is saturated, this could reduce the ABP by up to 50%.
Foundation Options	The site will likely be subject to significant cut and fill works to create suitable development platforms. Therefore, the proposed foundations will be subject to the finished floor levels (FFLs), volumetrics / cut and fill levels and proposed loadings. At this time, in the absence of the above, the foundation types cannot be accurately provided. However, based on the current ground conditions, the likely foundations will comprise: ✳ Strip/trench foundations bearing into competent firm to stiff CLAY or medium dense SAND; ✳ Deep Mass Trench to be completed in areas where competent stratum is identified at greater depth or in areas of tree influence; ✳ Ground improvement using bottom feed vibro stone column (VSC) to support a shallow reinforced concrete strip foundation where ground conditions are unsuitable for strip/trench; ✳ Raft foundations to limit the applied loading and mitigate the risk of differential settlement within reduced strength clays and loose granular deposits.



Foundation Options <i>Continued...</i>	✳ Driven piles in areas of soft clays, tree influence, location of pond and areas of peat. There is the potential for peat and organic soils to be present in the location of the current pond. Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards where CLAY deposits are present. If shallow mine workings are identified as requiring stabilisation by pressure grouting, pile lengths or 'set depths' will need to be designed to ensure that no unacceptable pressure is transposed onto treated workings. This will require pile depths to be limited and constructed by 'friction bearing'.
Building Floor Slabs	Ground-bearing floor slabs are unlikely to be viable given the anticipated depths or reworked Made Ground > 600 mm and/or the presence of shallow cohesive soils within influence distance of trees and local peat deposits.
Heave Precautions	As the underlying CLAY is of Low Volume Change Potential and heave precautions are not required to the internal face of the external load bearing walls (outside or within tree influence). If a ground bearing floor slab is to be constructed within the conjectured zone of tree influence, the CLAY will need to be removed to ensure that any desiccated soil cannot swell and induce heave to the structure. Alternatively, it may be possible to design the structure to resist the influence of clay heave using exaggerated sub-base and additional reinforcement within the slab to be designed by the Structural Engineer.
Soakaway Drainage	The presence of shallow groundwater, cohesive deposits and localised shallow peat deposits would likely preclude the use of soakaway drainage.
Sulphate Assessment	Concrete classification will be DS1 AC1s.
Cut/Fill	Development levels are unknown at this time; however, significant cut-and-fill works will be required to prepare the development platform. Where it is proposed to raise ground levels to construct the proposed development platform, depending on the depth of the proposed upfill, settlement analysis will be required to determine the potential for consolidation attributed to surcharge pressures.
Infrastructure / External Considerations	The presence of compressible peat soils in the northern and central sector represents a significant geotechnical constraint in terms of the proposed site infrastructure. The peat soils exhibit significant and unquantifiable potential for instant and long-term differing settlement with the potential for consolidation of the material by up to 30–50% of the material volume. A number of geotechnical engineering solutions exist to mitigate the potential adverse effect associated with un differential and total settlement within peat soils to the underside of the highway, private drives, utilise and service infrastructure. The final development solution will require a specific geotechnical design to consider the static and dynamic loading implied by the development and the maximum tolerable settlement.



Infrastructure / External Considerations	Suggested options to mitigate the risk associated with the peat are set out below: ✿ Excavation of the near surface compressible peat soils beneath roads, pavement and private driveways, the resulting excavation can be backfilled with site derived aggregate material to be placed according to a geotechnical compaction specification; ✿ Installation of 'band drains' prior to inducement of constant surcharge pressure to achieve required settlement prior to construction of engineered platform utilising geo-grid and aggregates; ✿ Use of structural support system such as extensive piling to support all roads, service corridors and infrastructure combined with geo-grid and aggregate platform to support highway, pavement and driveway.
Civil Engineering Excavations	The E3P Intrusive Ground Investigation has not identified the presence of weathered/competent bedrock at a shallow depth. Trial pit excavations were encountered to be unstable in locations with deeper/granular Made Ground. Running sands were also encountered in one location. These should be considered ahead of civil works in these areas. It is recommended that excavations are supported or battered back in accordance with the guidance contained in CIRIA R97. Minor water ingress will require localised dewatering/sump pumping during the construction of the site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Remediation	A significant programme of land remediation works will be required to process the historical landfill material and remove highly compressible peat deposits. Given the site setting and ground model, this will be a complex process requiring detailed design by a specialist contractor. The remediation will be constrained by the presence of a recorded landfill requiring specialist Environmental Permits and protocols to facilitate legislatively complaint management, recovery and re-use of materials.



RECOMMENDATIONS

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

- ✿ Specification for the proof drilling of recorded shallow workings and consolidation of any voids to mitigate surface subsidence risk.
- ✿ Detailed remediation options appraisal and design to assess viable options.
- ✿ Waste Management Strategy to review options for recovery and re-use of materials originating from a recorded landfill;
- ✿ Geotechnical settlement analysis to assess the potential for consolidation of the reduced strength superficial drift associated with surcharge loads imposed by bulk earthworks.
- ✿ A geotechnical options appraisal for foundation solutions.
- ✿ Further Investigation of Inaccessible Areas (Pond (central) and Woodland (north);
- ✿ Plot-Specific Foundation Schedule (Upon Receipt of The Final Development Levels);
- ✿ Arboricultural Survey;
- ✿ Slope Stability Assessment;
- ✿ Construction Phase Surface Water Management Plan;
- ✿ Geotechnical Earthworks Strategy (Infrastructure); and
- ✿ Remediation and Enabling Works Strategy.



Table of Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	14
1.1. Background	14
1.2. Proposed Development	14
1.3. Objectives	15
1.4. Scope of Works	15
1.5. Limitations	15
1.6. Confidentiality	15
2. GROUND INVESTIGATION	16
2.1. Previous Site Investigations	16
2.2. General Overview	18
2.3. Limitations of the Investigation	18
2.4. Scope of Investigation	18
2.5. In-Situ Standard Penetration Testing (SPT)	20
2.6. Laboratory Analysis	21
3. GROUND AND GROUNDWATER CONDITIONS	22
3.1. Summary of Ground Conditions	22
3.2. Topsoil	24
3.3. Made Ground	25
3.4. Drift Deposits	25
3.5. Solid Geology	26
3.6. Groundwater	27
3.7. Visual and Olfactory Evidence of Contamination	28
3.8. Soil Consistency	28
3.9. Side Stability and Ease of Excavation	30
3.10. Consolidation	37
3.11. Particle Size Distribution	37
3.12. Soil Density/Moisture Content Relationship	38
3.13. Soil Plasticity	38
3.14. pH and Sulphate	39
4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	40
4.1. Human Health Risk Assessment	40
4.2. Controlled Waters Risk Assessment	46
4.2.1. Controlled Water Risk Assessment and Mitigation	54
4.2.2. M-BAT Assessment	54
4.2.3. Discussion of Controlled Waters Risk Assessment	55
4.3. Ground Gas Risk Assessment Methodology	55
4.4. Monitoring Methodology	56
4.5. Summary of Monitoring Results	64
4.5.1. Groundwater	64
4.5.2. Barometric Pressure	64
4.5.3. Gas Flow	64
4.5.4. Gas Concentrations	64
4.6. Conclusion	65
4.7. Potable Water Supply	66
4.8. Conceptual Site Model	68
5. COAL MINING	72
5.1. Coal Mining Geology	72
5.1.1. Coal Authority Plan	73



5.1.2.	Coal Authority Recorded Shallow Workings	73
5.2.	Scope of Intrusive Ground Investigation	74
5.3.	Summary of Ground Investigation Works	74
5.3.1.	Rotary Boreholes to Investigate Workings in Coal	74
5.4.	Summary of Coal Mining Issues	75
6.	GEOTECHNICAL ASSESSMENT	77
6.1.	Proposed Development	77
6.2.	Site Preparation	77
6.3.	Foundation Conditions and Assessment of Potential Bearing Capacities	77
6.4.	Infrastructure Considerations	82
6.5.	Ground Floor Slabs	83
6.6.	Heave Precautions	83
6.7.	Highways Construction	84
6.8.	Drainage	84
6.9.	Concrete Durability	85
6.10.	Excavations	85
6.11.	Slope Stability	86
6.12.	Construction Activity and Inspection	86
6.13.	Geotechnical Risk Register	87
6.14.	Further Works	88
APPENDIX I LIMITATIONS		90
APPENDIX II GLOSSARY		92
APPENDIX III DRAWINGS		95
APPENDIX IV PHOTOGRAPHS		97
APPENDIX V E3P EXPLORATORY HOLE LOGS		103
APPENDIX VI CHEMICAL TESTING RESULTS		104
APPENDIX VII ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA		105
APPENDIX VIII GEOTECHNICAL TESTING RESULTS		107
APPENDIX IX COAL AUTHORITY REPORT		108

DRAWING LIST

15-075-001 - Site Location Plan
15-075-002 - Proposed Development Plan
15-075-005 - Historical Features Plan
15-075-004 - Site Features Plan
15-075-005 - Exploratory Hole Location Plan
15-075-006 - Depth of Made Ground Plan
15-075-007 - Depth of Topsoil Plan
15-075-010 - Conceptual Site Model
15-075-011 - Coal Mining Issues Plan
15-075-012 - Depth to Bedrock Plan
15-075-014 - Depth & Thickness of Peat Plan
15-075-015 - Development Constraints Plan
15-075-018 - Contamination Issues Plan



1. INTRODUCTION

1.1. BACKGROUND

E3P Ltd has been commissioned by Russell Homes Ltd (the client) to undertake a detailed Phase II Geoenvironmental Site Assessment for a parcel of land to the west of New Street, Littleborough; herein referred to as the site.

The site is located west of the current Russell Homes development, accessed off New Road.

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

1.2. PROPOSED DEVELOPMENT

Russell Homes intend to construct a low-rise residential development comprising 62 No. Residential dwellings with associated access, gardens, public open space, attenuation basin, estate roads and adopted utility infrastructure.

The Proposed Development Scheme is presented in Drawing 15-075-002 (Appendix III) and Figure 1.1 below.

FIGURE 1.1 SNAPSHOT OF THE PROPOSED DEVELOPMENT



1.3. OBJECTIVES

The objectives of the geoenvironmental assessment are as follows:

- ✿ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available in order to complete a desk study in line with Environment Agency (EA) document *Land Contamination: Risk Management (LCRM) (2019)*.
- ✿ Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified.
- ✿ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors.
- ✿ Assess the geotechnical information and provide preliminary recommendations in relation to foundations, pavement construction and floor slabs.
- ✿ Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of work includes the following elements:

- ✿ Detailed review of historic information;
- ✿ Design of suitable intrusive ground investigation;
- ✿ Window sample probeholes with, and construction of, environmental monitoring installations;
- ✿ Deep cable percussive boreholes with groundwater monitoring installations;
- ✿ Mechanically excavated trial pits;
- ✿ Deep Rotary Open Boreholes;
- ✿ In-situ geotechnical testing;
- ✿ Chemical and geotechnical laboratory analysis;
- ✿ Groundwater monitoring and sampling;
- ✿ Ground gas monitoring;
- ✿ Contamination risk assessment and conceptual site model;
- ✿ Geotechnical assessment and interpretation; and
- ✿ Factual and interpretive reporting.

1.5. LIMITATIONS

The limitations of this report are presented in Appendix I.

1.6. CONFIDENTIALITY

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



2. GROUND INVESTIGATION

2.1. PREVIOUS SITE INVESTIGATIONS

- ✳ E3P has completed a Phase I and II Geoenvironmental Assessment Report (Ref: 10-423-r1-rev 4, May 2020) for the adjacent Russell Homes development site to the east. A number of exploratory holes were located in the northern area of the subject site.
- ✳ E3P has been provided with the URS Phase II Environmental Investigation report which includes investigation in the north of the subject site area (Ref: 44320062, February 2007).
- ✳ A Phase I Geoenvironmental Site Assessment was completed by E3P for the subject site (Ref:15-075-R2-2, July 2022).

The key findings of the reports are summarised below:

E3P - Phase I & II Geoenvironmental Site Assessment (Ref: 10-423-r1-rev 4, May 2020)

- ✳ *E3P completed three mechanically excavated trial pits, two deep rotary boreholes and four dynamic cone penetrometer tests in the north of the subject site.*
- ✳ *TP116 identified PEAT between 0.30 m and 1.80 m bgl.*
- ✳ *Ground conditions generally comprised TOPSOIL overlying grey sandy GRAVEL of sandstone and firm to stiff grey sandy gravelly CLAY.*
- ✳ *RB106 identified light grey to brown SAND with boulders to 30.00 m bgl. RB104 further north recorded a complete loss of flush at 10.50 m with minimal recovery to 30.00 m. Drilling was recorded as consistent with voids not suspected.*
- ✳ *The solid bedrock geology was not encountered despite the drilling of boreholes to a depth of 30.00 m bgl.*
- ✳ *A groundwater strike was recorded in TP116 at 2.70 m bgl.*
- ✳ *No exceedances of the GAC were noted in the topsoil sample from TP115.*
- ✳ *No evidence of visual or olfactory evidence of hydrocarbon impact was noted.*
- ✳ *A cast driven piled solution was recommended for the proposed development.*

URS - Phase II Environmental Investigation (Ref: 44320062, February 2007)

- ✳ *URS completed one mechanically excavated trial pit and two boreholes within the north of the subject site.*
- ✳ *BH103 identified Made Ground to 0.80 m bgl overlying dark brown to black silty SAND and GRAVEL and soft sandy SILT to 3.40 m bgl. The silt was underlain by sandy GRAVEL of sandstone to 3.95 m bgl.*
- ✳ *BH104 identified Made Ground to 3.60 m bgl which was underlain by soft slightly gravelly CLAY. Soft dark brown PEAT/black organic rich SILT was noted between 4.70 to 5.00 m bgl.*
- ✳ *TP103 identified Topsoil to 0.20 m bgl underlain by soft orange brown silty SAND with lenses of firm orange brown SILT. Dark grey GRAVEL of sandstone was noted between 3.20 – 4.00 m bgl.*



- ✳ *Elevated concentrations of heavy metals (arsenic and lead) and non-volatile PAHs were recorded in soil samples from BH103 and BH104.*
- ✳ *Exceedances were noted for copper and lead in the groundwater sample from BH103.*

E3P – Phase I Geoenvironmental Site Assessment (Ref: 15-075-R1-2, July 2022)

- ✳ *The central-southern sector has been subject to overland flooding attributed to the accumulation of surface associated with blockages in failing surface water drainage.*
- ✳ *The southeast sector of the site was developed circa 1910 as part of Lower Mill Cottage to the east. The structures are no longer recorded on-site by 1960. A sandpit and clay pit is recorded in the far north of the Site from circa 1930, these features were subsequently backfilled. Between circa 1930 and 1960, allotment gardens were located in the east of the site.*
- ✳ *A historic landfill and registered landfill are recorded in the south of the site. Inert waste was deposited between March 1988 and December 1990. The Site has undergone some historic ground working; the Made Ground may produce hazardous ground gases such as methane and carbon dioxide.*
- ✳ *The site is underlain by Glacial Till (CLAY, SAND and GRAVEL) with a Secondary Undifferentiated aquifer. Alluvium deposits are noted in the south/central site with a Secondary A aquifer.*
- ✳ *Bedrock comprises the Pennine Lower Coal Measures Formation (MUDSTONE, SANDSTONE and SILTSTONE) with a Secondary A aquifer.*
- ✳ *A stream and spring is present onsite. The River Roch (main river) is located 52 m south.*
- ✳ *The closest groundwater abstraction is located 818 m northeast for public water supply; however, this is listed as revoked.*
- ✳ *The site is located in a high-risk development area. Coal seams are recorded to sub-crop across the site, with areas of recorded underground workings underlying the western side of the Site. Mine workings are recorded in the Upper Mountain and Lower Mountain seams between 7.00 – 22.00 m.*
- ✳ *The Coal Authority indicate probable shallow mine workings across the majority of the site. Mine shafts are recorded circa 120 – 140 m to the west/northwest, indicating access to workings in the immediate vicinity.*
- ✳ *Contaminant sources include Made Ground, possible fuel leaks/spillages, peat, alluvium deposits, and coal measures. Offsite potential contaminants sources are associated with landfills, former reservoirs, sewage works, and tanks associated with the offsite mill.*



2.2. 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 8th November 2022 and 23rd November 2022. The works are summarised in Table 2.1.

2.3. LIMITATIONS OF THE INVESTIGATION

- ✚ The presence of badger setts within the northern site, along with the dense woodland with mature trees restricted access during the intrusive investigation. Localised areas of invasive species, namely Himalayan Balsam was identified bordering the dense woodland in the north.
- ✚ Although the site pond situated within the central portion of the site has been partially drained prior to the intrusive investigation, surface water was still present covering a large proportion of the central and eastern site, resulting in the area being inaccessible for plant / machinery.
- ✚ The presence of these limitations resulted in the relocation of certain exploratory hole locations that were inaccessible during the site investigation. Exploratory holes were relocated as close to the areas as possible, within an accessible, safe area of the site.

2.4. SCOPE OF INVESTIGATION

TABLE 2.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE / RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
General Ground Conditions Including the Presence/Nature of Obstructions	WS101	Window Sample Probehole	5.45	2.00 – 5.00
	WS102		5.45	N/A
	WS103		5.45	2.00 – 5.00
	WS104		5.45	1.00 – 4.00
	WS105		5.45	2.00 – 5.00
	WS106		5.45	1.00 – 4.00
	WS107		2.41	N/A
	WS108		4.01	1.00 – 4.00
	WS109		4.21	1.00 – 3.00
	WS110		4.41	1.00 – 4.00
	WS111		2.41	1.00 – 2.00
	WS112		3.41	1.00 – 3.00
	TP101	Mechanically Excavated Trial Pit	2.80	N/A
	TP102		2.50	N/A
	TP103		2.70	N/A



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	TP104	Mechanically Excavated Trial Pit	2.60	N/A
	TP105		2.60	N/A
	TP106		2.30	N/A
	TP107		2.90	N/A
	TP108		2.90	N/A
	TP109		2.00	N/A
	TP110		2.85	N/A
	TP111		3.00	N/A
	TP112		2.30	N/A
	TP113		2.50	N/A
	TP114		2.80	N/A
	TP115		3.00	N/A
	TP116		2.40	N/A
	TP117		2.50	N/A
	TP118		1.90	N/A
	TP119		1.40	N/A
	TP120		2.20	N/A
	TP121		2.30	N/A
	TP122		2.30	N/A
	TP123		0.50	N/A
	TP124		1.00	N/A
	TP125 East		2.30	N/A
	TP125 West		2.30	N/A
	TP126		2.20	N/A
	TP127		2.20	N/A
	CP101	Cable Percussive Borehole	20.44	N/A
	CP102		20.44	5.00 – 9.00
	CP103		20.35	3.00 – 12.00
	CP104		20.37	N/A
	CP105		20.41	N/A



POTENTIAL SOURCE / RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (m bgl)	MONITORING WELLS RESPONSE ZONE (m bgl)
Evidence of Historic Coal Mining Activities	RB101	Rotary Borehole	56.00	N/A
	RB103		55.00	N/A
	RB104		56.00	N/A
	RB105		54.00	N/A
	RB106		54.00	N/A
	RB107		54.00	N/A
	RB108		55.00	N/A
	RB109		55.00	N/A

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

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

Cable percussive boreholes were advanced to undertake in-situ detailed geotechnical testing of the deeper soil horizons underlying the site.

The series of rotary boreholes were advanced to investigate the potential presence of shallow mine workings. These boreholes were drilled in accordance with the CA permissions process and industry best practice.

The sampling locations are illustrated in Drawing 15-075-005 (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.

2.5. 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 3.6 and discussed in Section 6.



2.6. LABORATORY ANALYSIS

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

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

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

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

- ✿ Atterberg Limits Determinations;
- ✿ Moisture Content;
- ✿ Particle Size Distribution;
- ✿ Single stage triaxial tests;
- ✿ Optimum Moisture Content / Maximum Dry Density using 2.5 kg Compaction Test; and
- ✿ One-Dimensional Consolidation Test.

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 6.



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 and Table 3.2.

TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)						
	MADE GROUND	TOPSOIL	SOFT CLAY	FIRM TO STIFF CLAY	SAND	GRAVEL	PEAT
WS101	0.00 – 3.10	-	3.10 – 5.00	5.00 – 5.45	-	-	-
WS102	0.00 – 1.80	-	-	1.80 – 2.90 4.30 – 5.00	5.00 – 5.45 (Medium Dense)	2.90 – 4.30 (Loose)	-
WS103	0.00 – 2.10	-	-	2.10 – 5.45	-	-	-
WS104	0.00 – 1.50	-	-	1.50 – 2.45	2.45 – 5.00 (Medium Dense) 5.00 – 5.45 (Loose)	-	-
WS105	0.00 – 1.10	-	1.10 – 3.00	3.00 – 5.45	-	-	-
WS106	-	0.00 – 0.40	-	0.40 – 1.90	2.30 – 2.80 (Medium Dense) 2.80 – 4.00 (Dense) 4.00 – 5.45 (Medium Dense)	1.90 – 2.30 (Medium Dense)	-
WS107	-	0.00 – 0.35	-	0.80 – 2.00	-	2.00 – 2.41 (Dense)	-
WS108	-	0.00 – 0.40	0.40 – 1.50	3.50 – 4.01	1.50 – 3.50 (Loose)	-	-
WS109	-	0.00 – 0.25	0.25 – 2.00	2.00 – 2.60 3.60 – 4.21	2.60 – 3.60 (Medium Dense)	-	-
WS110	-	0.00 – 0.10	0.10 – 1.10	-	2.00 – 4.00 (Medium Dense) 4.00 – 4.41 (Dense)	1.30 – 2.00 (Medium Dense)	1.10 – 1.30
WS111	-	0.00 – 0.30	-	-	0.30 – 0.80 0.80 – 2.00 (Medium Dense) 2.00 – 2.41 (Dense)	-	-
WS112	-	0.00 – 0.20	-	0.10 – 0.90	0.90 – 3.41 (Medium Dense)	-	-
TP101	>2.80	-	-	-	-	-	-
TP102	0.00 – 1.10	-	-	1.10 – 2.50	-	-	-
TP103	0.00 – 1.80	-	-	1.80 – 2.30	2.30 – 2.70	-	-



HOLE	DEPTH TO STRATUM (m bgl)						
	MADE GROUND	TOPSOIL	SOFT CLAY	FIRM TO STIFF CLAY	SAND	GRAVEL	PEAT
TP104	0.00 – 1.60	-	2.20 – 2.40	1.60 – 2.20	-	2.40 – 2.60	-
TP105	0.00 – 1.80	-	-	1.80 – 2.60	-	-	-
TP106	0.00 – 1.70	-	2.20 – 2.30	1.70 – 2.20	-	-	-
TP107	0.00 – 2.10	-	-	-	2.10 – 2.90	-	-
TP108	0.00 – 2.50	-	-	2.50 – 2.90	-	-	-
TP109	>2.00	-	-	-	-	-	-
TP110	>2.85	-	-	-	-	-	-
TP111	>3.00	-	-	-	-	-	-
TP112	-	0.00 – 0.35	-	-	0.35 – 2.30	-	-
TP113	-	0.00 – 0.40	-	-	0.40 – 2.50	-	-
TP114	-	0.00 – 0.30	0.30 – 2.80	-	-	-	-
TP115	-	0.00 – 0.30	0.30 – 2.65 2.80 – 3.00	-	-	-	2.65 – 2.80
TP116	-	0.00 – 0.25	0.25 – 0.80 1.40 – 1.90	-	1.90 – 2.00	2.00 – 2.40	0.80 – 1.40
TP117	-	0.00 – 0.30	0.30 – 2.10	-	2.10 – 2.50	-	-
TP118	-	0.00 – 0.25	0.25 – 0.70	-	0.70 – 1.90	-	-
TP119	-	0.00 – 0.20	0.20 – 1.40	-	-	-	-
TP120	-	0.00 – 0.30	-	-	0.30 – 2.20	-	-
TP121	-	0.00 – 0.20	-	1.60 – 2.30	0.20 – 1.60	-	-
TP122	-	0.00 – 0.30	-	0.30 – 1.50	-	1.50 – 2.30	-
TP123	>0.50	-	-	-	-	-	-
TP124	>1.00	-	-	-	-	-	-
TP125 East	-	0.00 – 0.30	1.40 – 2.30	0.30 – 1.40	-	-	-
TP125 West	0.00 – 1.20	-	1.90 – 2.30	1.20 – 1.90	-	-	-
TP126	-	0.00 – 0.30	-	-	0.30 – 2.20	-	-
TP127	0.00 – 0.90	-	-	0.90 – 2.20	-	-	-



TABLE 3.1 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (m bgl)					
	MADE GROUND	CLAY	SAND AND GRAVEL	SAND	GRAVEL	BEDROCK
CP101	0.00 – 4.50	7.60 – 20.44 (Firm to Stiff)	4.50 – 7.60 (Medium Dense)	-	-	-
CP102	0.00 – 4.70	8.80 – 20.42 (Firm to Stiff)	4.70 – 8.80 (Medium Dense)	-	-	-
CP103	0.00 – 2.80	-	17.80 – 20.35 (Medium Dense)	2.80 – 17.80 (Medium Dense)	-	-
CP104	0.00 – 1.20	3.00 – 12.20 (Soft SILT)	1.70 – 3.00 (Dense)	1.20 – 1.70 (Dense) 12.20 – 20.37 (Medium Dense)	-	-
CP105	0.00 – 3.90	6.10 – 10.40 (Firm to Stiff)	3.90 – 6.10 (Medium Dense) 10.40 – 20.41 (Medium Dense)	-	-	-
RB101	0.00 – 3.70	5.10 – 21.30	3.70 – 5.40	21.30 – 35.20 (Dense)	-	>35.20
RB103	0.00 – 1.20	20.30 – 28.60	1.20 – 8.70 28.60 – 35.10	8.70 – 19.30	19.30 – 20.30	>35.10
RB104	0.00 – 1.90	1.90 – 3.60 16.40 – 27.30	9.90 – 16.40	3.60 – 9.90 27.30 – 31.00	31.00 – 36.30	>36.30
RB105	0.00 – 1.00	13.30 – 17.00	4.80 – 13.30	1.00 – 4.80 24.00 – 30.60	17.00 – 24.00 30.60 – 33.10	>33.10
RB106	0.00 – 0.80	0.80 – 7.00 12.30 – 15.10 17.00 – 19.80	7.00 – 12.30 15.10 – 17.00 24.60 – 31.00	-	19.80 – 24.60 31.00 – 33.80	>33.80
RB107	0.00 – 0.60	0.60 – 10.50	10.50 – 19.60	26.00 – 31.00 (SAND AND CLAY)	19.60 – 26.00 31.00 – 34.30	>34.30
RB108	0.00 – 2.10	-	7.30 – 12.00 21.20 – 35.90	2.10 – 7.30 (SAND AND CLAY) 12.00 – 16.80 (SAND AND CLAY) 16.80 – 21.20	-	>35.90
RB109	0.00 – 1.40	1.40 – 12.30 (SILT) 12.30 – 26.20	26.20 – 34.70	-	-	>34.70

3.2. TOPSOIL

Topsoil was encountered within twenty exploratory hole locations between ground level and 0.40 m bgl.

Topsoil comprised dark brown to brown sandy CLAY with frequent rootlets within the north and west of the site, with slightly gravelly, sandy CLAY in the eastern sector. Gravel was noted to be subrounded to rounded of mudstone and sandstone.

Light orangish brown slightly gravelly very sandy CLAY with gravel of fine to coarse, subrounded mudstone and sandstone was identified within one location, TP126 in the northeast.



3.3. MADE GROUND

Made Ground was encountered within thirty exploratory hole locations from ground level to a proven depth of 4.70 m bgl (CP102).

Generally, Made Ground identified within the southern sector of the site comprised gravelly clay with angular mudstone, sandstone, and brick (reworked topsoil) with underlying brown and black very gravelly clay and clayey gravel with frequent cobbles and occasional boulders. Cobbles were encountered as brick, concrete, mudstone, and sandstone, with isolated areas containing asphalt, ceramic, plastic, and glass. Boulders were identified as concrete and mudstone.

Slag was encountered within two locations (TP101 and TP103). Peat was encountered as pockets of spongy black fibrous peat within the Made Ground deposits of TP103 and TP105. Made Ground comprising similar material was identified within the eastern site (TP123, TP124, and TP125 WEST).

TP125 was divided into two as Made Ground was encountered between ground level and 1.20 m bgl in the western half, and natural deposits were encountered within the eastern half. The depth of Made Ground was proven, 1.20 m bgl within TP125.

An isolated area of Made Ground was encountered in TP127 located within the northeast portion of the site in an area where historical ground workings have been identified. The Made Ground comprised sandy gravel of fine to coarse, angular glass, ash, and brick to a proven depth of 0.90 m bgl.

Made Ground deposits were identified within all cable percussive and rotary boreholes. Generally, Made Ground comprised gravelly clay, with gravel of fine to coarse, angular brick, ash, and concrete, and areas of reworked topsoil comprising gravelly, sandy clay with frequent rootlets.

Visual and olfactory contamination has been identified within the Made Ground deposits, with seven locations across the site identifying a hydrocarbon odour at depths of between 0.10m to 2.85 m bgl (TP101, TP103, TP107, TP109, TP110, TP111, and TP127).

The full depth of Made Ground was unproven within six exploratory hole locations (TP101, TP109, TP110, TP111, TP123, and TP124). Mechanically excavated trial pits were terminated on concrete boulders within TP101, TP109, and TP110 between 2.00 m bgl and 2.85 m bgl.

TP111 was terminated due to the excavator reaching its maximum depth at 3.00 m bgl. TP123, and TP124 were terminated due to the fast ingress of water flooding the trial pits between 0.50 m bgl and 1.00 m bgl.

A Depth of Made Ground Plan is presented as Drawing 15-075-003 in Appendix III.

3.4. DRIFT DEPOSITS

The natural drift geology was identified within forty-six of the fifty-two exploratory hole locations to a proven depth of 36.30m bgl. For the avoidance of doubt, the drift deposits were not encountered within the six locations where the depth of Made Ground was unproven.

Generally, the natural superficial cohesive deposits comprised firm to stiff gravelly, sandy CLAY was within the southern portion of site, underlying Made Ground deposits, with interbedded medium dense SAND and GRAVEL. Isolated areas soft CLAY (TP104, TP106, WS101, and WS105) and loose SAND and GRAVEL (WS102 and WS104) were noted within the southern site.

Exploratory holes within the northwest portion of the site identified predominantly granular deposits comprising reddish brown clayey, gravelly fine to coarse SAND with underlying SAND and GRAVEL to circa 13.30 m bgl, before encountering CLAY (RB105).



Generally, soft low strength very silty CLAY and sandy CLAY with areas of PEAT was identified within the northern section of the site. Rotary boreholes identified interbedded SAND, GRAVEL and CLAY deposits underlying sandy CLAY. Peat was identified as pockets of spongy brown fibrous PEAT within TP115 and WS108 between 0.50 m bgl and 1.70 m bgl. Layers of PEAT were identified within the northern section of the site in exploratory hole TP115 between 2.65 – 2.80 m bgl.

Spongy brown fibrous PEAT with a slight organic odour was identified within the eastern sector of the site, in close proximity to the pond. The maximum recorded thickness of the PEAT is 0.20 m, recorded at 1.10 m bgl (WS110). Surrounding exploratory holes within the eastern site identified underlying granular deposits of medium dense to dense SAND and GRAVEL, with isolated areas of very soft very low strength, to soft low strength silty, sandy CLAY (TP119). Silt was identified within CP104 between 3.00 – 12.20 m bgl, and RB109 between 1.40 – 12.30 m bgl, with underlying cohesive and interbedded granular deposits.

In areas surrounding the site pond, particularly within the northern and eastern section of the site, significant depths of SILT were identified with areas of PEAT and isolated areas of very soft CLAY. Water strikes were identified within shallow drift deposits.

Peat and compressible organic deposits are anticipated to extend across the area of the former / existing ponds where exploratory positions were limited due to standing water.

In the northeast site, natural drift deposits were identified as interbedded SAND, GRAVEL and CLAY. The CLAY was noted to be firm medium strength to stiff high strength gravelly, sandy CLAY with gravel of mudstone and sandstone. Granular deposits were identified as clayey, gravelly fine to coarse SAND with frequent cobbles of mudstone and sandstone. GRAVEL was noted to be clayey/sandy with frequent cobbles of mudstone and sandstone. An isolated area of very soft, very low strength silty CLAY was identified within TP125, potentially associated with surrounding Made Ground (TP125 WEST).

3.5. SOLID GEOLOGY

Bedrock was encountered within all rotary boreholes at depths of between 33.10m and 36.30m bgl to a proven termination depth of 56.00m bgl. The bedrock comprised MUDSTONE underlying natural drift deposits, with interbedded SANDSTONE from circa 37.00 m bgl to 46.20 m bgl.

Coal was not identified within any exploratory hole locations at depth.



3.6. GROUNDWATER

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

TABLE 3.2 SUMMARY GROUNDWATER STRIKES

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS101	3.00	Strike within very sandy CLAY
WS104	2.50	Strike within very sandy CLAY
WS108	2.00	Strike within granular deposits
TP101	0.40	Slow ingress through Made Ground
TP104	1.50	Slow ingress through Made Ground
TP104	2.00	Fast ingress through CLAY
TP105	2.30	Fast ingress above CLAY
TP107	2.00	Very slow ingress through Made Ground
TP108	1.30	Slow ingress through Made Ground
TP108	2.20	Slow ingress through Made Ground
TP112	2.20	Slow ingress through granular deposits
TP113	2.30	Slow ingress through granular deposits
TP114	1.70	Slow ingress through sandy silty CLAY
TP116	1.00	Slow ingress through PEAT
TP117	2.00	Slow ingress through sandy silty CLAY
TP118	1.00	Slow ingress through granular deposits – possible running sands
TP119	0.20	Fast ingress through sandy silty CLAY
TP121	1.00	Medium ingress above CLAY – running sands
TP122	1.90	Slow ingress through granular deposits
TP123	0.40	Fast ingress through Made Ground
TP124	0.30	Fast ingress through Made Ground
TP127	0.90	Slow ingress above CLAY
CP101	4.50	Strike within granular deposits
CP101	12.70	Strike within sandy CLAY
CP102	4.70	Strike within granular deposits
CP102	13.20	Strike within sandy CLAY
CP104	1.50	Strike within granular deposits
CP105	3.90	Strike within granular deposits

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

These results are summarised in Table 4.7.



3.7. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

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

TABLE 3.3 SUMMARY VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

LOCATION	DEPTH (m)	STRATUM	NOTES
TP101	2.40 – 2.80	MADE GROUND	Strong hydrocarbon odour
TP103	1.50 – 1.80	MADE GROUND	Slight hydrocarbon odour
TP107	0.70 – 1.60	MADE GROUND	Strong hydrocarbon odour
TP109	1.20 – 2.00	MADE GROUND	Slight hydrocarbon odour
TP110	1.70 – 2.85	MADE GROUND	Slight hydrocarbon odour
TP111	1.70 – 1.80	MADE GROUND	Slight hydrocarbon odour
TP127	0.10 – 0.90	MADE GROUND	Slight hydrocarbon odour

3.8. 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 3.4 and Table 3.5, which indicate the clay soils to vary between soft and stiff.

Strength test data is generally consistent with the field descriptions of the aforementioned soils.

TABLE 3.4 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPa)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP102	1.20	99.87	234.69
TP102	1.70	115.36	271.09
TP102	2.00	105.46	247.83
TP103	1.90	78.35	184.12
TP103	2.20	67.15	157.80
TP104	1.70	63.72	149.74
TP104	2.20	31.44	73.88
TP105	1.90	54.68	128.49
TP105	2.20	61.99	145.67
TP105	2.50	77.48	182.07
TP106	1.80	61.14	143.67
TP106	2.20	32.73	76.91
TP108	2.60	56.83	133.55



TABLE 3.4 SUMMARY OF HAND SHEAR VANE TESTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP111	2.00	81.79	192.20
TP111	2.60	61.56	144.66
TP114	0.50	22.41	52.66
TP114	1.00	23.26	54.66
TP114	1.50	28	65.80
TP114	2.00	23.26	54.66
TP115	1.00	15.33	36.02
TP115	2.00	16.33	38.37
TP115	2.80	10.66	25.05
TP116	0.50	23.26	54.66
TP117	0.50	28.42	66.78
TP117	1.00	25.42	59.73
TP117	1.50	24.99	58.72
TP119	0.30	18.96	44.55
TP119	0.60	26.28	61.75
TP121	1.70	129.12	303.43
TP121	2.00	118.79	279.15
TP122	0.40	38.33	90.07
TP122	0.60	42.2	99.17
TP122	1.00	41.33	97.12
TP125 East	1.00	92.55	217.49
TP125 East	2.00	16.38	38.49
TP125 West	1.00	92.55	217.49
TP125 West	2.00	16.38	38.49
TP127	1.00	82.22	193.21
TP127	1.30	86.96	204.35
TP127	1.70	42.62	100.15
TP127	2.00	40.04	94.09

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 3.6.



TABLE 3.5 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m ²)	CONSISTENCY
WS105	3.50	Brown slightly gravelly very sandy CLAY.	18	Very Soft
WS108	0.50	Brown peaty CLAY.	81	Very Soft

3.9. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation. In areas where shallow groundwater strikes were noted, particularly in areas in close proximity to the pond with localised areas of soft silty CLAY and PEAT, excavations became unstable and side walls were subject to collapse.

Excavations were also unstable in areas of granular Made Ground, in the southern and eastern sections of the site.

The presence of frequent cobbles and boulders of brick, concrete and mudstone within the Made Ground deposits meant that in the majority of exploratory holes, excavations were slow and in places. The underlying natural drift deposits were excavated with ease.



