PHASE II GEO-ENVIRONMENTAL SITE ASSESSMENT

South Heywood Phase 4
Land off Manchester Road
Heywood
OL10 2NL

Prepared for:

Russell Homes

Report Ref: 13-223-r1
Date Issued: July 2019



e3p | Environmental | Energy | Engineering

E3P

Heliport Business Park,
Liverpool Road,
Eccles,
Manchester,
M30 7RU

Tel : + 00 (0) 161 707 9612
http:\\www. e3p.co.uk

Registered in England
No.: 807255262

QUALITY ASSURANCE

REMARKS	Final
DATE	July 2019
PREPARED BY	E Fearn
QUALIFICATIONS	BSc (Hons), MSc, FGS
SIGNATURE	
CHECKED BY	N Sellars
QUALIFICATIONS	MSci (Hons), FGS
SIGNATURE	
AUTHORISED BY	M Dyer
QUALIFICATIONS	BSc, FGS, AIEMA, MIEnvSc, CEnv
SIGNATURE	
PROJECT NUMBER	13-223
IMS Template Reference: QR012-3	

EXECUTIVE SUMMARY		
Site Address	Land off Manchester Road, Heywood, OL10 2NL.	
Grid Reference	E 385978, N 409079	
Site Area	~29.22 Ha	
Current Site Use	The subject site is known as Collop Gate Farm and is an irregular shaped parcel of land located to the east of Manchester Road in Heywood. The area comprises of six undeveloped agricultural fields which are largely used for livestock grazing. The fields are separated by hedgerows and an access road through the centre of the site. Commercial buildings with associated hardstanding and metal storage containers are located in the north west of the site (former Collop Gate Farmstead). There is also a hardstanding storage area in the centre of the site, with a number of metal containers and stockpiles of aggregate. Whittle Brook flows along the southern boundary and though the eastern sector of the site before transecting westwards through the wider Collop Gate Development. There is a high pressure gas main located within five of the six agricultural fields, this infrastructure includes a no build blast radius.	
Proposed Development	E3P understands that Russel Homes have been granted Outline Planning Consent for a strategic mixed-use development that will comprise a 2.2km link road, residential housing and commercial / industrial land uses. Russell Homes intend to develop or divest the subject site for a residential end use comprising a series of low rise dwellings with associated private garden and landscaped areas, public open space, estate roads and infrastructure	
Environmental Setting	*Drift Geology*	Till (Devensian – Clay) across the site.
	Bedrock Geology	Pennine Lower Coal Measures Formation - Mudstone, Siltstone, Sandstone.
	Hydrogeology	Secondary undifferentiated aquifer (drift) overlying Secondary A aquifer (Solid). No groundwater abstractions have been identified within a 1km radius.
	Hydrology	Whittle Brook is located along the southern boundary and through the eastern sector of site.
	Flood Risk	Unaffected by flooding from rivers.
Site History	A review of the pertinent Ordnance Survey mapping dating from circa 1848 to the present day confirmed that the site has generally remained undeveloped agricultural land. Collop Gate Farm is recorded pre 1848 to the present day. A mine shaft was recorded in the centre of the site Pre 1910, which was named as 'old shaft' Pre 1923 (further shafts recorded by the coal authority). No other significant changes have been noted within the site boundary.	
Previous Reports	E3P has previously completed a high-level Desk Study for the complete South Heywood Development, the findings of which are documented within our report dated November 2016 (ref: 11-094-R1).	

Utility Locations	A full review of the utilities plans indicates that services are present within the site boundary. Electricity and BT enter the site from the north east via Manchester Road to the main commercial building. There is no sewer or clean water infrastructure within the site boundary. A high-pressure gas main is present through five of six fields within the site boundary, orientated south west to north east across the site.
Landfill Sites	There are no historic or authorised landfill sites located within 500m
Radon	Unaffected – no special precautions required.
E3P Intrusive Ground Investigation	
Site Investigation Works	E3P has completed an intrusive Ground Investigation comprising mechanically excavated trial pits, window sample probeholes, dynamic cone penetrometers, rotary boreholes, cable percussive boreholes and environmental monitoring installations.
Ground Conditions	**Topsoil** Topsoil was encountered in the majority of exploratory hole locations to a maximum proven depth of 0.70m bgl in CP102, however this was generally encountered to depths of between 0.10–0.40m bgl and comprised soft dark brown slightly sandy gravelly clay with gravel of mudstone. Chemical analysis suggests that the topsoil is likely to be suitable for re-use. **Made Ground** Made Ground deposits were encountered in the area of hardstanding in the north west and in the central sector of the site to a maximum proven depth of 4.50m bgl in RB103, although in general Made Ground was encountered to less than 2.0m bgl. In the north west, the Made Ground generally comprised dark grey gravel of asphalt overlying stiff dark brown slightly gravelly clay with brick. The central sector comprised reworked topsoil of soft dark brown sandy clay with occasional gravel of brick over firm grey brown sandy gravelly clay with gravel of brick mudstone and concrete. In a number of locations, the full thickness of Made Ground was not proven due to difficulty excavating. Aggregate has been placed to form areas of hardstanding in the north of the site and an access road through the site. **Drift Deposits** Drift deposits were encountered within the majority of exploratory locations with the exception of locations where the full depth of Made Ground could not be proven. The drift deposits are varied, generally comprising a firm to stiff, low to high strength, orange brown mottled grey CLAY with gravel of mudstone or a orangey light brown/reddish brown clayey SAND with gravel of mudstone. In the locations where peat was encountered, it was generally underlain by a dark grey coarse SAND (TP115, TP133, TP135, TP136 TP138 and TP139). A dark bluey grey sandy GRAVEL with coal-like traces was also encountered within one location (TP111) with gravel of shale. Peat deposits were encountered in 13No. locations in the north eastern sector of site between the depths of 0.20m bgl and 2.60m bgl and comprised of soft dark brown compressible peat. Peat is located within the proximity of the stream, indicating organic alluvial deposits in the near surface.

Ground Conditions	**Solid Geology** The solid bedrock geology was encountered between 4.20m and 24.10m bgl, becoming considerably deeper towards the east of the site. The solid geology comprises light grey weathered mudstone which is underlain by interbedded grey mudstone and grey sandstone with mudstone bands. In the north-western field of the site, shale with traces of coal and coal was identified between the depths of 24.00m bgl and 25.90m bgl (RB101) and 17.40m bgl and 21.00m bgl (RB102). **Groundwater** Groundwater was encountered at numerous locations across the site as seepages between the depths of 1.20m and 4.30m bgl.
Human Health	A Tier I Human Health Risk Assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of asbestos in the form of Chrysotile loose fibres in the Made Ground in TP142. Asbestos quantification has been completed to further assess where these soils may be placed; identifying 0.001%. No visual signs of ACM were encountered during the Ground Investigation; therefore, it is likely only trace fibres are present within these localised soils. The identified elevated concentration has a primary exposure pathway related to dust inhalation. This exceedance can be mitigated by the installation of a 600mm chemically suitable cover system. A 600mm cover system will be required in areas of Made Ground encountered across the site due to the presence of anthropogenic material and the potential for asbestos fibres. The cover system will require certified material with appropriate validation within proposed garden areas. Natural drift deposits encountered within the upper 600mm of finished ground levels can be directly overlain with a suitable cover (minimum 150mm topsoil). Made Ground may be removed during the site enabling works and as such the post enabling site conditions should be reviewed to ascertain if any gardens need a clean cover. Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas, however further chemical validation samples will be required to confirm this. There are also suitable sources of topsoil available on the site. A supplementary post demolition ground investigation will be required in the location of the existing buildings to assess the potential for contaminants in this area of the site.
Controlled Waters	The monitoring wells were noted to be dry during the sampling visit. Given no significant contamination has been identified in the soil analysis, in addition to the relatively low sensitivity of the site with respect to controlled waters, there is considered to be no unacceptable risk to the controlled water receptors and the wider environ.

Ground Gas	Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1 and in these areas it is considered that gas protection measures will not be required. Plots in the vicinity of WS108 should be classified as CS2/Amber 1 due to marginally elevated carbon dioxide. WS106 is classified as CS4/Red due to significantly elevated methane. The monitoring well was set within cohesive Made Ground with notable anthropogenic material. No organic material was noted, therefore the methane concentrations may be attributed to mine workings. Further continuous gas monitoring should be completed to accurately determine the ground gas regime and inform a robust risk assessment. Real time monitoring could be used to inform a quantitative risk assessment. If the methane is from mine workings, further close centre wells may be required to determine the extent of site impacted.
Potable Water Infrastructure	This will need to be confirmed following the completion of a UKWIR Risk Assessment. Post remediation and enabling works ground conditions may be different from those identified during this site investigation.
Geotechnical Assessment	
Underground Obstructions & Anomalies	The Made Ground could not be penetrated in a number of locations in the central sector, where cobbles were identified. Obstructions will be present beneath the existing buildings in the north of the site. During a phase of cut fill enabling works to create a developable platform, all below ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots. The former pond will present an area of locally poor ground, which will need to be located, delineated and investigated prior to the excavation and removal of all deleterious materials. The resulting excavation should be backfilled with material to be engineered in accordance with a suitable geotechnical specification in due consideration of the end use.
Allowable Bearing Pressure (ABP)	The underlying natural clay drift deposits have been assessed as being firm low strength to very stiff high strength with a net ABP in the order of 82-143kN/m^2 at circa 1.00m bgl increasing to 84-447kN/m^2 at circa 2.00–3.00m bgl. Granular drift deposits have been assessed as being loose to medium dense, with a net ABP of 63–208kN/m^2 at circa 1.00–3.00m bgl.
Foundation Options	Based on existing data and given the predominantly cohesive ground conditions, it is considered that the majority of the proposed dwellings could be constructed using traditional spread footings bearing in the firm to stiff clay or medium dense sand at a depth from 1.00–1.50m below current ground levels. Where deeper variable soft / loose natural clays, sand and gravels are identified or in locations where Made Ground deposits are present, dependent on development levels, plots may require locally deepening to Mass Trench Fill. *…Continued Overleaf*

Foundation Options	Due to the existing variances in the site topography, a phase of cut and fill enabling works will be required in order to create a proposed development. Therefore, upon completion of these enabling works, it is likely that the most cost effective option for the majority of the site would be re-engineer the newly placed Made Ground using Vibro Replacement Stone Columns (VRSC) to support a shallow strip or spread foundation or alternately use a piled foundation. Where soft clays are present and in the location of the infilled pond, a piled foundation will be required. Where peat deposits have been identified, the highly compressible material will require excavation to the base (circa 2.50m bgl) due to the potential for differential settlement within the proposed development. The resulting voids will then require backfilling with geotechnically suitable materials to the required development levels. It is therefore likely that a driven piled foundation would be required within areas of soft clays, where peat is retained beneath plots or where post remediation and enabling Made Ground extends to depths in excess of 2.0-2.50m bgl. 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. Consideration must be given to the varying soil matrices and differing settlement characteristics and where a foundation spans two varying matrices the sub-structure should be designed accordingly. It must be noted that piling will not be possible over any stabilised mine workings.
Building Floor Slabs	Ground bearing floor slabs are unlikely to be viable given the anticipate depths or re-worked made ground >600mm and shallow cohesive soils.
Heave Precautions	The Clay soils are classified as Low to High Volume Change Potential and where it is present at a shallow depth within the conjectured zone of potential tree influence, heave precautions will be required within the construction of a shallow foundation and to the underside of residential floor slabs.
Soakaway Drainage	BRE 365 soakaway testing was completed in four trial pits. The time to fall 25% was extrapolated for test 1 in SA102 and SA104 due to time constraints. The granular drift deposits in the clayey SAND in SA102 showed poor soakage potential, however the SAND in SA104 showed good soakage potential. The tests in SA101 and SA103 failed as they did not reach 25% or 75% effective storage depth. Therefore, considering the significant volumes of low permeability clay in the west of the site, it is considered that soakaway drainage may not be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – Soakaway Design.
Sulphate Assessment	Concrete classification will be DS1 AC1s.

CBR Design %	Granular soils can be re-engineered to ensure 5% within the sub-grade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 2-5% during drier climatic periods, however If water is allowed to shed onto the formation, the CBR will reduce to <2% which will require specialist engineering of the sub-grade. Within areas where peat has been identified, the highly compressible material will require excavation in areas of proposed infrastructure to the base due to the potential for differential settlement within the proposed development. The resulting voids will then require backfilling with geotechnically suitable materials to the required development levels.
Cut / Fill	Development levels unknown at this time, however an element of cut fill works will be required to prepare the development platform. Given the fine grained nature of the material, if site derived soils are use as upfill beneath plots where VSC is considered, this material will require compaction and engineering to an approved geotechnical specification. The natural clay soil can be engineered as a Class 2 material, however control of moisture content will be critical to ensure the required degree of compaction.
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using *Technical Guidance WM3: Waste Classification - Guidance on the classification and assessment of waste.*
Coal Mining	The Coal Authority Report confirms that there has been past underground mining beneath the property of the Arley coal seam which was last recorded to be mined in 1900. Based on records it is also probable that there are unrecorded shallow workings within the site boundary. Four mine shaft entries have been identified within the site from Coal Authority records (E385893, N408989; E385797, N 408986; E385983, N409013; E385909, N409032) and therefore potential instability associated with the mine shafts may present a risk to the proposed development. The shaft furthest east (Ref: 385409-001; E385983, N409013) was capped at ground level by the National Coal Board in 1978. A review of the mining geology confirmed there is no seam outcropping within the site boundary. The Coal Authority do not record a definitive seam outcrop within the boundary, however the Arley coal seam is recorded as present beneath the property thus it is presumed this is a sub-crop inferred from geological records or the wider area. The Arley coal seam outcrops to the north of the site with recorded workings and an extraction thickness of ~140mm. The seam is known to be present at depths in excess of 19.0m and as such is unlikely to pose any risk associated to the proposed development assuming the seam is overlain by a minimum of 10 x Seam Thickness of rock (14.0m). If it is assumed that the recorded outcrop ~300m north of the site is present at rockhead with a conservative assessment being 125m AOD using the CA recorded angle of dip (SW) at 11.3 degrees, the main Arley seam would be expected at 36m below rockhead or 90m AOD in the north east sector of the subject site. At this depth there would be more than the required 10x seam thickness rock cover over the main Arley seam to mitigate any subsidence induced by the consolidation of unrecorded and abandoned mine workings.

Coal Mining	However, when considering the mine abandonment plans, it is self-evident that there is a sub-crop of the Arley seam proven in the central south sector where coal is present in two leaves between 24m and 27m below ground level. In this sector rockhead is conjectured at ~20m therefore insufficient rock cover is anticipated and a risk of subsidence is identified. The geology of the subject site is complex with a fault transecting northwest / south east through the southern sector of the site with the downthrow to the north. The CA mine abandonment plan (ref: 4609) confirms the presence of recorded shallow workings in the Arely Coal sub-crop in the central / southern sector. Workings are known to be present in a thin leaf and thicker seam at a depth between 24-27m bgl with rockhead at 20m. In this sector, there is insufficient rock cover to accurately determine the extent of workings. It is probable that workings extend beyond the area mapped by the Coal Authority. It will be necessary to stabilise these workings by drilling and grouting on a close centred grid (6m x 6m with a centre hole equating to treatment of 4.5m2) to ensure the voids are consolidated and the risk of subsidence induced by successive cavitation of voids is mitigated adequately. Further close centred rotary open hole drilling is required to accurately determine the extent of the Arley coal sub-crop and define the extent to which stabilisation works are required in the central sector of the site. This work will inform the design of a specification for the consolidation of abandoned mine workings. The main Arley coal outcrop (~300m) north is conjectured to be at least 30m below rock head at the northern extremity of the subject site, therefore with adjustments made for topographical variance, it is unlikely that this seam of coal represents a risk of subsidence associated with the consolidation of unrecorded workings in the northern sectors. This will be confirmed by further investigation to locate the proven sub-crop. In the southwest sector, a fault is apparent (as recorded by the BGS) with an obvious downthrow to the northeast. The Arely sub-crop is identified in the E3P rotary boreholes in this sector, however given its inclined dip of ~11 degrees there appears to be sufficient rock cover (10x seam thickness) to mitigate the risk of subsidence induced by consolidation of unrecorded workings. This will be confirmed by the close centred drilling to position the sub-crop and extent to which workings represent a subsidence risk. Shaft 385409-001 has been capped, with the concrete cap visible at ground level. The remaining three shafts ref: 385408-001, 385408-002 and 385409-002 are located in the central western sector of the site, where coal is present in two leaves between 24m and 27m below ground level. Probe drilling will be required in the form of three probe spirals to identify the exact location of the shafts.

Recommendations	Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course: • Probe drilling to locate the three mine entries recorded and not found; • Rotary drilling to confirm location of Arley sub-crop and clearly define areas requiring stabilisation by drilling and grouting; • Further works to delineate the extent of compressible peat; • Plot Specific Foundation Schedule (upon receipt of the final development levels); • Arboriculture Survey; • Specification for the location of the mine entries and consolidation of all shallow abandoned mine workings; • Post Demolition Site Investigation; and • Remediation & Enabling Works Strategy.