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

TABLE 3.6 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	4	Sandy CLAY	7	5.91	N/A	Low Strength	Firm	29.57	60.80
	5	Sandy CLAY.	11	9.13	N/A	Medium Strength	Stiff	45.63	93.81
WS102	2	Gravelly CLAY	9	8.22	N/A	Medium Strength	Stiff	41.11	84.52
	3	Sandy GRAVEL	10	8.70	Loose	N/A	N/A	N/A	86.97
	4	Sandy GRAVEL	11	9.29	Loose	N/A	N/A	N/A	92.93
	5	Gravelly SAND	20	16.59	Medium Dense	N/A	N/A	N/A	165.92
WS103	3	Sandy CLAY	15	13.04	N/A	Medium Strength	Stiff	65.22	134.10
	4	Gravelly CLAY	12	10.14	N/A	Medium Strength	Stiff	50.69	104.22
	5	Gravelly CLAY	22	18.25	N/A	High Strength	Very Stiff	91.26	187.63
WS104	2	Very sandy CLAY.	9	8.22	N/A	Medium Strength	Stiff	41.11	84.52
	3	Gravelly SAND	23	20.00	Medium Dense	N/A	N/A	N/A	200.02
	4	Gravelly SAND	18	15.21	Medium Dense	N/A	N/A	N/A	152.07
	5	Gravelly SAND	12	9.96	Loose	N/A	N/A	N/A	99.55
WS105	2	Sandy CLAY	4	3.65	N/A	Very Low Strength	Soft	18.27	37.56
	3	Sandy CLAY	9	7.83	N/A	Low Strength	Firm	39.13	80.46
	4	Sandy CLAY	11	9.29	N/A	Medium Strength	Stiff	46.47	95.54
	5	Sandy CLAY	31	25.72	N/A	High Strength	Very Stiff	128.59	264.38
WS106	1	Sandy CLAY	12	12.10	N/A	Medium Strength	Stiff	60.49	124.37
	2	Sandy GRAVEL	16	14.62	Medium Dense	N/A	N/A	N/A	146.17
	3	Gravelly SAND	39	33.92	Dense	N/A	N/A	N/A	339.16
	4	Gravelly SAND	14	11.83	Medium Dense	N/A	N/A	N/A	118.28



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS106	5	Gravelly SAND	13	10.79	Medium Dense	N/A	N/A	N/A	107.85
WS107	1	Sandy CLAY	19	19.15	N/A	High Strength	Very Stiff	95.77	196.91
	2	Sandy GRAVEL.	50	45.68	Dense	N/A	N/A	N/A	456.77
WS108	1	Silty CLAY	5	5.04	N/A	Low Strength	Firm	25.20	51.82
	2	Gravelly SAND	5	4.57	Loose	N/A	N/A	N/A	45.68
	3	Gravelly SAND	5	4.35	Loose	N/A	N/A	N/A	43.48
	3.6	Sandy CLAY	50	42.66	N/A	Very High Strength	Very Stiff	213.32	438.59
WS109	1	Sandy CLAY	4	4.03	N/A	Low Strength	Firm	20.16	41.46
	2	Sandy CLAY	23	21.01	N/A	High Strength	Very Stiff	105.06	216.00
	3	Gravelly SAND	26	22.61	Medium Dense	N/A	N/A	N/A	226.11
	3.8	Gravelly CLAY	50	42.44	N/A	Very High Strength	Very Stiff	212.21	436.31
WS110	1	Gravelly CLAY	4	4.03	N/A	Low Strength	Firm	20.16	41.46
	2	Gravelly SAND	11	10.05	Medium Dense	N/A	N/A	N/A	100.49
	3	Gravelly SAND	22	19.13	Medium Dense	N/A	N/A	N/A	191.32
	4	Gravelly SAND	50	42.24	Dense	N/A	N/A	N/A	422.43
WS111	1	Gravelly SAND	20	20.16	Medium Dense	N/A	N/A	N/A	201.63
	2	Gravelly SAND	50	45.68	Dense	N/A	N/A	N/A	456.77
WS112	1	Gravelly SAND	10	10.08	Medium Dense	N/A	N/A	N/A	100.81
	2	Gravelly SAND	17	15.53	Medium Dense	N/A	N/A	N/A	155.30
	3	Gravelly SAND	50	43.48	Dense	N/A	N/A	N/A	434.83



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
CP101	5	SAND / GRAVEL	18	14.93	Medium Dense	N/A	N/A	N/A	149.33
	6.5	SAND / GRAVEL	29	23.68	Medium Dense	N/A	N/A	N/A	236.75
CP101	8	Sandy CLAY.	21	17.00	N/A	High Strength	Very Stiff	84.99	174.75
	9.5	Sandy CLAY.	21	16.92	N/A	High Strength	Very Stiff	84.62	173.99
	11	Sandy CLAY.	21	16.24	N/A	High Strength	Very Stiff	81.20	166.95
	12.5	Sandy CLAY.	23	16.80	N/A	High Strength	Very Stiff	84.02	172.75
	14	Sandy CLAY.	24	16.63	N/A	High Strength	Very Stiff	83.13	170.91
	15.5	Sandy CLAY.	29	19.10	N/A	High Strength	Very Stiff	95.51	196.37
	17	Sandy CLAY.	31	19.46	N/A	High Strength	Very Stiff	97.31	200.06
	18.5	Sandy CLAY.	42	25.18	N/A	High Strength	Very Stiff	125.90	258.84
	20	Sandy CLAY.	50	28.67	N/A	High Strength	Very Stiff	143.36	294.75
CP102	5	SAND / GRAVEL	7	5.81	Loose	N/A	N/A	N/A	58.07
	6.5	SAND / GRAVEL	20	16.33	Medium Dense	N/A	N/A	N/A	163.28
	8	SAND / GRAVEL	24	19.43	Medium Dense	N/A	N/A	N/A	194.27
	9.5	Sandy CLAY.	18	14.51	N/A	Medium Strength	Stiff	72.53	149.13
	11	Sandy CLAY.	21	16.24	N/A	High Strength	Very Stiff	81.20	166.95
	12.5	Sandy CLAY.	24	17.53	N/A	High Strength	Very Stiff	87.67	180.26
	14	Sandy CLAY.	23	15.93	N/A	High Strength	Very Stiff	79.66	163.79
	15.5	Sandy CLAY.	30	19.76	N/A	High Strength	Very Stiff	98.80	203.14
	17	Sandy CLAY.	32	20.09	N/A	High Strength	Very Stiff	100.45	206.52
	18.5	Sandy CLAY.	49	29.38	N/A	High Strength	Very Stiff	146.88	301.99



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

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)*
	20	Sandy CLAY.	50	28.67	N/A	High Strength	Very Stiff	143.36	294.75
CP103	3	Gravelly SAND	10	8.70	Loose	N/A	N/A	N/A	86.97
	4	Gravelly SAND	12	10.14	Medium Dense	N/A	N/A	N/A	101.38
CP103	5	Gravelly SAND	14	11.61	Medium Dense	N/A	N/A	N/A	116.15
	6.5	Gravelly SAND	16	13.06	Medium Dense	N/A	N/A	N/A	130.62
	8	Gravelly SAND	18	14.57	Medium Dense	N/A	N/A	N/A	145.70
	9.5	Gravelly SAND	20	16.12	Medium Dense	N/A	N/A	N/A	161.19
	11	Gravelly SAND	22	17.01	Medium Dense	N/A	N/A	N/A	170.14
	12.5	Gravelly SAND	23	16.80	Medium Dense	N/A	N/A	N/A	168.04
	14	Gravelly SAND	26	18.01	Medium Dense	N/A	N/A	N/A	180.11
	15.5	Gravelly SAND	31	20.42	Medium Dense	N/A	N/A	N/A	204.19
	17	Gravelly SAND	35	21.97	Medium Dense	N/A	N/A	N/A	219.73
	18.5	SAND / GRAVEL	50	29.98	Medium Dense	N/A	N/A	N/A	299.76
	20	SAND / GRAVEL	50	28.67	Medium Dense	N/A	N/A	N/A	286.72
CP104	2	SAND / GRAVEL	31	28.32	Medium Dense	N/A	N/A	N/A	283.20
	3	Clayey SILT	4	3.48	N/A	Very Low Strength	Soft	17.39	35.76
	4	Clayey SILT	5	4.22	N/A	Low Strength	Firm	21.12	43.43
	5	Clayey SILT	8	6.64	N/A	Low Strength	Firm	33.18	68.23
	6.5	Clayey SILT	9	7.35	N/A	Low Strength	Firm	36.74	75.53
	8	Clayey SILT	12	9.71	N/A	Medium Strength	Stiff	48.57	99.86
	9.5	Clayey SILT	18	14.51	N/A	Medium Strength	Stiff	72.53	149.13



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

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)*
	11	Clayey SILT	19	14.69	N/A	Medium Strength	Stiff	73.47	151.05
	12.5	SAND	19	13.88	Medium Dense	N/A	N/A	N/A	138.82
	14	SAND	40	27.71	Medium Dense	N/A	N/A	N/A	277.09
	15.5	SAND	18	11.86	Medium Dense	N/A	N/A	N/A	118.56
CP104	17	SAND	19	11.93	Medium Dense	N/A	N/A	N/A	119.28
	18.5	SAND	23	13.79	Medium Dense	N/A	N/A	N/A	137.89
	20	SAND	40	22.94	Medium Dense	N/A	N/A	N/A	229.38
CP105	4	SAND / GRAVEL	15	12.67	Medium Dense	N/A	N/A	N/A	126.73
	5	SAND / GRAVEL	23	19.08	Medium Dense	N/A	N/A	N/A	190.81
	6.5	Sandy CLAY	19	15.51	N/A	High Strength	Very Stiff	77.56	159.46
	8	Sandy CLAY	20	16.19	N/A	High Strength	Very Stiff	80.95	166.43
	9.5	Sandy CLAY	22	17.73	N/A	High Strength	Very Stiff	88.65	182.27
	11	SAND / GRAVEL	26	20.11	Medium Dense	N/A	N/A	N/A	201.07
	12.5	SAND / GRAVEL	28	20.46	Medium Dense	N/A	N/A	N/A	204.57
	14	SAND / GRAVEL	29	20.09	Medium Dense	N/A	N/A	N/A	200.89
	15.5	SAND / GRAVEL	31	20.42	Medium Dense	N/A	N/A	N/A	204.19
	17	SAND / GRAVEL	36	22.60	Medium Dense	N/A	N/A	N/A	226.00
	18.5	SAND / GRAVEL	47	28.18	Medium Dense	N/A	N/A	N/A	281.77
	20	SAND / GRAVEL	50	28.67	Medium Dense	N/A	N/A	N/A	286.72



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

June 2023

NOTES

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

The interpretation of in situ mass undrained shear strength (c_u) 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.



3.10. CONSOLIDATION

Two undisturbed samples of Glacial Till were submitted for oedometer analysis. The results are provided in Table 3.7.

TABLE 3.7 OEDOMETER CONSOLIDATION RESULTS

	DEPTH (m)	SAMPLE TYPE	MOISTURE CONTENT (%)	OEDOMETER CONSOLIDATION		
				PRESSURE RANGE (kPa)	M _v (m ² /MN)	C _v (m ² /year)
WS103	3.50	U100	17	0 – 55	0.529	0.680
				55 – 110	0.276	0.860
				110 – 220	0.182	0.874
				220 – 440	0.100	0.850
				440 – 55	0.057	2.136
WS110	0.50	U100	38	0 – 15	3.094	0.439
				15 – 30	1.260	0.661
				30 – 60	0.827	0.678
				60 – 120	0.510	0.654
				120 – 15	0.077	2.311

When considered at over-burden pressure with an additional load of 120 – 440 kPa the coefficient of volume compressibility (M_v) ranged from 0.057 m²/MN up to 3.094 m²/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 (C_v). As shown in Table 3.8, the coefficient ranges from 0.439 m²/yr to 2.311 m²/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.

3.11. 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 3.8 and the full results can be found in Appendix VIII.

TABLE 3.8 SUMMARY OF PARTICLE SIZE DISTRIBUTION TEST RESULTS

LOCATION	DEPTH (m)	SOIL FRACTION (%)			
		COBBLES	GRAVEL	SAND	SILT/CLAY
TP104	2.50	0	39	42	19
TP107	2.40	0	28	49	23
TP112	1.00	16	47	33	4
TP116	2.10	0	23	28	49
TP118	1.50	0	41	55	4
TP120	0.50	14	41	42	3



3.12. SOIL DENSITY/MOISTURE CONTENT RELATIONSHIP

Dry density / moisture content relationship analysis has been conducted on soils via utilising proctor compaction tests using a 2.5kg rammer. The results of the tests has been summarised in Table 3.9. The full test results can be found in Appendix VIII.

TABLE 3.9 SUMMARY DRY DENSITY AND MOISTURE CONTENT

LOCATION	LABORATORY DESCRIPTION	TOP DEPTH (m)	METHOD OF COMPACTION	INITIAL MOISTURE CONTENT (%)	OPTIMUM MOISTURE CONTENT (%)	MATERIAL RETAINED ON 37.5 mm SIEVE (%)	MAX DRY DENSITY (mg/m ³)	MATERIAL RETAINED ON 20.0 mm TEST SIEVE (%)
TP114	Brown slightly gravelly CLAY with some organic material.	1.00	2.5kg	47	33	0	1.33	0
TP122	Brown slightly gravelly sandy CLAY.	0.60	2.5KG	29	23	2	1.58	1

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

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

3.13. SOIL PLASTICITY

The Atterberg limits determinations, summarised in Table 3.10, show the clay to be of predominantly low plasticity with discrete areas of moderate plasticity clay.

TABLE 3.10 SUMMARY OF PLASTICITY INDEX TEST RESULTS

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425 µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS102	2.00	34	20	40	20	84	16.8	Low
WS104	3.00	20	15	26	11	68	7.48	Low
WS105	2.00	27	18	36	18	97	17.46	Low
WS109	2.00	38	24	51	27	84	22.68	Medium

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.



3.14. pH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in Appendix VI (summarised in Table 3.12), shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

TABLE 3.12 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP101	2.50	0.15	9.9	DS-1 AC-1s
TP102	1.20	0.0043	7.2	DS-1 AC-1s
TP107	1.00	0.2	8.8	DS-1 AC-1s
TP107	2.40	0.011	8.1	DS-1 AC-1s
TP109	1.40	0.11	8	DS-1 AC-1s
TP112	0.20	0.0063	6.2	DS-1 AC-1s
TP113	1.50	0.029	7.5	DS-1 AC-1s
TP114	1.00	0.14	7	DS-1 AC-1s
TP115	0.40	0.033	6.3	DS-1 AC-1s
TP118	0.10	0.016	5.8	DS-1 AC-1s
TP119	0.80	0.055	6.3	DS-1 AC-1s
TP125 WEST	1.60	0.022	7.5	DS-1 AC-1s
TP127	0.40	0.04	6.5	DS-1 AC-1s
WS101	3.50	0.014	7.8	DS-1 AC-1s
WS109	0.20	0.0099	6	DS-1 AC-1s
WS112	1.50	0.0031	8	DS-1 AC-1s



4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

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

4.1. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

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	21	27	N/A	1	No Further Action
Cadmium	mg/kg	11	21	0.7	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	21	3.5	N/A	1	No Further Action
Lead	mg/kg	200	21	180	N/A	1	No Further Action
Mercury	mg/kg	1.2	21	0.7	N/A	4	No Further Action
Nickel	mg/kg	130	21	84	N/A	1	No Further Action
Selenium	mg/kg	250	21	<1.0	N/A	1	No Further Action
Copper	mg/kg	2400	21	250	N/A	1	No Further Action
Zinc	mg/kg	3700	21	170	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	21	<1.0	N/A	1	No Further Action
Phenols – Total	mg/kg	120	21	<1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	7	<0.001 <0.001	TP101 2.50m TP109 1.40m	3	Further Action
Naphthalene	mg/kg	2.3	21	18 8.3 5.4 3.9 2.9	TP101 2.50m TP127 0.40m TP102 1.00m TP107 1.00m TP119 0.80m	4	Further Action
Acenaphthylene	mg/kg	170	21	2.8	N/A	2	No Further Action
Acenaphthene	mg/kg	210	21	31	N/A	1	No Further Action
Fluorene	mg/kg	170	21	50	N/A	1	No Further Action
Phenanthrene	mg/kg	95	21	210	TP101 2.50m	2	Further Action
Anthracene	mg/kg	2400	21	77	N/A	2	No Further Action
Fluoranthene	mg/kg	280	21	160	N/A	2	No Further Action
Pyrene	mg/kg	620	21	120	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	21	60 26	TP101 2.50m TP127 0.40m	2	Further Action
Chrysene	mg/kg	15	21	51 25	TP101 2.50m TP127 0.40m	2	Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	21	38 27 3.5 3.4	TP101 2.50m TP127 0.40m TP124 0.90m TP107 1.00m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	21	25	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	21	38 21 4 2.9 2.6	TP101 2.50m TP127 0.40m TP124 0.90m TP107 1.00m TP102 1.00m	2	Further Action



DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PATH-WAY	ASSESSMENT
Indeno(123-cd)Pyrene	mg/kg	27	21	15	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	21	4.3 3 0.38 0.3 0.27	TP101 2.50m TP127 0.40m TP107 1.00m TP124 0.90m WS109 0.20m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	21	15	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	21	<1.0	N/A	4	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	21	<1.0	N/A	4	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	21	<1.0	N/A	4	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	21	18	N/A	4	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	21	200	TP101 2.50m	4	Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	21	590	TP101 2.50m	1	Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	21	390	N/A	1	No Further Action

Notes

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

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

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

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

- ✳ Asbestos
- ✳ Naphthalene
- ✳ Phenanthrene
- ✳ Benzo(a)Anthracene
- ✳ Chrysene
- ✳ Benzo(b)Fluoranthene
- ✳ Benzo(a)Pyrene
- ✳ Dibenzo(a,h)Anthracene
- ✳ TPH C12-C16 (aromatic)
- ✳ TPH C16-C21 (aromatic)

Asbestos in the form of amosite fibres has been identified in Made Ground deposits of TP101 at 2.50 m bgl (<0.001%) and chrysotile fibrous debris in the Made Ground deposits of TP109 at 1.40 m bgl (<0.001%).



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

Four samples were analysed for SVOCs and identified concentrations of the following compounds above the laboratory limit of detection (LOD):

- ✳ Aniline (3.6 mg/kg in TP101 at 2.50 m bgl, 0.2 mg/kg in TP107 at 1.00 m bgl, 0.2 mg/kg in TP109 at 1.40 m bgl, 0.2 mg/kg in TP127 at 0.40 m bgl)
- ✳ Phenol (3.6 mg/kg in TP101 at 2.50 m bgl, 0.3 mg/kg in TP107 at 1.00 m bgl)
- ✳ 1,3-Dichlorobenzene (0.9 mg/kg in TP101 at 2.50 m bgl)
- ✳ 4-Methylphenol (2.6 mg/kg in TP101 at 2.50 m bgl, 0.4 mg/kg in TP127 at 0.40 m bgl)
- ✳ 2,4-Dimethylphenol (1.5 mg/kg in TP101 at 2.50 m bgl, 0.4 mg/kg in TP127 at 0.40 m bgl)
- ✳ 2-Methylnaphthalene (45 mg/kg in TP101 at 2.50 m bgl, 2.6 mg/kg in TP107 at 1.00 m bgl, 0.2 mg/kg in TP109 at 1.40 m bgl, 4.9 mg/kg in TP127 at 0.40 m bgl)
- ✳ Dibenzofuran (77 mg/kg in TP101 at 2.50 m bgl, 3.7 mg/kg in TP107 at 1.00 m bgl, 5.3 mg/kg in TP127 at 0.40 m bgl)
- ✳ Carbazole (23 mg/kg at TP101 at 2.50 m bgl, 1.1 mg/kg at TP107 at 1.00 m bgl, 2.9 mg/kg at TP127 at 0.40 m bgl)
- ✳ Anthraquinone (16 mg/kg at TP101 in 2.50 m bgl, 0.9 mg/kg in TP107 at 1.00 m bgl, 2.7 mg/kg in TP127 at 0.40 m bgl)

No target criteria is available for the SVOCs listed above. Where minimal concentrations of SVOCs have been identified, there is considered to be no unacceptable risk to future site users. However, significantly elevated concentrations of 2-Methylnaphthalene (45 mg/kg), Dibenzofuran (77 mg/kg), Carbazole (23 mg/kg), and Anthraquinone (16 mg/kg) have been identified within one location, TP101 at 2.50 m bgl.

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

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

- ✳ The main exposure pathways based on the Tier I exceedances are:
 - Fibre/dust inhalation.
 - Soil ingestion.
 - Dermal contact and ingestion.

The majority of the exceedances for are associated with Made Ground deposits (0.40 - 2.50m bgl), however, TP119 identified elevated PAHs (Naphthalene), located within natural CLAY deposits at 0.80m bgl. Elevated PAHs (Dibenzo(a,h)Anthracene) was also identified within natural topsoil deposits of WS109 at 0.20 m bgl. Made Ground was not identified within TP119 or WS109.

Elevated PAHs were identified within Made Ground deposits of TP102 and TP107 at 1.00 m bgl. The underlying, natural CLAY deposits were analysed between 1.20 – 2.40 m bgl and no elevated concentrations for any contaminants of concern were identified.



HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

The majority of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion, soil ingestion and consumption of homegrown produce. These exceedances can be mitigated by the installed of a 600 mm chemically suitable cover system within all proposed garden areas.

The specific design and installation process for the appropriate cover systems will be clearly defined within the site Remediation and Enabling Works Strategy; however, industry best practice will require the following minimum depths of certified clean cover:

- ✿ Private gardens where homegrown vegetables can be cultivated – 600 mm;
- ✿ Landscaped areas within private dwellings – 300 mm;
- ✿ Public open space – 300 mm.

It is anticipated that clean cover systems will be required in the central and southern sectors where significant Made Ground is identified.

With regards to the elevated heavy end TPH Aromatic C12-16 and C16-35, these elevated concentrations have only been identified within one isolated area of the site, TP101, and can be mitigated through delineation and localised hotspot removal.

Asbestos fibres in the form of amosite fibres has been identified in Made Ground deposits at TP101 at 2.50 m bgl (<0.001%) and chrysotile fibrous debris in TP109 at 1.40 m bgl (<0.001%). No visual signs of ACM were encountered during the ground investigation; it is, therefore, likely that only trace fibres are present in localised areas of the site. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 4.1.



FIGURE 4.1 ASBESTOS RISK MITIGATION CONCEPTUAL SITE MODEL



Notes

ND None Detect

0.001% Soils may contain $\leq 0.001\%$ asbestos using composite testing to ensure there is no potential risk to human health. This value is present within areas where there may be a short term low level exposure of soils containing trace asbestos fibres by construction workers where an appropriate level of asbestos management is employed (dust suppression)

0.1% Soils at a depth of $>1.00\text{m}$ bgl may contain $<0.1\%$ asbestos using composite testing where they will not be likely to be disturbed in the future and will therefore be in an area of low sensitivity. Risk assessment completed in accordance with Asbestos JIWG risk assessment tools.

Undefined- this will be dependent upon soils encountered during earthworks, which may be placed at these depths to ensure no potential risk to human health.

Isolated areas of topsoil and the majority of subsoil has been analysed and is likely to be suitable for re-use, however further samples will be required to confirm this.

Due to the depths of Made Ground encountered, as well as the visual and olfactory evidence of hydrocarbons noted, it is recommended that further targeted sampling and assessment is required in areas where the full depth of Made Ground was not encountered TP101, TP109, TP110, TP111, TP123, and TP124).

A watching brief should be completed during remediation works to monitor the locations where visual or olfactory hydrocarbon impact has been identified during all phases of investigation completed to date.



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 Made Ground with olfactory evidence of hydrocarbon impact has been identified within the southern, eastern, and northeast areas of the site.	High
Landfill A historic landfill and registered landfill are recorded in the south of the site. Inert waste was deposited between March 1988 and December 1990. Significant depths of Made Ground have been identified within the southern site to a maximum recorded depth of 4.70 m bgl (CP102), however, within this area the depth of Made Ground was unproven within four exploratory hole locations (TP101, TP109, TP110, and TP111).	High
Infilled Features A sandpit and clay pit are recorded in the far north of the site from circa 1930, these features were subsequently backfilled with. Made Ground was encountered within this area of the site to a proven depth of 0.90 m bgl, comprising black sandy gravel of angular, fine to coarse glass, ash, and brick with a slight hydrocarbon odour. The Made Ground is underlain by cohesive deposits comprising sandy, silty CLAY. It is to be noted the northern section of the site was largely inaccessible due to the presence of badger setts and the dense woodland, therefore the full coverage of infilled features has not yet been investigated.	Moderate to High
Surface Water Features The central-southern and eastern sector has been subject to flooding attributed to the accumulation of surface water associated with blockages in failing surface water drainage. There is potential for off site contamination to enter the site via the site stream and associated flooding activities.	High
Offsite Sources There is the potential for localised small fuel leaks or spillages from the former tanks at the northwest boundary which are a potential source of VOCs, SVOCs, PAHs, hydrocarbon compounds, acids, and metalloids. The former mill at the northern boundary associated with bleaching and dyeing is a potential source of semi-volatile and volatile organic compounds including chlorinated solvents. Elevated SVOCs above the limit of detection have been identified within four exploratory hole locations across the site (TP101, TP107, TP109 and TP127). As Made Ground was not identified within the northern/northwest site, samples were not analysed for SVOC analysis. Historical works have been identified offsite including a sewage works circa 60 m southeast. Based on the local topography, the location of surface watercourses and the presence of drainage ditches within the site boundary, it is considered likely that shallow groundwater, if present, will flow in a southerly direction, following the topographical gradient towards the River Roch, therefore any potential contaminants from the offsite sewage works is unlikely to leach northwards towards the site.	Moderate



Pathway		
Vertical Migration The site is underlain by interbedded SAND, GRAVEL and CLAY deposits, with localised areas of SILT and PEAT. Made Ground has been identified on site. Vertical migration of contaminants is likely to occur as a result of the high permeability deposits. In areas where CLAY has been identified, this will offer some protection towards the underlying Secondary A bedrock aquifer		High
Lateral Migration Lateral migration of contaminants is considered possible due to the presence of granular Made Ground and interbedded SAND and GRAVEL deposits across the site, however this will be more likely to result in vertical migration. The low permeability cohesive deposits will inhibit vertical migration and encourage lateral flow.		Medium
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated Aquifer with Secondary A Aquifer in the central site.	Medium
Aquifer Classification in Bedrock	Secondary A Aquifer	Medium
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected	Low
Distance to the Closest Groundwater Abstraction Point	The closest groundwater abstraction point is located 818 m northeast for public water supply; however, this is listed as revoked.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	A pond is located within the central site, with a stream flowing in a southeast direction from the northern boundary to eastern boundary. A spring is located along the western site boundary. The River Roch (main river) is located 52 m south.	High
The ICSM developed within the context of the site setting has identified the most significant pollutant pathway to be the lateral migration of potentially mobile phase-soluble contaminants towards and into the pond located on site. However, the pond is due to be infilled, thus removing this as a future surface water receptor. The underlying Secondary A Aquifer is a potentially sensitive receptor, however in the absence of any potable groundwater abstraction boreholes within influencing distance of the site, the overall sensitivity of this receptor is greatly reduced.		

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

The results of this assessment are presented in Table 4.3.



TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	The soil data analysis has not identified any detectable concentrations of VOCs above 1mg/kg or TPH C5 to C6 that might otherwise be indicative of VOC impact.	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	SVOC analysis has recorded minor elevated concentrations of Aniline, Phenol, 1,3-Dichlorobenzene, 4-Methylphenol, 2,4-Dimethylphenol, 2-Methylnaphthalene, Dibenzofuran, Carbazole, and Anthraquinone within four samples submitted for SVOC analysis. Significantly elevated concentrations of 2-Methylnaphthalene (45 mg/kg), Dibenzofuran (77 mg/kg), Carbazole (23 mg/kg), and Anthraquinone (16 mg/kg) have been identified within TP101 at 2.50 m bgl.	Further Discussion
C5-C10 > 5 mg/kg	All concentrations are below the laboratory LOD.	None
C10-C12 > 10 mg/kg	Concentrations of C10-C12 have been recorded above 10 mg/kg within one isolated area of the site, TP101 at 2.50 m bgl with 18 mg/kg.	Further Discussion
C12-C16 > 50 mg/kg	Concentrations of C12-C16 have been recorded above 50 mg/kg within one isolated area of the site, TP101 at 2.50 m bgl with 200 mg/kg.	Further Discussion
Phenols > 2 mg/kg	All concentrations are below the laboratory LOD.	None
Naphthalene > 2 mg/kg	Concentrations of naphthalene above 2 mg/kg have been recorded in Made Ground deposits of: TP101 at 2.50 m bgl; TP127 at 0.40 m bgl; TP102 at 1.00 m bgl, and TP107 at 1.00 m bgl. Elevated naphthalene was identified within natural CLAY deposits of TP119 at 0.80 m bgl (2.9 mg/kg).	Further Discussion
Total PAH > 10 mg/kg	Total concentrations of low-solubility PAH compounds greater than 10 mg/kg have been detected throughout the site, with a maximum concentration recorded in TP101 at 910 mg/kg.	Further Discussion
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	All concentrations are 500 mg/kg.	None

The Tier I assessment has included a comparison of leachate analysis from samples of the Made Ground and groundwater samples to environmental quality standards (EQS) in the first instance and in the absence of these to drinking water standards (DWS).

These are presented in Table 4.4 and Table 4.5.



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

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Arsenic	µg/l	50	10	4	0.67	N/A	3	10	N/A	No Further Action
Cadmium	µg/l	0.08-0.25	5	4	0.09	N/A	3	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	–	4	<0.2	N/A	3	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	50	4	<5.0	N/A	3	5.4	TP127 0.40m	Further Action
Copper	µg/l	1	2000	4	14 5.9 5.3 2.6	WS105 WS101 WS103 CP102	3	55 16 13	TP127 0.40m TP110 1.40m WS104 0.50m	Further Action
Total Cyanide	µg/l	1	50	4	<1.0	N/A	3	<1.0	N/A	No Further Action
Lead	µg/l	1.2	10	4	<0.2	N/A	3	43 1.5	TP127 0.40m TP110 1.40m	Further Action
Mercury	µg/l	–	1.0	4	<0.05	N/A	3	<0.5	N/A	No Further Action
Nickel	µg/l	4	20	4	3.9	N/A	3	8.6	TP127 0.40m	Further Action
Selenium	µg/l	–	10	4	1.2	N/A	3	<4.0	N/A	No Further Action
Zinc	µg/l	10.9	–	4	21	CP102	3	42 33 15	WS104 0.50m TP127 0.40m TP110 1.40m	Further Action
pH	6–9			4	6.9	N/A	3	7.9	N/A	No Further Action
Polycyclic Aromatic Hydrocarbons										
Naphthalene	µg/l	2	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Benzo[k]fluoranthene	µg/l	0.00017*	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	4	<0.01	N/A	3	<0.01	N/A	No Further Action
Aromatic Hydrocarbon										
TPH C5-C7 (benzene)	µg/l	10	1	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C8-C10 (xylene)	µg/l	30	300	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C10-C12 (naphthalene)	µg/l	2	500	4	<10	N/A	3	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	90 ⁴	4	<10	N/A	3	<10	N/A	No Further Action
TPH C16-C35	µg/l	–	90 ⁴	4	<10	N/A	3	<10	N/A	No Further Action
Aliphatic Hydrocarbon										
TPH C5-C6	µg/l	–	1000 ⁵	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	–	300	4	<1.0	N/A	3	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	–	300	4	<10	N/A	3	<10	N/A	No Further Action
TPH C12-C16	µg/l	–	300	4	<10	N/A	3	<10	N/A	No Further Action
TPH C16-C21	µg/l	–	300**	4	<10	N/A	3	<10	N/A	No Further Action
TPH C21-C35	µg/l	–	300**	4	<10	N/A	3	<10	N/A	No Further Action



Notes

Solubility <0.01µg/l

AA – Annual Average

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

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

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



TABLE 4.5 COMPARISON OF SURFACE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF SAMPLES	MAXIMUM CONCENTRATION IN SURFACE WATER	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA			08/11/2022 - POND		
Arsenic	µg/l	50	10	2	1.54		No Further Assessment
Cadmium	µg/l	0.08-0.25	5	2	0.03		No Further Assessment
Chromium (VI)	µg/l	3.4	–	2	0.8		No Further Assessment
Chromium (III)	µg/l	4.7	50	2	<5.0		No Further Assessment
Copper	µg/l	1	2000	2	6.2 4.5	POND WEST POND EAST	Further Assessment
Total Cyanide	µg/l	1	50	2	<1.0		No Further Assessment
Lead	µg/l	1.2	10	2	0.5		No Further Assessment
Mercury	µg/l	–	1.0	2	<0.05		No Further Assessment
Nickel	µg/l	4	20	2	2.1		No Further Assessment
Selenium	µg/l	–	10	2	<0.6		No Further Assessment
Zinc	µg/l	10.9	–	2	20	POND WEST	Further Assessment
pH	6–9			2	7.3		No Further Assessment
Naphthalene	µg/l	2	10*	2	<0.01		No Further Assessment
Anthracene	µg/l	0.1	10*	2	<0.01		No Further Assessment
Benzo[b]fluoranthene	µg/l	0.00017*	10*	2	<0.01		No Further Assessment
Benzo[k]fluoranthene	µg/l	0.00017*	10*	2	<0.01		No Further Assessment
Benzo(a)pyrene	µg/l	0.00017*	10*	2	<0.01		No Further Assessment
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	2	<0.01		No Further Assessment
Fluoranthene	µg/l	0.0063	10*	2	<0.01		No Further Assessment



DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF SAMPLES	MAXIMUM CONCENTRATION IN SURFACE WATER	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA			08/11/2022 - POND		
Benzo(ghi)perylene	µg/l	1.7–4	10*	2	<0.01		No Further Assessment
TPH C5-C7 (benzene)	µg/l	10	1	2	<1.0		No Further Assessment
TPH C7-C8 (toluene)	µg/l	74	700	2	<1.0		No Further Assessment
TPH C8-C10 (xylene)	µg/l	30	300	2	<1.0		No Further Assessment
TPH C10-C12 (naphthalene)	µg/l	2	90	2	<10		No Further Assessment
TPH C12-C16	µg/l	–	90	2	<10		No Further Assessment
TPH C16-C35	µg/l	–	90	2	<10		No Further Assessment
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 and DWS values for the following inorganic compounds:

- ✿ Chromium (VI) – Leachate
- ✿ Copper – Groundwater, leachate and surface water (pond).
- ✿ Lead – Leachate
- ✿ Nickel – Leachate
- ✿ Zinc – Groundwater, leachate and surface water (pond).

Elevated heavy metals have been identified in leachate and groundwater samples. Leachate samples were taken within Made Ground deposits between 0.40 m bgl and 1.40 m bgl. It should be noted that leachate analysis can overstate the risk and is not wholly representative of the site characterisation.

Where exceedances have been identified in leachate samples for chromium (VI), lead, and nickel, these have not been identified in the groundwater samples.

4.2.2. M-BAT ASSESSMENT

Due to exceedances for copper, nickel and zinc, an m-BAT assessment has been completed to assess the bioavailability of the metals with respect to surface water receptor (on-site pond). The chemical values from the surface water analysis have been input into the assessment.

Where the Risk Characterisation Ratio (RCR) is greater than 1, this indicates the bioavailable concentration is above the EQS and the receptor is therefore at risk. In this instance, surface water chemical data for DOC was input into the m-BAT.

The m-BAT assessment has confirmed that copper, zinc and nickel are not considered bioavailable in due to the RCR values being below 1.

In light of the above assessment, E3P do not consider the site to pose an unacceptable level of risk to surface waters for copper, zinc and nickel.



4.2.3. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

The site has largely remained undeveloped land with isolated areas of ground workings and developments. Historical mapping suggests the southeast site was developed circa 1910 associated with the Lower Mill Cottage to the east. All structures were demolished pre 1960. Tanks were identified adjacent to the northwest boundary associated with the offsite, historical mill pre 1960. A sandpit and clay pit is recorded in the far north of the site from circa 1930, these features were subsequently backfilled. Between circa 1930 and 1960, allotment gardens were located in the east of the site. A historic landfill and registered landfill are recorded in the south of the site. Inert waste was deposited between March 1988 and December 1990. At present, the site remains vacant agricultural land with no structures.

During the intrusive investigation, Made Ground of varying depths was identified within thirty exploratory hole locations at depths between ground level and 4.70 m bgl (CP102). Made Ground with olfactory evidence of hydrocarbon impact has been identified within the southern, eastern, and northeast areas of the site.

Widespread heavy metal contamination has been identified within leachate, groundwater, and surface water analysis, with PAH and localised TPH contamination within soil analysis at the site.

The pond located within the site is to be infilled to permit future development and therefore has been excluded from this assessment.

The underlying natural drift deposits comprise interbedded SAND, GRAVEL, and CLAY with localised areas of SILT and PEAT to a proven depth of between 33.10 – 36.30 m bgl. The interbedded cohesive deposits will serve to inhibit vertical migration towards the underlying Unproductive and Secondary A Aquifer. However, impacted groundwater has the potential to migrate laterally towards the River Roch.

Furthermore, it should also be noted the site is currently uncapped, rainfall is therefore is not currently being intercepted and subsequently infiltrates freely into the underlying the Made Ground, potentially mobilising the identified contaminants.

The proposed development will largely encapsulate the site, thus limiting the potential for infiltration and therefore leaching potential of any contaminants towards River Roch.

As the m-BAT screening tools have confirmed, the surface water receptors are not at risk from heavy metal contaminants. Therefore, although heavy metals exceed EQS thresholds, the heavy metal concentrations are bioavailable and therefore do not pose a risk to aquatic ecosystems.

In light of the above, and considering the distance from the site to the River Roch (~52m south), the site it no considered to pose an unacceptable level of risk to controlled waters.

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 4.6.

TABLE 4.6 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 CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 4.7.

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 4.7 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	CLAY	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	977	Raising	0.1	0.1	2.00 - 5.00	4.50	2.25
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		4.50	2.40
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		4.50	2.45
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	995	Falling	0.1	0.1		4.50	2.21
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	968	Falling	0.1	0.1		4.50	2.52
		31/01/23	0.1	0.1	0.0001	0.1	0.5	0.0005	19.9	1001	Steady	0.1	0.1		4.50	2.13
		13/02/23	0.1	0.1	0.0001	0.1	0.5	0.0005	19.4	1014	Falling	0.1	0.1		4.50	2.29
		01/03/23	0.1	0.1	0.0001	0.1	0.2	0.0002	19.6	1015	Falling	0.1	0.1		4.50	2.24
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	983	Steady	0.1	0.1		4.50	2.08
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	978	Falling	0.1	0.1		4.50	2.19
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.0	1013	Steady	0.1	0.1		4.50	2.06
		28/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.9	989	Steady	0.1	0.1		4.50	2.14
WS103	CLAY	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	977	Raising	0.1	0.1	2.00 - 5.00	4.90	2.50
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		4.90	2.80
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		4.90	2.95
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	995	Falling	0.1	0.1		4.90	2.90
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	698	Falling	0.1	0.1		4.90	3.01
		31/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1001	Steady	0.1	0.1		4.90	2.99



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)
		13/02/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	1015	Falling	0.1	0.1	2.00 - 5.00	4.90	2.51
		01/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	1016	Falling	0.1	0.1		4.90	3.11
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	984	Steady	0.1	0.1		4.90	2.79
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	978	Falling	0.1	0.1		4.90	2.18
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1013	Steady	0.1	0.1		4.90	2.68
		28/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	990	Steady	0.1	0.1		4.90	3.51
WS104	CLAY/SAND	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	977	Raising	0.1	0.1	1.00 - 4.00	3.10	2.65
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		3.10	2.70
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.9	993	Steady	0.1	0.1		3.10	2.90
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	995	Falling	0.1	0.1		3.10	1.65
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	967	Falling	0.1	0.1		3.10	1.56
		31/01/23	0.1	0.1	0.0001	0.1	0.3	0.0003	17.7	1002	Steady	0.1	0.1		3.10	1.13
		13/02/23	0.1	0.1	0.0001	0.1	0.2	0.0002	19.3	1015	Falling	0.1	0.1		3.10	2.25
		01/03/23	0.1	0.1	0.0001	0.1	0.2	0.0002	19.4	1016	Falling	0.1	0.1		3.10	2.28
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	984	Steady	0.1	0.1		3.10	1.83
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	978	Falling	0.1	0.1		3.10	1.38
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1013	Steady	0.1	0.1		3.10	1.91
		28/04/23	0.1	0.1	0.0001	0.1	0.4	0.0004	19.0	990	Steady	0.1	0.1		3.10	2.08



New Street, Littleborough
Phase II Geoenvironmental Site Assessment
June 2023

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)
WS105	CLAY	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	976	Raising	0.1	0.1	2.00 - 5.00	3.25	2.10
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		3.25	2.30
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		3.25	2.50
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	995	Falling	0.1	0.1		3.25	2.15
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	967	Falling	0.1	0.1		3.25	2.45
		31/01/23	0.1	1.4	0.0014	0.1	0.4	0.0004	19.4	1002	Steady	0.1	0.1		3.25	2.81
		13/02/23	0.1	0.1	0.0001	0.1	0.2	0.0002	19.3	1015	Falling	0.1	0.1		3.25	2.97
		01/03/23	0.1	0.1	0.0001	0.1	0.2	0.0002	19.5	1016	Falling	0.1	0.1		3.25	2.49
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	984	Steady	0.1	0.1		3.25	2.31
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	978	Falling	0.1	0.1		3.25	2.19
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.0	1013	Steady	0.1	0.1		3.25	2.35
		28/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	989	Steady	0.1	0.1		3.25	2.82
WS106	CLAY/SAND/ GRAVEL	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	976	Raising	0.1	0.1	1.00 - 4.00	2.95	Dry
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		2.95	Dry
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		2.95	Dry
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	995	Falling	0.1	0.1		2.95	Dry
		17/01/23	Monitoring Well Destroyed													N/A



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)
WS108	CLAY / SAND	24/11/22	0.1	0.1	0.0001	0.2	0.1	0.0002	19.7	976	Raising	0.1	0.1	1.00 - 4.00	3.25	2.70
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		3.25	2.90
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		3.25	3.00
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	995	Falling	0.1	0.1		3.25	1.35
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	967	Falling	0.1	0.1		3.25	1.34
		31/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1003	Steady	0.1	0.1		3.25	1.35
		13/02/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	1015	Falling	0.1	0.1		3.25	1.27
		01/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	1016	Falling	0.1	0.1		3.25	1.35
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	984	Steady	0.1	0.1		3.25	1.33
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	977	Falling	0.1	0.1		3.25	1.30
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1013	Steady	0.1	0.1		3.25	1.32
		28/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	991	Steady	0.1	0.1		3.25	1.34
WS109	CLAY / SAND	24/11/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	976	Raising	0.1	0.1	1.00 - 3.00	1.80	1.40
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		1.80	1.45
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		1.80	1.60
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	995	Falling	0.1	0.1		1.80	0.45
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	967	Falling	0.1	0.1		1.67	0.59
		31/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1003	Steady	0.1	0.1		1.61	0.61



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)
		13/02/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	1015	Falling	0.1	0.1		1.60	0.83
		01/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	1016	Falling	0.1	0.1		1.54	0.76
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	985	Steady	0.1	0.1		1.52	0.58
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	978	Falling	0.1	0.1		1.50	0.61
		18/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	1013	Steady	0.1	0.1		1.42	0.62
		28/04/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.2	990	Steady	0.1	0.1		1.37	0.71
WS111	SAND	24/11/22	0.1	0.1	0.0006	0.2	0.1	0.0012	19.6	978	Raising	0.6	0.1	1.00 - 2.00	1.95	Dry
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.0	994	Steady	0.1	0.1		1.95	Dry
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.8	993	Steady	0.1	0.1		1.95	Dry
		05/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	995	Falling	0.1	0.1		1.95	Dry
		17/01/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.5	967	Falling	0.1	0.1		1.95	Dry
		31/01/23	0.1	0.1	0.0001	2.0	2.0	0.0020	17.7	1002	Steady	0.1	0.1		1.95	Dry
		13/02/23	0.1	0.1	0.0001	0.2	0.2	0.0002	19.2	1015	Falling	0.1	0.1		1.95	Dry
		01/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.6	1015	Falling	0.1	0.1		1.95	Dry
		14/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	984	Steady	0.1	0.1		1.95	Dry
		30/03/23	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	979	Falling	0.1	0.1		1.95	Dry
		18/04/23	0.1	0.1	0.0001	3.6	3.6	0.0036	15.0	1012	Steady	0.1	0.1		1.95	Dry
		28/04/23	0.1	0.1	0.0001	3.4	3.4	0.0034	15.6	990	Steady	0.1	0.1		1.95	Dry



WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
CP102	CLAY/SAND/ GRAVEL	24/11/22	0.1	0.1	0.0104	0.1	0.1	0.0104	19.7	976	Raising	10.4	0.1	5.00 - 9.00	8.45	2.40
		09/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.1	994	Steady	0.1	0.1		8.45	6.80
		22/12/22	0.1	0.1	0.0001	0.1	0.1	0.0001	19.7	993	Steady	0.1	0.1		8.45	6.10
		05/01/23	Monitoring Well Destroyed												N/A	N/A

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

Monitoring well WS110 and CP103 were flooded during the visits completed to date, furthermore well WS109 was flooded on the fourth visit and CP102 on the first visit and therefore this data is either not available or could be deemed unreliable.

Each time a flooded well was encountered, the well was bailed and left to re-equilibrate. Wells were re-monitored after a period of 20–30 minutes.

Within the remaining monitoring wells, groundwater was observed between 1.35 m bgl (WS108) and 6.80 m bgl (CP102). In the four visits completed to date, the groundwater levels have fluctuated by no more than +/- 1.65m (WS108) in the window sample boreholes and +/- 4.40m in CP102.

4.5.2. BAROMETRIC PRESSURE

All the visits to take have been undertaken at atmospheric pressures of <1000mbar, with the pressure trends noted to be rising, steady, steady and falling, respectively in the four completed visits.

4.5.3. GAS FLOW

During the first monitoring visit, CP102 recorded a peak flow rate of 10.4 l/hr before returning to 0.1 l/hr (limit of detection of the analyser) for the visits since. WS111 recorded a peak flow of 0.6 l/hr before returning to 0.1 l/hr in the later visits.

The remaining monitoring wells recorded gas flow to be 0.1 l/hr.

4.5.4. GAS CONCENTRATIONS

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

Carbon dioxide concentrations were recorded at concentrations ranging from 0.1% v/v to 0.2 % v/v (WS108 and WS111).



4.6. CONCLUSION

The determined Characteristic Situation for each standpipe is presented in Table 4.8 overleaf.

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 4.8 GAS RISK PROFILE AND LOCATION

WELL	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	2.25-2.45	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS103	2.50-2.90	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS104	1.65-2.90	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS105	2.10-2.50	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS106	Dry	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS108	1.35-3.00	0.1	0.1	0.0001	0.2	0.0002	CS1	Green
WS109	0.45-1.60	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
WS110	Monitoring Well Flooded							
WS111	Dry	0.6	0.1	0.0006	0.2	0.0012	CS1	Green
WS112	N/A	0.1	0.1	0.0001	0.1	0.0001	CS1	Green
CP102	2.40-6.80	10.4	0.1	0.0104	0.1	0.0104	CS1	Green
CP103	Monitoring Well Flooded							

Peat deposits have been encountered on site (WS110, TP115, TP116), located in the central/northern site. Small pockets of peat were identified within Made Ground deposits of TP103 and TP105, as well as pockets within the natural, silty, organic CLAY of WS108. Along with Made Ground deposits, the peat is recognised as a potential source of hazardous ground gas.

Coal fragments have been identified within isolated areas of the site, within natural, gravelly CLAY and gravelly SAND deposits as fine to coarse gravel (TP121, WS111, and WS112). No significant coal measures have been identified site underlying the site and therefore, is unlikely to be a significant source of ground gas on site.

The ground gas monitoring suggests that the site can be classified as CS1/Green and therefore for the northern portion of the site no ground gas protection measures are recommended.

However due to the potential for ground gas generation relating to the landfilled material, peat deposits and Made Ground E3P recommend that CS2 ground has protection measures are installed across units within the southern sector. although this classification is subject to the completion of the overall monitoring programme.

It is recommended that the protection measures (where applicable) are agreed upon with the local authority prior to their adoption on-site.

Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.



4.7. POTABLE WATER SUPPLY

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

TABLE 4.9 PIPELINE SELECTION PE THRESHOLD CONCENTRATIONS

Contaminant Group	PE-threshold (mg/kg)	Concentrations at <u>Current</u> pipeline depth (mg/kg)
Total VOC	0.5	<1.0
Total BTEX And MTBE	0.1	<1.0
Total SVOCs (Excluding PAH and those substances marked with an *)	2	3.7 (TP107 1.00m) 2.6 (TP107 1.00m)
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	16 (TP107 1.00m) 12 (TP102 1.00m)
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<1.0
Phenols (From SVOC Analysis)*	2	0.3
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	NA
Ethers*	0.5	NA
Nitrobenzene*	0.5	<0.3
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	Elevated SVOCs above the 2 mg/kg PE-threshold have been identified within TP101 at 2.50 m and TP127 at 0.40 m (Aniline, Phenol, 4-Methylphenol, 2-Methylnaphthalene, Dibenzofuran, Carbazole, and Anthraquinone). Elevated EC10-EC16 was identified within TP101 at 2.50 m and TP127 at 0.40m, with a maximum concentration recorded at 200 mg/kg (TP101). Elevated EC16-EC40 was identified within TP101 at 2.50 m with 590 mg/kg.	
Is free product present in soil and groundwater?	None.	



Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	Yes – heavy end hydrocarbon impact and low solubility PAH has been identified within Made Ground. Groundwater levels have generally been identified within pipeline depth.
Will soils impacted with above determinands likely be utilised elsewhere on site?	Unknown.
Will soils be imported to site as part of any future earth works	Site levels will likely need to be raised as part of a phase of enabling works. The importation of materials may affect the WIR Risk Assessment which should be updated after completion.

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

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



4.8. CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 4.10 has been prepared for the site.

TABLE 4.10 CONCEPTUAL MODEL

POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL1 PL2	Heavy Metals, non-volatile PAH (Made Ground)	Dermal contact. Dermal contact and ingestion.	Future site users. Off-site receptors.	Likely	Moderate	LOW
Discussion: Non-volatile PAH impact has been identified within Made Ground deposits between 0.40 – 2.50 m bgl. TP119 identified elevated PAHs (Naphthalene), located within natural CLAY deposits at 0.80 m bgl. Elevated Dibenzo(a,h)Anthracene was also identified within natural topsoil deposits of WS109 at 0.20 m bgl. Elevated TPH C12-C16 Aromatic and TPH C16-C21 Aromatic has been identified in one Made Ground location, TP101 at 2.50 m bgl. No elevated heavy metals were identified site within samples submitted for soil analysis. Recommendation: A cover system to garden and landscaped areas where impacted Made Ground remains in-situ will prevent exposure to future site users. Construction works completed with PPE and provision of welfare.						
PL3	ACM in Made Ground	Inhalation of dust.	Future site users. Buildings. Off-site land users.	Likely	Moderate	LOW
Assessment: Asbestos in the form of amosite fibres has been identified in Made Ground deposits of TP101 at 2.50 m bgl (<0.001%) and chrysotile fibrous debris in the Made Ground deposits of TP109 at 1.40 m bgl (<0.001%). Due to the nature of the site, further asbestos within the Made Ground cannot be discounted. Recommendation: The soils will require placement in accordance with the asbestos CSM or removal from site. Any visible ACM will require licensed removal from site. Construction works completed with PPE and provision of welfare.						



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL4	Volatile Contaminants such as hydrocarbons (Made Ground)	Inhalation of vapours. Migration through permeable strata and preferential pathways.	Future site users. Off-site receptors.	Likely	Moderate	LOW
Assessment: Visual and olfactory contamination has been identified, with seven locations across the site identifying a hydrocarbon odour within Made Ground deposits between 0.10 – 2.85 m bgl, therefore a source of volatile contamination on-site cannot be entirely discounted. Recommendation: Due to the depths of Made Ground encountered, as well as the visual and olfactory evidence of hydrocarbons noted, it is recommended that further targeted sampling and assessment is required in areas where the depth of Made Ground has been unproven to determine the degree and extent of the volatile impact. Where required, hotspot removal should be undertaken where these soils may be chemically validated to assess chemical suitability for retention on site in an area of no future sensitivity.						
PL4	Methane, carbon dioxide (peat, coal measures and potentially infilled features on and within 250 m of the site)	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: Peat deposits have been encountered on site (WS110, TP115, TP116) with small pockets identified within three locations (TP103, TP105, and WS108). Peat and Made Ground have been identified as potential sources of hazardous ground gas. Preliminary ground gas monitoring suggests that the site can be classified as CS1.. Recommendation: Preliminary gas monitoring indicates that the site can be classified as CS1, and therefore no gas protection measures are required. However, precautionary CS2 measures should be adopted within the units across the southern portion of the site.						



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 (Secondary A Aquifer). Surface Water (Honksford Brook).	Likely	Moderate	LOW

Assessment:

Elevated concentrations of heavy metals have been encountered within groundwater, surface water, and leachate samples submitted for chemical analysis when compared to the Environmental Quality Standards.

The interbedded cohesive deposits underlying the site will serve to inhibit vertical migration towards the underlying Unproductive and Secondary A Aquifer. However, impacted groundwater has the potential to migrate laterally towards the Rich Roch.

Furthermore, it should also be noted the site is currently uncapped, rainfall is therefore is not currently being intercepted and subsequently infiltrates freely into the underlying the Made Ground, potentially mobilising the identified contaminants.

The proposed development will largely encapsulate the site, thus limiting the potential for infiltration and therefore leaching potential of any contaminants towards River Roch.

As the m-BAT screening tools have confirmed, the surface water receptors are not at risk from heavy metal contaminants. Therefore, although heavy metals exceed EQS thresholds, the heavy metal concentrations are bioavailable and therefore do not pose a risk to aquatic ecosystems.

In light of the above, and considering the distance from the site to the River Roch (~52m south), the site it no considered to pose an unacceptable level of risk to controlled waters.

Recommendation:

No further assessment required.



POLLUTANT LINKAGE	CONTAMINANT (SOURCE)	PATHWAY	RECEPTOR	PROBABILITY	CURRENT RISK	RESIDUAL RISK AFTER MITIGATION
PL6	Sulphate (potential ash within Made Ground)	Sulphate attack on concrete.	Building structure.	Likely	Moderate/Low	LOW
Assessment: Chemical analyses for pH and soluble sulphate 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 <i>Special Digest 1</i> (2005).						
Recommendation: Concrete should be designed in accordance with the chemical testing results.						
PL7	Organic contaminants such as hydrocarbons (Made Ground)	Ingestion of tainted water supply.	Future site users. Water pipes.	Likely	Moderate	LOW
Assessment: Visual and olfactory evidence of hydrocarbon contamination, as well as elevated concentrations of TPH has been identified at the proposed pipeline depth (0.75 m – 1.35 m). Fluctuating groundwater may mobilise contaminants.						
Recommendation: Based on the assessment of current site conditions, it is likely that PE barrier pipe will be required. This will need to be confirmed with a UKWIR risk assessment post remediation.						
PL8	Phytotoxic contaminants (Made Ground)	Direct Contact (plant uptake).	Flora.	Likely	Moderate	LOW
Assessment: Contamination has been encountered within shallow Made Ground across the site which may be taken up by flora in soft landscaping.						
Recommendation: Installation of a clean cover system within any areas of soft landscaping to prevent plant uptake of contaminants.						

Main exposure pathways:

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



5. COAL MINING

5.1. COAL MINING GEOLOGY

A desk-based coal mining risk assessment has identified coal seams recorded to sub-crop across the site, with areas of recorded underground workings underlying the western side of the site (CA mining Report Ref: 5103006852001). Mine workings are recorded in the Upper Mountain and Lower Mountain seams between 7.00 – 22.00 m. The Coal Authority also indicate probable shallow mine workings across the majority of the Site. Mine shafts are recorded circa 120 – 140 m to the west/ northwest, indicating access to workings in the immediate vicinity.

The coal mining geology is summarised in Table 5.1.

TABLE 5.1 COAL MINING GEOLOGY

COAL SEAM	THICKNESS	OUTCROP	DEPTH
Upper Mountain	30 cm	Beneath site dipping south (8.1 degrees)	7.00 m
Lower Mountain	60 m	Beneath site dipping south (8.1 degrees)	22.00 m

Figure 5.1 below is a photograph of the 1:10,000 plan for the site which shows the presence of coal seams outcropping within the site boundary.

FIGURE 5.1 PHOTOGRAPH OF THE 1:10,000 PLAN FOR THE SITE



5.1.1. COAL AUTHORITY PLAN

The Coal Authority plan referenced: MR-LARGE-PLOT-51003006852001-1649344698727 shows six conjectured outcrops on Site. Two of the outcrops are recorded as proven at the northern boundary.

FIGURE 5.2 COAL AUTHORITY PLAN FOR THE SITE

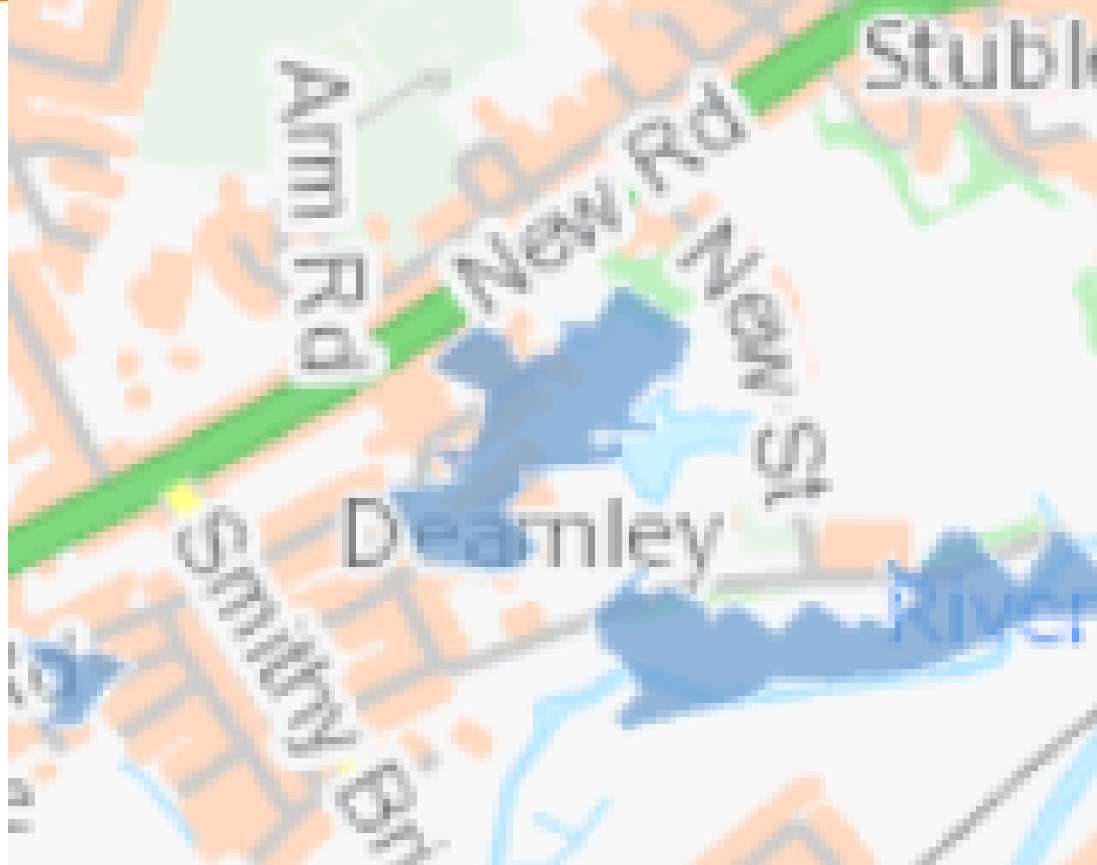


5.1.2. COAL AUTHORITY RECORDED SHALLOW WORKINGS

The Coal Authority GIS system records the presence of shallow workings in the central and north west sector as indicated in Figure 5.3 (overleaf).



FIGURE 5.3 COAL AUTHORITY RECORDED SHALLOW WORKINGS



5.2. SCOPE OF INTRUSIVE GROUND INVESTIGATION

In due consideration of the Upper Mountain and Lower Mountain seams recorded 7.00 – 22.00 m below the site, a series of eight rotary boreholes have been advanced in accordance with Coal Authority Permission to assess the potential presence of shallow workings within the seams and the potential for ground instability to induce a future subsidence event within the proposed development.

The works were completed under Coal Authority permit No. 25835.

5.3. SUMMARY OF GROUND INVESTIGATION WORKS

5.3.1. ROTARY BOREHOLES TO INVESTIGATE WORKINGS IN COAL

Eight rotary boreholes have been advanced at the locations detailed within the E3P exploratory borehole location plan at positions to intersect the potential coal seams and assess the potential for any workings.



TABLE 5.2 ROTARY BOREHOLES

ROTARY BOREHOLE	DEPTH TO ROCKHEAD (m bgl)	DEPTH TO COAL (m bgl)	EVIDENCE OF MINING ACTIVITY/SEAM	REMARKS
RB101	35.20	Not identified	-	No loss of flush or voids identified
RB103	35.10	Not identified	-	No loss of flush or voids identified
RB104	36.30	Not identified	-	No loss of flush or voids identified
RB105	33.10	Not identified	-	No loss of flush or voids identified
RB106	33.80	Not identified	-	No loss of flush or voids identified
RB107	34.30	Not identified	-	No loss of flush or voids identified
RB108	35.90	Not identified	-	No loss of flush or voids identified
RB109	34.70	Not identified	-	No loss of flush or voids identified

There was no evidence of coal identified within any of the boreholes to a proven depth of 56.00 m bgl, furthermore there was no evidence of loose ground, voids or loss of flush, which may be indicative of historic coal workings.

5.4. SUMMARY OF COAL MINING ISSUES

E3P has completed a coal mining risk assessment within the Phase I Geoenvironmental Site Assessment (Ref:15-075-R2-2, July 2022), reviewed BGS geological mapping and CA information, in addition to completing rotary boreholes to investigate mine workings beneath the site. A summary of the findings follow;

- ✳ Rotary boreholes and cable percussive boreholes have proven drift to depths in excess of 20 m bgl (rotary boreholes identifying drift to between 33.10 – 36.30 m bgl) and as such, the potential for shallow mine workings at depths which could potentially result in a subsidence event is considered to be very low.
- ✳ No evidence of coal seams or historic workings were identified. Coal was not identified within boreholes advanced into the bedrock, with no loss of flush, loose drilling or voids that would be indicative of coal mining activities.
- ✳ The rotary boreholes were advanced to depths of between 54.00 – 56.00 m bgl, recording circa 19.10 – 20.90 m of rock cover.
- ✳ The CA (CA Mining Report Ref: 5103006852001) suggested mine workings are recorded in the Upper Mountain and Lower Mountain seams 7.00 – 22.00 m below.
- ✳ The Coal Authority has definitive records in respect to the presence of workings within the Upper & Lower Mountain Coal sub-crops directly beneath the development site.
- ✳ Given the proven presence of workings in the shallow coal sub-crops, it is probable that the workings extend to a greater extent than that recorded within the Coal Authority records.
- ✳ The Coal Authority recorded the extraction thickness to range between 0.30m and 0.60m, this is considered to be a relatively thin seam of coal.



- ✿ No mine entries are recorded on or within influencing distance of the site, given the presence of recorded shallow workings, a shaft of drift adit would be expected to access the workings.
- ✿ E3P has requested copies of the original mine abandonment plans, a review of which will be used to define the area of proof drilling to fully define the extent and risk from recorded mine workings.

No evidence of shallow (<50 m bgl) coal extraction has been recorded, however, based on Coal Authority records, a sub-crop is conjectured to underlie the eastern portion of the site.

Upon review of the relevant mine abandonment plans for the site (Ref: 1882, 2654, 13662 and 16820), it appears the shallowest recorded seam is located at a depth of ~80m bgl. However, the site lies within a development high risk area (as defined by the Coal Authority) and therefore it cannot be discounted that unrecorded shallow seams are present beneath the site boundary.

Therefore, in accordance with industry best practice, as detailed within CIRIA 758, E3P has concluded that shallow mine workings may be present. The assessment has also concluded that there is likely insufficient rock cover over the seam to provide the required degree of stability in the event of successive collapses (cavitations), which could ultimately result in a “crown hole” subsidence event at the surface.

Due to this area having been mined, with known workings in the locality, the Coal Authority would likely take a highly risk-averse view in this instance, and due to the possibility of shallow unrecorded workings.

E3P recommend the mine workings be consolidated through drilling and pressure grouting to stabilise the site. A full and detailed specification for the consolidation of abandoned mine workings is required.

Due to the absence of any recorded seams within the upper 80m of the site, based on the Coal Authority abandonment plans for the site, it is critical to confirm the absence of unrecorded coal seams underlying each plot. Therefore, the sequence for the proof drill and grouting works will be to advance a borehole beneath each residential plot. If a coal seam is encountered which does not have sufficient rock cover (10x seam thickness), the location will be subject to Drill and grouting on a 6m grid, reduced to 4.5m and 3.0m centres accordingly, subject to Grout takes. If sufficient rock cover is present, grouting will not be required.



6. GEOTECHNICAL ASSESSMENT

6.1. PROPOSED DEVELOPMENT

Russell Homes intend to construct a low-rise residential development comprising 62 residential dwellings with associated access, gardens, public open space, attenuation basin, estate roads and infrastructure.

6.2. SITE PREPARATION

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

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

6.3. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

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

The results of this assessment are summarised in Table 6.1.



TABLE 6.1 SUMMARY OF ABP

GRANULAR SOILS			
Description	Depth (Range m bgl)	Relative Density	Allowable Bearing Pressure (kN/m ²)
SAND and GRAVEL (CP102, CP103)	3.00 – 5.00	Loose	58.07 – 86.97
SAND and GRAVEL (CP104)	2.00	Medium Dense	283.20
SAND and GRAVEL	4.00 – 8.00	Medium Dense	101.38 – 236.75
SAND and GRAVEL	9.50 – 17.00	Medium Dense	118.56 – 277.09
SAND and GRAVEL	18.50 – 20.00	Medium Dense	137.89 – 299.76
COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Pressure (kN/m ²)
Very Soft SILT (CP104)	3.00	17.39	35.76
Soft SILT (CP104)	4.00 – 6.50	21.12 – 36.74	35.76 – 68.23
Firm SILT (CP104)	8.00 – 11.00	48.57 – 73.47	99.86 – 151.06
Very Soft CLAY (TP115, TP119)	0.30 – 1.00	15.33 – 18.96	36.03 – 44.56
Very Soft CLAY (TP115, TP125 EAST/WEST)	2.00 – 2.80	10.66 – 16.38	25.06 – 38.49
Soft CLAY (TP114, TP116, TP117, TP119, TP122)	0.40 – 1.00	22.41 – 38.33	52.66 – 90.08
Soft CLAY (TP104, TP106, TP114, TP117)	1.50 – 2.20	23.26 – 32.73	54.66 – 76.92
Firm CLAY	0.60 – 2.60	40.04 – 67.15	94.09 – 157.80
Firm CLAY	9.50	72.53	149.13
Stiff CLAY	1.00 – 2.50	77.48 – 129.12	182.08 – 303.43
Stiff CLAY	6.50 – 11.00	77.56 – 88.65	159.46 – 182.27
Stiff CLAY	12.50 – 20.00	83.13 – 143.36	170.91 – 294.84
Very Stiff CLAY (CP102)	18.50	146.88	301.99

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

The Made Ground soils, particularly those in the landfilled portion of the site, are not considered suitable for foundations due to unquantifiable potential for long-term and differential settlement.

Furthermore, the areas of very soft to soft cohesive deposits are not deemed to be a suitable founding stratum for the proposed development due to exaggerated settlement and consolidation risk.



It is anticipated that the site will likely be subject to significant cut and fill works to create suitable development platform.

Therefore, the proposed foundations will be subject to the finished floor levels (FFLs), volumetrics / cut and fill levels and proposed loadings. At this time, in the absence of the above, the foundation types cannot be accurately provided. However, based on the current ground conditions, the likely foundations will comprise:

- ✿ Strip/trench foundations bearing into competent firm to stiff CLAY or medium dense SAND (likely to be in area of cut where shallow natural soils will be present);
- ✿ Deep Mass Trench to be completed in areas where competent stratum is identified at greater depth or in areas of tree influence;
- ✿ Raft foundations could be constructed within areas of reduced strength superficial drifts and engineered Made Ground. These structures will need to be designed with suitable settlement analysis.
- ✿ Ground improvement using bottom feed vibro stone column (VSC) to support a shallow reinforced concrete strip foundation where ground conditions are unsuitable for strip/trench (typically in areas of poor / variable ground conditions or deeper Made Ground); and
- ✿ Driven piled foundations (in areas of soft clays, tree influence, infilled pond or areas of peat).

Where a driven pile foundation is to be used, it will require specialist design to ensure that pressures on consolidated / stabilised mine workings are within the tolerable limits. This will in effect require a function bearing pile with limited depth.

There is the potential for peat and organic soils to be present in the location of the current pond extending across the central sector of the site.

The foundation solution for this development will be complex due to a number of factors, including compressible peat, reduced strength superficial drift and shallow mine workings. It is recommended that a detailed geotechnical appraisal is completed in due consideration of the ground model, development levels and structural loading.

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

To determine if VSC is viable at the subject site, E3P has completed a Ground Improvement Design Risk Matrix that is summarised in Table 6.2.



TABLE 6.2 GROUND IMPROVEMENT DESIGN RISK MATRIX

RISK ITEM	COMMENT	PASS/FAIL
Soft clays with an undrained shear strength less than 30 kN/m²	CLAY soils are generally firm to stiff with Cu > 30 kN. Areas of very soft to soft clay soils were encountered with a CU 10.66 – 38.33 kN/m ² ; however, it is considered that these will either be piled or soft material excavated to remove the organic deposits.	PASS
Ground with peat layers close to foundation level or the base of the stone column, or where intermediate layers of peat are thicker than 200 mm, either as a single layer or the sum of the thicknesses of individual layers throughout the length of the stone column	Peat and organic silts have been identified within the northern and eastern areas of the site. The maximum recorded thickness of the PEAT is 0.20 m, recorded at 1.10m bgl (WS110).	PASS
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground within the southern site (former landfill) will require removal and processing to render the site suitable for VSC.	PASS – on completion of enabling works
Loose or non-engineered fill not previously subject to rising or fluctuating water levels saturation	None identified.	PASS
Filled ground still settling or expected to settle under its own weight or due to the effects of surcharging/upfilling where there is a high organic content or where decay is continuing	Made Ground has been identified within the southern site associated with a historical landfill. Inert waste was deposited between March 1988 and December 1990. Is it unknown whether material has consolidated under self-weight settlement or is still settling.	PASS
Fill, containing degradable material where organic material forms more than 15% of fill by volume	Peat was encountered as pockets of spongy black fibrous peat within the Made Ground deposits of TP103 and TP105.	PASS
Clays with a plasticity index greater than 40%	None identified.	PASS
Highly sensitive soils liable to collapse or remoulding	None identified.	PASS
Cohesive soils with trees in influencing distance	Plots where tree influence has been modelled and will either be subject to a piled or mass trench-fill solution.	PASS
Overall Risk Rating and Suitability for Vibratory Ground Improvement		PASS

A summary of anticipated foundations based on the current site level is presented in Table 6.3.



TABLE 6.3 ANTICIPATED FOUNDATIONS

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH (m bgl)	GROUND WATER (m bgl)	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	>5.00	3.00	CLAY	N	Engineered	DS-1 AC-1s
WS102	4.75	N/A	Stiff CLAY	N	Engineered	DS-1 AC-1s
WS103	2.55	N/A	Firm CLAY	N	Trench Fill/ Engineered	DS-1 AC-1s
WS104	1.95	2.50	Firm CLAY	N	Trench Fill	DS-1 AC-1s
WS105	3.85	N/A	Firm CLAY	N	Engineered	DS-1 AC-1s
WS106	0.85	N/A	Firm CLAY	N	Shallow Strip	DS-1 AC-1s
WS107	1.25	N/A	Stiff CLAY	N	Shallow Strip	DS-1 AC-1s
WS108	3.95	N/A	Very stiff CLAY	Y	Engineered	DS-1 AC-1s
WS109	2.95	N/A	SAND	Y	Trench Fill/ Engineered	DS-1 AC-1s
WS110	1.65	N/A	GRAVEL	N	Trench Fill	DS-1 AC-1s
WS111	1.15	N/A	SAND	N	Shallow Strip	DS-1 AC-1s
WS112	1.25	N/A	SAND	N	Shallow Strip	DS-1 AC-1s
TP101	>2.80	0.40	TBC	N	Engineered	DS-1 AC-1s
TP102	1.55	N/A	Stiff CLAY	N	Engineered	DS-1 AC-1s
TP103	>2.70	N/A	SAND	N	Engineered	DS-1 AC-1s
TP104	>2.60	1.50 2.00	GRAVEL	N	Engineered	DS-1 AC-1s
TP105	2.25	2.30	Firm CLAY	N	Engineered	DS-1 AC-1s
TP106	>2.30	N/A	TBC	N	Engineered	DS-1 AC-1s
TP107	>2.10	2.00	SAND	N	Engineered	DS-1 AC-1s
TP108	2.95	1.30 2.20	CLAY	N	Engineered	DS-1 AC-1s
TP109	>2.00	N/A	TBC	N	Engineered	DS-1 AC-1s
TP110	>2.85	N/A	TBC	N	Engineered	DS-1 AC-1s



TP111	>3.00	N/A	TBC	N	Engineered	DS-1 AC-1s
TP112	0.70	2.20	SAND	N	Engineered	DS-1 AC-1s
TP113	0.75	2.30	SAND	N	Engineered	DS-1 AC-1s
TP114	>2.80	1.70	TBC	Y	Engineered	DS-1 AC-1s
TP115	>3.00	N/A	TBC	N	Engineered	DS-1 AC-1s
TP116	2.35	1.00	GRAVEL	Y	Engineered	DS-1 AC-1s
TP117	2.45	2.00	SAND	N	Engineered	DS-1 AC-1s
TP118	1.05	1.00	SAND	N	Engineered	DS-1 AC-1s
TP119	>1.40	0.20	TBC	N	Engineered	DS-1 AC-1s
TP120	0.65	N/A	SAND	N	Engineered	DS-1 AC-1s
TP121	0.55	1.00	SAND	N	Engineered	DS-1 AC-1s
TP122	0.75	1.90	Firm CLAY	N	Engineered	DS-1 AC-1s
TP123	>0.50	0.40	TBC	N	Engineered	DS-1 AC-1s
TP124	>1.00	0.30	TBC	N	Engineered	DS-1 AC-1s
TP125 East	>2.30	N/A	CLAY	N	Engineered	DS-1 AC-1s
TP125 West	>2.30	N/A	CLAY	N	Engineered	DS-1 AC-1s
TP126	0.65	N/A	SAND	N	Shallow Strip	DS-1 AC-1s
TP127	1.35	N/A	Stiff CLAY	N	Trench Fill	DS-1 AC-1s

* TBC = To be confirmed; VSC = Vibro Stone Column; MD = Medium Dense; N/A = Not applicable

It is recommended that, at working drawing stage, a foundation schedule is prepared for the development (considering the information in Table 6.2) taking account of the physical change of natural clay soils and the current/proposed locations of trees, once the cut and fill has been completed.

6.4. INFRASTRUCTURE CONSIDERATIONS

The presence of compressible peat soils in the northern and central sector represents a significant geotechnical constraint in terms of the proposed site infrastructure. The peat soils exhibit significant, and unquantifiable potential for instant and long-term differing settlement with the potential for consolidation of the material by up to 30–50% of the material volume.



A number of geotechnical engineering solutions exist to mitigate the potential adverse effect associated with un differential and total settlement within peat soils to the underside of the highway, private drives, utilise and service infrastructure. The final development solution will require a specific geotechnical design to consider the static and dynamic loading implied by the development and the maximum tolerable settlement.

Suggested options to mitigate the risk associated with the peat are set out below:

-  Excavation of the near surface compressible peat soils beneath roads, pavement and private driveways, the resulting excavation can be backfilled with site derived aggregate material to be placed according to a geotechnical compaction specification;
-  Installation of 'band drains' prior to inducement of constant surcharge pressure to achieve required settlement prior to construction of engineered platform utilising geo-grid and aggregates;

Use of structural support system such as extensive piling to support all roads, service corridors and infrastructure combined with geo-grid and aggregate platform to support highway, pavement and driveway.

6.5. GROUND FLOOR SLABS

The site is underlain by variable ground conditions, with Made Ground in the south, and soft CLAYS and SILTS with isolated PEAT in the north/east. Given the structures that are proposed, and the presence of underlying soft clays and peat deposits it is considered that ground-bearing floor slabs will require settlement analysis and detailed design to accommodate variability of the formation and account for differential settlement.

The location and thickness of peat deposits will require detailed settlement analysis utilising the structural design parameters to determine if a ground bearing floor slab is viable in the sectors underlain by peat. Raft foundations may provide a suitable engineering solution, or alternatively the peat deposits may need to be removed in their entirety as part of the wider cut and fill earthworks.

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, within the southern site, the underlying stratum would have in excess of 600 mm of infill and, as such, a suspended floor slab will be required.

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

6.6. 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 6.4.

TABLE 6.4 SUMMARY OF HEAVE PRECAUTIONS

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

6.7. 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.

6.8. DRAINAGE

The presence of Made Ground across some areas of the site along with isolated areas of peat and organic silt 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. Additionally, Made Ground can be removed prior to future development.



The site is underlain by mixed geology mainly comprising interbedded SAND, GRAVEL, and CLAY. In areas of low permeability CLAY, the use of soakaway drainage will be limited, and as the lateral continuity of the Made Ground cannot be assured, it is not recommended that soakaways are utilised for the disposal of surface water runoff.

In addition, the current site pond associated with the accumulation of surface waters from overland flow / flooding and failing to drain suggests the site has limited soakaway potential.

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

6.9. 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).

6.10. 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 shallow groundwater strikes were present, particularly in areas in close proximity to the pond with localised areas of soft silty CLAY and PEAT, excavations became unstable and side walls were subject to collapse.

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

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

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

TABLE 6.4 CIVIL ENGINEERING EXCAVATION RISK MATRIX

RISK ITEM	PRESENT	COMMENT
Running Sands	No	Running sands were identified within TP121 and TP118 at 1.00 m bgl.
Minor Water Ingress	No	Minor water ingress will require localised dewatering/sump pumping during the construction of site drainage infrastructure.
Shallow Bedrock	No	Shallow bedrock has not been encountered.



6.11. SLOPE STABILITY

The site is largely undulating with a significant slope present in the northwest site sloping southwards, and along the southeast boundary sloping north/northwest.

As and when detailed topographic information is available and in due consideration of the proposed development design, structural and infrastructure loading, a detailed slope stability model will be required.

This model will seek to determine the potential for newly imposed loadings to generate a risk of instability or failure within the off-site embankment and the need for any mitigation measures such as piled foundations to transfer loadings below the base of the slope.

6.12. CONSTRUCTION ACTIVITY AND INSPECTION

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

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



6.13. GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of Contaminated Soils	Site	15	Hydrocarbon, asbestos, and PAH impact has been identified at the site. A Remediation Strategy will be required to specify suitable mitigation measures.
Bedrock	Site	N/A	Shallow bedrock has not been identified.
Obstructions	Site	10	Obstructions were identified within Made Ground deposits, particularly within the southern site associated with a historical landfill. Obstructions were identified as cobbles and boulders of brick, concrete, and mudstone.
Artificially Levelled and Filled Platforms	Site	30	The site appears to have been levelled and artificially backfilled within the southern section of the site associated with the historical landfill.
Retaining Walls	N/A	N/A	None identified.
Trench Collapse	Site	40	Made Ground present beneath the site is likely to be loosely compacted and possibly prone to collapse.
Mature Trees	Site	15	Arboriculture survey required to determine areas of potential tree influence. A dense woodland is present within the northern site, with sporadic semi-mature and mature trees in the located within the site boundary.
Volume Change Potential Clay	Site	60	The site is underlain by cohesive and granular soils. An assessment of the clays has identified the soils to have a low volume change potential and therefore, heave precautions are not required at the site.
Peat	Site	5	Peat has been identified, this is a highly compressible stratum that represents a risk in terms of consolidation inducing failure to structures and infrastructure.
Running Sands	Site	<5	Running sands were in the eastern sector at 1.00 m bgl in two locations (TP121 and TP118).
Ground Dissolution	N/A	N/A	Data searches indicate no hazard.
Concrete Design	Site	100	DS-1, AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).
Low-Permeability Ground	Site	100	The underlying cohesive soils (clay and silts) interbedded within the granular deposits are likely to be of low permeability.



POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Services/Sensitive Structures	Site	10	A review of online services has identified a number of services within the site boundary including overhead BT cables in the east of the site and combined public sewers in the west/south. Manholes were noted in the west and south of the site during the intrusive investigation. Piling may not be possible within close proximity to any sensitive infrastructure.
Abnormal Foundation Solutions	Site	60	Dependent on development levels, in areas of deep Made Ground, tree influence, soft clays, loose sand/gravel, organic silts, and peat deposits, an abnormal foundation solution (MTF, Pile) may be required.
Areas Not Investigated	Site		The presence of a dense woodland with mature trees, badger setts, and invasive species (Himalayan Balsam) in the northern site restricted access. The pond limited investigation in the central portion of the site, though exploratory locations were positioned as near as possible.
Surface Water Features	Site	25	A pond is located in the centre of the site.
Infilled Pond	Site	25	The ponds is due to be infilled, thus removing this as a future surface water receptor.
Slope	Site	15	A significant slope is identified, detailed assessment and modelling is required to assess the long-term stability in both the temporary and permanent state associated with current, temporary, and permanent loading.

6.14. 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 (Pond (central) and Woodland (north);
- ✦ Plot-Specific Foundation Schedule (Upon Receipt of The Final Development Levels);
- ✦ Arboricultural Survey;
- ✦ Slope Stability Assessment;
- ✦ Construction Phase Surface Water Management Plan;
- ✦ Geotechnical Earthworks Strategy (Infrastructure); and
- ✦ Remediation and Enabling Works Strategy.