Table of Contents

1. INTRODUCTION 13
1.1 Background 13
1.2 Proposed Development 13
1.3 Objectives 14
1.4 Previous Reports 14
1.5 Limitations 14
1.6 Confidentiality 15

2. SITE SETTING 16
2.1 Site Summary 16
2.2 Current Site Use 16
2.3 Surrounding Area 17
2.1 Coal Mining – Desk Study 17
2.2 Coal Mining Information 18
2.3 Coal Mining Risk Assessment 20

3. SITE HISTORY 22
3.1 On-Site Historical Development 22
3.2 Off-Site Historical Development 24

4. INITIAL CONCEPTUAL SITE MODEL 26
4.1 Initial CSM 26

5. E3P GROUND INVESTIGATION 28
5.1 General 28
5.2 In-Situ Standard Penetration Testing (SPT) 29
5.3 In-Situ California Bearing Ratio (CBR) 29
5.4 Permeability Tests 29
5.5 Laboratory Analysis 29

6. GROUND AND GROUNDWATER CONDITIONS 30
6.1 Ground and Groundwater Conditions 30
6.1.1 Summary of Ground Conditions 30
6.1.2 Groundwater 33
6.1.3 Visual and Olfactory Evidence of Contamination 33
6.1.4 Soil Consistency 34
6.1.5 Side Stability and Ease of Excavation 35
6.1.6 Soil Compressibility 40
6.1.7 Soli Infiltration 40
6.1.8 Soil Plasticity 41
6.1.9 California Bearing Ratio 42
6.1.10 pH and Sulphate 43
6.2 Ground Gas 44
6.2.1 Investigation Rationale 44
6.2.2 Monitoring Methodology 45

7. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT 48
7.1 Human Health Risk Assessment 48
7.2 Controlled Waters Risk Assessment 51
7.3 Ground Gas 54

7.4 Sources of Ground Gas 55
7.4.1 Groundwater 55
7.4.2 Gas Flow 55
7.4.3 Gas Concentrations 55
7.4.4 Gas Assessment 56
7.5 Residential Building Gas Risk Mitigation 56
7.6 Conceptual Site Model 60

8. GEOTECHNICAL ASSESSMENT 62
8.1 Proposed Development 62
8.2 Summary of Ground Conditions 62
8.3 Site Preparation 63
8.4 Foundation Conditions & Assessment of Potential Bearing Capacities 63
8.5 Ground Floor Slabs 68
8.6 Heave Precautions 68
8.7 Infrastructure & External Hardstanding 69
8.8 Pavement Construction 69
8.9 Drainage 69
8.10 Concrete Durability 70
8.11 Excavations 70
8.12 Coal Mining 71
8.13 Further Works 74
8.14 Construction Activity and Inspection 74

9. CONCLUSIONS AND RECOMMENDATIONS 76

APPENDICES

Appendix I Limitations
Appendix II Glossary
Appendix III Drawings

Drawing No 13-223-001 – Site Location Plan
Drawing No 13-223-002 – Draft Development Layout
Drawing No 13-223-003 – Historical Features Plan
Drawing No 13-223-004 – Current Site Features Plan
Drawing No 13-223-005 – Exploratory Hole Location Plan
Drawing No 13-223-006 – Depth of Topsoil Plan
Drawing No 13-223-007 – Depth of Made Ground Plan
Drawing No 13-223-008 – Depth to Founding Strata Plan
Drawing No 13-223-009 – Depth and Thickness of Peat Plan
Drawing No 13-223-010 – Coal Mining Issues Plan
Drawing No 13-223-012 – Depth to Bedrock Plan
Drawing No 13-223-013 – Depth and Thickness of Coal Plan
Drawing No 13-223-014 – Conceptual Site Model Plan
Drawing No 13-223-015 – Concept Foundation Zoning Plan
Drawing No 13-223-016 – Gas Assessment Plan

Appendix IV Photographs
Appendix V E3P Exploratory Hole Logs
Appendix VI Chemical Testing Results

Appendix VII Origin of Tier I Generic Assessment Criteria
Appendix VIII Geotechnical Testing Results
Appendix IX Dynamic Cone Penetrometer Test Certificates
Appendix X Permeability Test Certificates
Appendix XI Coal Mining Consultants Report and Abandonment Plans

1. INTRODUCTION

1.1 Background

E3P has been commissioned by Russell Homes to undertake a detailed Phase II Geo-Environmental Site Investigation for a parcel of predominantly agricultural land off Manchester Road in, Heywood.

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

The scope of work consisted of following elements.

- *Summary of desk study information;*
- *Design of suitable intrusive Ground Investigation;*
- *Window sample probeholes with and construction of environmental monitoring installations;*
- *Deep Cable Percussive Boreholes;*
- *Rotary Boreholes;*
- *Mechanically excavated trial pits;*
- *In-situ Geotechnical Testing;*
- *Chemical & Geotechnical Laboratory analysis;*
- *Groundwater monitoring and sampling;*
- *Ground gas monitoring;*
- *Contamination Risk Assessment & Conceptual Site Model;*
- *Geotechnical Assessment & Interpretation; and,*
- *Factual and interpretive reporting.*

1.2 Proposed Development

E3P understands that Russel Homes have been granted Outline Planning Consent for a strategic mixed-use development that will comprise a 2.2km link road, residential housing and commercial / industrial land use. Russell Homes intend to develop the phase 4 development area which is located in the eastern sector of the wider development, for a residential end use comprising a series of low rise dwellings with associated private garden and landscaped areas, public open space, estate roads and infrastructure. Drawing 13-223-002 (Appendix III) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.1 overleaf:

Figure 1.1 Snapshot of Proposed Development



1.3 Objectives

The objectives of the Geo-Environmental Investigation are to:

- 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; and,
- Provide recommendations regarding future works required.

1.4 Previous Reports

The following reports have previously been completed for the site:

E3P – *Phase I Geo-Environmental Site Assessment.* Ref: Report No. 11-094-r1, dated November 2016.

The pertinent points of the previous E3P report has been included within Section 6.0 of this report.

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. SITE SETTING

2.1 Site Summary

Site Address	Land off Manchester Road, Heywood, OL10 2NL
National Grid Reference	E 385978, N 409079
Site Area	~29.22 Ha

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III as Drawing 13-223-001.

2.2 Current Site Use

E3P has undertaken a site walkover of the entire site and a description of the key findings is summarised in Table 2.1.

Table 2.1 Site Description

Occupancy/use	The subject site is known as Collop Gate Farm and is an irregular shaped parcel of land located to the east of Manchester Road in Heywood. The area comprises of six undeveloped agricultural fields which are largely used for livestock grazing. The fields are separated by hedgerows and an access road through the centre of the site. Commercial buildings with associated hardstanding and metal storage containers are located in the north west of the site. There is also a hardstanding storage area in the centre of the site, with a number of metal containers and stockpiles of aggregate. Whittle Brook flows along the southern boundary and though the eastern sector of the site. There is a high pressure gas main located within five of the six agricultural fields.	
Structures	There are 6 No. commercial buildings and associated infrastructure in the northern sector of site. There are no other structures within the site boundary.	
Access	Access is from Manchester Road to the east at the Collop Gate Farm entrance.	
Retaining structures	None apparent within the site boundary.	
Surface Cover (%)	Buildings:	5%
	Hardstand:	5%
	Soft cover:	90%
Vegetation/Ecology	Vegetation is present across the site with grass which is short due to livestock grazing. Rough scrub vegetation is present along the hedgerows of the field boundaries. A Habitat Survey will be required to support the planning application.	

Hazardous Material Storage	No Above Ground Storage Tanks (AST) or Underground Storage Tanks (UST) were observed at the site during the preliminary site walkover. Due to the predominantly undeveloped nature of the site it is unlikely hazardous materials storage will have occurred on the site.
Asbestos Containing Material (ACM)	No evidence of ACM was noted during the site walkover and site investigation.
Polychlorinated Biphenyls (PCBs)	There is no equipment identified which may contain PCBs within the site boundary or in close proximity.
Waste Storage	Potentially hazardous waste streams are unlikely to be generated at the site and none were observed during the preliminary site inspection.
Drainage	Drainage connections are available throughout Manchester Road to the west.

2.3 Surrounding Area

The surrounding area land uses are summarised in Table 2.2.

Table 2.2 Surrounding Land Uses

DIRECTION	LAND USE
North	Residential dwellings.
East	Residential dwellings and Middleton Road.
South	Whittle Brook and agricultural fields.
West	Manchester Road, residential dwellings and commercial unit.

2.1 Coal Mining – Desk Study

The Coal Authority operates a risk based approach to the assessment of potential instability issues associated with future development of land located within the pre-defined Coal Authority Consultation Areas. This risk based approach sub-divides the potential risk into 'Low & High' Risk Categories.

The Risk Categories can be defined as:

Low Risk Sites - Deemed to be land where coal mining has taken place, however it was at such depth not to pose a risk to new development and it therefore contains no known recorded risks and as such no further assessment is required.

For Low Risk Sites, the Coal Authority categorically state:

"If your proposed development is within the Development Low Risk Area ***there is no need for you to submit any coal mining information with your planning application*** *and The Coal Authority will not be consulted by the LPA. The LPA will include our Standing Advice as an informative note within the decision notice".*

High Risk Sites are deemed to be landholdings located within an area known to contain legacy risks that include:

- *Mine entries (shaft or Adit);*
- *Shallow Coal Workings (recorded and probable);*
- *Workable coal seam outcrops;*
- *Mine gas sites and areas;*
- *Recorded coal mining related hazards;*
- *Geological features (fissures and break lines); and,*
- *Former surface mining sites (sometimes using historic opencast extraction methods).*

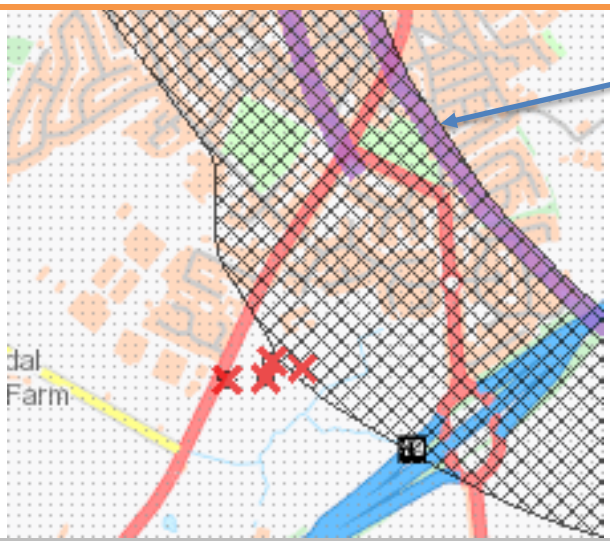
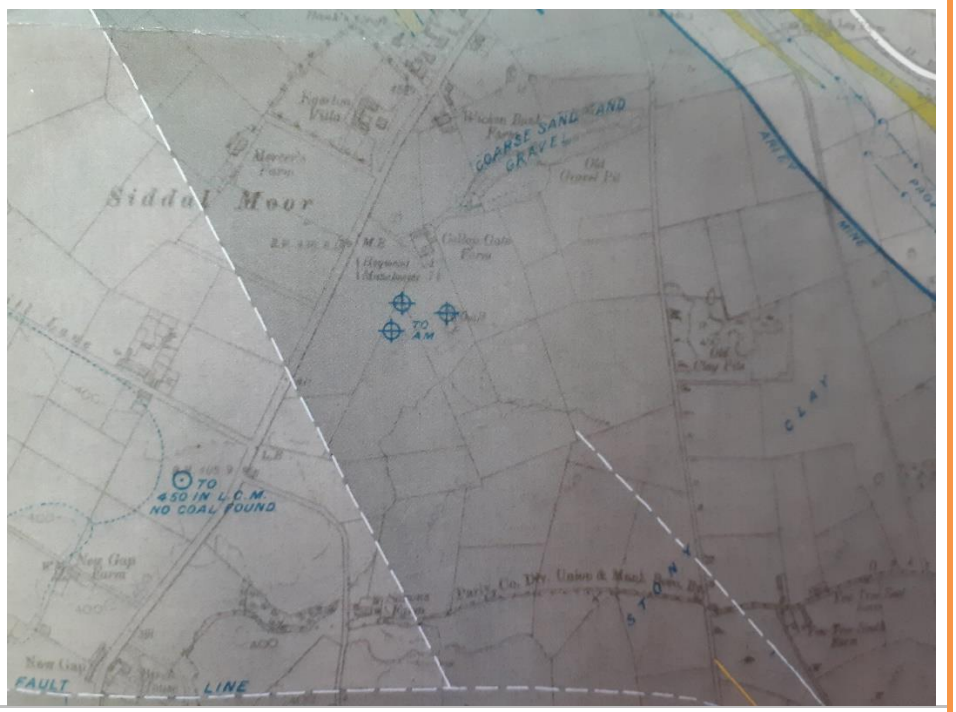
2.2 Coal Mining Information

Prior to the enactment of the Coal Mines Regulation Act (1872) which came into force on the 1st January 1883, there was no statutory requirement to record the extent of abandoned mine workings and as such the Coal Authority has no knowledge of extensive workings throughout the UK Coal Fields where shallow workings are present at a depth which could result in a subsidence event in the future (through successive cavitation) associated with failure of support mechanism.

To determine if a site may have unrecorded or recorded coal mine workings requires a consideration of a wide range of information and E3P has completed a review of relevant information in relation to potential coal mining activities. Table 2.3 provides a summary of pertinent coal mining information.

Table 2.3 Coal Mining Information

SOURCES OF INFORMATION	SUMMARY
Coal Authority Mining Report	The Coal Authority Mining Report (Ref: 51002059407001) dated 21st March 2019 has been obtained for the subject site by E3P. This report confirmed: ▪ *The property is within a surface area affected by past underground mining;* ▪ *There are probable unrecorded shallow workings;* ▪ *Four coal mine entries are located on site* ▪ *No coal outcrops are recorded;* ▪ *There is no record of a mine gas emission requiring action by the Coal Authority within the boundary of the property;* ▪ *The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining; and* ▪ *The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.*
Coal Authority Interactive Map	The Coal Authority confirms that the majority of the site is located in a development high risk area. Four mine shafts are recorded in the south west of the site. The Arley coal seam is shown to outcrop ~300m to the north of the site, dipping in a south westerly direction with probable shallow coal workings. Ground level at the outcrop is ~135m AOD approximately 6m higher than the highest point of the subject site. There are four mapped mine shafts all appearing to be associated with the coal seam outcropping to the north.

SOURCES OF INFORMATION	SUMMARY
Coal Authority Interactive Map	
British Geological Survey Mapping	The 1:10,000 geological mapping for the area indicates the presence of the Arley coal seam outcropping at its closest point approximately 300m north east of the site. The seam is understood to be dipping in a south westerly direction beneath the site. Three mine shafts are shown on site, presumably associated with the Arley seam. It is likely that there are workings within the identified coal seam. A fault is shown to the south of the site with the downthrow side to the south east, however the depth of bedrock encountered suggests that the downthrow side is actually to the north east. 
Review of Coal Authority Archive	Coal Authority archives / Mine Abandonment Plans are available, which record the site as Siddall Moor Colliery. No significant coal reserves were encountered. The plans are included in Appendix XI.

SOURCES OF INFORMATION	SUMMARY
Historical Ordnance Survey Mapping	A review of the 1:10,000 Ordnance Survey mapping from c. 1850 which has records of mine workings which pre-dated the Mining & Regulation Act of 1872 identified the following features which indicate historical mine workings in proximity to the application site: ▪ Coal Shaft – on site; ▪ Sand Pit/Old Gravel Pit 10m North In consideration of the historical mining features in proximity to the site and potential for coal close to the surface it is considered possible that coal extraction has occurred underlying the site at relatively shallow depths although further investigation would be required to determine the extent and depth of any worked seams.
Historical Site Investigations	E3P has not been provided with any historic site investigation reports.

2.3 Coal Mining Risk Assessment

This Risk Assessment comprises a desk-based review of all available information on the coal mining issues which are relevant to the application site deemed to be located within a 'High Risk' area. This includes:

- Interpretation of information to identify and assess the risks to the proposed development from coal mining legacy, including the cumulative impact of issues;
- Setting out appropriate mitigation measures to address the coal mining legacy issues affecting the site, including any necessary remedial works and/or demonstrate how coal mining issues have influenced the proposed development; and,
- Demonstrating to the Local Planning Authority that the application site is, or can be made, safe and stable to meet the requirements of national planning policy with regard to development on unstable land.

The Desk Based Coal Mining Risk Assessment is summarised in Table 2.4.

Table 2.4 Summary of Coal Mining Risk Assessment

COAL MINING RISK ASSESSMENT	YES / NO	DESK BASED RISK ASSESSMENT
Recorded Underground Coal Mining at Shallow Depth (<30m)	**Yes**	**High**
Recorded Underground Coal Mining at Shallow Depth (>30m)	**No**	**Low**
Evidence of unrecorded surface extraction of coal outcrop	**No**	**Low**
Unrecorded Underground Coal Mining at Shallow Depth (<30m)	**Yes**	**High**
Mine Entries (Shaft / Adits)	**Yes**	**High**
Coal Mining Geology – Fractures / Fissures	**No**	**Low**
Recorded Gas Emissions	**No**	**Low**
Recorded Mining Surface Hazard	**No**	**Low**
Surface Mining (opencast)	**No**	**Very Low / Low**

Based on the above, a high risk of unrecorded coal mining at shallow depth has been identified.

The Coal Authority as a statutory consultee will require a series of rotary open holes across the site to determine the presence of any coal on site and understand the nature of any coal workings.

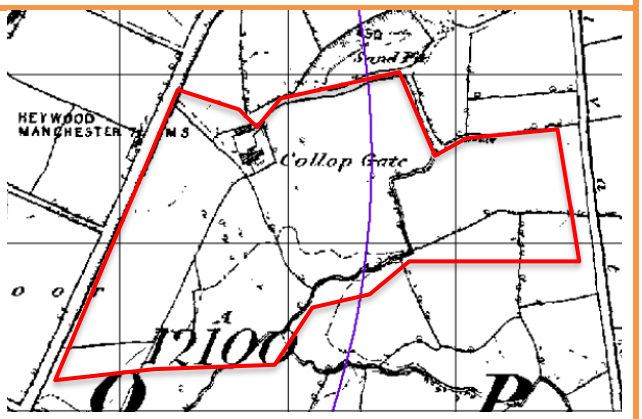
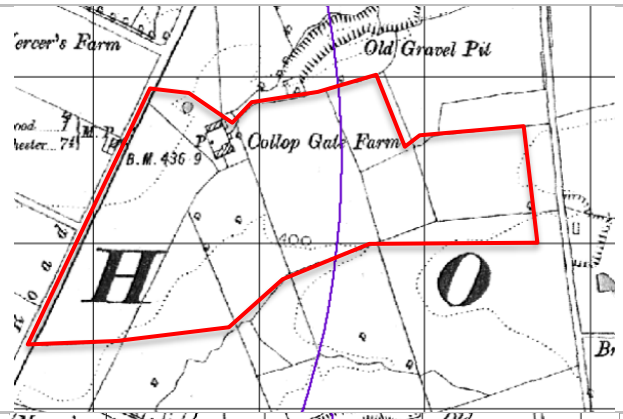
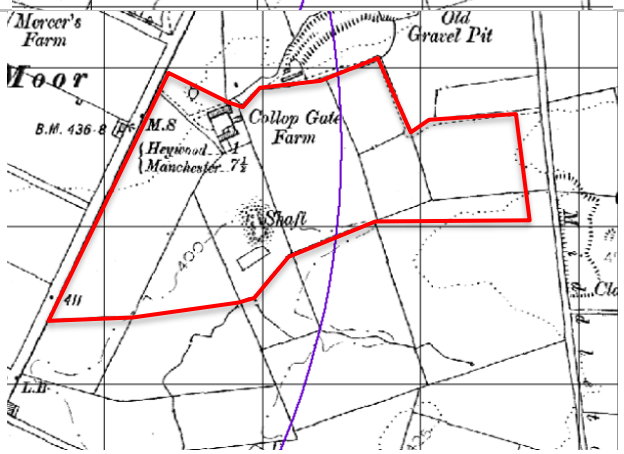
Furthermore, the Coal Authority will require exploratory investigations to be undertaken in the locality of the mine shafts in the western sector.

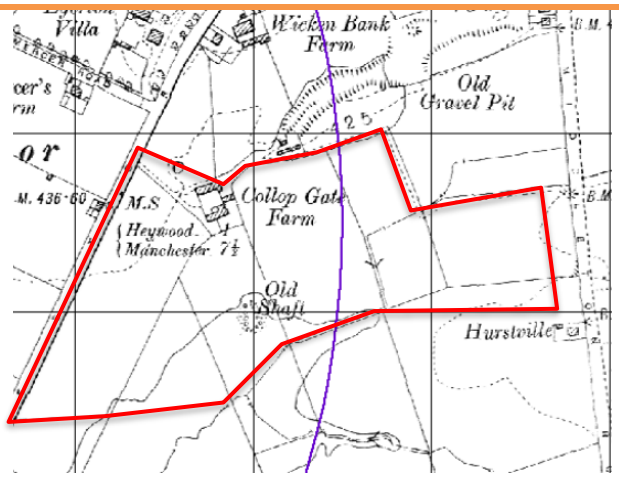
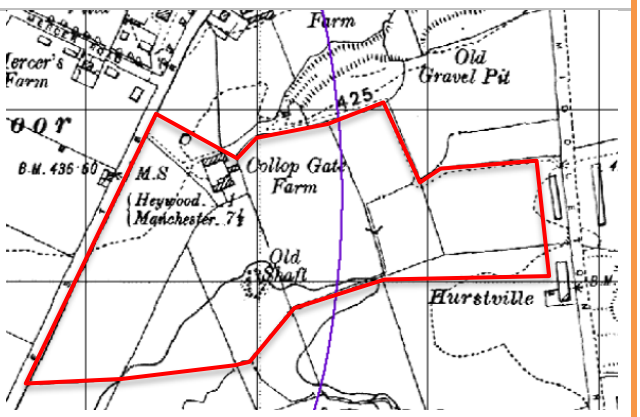
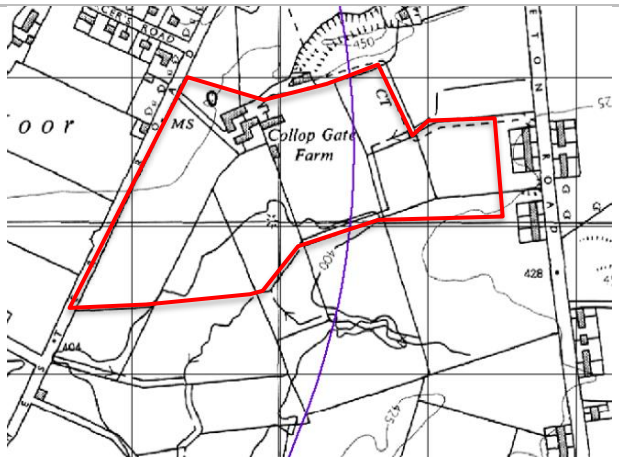
3. SITE HISTORY

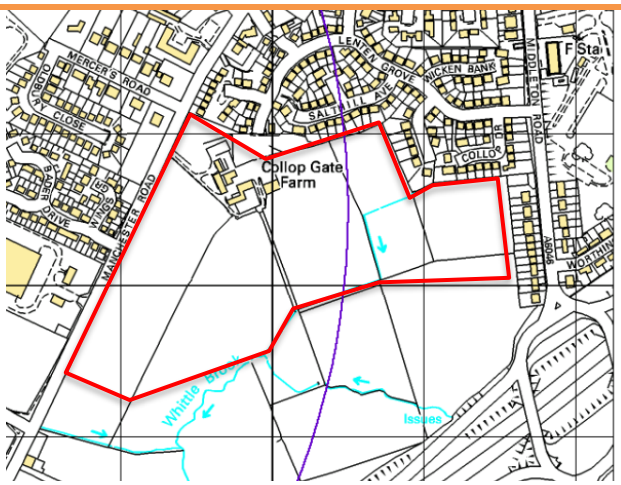
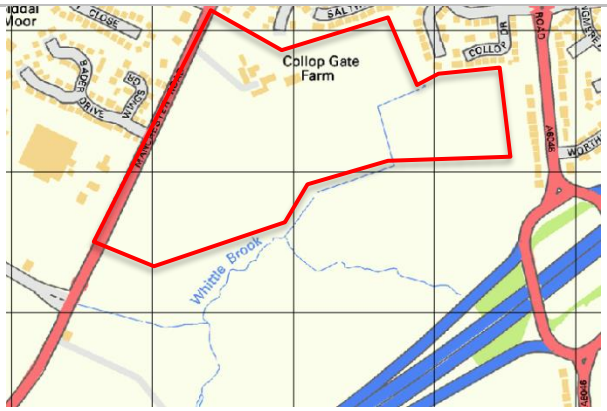
3.1 On-Site Historical Development

A review of historical mapping pertinent to the site is summarised in Table 3.1 below. In addition, historical site features are presented on Drawing No 13-223-003 in Appendix III.

Table 3.1 Site Historical Development

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1848-1851 1:10,560	The majority of the site is recorded as undeveloped agricultural land. Collop Gate Farm is recorded in the northern sector. A footpath appears to be present within the central and western fields. A drainage ditch is also present in the eastern field and along the southern boundary.	
1894 1:10,560	A pond in the northern corner of site is recorded. There are no significant changes except for a few sporadic trees in the centre of the site.	
1910 1:10,560	A mine shaft and associated building are recorded within the central sector of the site.	

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1923-1932 1:10,560	The mine shaft is now recorded as 'old shaft' and the building is no longer present. No further changes have been identified.	
1938 1:10,560	Buildings are recorded at the eastern site boundary. No other significant changes have been identified.	
1965-1968 1:10,000	There are no significant changes identified within the site boundary.	

MAP EDITION	HISTORICAL LAND USE	HISTORICAL MAP EXCERPT
1999 1:10,000	The pond is no longer recorded. There are no other significant changes within the site boundary.	
2016 1:10,000	There are no significant changes within the site boundary	
Google Earth 2016	There are numerous track marks in the field to the south of Collop Gate Farm. The storage area in the north of the field is identified.	

3.2 Off-Site Historical Development

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 500m radius of the site is summarised below in Table 3.2.

Table 3.2 Surrounding Potentially Contaminative Land Uses.

SURROUNDING FEATURE	DISTANCE	DATES	DIRECTION
Sand Pit *Then named Old Gravel Pit* *Then no longer recorded*	0m	Pre1848-Pre1894 Pre1894-Pre1974 Pre1974-Present	North
Pond *Then no longer recorded*	384m	Pre1894-Pre1974	North
Garage *Then named as Fuel Station* *Then no longer recorded*	259m	Pre1965-Pre1974 Pre1974-Pre1999 Pre1999-Present	North East
Pond *Then no longer recorded*	332m	Pre1894-Pre1910	North East
Unnamed Sand/Gravel Pit *The no longer recorded*	85m	Pre1894-Pre1938	South East
Pond *Then no longer recorded*	110m	Pre1894-Pre1938	South East
Depot	474m	Pre1974-Present	West
Sewage Works *Then no longer recorded*	480m	Pre1983-Pre2016	West
Tank *Then no longer recorded*	405m	Pre1923-Pre1965	North West

4. INITIAL CONCEPTUAL SITE MODEL

4.1 Initial CSM

In accordance with Environment Agency, CLR 11 (2004) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), E3P Ltd has developed an initial CSM to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 4.1.

Table 4.1 Initial Conceptual Site Model

SOURCE	PATHWAY	RECEPTOR
Human Health		
Heavy metals / Non-volatile PAH associated with localised infilling	Dermal Contact and Ingestion Consumption of Home-grown Produce	Construction Workers Residential End Users
Discussion: Due to the largely undeveloped nature of the site, there are limited potential sources of contamination identified. However, Made Ground associated with any localised infilling may be a potential source of heavy metals and semi-volatile Polycyclic Aromatic Hydrocarbons (PAH) which may pose a short-term risk to construction workers who may come into contact with impacted soils during earthworks. All construction works must be undertaken using the appropriate Personal Protective Equipment (PPE) to remove this potential risk. Future residential users may come into contact with impacted soils within any garden and landscaped areas. If impacted soils are identified then localised remediation or an appropriate cover system, designed in accordance with BRE465 (*Cover Systems for Land Regeneration),* will remove the exposure pathway and therefore risk to future residential site users.		
Asbestos Containing Materials (ACM) within Made Ground	Fibre / Dust Inhalation	Construction Workers Residential End Users Third Party Property
Discussion: Historic infilling of natural depressions, ponds or field boundaries may have occurred with soils containing asbestos, such as ash deposits and building demolition material, therefore this could now be present within Made Ground, however the potential for this is considered to be low. No significant potential sources of ACM are identified, however, if present disturbance of potentially asbestos impacted Made Ground soils may give rise to dust generation, and migration of asbestos fibres on or off site. If present, impacted soil poses a risk to construction workers and future end users. ACM poses a risk through fibre and dust inhalation and if present may pose a risk to construction workers during any future earthworks / demolition and to adjacent third party property should dust be generated during those works. These risks can be mitigated through the development of a detailed enabling works strategy following guidance and protocol specified within the Control of Asbestos Regulations (2012) and industry best practice as detailed in CIRIA733 (Asbestos in Soil and Made Ground: A guide to understanding risk).		

Hazardous Ground Gases		
Methane and Carbon Dioxide associated with any localised infilling	Inhalation Accumulation	Construction Workers Residential End Users
Discussion: The presence of infilled depressions, ponds or field boundaries and possible peat may be a source of hazardous ground gas (such as carbon dioxide & methane) which may pose a risk to construction workers and residential end users. Carbon dioxide and methane have associated asphyxiation and explosive risks, respectively.		
Controlled Waters		
Mobile Contaminants	Vertical / Lateral Migration	Secondary A Aquifer Whittle Brook
Discussion: Significant on-site sources of potentially mobile contaminants are not anticipated at the subject site. The Secondary A Aquifer within the underlying bedrock geology is considered a potential receptor, however, given the absence of any potable groundwater abstractions within close proximity to the site the overall sensitivity of this receptor is reduced. Whittle Brook is located along the southern boundary of site however, in the absence of any potentially significant sources of mobile contaminants, the site is considered to pose a low risk to controlled waters		
Buildings and Infrastructure		
pH & Sulphate	Corrosion of Concrete	Foundations / Concrete
Discussion Presence of pH and sulphate within any localised Made Ground deposits may result in corrosion of buried concrete within the proposed development. Assessment must be undertaken to confirm the levels of pH and sulphate within Made Ground deposits and thus determine the concrete classification.		
Ecology		
None Identified	Lateral Migration	Whittle Brook
Discussion Semi-mature trees and hedgerows are located along field boundaries which may provide habitats for protected wildlife (nesting birds or roosting bats). A habit survey will be required to support a planning application. In the likely absence of any significant sources of mobile contaminants, the risk to ecology and aquatic ecosystems is considered to be low.		

5. E3P GROUND INVESTIGATION

5.1 General

A Ground Investigation has been designed based on the findings of the desk study with exploratory holes advanced to target specific potential contaminant sources summarised in Table 5.1. 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 the 29th April 2019 and the 2nd May 2019. The works are summarised in Table 5.1.

Table 5.1 Summary of Fieldwork

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (mbgl)	MONITORING WELLS RESPONSE ZONE (mbgl)
General Ground Conditions including the presence / nature of obstructions.	WS101	Window Sample Probehole	5.45	1.00-4.00
	WS102		3.45	N/A
	WS103		3.45	1.00-3.50
	WS104		3.45	1.00-2.00
	WS105		5.45	1.00-4.00
	WS106		2.45	0.50-2.00
	WS107		1.45	N/A
	WS107 A		2.45	0.50-2.00
	WS108		4.45	1.00-3.50
	WS109		3.45	0.50-2.50
	WS110		3.45	0.50-2.50
	WS111		3.45	N/A
	WS112		3.45	0.50-2.50
	WS113		3.45	0.50-2.50
	WS114		3.45	0.50-3.00
	WS115		4.45	1.00-4.00
	WS116		5.45	0.50-3.50
	WS117		3.45	N/A
	WS118		5.45	0.50-2.0
General Ground Conditions including the presence / nature of obstructions	TP101-TP144	Mechanically Excavated Trial Pit	2.80	N/A
General Ground Permeability	SA101-SA104	Soakaway Pit	3.10	N/A
General Ground Conditions including the presence / nature of obstructions	CP101-CP102	Cable Percussion Boreholes	15.95	N/A
General Ground Conditions including the presence / nature of obstructions	RB101-RB112	Rotary Open Holes	31.50	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 any 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.

A 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.

Trial trenches were advanced to locate the presence of the former mine shafts in the west of the site in an attempt to accurately identify the location.

The sampling locations are illustrated in Drawing 13-223-004 (Appendix III). The ground conditions encountered are indicated on the logs which are provided in Appendix VI.

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.

5.2 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 VI and presented in Table 6.5 and discussed in Section 8.0.

5.3 In-Situ California Bearing Ratio (CBR)

In-situ CBR tests were undertaken at selected locations using a TRL probe. Tests were undertaken at depths of between 300mmm and 1m below ground level in order to intersect the likely pavement sub formation level. The results are presented in Table 6.9 and test certificates are included within Appendix IX.

5.4 Permeability Tests

Four soakaway permeability tests were undertaken (SA101-SA104) in order to assess the likely permeability of the underlying strata to determine the potential suitability for soakaway drainage within the proposed development. The results are presented in Table 6.7 and the test certificates are included within Appendix X.

5.5 Laboratory Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulphate, water soluble sulphate (2:1 extract), sulphide, cyanide, phenols, total and speciated poly-aromatic hydrocarbons (PAHs), SVOCs, VOCs, asbestos and total and speciated petroleum hydrocarbon (TPH). I2 Analytical undertook the analytical work and the testing results are included in Appendix VII and discussed in Section 7.0

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

- Atterberg Limits Determinations;
- Single Stage Triaxial Tests;
- Consolidation Tests;
- Particle Size Distribution.

Laboratory analysis sheets are included in Appendix VIII and are summarised in Section 8.0.

6. GROUND AND GROUNDWATER CONDITIONS

6.1 Ground and Groundwater Conditions

6.1.1 Summary of Ground Conditions

The Ground Investigation generally confirms the published geology and identifies the strata set out in Table 6.1:

Table 6.1 Summary of Strata

HOLE	DEPTH TO STRATUM (MBGL)							
	MADE GROUND	TOPSOIL	PEAT/SILT	SOFT CLAY	STIFF CLAY	SAND	GRAVEL	BED ROCK
TP101	-	0.00-0.30	-	-	0.30-2.60	-	-	-
TP102	-	0.00-0.30	-	-	0.90-2.40	0.30-0.90	-	-
TP103	-	0.00-0.30	-	-	0.30-2.80	-	-	-
TP104	-	0.00-0.30	-	-	0.30-1.90	-	-	-
TP105	-	0.00-0.30	-	-	1.70-2.50	0.30-1.70	-	-
TP106	-	0.00-0.30	-	-	0.30-2.00	-	-	-
TP107	-	0.00-0.30	-	-	0.30-1.80	1.80-2.10	-	-
TP108	-	0.00-0.30	-	-	1.30-2.20	0.30-1.30	-	-
TP109	-	0.00-0.40	-	-	1.10-2.60	0.40-1.10	-	-
TP110	0.00-1.60	-	-	-	-	-	-	-
TP111	-	0.00-0.30	-	-	0.80-2.30	-	0.30-0.80	-
TP112	0.00-2.10	-	-	-	-	-	-	-
TP113	0.00-1.20	-	-	-	-	-	-	-
TP114	-	0.00-0.30	-	-	0.30-2.30	-	-	-
TP115	-	0.00-0.30	PEAT 0.30-1.40	-	-	1.40-1.90	-	-
TP116	-	0.00-0.30	-	-	0.30-2.30	-	-	-
TP117	-	0.00-0.20	-	-	0.20-1.30	1.30-2.40	-	-
TP118	-	0.00-0.30	-	-	0.30-2.40	-	-	-
TP119	-	0.00-0.35	-	-	-	0.35-2.30	-	-
TP120	-	0.00-0.30	-	-	1.20-2.60	0.30-1.20	-	-
TP121	-	0.00-0.30	-	-	-	0.30-2.30	-	-
TP122	-	0.00-0.20	-	-	0.20-2.50	-	-	-
TP123	-	0.00-0.20	PEAT 2.20-2.40	-	0.20-2.20 2.40-2.70	-	-	-
TP124	-	0.00-0.20	-	-	0.20-2.40	-	-	-
TP125	-	0.00-0.20	PEAT 2.10-2.30	-	0.20-2.10 2.30-2.70	-	-	-
TP126	-	0.00-0.20	-	-	-	0.20-2.40	-	-
TP127	-	0.00-0.30	-	-	0.30-2.30	-	-	-
TP128	-	0.00-0.30	-	-	0.30-2.60	-	-	-
TP129	-	0.00-0.20	-	-	-	0.20-2.20	-	-
TP130	-	0.00-0.30	-	-	-	0.30-2.20	-	-
TP131	-	0.00-0.30	-	-	-	0.30-2.50	-	-
TP132	-	0.00-0.30	-	-	-	0.30-1.90	-	-
TP133	-	0.00-0.30	PEAT 0.30-1.30	-	-	1.30-2.40	-	-
TP134	-	0.00-0.30	-	-	-	0.30-2.10	-	-
TP135	-	0.00-0.30	PEAT 0.30-1.10	-	-	1.10-2.10	-	-
TP136	-	0.00-0.30	PEAT 0.30-0.60	-	-	0.60-2.40	-	-
TP137	-	0.00-0.30	-	-	0.30-1.60	-	1.60-2.40	-
TP138	-	0.00-0.30	PEAT 0.30-1.40	-	-	1.40-2.50	-	-
TP139	-	0.00-0.30	PEAT 0.30-0.80	-	-	0.80-1.90	-	-
TP140	-	0.00-0.35	-	-	0.35-2.50	-	-	-

HOLE	DEPTH TO STRATUM (MBGL)							
	MADE GROUND	TOPSOIL	PEAT/SILT	SOFT CLAY	STIFF CLAY	SAND	GRAVEL	BED ROCK
TP141	0.00-2.20	-	-	-	-	-	-	-
TP142	0.00-1.80	-	-	-	-	-	-	-
TP143	0.00-1.40	-	-	-	-	-	-	-
TP144	0.00-1.60	-	-	-	-	-	-	-
WS101	-	0.00-0.30	-	-	0.30-5.45	-	-	-
WS102	-	0.00-0.40	-	-	0.40-3.45		-	-
WS103	-	0.00-0.20	-	-	0.40-3.45	0.20-0.40	-	-
WS104	-	0.00-0.40	-	-	1.10-3.45	0.40-1.10	-	-
WS105	0.00-1.80	-	-	1.80-2.60	2.60-5.45		-	-
WS106	0.00-2.45	-	-	-	-		-	-
WS107	0.00-1.45	-	-	-	-		-	-
WS107A	0.00-2.45	-	-	-	-		-	-
WS108	0.00-0.45	-	-	-	0.45-3.45	3.45-4.45	-	-
WS109	0.00-0.65	-	PEAT 0.65-1.50	-	-	1.50-3.45	-	-
WS110	0.00-0.45	-	-	-	0.45-2.40		2.40-3.45	-
WS111	-	0.00-0.20	PEAT 0.20-0.60	-	-	0.60-3.45	-	-
WS112	-	0.00-0.20	PEAT 0.20-1.10	-	-	1.10-3.45	-	-
WS113	-	0.00-0.30	-	-	-	0.30-3.45	-	-
WS114	-	0.00-0.30	-	-	-	0.30-3.45	-	-
WS115	-	0.00-0.25	PEAT 0.25-0.50 1.60-2.60	-	0.50-1.60 2.60-2.90	2.90-4.45	-	-
WS116	-	0.00-0.10	-	-	0.10-5.45		-	-
WS117	-	0.00-0.30	-	-	-	0.30-3.45	-	-
WS118	0.00-1.80	-	-	-	1.80-5.45		-	-
SA101	-	0.00-0.40	-	-	0.40-3.10		-	-
SA102	0.00-0.40	-	-	-	-	0.40-2.40	-	-
SA103	0.00-0.30	-	-	-	-	0.30-2.40	-	-
SA104	-	0.00-0.30	-	-	-	0.30-1.50	-	-
CP101	-	0.00-0.50	-	-	0.50-5.10	-	-	5.10-10.45
CP102	-	0.00-0.70	SILT 10.60-11.70	0.70-3.00	3.00-8.00 11.70-13.80	-	8.00-10.60 13.80-15.95	-
RB101	-	0.00-0.20	-	-	0.20-4.20	-	-	4.20-30.00
RB102	-	0.00-0.20	-	-	0.20-4.60	-	-	4.60-30.00
RB103	0.00-4.50		-	-	4.50-12.60	-	-	12.60-30.00
RB104	-	0.00-0.20	-	-	0.20-7.50	7.50-19.90	-	19.90-30.00
RB105	0.00-3.00		-	-	3.00-20.40	-	-	20.40-30.00
RB106	-	0.00-0.20	-	-	0.20-4.50 8.50-11.60	4.50-8.50 11.60-20.30	-	20.30-30.00
RB107	-	0.00-0.20	-	-	0.20-2.70 8.40-16.40	2.70-8.40	-	16.40-30.00
RB108	-	0.00-0.20	PEAT 0.20-1.00	-	12.20-19.70	1.00-12.20	-	19.70-30.00
RB109	-	0.00-0.20	-	-	0.20-3.00 17.60-24.10	3.00-17.60	-	24.10-31.50
RB110	-	0.00-0.40	-	-	8.90-19.50	0.40-8.90	-	19.50-30.00

HOLE	DEPTH TO STRATUM (MBGL)							
	MADE GROUND	TOPSOIL	PEAT/SILT	SOFT CLAY	STIFF CLAY	SAND	GRAVEL	BED ROCK
RB111	-	0.00-0.40	-	-	12.00-18.90	0.40-12.00	-	18.90-30.00
RB112	0.00-1.80	-	-	-	1.80-5.90	-	-	5.90-30.00

Topsoil

Topsoil was encountered in the majority of exploration locations to a maximum proven depth 0.70m bgl in CP102, however this was generally encountered to depths of between 0.10–0.40m bgl. Topsoil comprised soft dark brown slightly sandy gravelly clay with gravel of mudstone.