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



New Street, Littleborough

Phase II Geoenvironmental Site Assessment

January 2023

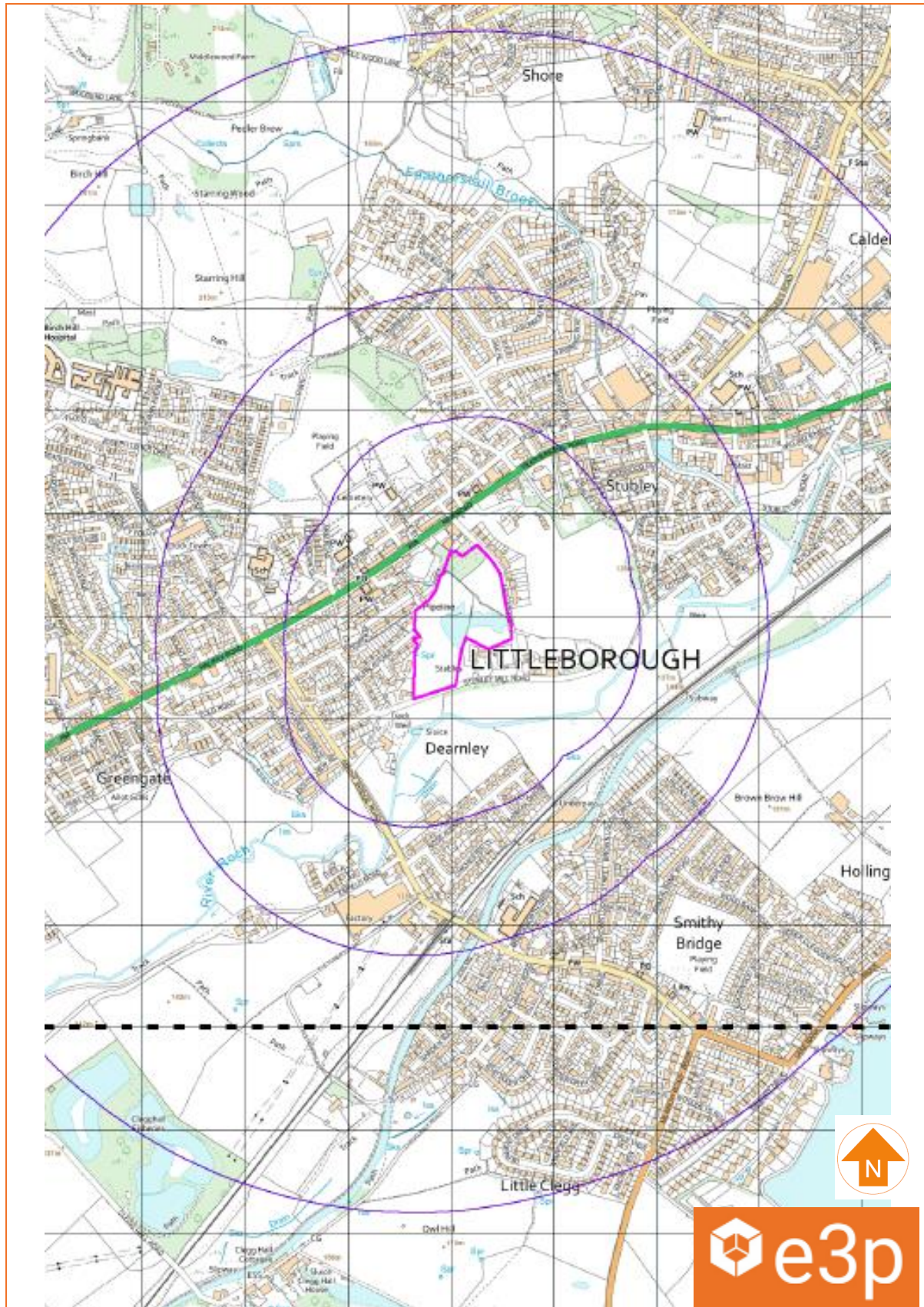
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection

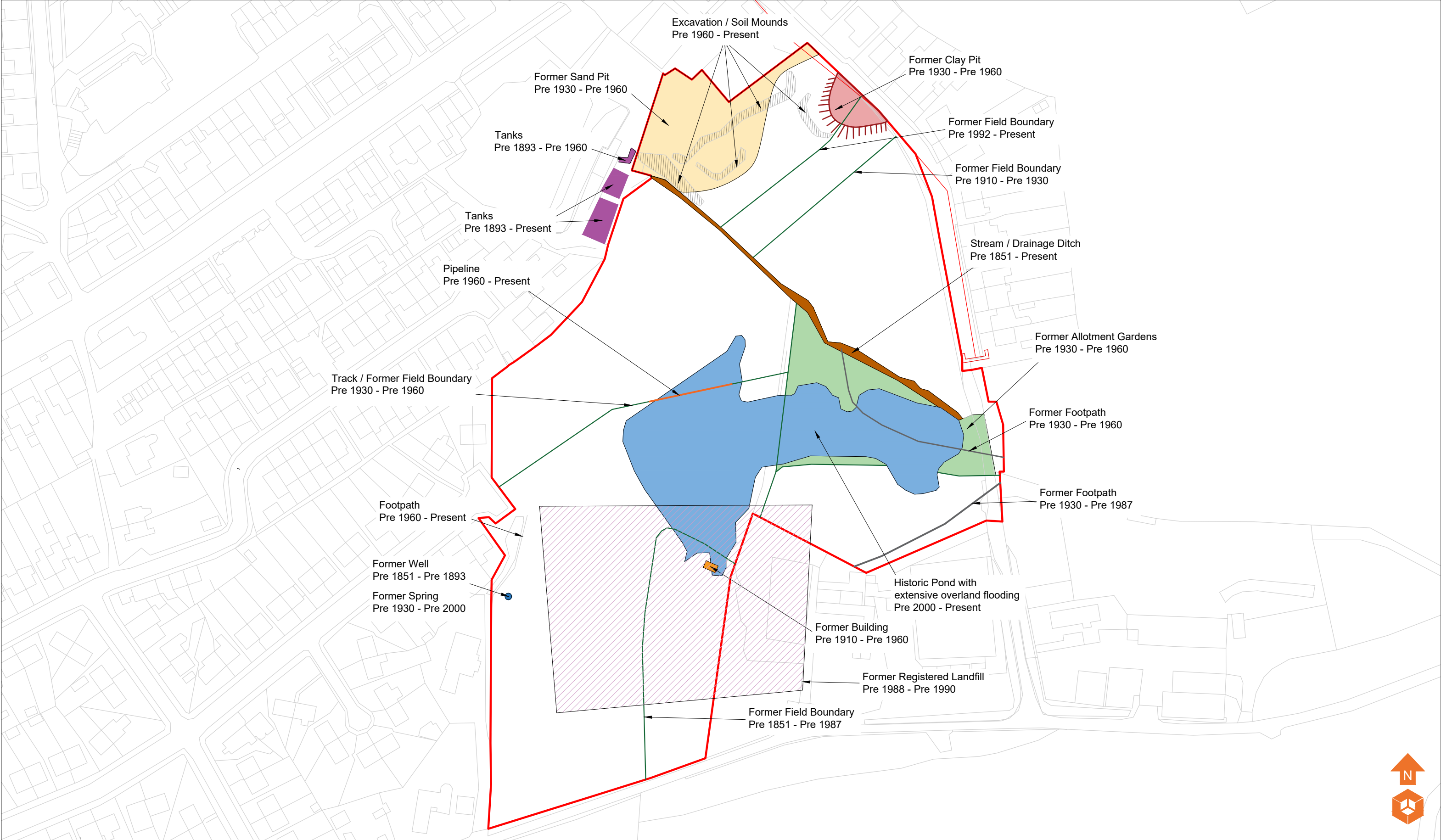


APPENDIX III

DRAWINGS

DRAWING 15-075-001 – SITE LOCATION PLAN





- Site Features
- | | | | |
|--|-------------------------|--|----------------------------|
| | Historic Pond | | Pipeline |
| | Allotment Gardens | | Footpath |
| | Spring | | Excavation / Soil Mounds |
| | Former Building | | Former Registered Landfill |
| | Stream / Drainage Ditch | | |
| | Sand Pit | | |
| | Tanks | | |
| | Clay Pit | | |
| | Field Boundaries | | |

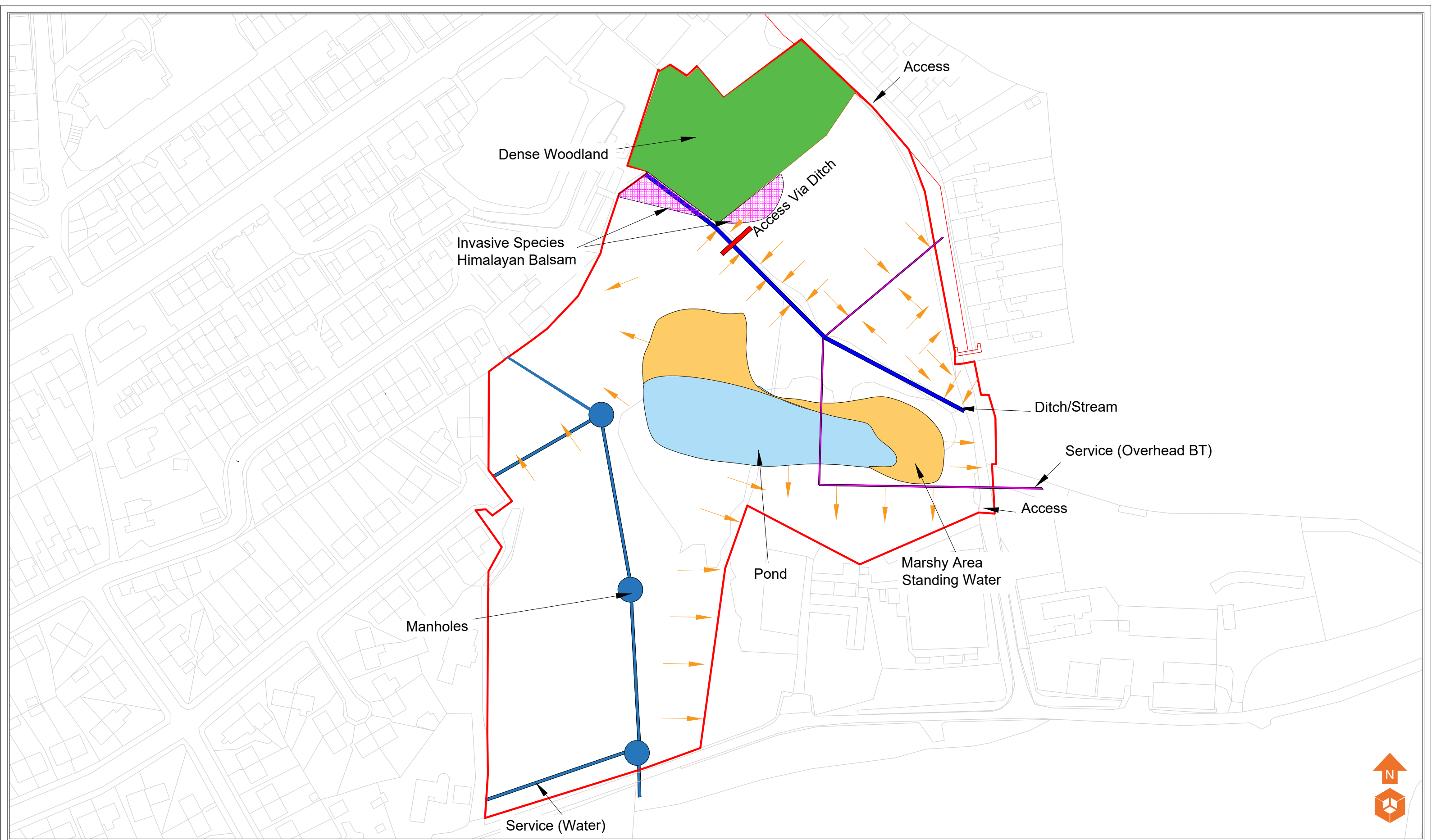
Notes:				
P1	REVD	12.12.2022	OW	AR
P1	REVC	27.04.2022	EB	NS
P1	REVB	13.04.2022	LM	NS
P1	REVA	12.04.2022	LM	NS
Phase	Issue	Date	Drawn	Checked

Client:
Russell Homes
Job Title:
Land to the West of New Street

Job No:
15-075
Drawing No:
003
Date:
12.12.2022
Scale:
NTS
Drawing Title:
Historical Features Plan

Environmental Engineering
Partnership Ltd
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Urmston, Manchester, M41 7JQ
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Site Features

- Service (Water) & Manholes
- Pond
- Marshy Area
- Dense Woodland
- Ditch/Stream
- Arrows to Show Change in Topography
- Invasive Species Himalayan Balsam

Notes:

P1	REVB	12.12.2022	OW	AR
P1	REVA	15.11.2022	OW	AR
Phase	Issue	Date	Drawn	Checked

Client:

Russell Homes

Job Title:

Land to the West of New Street

Job No:

15-075

Drawing No:

004

Date:

12.12.2022

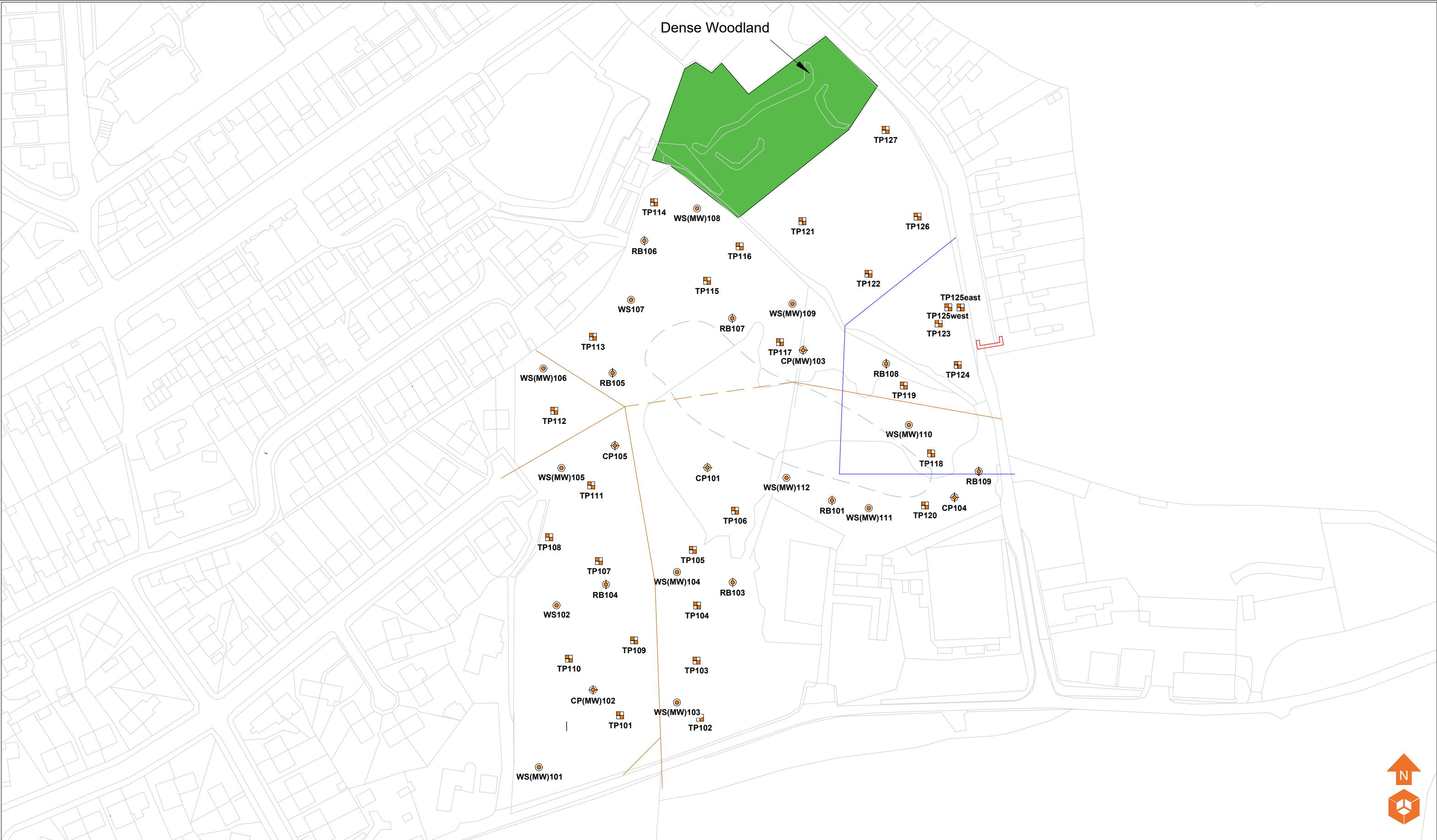
Scale:

NTS

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Location Symbols					
	Approximate Window Sample Probehole Location				
	Approximate Trial Pit Location				
	Approximate Cable Percussive Borehole Location				
	Approximate Rotary Borehole Location				
	BT/Telecoms				
	Drains				

Notes:					
P1	REVE	03.03.2023	LM	AS	
P1	REVD	12.12.2022	OW	AR	
P1	REVC	16.11.2022	OW	AR	
P1	REVB	03.11.2022	OW	EF	
P1	REVA	29.09.2022	EB	MD	
Phase	Issue	Date	Drawn	Checked	

Client:	
Russell Homes	
Job Title:	
Land to the West of New Street	

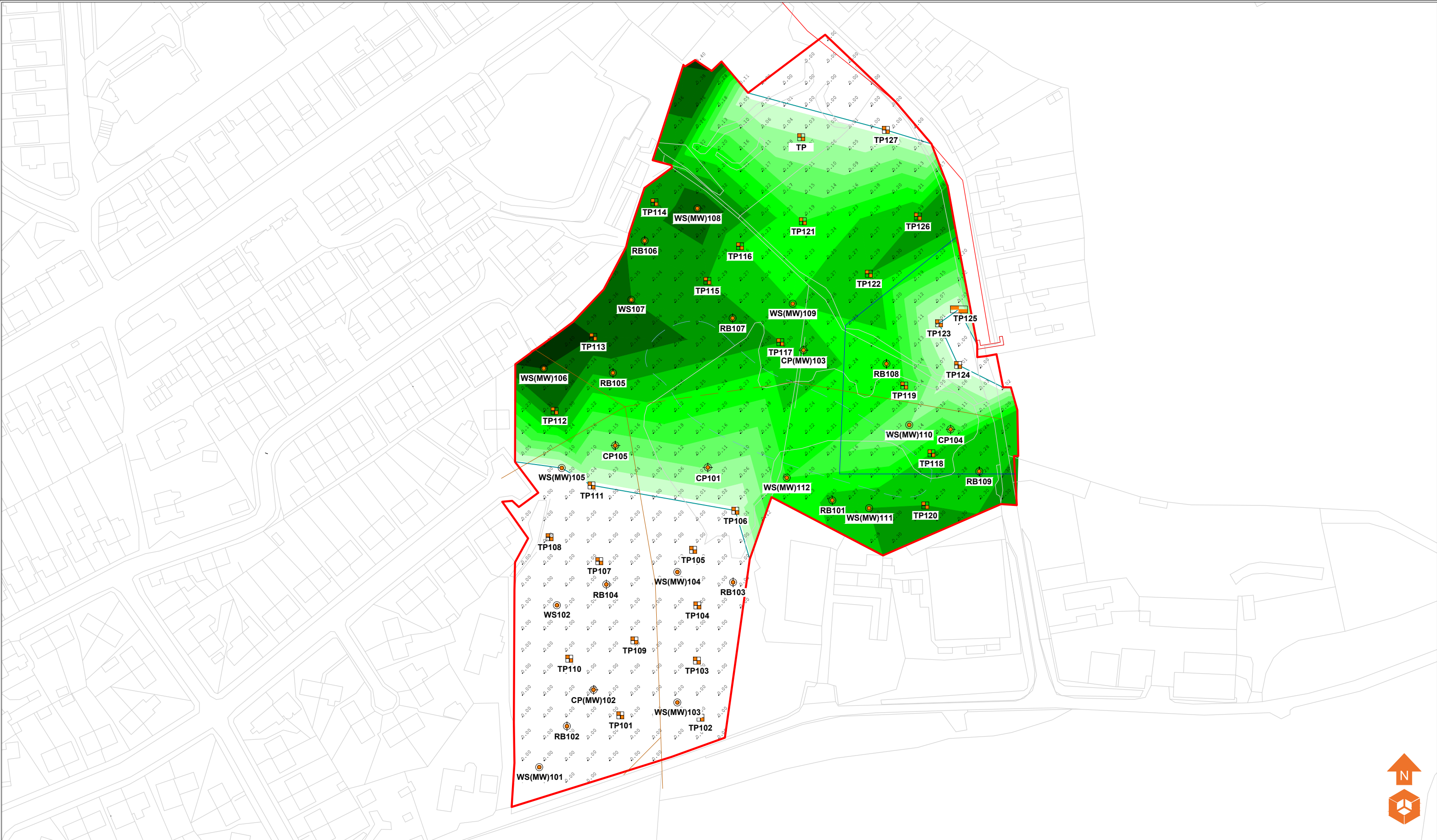
Job No:
15-075
Drawing No:
005

Date:
03.03.2023
Scale:
NTS@ A3

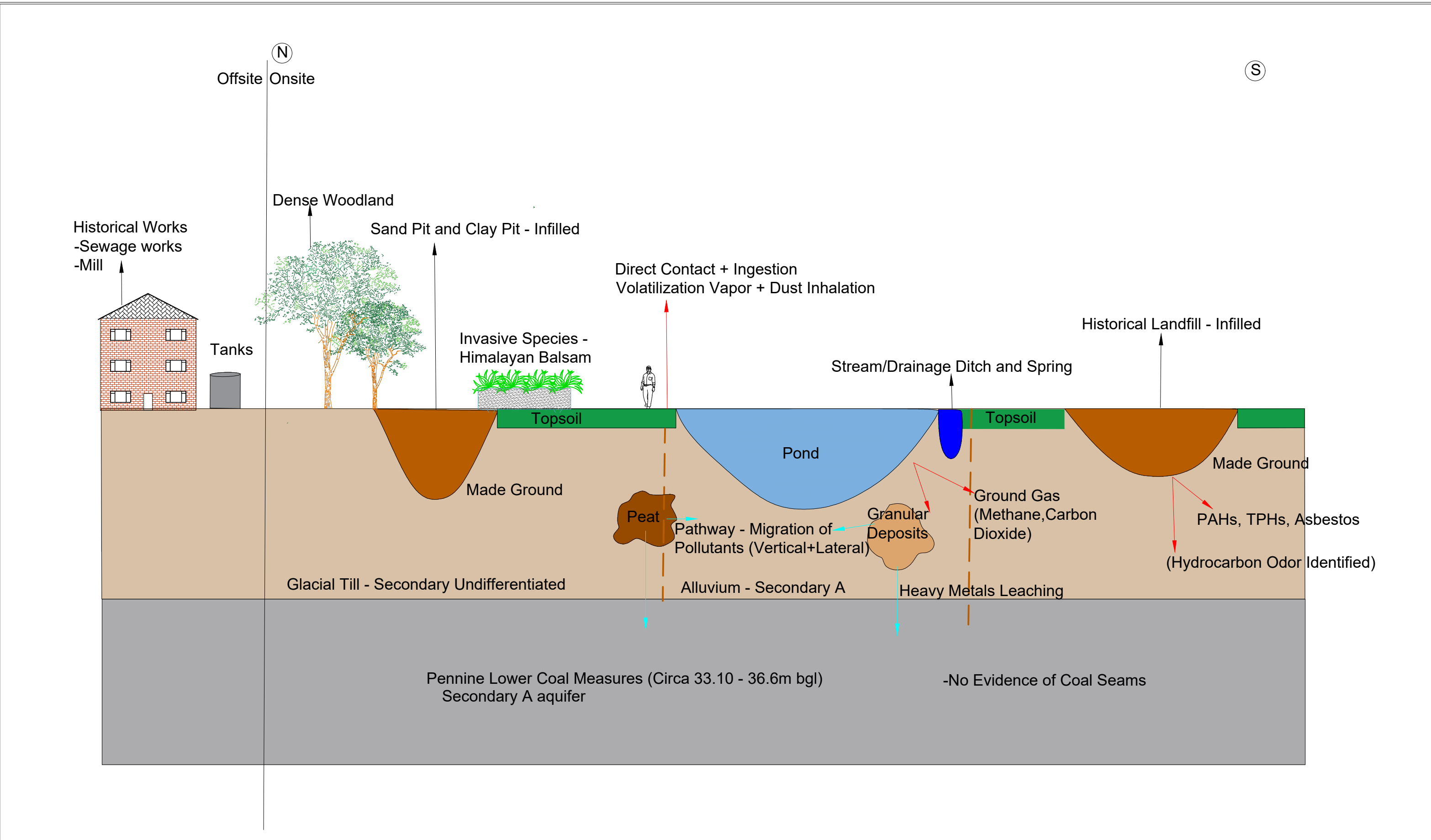


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Website: www.e3p.co.uk

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Location Symbols		Topsoil Depth (m)					Notes:					Client:		Job No:		Date:		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	
	Approximate Window Sample Probehole Location		Approximate Trial Pit Location		Approximate Cable Percussive Borehole Location		Approximate Rotary Borehole Location						Russell Homes		Drawing No:		Scale:		
	BT/Telecoms		Drains												007		NTS@ A3		
								Job 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.		
P1					REVA		21.11.2022		EB		AR		Land to the West of New Street						
Phase					Issue		Date		Drawn		Checked								



Geology Key

- Made Ground
- Secondary Aquifer
- Peat
- Granular Deposits
- Pond
- Stream
- Topsoil
- Tank

Notes:

P1	REVA	12.12.2022	OW	AR
Phase	Issue	Date	Drawn	Checked

Client:

Russell Homes

Job Title:

Land to the West of
New Street

Job No:

15-075

Drawing No:

010

Date:

12.12.2022

Scale:

1:1000 @ A3

Drawing Title:

Conceptual Site
Model



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Depth and Thickness of Peat			
Location	Depth to Top of Peat (mBGL)	Depth to Base of Peat (mBGL)	Thickness of Peat (m)
TP115	2.65	2.80	0.15
TP116	0.80	1.40	0.60
WS110	1.10	1.30	0.20

Dense Woodland



- Location Symbols**
- Approximate Window Sample Probehole Location
 - Approximate Window Sample Probehole Location with Install
 - Approximate Trial Pit Location
 - Approximate Hand Dug Pit Location
 - Approximate Soakaway Test Location
 - Approximate Cable Percussive Borehole Location
 - Approximate Rotary Borehole Location
 - Approximate California Bearing Ratio Test Location
 - Approximate Dynamic Cone Penetrometer Test Location

- Peat Thickness (m)**
- Thickness of Peat 0.00 - 0.19m
 - Thickness of Peat 0.20 - 0.39m
 - Thickness of Peat 0.40 - 0.59m
 - Thickness of Peat >0.60m
 - Recorded Depth to Top of Peat (mBGL)

Notes:

Client:

Job No:

Date:

Russell Homes

15-075

21.11.2022

Drawing No:

Scale:

014

NTS



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P1	REVA	21.11.2022	HM	AR
Phase	Issue	Date	Drawn	Checked

Land to the West of New Street

Depth and Thickness of Peat Plan

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Location Symbols		Development Constraints	
	Approximate Window Sample Probehole Location		Made Ground
	Approximate Trial Pit Location		Peat
	Approximate Cable Percussive Borehole Location		Soft Clay
	Approximate Rotary Borehole Location		Loose Gravel/Sand
	BT/Telecoms		Soft Silt
	Drains		

Notes:				
P1	REVA	12.12.2022	OW	AR
Phase	Issue	Date	Drawn	Checked

Client:	
Russell Homes	
Job Title:	
Land to the West of New Street	

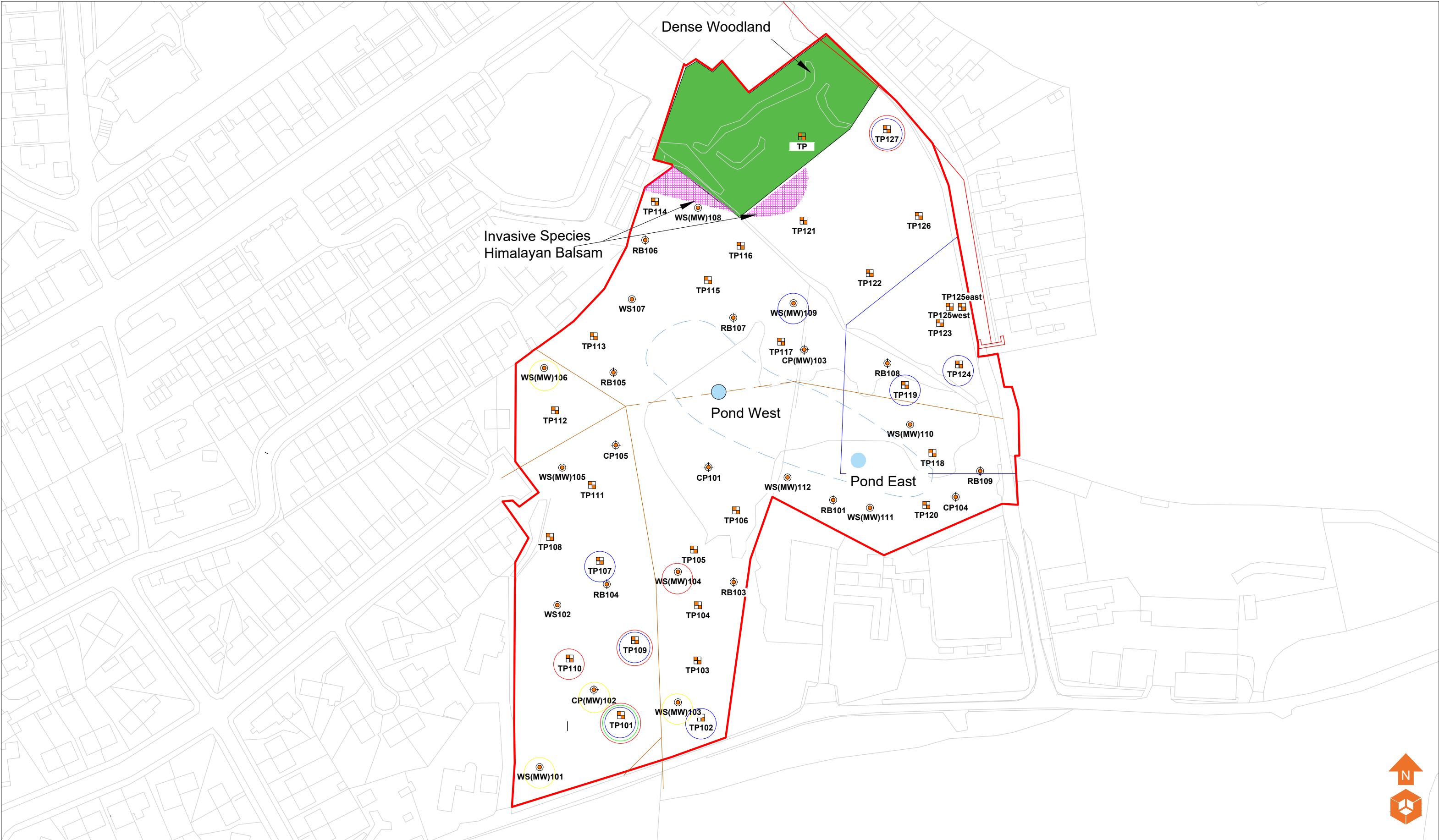
Job No:	
15-075	
Drawing No:	
015	

Date:	
12.12.2022	
Scale:	
NTS@ A3	



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Location Symbols Approximate Window Sample Probehole Location Approximate Trial Pit Location Approximate Cable Percussive Borehole Location Approximate Rotary Borehole Location BT/Telecoms Drains Soil Elevated PAHs Elevated TPHs Asbestos (<0.001%) Leachate Elevated Heavy Metals Groundwater Elevated Heavy Metals Surface Water-Pond Elevated Heavy Metals		Notes: <table><tr><td></td><td></td><td></td><td></td><td></td></tr><tr><td>P1</td><td>REVA</td><td>12.12.2022</td><td>OW</td><td>AR</td></tr><tr><td>Phase</td><td>Issue</td><td>Date</td><td>Drawn</td><td>Checked</td></tr></table>							P1	REVA	12.12.2022	OW	AR	Phase	Issue	Date	Drawn	Checked	Client: Russell Homes Land to the West of New Street		Job No: 15-075 Drawing No: 018	Date: 12.12.2022 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 The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.
P1	REVA	12.12.2022	OW	AR																			
Phase	Issue	Date	Drawn	Checked																			

APPENDIX IV PHOTOGRAPHS

PLATE 1 SOUTH SITE FACING NORTHWEST



PLATE 2 CENTRAL SITE FACING EAST - POND



PLATE 3 EAST SITE FACING EAST - POND



PLATE 4 CENTRAL SITE FACING WEST - POND



PLATE 5 SOUTH SITE FACING NORTH



PLATE 6 EAST SITE - STREAM



PLATE 7 EAST SITE FACING NORTHWEST



PLATE 8 TP107 EXCAVATION AND ARISING – MADE GROUND



PLATE 9 TP115 EXCAVATION AND ARISINGS – NATURAL DRIFT WITH POCKETS OF PEAT



APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392568.00 - 415668.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20
Depth 2.80

Scale
1:30

Client: Russell Homes

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.40	0.50	ES(L)		0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
				1.40			MADE GROUND: Dark brown gravelly clay with frequent cobbles. Gravel is fine to coarse angular of mudstone, sandstone and brick. Cobbles are angular of brick, sandstone and rare timber.	1
	2.50	ES		2.40			MADE GROUND: Black very gravelly clay with frequent cobbles and a strong hydrocarbon odour. Gravel is fine to coarse angular of mudstone, sandstone, brick, timber and slag. Cobbles are angular of timber, concrete and slag.	2
				2.80			End of Pit at 2.80m	3
								4

Trial Pit Photographs



TP101



TP101 spoil

Remarks: 1. Terminated on concrete boulder at 2.80 m bgl. 2. Water strike encountered at 0.40 m bgl as slow ingress through Made Ground.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392612.00 - 415687.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.50

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
	1.00	ES					MADE GROUND: Dark brown clayey gravel with frequent cobbles and boulders. Gravel is fine to coarse angular of mudstone, sandstone, brick, ceramic, timber, concrete and rare asphalt, rope and glass. Cobbles are angular of mudstone, sandstone and timber. Boulders are angular of mudstone.	1
	1.20	ES		1.10				
	1.20	HVP	99.87				Stiff high strength light yellowish brown mottled grey slightly gravelly sandy CLAY with frequent pockets of grey fine to coarse SAND and reddish brown fine to medium SAND. Gravel is fine to coarse subrounded of mudstone and sandstone.	
	1.50	B						
	1.70	HVP	115.36	1.80			Stiff high strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular of mudstone and sandstone.	2
	2.00	HVP	105.46					
				2.50			End of Pit at 2.50m	3
								4

Trial Pit Photographs



TP102



TP102 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392608.00 - 415711.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20
Depth 2.70

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
							MADE GROUND: Brown clayey gravel with frequent cobbles. Gravel is fine to coarse angular of mudstone, sandstone, ceramic and brick. Cobbles are angular of brick, timber, mudstone, sandstone and rare slag.	1
	1.60	ES		1.50				
	1.90	HVP	78.35	1.80			MADE GROUND: Black clayey gravel with frequent cobbles, a slight hydrocarbon odour and occasional pockets of spongy black fibrous PEAT. Gravel is fine to coarse angular of mudstone, sandstone, brick, timber and slag.	
	2.00	ES					Stiff high strength light yellowish brown mottled grey gravelly sandy CLAY with frequent pockets of brown fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone. Becoming firm medium strength at circa 2.20 m bgl.	2
	2.20	HVP	67.15	2.30			Orangish brown gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone.	
				2.70			End of Pit at 2.70m	3
								4

Trial Pit Photographs



TP103



TP103 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392609.00 - 415732.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.60

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.10	ES		0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
				0.65			MADE GROUND: Brown clayey gravel. Gravel is fine to coarse subrounded to subangular of mudstone, sandstone and brick.	
							MADE GROUND: Dark brown clayey gravel with frequent cobbles. Gravel is fine to coarse angular of mudstone, sandstone, brick and timber. Cobbles are angular of mudstone, sandstone, brick and plastic.	1
▼ 1.50	1.70	HVP	63.72	1.60			Firm medium strength light greyish brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone. Becoming soft low strength at circa 2.20 m bgl.	2
▼ 2.00	2.20	HVP	31.44	2.40			Grey slightly clayey very sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone. Cobbles are subrounded of mudstone and sandstone.	3
	2.50	B		2.60			End of Pit at 2.60m	4
	2.50	ES						

Trial Pit Photographs



TP104



TP104 spoil

Remarks: 1. Complete. 2. Unstable at 1.20 m bgl due to granular Made Ground deposits. 3. Water strike encountered at 1.50 m bgl as slow ingress through granular Made Ground and at 2.00 m bgl as fast ingress through sandy CLAY.

Stability: Unstable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392606.00 - 415752.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.60

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.30	0.10			0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
	0.60			0.60			MADE GROUND: Dark brown clayey sandy gravel with frequent cobbles and boulders. Gravel is fine to coarse angular of mudstone, sandstone, concrete, brick and ceramic. Cobbles and boulders are angular of ceramic and concrete.	
	1.00	ES		1.00			MADE GROUND: Dark brown mottled black slightly gravelly silty clay with frequent roots and rootlets, an organic odour and occasional pockets of spongy black fibrous PEAT. Gravel is fine to coarse subangular of mudstone and sandstone.	1
	1.90	HVP	54.68	1.80			Firm medium strength light orangish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	2
	2.20	HVP	61.99	2.40			Stiff high strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular of mudstone and sandstone.	
	2.50	HVP	77.48	2.60			End of Pit at 2.60m	3
								4

Trial Pit Photographs



TP105



TP105 spoil

Remarks: 1. Complete. 2. Water strike encountered at 2.30 m bgl as fast ingress above CLAY.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392622.00 - 415763.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.30

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.15			0.15			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
	0.50	ES					MADE GROUND: Dark brown slightly clayey gravel with frequent cobbles. Gravel is fine to coarse angular of ceramic, brick, mudstone, sandstone and timber. Cobbles are angular of mudstone, brick, concrete and timber.	1
	1.80	HVP	61.14	1.70			Firm medium strength light greyish brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone. Becoming soft low strength at 2.20 m bgl.	2
	2.00	ES						
	2.20	HVP	32.73	2.30			End of Pit at 2.30m	3
								4

Trial Pit Photographs



TP106



TP106 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392565.00 - 415734.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.90

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.00	0.20			0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
	0.70			0.70			MADE GROUND: Brown very gravelly clay. Gravel is fine to coarse subangular to angular of mudstone, sandstone and brick.	
	1.00	ES		1.00			MADE GROUND: Black slightly clayey sandy gravel with frequent cobbles and boulders and a strong hydrocarbon odour. Gravel is fine to coarse subangular to angular of mudstone, sandstone, brick, concrete, timber, plastic and rare metal. Cobbles and boulders and angular of concrete, brick and timber.	1
	1.60			1.60			MADE GROUND: Brown very gravelly clay. Gravel is fine to coarse subangular of mudstone, sandstone and brick.	2
	2.10			2.10			Brown very clayey very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	3
	2.40	B		2.40				
	2.40	ES		2.40				
	2.90			2.90			End of Pit at 2.90m	4

Trial Pit Photographs



TP107



TP107 spoil

Remarks: 1. Complete. 2. Unstable at 1.20 m bgl due to saturated granular Made Ground deposits. 3. Water strike encountered at 2.00 m bgl as very slow ingress through granular Made Ground deposits.

Stability: Unstable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392551.00 - 415756.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.90

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick. (Reworked Topsoil)	
				0.60			MADE GROUND: Brown very gravelly clay with occasional cobbles. Gravel is fine to coarse subrounded to subangular of mudstone, sandstone and rare brick, ceramic and metal. Cobbles are subangular to angular of mudstone and brick.	
	1.00	ES(L)					MADE GROUND: Black slightly gravelly slightly sandy clay with frequent cobbles and occasional boulders. Gravel is fine to coarse subangular to angular of mudstone, sandstone, brick, timber and rope. Cobbles are subangular to angular of mudstone, brick and timber. Boulders are angular of concrete and brick.	1
▼ 1.30								
▼ 2.20								2
	2.60	HVP	56.83	2.50			Firm medium strength dark brown slightly gravelly CLAY. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	
				2.90				
							End of Pit at 2.90m	3
								4

Trial Pit Photographs



TP108



TP108 spoil

Remarks: 1. Complete. 2. Water strike encountered at 1.30 m bgl and 2.20 m bgl as slow ingress through granular Made Ground deposits.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392573.00 - 415710.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.00

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and brick. (Reworked Topsoil)	
				1.20			MADE GROUND: Brown very gravelly clay with frequent cobbles. Gravel is fine to coarse subangular to angular of mudstone, sandstone, brick and timber. Cobbles are angular of mudstone and brick.	1
	1.40	ES(L)		2.00			MADE GROUND: Black slightly sandy gravelly clay with frequent cobbles, occasional boulders and a slight hydrocarbon odour. Gravel is fine to coarse angular of mudstone, sandstone, brick, timber and rare metal. Cobbles are angular of mudstone and brick. Boulders and angular of concrete.	2
							End of Pit at 2.00m	3
								4

Trial Pit Photographs



TP109



TP109 spoil

Remarks: 1. Terminated on concrete boulder at 2.00 m bgl.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392551.00 - 415695.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.85

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and brick. (Reworked Topsoil)	
				1.70			MADE GROUND: Dark brown very gravelly clay with occasional cobbles. Gravel is fine to coarse subangular to angular of mudstone, sandstone, brick and rare plastic. Cobbles are angular of mudstone, brick and timber.	1
							MADE GROUND: Black slightly silty gravelly clay with frequent cobbles, occasional boulders and a slight hydrocarbon odour. Gravel is fine to coarse subangular to subrounded of mudstone, brick and ceramic. Cobbles and boulders are angular of concrete, brick and timber.	2
	2.80	ES		2.85			End of Pit at 2.85m	3
								4

Trial Pit Photographs



TP110



TP110 spoil

Remarks: 1. Terminated on concrete boulder at 2.85 m bgl.

Stability: Stable



e3p

Trial Pit Log

TrialPit No

TP111

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075Co-ords: 392564.00 - 415775.00
Level:Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
3.00

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and brick. (Reworked Topsoil)	
	1.60	ES		1.70			MADE GROUND: Dark brown very gravelly clay with occasional cobbles and boulders. Gravel is fine to coarse angular of mudstone, sandstone, brick and rare ceramic. Cobbles are angular of mudstone sandstone, timber and ceramic. Boulders are angular of concrete and brick.	1
	2.00	HVP	81.79	1.80			MADE GROUND: Black sandy very gravelly clay with a slight hydrocarbon odour. Gravel is fine to coarse angular of mudstone, sandstone and brick.	2
	2.60	HVP	61.56				MADE GROUND: Dark brown slightly sandy gravelly clay with occasional cobbles. Gravel is fine to coarse angular of mudstone, sandstone and brick. Cobbles are angular of concrete.	
				3.00			End of Pit at 3.00m	3
								4

Trial Pit Photographs



TP111 spoil



TP111

Remarks: 1. Terminated due to the excavator reaching maximum depth.

Stability: Stable



Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392544.00 - 415799.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

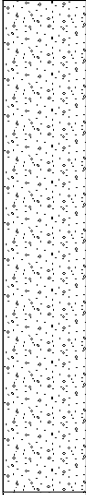
Scale
1:30

Client: Russell Homes

Depth
2.30

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.35			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
	1.00	B					Reddish brown slightly clayey very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subrounded of mudstone and sandstone.	1
 2.20				2.30			End of Pit at 2.30m	2
								3
								4

Trial Pit Photographs



TP112



TP112 spoil

Remarks: 1. Complete. 2. Water strike encountered at 2.20 m bgl as slow ingress through granular deposits.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392558.00 - 415825.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

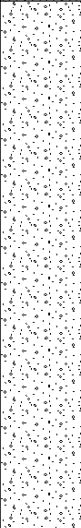
Scale
1:30

Client: Russell Homes

Depth
2.50

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.30				0.40			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
	1.50	ES					Reddish brown slightly clayey very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subrounded of mudstone and sandstone.	1 2
				2.50			End of Pit at 2.50m	3 4

Trial Pit Photographs



TP113



TP113 spoil

Remarks: 1. Complete. 2. Water strike encountered at 2.30 m bgl as slow ingress through granular deposits.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392585.00 - 415869.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20
Depth 2.80

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 1.70				0.30			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
	0.50	HVP	22.41				Soft low strength light orangish brown mottled grey very silty CLAY with frequent rootlets.	
	1.00 1.00 1.00	B ES HVP	23.26	0.95			Soft low strength light grey sandy very silty CLAY.	1
	1.50	HVP	28					
	2.00	HVP	23.26					2
				2.80			End of Pit at 2.80m	3
								4

Trial Pit Photographs



TP114



TP114 spoil

Remarks: 1. Complete. 2. Water strike encountered at 1.70 m bgl as slow ingress through sandy silty CLAY.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392601.00 - 415849.00
Level:

Date
08/11/2022

Location: New Street

Dimensions (m): 2.20

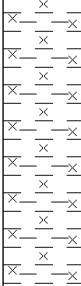
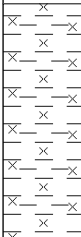
Scale
1:30

Client: Russell Homes

Depth
3.00

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.40	ES		0.30			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
				0.50			Very soft very low strength light brown sandy CLAY.	
	1.00	HVP	15.33				Very soft very low strength brown sandy silty CLAY with occasional pockets of spongy brown fibrous PEAT.	1
	2.00	HVP	16.33	1.70			Very soft very low strength light grey sandy very silty CLAY with an organic odour.	2
	2.80	HVP	10.66	2.65			Spongy brown fibrous PEAT with a slight organic odour.	
				2.80			Very soft very low strength light grey very silty CLAY.	3
				3.00			End of Pit at 3.00m	4

Trial Pit Photographs



TP115



TP115 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392621.00 - 415857.00
Level:

Date
09/11/2022

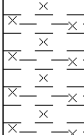
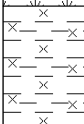
Location: New Street

Dimensions (m): 2.20
Depth 2.40
0.70

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 1.00	0.50	ES HVP	23.26	0.25			Dark brown very sandy CLAY with frequent rootlets. (TOPSOIL)	
	0.50						Soft low strength light greyish brown very silty CLAY.	
				0.80			Spongy brown fibrous PEAT with a slight organic odour.	1
				1.40			Soft low strength light grey sandy very silty CLAY.	
	2.10	B		1.90			Light grey slightly gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	2
				2.00			Light grey slightly clayey sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subrounded of mudstone and sandstone.	
				2.40			End of Pit at 2.40m	

Trial Pit Photographs



TP116



TP116 spoil

Remarks: 1. Complete. 2. Water strike encountered at 1.00 m bgl as slow ingress through PEAT. 3. Unstable pit at 1.50 m bgl below PEAT.

Stability: Unstable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392632.00 - 415824.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

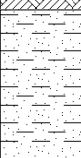
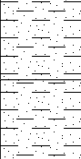
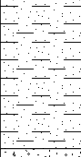
Scale
1:30

Client: Russell Homes

Depth
2.50

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 2.00				0.30			Dark brown very sandy CLAY with frequent rootlets. (TOPSOIL)	
	0.40 0.50	ES HVP	28.42				Soft low strength light orangish brown mottled grey silty sandy CLAY.	1
	1.00	HVP	25.42				Soft low strength light grey very silty very sandy CLAY.	2
	1.50	HVP	24.99				Light grey slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	3
				2.10 2.50			End of Pit at 2.50m	4

Trial Pit Photographs



TP117



TP117 spoil

Remarks: 1. Complete. 2. Water strike encountered at 2.00 m bgl as slow ingress through sandy silty CLAY. 3. Unstable pit at 0.50 m bgl due to saturated sandy silty CLAY.

Stability: Unstable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392684.00 - 415772.00
Level:

Date
09/11/2022

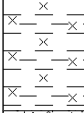
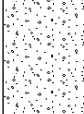
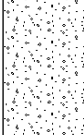
Location: New Street

Dimensions (m): 2.20
Depth 1.90

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 1.00	0.10	ES		0.25			Dark brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. (TOPSOIL)	
				0.70			Soft low strength light orangish brown mottled grey slightly sandy silty CLAY with occasional roots.	
				1.20			Light grey slightly clayey very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	1
				1.30			Light brown fine to medium SAND.	
	1.50	B		1.90			Light greyish brown slightly clayey very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subrounded to rounded of mudstone and sandstone.	
							End of Pit at 1.90m	2
								3
								4

Trial Pit Photographs



TP118



TP118 spoil

Remarks: 1. Terminated at 1.90 m bgl due to unstable pit associated with saturated granular deposits at 1.00 m bgl - running sands. 2. Water strike encountered at 1.00 m bgl through granular deposits.

Stability: Unstable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392676.00 - 415808.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20
0.70
Depth 1.40

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.20	0.30	HVP	18.96	0.20			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
							Very soft very low strength brown silty very sandy CLAY with frequent roots.	
	0.60	HVP	26.28	0.50			Soft low strength greyish brown gravelly very sandy very silty CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	
	0.80	ES						
				1.40			End of Pit at 1.40m	

Trial Pit Photographs



TP119



TP119 spoil

Remarks: 1. Terminated at 1.40 m bgl due to fast ingress of water flooding Trial Pit. 2. Water strike encountered at 0.20 m bgl through silty sandy CLAY. 3. Gravelly CLAY encountered at 1.00 m bgl - HSV test not viable.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392680.00 - 415759.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

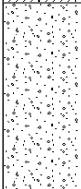
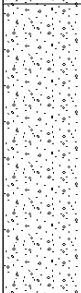
Scale
1:30

Client: Russell Homes

Depth
2.20

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30			0.30			Dark brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	
	0.50	B					Light orangish brown very gravelly fine to coarse SAND with frequent roots. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	1
	1.05			1.05			Light orangish brown very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subrounded to rounded of mudstone and sandstone.	2
	1.50	ES						
	2.20			2.20			End of Pit at 2.20m	3
								4

Trial Pit Photographs



TP120



TP120 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392650.00 - 415858.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

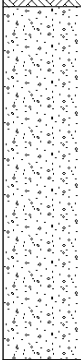
Scale
1:30

Client: Russell Homes

Depth
2.30

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼ 1.00	0.10	ES		0.20			Dark brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. (TOPSOIL)	
							Light brown slightly clayey very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded of mudstone and sandstone. Cobbles are subrounded to subangular of mudstone and sandstone.	1
	1.70	HVP	129.12	1.60			Stiff high strength brown slightly sandy very gravelly CLAY with occasional pockets of brown gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone, sandstone and rare coal.	2
	2.00	HVP	118.79	2.30				
							End of Pit at 2.30m	3
								4

Trial Pit Photographs



TP121



TP121 spoil

Remarks: 1. Complete. 2. Water strike encountered at 1.00 m bgl as medium ingress above CLAY - running sands.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392674.00 - 415844.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.30

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼ 1.90	0.40	HVP	38.33	0.30			Dark brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. (TOPSOIL)	
	0.60	B					Firm medium strength light orangish brown slightly gravelly very sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	
	0.60	ES						
	0.60	HVP	42.2	0.90			Firm medium strength brown mottled grey sandy gravelly CLAY. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	1
	1.00	HVP	41.33	1.50			Grey slightly clayey sandy GRAVEL with frequent cobbles. Gravel is fine to coarse subrounded of mudstone and sandstone. Cobbles are subrounded of mudstone and sandstone.	2
				2.30			End of Pit at 2.30m	3
								4

Trial Pit Photographs



TP122



TP122 spoil

Remarks: 1. Complete. 2. Water strike encountered at 1.90 m bgl as slow ingress through granular deposits.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392695.00 - 415831.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 3.10

Scale
1:30

Client: Russell Homes

Depth
0.50

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
 0.40	0.20	ES(L)		0.30			MADE GROUND: Dark brown sandy gravelly clay with occasional rootlets. Gravel is fine to coarse angular of mudstone, sandstone, brick, plastic, glass and ceramic. (Reworked Topsoil)
				0.50			MADE GROUND: Brown very sandy gravel with frequent cobbles. Gravel is fine to coarse angular of mudstone, sandstone, brick, ceramic, concrete, metal and rare plastic. Cobbles are angular of concrete, brick and sandstone.
							End of Pit at 0.50m

1
2
3
4

Trial Pit Photographs



TP123



TP123 spoil

Remarks: 1. Terminated at 0.50 m bgl due to fast ingress of water flooding Trial Pit. 2. Water strike encountered at 0.40 m bgl through granular Made Ground.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392700.00 - 415822.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
1.00

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.30				0.40			MADE GROUND: Dark brown sandy very gravelly clay. Gravel is fine to coarse angular of mudstone, sandstone, brick and metal.	
	0.90	ES		1.00			MADE GROUND: Dark brown slightly clayey very gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse angular of mudstone, sandstone, brick, concrete and metal rebar. Cobbles are angular of brick and concrete.	1
							End of Pit at 1.00m	2 3 4

Trial Pit Photographs



TP124



TP124 spoil

Remarks: 1. Terminated at 1.00 m bgl due to fast ingress of water flooding Trial Pit and the presence of a land drain.
2. Water strike encountered at 0.30 m bgl through granular Made Ground.

Stability: Stable



e3p

Trial Pit Log

TrialPit No
TP125 East
Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075Co-ords: 392703.00 - 415833.00
Level:Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.30

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			Brown slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	
	1.00	HVP	92.55	1.40			Stiff high strength light orangish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	1
				1.90			Very soft very low strength black very silty CLAY with a slightly organic odour.	
	2.00	HVP	16.38	2.30			Very soft very low strength light grey sandy very silty CLAY.	2
							End of Pit at 2.30m	3
								4

Remarks: 1. Complete. 2. Eastern half of TP125 encountering natural drift deposits.

Stability: Stable



Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392702.00 - 415833.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20
Depth 2.30

Scale
1:30

Logged
A.Rae

Client: Russell Homes

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			MADE GROUND: Black sandy very gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and brick.	
	1.00	HVP	92.55	1.20			MADE GROUND: Dark brown slight clayey sandy gravel with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone, brick, material, metal and plastic. Cobbles are angular of brick.	1
	1.60	ES		1.90			Stiff high strength light orangish brown mottled grey slightly gravelly CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	
	2.00	HVP	16.38	2.30			Very soft very low strength light grey sandy very silty CLAY.	2
							End of Pit at 2.30m	3
								4

Remarks: 1. Complete. 2. Western half of TP125 encountering Made Ground deposits overlying natural CLAY.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392686.00 - 415879.00
Level:

Date
09/11/2022

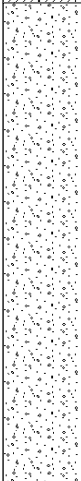
Location: New Street

Dimensions (m): 2.20
Depth 2.20

Scale
1:30

Client: Russell Homes

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.20	ES		0.30			Light orangish brown slightly gravelly very sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	
	1.00	B		2.20			Brown clayey gravelly fine to coarse SAND with frequent cobbles. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Cobbles are subangular to angular of weathered sandstone.	1 2 3 4
							End of Pit at 2.20m	

Trial Pit Photographs



TP126



TP126 spoil

Remarks: 1. Complete.

Stability: Stable

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415907.00
Level:

Date
09/11/2022

Location: New Street

Dimensions (m): 2.20

Scale
1:30

Client: Russell Homes

Depth
2.20

0.70

Logged
A.Rae

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.90	0.10			0.10			MADE GROUND: Black very sandy very gravelly clay with frequent rootlets. Gravel is fine to coarse angular of ash, glass, brick, mudstone and sandstone.	
	0.40	ES(L)					MADE GROUND: Black sandy gravel with a slight hydrocarbon odour. Gravel is fine to coarse angular of glass, ash and brick.	
	1.00	HVP	82.22	0.90			Stiff high strength light orangish brown slightly sandy CLAY.	1
	1.30	HVP	86.96					
	1.70	HVP	42.62	1.60			Firm medium strength dark grey silty CLAY.	2
	2.00	HVP	40.04	2.20			End of Pit at 2.20m	3
								4

Trial Pit Photographs



TP127



TP127 spoil

Remarks: 1. Complete. 2. Water strike encountered at 0.90 m bgl as slow ingress above CLAY.

Stability: Stable

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392539.00 - 415657.00

Hole Type
WS

Location: New Street

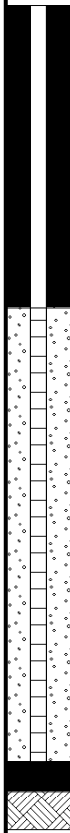
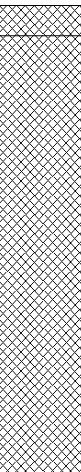
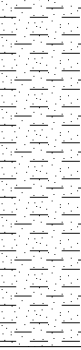
Level:

Scale
1:50

Client: Russell Homes

Dates: 08/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
		1.00	D	N=10 (1,2/2,3,2,3)				MADE GROUND: Medium dense brown gravelly clay with occasional cobbles. Gravel is fine to coarse angular of mudstone, sandstone, brick, timber and asphalt. Cobbles are angular of brick.	1
		1.00							
		2.00		N=12 (2,3/3,3,3,3)					2
		3.00	D	N=13 (2,1/2,3,4,4)	3.10				3
		3.00							
		3.50	ES					Soft low strength dark brown slightly gravelly very sandy CLAY with frequent pockets of brown very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of sandstone. Becoming firm medium strength at circa 5.00 m bgl.	4
		4.00		N=7 (4,3/3,1,2,1)					
		5.00		N=11 (4,3/3,2,2,4)					5
					5.45			End of borehole at 5.45 m	6

Remarks

1. Complete. Water strike encountered at 3.00 m bgl through very sandy CLAY.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392546.00 - 415721.00

Hole Type
WS

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 08/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
		1.00		N=10 (3,2/2,3,3,2)				MADE GROUND: Firm medium strength brown slightly sandy slightly gravelly clay. Gravel is fine to coarse angular of mudstone, sandstone, brick and timber.	1
		2.00	D	N=9 (1,1/2,3,2,2)	1.80			Firm medium strength brown slightly gravelly CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	2
		2.00			2.00			Firm medium strength dark brown slightly silty slightly gravelly CLAY with occasional pockets of brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	
		3.00	ES	N=10 (3,2/1,2,3,4)	2.90			Loose dark brown very sandy GRAVEL. Gravel is fine to coarse subangular of mudstone and sandstone.	3
		3.20							
		4.00		N=11 (2,3/3,2,3,3)					4
					4.30			Stiff high strength dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse subangular of mudstone and sandstone.	
		5.00		N=20 (4,5/5,6,5,4)	5.00			Medium dense dark brown very gravelly fine to coarse SAND. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete.

Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392593.00 - 415683.00

Hole Type
WS

Location: New Street

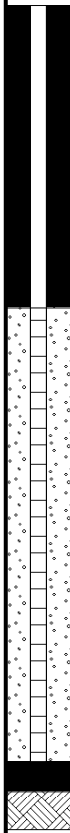
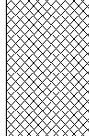
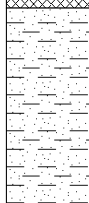
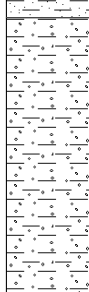
Level:

Scale
1:50

Client: Russell Homes

Dates: 08/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
		1.00 1.00 1.30	D ES(L)	N=10 (1,1/2,3,3,2)	0.80			MADE GROUND: Brown gravelly clay with occasional cobbles. Gravel is fine to coarse angular of mudstone, sandstone and brick. Cobbles are angular of sandstone.	1
		2.00 2.00	D	N=9 (3,4/3,2,2,2)	2.10			MADE GROUND: Stiff high strength dark brown slightly gravelly slightly sandy clay. Gravel is fine to coarse subangular to angular of mudstone, sandstone and rare brick.	2
		3.00 3.00	D	N=15 (2,3/3,4,4,4)				Firm medium strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	3
		3.50	U		3.50			Firm medium strength brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Becoming stiff high strength at circa 5.00 m bgl.	4
		4.00 4.00	D	N=12 (3,3/2,3,4,3)					
		5.00		N=22 (5,5/5,5,5,7)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete.

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392594.00 - 415731.00

Hole Type
WS

Location: New Street

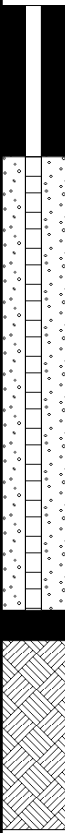
Level:

Scale
1:50

Client: Russell Homes

Dates: 08/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
		0.50	ES(L)					MADE GROUND: Stiff high strength brown very gravelly clay. Gravel is fine to coarse subangular to subrounded of mudstone, sandstone and rare brick, ceramic and asphalt.	1
		1.00	D	N=10 (2,2/3,3,2,2)					
		1.00							
		1.50			1.50			Firm medium strength dark brown slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	2
		2.00	D	N=9 (3,3/2,2,2,3)	2.00			Firm medium strength dark brown very sandy CLAY.	
		2.00							
		2.50	U		2.45			Medium dense brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Becoming loose at circa 5.00 m bgl.	3
		3.00	D	N=23 (3,3/6,6,6,5)					
		3.00							
		4.00	D	N=18 (2,3/3,4,5,6)					4
		4.00							
		5.00		N=12 (3,3/2,4,3,3)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. Water strike encountered at 2.50 m bgl through very sandy CLAY.

Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392539.00 - 415809.00

Hole Type
WS

Location: New Street

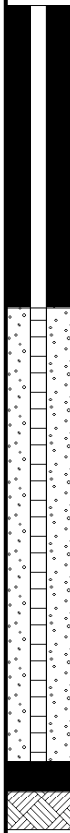
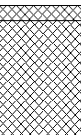
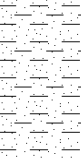
Level:

Scale
1:50

Client: Russell Homes

Dates: 08/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			MADE GROUND: Dark brown slightly gravelly clay with frequent rootlets. Gravel is fine to coarse angular of mudstone, sandstone and rare brick and rope. (Reworked Topsoil)	
		1.00	D		0.90			MADE GROUND: Brown gravelly clay. Gravel is fine to coarse subangular to angular of mudstone, sandstone and brick.	1
		1.00		N=10 (2,1/2,2,3,3)	1.10			MADE GROUND: Firm medium strength dark brown slightly sandy slightly gravelly clay. Gravel is fine to coarse subangular of mudstone, sandstone and rare brick.	
		1.10	ES					Very soft very low strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Becoming firm medium strength at circa 3.00 m bgl.	2
		2.00	D						
		2.00		N=4 (1,1/1,1,1,1)					
		3.00	D		3.10			Firm medium strength greyish brown slightly sandy silty CLAY.	3
		3.00		N=9 (3,2/2,2,2,3)	3.40			Firm medium strength dark brown slightly gravelly sandy CLAY with pockets of brown GRAVEL. Gravel is fine to medium subangular of mudstone and sandstone. Becoming stiff high strength at circa 5.00 m bgl.	4
		3.50	U						
		4.00	D						
		4.00		N=11 (3,2/3,3,2,3)					
		5.00		N=31 (7,8/8,8,7,8)					5
					5.45			End of borehole at 5.45 m	6
									7
									8
									9
									10

Remarks

1. Complete. 2. No recovery at 3.00 m bgl.

Borehole Log

Borehole No.

WS106

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392574.00 - 415839.00

Hole Type
WS

Location: New Street

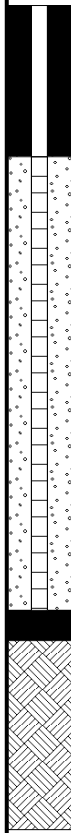
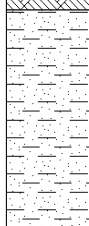
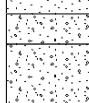
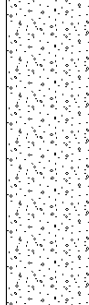
Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			Dark brown sandy CLAY with frequent rootlets. (TOPSOIL)	
		1.00 1.00	D	N=12 (3,4/4,3,2,3)				Firm medium strength light orangish brown mottled grey slightly gravelly very sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	1
		2.00		N=16 (4,5/6,4,3,3)	1.90			Medium dense brown very sandy GRAVEL. Gravel is fine to coarse subrounded of mudstone and sandstone.	2
		2.40	ES		2.30			Medium dense brown fine to medium SAND.	
		3.00		N=39 (7,17/11,10,8,10)	2.80 3.00			Dense brown slightly clayey very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone.	3
		4.00		N=14 (2,2/3,3,4,4)				Dense brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to rounded of mudstone and sandstone. Becoming medium dense at circa 4.00 m bgl.	4
		5.00		N=13 (3,4/3,3,3,4)					5
					5.45			End of borehole at 5.45 m	
									6
									7
									8
									9
									10

Remarks

1. Complete.



Borehole Log

Borehole No.

WS107

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392548.00 - 415771.00

Hole Type
WS

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.35			Dark brown slightly sandy CLAY with frequent rootlets. (TOPSOIL)	
					0.80			Greyish brown sandy CLAY.	
		1.00 1.00 1.20 1.50	D ES U	N=19 (1,2/4,4,4,7)				Stiff high strength light orangish brown mottled grey slightly gravelly very sandy CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	1
		2.00		58 (3,10/58 for 255mm)	2.00			Dense brown slightly clayey sandy GRAVEL. Gravel is fine to coarse subangular of sandstone.	2
					2.41			End of borehole at 2.41 m	
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Refusal on dense GRAVEL at 2.41 m bgl.



Borehole Log

Borehole No.

WS108

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392601.00 - 415873.00

Hole Type
WS

Location: New Street

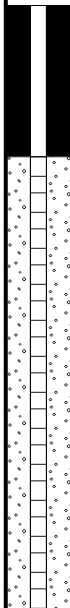
Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	U		0.40			Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	1
		1.00	ES	N=5 (1,1/1,2,1,1)				Soft low strength dark brown very sandy very silty CLAY with an organic odour, occasional rootlets and occasional pockets of spongy brown fibrous PEAT at 1.30 m bgl.	
		1.20			1.50			Loose grey slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone.	2
		2.00		N=5 (1,2/2,1,1,1)					3
		3.00		N=5 (1,1/2,1,1,1)					4
		3.60		59 (11,13/59 for 255mm)	3.50			Very stiff very high strength grey gravelly sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	5
					4.01			End of borehole at 4.01 m	6
									7
									8
									9
									10

Remarks

1. Refusal on dense GRAVEL at 4.01 m bgl. 2. No recovery at 3.00 m bgl. 3. Water strike encountered at 2.00 m bgl through granular deposits.

Borehole Log

Borehole No.

WS109

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392637.00 - 415837.00

Hole Type
WS

Location: New Street

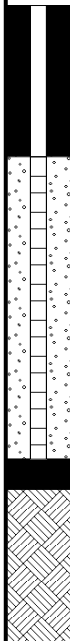
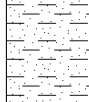
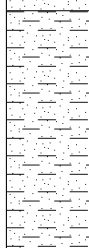
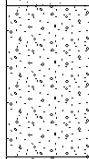
Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.25			Dark brown slightly sandy CLAY with frequent rootlets. (TOPSOIL)	
		1.00	D	N=4 (1,1/1,1,1,1)	1.00			Soft low strength light orangish brown very sandy CLAY.	1
		2.00	D	N=23 (2,2/4,6,6,7)	2.60			Soft low strength brown very sandy CLAY. Becoming stiff high strength at circa 2.00 m bgl.	2
		3.00	D	N=26 (3,4/4,5,7,10)	3.60			Medium dense brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone.	3
		3.80	D	60 (11,14/60 for 255mm)	4.21			Very stiff very high strength brown slightly gravelly CLAY with occasional cobbles. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. Cobbles are angular of weathered sandstone.	4
		4.00	D					End of borehole at 4.21 m	

Remarks

1. Refusal on weathered SANDSTONE cobble at 4.21 m bgl.

Borehole Log

Borehole No.

WS110

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392681.00 - 415790.00

Hole Type
WS

Location: New Street

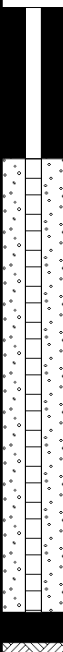
Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10			Dark brown slightly gravelly very sandy CLAY with frequent rootlets. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	
		0.50	U					Soft low strength dark brown very sandy very gravelly CLAY. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	
		1.00	D		1.10			Spongy brown fibrous PEAT with a slight organic odour.	1
		1.00		N=4 (1,1/1,1,1,1)	1.30				
		1.60	ES					Medium dense black slightly clayey very sandy GRAVEL. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	
		2.00		N=11 (1,2/1,3,4,3)	2.00				2
								Medium dense brown slightly clayey very gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone.	
		3.00		N=22 (5,6/5,5,6,6)	2.90				3
								Medium dense brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded of mudstone and sandstone. Becoming dense at circa 4.00 m bgl.	
		4.00		67 (10,13/67 for 255mm)	4.41				4
End of borehole at 4.41 m									5
									6
									7
									8
									9
									10

Remarks

1. Refusal on dense SAND at 4.41 m bgl.

Borehole Log

Borehole No.

WS111

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392667.00 - 415757.00

Hole Type
WS

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.30			Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (TOPSOIL)	
		1.00		N=20 (4,4/5,4,5,6)	0.80			Light orangish brown gravelly very clayey fine to coarse SAND. Gravel is fine to coarse subrounded to subangular of mudstone, sandstone and coal.	1
		2.00		54 (7,10/54 for 255mm)	2.41			Medium dense brown gravelly fine to coarse SAND. Gravel is fine to coarse subangular to subrounded of mudstone, sandstone and coal. Becoming dense at circa 2.00 m bgl.	2
								End of borehole at 2.41 m	3
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Refusal on dense SAND at 2.41 m bgl.

Borehole Log

Borehole No.

WS112

Sheet 1 of 1

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392623.00 - 415770.00

Hole Type
WS

Location: New Street

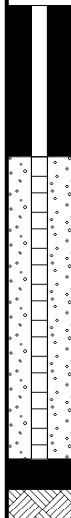
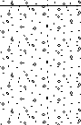
Level:

Scale
1:50

Client: Russell Homes

Dates: 09/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is fine to coarse subrounded of mudstone and sandstone. (TOPSOIL)	
		1.00		N=10 (2,2/2,3,2,3)	0.90			Light orangish brown mottled grey slightly gravelly very sandy CLAY. Gravel is fine to coarse subrounded of mudstone and sandstone.	1
		1.50	ES					Medium dense brown slightly clayey gravelly fine to coarse SAND with occasional cobbles. Gravel is fine to coarse subrounded of mudstone and sandstone. Cobbles are subangular of sandstone.	2
		2.00		N=17 (4,3/4,5,4,4)	2.00			Medium dense brown gravelly fine to coarse SAND. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone.	2
		3.00		73 (7,8/73 for 255mm)	2.60			Dense brown slightly clayey gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to subangular of mudstone, sandstone and coal.	3
					3.41		End of borehole at 3.41 m		
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Refusal on dense SAND at 3.41 m bgl.

Borehole Log

Borehole No.

CP101

Sheet 1 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392603.00 - 415773.00

Hole Type
CP

Location: New Street

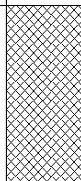
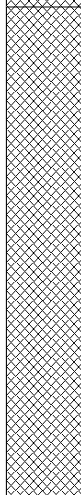
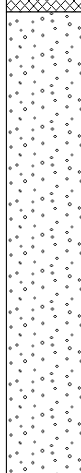
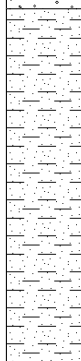
Level:

Scale
1:50

Client: Russell Homes

Dates: 16/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		1.20			MADE GROUND: Dark brown gravel. Gravel is fine to coarse angular of brick, concrete and asphalt.	1
		1.00 1.00	D	N=5 (3,4/2,1,1,1)				MADE GROUND: Soft low strength brown sandy gravelly clay. Gravel is fine to coarse angular of mudstone and sandstone.	2
		2.00 2.00	D	N=4 (1,1/1,1,1,1)					3
		3.00 3.00	D	N=4 (1,1/1,1,1,1)					4
		4.00 4.00	D	N=6 (1,1/1,1,2,2)	4.50				5
		5.00 5.00	D	N=18 (2,3/4,4,5,5)					6
		6.50 6.50	D	N=29 (8,4/6,7,8,8)					7
		8.00 8.00	D	N=21 (2,3/4,5,6,6)	7.60				8
		9.50 9.50	D	N=21 (2,3/4,5,6,6)					9
									10

Continued on next sheet

Remarks

1. Complete. 2. Water strike encountered at 4.50 m bgl through granular deposits. 3. Water strike encountered at 12.70 m bgl through sandy CLAY. 4. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour.



Borehole Log

Borehole No.

CP101

Sheet 2 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392603.00 - 415773.00

Hole Type
CP

Location: New Street

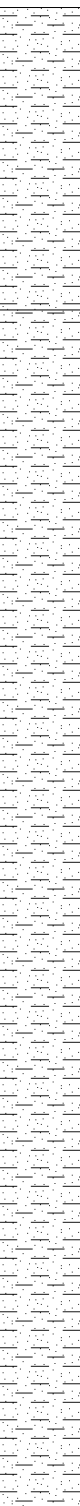
Level:

Scale
1:50

Client: Russell Homes

Dates: 16/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00 11.00	D	N=21 (3,4/4,5,6,6)	12.00			Firm medium strength brown sandy boulder CLAY with bands of laminated CLAY.	11
		12.50 12.50	D	N=23 (3,4/5,5,6,7)					12
		14.00 14.00	D	N=24 (3,4/5,6,6,7)					13
		15.50 15.50	D	N=29 (3,4/5,7,8,9)					14
		17.00 17.00	D	N=31 (4,5/7,7,8,9)					15
		18.50 18.50	D	N=42 (5,6/8,10,12,12)					16
		20.00	D						17
									18
Continued on next sheet									19
									20

Remarks

1. Complete. 2. Water strike encountered at 4.50 m bgl through granular deposits. 3. Water strike encountered at 12.70 m bgl through sandy CLAY. 4. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour.





Borehole Log

Borehole No.

CP101

Sheet 3 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392603.00 - 415773.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 16/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.00		50 (6,10/50 for 295mm)	20.44			End of borehole at 20.44 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Complete. 2. Water strike encountered at 4.50 m bgl through granular deposits. 3. Water strike encountered at 12.70 m bgl through sandy CLAY. 4. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour.



Borehole Log

Borehole No.

CP102

Sheet 1 of 4

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392559.00 - 415687.00

Hole Type
CP

Location: New Street

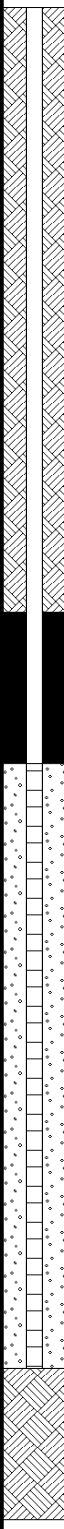
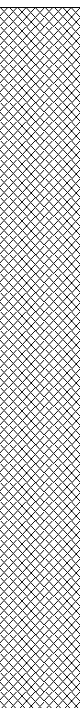
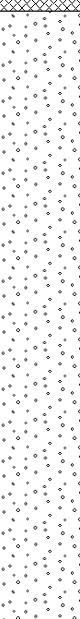
Level:

Scale
1:50

Client: Russell Homes

Dates: 17/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D		4.70			MADE GROUND: Dark brown gravelly clay. Gravel is fine to coarse angular of brick and concrete.	1
		1.00 1.00	D	N=20 (1,2/6,7,4,3)					
		2.00 2.00	D	N=4 (1,1/1,1,1,1)					
		3.00 3.00	D	N=4 (1,1/1,1,1,1)					
		4.00 4.00	D	N=7 (1,2/3,2,1,1)				Medium dense brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	5
		5.00 5.00	D	N=17 (1,2/4,4,4,5)					
		6.50 6.50	D	N=20 (2,3/4,5,6,5)					
		8.00 8.00	D	N=24 (3,3/5,6,6,7)					
		8.80 9.00							
		9.50 9.50	D	N=18 (2,3/3,4,5,6)					
Continued on next sheet									10

Remarks

1. Complete. 2. Water strike encountered at 4.70 m bgl through granular deposits. 3. Chiselling from 6.60 m bgl to 6.80 m bgl for 30 minutes. 4. Water strike encountered at 13.20 m bgl through sandy CLAY. 5. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour. 6. Monitoring well installed - response zone between 5.00 m bgl and 9.00 m bgl.



Borehole Log

Borehole No.

CP102

Sheet 2 of 4

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392559.00 - 415687.00

Hole Type
CP

Location: New Street

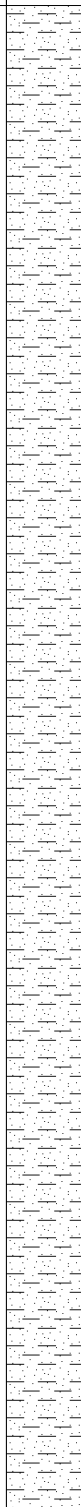
Level:

Scale
1:50

Client: Russell Homes

Dates: 17/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00 11.00	D	N=21 (2,3/4,5,6,6)					11
		12.50 12.50	D	N=24 (3,4/5,6,6,7)					12
		14.00		N=23 (3,4/5,5,6,7)					13
		15.50 15.50	D	N=30 (3,4/6,7,8,9)					14
		17.00 17.00	D	N=32 (4,6/7,7,9,9)					15
		18.50 18.50	D	N=49 (5,7/9,10,17,13)					16
									17
									18
		20.00	D						19
								Continued on next sheet	20

Remarks

1. Complete. 2. Water strike encountered at 4.70 m bgl through granular deposits. 3. Chiselling from 6.60 m bgl to 6.80 m bgl for 30 minutes. 4. Water strike encountered at 13.20 m bgl through sandy CLAY. 5. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour. 6. Monitoring well installed - response zone between 5.00 m bgl and 9.00 m bgl.





Borehole Log

Borehole No.

CP102

Sheet 3 of 4

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392559.00 - 415687.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 17/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.00		50 (6,9/50 for 275mm)	20.42				
								End of borehole at 20.44 m	
									21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Continued on next sheet

Remarks

1. Complete. 2. Water strike encountered at 4.70 m bgl through granular deposits. 3. Chiselling from 6.60 m bgl to 6.80 m bgl for 30 minutes. 4. Water strike encountered at 13.20 m bgl through sandy CLAY. 5. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour. 6. Monitoring well installed - response zone between 5.00 m bgl and 9.00 m bgl.





Borehole Log

Borehole No.

CP102

Sheet 4 of 4

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392559.00 - 415687.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 17/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		34.00		N=4 (1,1/1,1,1,1)					31 32 33 34 35 36 37 38 39 40

Remarks

1. Complete. 2. Water strike encountered at 4.70 m bgl through granular deposits. 3. Chiselling from 6.60 m bgl to 6.80 m bgl for 30 minutes. 4. Water strike encountered at 13.20 m bgl through sandy CLAY. 5. Chiselling from 19.00 m bgl to 20.00 m bgl for 1 hour. 6. Monitoring well installed - response zone between 5.00 m bgl and 9.00 m bgl.



Borehole Log

Borehole No.

CP103

Sheet 1 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392640.00 - 415819.00

Hole Type
CP

Location: New Street

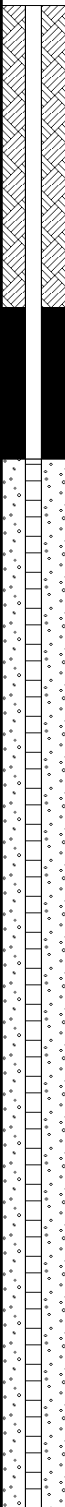
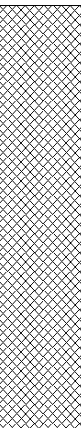
Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D					MADE GROUND: Dark brown gravelly clay. Gravel is fine to coarse angular of brick.	
		1.00 1.00	D	50 (1,1/50 for 200mm)					1
		2.00 2.00	D	N=8 (1,1/2,2,2,2)					2
		3.00 3.00	D	N=10 (1,2/3,3,3,2)	2.80			Medium dense brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	3
		4.00 4.00	D	N=12 (1,2/3,3,3,3)					4
		5.00 5.00	D	N=14 (2,2/3,3,4,4)					5
		6.50 6.50	D	N=16 (2,3/4,4,4,5)					6
		8.00 8.00	D	N=18 (2,3/4,4,5,5)					7
		9.50 9.50	D	N=20 (2,3/4,5,6,5)					8
					10.00				9
								Continued on next sheet	10

Remarks

1. Complete. 2. Chiselling from 1.20 m bgl to 1.70 m bgl for 1 hour. 3. Chiselling from 18.50 m bgl to 20.00 m bgl for 1.5 hours. 3. Monitoring well installed - response zone between 3.00 m bgl and 12.00 m bgl.



Borehole Log

Borehole No.

CP103

Sheet 2 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392640.00 - 415819.00

Hole Type
CP

Location: New Street

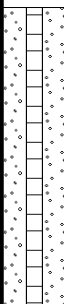
Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00 11.00	D	N=22 (3,4/5,5,6,6)	17.80			Medium dense brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	11
		12.50 12.50	D	N=23 (3,4/5,6,6,6)				12	
		14.00 14.00	D	N=26 (3,3/5,6,7,8)				13	
		15.50 15.50	D	N=31 (4,5/7,7,8,9)				14	
		17.00 17.00	D	N=35 (4,6/8,8,9,10)				15	
		18.50 18.50	D	50 (8,12/50 for 180mm)				16	
									17
									18
									19
									20
Continued on next sheet									

Remarks

1. Complete. 2. Chiselling from 1.20 m bgl to 1.70 m bgl for 1 hour. 3. Chiselling from 18.50 m bgl to 20.00 m bgl for 1.5 hours. 3. Monitoring well installed - response zone between 3.00 m bgl and 12.00 m bgl.





Borehole Log

Borehole No.