Made Ground

Made Ground deposits were encountered in the area of hardstanding in the north west and in the central sector of the site to a maximum proven depth of 4.50m bgl in RB103, although in general Made Ground was encountered to less than 2.00m bgl.

In the north west, the Made Ground generally comprised dark grey gravel of asphalt overlying stiff dark brown slightly gravelly clay with brick.

The central sector comprised reworked topsoil of soft dark brown sandy clay with occasional gravel of brick over firm grey brown sandy gravelly clay with gravel of brick mudstone and concrete.

In a number of locations, the full thickness of Made Ground was not proven due to difficulty excavating.

Aggregate has been placed to form areas of hardstanding in the north of the site and an access road through the site.

The depth of Made Ground is shown on drawing 13-223-007 (Appendix III).

Drift Deposits

Drift deposits were encountered within the majority of exploratory positions with the exception of locations where the full depth of Made Ground could not be proven. The drift deposits are varied, generally comprising a firm to stiff, low to high strength, orange brown mottled grey CLAY with gravel of mudstone or a orangey light brown/reddish brown clayey SAND with gravel of mudstone.

In the locations where peat was encountered, it was generally underlain by a dark grey coarse SAND (TP115, TP133, TP135, TP136 TP138 and TP139). A dark bluey grey sandy GRAVEL with coal-like traces was also encountered within one location (TP111) with gravel of shale.

Peat deposits were encountered in 13No. locations in the north eastern sector of site between the depths of 0.20m bgl and 2.60m bgl and comprised of soft dark brown compressible peat. Peat is located within the proximity of the stream, indicating organic alluvial deposits in the near surface.

Solid Geology

The solid bedrock geology was encountered between 4.20m and 24.10m bgl, becoming considerably deeper towards the east of the site due to the presence of a fault, where the downthrow side is to the north east. The solid geology comprises light grey weathered

mudstone which is underlain by interbedded grey mudstone and grey sandstone with mudstone bands.

In the north-western field of the site, shale with traces of coal and coal was identified between the depths of 24.00m bgl and 25.90m bgl (RB101) and 17.40m bgl and 21.00m bgl (RB102).

Groundwater

Groundwater was encountered at numerous locations across the site as seepages between the depths of 1.20m and 4.30m bgl.

6.1.2 Groundwater

Groundwater strikes were encountered as seepages between 1.20m and 4.30m bgl. Groundwater was generally encountered as perched water within the cohesive soils and as a slow seepage in the granular drift deposits. The depth of the seepages are shown on the exploratory hole records and summarised in Table 6.2.

Table 6.2 Summary Groundwater Strikes

LOCATION	DEPTH TO STRIKE (m)	NOTES
WS104	1.20	Slow seepage
WS105	4.30	Slow seepage
WS108	2.00	Slow seepage
WS109	1.70	Slow seepage
WS110	2.50	Slow seepage
WS111	2.40	Slow seepage
WS112	1.90	Slow seepage
WS114	2.80	Slow seepage
WS115	3.10	Slow seepage
TP115	1.50	Slow seepage
TP116	2.00	Slow seepage
TP117	1.35	Slow seepage
TP118	1.80	Slow seepage
TP120	2.10	Slow seepage
TP124	1.20	Slow seepage
TP125	2.20	Slow seepage
TP130	1.60	Slow seepage
TP133	1.00	Slow seepage
TP134	2.00	Slow seepage
TP137	2.10	Slow seepage
TP138	1.10	Slow seepage
SA102	1.40	Slow seepage

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 6.12.

6.1.3 Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of contamination was identified during the site investigation.

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.

6.1.4 Soil Consistency

Undrained shear strength values were measured using both field hand shear vane tests and laboratory undrained

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 6.3 and Table 6.4 which indicate the clay soils to vary between firm and very stiff. Strength test data is generally consistent with the field descriptions of the soils given above.

Table 6.3 Summary of Hand Shear Vane Tests

LOCATION	DEPTH	SHEAR STRENGTH KPA	CALCULATED ALLOWABLE BEARING PRESSURE kN/m^2
TP101	0.40	61	143.35
TP101	0.90	68	159.80
TP101	1.40	78	183.30
TP101	1.90	106	249.10
TP101	2.40	103	242.05
TP102	1.00	77	180.95
TP102	2.00	91	213.85
TP103	0.40	59	138.65
TP103	0.90	62	145.70
TP103	1.40	68	159.80
TP103	1.90	75	176.25
TP103	2.40	80	188.00
TP104	0.40	45	105.75
TP104	0.90	69	162.15
TP104	1.40	75	176.25
TP105	1.80	44	103.40
TP105	2.30	77	180.95
TP106	0.40	43	101.05
TP106	1.00	49	115.15
TP106	1.40	61	143.35
TP106	2.00	77	180.95
TP107	0.50	59	138.65
TP107	1.00	73	171.55
TP107	1.50	75	176.25
TP108	1.40	39	91.65
TP108	1.90	43	101.05
TP109	1.20	47	110.45
TP109	1.70	51	119.85
TP109	2.20	54	126.90
TP111	0.90	61	143.35
TP111	1.50	60	141.00
TP111	1.90	65	152.75
TP114	0.60	44	103.40
TP114	0.90	46	108.10
TP114	1.50	55	129.25
TP114	2.00	59	138.65
TP117	0.30	46	108.10
TP117	1.00	61	143.35
TP118	0.50	53	124.55
TP118	1.00	62	145.70
TP118	1.50	78	183.30
TP118	2.00	84	197.40

LOCATION	DEPTH	SHEAR STRENGTH KPA	CALCULATED ALLOWABLE BEARING PRESSURE kN/m²
TP120	1.50	46	108.10
TP120	2.00	53	124.55
TP120	1.50	67	157.45
TP122	0.30	46	108.10
TP122	1.30	48	112.80
TP122	2.30	53	124.55
TP123	0.30	64	150.40
TP123	1.30	69	162.15
TP124	0.50	44	103.40
TP124	1.00	50	117.50
TP124	1.50	60	141.00
TP127	0.50	153	359.55
TP127	1.00	167	392.45
TP127	1.50	173	406.55
TP127	2.00	177	415.95
TP128	0.50	53	124.55
TP128	1.00	59	138.65
TP128	1.50	71	166.85
TP128	2.00	98	230.30
TP137	0.40	48	112.80
TP137	1.40	53	124.55
TP140	0.50	53	124.55
TP140	1.00	62	145.70
TP140	1.50	70	164.50
TP140	2.00	77	180.95

Table 6.4 Summary of Undrained Shear Strength Test Results

LOCATION	SAMPLE DEPTH (m)	LAB DESCRIPTION	UNDRAINED SHEAR STRENGTH (kN/m²)	CONSISTENCY
CP101	1.00-1.50	Stiff brown slightly gravelly very sandy CLAY.	80	Stiff
WS102	1.50-2.00	Firm brown slightly gravelly very sandy CLAY.	70	Firm

Results of the Standard Penetration Tests, including undrained shear strengths derived from SPTs are included on Table 6.5.

6.1.5 Side Stability and Ease of Excavation

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation. The natural strata was excavated with relative ease; where the deposits were granular, the excavations were likely to collapse.

The presence of brick and concrete cobbles within the Made Ground deposits meant that in certain places excavation was slow through the Made Ground and in some places, Made Ground could not be fully penetrated.

Table 6.5 Standard/Cone Penetration Test Results

BOREHOLES	DEPTH (mbgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE $(N_1)_{60}$	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m^2)
WS101	1	Gravelly CLAY	8	8.07	N/A	Medium strength	Stiff	40.33
WS101	2	Gravelly CLAY	8	7.31	N/A	Low strength	Firm	36.54
WS101	3	Gravelly CLAY	10	8.70	N/A	Medium strength	Stiff	43.48
WS101	4	Gravelly CLAY	13	10.98	N/A	Medium strength	Stiff	54.92
WS101	5	Gravelly CLAY	13	10.79	N/A	Medium strength	Stiff	53.93
WS102	1	Gravelly CLAY	10	10.08	N/A	Medium strength	Stiff	50.41
WS102	2	Gravelly CLAY	9	8.22	N/A	Medium strength	Stiff	41.11
WS102	3	Gravelly CLAY	45	39.13	N/A	Very high strength	Very stiff	195.67
WS103	1	Gravelly CLAY	11	11.09	N/A	Medium strength	Stiff	55.45
WS103	2	Gravelly CLAY	12	10.96	N/A	Medium strength	Stiff	54.81
WS103	3	Silty CLAY	50	43.48	N/A	Very high strength	Very stiff	217.41
WS104	1	Clayey SAND	0	0.00	-	-	-	-
WS104	2	Gravelly CLAY	10	9.14	N/A	Medium strength	Stiff	45.68
WS104	3	Gravelly CLAY	7	6.09	N/A	Low strength	Firm	30.44
WS105	1	MG: Gravelly Clay	13	13.11	N/A	Medium strength	Stiff	65.53
WS105	2	Gravelly CLAY	1	0.91	N/A	Extremely low strength	Very soft	4.57
WS105	3	Gravelly CLAY	6	5.22	N/A	Low strength	Firm	26.09
WS105	4	Gravelly CLAY	11	9.29	N/A	Medium strength	Stiff	46.47
WS105	5	Gravelly CLAY	30	24.89	N/A	High strength	Very stiff	124.44
WS106	1	MG: Gravelly Clay	10	10.08	N/A	Medium strength	Stiff	50.41
WS106	2	MG: Gravelly Clay	39	35.63	N/A	Very high strength	Very stiff	178.14
WS107	1	MG: Gravelly Clay	47	47.38	N/A	Very high strength	Very stiff	236.92
WS107A	1	MG: Gravelly Clay	11	11.09	N/A	Medium strength	Stiff	55.45
WS107A	2	MG: Gravelly Clay	25	22.84	N/A	High strength	Very stiff	114.19

BOREHOLES	DEPTH (mbgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE $(N_1)_{60}$	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m^2)
WS108	1	Sandy CLAY	8	8.07	N/A	Medium strength	Stiff	40.33
WS108	2	Sandy CLAY	11	10.05	N/A	Medium strength	Stiff	50.24
WS108	3	Sandy CLAY	7	6.09	N/A	Low strength	Firm	30.44
WS108	4	Gravelly SAND	12	10.14	Medium dense	N/A	N/A	N/A
WS109	1	PEAT	11	11.09	N/A	Medium strength	Stiff	55.45
WS109	2	SAND	10	9.14	Loose	N/A	N/A	N/A
WS109	3	SAND	11	9.57	Loose	N/A	N/A	N/A
WS110	1	Sandy CLAY	9	9.07	N/A	Medium strength	Stiff	45.37
WS110	2	Sandy CLAY	6	5.48	N/A	Low strength	Firm	27.41
WS110	3	Sandy GRAVEL	26	22.61	Medium dense	N/A	N/A	N/A
WS111	1	Clayey SAND	0	0	-	-	N/A	N/A
WS111	2	Clayey SAND	6	5.48	Loose	N/A	N/A	N/A
WS111	3	Clayey SAND	24	20.87	Medium dense	N/A	N/A	N/A
WS112	1	PEAT	8	8.07	N/A	Medium strength	Stiff	40.33
WS112	2	SAND	10	9.14	Loose	N/A	N/A	N/A
WS112	3	SAND	15	13.04	Medium dense	N/A	N/A	N/A
WS113	1	Gravelly SAND	15	15.12	Medium dense	N/A	N/A	N/A
WS113	2	Gravelly SAND	16	14.62	Medium dense	N/A	N/A	N/A
WS113	3	Gravelly SAND	19	16.52	Medium dense	N/A	N/A	N/A
WS114	1	Gravelly SAND	11	11.09	Medium dense	N/A	N/A	N/A
WS114	2	Gravelly SAND	9	8.22	Loose	N/A	N/A	N/A
WS114	3	Gravelly SAND	11	9.57	Loose	N/A	N/A	N/A
WS115	1	Gravelly CLAY	8	8.07	N/A	Medium strength	Stiff	40.33
WS115	2	PEAT	9	8.22	N/A	Medium strength	Stiff	41.11
WS115	3	SAND	9	7.83	Loose	N/A	N/A	N/A

BOREHOLES	DEPTH (mbgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE $(N_1)_{60}$	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m^2)
WS115	4	SAND	14	11.83	Medium dense	N/A	N/A	N/A
WS116	1	Gravelly CLAY	8	8.07	N/A	Medium strength	Stiff	40.33
WS116	2	Silty CLAY	10	9.14	N/A	Medium strength	Stiff	45.68
WS116	3	Silty CLAY	16	13.91	N/A	Medium strength	Stiff	69.57
WS116	4	Silty CLAY	15	12.67	N/A	Medium strength	Stiff	63.36
WS116	5	Silty CLAY	14	11.61	N/A	Medium strength	Stiff	58.07
WS117	1	SAND	9	9.07	Loose	N/A	N/A	N/A
WS117	2	Silty SAND	7	6.39	Loose	N/A	N/A	N/A
WS117	3	Silty SAND	10	8.70	Loose	N/A	N/A	N/A
WS118	2	Sandy CLAY	13	11.88	N/A	Medium strength	Stiff	59.38
WS118	3	Sandy CLAY	15	13.04	N/A	Medium strength	Stiff	65.22
WS118	4	Sandy CLAY	14	11.83	N/A	Medium strength	Stiff	59.14
WS118	5	CLAY	16	13.27	N/A	Medium strength	Stiff	66.37
CP101	2	Boulder CLAY	6	5.48	N/A	Low strength	Firm	27.41
CP101	3	Boulder CLAY	8	6.96	N/A	Low strength	Firm	34.79
CP101	5	Boulder CLAY	12	9.96	N/A	Medium strength	Stiff	49.78
CP102	1	Boulder CLAY	3	3.02	N/A	Very low strength	Soft	15.12
CP102	3	Boulder CLAY	5	4.35	N/A	Low strength	Firm	21.74
CP102	6	Boulder CLAY	9	7.38	N/A	Low strength	Firm	36.89
CP102	6.5	Boulder CLAY	15	12.25	N/A	Medium strength	Stiff	61.23
CP102	8	Boulder CLAY	14	11.33	N/A	Medium strength	Stiff	56.66
CP102	9.5	SAND and GRAVEL	14	11.28	Medium dense	N/A	N/A	N/A
CP102	11	Silt	11	8.51	N/A	Medium strength	Stiff	42.53
CP102	12	Boulder CLAY	14	10.23	N/A	Medium strength	Stiff	51.14
CP102	14	GRAVEL	18	12.47	Medium dense	N/A	N/A	N/A

BOREHOLES	DEPTH (mbgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE $(N_1)_{60}$	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m^2)
CP102	15.5	GRAVEL	22	14.49	Medium dense	N/A	N/A	N/A

6.1.6 Soil Compressibility

Consolidation Tests have been undertaken on selected samples of clay using an odometer to obtain consolidation properties. Tests include an unload cycle to help assess potential heave. The results are included in Table 6.6 and show the Clay to be of very low to high compressibility consistent with the soils visual description.

Table 6.6 Summary Consolidation Test Data

LOCATION	DEPTH (m)	LOAD INCRAMENT	Mv	Cv
CP101	4.00-4.45	0-84.5	0.416	2.027
		84.5-169	0.146	2.021
		169-338	0.106	1.972
		338-676	0.058	1.724
		676-84.5	0.019	3.777
WS102	1.50-2.00	0-35	0.322	26.723
		35-70	0.182	7.958
		70-140	0.150	6.342
		140-280	0.113	2.452
		280-35	0.028	3.442

The results have determined that the clay soil is of medium compressibility under a loading of 140kN/m^2. 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 as it would appear that at depth the cohesive deposits are wet of the optimum.

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

6.1.7 Soli Infiltration

In-situ soakaway tests were undertaken within four trial pit locations at SA101, SA102, SA103 and SA104. The tests were generally undertaken in the natural granular drift stratum in order to assess the likely permeability of the strata to determine the potential suitability for soakaway drainage within the proposed development.

The results are presented in Table 6.7 and the test certificates are included within Appendix X.

Table 6.7 Soil Infiltration Results

LOCATION	DEPTH (m)	MATERIAL	TEST NO.	SOIL INFILTRATION RATE (m/s)
SA101	3.10	Stiff sandy gravelly CLAY	Test No.1	N/A
SA102	2.40	Slightly gravelly clayey SAND	Test No.1	1.43E-07
SA103	2.40	Clayey SAND	Test No.1	N/A
SA104	1.50	SAND	Test No.1	7.00E-05

Soil infiltration was taken over the wetted area from between 75% and 25% of the effective depth.

The time to fall 25% was extrapolated for test 1 in SA102 and SA104. The granular drift deposits in the clayey SAND in SA102 showed poor soakage potential, however the SAND in SA104 showed good soakage potential.