CP103

Sheet 3 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392640.00 - 415819.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.00		50 (10,14/50 for 200mm)	20.35				
								End of borehole at 20.35 m	
									21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Complete. 2. Chiselling from 1.20 m bgl to 1.70 m bgl for 1 hour. 3. Chiselling from 18.50 m bgl to 20.00 m bgl for 1.5 hours. 3. Monitoring well installed - response zone between 3.00 m bgl and 12.00 m bgl.



Borehole Log

Borehole No.

CP104

Sheet 1 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392697.00 - 415767.00

Hole Type
CP

Location: New Street

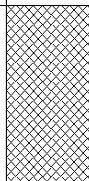
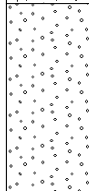
Level:

Scale
1:50

Client: Russell Homes

Dates: 15/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D					MADE GROUND: Dark brown gravelly clay. Gravel is fine to coarse angular of brick.	
		1.00 1.00	D	N=11 (1,2/2,3,3,3)	1.20			Dense brown fine to coarse SAND.	1
		2.00 2.00	D	N=31 (4,5/7,7,8,9)	1.70			Dense brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	2
		3.00 3.00	D	N=4 (1,1/1,1,1,1)	3.00			Soft brown clayey SILT.	3
		4.00 4.00	D	N=5 (1,1/1,1,2,1)					4
		5.00 5.00	D	N=8 (1,1/2,2,2,2)					5
		6.50 6.50	D	N=9 (1,2/2,2,2,3)					6
		8.00 8.00	D	N=12 (1,2/2,3,3,4)					7
		9.50 9.50	D	N=18 (2,3/4,4,5,5)					8
									9
									10

Continued on next sheet

Remarks

1. Complete. 2. Water strike encountered at 1.50 m bgl through granular deposits. 3. Chiselling from 14.00 m bgl to 14.20 m bgl for 45 minutes. 4. Chiselling from 15.30 m bgl to 15.70 m bgl for 1 hour.



Borehole Log

Borehole No.

CP104

Sheet 2 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392697.00 - 415767.00

Hole Type
CP

Location: New Street

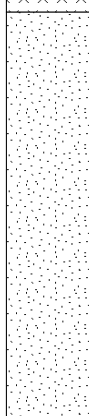
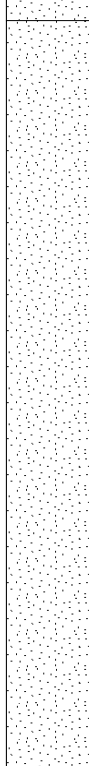
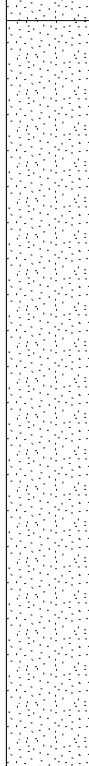
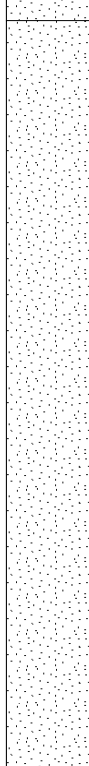
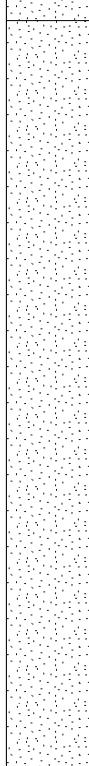
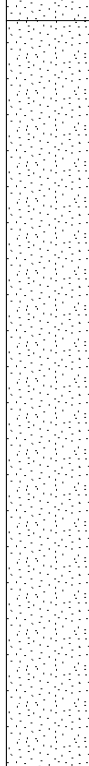
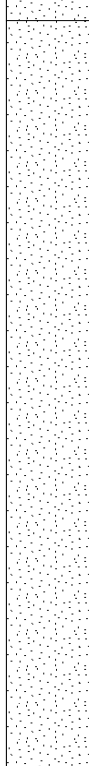
Level:

Scale
1:50

Client: Russell Homes

Dates: 15/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		11.00 11.00	D	N=19 (2,3/4,4,5,6)	12.20				11
		12.50 12.50	D	N=19 (2,3/3,5,5,6)				Medium dense grey fine to coarse SAND with bands of CLAY and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	12
		14.00 14.00	D	N=40 (25 for 30mm/21,7,6,6)	15.00				13
		15.50 15.50	D	N=18 (17, 11/6,4,4,4)				Medium dense grey fine to coarse SAND with bands of CLAY and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	14
		17.00 17.00	D	N=19 (2,2/4,4,5,6)					15
		18.50 18.50	D	N=23 (3,4/5,6,6,6)					16
		20.00	D						17
									18
								Continued on next sheet	19
									20

Remarks

1. Complete. 2. Water strike encountered at 1.50 m bgl through granular deposits. 3. Chiselling from 14.00 m bgl to 14.20 m bgl for 45 minutes. 4. Chiselling from 15.30 m bgl to 15.70 m bgl for 1 hour.





Borehole Log

Borehole No.

CP104

Sheet 3 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392697.00 - 415767.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 15/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.00		N=40 (35 for 70mm/21,7,6,6)	20.37			End of borehole at 20.37 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Complete. 2. Water strike encountered at 1.50 m bgl through granular deposits. 3. Chiselling from 14.00 m bgl to 14.20 m bgl for 45 minutes. 4. Chiselling from 15.30 m bgl to 15.70 m bgl for 1 hour.



Borehole Log

Borehole No.

CP105

Sheet 1 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392566.00 - 415778.00

Hole Type
CP

Location: New Street

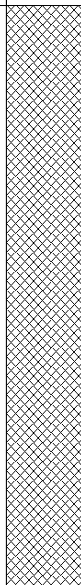
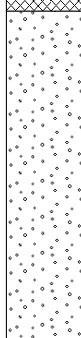
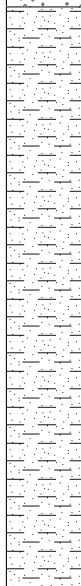
Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	D					MADE GROUND: Dark brown gravelly clay. Gravel is fine to coarse angular of brick and concrete.	
		1.00 1.00	D	N=6 (1,1/2,2,1,1)					1
		2.00 2.00	D	N=4 (1,1/1,1,1,1)					2
		3.00 3.00	D	N=5 (1,2/1,1,2,1)				Medium dense brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	3
		4.00 4.00	D	N=15 (2,3/3,4,4,4)	3.90				4
		5.00 5.00	D	N=23 (3,4/5,5,6,7)					5
		6.50 6.50	D	N=19 (2,3/4,4,5,6)	6.10			Firm brown sandy boulder CLAY.	6
		8.00 8.00	D	N=20 (2,3/4,5,5,6)					7
		9.50 9.50	D	N=22 (2,4/5,5,6,6)					8
								Continued on next sheet	9
									10

Remarks

1. Complete. 2. Water strike encountered at 3.90 m bgl through granular deposits. 3. Chiselling from 0.50 m bgl to 0.80 m bgl for 30 minutes. 4. Chiselling from 11.90 m bgl to 12.10 m bgl for 1 hour. 5. Chiselling from 18.50 m bgl to 20.00 m gl for 1.5 hours.



Borehole Log

Borehole No.

CP105

Sheet 2 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392566.00 - 415778.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.40				
		11.00 11.00	D	N=26 (3,4/6,6,7,7)				Medium dense brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	11
									12
		12.50 12.50	D	N=28 (3,4/6,7,7,8)				Medium dense brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	13
					13.00				14
		14.00 14.00	D	N=29 (4,5/6,7,7,9)					15
									16
		15.50 15.50	D	N=31 (4,5/7,7,8,9)					17
		17.00 17.00	D	N=36 (5,6/8,9,9,10)					18
		18.50 18.50	D	N=47 (6,9/10,11,12,14)					19
		20.00	D						20

Continued on next sheet

Remarks

1. Complete. 2. Water strike encountered at 3.90 m bgl through granular deposits. 3. Chiselling from 0.50 m bgl to 0.80 m bgl for 30 minutes. 4. Chiselling from 11.90 m bgl to 12.10 m bgl for 1 hour. 5. Chiselling from 18.50 m bgl to 20.00 m bgl for 1.5 hours.





Borehole Log

Borehole No.

CP105

Sheet 3 of 3

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392566.00 - 415778.00

Hole Type
CP

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		20.00		50 (6,10/50 for 265mm)	20.41			End of borehole at 20.41 m	21
									22
									23
									24
									25
									26
									27
									28
									29
									30

Remarks

1. Complete. 2. Water strike encountered at 3.90 m bgl through granular deposits. 3. Chiselling from 0.50 m bgl to 0.80 m bgl for 30 minutes. 4. Chiselling from 11.90 m bgl to 12.10 m bgl for 1 hour. 5. Chiselling from 18.50 m bgl to 20.00 m bgl for 1.5 hours.





Borehole Log

Borehole No.

RB101

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392652.00 - 415761.00

Hole Type
BH

Location: New Street

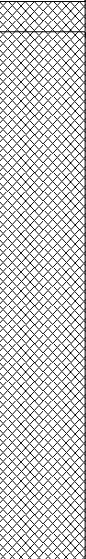
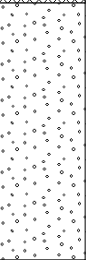
Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (Reworked Topsoil) MADE GROUND: Black gravelly clay. Gravel is fine to coarse angular of ash and brick.	1
					3.70			Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	4
					5.40			Light grey boulder CLAY.	6
								Continued on next sheet	10

Remarks

1. Complete.





Borehole Log

Borehole No.

RB101

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392652.00 - 415761.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB101

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392652.00 - 415761.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.30				21
								Dense light brown fine to coarse SAND with bands of GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	22
									23
									24
									25
									26
									27
									28
									29
									30

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB101

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392652.00 - 415761.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					35.20				31
									32
									33
									34
									35
								Light grey MUDSTONE.	36
									37
									38
									39
									40

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB103

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392613.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.20			MADE GROUND: Black gravelly clay. Gravel is fine to coarse angular of ash and brick.	1
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	2
									3
									4
									5
									6
									7
									8
					8.70			Light brown fine to coarse SAND with bands of CLAY.	9
									10

Continued on next sheet

Remarks
1. Complete.





Borehole Log

Borehole No.

RB103

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392613.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					20.30			Brown CLAY.	21
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	29
					28.60				30

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB103

Sheet 5 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392613.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					41.20			Grey SANDSTONE.	41
								Grey MUDSTONE with occasional bands of dark grey MUDSTONE.	42
					49.00			Grey SANDSTONE with bands of MUDSTONE.	43
									44
									45
									46
									47
									48
									49
									50

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB103

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392613.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					55.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.





Borehole Log

Borehole No.

RB104

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392564.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.90			MADE GROUND: Black gravelly clay. Gravel is fine to coarse angular of ash and brick.	1
								Brown CLAY.	2
					3.60			Grey silty fine to coarse SAND.	4
									5
									6
									7
									8
									9
					9.90				10

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB104

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392564.00 - 415727.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Brown fine to coarse SAND and GRAVEL with bands of CLAY. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	11
									12
									13
									14
									15
									16
					16.40			Grey MUDSTONE. Brown CLAY.	17
									18
									19
									20

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB104

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392564.00 - 415727.00

Hole Type
BH

Location: New Street

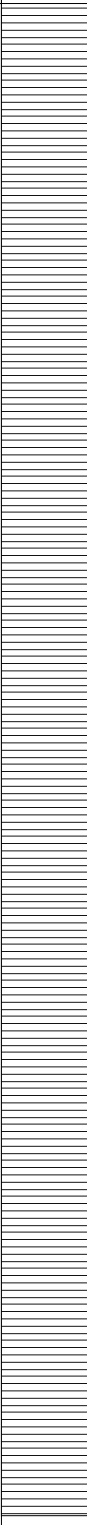
Level:

Scale
1:50

Client: Russell Homes

Dates: 21/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					31.00				
	</								

Remarks

1. Complete.







Borehole Log

Borehole No.

RB105

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					1.00			MADE GROUND: Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (Reworked Topsoil)	
								Brown clayey fine to coarse SAND.	1
									2
									3
									4
					4.80			Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB105

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					13.30				11
									12
									13
								Brown CLAY.	14
									15
									16
					17.00				17
								Brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	18
									19
									20

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB105

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					24.00			Brown fine to coarse SAND with bands of CLAY.	21 22 23 24 25 26 27 28 29 30
								Continued on next sheet	

Remarks

1. Complete.



Borehole Log

Borehole No.

RB105

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					30.60				
								Brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	31
									32
					33.10			Grey MUDSTONE.	33
									34
									35
									36
					37.00			Grey SANDSTONE.	37
									38
					38.60			Dark greyish black MUDSTONE.	39
									40

Continued on next sheet

Remarks
1. Complete.



Borehole Log

Borehole No.

RB105

Sheet 5 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

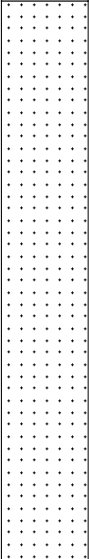
Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description										
		Depth (m)	Type	Results														
					40.10			Grey MUDSTONE with bands of dark grey MUDSTONE.	41									
					42													
					43													
					44													
					45													
					46													
									Grey SANDSTONE with bands of MUDSTONE.	47								
										48								
										49								
										50								
										Continued on next sheet								



Borehole Log

Borehole No.

RB105

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392567.00 - 415810.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					54.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.





Borehole Log

Borehole No.

RB106

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392579.00 - 415860.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.80			MADE GROUND: Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (Reworked Topsoil)	
								Brown sandy CLAY.	1
									2
									3
									4
									5
									6
									7
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	8
									9
									10

Continued on next sheet

Remarks

1. Complete.



Borehole Log

Borehole No.

RB106

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392579.00 - 415860.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.30				11
								Brown CLAY.	12
					15.10				13
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	14
					17.00				15
								Brown CLAY.	16
					19.80				17
								Brown GRAVEL. Gravel is fine to coarse	18
								Continued on next sheet	19
									20

Remarks

1. Complete.



Borehole Log

Borehole No.

RB106

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392579.00 - 415860.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					24.60			subrounded to subangular of mudstone and sandstone.	21
									22
									23
									24
								Brown fine to coarse SAND and GRAVEL with bands of CLAY. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	25
									26
									27
									28
									29
									30

Continued on next sheet

Remarks

1. Complete.



Borehole Log

Borehole No.

RB106

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392579.00 - 415860.00

Hole Type
BH

Location: New Street

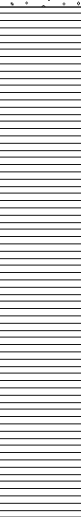
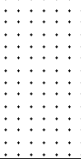
Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					31.00				31
								Brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	32
					33.80			Grey MUDSTONE with bands of dark grey MUDSTONE.	34
									35
					37.30			Dark greyish black MUDSTONE.	36
									37
					38.90			Grey SANDSTONE with bands of MUDSTONE.	38
									39
								Continued on next sheet	40

Remarks

1. Complete.





Borehole Log

Borehole No.

RB106

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392579.00 - 415860.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					54.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.60			MADE GROUND: Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (Reworked Topsoil)	
								Brown CLAY with bands of GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.50				
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	11
									12
									13
									14
									15
									16
									17
									18
									19
					19.60			Brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and	20
								Continued on next sheet	

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								sandstone.	21
									22
									23
									24
									25
					26.00			Brown fine to coarse SAND and CLAY.	26
									27
									28
									29
									30

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					31.00				31
								Brown GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	32
					34.30				33
								Grey MUDSTONE.	34
									35
					37.20			Dark greyish black MUDSTONE.	36
									37
									38
					39.60			Grey MUDSTONE.	39
									40

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 5 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					43.00				41
									42
									43
									44
									45
									46
									47
									48
									49
									50

Grey SANDSTONE with bands of dark grey MUDSTONE.

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB107

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392614.00 - 415830.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					54.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.





Borehole Log

Borehole No.

RB108

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415813.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					2.10			MADE GROUND: Black gravelly clay. Gravel is fine to coarse angular of brick.	1
								Brown fine to coarse SAND and CLAY.	2
									3
									4
									5
									6
					7.30			Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	7
									8
									9
									10

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB108

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415813.00

Hole Type
BH

Location: New Street

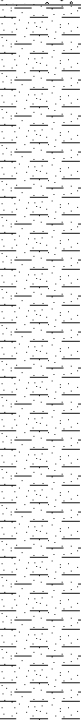
Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.00				11
								Brown fine to coarse SAND and CLAY.	12
									13
									14
									15
					16.80			Brown fine to coarse SAND.	17
									18
									19
									20

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB108

Sheet 3 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415813.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					21.20				21
								Brown fine to coarse SAND and GRAVEL. Gravel is fine to coarse subrounded to subangular of mudstone and sandstone.	22
									23
									24
									25
									26
									27
									28
									29
									30

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB108

Sheet 5 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415813.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					40.20			Grey SANDSTONE with bands of MUDSTONE.	41
									42
									43
									44
					47.20			Grey MUDSTONE with bands of dark greyish black MUDSTONE.	47
									48
					49.30			Grey SANDSTONE with bands of MUDSTONE.	49
									50

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB108

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392672.00 - 415813.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 23/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					55.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.





Borehole Log

Borehole No.

RB109

Sheet 1 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392709.00 - 415771.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Brown slightly gravelly sandy CLAY with frequent rootlets. Gravel is fine to coarse subangular to subrounded of mudstone and sandstone. (Reworked Topsoil) MADE GROUND: Black gravelly clay. Gravel is fine to coarse angular of ash and brick.	1
					1.40			Light grey SILT.	2
									3
									4
									5
									6
									7
									8
									9
									10

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB109

Sheet 2 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392709.00 - 415771.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					12.30				11
								Light grey silty CLAY.	12
									13
									14
									15
									16
									17
									18
									19
									20

Continued on next sheet

Remarks

1. Complete.







Borehole Log

Borehole No.

RB109

Sheet 4 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392709.00 - 415771.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					34.70				31
									32
									33
									34
									35
									36
									37
									38
									39
									40

Light grey MUDSTONE.

Continued on next sheet

Remarks

1. Complete.





Borehole Log

Borehole No.

RB109

Sheet 5 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392709.00 - 415771.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					42.20			Light grey MUDSTONE with bands of dark grey SANDSTONE.	41 42 43 44 45 46 47 48 49 50
Continued on next sheet									

Remarks

1. Complete.





Borehole Log

Borehole No.

RB109

Sheet 6 of 6

Project Name: Littleborough Phase 3

Project No.
15075

Co-ords: 392709.00 - 415771.00

Hole Type
BH

Location: New Street

Level:

Scale
1:50

Client: Russell Homes

Dates: 22/11/2022 -

Logged By
A.Rae

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					55.00				51
									52
									53
									54
									55
									56
									57
									58
									59
									60

Remarks

1. Complete.



APPENDIX VI

CHEMICAL TESTING

RESULTS

April Rae
e3p
Taylor Road
Urmston
Manchester
M41 7JQ

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

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

e: arae@e3p.co.uk

Analytical Report Number : 22-96619

Project / Site name:	Littleborough Phase 3	Samples received on:	10/11/2022
Your job number:	15-075	Samples instructed on/ Analysis started on:	15/11/2022
Your order number:	003463	Analysis completed by:	05/12/2022
Report Issue Number:	1	Report issued on:	05/12/2022
Samples Analysed:	3 leachate samples - 21 soil samples		


Signed:

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

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

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

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

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

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

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

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number	2499240	2499241	2499242	2499243	2499244
Sample Reference	TP101	TP102	TP102	TP107	TP107
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	2.50	1.00	1.20	1.00	2.40
Date Sampled	08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	29
Moisture Content	%	0.01	NONE	8.2	12
Total mass of sample received	kg	0.001	NONE	0.3	0.3

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.9	-	7.2	8.8	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	670	-	64	750	81
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.15	-	0.0043	0.2	0.011
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	300	-	8.5	390	22
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	152	-	4.3	195	10.9
Sulphide	mg/kg	1	NONE	1800	-	13	110	7.5
Total Sulphur	mg/kg	50	MCERTS	2300	-	58	1200	150
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.7	-	0.5	1.2	0.7

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	18	5.4	0.06	3.9	0.09
Acenaphthylene	mg/kg	0.05	NONE	2.8	< 0.05	< 0.05	0.14	< 0.05
Acenaphthene	mg/kg	0.05	NONE	31	2.4	< 0.05	3.1	< 0.05
Fluorene	mg/kg	0.05	NONE	50	2.7	< 0.05	4	< 0.05
Phenanthrene	mg/kg	0.05	NONE	210	6.7	< 0.05	20	0.08
Anthracene	mg/kg	0.05	NONE	77	1.7	< 0.05	6.4	< 0.05
Fluoranthene	mg/kg	0.05	NONE	160	7.5	< 0.05	12	0.1
Pyrene	mg/kg	0.05	NONE	120	6.4	< 0.05	9.3	0.1
Benzo(a)anthracene	mg/kg	0.05	NONE	60	2.9	< 0.05	4.2	< 0.05
Chrysene	mg/kg	0.05	NONE	51	3.1	< 0.05	4.2	0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	38	2.4	< 0.05	3.4	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	25	1.8	< 0.05	1.7	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	38	2.6	< 0.05	2.9	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	15	1.2	< 0.05	1.6	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	4.3	0.2	< 0.05	0.38	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	15	1.3	< 0.05	1.5	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	910	48.2	< 0.80	78.5	< 0.80
-----------------------------	-------	-----	------	-----	------	--------	------	--------

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number	2499240	2499241	2499242	2499243	2499244
Sample Reference	TP101	TP102	TP102	TP107	TP107
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	2.50	1.00	1.20	1.00	2.40
Date Sampled	08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.1	9.6	7.8	8.6	5.9
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	230	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.95	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.2	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.4	< 0.2	0.5	< 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	27	-	23	32	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	38	31	11	130	27
Lead (aqua regia extractable)	mg/kg	1	MCERTS	36	75	11	180	18
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	19	25	16	42	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	-	24	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	54	91	35	170	48

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	NONE	18	< 2.0	< 2.0	2.2	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	NONE	200	12	< 4.0	16	< 4.0
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	NONE	590	26	< 1.0	42	< 1.0
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	NONE	390	44	< 1.0	110	< 1.0
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	56	< 10	< 10	32	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	1300	81	< 10	200	< 10

VOCs

Chloromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Bromomethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trichloromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Benzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Tetrachloromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trichloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Dibromomethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Bromodichloromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Toluene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499240	2499241	2499242	2499243	2499244
Sample Reference				TP101	TP102	TP102	TP107	TP107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.50	1.00	1.20	1.00	2.40
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,1,2-Trichloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Dibromochloromethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Chlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
p & m-Xylene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Styrene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
o-Xylene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Isopropylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Bromobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
n-Propylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
p-Isopropyltoluene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	< 1.0	-

SVOCs

Aniline	mg/kg	0.1	NONE	3.6	-	-	0.2	-
Phenol	mg/kg	0.2	NONE	3.6	-	-	0.3	-
2-Chlorophenol	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	0.9	-	-	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
2-Methylphenol	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Hexachloroethane	mg/kg	0.05	NONE	< 0.05	-	-	< 0.05	-
Nitrobenzene	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	2.6	-	-	0.2	-
Isophorone	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	1.5	-	-	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Naphthalene	mg/kg	0.05	NONE	54	-	-	3.9	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499240	2499241	2499242	2499243	2499244
Sample Reference				TP101	TP102	TP102	TP107	TP107
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.50	1.00	1.20	1.00	2.40
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	< 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	45	-	-	2.6	-
2-Chloronaphthalene	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
Dimethylphthalate	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
Acenaphthylene	mg/kg	0.05	NONE	2.6	-	-	0.14	-
Acenaphthene	mg/kg	0.05	NONE	72	-	-	3.1	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
Dibenzofuran	mg/kg	0.2	NONE	77	-	-	3.7	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Diethyl phthalate	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
4-Nitroaniline	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
Fluorene	mg/kg	0.05	NONE	110	-	-	4	-
Azobenzene	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	< 0.2	-	-	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Phenanthrene	mg/kg	0.05	NONE	380	-	-	20	-
Anthracene	mg/kg	0.05	NONE	130	-	-	6.4	-
Carbazole	mg/kg	0.3	NONE	23	-	-	1.1	-
Dibutyl phthalate	mg/kg	0.2	NONE	< 0.2	-	-	0.2	-
Anthraquinone	mg/kg	0.3	NONE	16	-	-	0.9	-
Fluoranthene	mg/kg	0.05	NONE	270	-	-	12	-
Pyrene	mg/kg	0.05	NONE	190	-	-	9.3	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	< 0.3	-	-	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	NONE	98	-	-	4.2	-
Chrysene	mg/kg	0.05	NONE	78	-	-	4.2	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	99	-	-	3.4	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	110	-	-	1.7	-
Benzo(a)pyrene	mg/kg	0.05	NONE	59	-	-	2.9	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	25	-	-	1.6	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	7.1	-	-	0.38	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	24	-	-	1.5	-

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

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499245	2499246	2499247	2499248	2499249
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40	2.80	1.60	0.20	1.50
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	14	19	17	14
Total mass of sample received	kg	0.001	NONE	0.8	0.3	0.3	0.3	0.3

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	-	-	6.2	7.5
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	430	-	-	580	150
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.11	-	-	0.0063	0.029
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	230	-	-	13	59
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	114	-	-	6.3	29.4
Sulphide	mg/kg	1	NONE	70	-	-	1.3	4.6
Total Sulphur	mg/kg	50	MCERTS	1200	-	-	390	120
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.5	-	-	3.7	0.6

Total Phenols

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

Naphthalene	mg/kg	0.05	NONE	0.29	0.62	0.16	0.22	0.06
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	NONE	0.58	0.43	< 0.05	0.14	< 0.05
Fluorene	mg/kg	0.05	NONE	0.47	0.43	< 0.05	0.1	< 0.05
Phenanthrene	mg/kg	0.05	NONE	3.1	1.8	0.08	1.2	0.05
Anthracene	mg/kg	0.05	NONE	0.91	0.59	< 0.05	0.23	< 0.05
Fluoranthene	mg/kg	0.05	NONE	5.3	3.2	0.1	2.2	0.14
Pyrene	mg/kg	0.05	NONE	4.7	2.8	0.11	2	0.15
Benzo(a)anthracene	mg/kg	0.05	NONE	1.7	1.3	0.06	1.3	0.05
Chrysene	mg/kg	0.05	NONE	2.2	1.4	0.06	1.1	0.12
Benzo(b)fluoranthene	mg/kg	0.05	NONE	2.1	1.1	< 0.05	1.5	0.07
Benzo(k)fluoranthene	mg/kg	0.05	NONE	1.2	0.81	0.06	0.63	0.06
Benzo(a)pyrene	mg/kg	0.05	NONE	2	1.1	< 0.05	1.1	0.06
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	0.97	0.46	< 0.05	0.63	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	0.22	< 0.05	< 0.05	0.15	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	1.2	0.6	< 0.05	0.68	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	26.8	16.7	< 0.80	13.3	< 0.80
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Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499245	2499246	2499247	2499248	2499249
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40	2.80	1.60	0.20	1.50
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	8.4	12	24	10
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	210	110	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.85	0.77	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	0.3	0.6	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	0.3	< 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	39	-	-	21	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	210	29	35	43	20
Lead (aqua regia extractable)	mg/kg	1	MCERTS	140	50	34	130	23
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.5	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	23	18	23	17
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	-	24	27	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	70	76	89	47

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	NONE	5.5	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	NONE	26	14	< 1.0	6.3	< 1.0
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	NONE	56	45	< 1.0	12	< 1.0
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	87	59	< 10	18	< 10

VOCs

Chloromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Chloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Bromomethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	< 1.0	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1-Dichloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
2,2-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	-	-
Trichloromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dichloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1-Dichloropropene	µg/kg	1	NONE	< 1.0	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
Benzene	µg/kg	1	NONE	< 1.0	-	-	-	-
Tetrachloromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	-	-
Trichloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
Dibromomethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Bromodichloromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	< 1.0	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	< 1.0	-	-	-	-
Toluene	µg/kg	1	NONE	< 1.0	-	-	-	-

Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499245	2499246	2499247	2499248	2499249
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40	2.80	1.60	0.20	1.50
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,1,2-Trichloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,3-Dichloropropane	µg/kg	1	NONE	< 1.0	-	-	-	-
Dibromochloromethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dibromoethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Chlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Ethylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
p & m-Xylene	µg/kg	1	NONE	< 1.0	-	-	-	-
Styrene	µg/kg	1	NONE	< 1.0	-	-	-	-
Tribromomethane	µg/kg	1	NONE	< 1.0	-	-	-	-
o-Xylene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	< 1.0	-	-	-	-
Isopropylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
Bromobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
n-Propylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
2-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	-	-
4-Chlorotoluene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
tert-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
sec-Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
p-Isopropyltoluene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
Butylbenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-
Hexachlorobutadiene	µg/kg	1	NONE	< 1.0	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	< 1.0	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	0.2	-	-	-	-
Phenol	mg/kg	0.2	NONE	< 0.2	-	-	-	-
2-Chlorophenol	mg/kg	0.1	NONE	< 0.1	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	< 0.2	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	0.2	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	< 0.1	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2-Methylphenol	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Hexachloroethane	mg/kg	0.05	NONE	< 0.05	-	-	-	-
Nitrobenzene	mg/kg	0.3	NONE	< 0.3	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Isophorone	mg/kg	0.2	NONE	< 0.2	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	< 0.3	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	< 0.3	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Naphthalene	mg/kg	0.05	NONE	0.29	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	< 0.3	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	-	-	-	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499245	2499246	2499247	2499248	2499249
Sample Reference				TP109	TP110	TP111	TP112	TP113
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.40	2.80	1.60	0.20	1.50
Date Sampled				08/11/2022	08/11/2022	08/11/2022	08/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	< 0.1	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	0.2	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	NONE	< 0.1	-	-	-	-
Dimethylphthalate	mg/kg	0.1	NONE	< 0.1	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	< 0.1	-	-	-	-
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	-	-	-	-
Acenaphthene	mg/kg	0.05	NONE	0.58	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Dibenzofuran	mg/kg	0.2	NONE	< 0.2	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Diethyl phthalate	mg/kg	0.2	NONE	< 0.2	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Fluorene	mg/kg	0.05	NONE	0.47	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Phenanthrene	mg/kg	0.05	NONE	3.1	-	-	-	-
Anthracene	mg/kg	0.05	NONE	0.91	-	-	-	-
Carbazole	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	< 0.2	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Fluoranthene	mg/kg	0.05	NONE	5.3	-	-	-	-
Pyrene	mg/kg	0.05	NONE	4.7	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	< 0.3	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	1.7	-	-	-	-
Chrysene	mg/kg	0.05	NONE	2.2	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	2.1	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	1.2	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	2	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	0.97	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	0.22	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	1.2	-	-	-	-

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

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499250	2499251	2499252	2499253	2499254
Sample Reference				TP114	TP115	TP118	TP119	TP124
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.40	0.10	0.80	0.90
Date Sampled				08/11/2022	08/11/2022	09/11/2022	09/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	22
Moisture Content	%	0.01	NONE	37	31	10	38	12
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7	6.3	5.8	6.3	-
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	580	490	580	370	-
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.14	0.033	0.016	0.055	-
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	280	66	32	110	-
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	141	33.2	16.1	54.5	-
Sulphide	mg/kg	1	NONE	6.5	4.2	1.5	12	-
Total Sulphur	mg/kg	50	MCERTS	870	390	240	1100	-
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	4.6	2.7	3.4	6.1	-

Total Phenols

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

Naphthalene	mg/kg	0.05	NONE	0.19	0.27	0.2	2.9	0.33
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.05	< 0.05	0.33
Acenaphthene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.22	0.06	0.38
Fluorene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.2	0.12	0.57
Phenanthrene	mg/kg	0.05	NONE	< 0.05	0.13	1.7	0.15	5.8
Anthracene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.33	< 0.05	1.4
Fluoranthene	mg/kg	0.05	NONE	< 0.05	0.41	2.7	0.22	11
Pyrene	mg/kg	0.05	NONE	< 0.05	0.39	2.5	0.2	10
Benzo(a)anthracene	mg/kg	0.05	NONE	< 0.05	0.21	1.2	0.1	3.7
Chrysene	mg/kg	0.05	NONE	< 0.05	0.24	1.5	0.12	4.2
Benzo(b)fluoranthene	mg/kg	0.05	NONE	< 0.05	0.16	1.7	0.11	3.5
Benzo(k)fluoranthene	mg/kg	0.05	NONE	< 0.05	0.23	0.67	0.07	2.5
Benzo(a)pyrene	mg/kg	0.05	NONE	< 0.05	0.14	1.2	0.11	4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	< 0.05	0.08	0.74	< 0.05	1.8
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.15	< 0.05	0.3
Benzo(ghi)perylene	mg/kg	0.05	NONE	< 0.05	0.11	0.9	< 0.05	2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	< 0.80	2.37	16	4.2	51.7
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Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499250	2499251	2499252	2499253	2499254
Sample Reference				TP114	TP115	TP118	TP119	TP124
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.40	0.10	0.80	0.90
Date Sampled				08/11/2022	08/11/2022	09/11/2022	09/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	2	13	27	5.7	11
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	-	130
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	-	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	-	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	< 0.2	< 0.2	0.4	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	3.5	< 1.8	2.2	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16	32	19	17	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14	30	43	26	76
Lead (aqua regia extractable)	mg/kg	1	MCERTS	14	41	120	20	120
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.7	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	8.2	26	19	16	30
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	-	-	-	-	33
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	16	78	79	51	82

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	3	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	NONE	< 4.0	< 4.0	< 4.0	< 4.0	7.1
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	NONE	1.9	< 1.0	15	< 1.0	29
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	NONE	24	< 1.0	35	28	76
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	27
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	26	< 10	50	31	140

VOCs

Chloromethane	µg/kg	1	NONE	-	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-	-
Bromomethane	µg/kg	1	NONE	-	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	-	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloroethane	µg/kg	1	NONE	-	-	-	-	-
2,2-Dichloropropane	µg/kg	1	NONE	-	-	-	-	-
Trichloromethane	µg/kg	1	NONE	-	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	NONE	-	-	-	-	-
1,2-Dichloroethane	µg/kg	1	NONE	-	-	-	-	-
1,1-Dichloropropene	µg/kg	1	NONE	-	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-	-
Benzene	µg/kg	1	NONE	-	-	-	-	-
Tetrachloromethane	µg/kg	1	NONE	-	-	-	-	-
1,2-Dichloropropane	µg/kg	1	NONE	-	-	-	-	-
Trichloroethene	µg/kg	1	NONE	-	-	-	-	-
Dibromomethane	µg/kg	1	NONE	-	-	-	-	-
Bromodichloromethane	µg/kg	1	NONE	-	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	-	-
Toluene	µg/kg	1	NONE	-	-	-	-	-

Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499250	2499251	2499252	2499253	2499254
Sample Reference				TP114	TP115	TP118	TP119	TP124
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.40	0.10	0.80	0.90
Date Sampled				08/11/2022	08/11/2022	09/11/2022	09/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,1,2-Trichloroethane	µg/kg	1	NONE	-	-	-	-	-
1,3-Dichloropropane	µg/kg	1	NONE	-	-	-	-	-
Dibromochloromethane	µg/kg	1	NONE	-	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dibromoethane	µg/kg	1	NONE	-	-	-	-	-
Chlorobenzene	µg/kg	1	NONE	-	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	-	-
Ethylbenzene	µg/kg	1	NONE	-	-	-	-	-
p & m-Xylene	µg/kg	1	NONE	-	-	-	-	-
Styrene	µg/kg	1	NONE	-	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-	-
o-Xylene	µg/kg	1	NONE	-	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	-	-
Isopropylbenzene	µg/kg	1	NONE	-	-	-	-	-
Bromobenzene	µg/kg	1	NONE	-	-	-	-	-
n-Propylbenzene	µg/kg	1	NONE	-	-	-	-	-
2-Chlorotoluene	µg/kg	1	NONE	-	-	-	-	-
4-Chlorotoluene	µg/kg	1	NONE	-	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	-	-	-	-	-
tert-Butylbenzene	µg/kg	1	NONE	-	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	-	-	-	-	-
sec-Butylbenzene	µg/kg	1	NONE	-	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-	-
p-Isopropyltoluene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-	-
Butylbenzene	µg/kg	1	NONE	-	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	-	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	-	-	-	-	-
Hexachlorobutadiene	µg/kg	1	NONE	-	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	-	-	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	-	-
Phenol	mg/kg	0.2	NONE	-	-	-	-	-
2-Chlorophenol	mg/kg	0.1	NONE	-	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-	-	-	-
2-Methylphenol	mg/kg	0.3	NONE	-	-	-	-	-
Hexachloroethane	mg/kg	0.05	NONE	-	-	-	-	-
Nitrobenzene	mg/kg	0.3	NONE	-	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-	-
Isophorone	mg/kg	0.2	NONE	-	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Naphthalene	mg/kg	0.05	NONE	-	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-	-

Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499250	2499251	2499252	2499253	2499254
Sample Reference				TP114	TP115	TP118	TP119	TP124
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.40	0.10	0.80	0.90
Date Sampled				08/11/2022	08/11/2022	09/11/2022	09/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-	-	-	-
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	NONE	-	-	-	-	-
Dimethylphthalate	mg/kg	0.1	NONE	-	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-	-
Acenaphthylene	mg/kg	0.05	NONE	-	-	-	-	-
Acenaphthene	mg/kg	0.05	NONE	-	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-	-
Dibenzofuran	mg/kg	0.2	NONE	-	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-	-	-	-
Diethyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-	-
Fluorene	mg/kg	0.05	NONE	-	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	-	-	-	-
Phenanthrene	mg/kg	0.05	NONE	-	-	-	-	-
Anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Carbazole	mg/kg	0.3	NONE	-	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-	-
Fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Chrysene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	-	-	-

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

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number	2499255	2499256	2499257	2499258	2499259
Sample Reference	TP125 WEST	TP127	WS101	WS104	WS109
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.60	0.40	3.50	0.50	0.20
Date Sampled	09/11/2022	09/11/2022	08/11/2022	08/11/2022	09/11/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	25	15
Total mass of sample received	kg	0.001	NONE	0.3	0.3

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

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.5	6.5	7.8	-	6
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	140	420	68	-	610
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.022	0.04	0.012	-	0.0099
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	44	79	23	-	20
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	21.8	39.6	11.7	-	9.9
Sulphide	mg/kg	1	NONE	39	23	7.6	-	5.5
Total Sulphur	mg/kg	50	MCERTS	480	490	150	-	450
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.4	2.2	1.1	-	4.7

Total Phenols

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

Naphthalene	mg/kg	0.05	NONE	0.08	8.3	0.25	0.25	0.3
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	0.29	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	NONE	< 0.05	11	< 0.05	0.47	0.37
Fluorene	mg/kg	0.05	NONE	< 0.05	8.6	< 0.05	0.35	0.25
Phenanthrene	mg/kg	0.05	NONE	0.09	49	0.15	3.7	2.6
Anthracene	mg/kg	0.05	NONE	< 0.05	8.9	< 0.05	0.91	0.47
Fluoranthene	mg/kg	0.05	NONE	0.26	53	0.19	5.8	4.2
Pyrene	mg/kg	0.05	NONE	0.28	44	0.19	5.1	3.7
Benzo(a)anthracene	mg/kg	0.05	NONE	0.16	26	0.07	2	2.1
Chrysene	mg/kg	0.05	NONE	0.17	25	0.16	2.4	1.7
Benzo(b)fluoranthene	mg/kg	0.05	NONE	0.18	27	< 0.05	1.8	2.2
Benzo(k)fluoranthene	mg/kg	0.05	NONE	0.19	9.6	0.11	1.3	1.1
Benzo(a)pyrene	mg/kg	0.05	NONE	0.17	21	0.06	1.9	1.6
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	0.09	11	< 0.05	0.84	0.99
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	< 0.05	3	< 0.05	0.12	0.27
Benzo(ghi)perylene	mg/kg	0.05	NONE	0.12	12	< 0.05	0.94	1.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	1.79	317	1.18	27.8	23
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Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499255	2499256	2499257	2499258	2499259
Sample Reference				TP125 WEST	TP127	WS101	WS104	WS109
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.40	3.50	0.50	0.20
Date Sampled				09/11/2022	09/11/2022	08/11/2022	08/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.7	24	2.7	4.8	30
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	120	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	-	0.67	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	-	< 0.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.2	0.7
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	2.9
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	34	21	-	23
Copper (aqua regia extractable)	mg/kg	1	MCERTS	18	250	25	17	50
Lead (aqua regia extractable)	mg/kg	1	MCERTS	15	150	17	28	160
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	84	18	19	20
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	-	-	-	20	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	41	63	42	44	100

Petroleum Hydrocarbons

TPH (C5 - C6) HS_ID_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) HS_ID_TOTAL	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) EH_CU_ID_TOTAL	mg/kg	2	NONE	< 2.0	4.2	< 2.0	3.8	< 2.0
TPH (C12 - C16) EH_CU_ID_TOTAL	mg/kg	4	NONE	< 4.0	33	< 4.0	9.2	< 4.0
TPH (C16 - C21) EH_CU_ID_TOTAL	mg/kg	1	NONE	< 1.0	130	< 1.0	17	9.3
TPH (C21 - C35) EH_CU_ID_TOTAL	mg/kg	1	NONE	< 1.0	220	< 1.0	29	17
TPH (C35 - C40) EH_CU_ID_TOTAL	mg/kg	10	NONE	< 10	23	< 10	< 10	< 10
TPH Total C5 - C40 EH_CU+HS_ID_TOTAL	mg/kg	10	NONE	< 10	410	< 10	59	26

VOCs

Chloromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Chloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Bromomethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	< 1.0	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	-	< 1.0	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1-Dichloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
2,2-Dichloropropane	µg/kg	1	NONE	-	< 1.0	-	-	-
Trichloromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1,1-Trichloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2-Dichloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1-Dichloropropene	µg/kg	1	NONE	-	< 1.0	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	< 1.0	-	-	-
Benzene	µg/kg	1	NONE	-	< 1.0	-	-	-
Tetrachloromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2-Dichloropropane	µg/kg	1	NONE	-	< 1.0	-	-	-
Trichloroethene	µg/kg	1	NONE	-	< 1.0	-	-	-
Dibromomethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Bromodichloromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	-	< 1.0	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	-	< 1.0	-	-	-
Toluene	µg/kg	1	NONE	-	< 1.0	-	-	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499255	2499256	2499257	2499258	2499259
Sample Reference				TP125 WEST	TP127	WS101	WS104	WS109
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.40	3.50	0.50	0.20
Date Sampled				09/11/2022	09/11/2022	08/11/2022	08/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
1,1,2-Trichloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,3-Dichloropropane	µg/kg	1	NONE	-	< 1.0	-	-	-
Dibromochloromethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2-Dibromoethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Chlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Ethylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
p & m-Xylene	µg/kg	1	NONE	-	< 1.0	-	-	-
Styrene	µg/kg	1	NONE	-	< 1.0	-	-	-
Tribromomethane	µg/kg	1	NONE	-	< 1.0	-	-	-
o-Xylene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	-	< 1.0	-	-	-
Isopropylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
Bromobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
n-Propylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
2-Chlorotoluene	µg/kg	1	NONE	-	< 1.0	-	-	-
4-Chlorotoluene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
tert-Butylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
sec-Butylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,3-Dichlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
p-Isopropyltoluene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2-Dichlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,4-Dichlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
Butylbenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-
Hexachlorobutadiene	µg/kg	1	NONE	-	< 1.0	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	-	< 1.0	-	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	0.2	-	-	-
Phenol	mg/kg	0.2	NONE	-	< 0.2	-	-	-
2-Chlorophenol	mg/kg	0.1	NONE	-	< 0.1	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	< 0.2	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	< 0.2	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	< 0.1	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	< 0.1	-	-	-
2-Methylphenol	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Hexachloroethane	mg/kg	0.05	NONE	-	< 0.05	-	-	-
Nitrobenzene	mg/kg	0.3	NONE	-	< 0.3	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	0.4	-	-	-
Isophorone	mg/kg	0.2	NONE	-	< 0.2	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	< 0.3	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	0.4	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	< 0.3	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Naphthalene	mg/kg	0.05	NONE	-	8.3	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	< 0.3	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	< 0.1	-	-	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number				2499255	2499256	2499257	2499258	2499259
Sample Reference				TP125 WEST	TP127	WS101	WS104	WS109
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.60	0.40	3.50	0.50	0.20
Date Sampled				09/11/2022	09/11/2022	08/11/2022	08/11/2022	09/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Hexachlorobutadiene	mg/kg	0.1	NONE	-	< 0.1	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	< 0.1	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	< 0.1	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	< 0.2	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	4.9	-	-	-
2-Chloronaphthalene	mg/kg	0.1	NONE	-	< 0.1	-	-	-
Dimethylphthalate	mg/kg	0.1	NONE	-	< 0.1	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	< 0.1	-	-	-
Acenaphthylene	mg/kg	0.05	NONE	-	0.29	-	-	-
Acenaphthene	mg/kg	0.05	NONE	-	11	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Dibenzofuran	mg/kg	0.2	NONE	-	5.3	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Diethyl phthalate	mg/kg	0.2	NONE	-	< 0.2	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Fluorene	mg/kg	0.05	NONE	-	8.6	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Phenanthrene	mg/kg	0.05	NONE	-	49	-	-	-
Anthracene	mg/kg	0.05	NONE	-	8.9	-	-	-
Carbazole	mg/kg	0.3	NONE	-	2.9	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	< 0.2	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	2.7	-	-	-
Fluoranthene	mg/kg	0.05	NONE	-	53	-	-	-
Pyrene	mg/kg	0.05	NONE	-	44	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	< 0.3	-	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	26	-	-	-
Chrysene	mg/kg	0.05	NONE	-	25	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	27	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	9.6	-	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	21	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	11	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	3	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	12	-	-	-

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

Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499260
Sample Reference				WS112
Sample Number				None Supplied
Depth (m)				1.50
Date Sampled				09/11/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	30
Moisture Content	%	0.01	NONE	10
Total mass of sample received	kg	0.001	NONE	0.3

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-
Asbestos in Soil	Type	N/A	ISO 17025	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-
Asbestos Quantification Total	%	0.001	ISO 17025	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	< 50
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.0031
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	6.1
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	3.1
Sulphide	mg/kg	1	NONE	4
Total Sulphur	mg/kg	50	MCERTS	< 50
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.4

Total Phenols

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

Naphthalene	mg/kg	0.05	NONE	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	< 0.05
Acenaphthene	mg/kg	0.05	NONE	< 0.05
Fluorene	mg/kg	0.05	NONE	< 0.05
Phenanthrene	mg/kg	0.05	NONE	< 0.05
Anthracene	mg/kg	0.05	NONE	< 0.05
Fluoranthene	mg/kg	0.05	NONE	< 0.05
Pyrene	mg/kg	0.05	NONE	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	< 0.05
Chrysene	mg/kg	0.05	NONE	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	< 0.80
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Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number				2499260
Sample Reference				WS112
Sample Number				None Supplied
Depth (m)				1.50
Date Sampled				09/11/2022
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	3.1
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-
Boron (water soluble)	mg/kg	0.2	MCERTS	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	17
Lead (aqua regia extractable)	mg/kg	1	MCERTS	8.2
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	39

Petroleum Hydrocarbons

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

VOCs

Chloromethane	µg/kg	1	NONE	-
Chloroethane	µg/kg	1	NONE	-
Bromomethane	µg/kg	1	NONE	-
Vinyl Chloride	µg/kg	1	NONE	-
Trichlorofluoromethane	µg/kg	1	NONE	-
1,1-Dichloroethene	µg/kg	1	NONE	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-
1,1-Dichloroethane	µg/kg	1	NONE	-
2,2-Dichloropropane	µg/kg	1	NONE	-
Trichloromethane	µg/kg	1	NONE	-
1,1,1-Trichloroethane	µg/kg	1	NONE	-
1,2-Dichloroethane	µg/kg	1	NONE	-
1,1-Dichloropropene	µg/kg	1	NONE	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-
Benzene	µg/kg	1	NONE	-
Tetrachloromethane	µg/kg	1	NONE	-
1,2-Dichloropropane	µg/kg	1	NONE	-
Trichloroethene	µg/kg	1	NONE	-
Dibromomethane	µg/kg	1	NONE	-
Bromodichloromethane	µg/kg	1	NONE	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	-
Toluene	µg/kg	1	NONE	-

Analytical Report Number: 22-96619
 Project / Site name: Littleborough Phase 3
 Your Order No: 003463

Lab Sample Number					2499260
Sample Reference					WS112
Sample Number					None Supplied
Depth (m)					1.50
Date Sampled					09/11/2022
Time Taken					None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
1,1,2-Trichloroethane	µg/kg	1	NONE	-	-
1,3-Dichloropropane	µg/kg	1	NONE	-	-
Dibromochloromethane	µg/kg	1	NONE	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-
1,2-Dibromoethane	µg/kg	1	NONE	-	-
Chlorobenzene	µg/kg	1	NONE	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	-	-
Ethylbenzene	µg/kg	1	NONE	-	-
p & m-Xylene	µg/kg	1	NONE	-	-
Styrene	µg/kg	1	NONE	-	-
Tribromomethane	µg/kg	1	NONE	-	-
o-Xylene	µg/kg	1	NONE	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	-	-
Isopropylbenzene	µg/kg	1	NONE	-	-
Bromobenzene	µg/kg	1	NONE	-	-
n-Propylbenzene	µg/kg	1	NONE	-	-
2-Chlorotoluene	µg/kg	1	NONE	-	-
4-Chlorotoluene	µg/kg	1	NONE	-	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	-	-
tert-Butylbenzene	µg/kg	1	NONE	-	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	-	-
sec-Butylbenzene	µg/kg	1	NONE	-	-
1,3-Dichlorobenzene	µg/kg	1	NONE	-	-
p-Isopropyltoluene	µg/kg	1	NONE	-	-
1,2-Dichlorobenzene	µg/kg	1	NONE	-	-
1,4-Dichlorobenzene	µg/kg	1	NONE	-	-
Butylbenzene	µg/kg	1	NONE	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	-	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	-	-
Hexachlorobutadiene	µg/kg	1	NONE	-	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	-	-

SVOCs

Aniline	mg/kg	0.1	NONE	-	-
Phenol	mg/kg	0.2	NONE	-	-
2-Chlorophenol	mg/kg	0.1	NONE	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-
2-Methylphenol	mg/kg	0.3	NONE	-	-
Hexachloroethane	mg/kg	0.05	NONE	-	-
Nitrobenzene	mg/kg	0.3	NONE	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-
Isophorone	mg/kg	0.2	NONE	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-
Naphthalene	mg/kg	0.05	NONE	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Lab Sample Number					2499260
Sample Reference					WS112
Sample Number					None Supplied
Depth (m)					1.50
Date Sampled					09/11/2022
Time Taken					None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-
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	NONE	-	-
Dimethylphthalate	mg/kg	0.1	NONE	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-
Acenaphthylene	mg/kg	0.05	NONE	-	-
Acenaphthene	mg/kg	0.05	NONE	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-
Dibenzofuran	mg/kg	0.2	NONE	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-
Diethyl phthalate	mg/kg	0.2	NONE	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-
Fluorene	mg/kg	0.05	NONE	-	-
Azobenzene	mg/kg	0.3	NONE	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	-
Phenanthrene	mg/kg	0.05	NONE	-	-
Anthracene	mg/kg	0.05	NONE	-	-
Carbazole	mg/kg	0.3	NONE	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-
Fluoranthene	mg/kg	0.05	NONE	-	-
Pyrene	mg/kg	0.05	NONE	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-
Chrysene	mg/kg	0.05	NONE	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-

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

Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3
Your Order No: 003463

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

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

Quantitative Analysis

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

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

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

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2499240	TP101	2.50	160	Loose Fibres	Amosite	< 0.001	< 0.001
2499245	TP109	1.40	121	Loose Fibrous Debris	Chrysotile	< 0.001	< 0.001

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



4041



Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3

Your Order No: 003463

Lab Sample Number				2499261	2499262	2499263
Sample Reference				TP110	TP127	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.40	0.40	0.50
Date Sampled				08/11/2022	09/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.9	7.6	7.9
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	1.7	1.8	1.6
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Speciated PAHs

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

Total PAH

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

Arsenic (dissolved)	µg/l	1	ISO 17025	3.6	10	3
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	U/S*	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.3	5.4	2.2
Copper (dissolved)	µg/l	0.7	ISO 17025	16	55	13
Lead (dissolved)	µg/l	1	ISO 17025	1.5	43	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	3.8	8.6	1.5
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	15	33	42

Monoaromatics & Oxygenates

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

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_ID_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10
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Analytical Report Number: 22-96619
Project / Site name: Littleborough Phase 3

Your Order No: 003463

Lab Sample Number				2499261	2499262	2499263
Sample Reference				TP110	TP127	WS104
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.40	0.40	0.50
Date Sampled				08/11/2022	09/11/2022	08/11/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			
TPH-CWG - Aliphatic >C5 - C6 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10 _{HS_ID_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 _{EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH_ID_AL_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 _{HS_ID_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 _{EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) _{HS+EH_ID_AR_MS}	µg/l	10	NONE	< 10	< 10	< 10

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

*U/S due to high variances between chromium (hexavalent) and chromium (dissolved) caused by method differences.

Analytical Report Number : 22-96619

Project / Site name: Littleborough Phase 3

* 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 *
2499240	TP101	None Supplied	2.5	Brown clay and sand with gravel.
2499241	TP102	None Supplied	1	Brown clay and sand with gravel and stones.
2499242	TP102	None Supplied	1.2	Brown clay and sand.
2499243	TP107	None Supplied	1	Brown clay and sand with gravel.
2499244	TP107	None Supplied	2.4	Brown clay and sand with gravel.
2499245	TP109	None Supplied	1.4	Brown clay with gravel.
2499246	TP110	None Supplied	2.8	Brown clay and sand with gravel.
2499247	TP111	None Supplied	1.6	Brown clay and sand with gravel.
2499248	TP112	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
2499249	TP113	None Supplied	1.5	Brown sandy clay.
2499250	TP114	None Supplied	1	Brown loam and clay with gravel and vegetation.
2499251	TP115	None Supplied	0.4	Brown clay and sand with vegetation.
2499252	TP118	None Supplied	0.1	Brown loam and sand with vegetation.
2499253	TP119	None Supplied	0.8	Brown loam and clay with gravel and vegetation.
2499254	TP124	None Supplied	0.9	Brown loam and sand with vegetation and stones.
2499255	TP125 WEST	None Supplied	1.6	Brown clay and loam.
2499256	TP127	None Supplied	0.4	Brown loam and sand with rubble and vegetation.
2499257	WS101	None Supplied	3.5	Brown clay and sand with gravel and vegetation.
2499258	WS104	None Supplied	0.5	Brown loam and clay with gravel and stones.
2499259	WS109	None Supplied	0.2	Brown loam and sand with gravel and vegetation.
2499260	WS112	None Supplied	1.5	Brown sand with gravel and stones.

Analytical Report Number : 22-96619

Project / Site name: Littleborough Phase 3

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 dphenylcarbazide 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	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
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	NONE
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 : 22-96619

Project / Site name: Littleborough Phase 3

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	NONE
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	L0738-PL	W	NONE
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L0738-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	NONE
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK 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 300C

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

Analytical Report Number : 22-96619

Project / Site name: Littleborough Phase 3

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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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



4041



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Analytical Report Number : 22-99151

Project / Site name:	Little Borough	Samples received on:	25/11/2022
Your job number:	15075	Samples instructed on/ Analysis started on:	25/11/2022
Your order number:		Analysis completed by:	02/12/2022
Report Issue Number:	1	Report issued on:	02/12/2022
Samples Analysed:	4 water samples		


Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

Analytical Report Number: 22-99151

Project / Site name: Little Borough

Lab Sample Number				2513441	2513442	2513443	2513444
Sample Reference				WS101	WS103	WS105	CP102
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				24/11/2022	24/11/2022	24/11/2022	24/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

General Inorganics

pH	pH Units	N/A	ISO 17025	6.6	6.6	6.7	6.9
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	6.09	6.26	4.55	5.23

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	2.2	1.6	1.3	1.1
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	65	64	50	82
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.47	0.47	0.67	0.49
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.07	0.09	0.08	0.08
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2
Copper (dissolved)	µg/l	0.5	ISO 17025	5.9	5.3	14	2.6
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2
Manganese (dissolved)	µg/l	0.05	ISO 17025	1100	1200	770	2200
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	3.9	3.6	3.8	3.1
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.2	0.9	0.6	0.8
Zinc (dissolved)	µg/l	0.5	ISO 17025	8.9	7.8	4.2	21

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

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

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

Analytical Report Number: 22-99151

Project / Site name: Little Borough

Lab Sample Number				2513441	2513442	2513443	2513444
Sample Reference				WS101	WS103	WS105	CP102
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				24/11/2022	24/11/2022	24/11/2022	24/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)				Units	Limit of detection	Accreditation Status	

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)*	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene*	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Styrene*	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene*	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 22-99151
Project / Site name: Little Borough

Lab Sample Number				2513441	2513442	2513443	2513444
Sample Reference				WS101	WS103	WS105	CP102
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				24/11/2022	24/11/2022	24/11/2022	24/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0

Analytical Report Number: 22-99151

Project / Site name: Little Borough

Lab Sample Number				2513441	2513442	2513443	2513444
Sample Reference				WS101	WS103	WS105	CP102
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				24/11/2022	24/11/2022	24/11/2022	24/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01

Analytical Report Number: 22-99151
Project / Site name: Little Borough

Lab Sample Number				2513441	2513442	2513443	2513444
Sample Reference				WS101	WS103	WS105	CP102
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				24/11/2022	24/11/2022	24/11/2022	24/11/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
3&4-Methylphenol	µg/l	0.1	NONE	< 0.10	< 0.10	< 0.10	< 0.10

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

*Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted and the failure justified as having no significant impact on sample data reported.

Analytical Report Number : 22-99151

Project / Site name: Little Borough

Water matrix abbreviations:

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

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

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



4041



Analytical Report Number : 22-99151

Project / Site name: Little Borough

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
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				

Analytical Report Number : 22-99151

Project / Site name: Little Borough

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

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
CP102	None Supplied	W	2513444	c	pH at 20oC in water (automated)	L099-PL	c
WS101	None Supplied	W	2513441	c	pH at 20oC in water (automated)	L099-PL	c
WS103	None Supplied	W	2513442	c	pH at 20oC in water (automated)	L099-PL	c
WS105	None Supplied	W	2513443	c	pH at 20oC in water (automated)	L099-PL	c

**Martin Dyer**

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Analytical Report Number : 21-28227

Project / Site name:	Littleborough	Samples received on:	09/12/2021
Your job number:	15075	Samples instructed on/ Analysis started on:	09/12/2021
Your order number:	15075-MD	Analysis completed by:	15/12/2021
Report Issue Number:	1	Report issued on:	15/12/2021
Samples Analysed:	2 water samples		


Signed:

Joanna Wawrzeczko
Technical Reviewer (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

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



Analytical Report Number: 21-28227

Project / Site name: Littleborough

Your Order No: 15075-MD

Lab Sample Number				2111692	2111693
Sample Reference				POND EAST	POND WEST
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				08/11/2021	08/11/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)				Units	Limit of detection Accreditation Status

General Inorganics

pH	pH Units	N/A	ISO 17025	7.3	7.3
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	5.82	6.09

Total Phenols

Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0	< 1.0
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Heavy Metals / Metalloids

Calcium (dissolved)	mg/l	0.012	ISO 17025	30	31
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0

Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.79	1.54
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.03	0.03
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.6	0.8
Copper (dissolved)	µg/l	0.5	ISO 17025	4.5	6.2
Lead (dissolved)	µg/l	0.2	ISO 17025	0.5	0.5
Manganese (dissolved)	µg/l	0.05	ISO 17025	19	27
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	1.6	2.1
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	< 0.6
Zinc (dissolved)	µg/l	0.5	ISO 17025	7.9	20

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH1 (C10 - C40) EH_2D_TOTAL_#1_#2	µg/l	10	NONE	< 10	< 10
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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_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_1D_AL_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_1D_AL_#1_#2_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_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) HS+EH_1D_AR_#1_#2_MS	µg/l	10	NONE	< 10	< 10



Analytical Report Number: 21-28227
Project / Site name: Littleborough

Your Order No: 15075-MD

Lab Sample Number				2111692	2111693
Sample Reference				POND EAST	POND WEST
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				08/11/2021	08/11/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0



Analytical Report Number: 21-28227
Project / Site name: Littleborough

Your Order No: 15075-MD

Lab Sample Number				2111692	2111693
Sample Reference				POND EAST	POND WEST
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				08/11/2021	08/11/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0

SVOCs

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



Analytical Report Number: 21-28227

Project / Site name: Littleborough

Your Order No: 15075-MD

Lab Sample Number				2111692	2111693
Sample Reference				POND EAST	POND WEST
Sample Number				None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied
Date Sampled				08/11/2021	08/11/2021
Time Taken				None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05
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	ISO 17025	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
3&4-Methylphenol	µg/l	0.1	NONE	< 0.10	< 0.10

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



Analytical Report Number : 21-28227

Project / Site name: Littleborough

Water matrix abbreviations:

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Monohydric phenols in water - LOW LEVEL 1 ug/l	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	NONE
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Low level total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

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

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



Analytical Report Number : 21-28227

Project / Site name: Littleborough

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
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				

Sample Deviation Report

Analytical Report Number : 21-28227

Project / Site name: Littleborough

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
POND EAST	None Supplied	W	2111692	c	BTEX and MTBE in water (Monoaromatics)	L073B-PL	c
POND EAST	None Supplied	W	2111692	c	Hexavalent chromium in water	L080-PL	c
POND EAST	None Supplied	W	2111692	c	Dissolved Organic Carbon in water	L037-PL	c
POND EAST	None Supplied	W	2111692	c	Low level total cyanide in water	L080-PL	c
POND EAST	None Supplied	W	2111692	c	Metals in water by ICP-MS (dissolved)	L012-PL	c
POND EAST	None Supplied	W	2111692	c	Metals in water by ICP-OES (dissolved)	L039-PL	c
POND EAST	None Supplied	W	2111692	c	Monohydric phenols in water - LOW LEVEL 1 ug/l	L080-PL	c
POND EAST	None Supplied	W	2111692	c	Semi-volatile organic compounds in water	L102B-PL	c
POND EAST	None Supplied	W	2111692	c	TPH1 (Waters)	L070-PL	c
POND EAST	None Supplied	W	2111692	c	TPHCWG (Waters)	L070-PL	c
POND EAST	None Supplied	W	2111692	c	Volatile organic compounds in water	L073B-PL	c
POND EAST	None Supplied	W	2111692	c	pH at 20oC in water (automated)	L099-PL	c
POND WEST	None Supplied	W	2111693	c	BTEX and MTBE in water (Monoaromatics)	L073B-PL	c
POND WEST	None Supplied	W	2111693	c	Hexavalent chromium in water	L080-PL	c
POND WEST	None Supplied	W	2111693	c	Dissolved Organic Carbon in water	L037-PL	c
POND WEST	None Supplied	W	2111693	c	Low level total cyanide in water	L080-PL	c
POND WEST	None Supplied	W	2111693	c	Metals in water by ICP-MS (dissolved)	L012-PL	c
POND WEST	None Supplied	W	2111693	c	Metals in water by ICP-OES (dissolved)	L039-PL	c
POND WEST	None Supplied	W	2111693	c	Monohydric phenols in water - LOW LEVEL 1 ug/l	L080-PL	c
POND WEST	None Supplied	W	2111693	c	Semi-volatile organic compounds in water	L102B-PL	c
POND WEST	None Supplied	W	2111693	c	TPH1 (Waters)	L070-PL	c
POND WEST	None Supplied	W	2111693	c	TPHCWG (Waters)	L070-PL	c
POND WEST	None Supplied	W	2111693	c	Volatile organic compounds in water	L073B-PL	c
POND WEST	None Supplied	W	2111693	c	pH at 20oC in water (automated)	L099-PL	c

APPENDIX VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C₅-C₆ (aliphatic)	
TPH C₆-C₈ (aliphatic)	
TPH C₈-C₁₀ (aliphatic)	
TPH C₁₀-C₁₂ (aliphatic)	
TPH C₁₂-C₁₆ (aromatic)	
TPH C₁₆-C₂₁ (aromatic)	
TPH C₂₁-C₃₅ (aromatic)	



APPENDIX VIII

GEOTECHNICAL TESTING

RESULTS



LABORATORY REPORT



4043

Contract Number: PSL22/7270

Report Date: 09 December 2022

Client's Reference: 15-075

Client Name: E3P
Taylor Road
Urmston
Manchester
M41 7JQ

For the attention of: April Rae/Alex Smith

Contract Title: Littleborough

Date Received: 11/11/2022

Date Commenced: 11/11/2022

Date Completed: 9/12/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
(Senior Technician)

S Eyre
(Senior Technician)


T Watkins
(Senior Technician)

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
TP104		B	2.50		Brown very clayey SAND & GRAVEL.
TP107		B	2.40		Brown very gravelly very clayey SAND.
TP112		B	1.00		Brown very sandy slightly silty GRAVEL with cobbles.
TP114		B	1.00		Brown slightly gravelly CLAY with some organic material.
TP116		B	2.10		Brown very gravelly very sandy CLAY.
TP118		B	1.50		Brown very gravelly slightly silty SAND.
TP120		B	0.50		Brown slightly silty SAND & GRAVEL with cobbles.
TP122		B	0.60		Brown slightly gravelly sandy CLAY.
WS102		D	2.00		Brown gravelly sandy CLAY.
WS103		U	3.50		Brown slightly gravelly very sandy CLAY.
WS104		D	3.00		Brown very gravelly very sandy CLAY.
WS105		D	2.00		Brown slightly gravelly sandy CLAY.
WS105		U	3.50		Very soft brown slightly gravelly sandy CLAY.
WS108		U	0.50		Very soft brown peaty CLAY.
WS109		D	2.00		Brown gravelly slightly sandy CLAY.
WS110		U	0.50		Brown gravelly CLAY.



4043

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PSL22/7270

Client Ref:

15-075

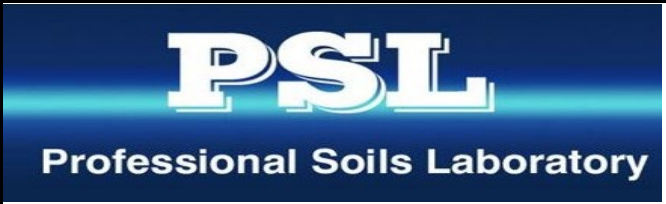
SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

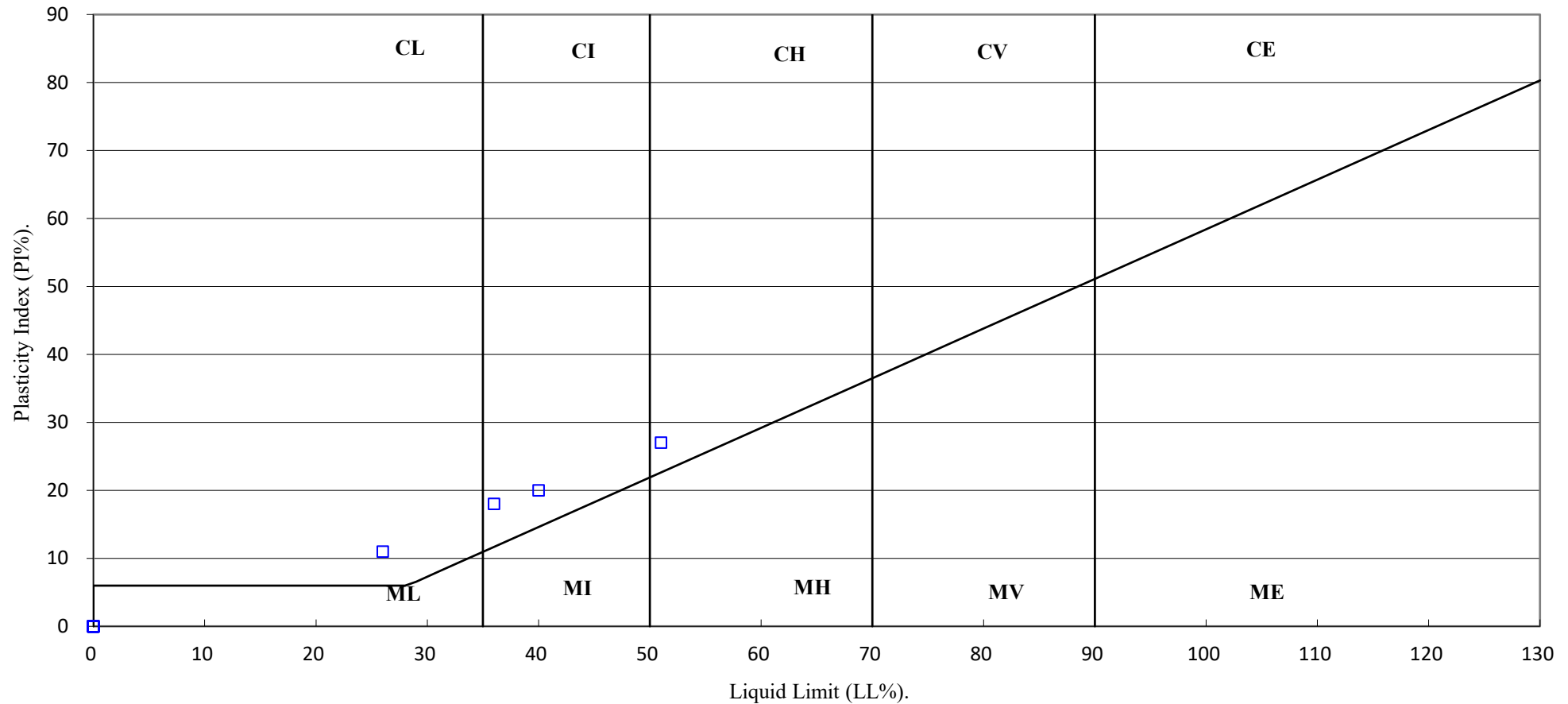
Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
TP114		B	1.00		47							
TP122		B	0.60		29							
WS102		D	2.00		34			40	20	20	84	Intermediate Plasticity CI
WS104		D	3.00		20			26	15	11	68	Low Plasticity CL
WS105		D	2.00		27			36	18	18	97	Intermediate Plasticity CI
WS109		D	2.00		38			51	24	27	84	High Plasticity CH

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.

		Littleborough	Contract No:
			PSL22/7270
			Client Ref:
			15-075

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

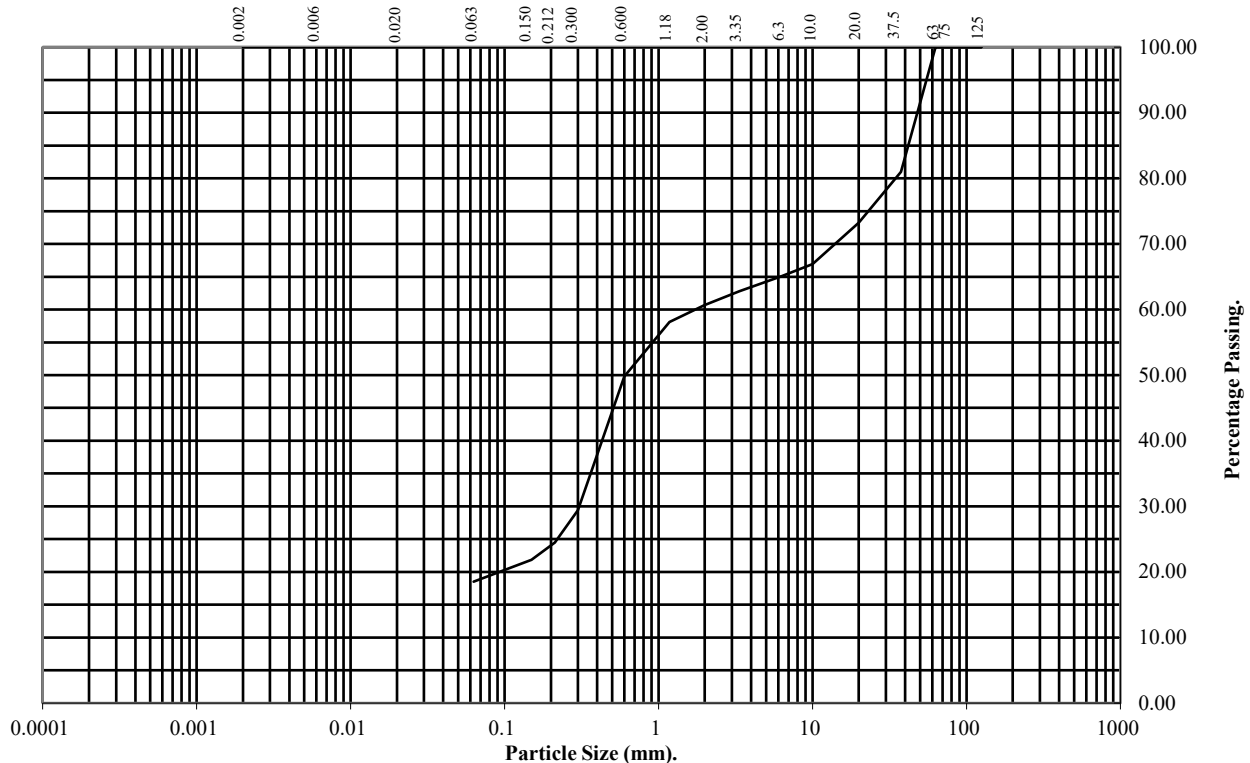
Hole Number: TP104

Top Depth (m): 2.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	81
20	73
10	67
6.3	65
3.35	63
2	61
1.18	58
0.6	50
0.3	29
0.212	24
0.15	22
0.063	19

Soil Fraction	Total Percentage
Cobbles	0
Gravel	39
Sand	42
Silt/Clay	19

Remarks:

See Summary of Soil Descriptions



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Client Ref:
15-075

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

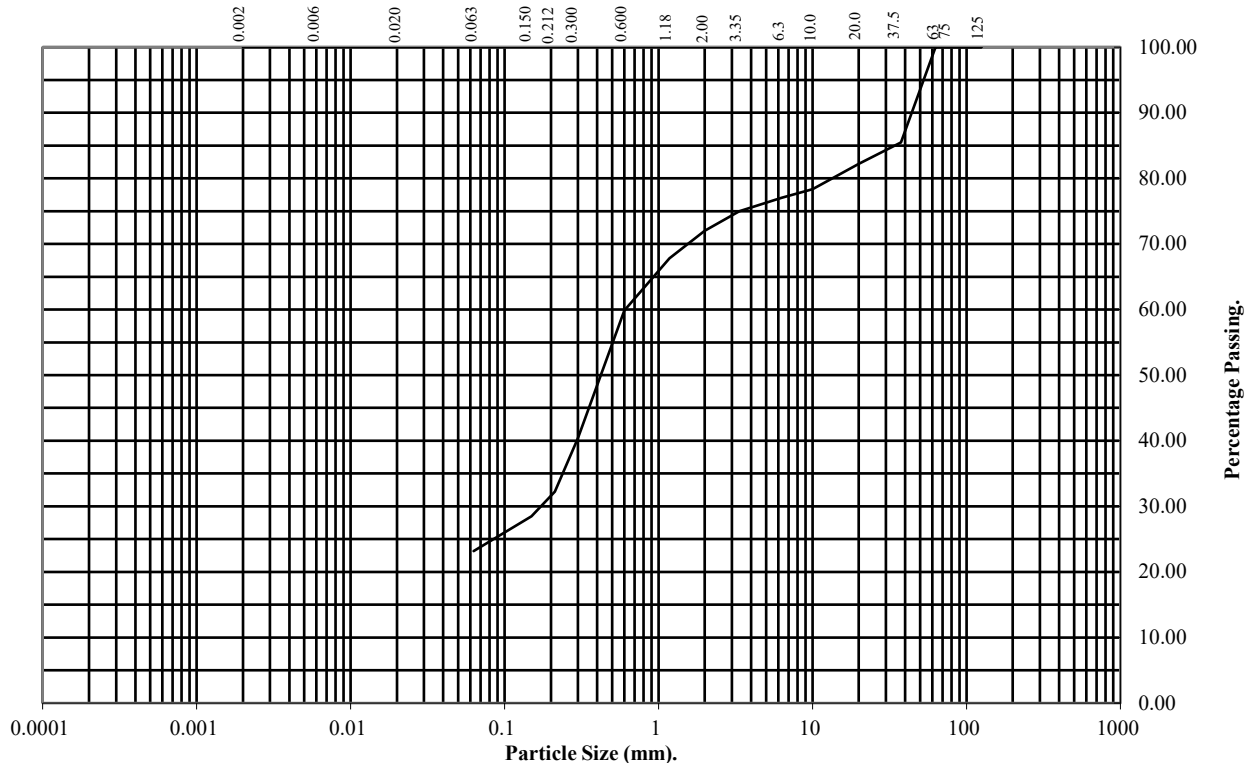
Hole Number: TP107

Top Depth (m): 2.40

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	85
20	82
10	78
6.3	77
3.35	75
2	72
1.18	68
0.6	60
0.3	40
0.212	32
0.15	28
0.063	23

Soil Fraction	Total Percentage
Cobbles	0
Gravel	28
Sand	49
Silt/Clay	23

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

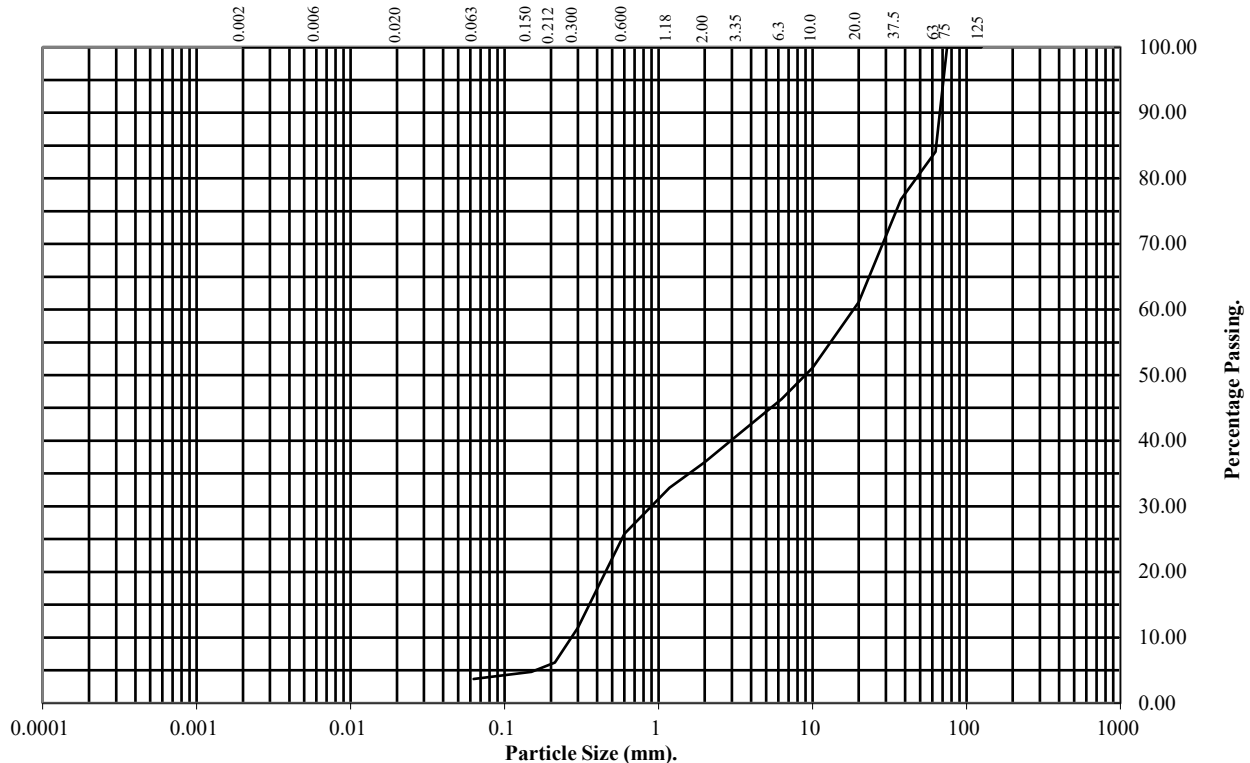
Hole Number: TP112

Top Depth (m): 1.00

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	84
37.5	77
20	61
10	51
6.3	46
3.35	41
2	37
1.18	33
0.6	26
0.3	12
0.212	6
0.15	5
0.063	4