The tests in SA101 and SA103 failed as they did not reach 25% or 75% effective storage depth.

Therefore, considering the significant volumes of low permeability clay in the west of the site, it is considered that soakaway drainage may not be suitable for the proposed development. However, the application of soakaway drainage will ultimately be dependent on the specific requirements of the development. All soakaways should be designed in accordance with BRE Special Digest 365 – *Soakaway Design*.

6.1.8 Soil Plasticity

The Liquid and Plastic Limits of samples of natural in-situ clay are determined using the cone penetrometer method and the rolling thread test. These tests enable determination of an average Plasticity Index (PI) for each "type" of clay, although judgement is applied where variable results are reported.

PI can be related to shrinkability (low, medium or high) and then to minimum founding depth.

E3P typically only consider a soil to be shrinkable if the proportion finer than 63µm is >35%.

PI results are compared against guidance given in the NHBC Standards, Chapter 4.2 (revised January 2014), which advocates the use of modified Plasticity Index (I'p), defined as:

I'p = Ip * (%< 425µm/100)

ie if PI is 30%, but the soil contains 80% < 425µm, then: I'p = 30 * 80/100 = 24%.

It should be noted that in accordance with the requirements of BS 1377, the % passing the 425µm sieve is routinely reported by testing labs.

E3P apply engineering judgment where PI results are spread over a range of classifications. Consideration is given to the average values for each particular soil type (ie differentiate between residual soil and alluvium), the number of results in each class and the actual values.

The Atterberg Limits determinations, summarised in Table 6.8 show the clay to be of predominantly low plasticity, with a localised area (WS105) of high plasticity.

Table 6.8 Summary of Plasticity Index Test Results

LOCATION	DEPTH (m)	NATURAL MOISTURE CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING 425µm SIEVE (%)	MODIFIED PLASTICITY INDEX	NHBC VOLUME CHANGE POTENTIAL
WS101	3.00-3.45	15	19	40	21	93	19.53	Low
WS102	1.00-1.45	14	14	29	15	94	14.10	Low
WS103	1.00-1.45	13	17	33	16	97	15.52	Low
WS104	2.002-2.45	15	18	37	19	91	17.29	Low
WS105	2.00-2.45	69	53	129	76	98	74.48	High
WS106	1.00-1.45	19	20	38	18	86	15.48	Low
WS108	2.00-2.45	16	15	31	16	96	15.36	Low
WS116	1.00-1.45	16	17	35	18	96	17.28	Low

The results of the Atterberg Limits testing confirmed that the soils would be deemed to be Low Volume Change Potential, with a localised area (WS105) deemed to be High Volume Change Potential in accordance with the classification system utilised by the LABC / NHBC industry guidance.

6.1.9 California Bearing Ratio

The California Bearing Ratio (CBR) for the soils were measured using an in situ TRL probe. The results are summarised in Table 6.9.

The result sheets are included in Appendix IX and the locations are shown on Drawing 13-223-005 (Appendix III). CBR results have been averaged from the blow counts across the strata tested and any abnormally high blow counts ignored as these are likely to be from larger granular material and so represent anomalies.

Table 6.9 Summary of DCP Results

LOCATION	DEPTH (m)	STRATA	IN SITU OR LAB TEST	CBR (%)
DCP101	0.46-0.90	Gravelly SAND	In-Situ	5.60%
DCP102	0.40-0.67	Gravelly CLAY	In-Situ	3.55%
DCP103	0.46-0.70	Gravelly CLAY	In-Situ	5.25%
DCP104	0.49-0.81	Gravelly CLAY	In-Situ	28.55%
DCP105	0.70-0.88	PEAT	In-Situ	4.01%
DCP106	0.51-0.90	Gravelly CLAY	In-Situ	10.33%
DCP107	0.48-0.89	Clayey SAND	In-Situ	2.23%
DCP108	0.48-0.64	PEAT	In-Situ	4.43%
DCP109	0.47-0.64	PEAT	In-Situ	4.37%
DCP110	0.53-0.88	Clayey SAND	In-Situ	6.34%
DCP111	0.39-0.51	SAND	In-Situ	6.06%
DCP112	0.18-0.40	SAND	In-Situ	6.55%

It should be noted that the CBR's reported herein were obtained from soils in a highly undisturbed state, however if the topsoil and surface cover is removed during periods of wetter climatic condition, the formation will soften reducing the CBR.

6.1.10 pH and Sulphate

Chemical analyses for pH and soluble sulphate content contained in Appendix VI (summarised in Table 6.10), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

Elevated sulphate concentrations meeting Class DS-2, AC-1s were noted within the Made Ground deposits in WS105 at 0.05m bgl.

Table 6.10 Summary of pH and Sulphate Data

LOCATION	DEPTH (m)	SO_4 IN 2:1 WATER / SOIL (g/l)	pH VALUE	CLASSIFICATION
WS101	1.20	0.025	5.4	DS-1 AC-1s
WS102	0.30	0.024	7.4	DS-1 AC-1s
WS105	0.05	0.76	7.9	DS-2 AC-1s
WS109	0.90	0.050	6.3	DS-1 AC-1s
WS111	1.30	0.057	7.4	DS-1 AC-1s
WS114	1.30	0.020	6.7	DS-1 AC-1s
WS116	0.80	0.016	7.4	DS-1 AC-1s
TP105	0.70	0.055	6.9	DS-1 AC-1s
TP109	0.30	0.35	7.8	DS-1 AC-1s
TP111	0.60	0.14	4.8	DS-1 AC-1s
TP113	0.60	0.032	7.7	DS-1 AC-1s
TP114	0.20	0.058	7.8	DS-1 AC-1s
TP114	0.40	0.014	6.9	DS-1 AC-1s
TP120	1.20	0.024	6.9	DS-1 AC-1s
TP123	0.10	0.021	6.9	DS-1 AC-1s
TP124	0.80	0.030	6.6	DS-1 AC-1s
TP125	0.90	0.13	4.8	DS-1 AC-1s

LOCATION	DEPTH (m)	SO_4 IN 2:1 WATER / SOIL (g/l)	pH VALUE	CLASSIFICATION
TP126	1.10	0.021	6.3	DS-1 AC-1s
TP131	1.20	0.012	6.6	DS-1 AC-1s
TP137	1.00	0.023	7.1	DS-1 AC-1s

6.2 Ground Gas

A ground gas assessment has been completed in accordance with guidance provided within CIRIA 665 *Assessing risk posed by hazardous ground gases to buildings*.

6.2.1 Investigation Rationale

The ICSM has identified that the underlying Made Ground / the backfilled pond / peat/alluvial may represent a potential source of ground gas generation. Based the identification of these sources, E3P has determined that the site represents a low to moderate ground gas source generation potential.

Within the context of the proposed residential end use and ground gas generation potential, the gas assessment requires nine visits are required over six months with at least two sets of readings at low or falling atmospheric pressure as set out within CIRIA 665 Tables 5.5a and 5.5b.

The spacing requirements for monitoring wells are detailed within CIRIA 665 Table 4.2 this indicates that for low gas hazard sites (*Made Ground with limited degradable material, organic clay of limited thickness*) and a high sensitivity development nominal well spacing should be between 25m and 50m.

Table 6.11 Ground Gas Monitoring Location Rationale

LOCATION	GROUND GAS SOURCE	DEPTH OF MONITORING WELL (m)
WS101	Natural strata	1.00-4.00
WS103	Natural strata	1.00-3.50
WS104	Natural strata	1.00-2.00
WS105	Made Ground	1.00-4.00
WS106	Made Ground	0.50-2.00
WS107A	Made Ground	0.50-2.00
WS108	Natural strata	1.00-3.50
WS109	Natural strata	0.50-2.50
WS110	Natural strata	0.50-2.50
WS112	Natural strata / Peat	0.50-2.50
WS113	Natural strata	0.50-2.50
WS114	Natural strata	0.50-3.00
WS115	Natural strata / Peat	1.00-4.00
WS116	Natural strata	0.50-3.50

6.2.2 Monitoring Methodology

Concentrations of methane (CH_4), carbon dioxide (CO_2) and Oxygen (O_2) were measured using an infra-red gas analyser (GFM435) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an attached flow pod.

Gas measurements were recorded for a minimum of sixty seconds at each location, at which point the maximum concentration of CH_4 and CO_2 together with the lowest concentration of O_2 were recorded. The results of the ground gas monitoring are presented in Table 6.12.

Table 6.12 Summary of Ground Gas Monitoring Results

WELL	DATE	CH_4 INITIAL %V/V	CH_4 STEADY %V/V	CH_4 GSV l/hr	CO_2 INITIAL %V/V	CO_2 STEADY %V/V	CO_2 GSV l/hr	O_2 %V/V	ATMOS (mB)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE / STRATUM (mbgl)	DEPTH TO BASE (mbgl)	DEPTH TO WATER (mbgl)
WS101	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	1011	Falling	0.10	1.00-4.00	4.02	Dry
	12/6/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	993	Falling	0.10		4.02	Dry
WS103	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.3	1011	Falling	0.10	1.00-3.50	2.80	Dry
	12/6/19	0.1	0.1	0.0005	0.4	0.4	0.0021	20.1	993	Falling	0.52		2.90	Dry
WS104	15/05/19	Gas Tap Removed										1.00-2.00	1.70	1.12
	12/6/19	0.1	0.1	-0.0022	1.8	1.8	-0.0398	17.6	993	Falling	-2.21		1.70	0.87
WS105	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	1011	Falling	0.10	1.00-4.00	3.42	2.07
	12/6/19	0.1	0.1	0.0020	1.8	1.8	0.0356	10.9	993	Falling	1.98		3.36	1.42
WS106	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1011	Falling	0.10	0.50-2.00	2.00	Dry
	12/6/2019	28.5	28.5	0.5643	1.2	1.2	0.0238	0.5	993	Falling	1.98		2.00	1.66
WS107 A	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1011	Falling	0.10	0.50-2.00	1.38	Dry
	12/6/19	0.1	0.1	0.0016	0.1	0.1	0.0016	20.6	993	Falling	1.6		1.29	GL
WS108	15/05/19	0.1	0.1	0.0001	0.2	0.2	0.0002	17.1	1013	Falling	0.10	1.00-3.50	2.47	Dry
	12/6/19	0.1	0.1	0.0009	6.6	6.6	0.0561	9.3	996	Falling	0.85		2.36	1.9
WS109	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	1013	Falling	0.10	0.50-2.50	1.33	1.25
	12/6/19	0.1	0.1	0.0001	0.3	0.3	0.0003	20.6	996	Falling	0.10		1.40	0.64
WS110	15/05/19	0.1	0.1	0.0001	0.8	0.8	0.0008	19.9	1013	Falling	0.10	0.50-2.50	2.33	1.20
	12/6/19	0.1	0.1	0.0008	0.1	0.1	0.0008	20.5	996	Falling	0.79		2.35	1.16
WS112	15/05/19	Gas Tap Removed										0.50-2.50	-	-
	12/6/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	996	Falling	0.10		1.42	0.28
WS113	15/05/19	0.1	0.1	0.0001	1.2	1.2	0.0016	19.6	1013	Falling	0.13	0.50-2.50	1.61	1.47
	12/6/19	0.1	0.1	0.0009	1.6	1.6	0.0136	18.5	996	Falling	0.85		1.67	1.65
WS114	15/05/19	0.1	0.1	0.0001	0.2	0.2	0.0002	20.6	1013	Falling	0.10	0.50-3.00	1.72	1.32
	12/6/19	0.1	0.1	-0.0013	0.1	0.1	-0.0013	20.6	996	Falling	-1.26		1.67	0.45

WELL	DATE	CH_4 INITIAL %V/V	CH_4 STEADY %V/V	CH_4 GSV l/hr	CO_2 INITIAL %V/V	CO_2 STEADY %V/V	CO_2 GSV l/hr	O_2 %V/V	ATMOS (mB)	ATMOS. DYNAMIC	FLOW (l/hr)	RESPONSE ZONE / STRATUM (mbgl)	DEPTH TO BASE (mbgl)	DEPTH TO WATER (mbgl)
WS115	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.8	1013	Falling	0.10	1.00-4.00	1.12	0.50
	12/6/19	0.1	0.1	-0.0042	0.1	0.1	-0.0042	20.6	996	Falling	-4.24		1.07	0.33
WS116	15/05/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.9	1013	Falling	0.10	0.50-3.50	3.08	1.15
	12/6/19	0.1	0.1	0.0001	0.1	0.1	0.0001	20.7	996	Falling	0.10		3.07	1.04

7. 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.

7.1 Human Health Risk Assessment

At a 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 7.1.

Table 7.1 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	38	36	N/A	1	No Further Action
Cadmium	mg/kg	11	38	1.5	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.1	38	<4.0	N/A	1	No Further Action
Lead	mg/kg	200	38	90	N/A	1	No Further Action
Mercury	mg/kg	1.2	38	0.8	N/A	3	No Further Action
Nickel	mg/kg	180	38	28	N/A	1	No Further Action
Selenium	mg/kg	250	38	3.1	N/A	1	No Further Action
Copper	mg/kg	2400	38	81	N/A	1	No Further Action
Zinc	mg/kg	3700	38	160	N/A	1	No Further Action
Cyanide - Total	mg/kg	791	38	<1.0	N/A	1	No Further Action
Phenols - Total.	mg/kg	210	20	<1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	22	Chrysotile	TP142 0.50m	4	**Further Action**
Naphthalene	mg/kg	2.3	39	1.1	N/A	3	No Further Action
Acenaphthylene	mg/kg	170	39	<0.05	N/A	2	No Further Action
Acenaphthene	mg/kg	210	39	0.21	N/A	1	No Further Action
Fluorene	mg/kg	170	39	<0.05	N/A	1	No Further Action
Phenanthrene	mg/kg	95	39	1.6	N/A	2	No Further Action
Anthracene	mg/kg	2400	39	0.39	N/A	2	No Further Action
Fluoranthene	mg/kg	280	39	2.7	N/A	2	No Further Action
Pyrene	mg/kg	620	39	2.7	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	39	1.3	N/A	2	No Further Action
Chrysene	mg/kg	15	39	1.4	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	39	1.6	N/A	2	No Further Action
Benzo(k)Fluoranthene	mg/kg	77	39	0.90	N/A	2	No Further Action
Benzo(a)Pyrene**	mg/kg	2.2	39	1.6	N/A	2	No Further Action
Indeno(123-cd)Pyrene	mg/kg	27	39	0.72	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	39	0.24	N/A	2	No Further Action
Benzo(ghi)Perylene	mg/kg	320	39	0.90	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	29	<1.0	N/A	3	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	29	<0.10	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	29	<0.10	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	29	7.0	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	29	26	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	29	52	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	29	250	N/A	1	No Further Action

Notes
Main Exposure Pathways: 1 = Soil Ingestion, 2 = Dermal Contact & Ingestion, 3 = Vapour Inhalation (indoor), 4 = Dust Inhalation.
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 (C_5-C_{12}) and the Tier 1 values for aromatic compound for the non-volatile fractions (C_{12}-C_{35}). 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 7.1, the results of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

- Chrysotile

Asbestos in the form of loose Chrysotile fibres has been identified in the cohesive Made Ground in TP142 at 0.001%. Further delineation sampling should be completed to further assess the risk and increase confidence in respect to asbestos fibre concentration and spatial distribution of impact.

No significant concentrations of VOC's were identified in the soils submitted for chemical analysis.

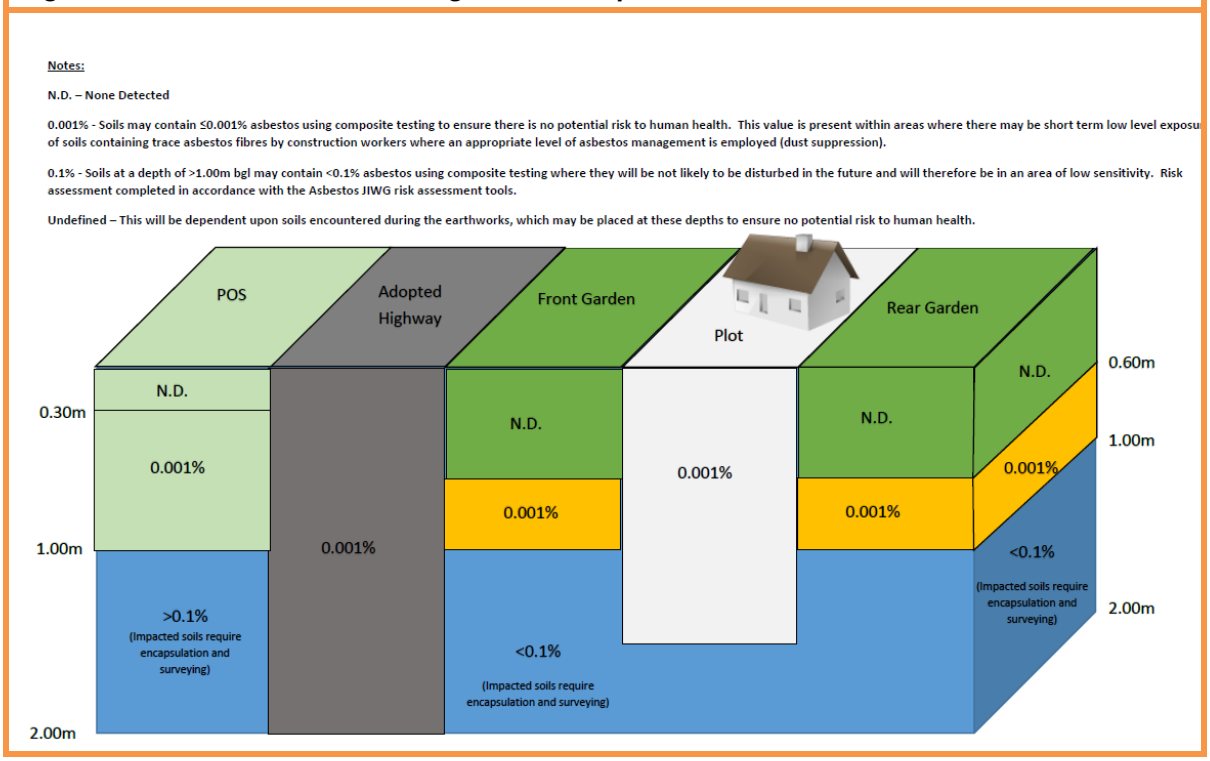
The identified elevated concentration has a primary exposure pathway related to dust inhalation. This exceedance can be mitigated by the installation of a 600mm chemically suitable cover system.

A 600mm cover system will be required in areas of Made Ground encountered across the site due to the presence of anthropogenic material and the potential for asbestos fibres. The cover system will require certified material with appropriate validation within proposed garden areas. Natural drift deposits encountered within the upper 600mm of finished ground levels can be directly overlain with a suitable cover (minimum 150mm topsoil).

Made Ground may be removed during the site enabling works and as such the post enabling site conditions should be reviewed to ascertain if any gardens need a clean cover.

Asbestos quantification has been undertaken to further assess where these soils may be placed. No visual signs of ACM were encountered during the Ground Investigation; however loose fibres are identified as present. Impacted soils will need to be managed according to the Asbestos Risk Mitigation Conceptual Site Model shown in Figure 7.1.

Figure 7.1 Asbestos Risk Mitigation Conceptual Site Model



Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas, however further chemical validation samples will be required to confirm this. There are also suitable sources of topsoil available on the site.

A supplementary post demolition ground investigation will be required in the location of the existing Collop Gate buildings to assess the potential for contaminants in this area of the site.

7.2 Controlled Waters Risk Assessment

The site sensitivity with respect to controlled waters is summarised within Table 7.2.

Table 7.2 Controlled Waters Sensitivity Profile

RISK PROFILE	DISCUSSION	SENSITIVITY RATING
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not located within a Groundwater Source Protection Zone or Drinking Water Safeguard Zone.	**LOW**
Distance to the closest groundwater abstraction point.	No groundwater abstractions have been identified within a 1km radius**.**	**LOW**
Aquifer Classification in Superficial Drift Deposits.	Undifferentiated.	**LOW**
Aquifer classification in Bedrock.	The aquifer classification of the bedrock underlying the area is a Secondary A Aquifer. The site is predominantly underlain by low permeability clay soils to depths in excess of 5.0m which may reduce the potential for mobile phase contaminants to migrate towards a viable receptor.	**MODERATE**
Viability for Anthropogenic soil in direct contact with aquifer (drift or bedrock).	Localised areas of Made Ground; however these deposits are generally underlain by low permeability deposits to depths of greater than 5.0m.	**LOW**
Is the site located within 50m of a surface watercourse?	Whittle Brook is located on site.	**HIGH**
Summary The ICSM developed within the context of the site setting has only identified a single viable pollutant risk which would be the lateral migration of potentially mobile phase soluble contaminants towards the adjacent Whittle Brook on the southern boundary. However, the overall sensitivity of this receptor is reduced given the absence of any identifiable pollutant and thus the potential for the creation of a complete pollutant linkage.		

To further refine the ICSM, E3P has undertaken an initial qualitative assessment of the soil data analysis to assess the potential for a source of separate phase or dissolved phase contamination originating from either a defined on-site source or from impacted soils. This assessment is summarised in Table 7.3.

Table 7.3 Qualitative Risk to Controlled Waters from Soil Analytical Results

BTEX - >1mg/kg	The soil data analysis has not identified any detectable concentrations of TPH C5 to C6 that might otherwise be indicative of VOC impact.
Total VOC - > 1mg/kg	
Total SVOC - > 1 mg/kg	PAH analysis recorded concentrations either below or only slightly elevated above the laboratory LOD.
C5-C10 - > 5mg/kg	All concentrations are below the laboratory LOD.
C10-C12 - > 10mg/kg	All concentrations are less than 10mg/kg with the maximum concentration being 7.0 mg/kg in TP114 (0.20m).
C12-C16 - > 50mg/kg	All concentrations are less than 50mg/kg with the maximum concentration being 26mg/kg at TP101 (0.20m).
Phenols – > 2mg/kg	All concentrations are below the laboratory LOD.
Naphthalene - > 2mg/kg	The most soluble SVOC (Naphthalene) has been not identified at concentrations greater than 2mg/kg.
Total PAH - > 10mg/kg	Concentrations of low solubility PAH compounds greater than 10mg/kg have been detected within 7No. of the 39No. locations tested.
PCB - > 1mg/kg	No potential sources of PCB have been identified.
Heavy metals - > 500mg/kg	Concentrations of heavy metals are all below 500mg/kg.

In due consideration of the ICSM which has identified a potential pollutant linkage associated with the migration towards the adjacent Whittle Brook, E3P has undertaken a Tier I controlled waters risk assessment. The Tier I assessment has included a comparison of leachate analysis samples to Environmental Quality Standards (EQS) in the first instance and where absent Drinking Water Standards.

These are presented in Table 7.4.

Table 7.4 Comparison of Groundwater Analysis with Tier 1 Screening Levels

DETERMINAND	UNITS	EQS SCREENING VALUE [1, 2, 3]		DWS [3,4,5]	N (L-Leachate, GW –Groundwater)	MC	LOC OF EX	ASSESSMENT
		AA	MAC					
Arsenic	µg/l	50	-	10	2 L	5.4	N/A	No Further Action
Cadmium	µg/l	0.08	0.45	5	2 L	<0.08	N/A	No Further Action
Chromium (VI)	µg/l	3.4	-	-	2 L	<5.0	N/A	No Further Action
Chromium (III)	µg/l	4.7	-	50	2 L	2.9	N/A	No Further Action
Copper (hardness)	µg/l	1-28		2000	2 L	48	TP143 - 0.80m (EQS)	Further Action
Total Cyanide	µg/l	1	-	50	2 L	<1.0	N/A	No Further Action
Lead	µg/l	1.2	14	10	2 L	5.3	TP143 - 0.80m (EQS)	Further Action
Mercury	µg/l	-	0.07	1.0	2 L	<0.5	N/A	No Further Action
Nickel	µg/l	4	34	20	2 L	8.2	TP143 – 0.8m (EQS)	Further Action
Selenium	µg/l		-	10	2 L	<4.0	N/A	No Further Action
Zinc(hardness)	µg/l	8-125	-	-	2 L	14	N/A	No Further Action
pH		6-9			2 L	8.1	N/A	No Further Action
PAH								
Naphthalene	µg/l	2	130	10*	2 L	<0.01	N/A	No Further Action
Anthracene	µg/l	0.1	0.1		2 L	<0.01	N/A	No Further Action
Benzo[b]fluoranthene	µg/l	1.7^{-4}	0.017		2 L	<0.01	N/A	No Further Action
Benzo[k]fluoranthene	µg/l	1.7^{-4}	0.017		2 L	<0.01	N/A	No Further Action
Benzo(a)pyrene	µg/l	1.7^{-4}	0.27		2 L	<0.01	N/A	No Further Action
Fluoranthene	µg/l	0.0063	0.12		2 L	<0.01	N/A	No Further Action
Benzo(ghi)perylene	µg/l	1.7^{-4}	8.2^{-3}		2 L	<0.01	N/A	No Further Action
TPH-Aromatic								
TPH C5-C6 (benzene)	µg/l	10	50	1	2 L	<1.0	N/A	No Further Action
TPH C6-C8 (toluene)	µg/l	50	-	700	2 L	<1.0	N/A	No Further Action
TPH C8-C10 (ethyl Benzene)	µg/l	20	-	300	2 L	<1.0	N/A	No Further Action
TPH C10-C12 (xylene)	µg/l	30	-	500	2 L	<10	N/A	No Further Action
TPH C12-C16	µg/l	2	130	90[5]	2 L	<10	N/A	No Further Action
TPH C16-C35	µg/l	50#	50#	90[5]	2 L	<10	N/A	No Further Action
TPH Aliphatic [5]								
TPH C5-C6	µg/l	-	-	15000	2 L	<1.0	N/A	No Further Action
TPH C6-C8	µg/l	-	-	15000	2 L	<1.0	N/A	No Further Action
TPH C8-C10	µg/l	-	-	300	2 L	<1.0	N/A	No Further Action
TPH C10-C12	µg/l	-	-	300	2 L	<10	N/A	No Further Action
TPH C12-C16	µg/l	-	-	300	2 L	<10	N/A	No Further Action
TPH C16 – C21	µg/l	-	-	300**	2 L	<10	N/A	No Further Action
TPH C21-C35	µg/l	-	-	300**	2 L	<10	N/A	No Further Action
VOC								
Tetrachloroethylene	µg/l	0.4	-	10	-	-	-	-
Trichloroethylene	µg/l	10	-	10	-	-	-	-
Trichlorobenzene	µg/l	0.4	-	-	-	-	-	-
Trichloromethane	µg/l	2.5	-	-	-	-	-	-
Dichloromethane	µg/l	20	-	200	-	-	-	-
Carbon Tetrachloride	µg/l	12	-	3	-	-	-	-
Vinyl Chloride	µg/l	-	-	0.3	-	-	-	-

Notes
Solubility <0.01µg/l

AA – Annual Average
MAC- Maximum Admissible Concentration
* Sum of The specified compounds are benzo[b]fluoranthene (CAS 205-99-2), benzo[k]fluoranthene (CAS 207-08-9), benzo[g,h,i]perylene (CAS 191-24-2) and indeno[1,2,3-c,d]pyrene (CAS 193-39-5)

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

For the purposes of the Tier 1 assessment E3P has compared the laboratory test data directly to the EQS values, which are for the protection of surface water quality.

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

- Nickel
- Copper
- Lead

The exceedances are identified within a leachate sample from the cohesive Made Ground at TP143 where anthropogenic material including brick and concrete was identified.

It should be noted that the Tier I assessment criteria provides a conservative view, which may over-state the risk. Inorganic determinants identified above are of a general low solubility and therefore mobility, suggesting that these will not migrate to controlled water receptors.

Given the site is underlain by low permeability predominantly cohesive Glacial Till Deposits which will afford protection to the underlying Secondary A Aquifer; there is considered to be a low risk to controlled waters and the wider environ as no complete pollutant linkage can be determined.

Based on the above, there is considered to be no unacceptable level of risk to the controlled water receptors.

7.3 Ground Gas

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

CIRIA C665 and NHBC Report No 10627-R01, provide assessments for carbon dioxide and methane based upon Gas Screening Values (GSVs) utilising flow rates and concentrations. The site based GSVs for steady state methane and carbon dioxide are based upon the following equation:

$$GSV = \frac{concentration\ (by\ vol)}{100} \times flowrate\ (1/hr)$$

The GSVs within CIRA C665 are based upon all buildings other than standard residential houses. The NHBC GSVs are based upon standard residential houses with precast concrete

floors (block and beam). The CIRIA 665 report author (Steve Wilson) since provided further clarification regarding which guidance should be adopted for residential houses which have suspended cast in situ concrete floor slab, for the avoidance of doubt it was confirmed that the GSVs within the CIRIA 665 guidance should be adopted.

The thresholds for GSVs based upon NHBC and CIRIA guidance are provided within Table 7.5.

Table 7.5 Residential Thresholds for Gas Screening Values (GSV) in accordance with CIRIA C665 and NHBS Report No 10627-R01 – Residential End Use.

CIRIA – NO SUB-FLOOR VOID		NHBC – SUBFLOOR VOID		
CLASSIFICATION	GSV (METHANE AND CARBON DIOXIDE)	CLASSIFICATION	GSV (METHANE)	GSV (CARBON DIOXIDE)
CS1	<0.07	Green	<0.13	<0.76
CS2	<0.70	Amber 1	<0.63	<1.60
CS3	<3.5	Amber 2	<1.60	<3.10
CS4	<15	Red	>1.60	>3.10
CS5	<70	-	-	-
CS6	>70	-	-	-

7.4 Sources of Ground Gas

The Phase I report and subsequent Ground Investigation has identified the following potential sources of ground gas:

- Made Ground Deposits
- Peat
- Coal Seams

7.4.1 Groundwater

Within the monitoring wells, groundwater levels were observed within the majority of monitoring wells, however four locations were found to be dry. The majority of the monitoring wells were set within a low permeability clay stratum and groundwater may be a result of surface water collecting in the well rather than a measure of true groundwater.

7.4.2 Gas Flow

The measure of positive flow is considered to be the result of groundwater fluctuations and flooding of the well causing compression as opposed to gas generation as highest flows are recorded during periods of high groundwater levels.

Negative flows were recorded in WS104, WS114 and WS115. Negative flows are indicative of back pressure from wind being greater than the active flow from the wells, however negative flows were not recorded within any of the monitoring wells.

7.4.3 Gas Concentrations

Significantly elevated methane concentrations were recorded in WS106 at 28.5%v/v. No other elevated methane concentrations were recorded.

Carbon dioxide concentrations were recorded within all the monitoring wells at concentrations ranging from 0.1% v/v to 6.6% v/v (WS108). The maximum carbon dioxide concentrations were also associated with low oxygen concentrations.

7.4.4 Gas Assessment

In accordance with the methodology outlined with the CIRIA publication C665, E3P have utilised the results of the ground gas monitoring surveys to calculate a tentative Gas Screening Value (GSV). The GSVs for the monitoring positions are summarised in Table 7.6.

Table 7.6 Gas Risk Profile & Location

LOCATION	Max CO2	GSV	Max CH4	GSV	Classification
WS101	0.1	0.0001	0.1	0.0001	Green / CS1
WS103	0.4	0.0021	0.1	0.0005	Green / CS1
WS104	1.8	-0.0398	0.1	-0.0022	Green / CS1
WS105	1.8	0.0001	0.1	0.0001	Green / CS1
WS106	1.2	0.0238	28.5	0.5643	Red / CS4
WS107	0.1	0.0016	0.1	0.0016	Green / CS1
WS108	6.6	0.0561	0.1	0.0009	Amber 1 / CS2
WS109	0.3	0.0003	0.1	0.0001	Green / CS1
WS110	0.8	0.0008	0.1	0.0008	Green / CS1
WS113	1.6	0.0136	0.1	0.0009	Green / CS1
WS114	0.2	-0.0013	0.1	-0.0013	Green / CS1
WS115	0.1	-0.0042	0.1	-0.0042	Green / CS1
WS116	0.1	0.0001	0.1	0.0001	Green / CS1

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1 and in these areas it is considered that gas protection measures will not be required.

Plots in the vicinity of WS108 should be classified as CS2/Amber 1 due to marginally elevated carbon dioxide.

WS106 is classified as CS4/Red due to significantly elevated methane. The monitoring well was set within cohesive Made Ground with notable anthropogenic material. No organic material was noted, therefore the methane concentrations may be attributed to mine workings. Further continuous gas monitoring should be completed to accurately determine the ground gas regime and inform a robust risk assessment. Real time monitoring could be used to inform a quantitative risk assessment. If the methane is from mine workings, further close centre wells may be required to determine the extent of site impacted.

7.5 Residential Building Gas Risk Mitigation

British Standard BS8485 (2015) provides two types of residential property that require assessment. These building types are:

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

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

Based on the ground gas risk assessment and the proposed Type A Building, it is envisaged that a point score of 3.5 or 6.5 will be required for affected properties as summarised in Table 7.7.

Table 7.7 BS8485 (2015)+A1(2019) Points Required for Type A and B Building

Characteristic Situation	NHBC Traffic Light System	Minimum gas protection score (points)	
		High Risk	Medium Risk
		Type A building	Type B building
1	Green	0	0
2	Amber 1	3.5	3.5
3	Amber 2	4.5	4
4	Red	6.5 A)	5.5 A)
5	N/A	— B)	6
6	N/A	— B)	— B)

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

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

3.5 points or 6.5 must be achieved by installation of a suitable combination of measures detailed in Table 7.8.

Table 7.8 Summary of Ground Gas Mitigation Measures - BS8485 (2015)+A1(2019)

GAS PROTECTION SCORES FOR THE STRUCTURAL BARRIER	SCORE[A]
a) Floor and substructure design	
Precast suspended segmental subfloor (i.e. beam and block).	0
Cast in situ ground bearing floor slab (with only nominal mesh reinforcement.	0.5
Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations.	1 or 1.5[B]
Basement floor and walls conforming to BS 8102:2009, Grade 2 waterproofing.[C,D]	2
Basement floor and walls conforming to BS 8102:2009, Grade 3 waterproofing. [C,D]	2.5

A) The scores are conditional on breaches of floor slabs, etc., being effectively sealed.
B) To achieve a score of 1.5 the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in (see A.2.2.2).
C) The score is conditional on the waterproofing being provided by a suitable structural barrier with the design and detailing of the walls and floor meeting the requirements for Type B protection. The score cannot be assigned for Type A (waterproof membrane) or Type C (drained cavity wall).
D) If a membrane is installed beneath and around the basement to provide Type A waterproofing (BS 8102:2009), it can be assigned a gas protection score in accordance with Table 7, if it meets all the criteria for a gas resistant membrane in that table.
When practical, utilities should enter the building above floor level with any conduit or meter housing being properly vented outside of the building.

PROTECTION ELEMENT SYSTEM		SCORE	COMMENTS
Gas protection scores for ventilation protection measures			
(a) Pressure relief pathway (usually formed of low fines gravel or with a thin geocomposite blanket or strips terminating in a gravel trench external to the building)		0.5	Whenever possible a pressure relief pathway (as a minimum) should be installed in all gas protection measures systems. If the layer has a low permeability and / or is not terminated in a venting trench (or similar), then the score is zero.
(b) Passive sub floor dispersal layer: Media used to provide the dispersal layer are: • *Clear void* • *Polystyrene void former blanket* • *Geocomposite void former blanket* • *No-fines gravel layer with gas drains* • *No-fines gravel layer*	Very good performance	2.5	The ventilation effectiveness of different media depends on a number of different factors including the transmissivity of the medium, the width of the building, the side ventilation spacing and type and the thickness of the layer. The selected score should be assigned taking into account the recommendations in Annex B of BS8485:2015. Passive ventilation should be designed to meet at least "good performance".
	Good performance	1.5	
(c) Active dispersal layer, usually comprising fans with active abstraction (suction) from a sub floor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers.		1.5 to 2.5	This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. There should be robust management systems in place to ensure the continued maintenance of the system, including pumps and vents. Active ventilation should always be designed to meet at least "good performance".
(d) Active positive pressurization by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket.		1.5 to 2.5	This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. The score assigned should be based on the efficient "coverage" of the building footprint and the redundancy of the system. Active ventilation should always be designed to meet at least "good performance".

(e) Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft car park)	4	Assumes that the car park is vented to deal with car exhaust fumes, designed to *Buildings Regulations 2000, Approved Document F [9].*
Gas protection score for the gas resistant membrane		
Gas resistant membrane meeting all of the following criteria: • *Sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m^2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method_;* • *Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;* • *Sufficiently strong to withstand the installation process and following trades until covered (eg penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools etc);* • *Capable, after installation, of providing a complete barrier to the entry of the relevant gas; and,* • *Verified in accordance with CIRIA C735.*	2	The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints. If a membrane is installed that does not meet all the criteria opposite then the score is zero.
A) membrane with a methane gas transmission rate <40.0 ml/day/m2/atm (average) for sheets and joints (tested in accordance with BS ISO 15105-1:2007 manometric method) is regarded as sufficiently impervious. B) For example, reinforced LDPE (virgin polymer) membranes having a minimum mass per unit area of 370 g/m2 and not significantly less than 0.4 mm thickness between the reinforcement scrim (tested in accordance with Procedure D (2 mm diameter tip) of BS EN ISO 9863-1:2016) installed above floor slabs are considered sufficiently strong to meet the performance criteria (see also C.3). Thicker and more robust membranes or an additional membrane protection layer should be installed directly beneath cast-in-situ floor slabs.		

7.6 Conceptual Site Model

Following the completion of the intrusive site investigation, chemical analysis and risk assessment the conceptual model shown in Table 7.9 has been prepared for the site.