Soil Fraction	Total Percentage
Cobbles	16
Gravel	47
Sand	33
Silt/Clay	4

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

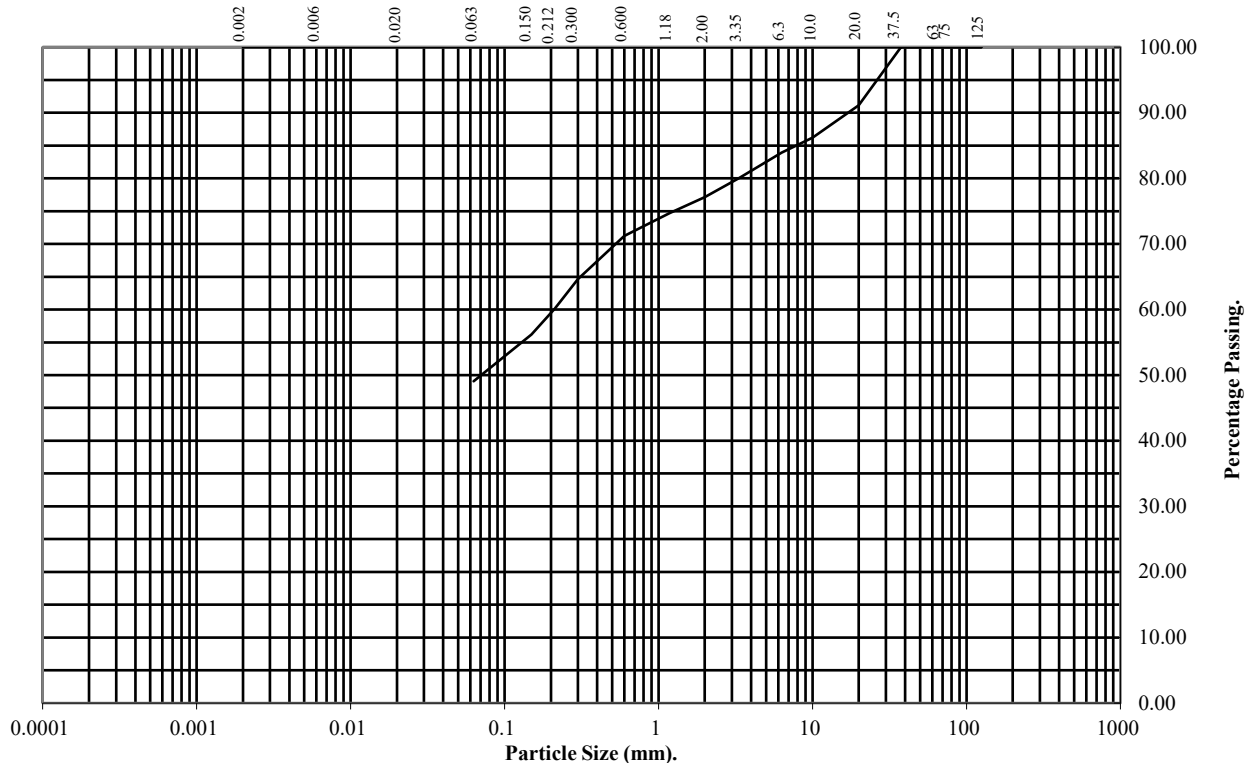
Hole Number: TP116

Top Depth (m): 2.10

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	91
10	86
6.3	84
3.35	80
2	77
1.18	75
0.6	71
0.3	65
0.212	60
0.15	56
0.063	49

Soil Fraction	Total Percentage
Cobbles	0
Gravel	23
Sand	28
Silt/Clay	49

Remarks:

See Summary of Soil Descriptions



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PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

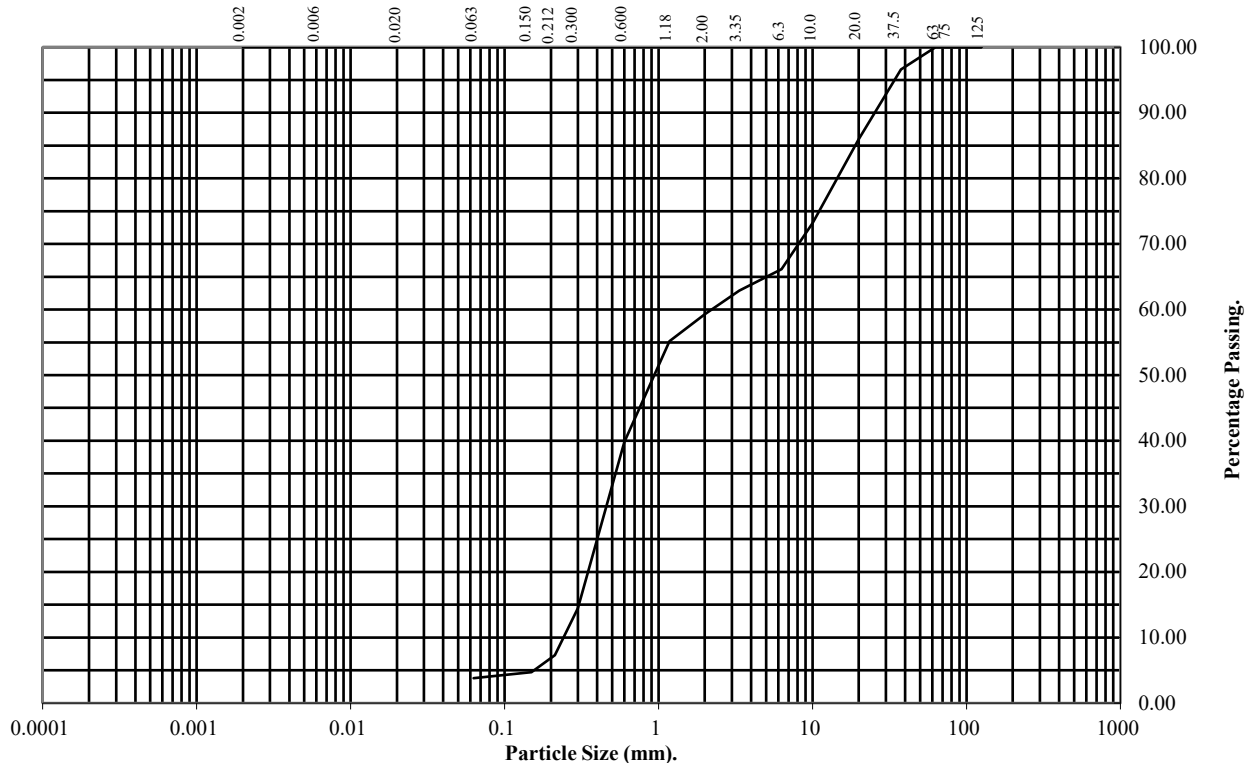
Hole Number: TP118

Top Depth (m): 1.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	97
20	86
10	73
6.3	66
3.35	63
2	59
1.18	55
0.6	40
0.3	14
0.212	7
0.15	5
0.063	4

Soil Fraction	Total Percentage
Cobbles	0
Gravel	41
Sand	55
Silt/Clay	4

Remarks:

See Summary of Soil Descriptions



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Contract No:

PSL22/7270

Client Ref:

15-075

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

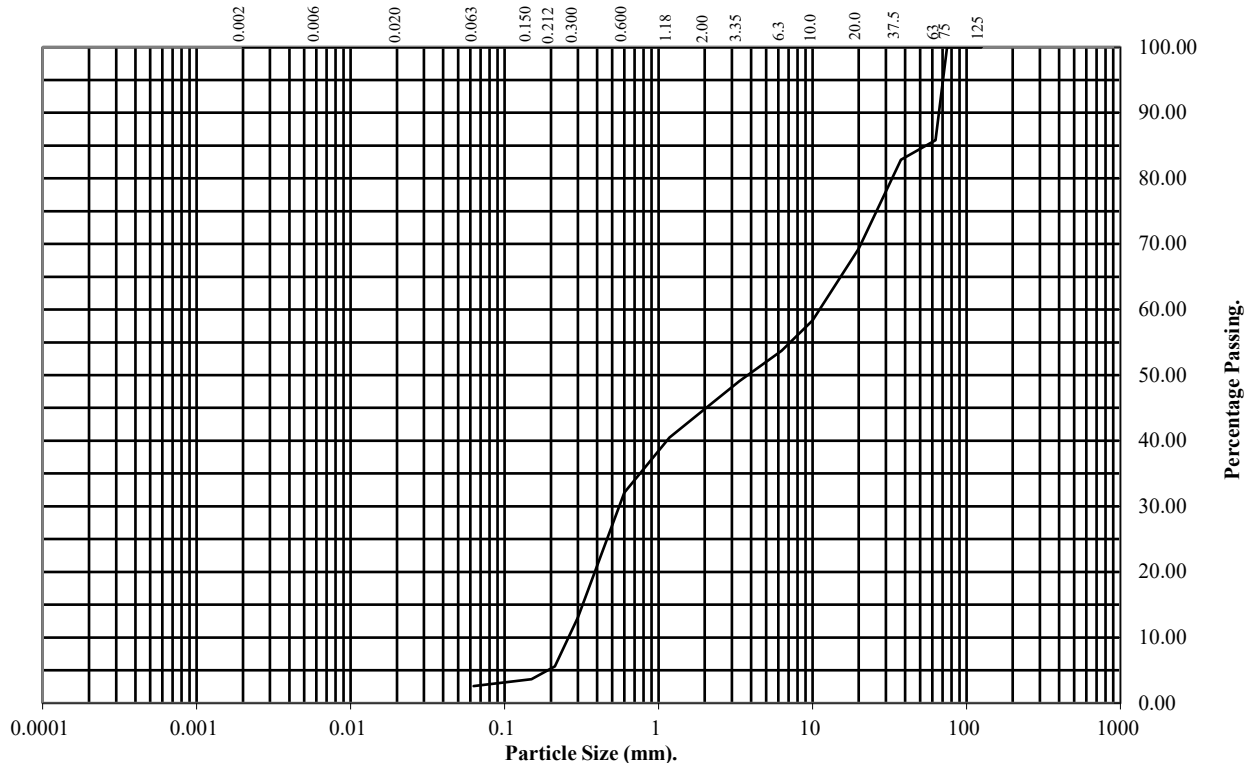
Hole Number: TP120

Top Depth (m): 0.50

Sample Number:

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	86
37.5	83
20	69
10	58
6.3	54
3.35	49
2	45
1.18	40
0.6	32
0.3	13
0.212	6
0.15	4
0.063	3

Soil Fraction	Total Percentage
Cobbles	14
Gravel	41
Sand	42
Silt/Clay	3

Remarks:

See Summary of Soil Descriptions



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Contract No:
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Client Ref:
15-075

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

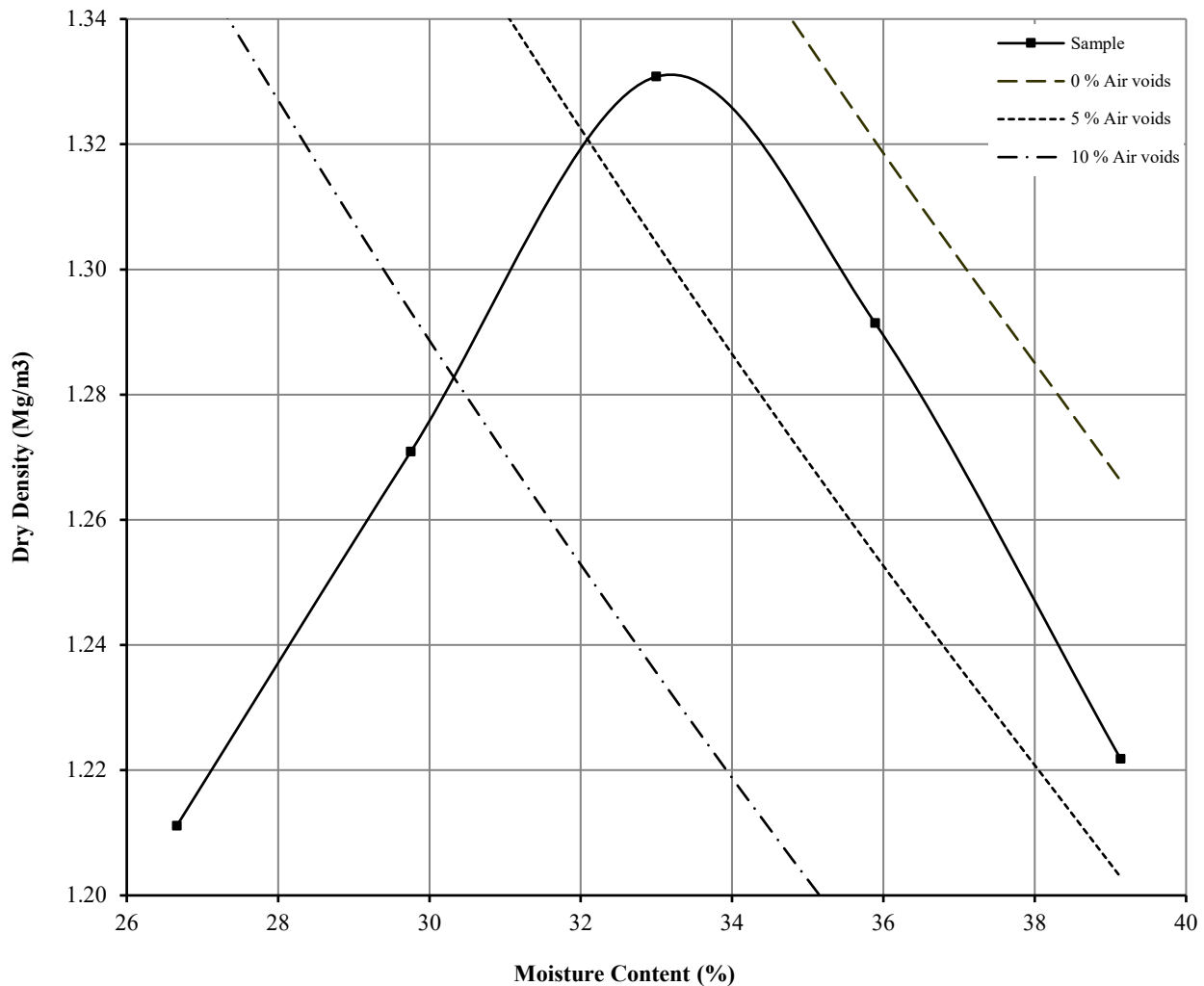
Hole Number: TP114

Top Depth (m) : 1.00

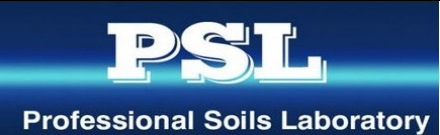
Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	47	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m ³):	2.51	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.33		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	33			
Remarks See summary of soil descriptions				

		Littleborough	Contract
			PSL22/7270
			Client Ref
			15-075

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.3 : 1990

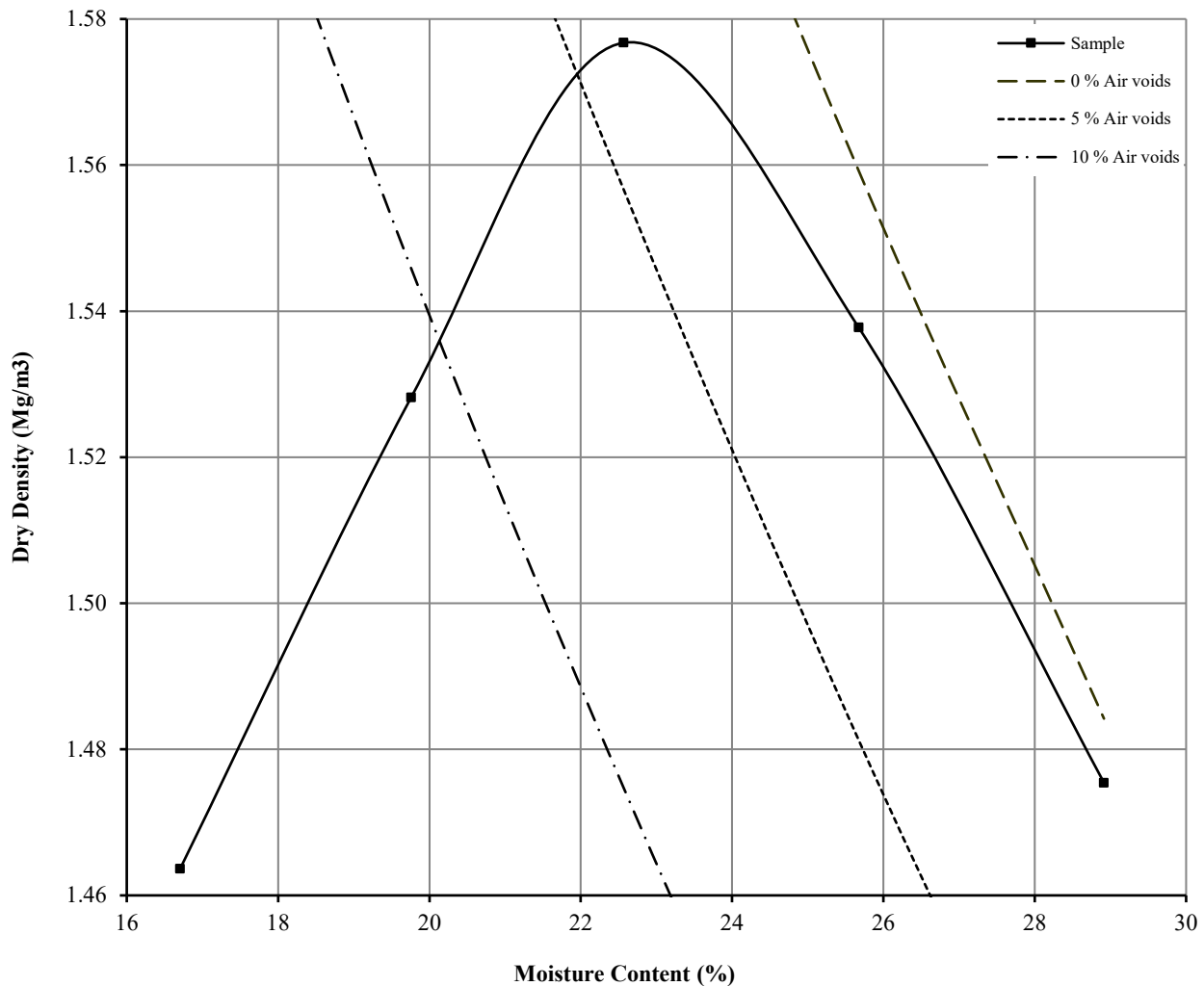
Hole Number: TP122

Top Depth (m) : 0.60

Sample Number:

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	29	Method of Compaction:	2.5kg	Separate Samples
Particle Density (Mg/m3):	2.6	Assumed	Material Retained on 37.5 mm Test Sieve (%):	2
Maximum Dry Density (Mg/m3):	1.58		Material Retained on 20.0 mm Test Sieve (%):	1
Optimum Moisture Content (%):	23			
Remarks See summary of soil descriptions				



Littleborough

Contract
PSL22/7270
Client Ref
15-075

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

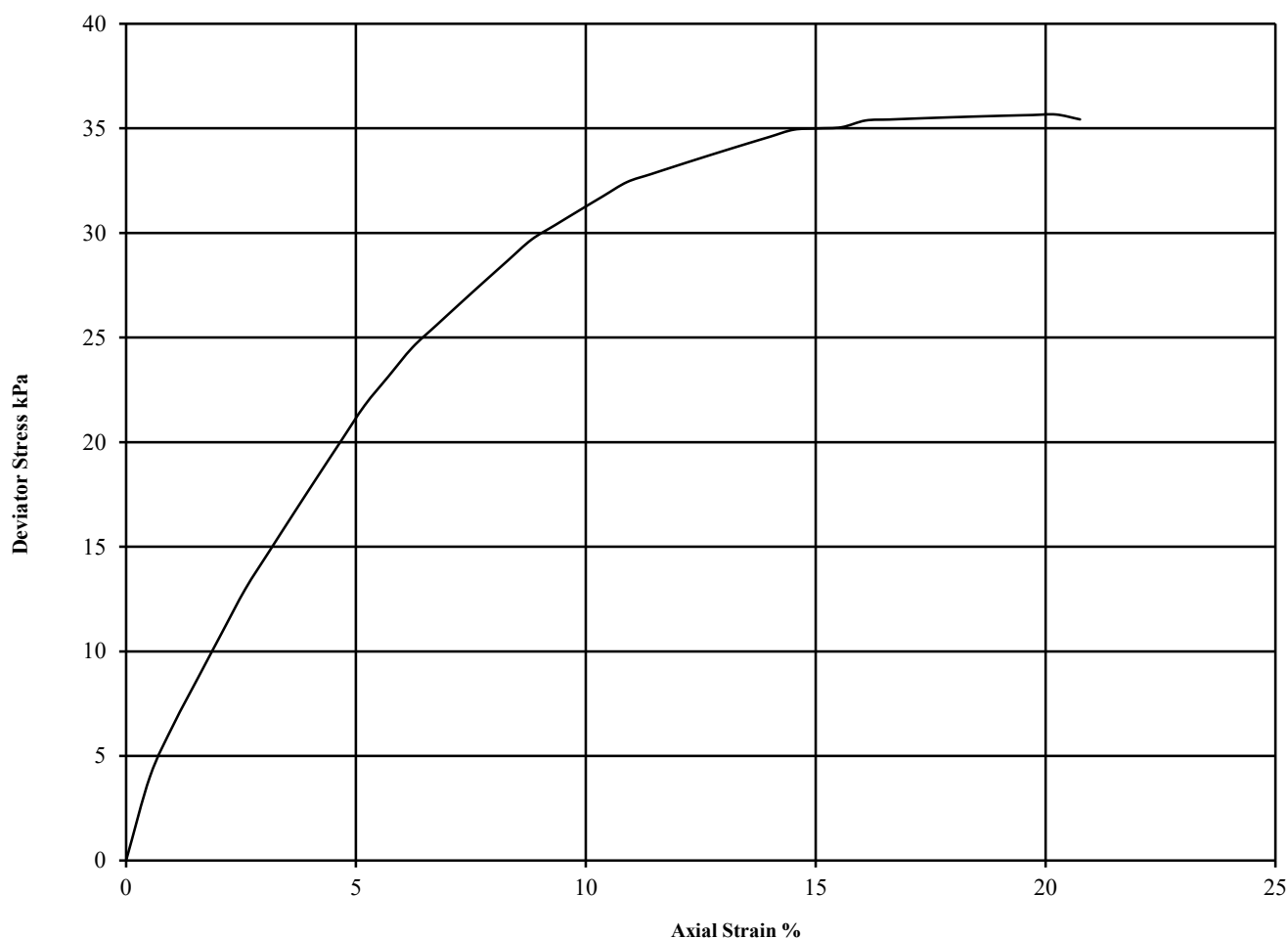
Hole Number: WS105

Top Depth (m): 3.50

Sample Number:

Base Depth (m):

Sample Type U



Diameter (mm):		83		Height (mm):		160		Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.40 See summary of soil descriptions		
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$					
1	29	1.46	1.14	55	36	18	20.2	Plastic			



4043

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Professional Soils Laboratory

Littleborough

Contract No:

PSL22/7270

Client Ref:

15-075

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

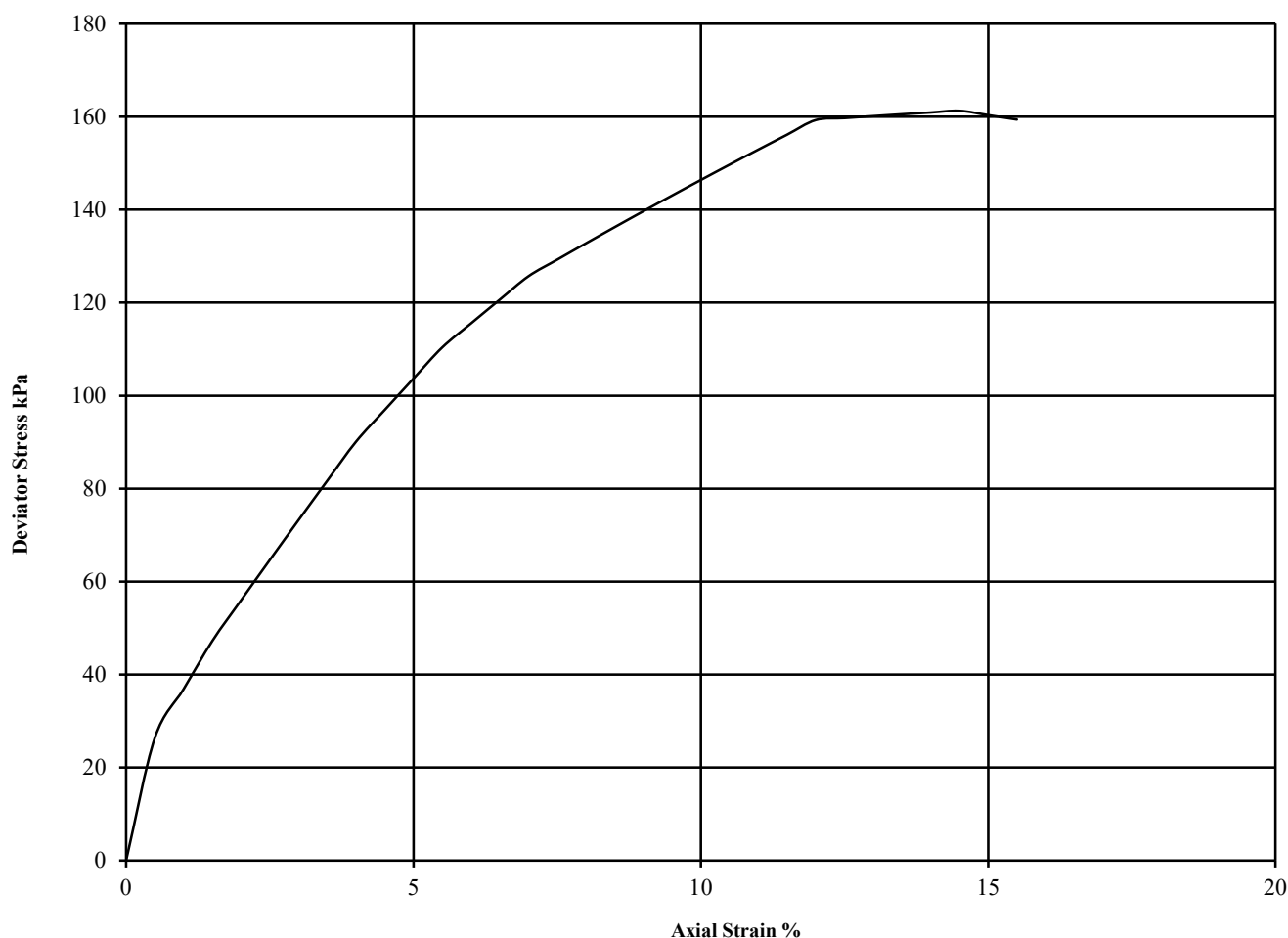
Hole Number: WS108

Top Depth (m): 0.50

Sample Number:

Base Depth (m):

Sample Type U



Diameter (mm):		38	Height (mm):		76	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.79 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	69	1.25	0.74	15	161	81	14.5	Plastic	



4043

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Littleborough

Contract No:

PSL22/7270

Client Ref:

15-075

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: WS103

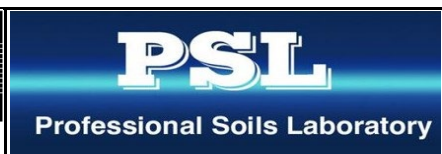
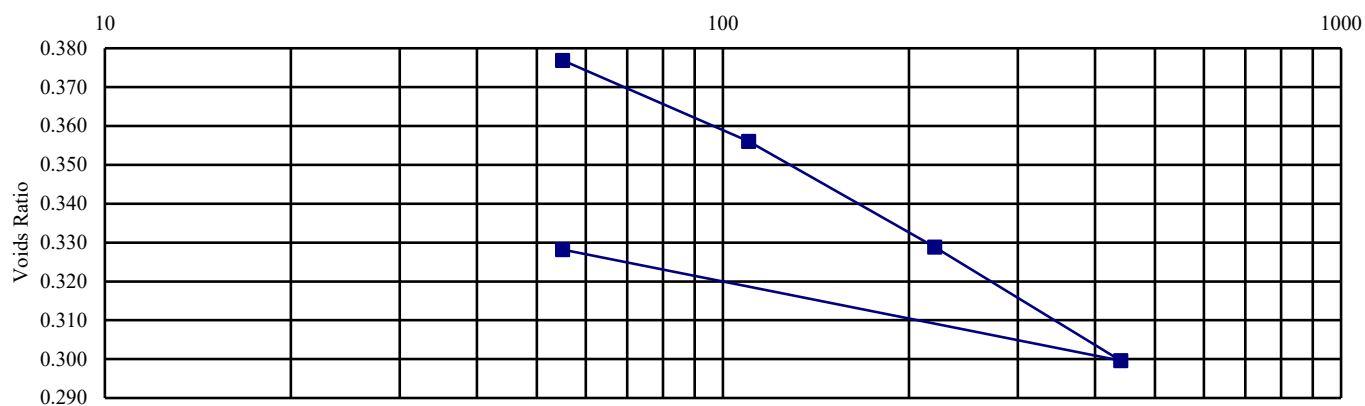
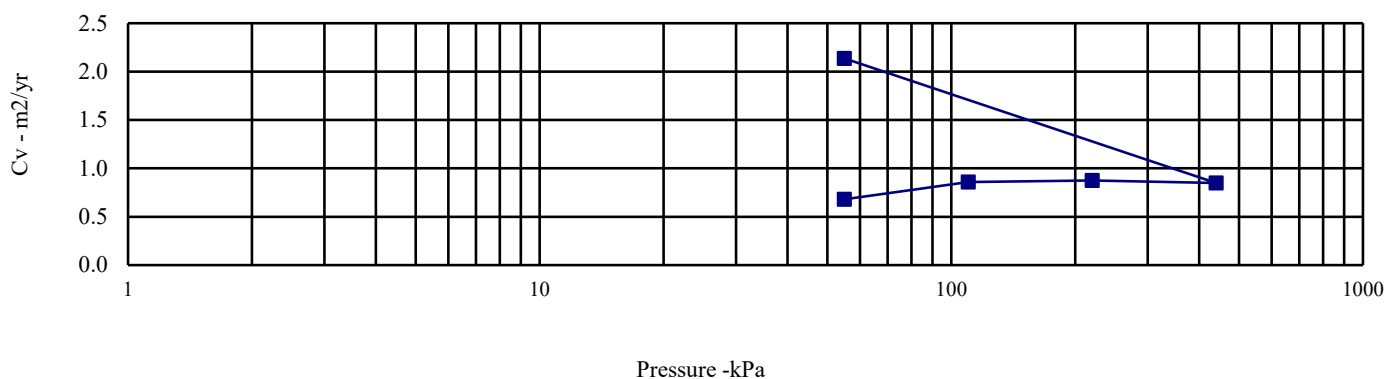
Top Depth (m): 3.50

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	17	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.18	0	55	0.529	0.680	Method used to	
Dry Density (Mg/m3):	1.87	55	110	0.276	0.860	determine CV:	T90
Voids Ratio:	0.418	110	220	0.182	0.874	Nominal temperature	
Degree of saturation:	104.6	220	440	0.100	0.850	during test ' C:	20
Height (mm):	20.016	440	55	0.057	2.136	Remarks:	
Diameter (mm)	75.025					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Littleborough

Contract No:
PSL22/7270
Client Ref:
15-075

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: WS110

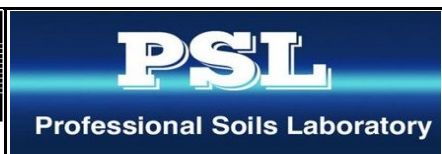
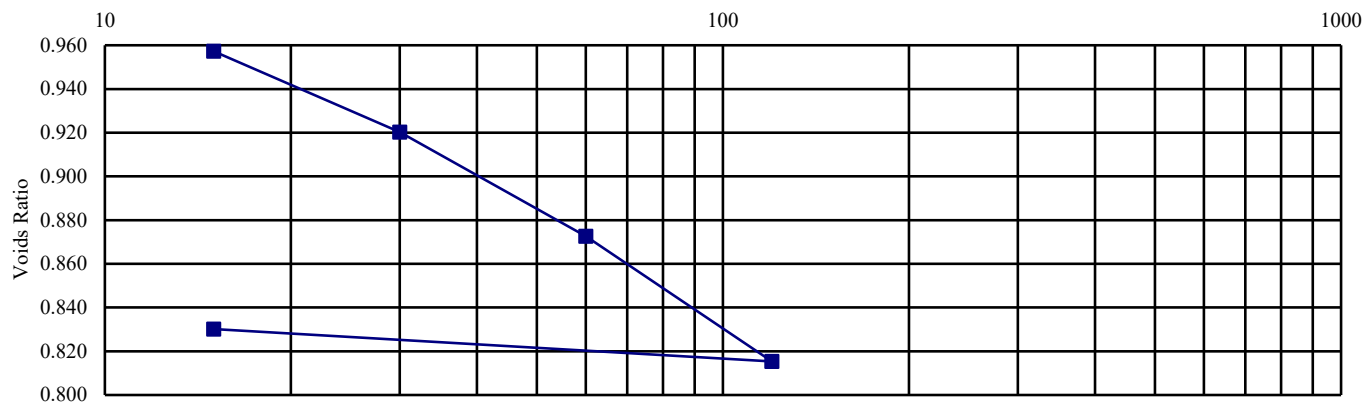
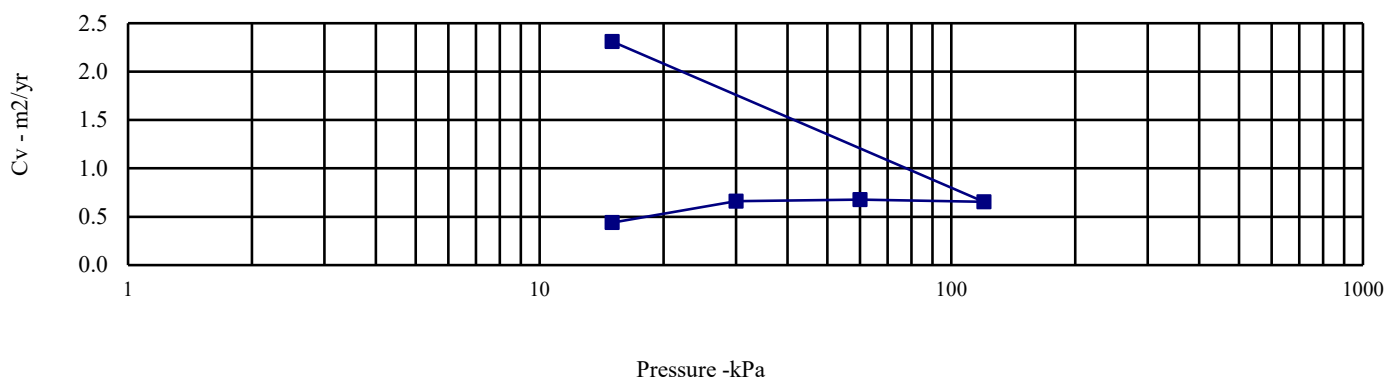
Top Depth (m): 0.50

Sample Number:

Base Depth (m) :

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	38	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	1.78	0	15	3.094	0.439	Method used to	
Dry Density (Mg/m3):	1.29	15	30	1.260	0.661	determine CV:	T90
Voids Ratio:	1.053	30	60	0.827	0.678	Nominal temperature	
Degree of saturation:	94.6	60	120	0.510	0.654	during test ' C:	20
Height (mm):	20.036	120	15	0.077	2.311	Remarks:	
Diameter (mm)	75.025					See summary of soil descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Littleborough

Contract No:
PSL22/7270
Client Ref:
15-075

APPENDIX IX COAL AUTHORITY REPORT



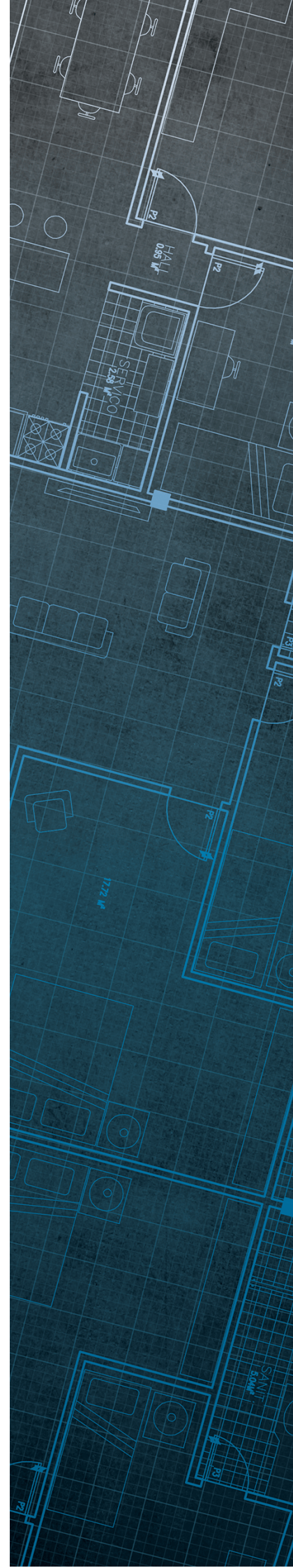
The Coal
Authority

Consultants Coal Mining Report

Littleborough
Littleborough
Rochdale
OL15 8HW

Date of enquiry: 7 April 2022
Date enquiry received: 7 April 2022
Issue date: 7 April 2022

Our reference: 51003006852001
Your reference: 001250/NS



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

E3P

Enquiry address

Littleborough
Littleborough
Rochdale
OL15 8HW

How to contact us

0345 762 6848 (UK)
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200 Lichfield Lane
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NG18 4RG

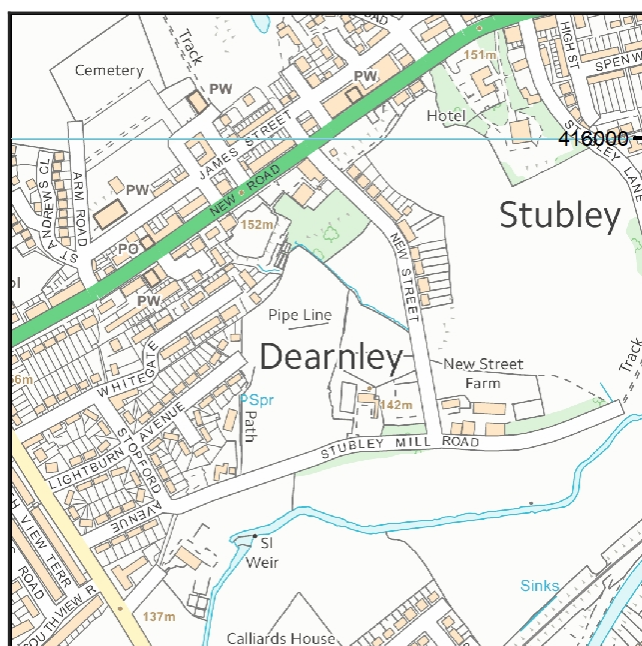
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

Colliery	Seam	Mineral	Coal Authority reference	Depth (m)	Direction to working	Dipping rate of seam worked (degrees)	Dipped direction of seam worked	Extraction thickness (cm)	Year last mined
unnamed	UPPER MOUNTAIN	Coal	3X63	7	Beneath Property	8.1	South	30	1867
unnamed	UPPER MOUNTAIN	Coal	3X66	18	Beneath Property	8.1	South	30	1867
unnamed	LOWER MOUNTAIN	Coal	3XAN	22	Beneath Property	8.1	South	60	1886

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

13662	1882	NW118
16820	2654	PO0

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

Seam name	Mineral	Seam workable	Distance to outcrop (m)	Direction to outcrop	Bearing of outcrop
BASSEY	Coal	Yes	Within	N/A	184
BASSEY	Coal	Yes	20.2	North-East	353
INCH	Coal	Yes	Within	N/A	113
LOWER FOOT	Coal	Yes	Within	N/A	174
LOWER FOOT	Coal	Yes	Within	N/A	190
LOWER MOUNTAIN	Coal	Yes	Within	N/A	1
LOWER MOUNTAIN	Coal	Yes	Within	N/A	192
UPPER FOOT	Coal	Yes	Within	N/A	195
UPPER MOUNTAIN	Coal	Yes	Within	N/A	126

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

Distance to site investigation (m)	Direction
Within	N/A

See Section 4 for further information.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

The following potential risks have been identified and as part of your risk assessment should be investigated further.

Development advice

The site is within an area of historical coal mining activity. Should you require advice and/or support on understanding the mining legacy, its risks to your development or what next steps you need to take, please contact us.

Site investigations

The site is within an area of previous interest. It is close to where the Coal Authority has received information relating to past site investigations.

The site requires further investigation and may influence how you approach your risk assessment.

For further information on specific site or ground investigations in relation to any issues raised in Section 4, please call us on 0345 762 6848 or email us at groundstability@coal.gov.uk.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