Table 7.9 Conceptual Model

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
PL1	Inhalation of dust	Future site users. Offsite receptors	ACM identified in Made Ground.	Low Likelihood	Low	**Assessment:** ACM identified at one location of Made Ground at depth of 0.50m. **Recommendation:** Further delineation sampling should be completed to further assess the risk. Cover system to garden and landscaped areas where Made Ground is retained will prevent exposure to future site users. Construction works completed with PPE and provision of welfare in accordance with JIWG guidelines.	**LOW**
PL2	Inhalation of gas. Migration through permeable strata and preferential pathways. Explosion in confined spaces.	Future site users. Buildings. Offsite land users.	Methane, carbon dioxide. (Peat, coal measures and potentially infilled features on and within 250m of the site).	Likely	Moderate	**Assessment:** Likely due to the presence of alluvium and peat in the south of the site coupled with sensitive nature of the proposed development (residential). Glacial Till will likely restrict migration of any coal measures gas into shallow foundations. **Recommendation:** Continuous and Spot Monitoring required.	**MODERATE**

POLLUTANT LINKAGE	PATHWAY	RECEPTOR	CONTAMINANT (SOURCE)	PROBABILITY	RISK	ASSESSMENT AND RECOMMENDATIONS	RESIDUAL RISK AFTER MITIGATION
PL3	Surface Run-off. Migration through permeable strata and preferential pathways Perched waters migration.	Groundwater (Secondary A Aquifer). Surface water (Whittle Brook).	Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds (Made Ground).	Low Likelihood	Low	**Assessment:** Low likelihood as no significant sources of mobile contamination identified. Glacial Till across the site may inhibit migration into the underlying Bedrock Aquifer or Whittle Brook. **Recommendation:** No further action required.	**LOW**
PL4	Sulphate attack on concrete.	Building structure.	Sulphate (potential ash within Made Ground).	Likely	Moderate	**Assessment:** Likely probability as ash is anticipated within the localised made ground on the site which may be in contact with concrete used in future buildings Moderate risk assumed at this stage. **Recommendation:** Localised DS-2, AC-1s.	**LOW**
PL5	Ingestion of tainted water supply.	Future site users. Water pipes.	Organic Contaminants such as hydrocarbons (Made Ground).	Low Likelihood	Moderate	**Assessment:** Low likelihood as no significant contamination has been identified at pipeline depth across the centre of the site (0.75-1.35m). **Recommendation:** Pipeline risk assessment.	**LOW**
PL6	Direct Contact (plant uptake).	Flora.	Phytotoxic Contaminants (Made Ground).	Low Likelihood	Low	**Assessment:** Low likelihood as no significant contamination is identified. **Recommendation:** Cover system required in areas of Made Ground.	**LOW**

8. GEOTECHNICAL ASSESSMENT

8.1 Proposed Development

E3P understands that Russell Homes have been granted Outline Planning Consent for a strategic mixed-use development that will comprise a 2.2km link road, residential housing and commercial / industrial land uses. Russell Homes intend to either develop or divest the site for a residential end use comprising a series of low rise dwellings with associated private garden and landscaped areas, public open space, estate roads and infrastructure

8.2 Summary of Ground Conditions

Topsoil

Topsoil was encountered in majority of exploration locations to a maximum proven depth 0.70m bgl in CP102, however this was generally encountered to depths of between 0.10m – 0.40m bgl. Topsoil comprised soft dark brown slightly sandy gravelly clay with gravel of mudstone.

Made Ground

Made Ground deposits were encountered in the area of hardstanding in the north west and in the central sector of the site to a maximum proven depth of 4.50m bgl in RB103, although in general Made Ground was encountered to less than 2.0m bgl.

In the north west, the Made Ground generally comprised dark grey gravel of asphalt overlying stiff dark brown slightly gravelly clay with brick. The central sector comprised reworked topsoil of soft dark brown sandy clay with occasional gravel of brick over firm grey brown sandy gravelly clay with gravel of brick mudstone and concrete.

In a number of locations, the full thickness of Made Ground was not proven due to difficulty excavating.

Aggregate has been placed to form areas of hardstanding in the north of the site and an access road through the site.

Drift Deposits

Drift deposits were encountered within the majority of exploratory locations with the exception of locations where the full depth of Made Ground could not be proven. The drift deposits are varied, generally comprising a firm to stiff, low to high strength, orange brown mottled grey CLAY with gravel of mudstone or orangey light brown/reddish brown clayey SAND with gravel of mudstone.

In the locations where peat was encountered, it was generally underlain by a dark grey coarse SAND (TP115, TP133, TP135, TP136 TP138 and TP139). A dark bluey grey sandy GRAVEL with coal-like traces was also encountered within one location (TP111) with gravel of shale.

Peat deposits were encountered in 13No. locations in the north eastern sector of site between the depths of 0.20m bgl and 2.60m bgl and comprised of soft dark brown compressible peat. Peat is located within the proximity of the stream, indicating organic alluvial deposits in the near surface.

Solid Geology

The solid bedrock geology was encountered between 4.20m and 24.10m bgl, becoming considerably deeper towards the east of the site. The solid geology comprises light grey weathered mudstone which is underlain by interbedded grey mudstone and grey sandstone with mudstone bands.

Groundwater

Groundwater was encountered at numerous locations across the site as seepages between the depths of 1.20m and 4.30m bgl.

In the north-western field of the site, shale with traces of coal and coal was identified between the depths of 24.00m bgl and 25.90m bgl (RB101) and 17.40m bgl and 21.00m bgl (RB102).

8.3 Site Preparation

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works. This should include:

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

8.4 Foundation Conditions & 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 assessment of ABP is summarised in Table 8.1.

Table 8.1 Summary of ABP Assessment

GRANULAR SOILS			
Description	**Depth (range bgl)**	**Relative Density**	**Allowable Bearing Pressure (kN/m²)**
SAND	1.00-3.00	Loose – Medium Dense	**63-208**
COHESIVE SOILS			
Description	**Depth (range m bgl)**	**Undrained Shear Strength (Cu) kN/m²**	**Allowable Bearing Pressure (kN/m²)**
Firm to very stiff CLAY	1.00-2.00	40-70	**82-143**
Firm to very stiff CLAY	2.00-4.00	41-217	84-447

Based on existing data and given the predominantly cohesive ground conditions, it is considered that the majority of the proposed dwellings could be constructed using traditional spread footings bearing in the firm to stiff clay or medium dense sand at a depth from 1.00m to 1.50m below current ground levels.

Where deeper variable soft / loose natural clays, sand and gravels are identified or in locations where Made Ground deposits are present, dependent on development levels, plots may require locally deepening to Mass Trench Fill.

Due to the existing variances in the site topography, a phase of cut and fill enabling works will be required in order to create a proposed development. Therefore, upon completion of these enabling works, it is likely that the one cost effective option would be re-engineer all newly placed Made Ground using Vibro Replacement Stone Columns (VRSC) to support a shallow strip or spread foundation or alternately use a piled foundation.

Where areas of soft clay and loose sands are present, ground improvement by the use of VSC will be viable given the undrained strength of the clay is >30kN/m2 and thus suitable.

Where very soft clays are present and in the location of the infilled pond, a piled foundation will be required.

Where peat deposits have been identified, the highly compressible material will require excavation to the base (circa 2.50m bgl) due to the potential for unacceptable differential an total settlement within the proposed development. The resulting voids will then require backfilling with geotechnically suitable materials to the required development levels. It is therefore likely that a driven piled foundation would be required within areas of soft clays, where peat is retained beneath plots or where post remediation and enabling Made Ground extends to depths in excess of 2.0–2.50m bgl.

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. Consideration must be given to the varying soil matrices and differing settlement characteristics and where a foundation spans two varying matrices the sub-structure should be designed accordingly

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

Table 8.2 Anticipated Foundations

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH	GROUND WATER	TARGET STRATUM	TREES	FOUNDATION TYPE	TYPE OF CONCRETE
WS101	0.9	N/A	Stiff CLAY	N	Strip	DS-1 AC-1s
WS102	0.9	N/A	Stiff CLAY	N	Strip	DS-1 AC-1s
WS103	0.9	N/A	Stiff CLAY	N	Strip	DS-1 AC-1s
WS104	2.45	1.20	Stiff CLAY	N	Trench Fill	DS-1 AC-1s
WS105	3.05	4.30	Stiff CLAY	N	Driven Pile	DS-2 AC-1s
WS106	>2.5	N/A	TBC	N	Vibro	DS-1 AC-1s
WS107	>1.45	N/A	TBC	N	Vibro	DS-1 AC-1s
WS107 A	>2.5	N/A	TBC	N	Vibro	DS-1 AC-1s
WS108	0.9	2.00	Stiff CLAY	N	Strip	DS-1 AC-1s

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH	GROUND WATER	Target Stratum	Trees	FOUNDATION TYPE	TYPE OF CONCRETE
WS109	1.85	1.70	MD SAND	N	Trench Fill	DS-1 AC-1s
WS110	0.9	2.50	Firm CLAY	N	Strip	DS-1 AC-1s
WS111	3.35	2.40	MD SAND	N	Driven Pile	DS-1 AC-1s
WS112	3.35	1.90	MD SAND	N	Driven Pile	DS-1 AC-1s
WS113	0.9	N/A	MD SAND	N	Strip	DS-1 AC-1s
WS114	0.9	2.80	MD SAND	N	Strip	DS-1 AC-1s
WS115	4.35	3.10	MD SAND	N	Driven Pile	DS-1 AC-1s
WS116	0.9	N/A	Stiff CLAY	N	Strip	DS-1 AC-1s
WS117	>3.45	N/A	TBC	N	Driven Pile	DS-1 AC-1s
WS118	2.25	N/A	Stiff CLAY	N	Trench Fill	DS-1 AC-1s
TP101	0.9	N/A	Firm CLAY	N	Strip	DS-1 AC-1s
TP102	1.35	N/A	Stiff CLAY	N		DS-1 AC-1s
TP103	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP104	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP105	0.9	N/A	SAND	N		DS-1 AC-1s
TP106	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP107	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP108	0.9	N/A	SAND	N		DS-1 AC-1s
TP109	0.9	N/A	SAND	N		DS-1 AC-1s
TP110	>1.6	N/A	TBC	N	Vibro	DS-1 AC-1s
TP111	0.9	N/A	GRAVEL	N	Strip	DS-1 AC-1s
TP112	>2.1	N/A	TBC	N	Vibro	DS-1 AC-1s
TP113	>1.2	N/A	TBC	N	Vibro	DS-1 AC-1s
TP114	0.9	N/A	Firm CLAY	N	Strip	DS-1 AC-1s
TP115	1.75	1.50	SAND	N	Trench Fill	DS-1 AC-1s
TP116	>2.5	2.00	TBC	N	Driven Pile	DS-1 AC-1s
TP117	0.9	1.35	Firm CLAY	N	Strip	DS-1 AC-1s
TP118	0.9	1.80	Firm CLAY	N	Strip	DS-1 AC-1s
TP119	0.9	N/A	SAND	N	Strip	DS-1 AC-1s
TP120	1.65	2.10	Firm CLAY	N	Trench Fill	DS-1 AC-1s
TP121	0.9	N/A	SAND	N	Strip	DS-1 AC-1s
TP122	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP123	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP124	0.9	1.20	Firm CLAY	N		DS-1 AC-1s
TP125	0.9	2.20	Firm CLAY	N		DS-1 AC-1s
TP126	0.9	N/A	SAND	N		DS-1 AC-1s
TP127	0.9	N/A	Stiff CLAY	N		DS-1 AC-1s
TP128	0.9	N/A	Firm CLAY	N		DS-1 AC-1s
TP129	>2.5	N/A	SAND	N	Vibro	DS-1 AC-1s
TP130	>2.5	1.60	SAND	N	Vibro	DS-1 AC-1s
TP131	>2.5	N/A	SAND	N	Vibro	DS-1 AC-1s
TP132	>2.5	N/A	SAND	N	Vibro	DS-1 AC-1s
TP133	3.35	1.00	SAND	N	Driven Pile	DS-1 AC-1s
TP134	3.35	2.00	SAND	N		DS-1 AC-1s
TP135	3.35	N/A	SAND	N		DS-1 AC-1s
TP136	3.35	N/A	SAND	N		DS-1 AC-1s
TP137	0.9	2.10	Firm CLAY	N	Strip	DS-1 AC-1s
TP138	3.35	1.10	SAND	N	Driven Pile	DS-1 AC-1s
TP139	3.35	N/A	SAND	N	Driven Pile	DS-1 AC-1s

LOCATION	ANTICIPATED FOUNDING STRATA DEPTH	GROUND WATER	Target Stratum	Trees	FOUNDATION TYPE	TYPE OF CONCRETE
TP140	0.9	N/A	Firm CLAY	N	Strip	DS-1 AC-1s
TP141	>2.2	N/A	TBC	N	Vibro	DS-1 AC-1s
TP142	>1.8	N/A	TBC	N		DS-1 AC-1s
TP143	>1.4	N/A	TBC	N		DS-1 AC-1s
TP144	>1.6	N/A	TBC	N		DS-1 AC-1s
CP101	0.95	N/A	Firm CLAY	N	Strip	DS-1 AC-1s
CP102	3.45	N/A	Firm CLAY	N	Driven Pile	DS-1 AC-1s

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

- *Shallow strip foundations bearing on firm to very stiff CLAY or medium dense SAND at c 1.0m bgl;*
- *Trench fill to support re-enforced strip foundations in areas of variable ground and/or potential tree influence;*
- *Localised driven piles within areas of low strength clay soils or organic soils. Although it must be noted that pile foundations over stabilized mine workings is not a viable solution in this instance; and*
- *Ground improvement by the installation of Vibro Stone Columns to ensure increased / uniform safe ABP within variable firm clays and granular soils to support a doubly re-enforced strip foundation.*

Table 8.3 Ground Improvement Design Risk Matrix

RISK ITEM	COMMENT	PASS / FAIL
Soft clays with an undrained shear strength less than 30kN/m^2	Clay soils are generally firm to stiff with Cu >40kN. isolated areas of softer clay soils were encountered with Cu >30kNm2.; 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 200mm 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 the eastern sector. It is likely that plots overlying these areas will be piled	**PASS**
Voided filled ground, e.g. old water tanks, pottery, glass bottles, concrete rubble or brick fill of unsuitable grading	Made Ground beneath the central sector will require removal and processing to render the site suitable for VSC. The existing buildings substructure will also require excavation and processing into a graded aggregate suitable for Vibro Treatment.	**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/up-filling where there is a high organic content or where decay is continuing.	None Identified	**PASS**
Fill, containing degradable material where organic material forms more than 15% of fill by volume	None Identified	**PASS**
Clays with a plasticity index greater than 40%	Yes – at WS105 of 74.48%.	**FAIL**
Highly sensitive soils liable to collapse or remoulding	None Identified.	**PASS**
Cohesive soils with trees in influencing distance.	Plots where in tree influence have been modelled and will either be subject to a piled or Mass Trench Fill solution.	**PASS**
Sensitive Infrastructure	A high pressure gas main is located on site.	**FAIL**
Overall Risk Rating & Suitability for Vibratory Ground Improvement		**PASS for plots outside of the gas main influence**

A concept Foundation Zoning Plan is included as Drawing 13-223-015 in Appendix III.

8.5 Ground Floor Slabs

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

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

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

8.6 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 to High Volume Change Potential and where it is present at a shallow depth within the conjectured zone of potential tree influence, heave precautions will be required within the construction of a shallow foundation and to the underside of floor residential floor slabs.

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 sub-floor void of 200mm 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 heave precautions that can tolerate 50mm 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 present in Table 8.4.

Table 8.4 Summary of Heave Precautions

		MINIMUM VOID DIMENSION FOR FOUNDATIONS, GROUND BEAMS AND SUSPENDED IN-SITU CONCRETE GROUND FLOORS		MINIMUM VOID DIMENSIONS UNDER PRE-CAST 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)	>2.50	Engineer Design		Engineer Design
	2.00-2.50	35	150	300
	1.50-2.00	25	75	
Moderate Plasticity (20-40)	>2.50	Engineer Design		Engineer Design
	2.00-2.50	25	100	250
	1.50-2.00	25	50	
Low Plasticity (<20)	2.00-2.50	-	50	200
	>2.00	No Special Precautions		

8.7 Infrastructure & External Hardstanding

The presence of peat with no safe allowable bearing pressure represents a significant risk associated with consolidation of the underlying stratum under very low infrastructure loadings and construction plant.

It will therefore be necessary to remove this material from all areas of proposed private driveway, hardstand, services, adopted highway and drainage infrastructure to mitigate the unacceptable risk associated with consolidation and ultimately failure within the sub-grade that would be induced.

The completion of this operation will incur difficulties associated with the excavation, management and re-use of peat soils and the subsequent backfilling of the resulting excavation to achieve the required engineering performance criteria.

8.8 Pavement Construction

A programme of remediation and enabling works will be required to remediate the proposed road sub-grade in accordance with the requirements of the highways design manual (series 600) for a Method Compaction.

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

8.9 Drainage

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

Furthermore, the site is predominantly underlain by circa 1-2m of likely low permeability gravelly CLAY. Therefore, the use of soak-away drainage will be limited, and as the lateral

continuity of the Made Ground cannot be assured it is not recommended that soakaways utilised for disposal of surface water runoff.

8.10 Concrete Durability

Based upon the results of the chemical analyses summarised in 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).

8.11 Excavations

Trial Pits were generally stable in both Made Ground and natural strata, as such it is considered that near surface excavations may be feasible. Areas where natural granular strata exceeded 1.50m in the east, excavations were generally less stable.

Site observations indicated that excavations should be feasible in the near surface with normal plant, however obstructions were identified in the near surface including hardstanding areas in the centre of the site. It is anticipated that any obstructions will be grubbed out during the reduced level dig for the sub structure works.

However, due to the depth and variability of the Made Ground and likelihood of trench collapse in the granular strata, 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. Consideration should be given for the potential for dewatering gravels in the surrounding areas to the subject site that may cause structural damage to buildings sub-structures in close proximity to the site.

Table 8.5 Civil Engineering Excavation Risk Matrix

Risk Item	Present	Comment
Running Sands	No	Dewatering may be required during excavation for drainage infrastructure. Excavations for a traditional spread foundation will not be viable within saturated stratum due to the inability to cast the concrete foundation.
Minor Water ingress	Yes	Minor water ingress will require localised dewatering / sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	Shallow Bedrock was identified at its shallowest depth of 4.20m bgl.

8.12 Coal Mining

A detailed coal mining risk assessment has been undertaken due to the identified presence of shallow coal mining (recorded shaft / potential shallow workings) on-site and in the immediate surrounding area.

8.12.1 Coal Mining Geology

COAL SEAM	THICKNESS	OUTCROP	DEPTH
Arley	140cm	**No outcrop within 100m of the site boundary – underlies the site.**	**19m beneath subject site.**

A review of the mining geology confirmed there is no seam outcropping within the site boundary. The Coal Authority do not record a definitive seam outcrop within the boundary, however the Arley coal seam is recorded as present beneath the property thus it is presumed this is a sub-crop inferred from geological records or the wider area.

The Arley coal seam outcrops to the north of the site with recorded workings and an extraction thickness of ~140mm. The seam is known to be present at depths in excess of 19.0m and as such is unlikely to pose any risk associated to the proposed development assuming the seam is overlain by a minimum of 10 x Seam Thickness of rock (14.0m).

If it is assumed that the recorded outcrop ~300m north of the site is present at rockhead with a conservative assessment being 125m AOD using the CA recorded angle of dip (SW) at 11.3 degrees, the main Arley seam would be expected at 36m below rockhead or 90m AOD in the north east sector of the subject site. At this depth there would be more than the required 10x seam thickness rock cover over the main Arley seam to mitigate any subsidence induced by the consolidation of unrecorded and abandoned mine workings.

However, when considering the mine abandonment plans, it is self-evident that there is a sub-crop of the Arley seam proven in the central south sector where coal is present in two leaves between 24m and 27m below ground level. In this sector rockhead is conjectured at ~20m therefore insufficient rock cover is anticipated and a risk of subsidence is identified.

The geology of the subject site is complex with a fault transecting northwest / south east through the southern sector of the site with the downthrow to the north.

8.12.2 Recorded Coal Authority Workings

FEATURE	LOCATION	REFERENCE	COMMENT
Shaft	385893 408989	**385408-001**	**Uncapped no further information.**
Shaft	385797 408986	**385408-002**	**Uncapped no further information.**
Shaft	385983 409013	**385409-001**	**The Coal Authority has recorded that the shaft was capped at ground level by the National Coal Board in 1978.**
Shaft	385909 409032	**385409-002**	**Uncapped no further information.**

8.12.3 Scope of intrusive Ground Investigation

In due consideration of the potential presence of a sub-crop within the Arley coal seam and an area of potential shallow mine workings within the central sector of the site, a series of rotary boreholes have been advanced in accordance with Coal Authority Permission ref: 17859 to assess the potential presence of shallow workings within this seam and the potential for ground instability to induce a future subsidence event within the proposed development.

Given the presence of four recorded mine entries on-site, a series of Trial Trench investigations were excavated in accordance with Coal Authority Permission ref: 17859 in a controlled manner and in strict accordance with the E3P site Health & Safety procedure.

8.12.4 Summary of Ground Investigation Works

Rotary Boreholes to Investigate Workings in Coal

Twelve No. rotary boreholes have been advanced at the locations detailed within the E3P exploratory borehole location plan at positions to interject the potential coal seams and assess the potential for any workings.

ROTARY BOREHOLE	DEPTH TO ROCKHEAD	DEPTH TO TOP / (THICKNESS) OF COAL	EVIDENCE OF MINING ACTIVITY / SEAM	REMARKS
RB101	4.20	24.00-25.10m Coal traces 25.10-25.90m Coal	Seam Intact	Arely Sub-crop
RB102	4.60	17.40-17.60m Coal 19.90-21.00m Coal	Seam Intact	Arely Sub-crop
RB103	12.60	N/A	No	Low Risk
RB104	19.90	N/A	No	Potentially within area of known workings
RB105	20.40	N/A	No	Potentially within area of known workings
RB106	20.30	N/A	No	Possibly to the north of Arley sub-crop – clarification needed
RB107	16.40	N/A	No	Possibly to the north of Arley sub-crop – clarification needed
RB108	19.70	N/A	No	Likely to the north of Arley sub-crop – clarification needed
RB109	24.10	N/A	No	Likely to the north of Arley sub-crop – clarification needed
RB110	19.50	N/A	No	Likely to the north of Arley sub-crop – clarification needed
RB111	18.90	N/A	No	Likely to the north of Arley sub-crop – clarification needed

ROTARY BOREHOLE	DEPTH TO ROCKHEAD	DEPTH TO TOP / (THICKNESS) OF COAL	EVIDENCE OF MINING ACTIVITY / SEAM	REMARKS
RB112	5.90	N/A	No	North of Arley sub-crop, no coal identified and sufficient rock cover. Reduced risk.

8.12.5 Trial Trench to Locate Mine Entries

A series of Trial Trenches were formed across the area of the Coal Authority recorded positions (NGR) for the mine entries 385408-001, 385408-002 and 385409-002.

The trial trenches were formed to facilitate the inspection of superficial drift deposits. The specific aim of the excavation was to assess the potential presence of anthropogenic features such as a shaft lining that would indicate the recorded mine entry in this sector.

8.12.6 Discussion of Coal Mining Issues & potential for subsidence induced by consolidation of workings.

The CA mine abandonment plan (ref: 4609) confirms the presence of recorded shallow workings in the Arely Coal sub-crop in the central / southern sector. Workings are known to be present in a thin leaf and thicker seam at a depth between 24-27m bgl with rockhead at 20m. In this sector, there is insufficient rock cover to accurately determine the extent of workings. It is probable that workings extend beyond the area mapped by the Coal Authority.

It will be necessary to stabilise these workings by drilling and grouting on a close centred grid (6m x 6m with a centre hole equating to treatment of 4.5m2) to ensure the voids are consolidated and the risk of subsidence induced by successive cavitation of voids is mitigated adequately.

Further close centred rotary open hole drilling is required to accurately determine the extent of the Arley coal sub-crop and define the extent to which stabilisation works are required in the central sector of the site. This work will inform the design of a specification for the consolidation of abandoned mine workings.

The main Arley coal outcrop (~300m) north is conjectured to be at least 30m below rock head at the northern extremity of the subject site, therefore with adjustments made for topographical variance, it is unlikely that this seam of coal represents a risk of subsidence associated with the consolidation of unrecorded workings in the northern sectors. This will be confirmed by further investigation to locate the proven sub-crop.

In the southwest sector, a fault is apparent (as recorded by the BGS) with an obvious downthrow to the northeast. The Arely sub-crop is identified in the E3P rotary boreholes in this sector, however given its inclined dip of ~11 degrees there appears to be sufficient rock cover (10x seam thickness) to mitigate the risk of subsidence induced by consolidation of unrecorded workings. This will be confirmed by the close centred drilling to position the sub-crop and extent to which workings represent a subsidence risk.

Shaft 385409-001 has been capped, with the concrete cap visible at ground level.

The remaining three shafts ref: 385408-001, 385408-002 and 385409-002 are located in the central western sector of the site, where coal is present in two leaves between 24m and 27m below ground level.

Probe drilling will be required in the form of three probe spirals to identify the exact location of the shafts.

8.13 Further Works

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

- Plot Specific Foundation Schedule (upon receipt of the final development levels);
- Probe drilling to locate the three mine entries recorded and not found;
- Rotary drilling to confirm location of Arley sub-crop and clearly define areas requiring stabilisation by drilling and grouting
- Arboricultural Survey;
- Materials Management Plan;
- Geotechnical Earthworks Strategy (Infrastructure).
- Remediation & Enabling Works strategy;
- Full three-dimensional earthworks Cut / Fill Model; and
- Specification for the location of the mine entries and consolidation of all shallow abandoned mine workings.

8.14 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 formation 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 utilised;
- It is considered that de-watering 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; and,

- 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 the use of Personnel Protective Equipment (PPE).

9. CONCLUSIONS AND RECOMMENDATIONS

Contaminated Land	
Human Health	A Tier I Human Health Risk Assessment has been undertaken using the chemical analysis results of the soils and comparing to the relevant Tier I criteria. This assessment has identified the presence of asbestos in the form of Chrysotile loose fibres in the Made Ground in TP142. Asbestos quantification has been completed to further assess where these soils may be placed; identifying 0.001%. No visual signs of ACM were encountered during the Ground Investigation; therefore, it is likely only trace fibres are present within these localised soils. The identified elevated concentration has a primary exposure pathway related to dust inhalation. This exceedance can be mitigated by the installation of a 600mm chemically suitable cover system. A 600mm cover system will be required in areas of Made Ground encountered across the site due to the presence of anthropogenic material and the potential for asbestos fibres. The cover system will require certified material with appropriate validation within proposed garden areas. Natural drift deposits encountered within the upper 600mm of finished ground levels can be directly overlain with a suitable cover (minimum 150mm topsoil). Made Ground may be removed during the site enabling works and as such the post enabling site conditions should be reviewed to ascertain if any gardens need a clean cover. Chemical analysis of the natural clay drift deposits has identified these soils to be acceptable for use as subsoil within the proposed garden areas, however further chemical validation samples will be required to confirm this. There are also suitable sources of topsoil available on the site. A supplementary post demolition ground investigation will be required in the location of the existing buildings to assess the potential for contaminants in this area of the site.
Controlled Waters	Low risk to controlled waters.
Ground Gas	Preliminary ground gas monitoring suggests that the site can be predominantly classified as CS1 and in these areas it is considered that gas protection measures will not be required. Plots in the vicinity of WS108 should be classified as CS2/Amber 1 due to marginally elevated carbon dioxide. WS106 is classified as CS4/Red due to significantly elevated methane. The monitoring well was set within cohesive Made Ground with notable anthropogenic material. No organic material was noted, therefore the methane concentrations may be attributed to mine workings. Further continuous gas monitoring should be completed to accurately determine the ground gas regime and inform a robust risk assessment. Real time monitoring could be used to inform a quantitative risk assessment. If the methane is from mine workings, further close centre wells may be required to determine the extent of site impacted.
Potable Water	This will need to be confirmed following the completion of a UKWIR Risk Assessment. Post remediation and enabling works ground conditions may be different from those identified during this site investigation.

Geotechnical Issues

The Made Ground could not be penetrated in a number of locations in the central sector, where cobbles were identified.

Obstructions will be present beneath the existing buildings in the north of the site. During a phase of cut fill enabling works to create a developable platform, all below ground obstructions will require grubbing out to the base of the Made Ground to enable the construction of proposed plots.

The former pond will present an area of locally poor ground, which will need to be located, delineated and investigated prior to the excavation and removal of all deleterious materials. The resulting excavation should be backfilled with material to be engineered in accordance with a suitable geotechnical specification in due consideration of the end use.

Based on existing data and given the predominantly cohesive ground conditions, it is considered that the majority of the proposed dwellings could be constructed using traditional spread footings bearing in the firm to stiff clay or medium dense sand at a depth from 1.00m to 1.50m below current ground levels.

Where deeper variable soft / loose natural clays, sand and gravels are identified or in locations where Made Ground deposits are present, dependent on development levels, plots may require locally deepening to Mass Trench Fill.

Due to the existing variances in the site topography, a phase of cut and fill enabling works will be required in order to create a proposed development. Therefore, upon completion of these enabling works, it is likely that the most cost effective option for the majority of the site would be re-engineer the newly placed Made Ground using Vibro Replacement Stone Columns (VRSC) to support a shallow strip or spread foundation or alternately use a piled foundation.

Where soft clays are present and in the location of the infilled pond, a piled foundation will be required.

Where peat deposits have been identified, the highly compressible material will require excavation to the base (circa 2.50m bgl) due to the potential for differential settlement within the proposed development. The resulting voids will then require backfilling with geotechnically suitable materials to the required development levels. It is therefore likely that a driven piled foundation would be required within areas of soft clays, where peat is retained beneath plots or where post remediation and enabling Made Ground extends to depths in excess of 2.0-2.50m bgl.

It must be noted that piling will not be possible over any stabilised mine workings.

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.

Consideration must be given to the varying soil matrices and differing settlement characteristics and where a foundation spans two varying matrices the sub-structure should be designed accordingly.

Probe drilling is required to locate the 3 No. mine entries recorded and not found. **In addition, further r**otary boreholes will be required to confirm location of Arley sub-crop and clearly define areas requiring stabilisation by drilling and grouting;

Further works are required to delineate the extent of compressible peat. The presence of peat with no safe allowable bearing pressure represents a significant risk associated with consolidation of the underlying stratum under very low infrastructure loadings and construction plant.

It will therefore be necessary to remove this material from all areas of proposed private driveway, hardstand, services, adopted highway and drainage infrastructure to mitigate the unacceptable risk associated with consolidation and ultimately failure within the sub-grade that would be induced.

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 1.2.

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 be 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

AST	Above Ground Storage Tank	**SGV**	Soil Guideline Value
BGS	British Geological Survey	**SPH**	Separate Phase Hydrocarbon
BSI	British Standards Institute	**TPH CWG**	Total Petroleum Hydrocarbon (Criteria Working Group)
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	**SPT**	Standard Penetration Test
CIEH	Chartered Institute of Environmental Health	**SVOC**	Semi Volatile Organic Compound
CIRIA	Construction Industry Research Association	**UST**	Underground Storage Tank
CLEA	Contaminated Land Exposure Assessment	**VCCs**	Vibro Concrete Columns
CSM	Conceptual Site Model	**VOC**	Volatile Organic Compound
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)	**WTE**	Water Table Elevation
DWS	Drinking Water Standard	**m**	Metres
EA	Environment Agency	**km**	Kilometres
EQS	Environmental Quality Standard	**%**	Percent
GAC	General Assessment Criteria	**%v/v**	Percent volume in air
GL	Ground Level	**mb**	Milli Bars (atmospheric pressure)
GSV	Gas Screening Value	**l/hr**	Litres per hour
HCV	Health Criteria Value	**µg/l**	Micrograms per Litre (parts per billion)
ICSM	Initial Conceptual Site Model	**ppb**	Parts Per Billion
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)	**mg/kg**	Milligrams per kilogram (parts per million)
ND	Not Detected	**ppm**	Parts Per Million
LMRL	Lower Method Reporting Limit	**mg/m^3**	Milligram per metre cubed
NR	Not Recorded	**m bgl**	Metres Below Ground Level
PAH	Polycyclic Aromatic Hydrocarbon	**m bcl**	Metre Below Cover Level
PCB	Poly-Chlorinated Biphenyl	**mAOD**	Metres Above Ordnance Datum (sea level)
PID	Photo Ionisation Detector	**kN/m^2**	Kilo Newtons per metre squared
QA	Quality Assurance	**µm**	Micro metre
SGV	Soil Guideline Value		

APPENDIX III
DRAWINGS





Drawing 13-223-001

Site Location Plan



Key:

Notes:

P1	-	13-06-2019	DRAFT	CB	MD
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Russell Homes

Job No: 13-223

Date: 13-06-2019

Drawing No: 002

Scale: N.T.S

Job Title: South Heywood (Phase 4)

Drawing Title: Proposed Development Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Historical Features

- Whittle Brook (Pre 1848 - Present)
- Collop Gate Farm (Pre 1848 - Present)
- Gravel Pit (Pre 1894 - Pre 1974)
- Mine Shaft - Disused (Pre 1910 - Present)

Notes:

P1	-	13-06-2019	DRAFT	CB	MD
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Russell Homes

Job No: 13-223

Date: 13-06-2019

Drawing No: 003

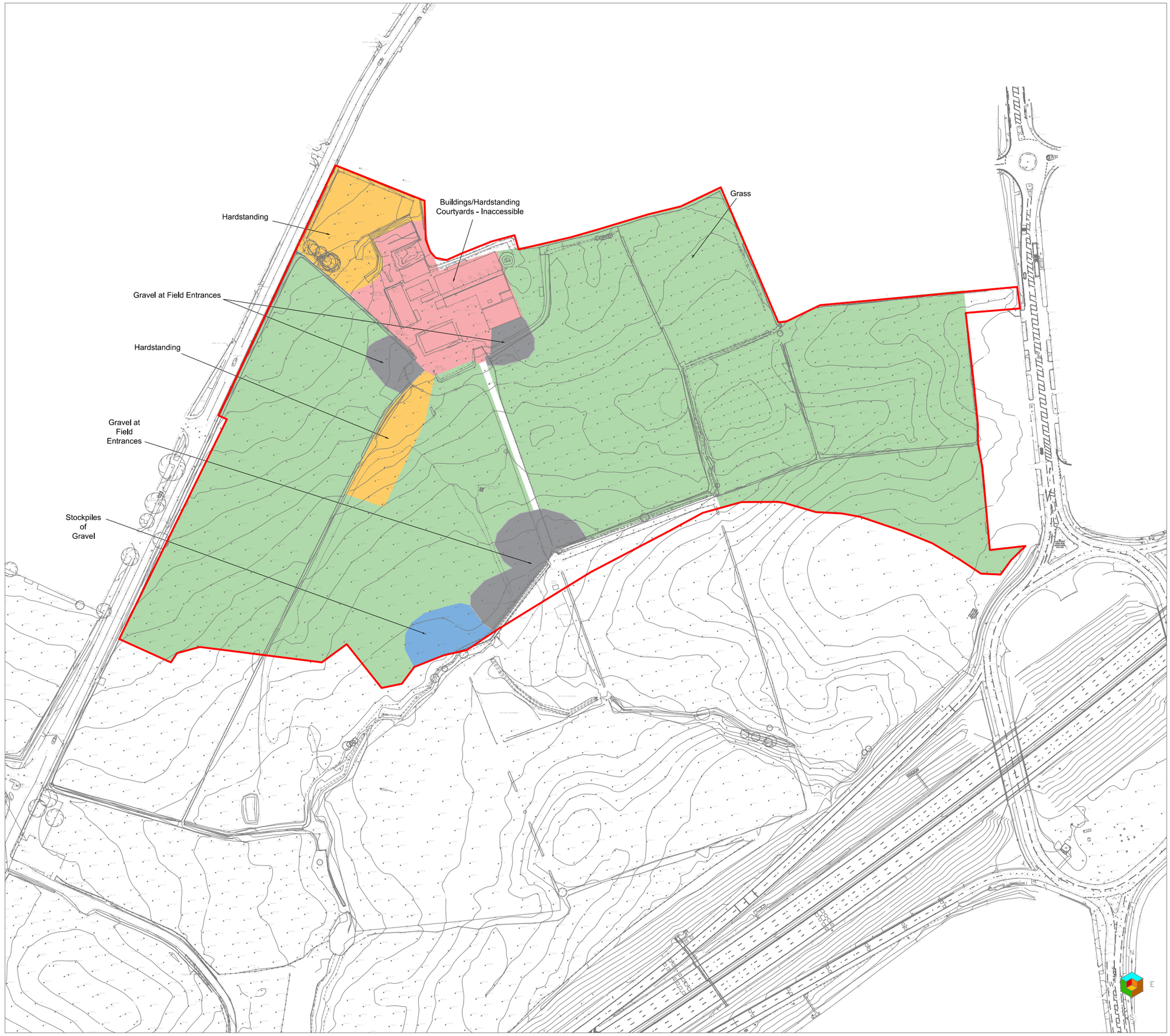
Scale: N.T.S

Job Title: South Heywood (Phase 4)

Drawing Title: Historical Features Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Current Site Features

- Grass
- Buildings and Hardstanding Courtyards - Inaccessible
- Gravel at Field Entrances
- Stockpiles of Gravel
- Hardstanding

Notes:

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	07-05-2019	DRAFT	CB	MD

Client: Russell Homes

Job No: 13-223

Date: 07-05-2019

Drawing No: 004

Scale: N.T.S

Job Title: South Heywood (Phase 4)

Drawing Title: Current Site Features Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location
- DCP101 — Approximate Dynamic Cone Penetrometer Test Location

Historical Features

- Whittle Brook (Pre 1848 - Present)
- Collop Gate Farm (Pre 1848 - Present)
- Mine Shaft - Disused (Pre 1910 - Present)

Notes:

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	07-05-2019	DRAFT	CB	MD

Client: Russell Homes

Job No: 13-223

Date: 07-05-2019

Drawing No: 005

Scale: 1:1250 @ A3

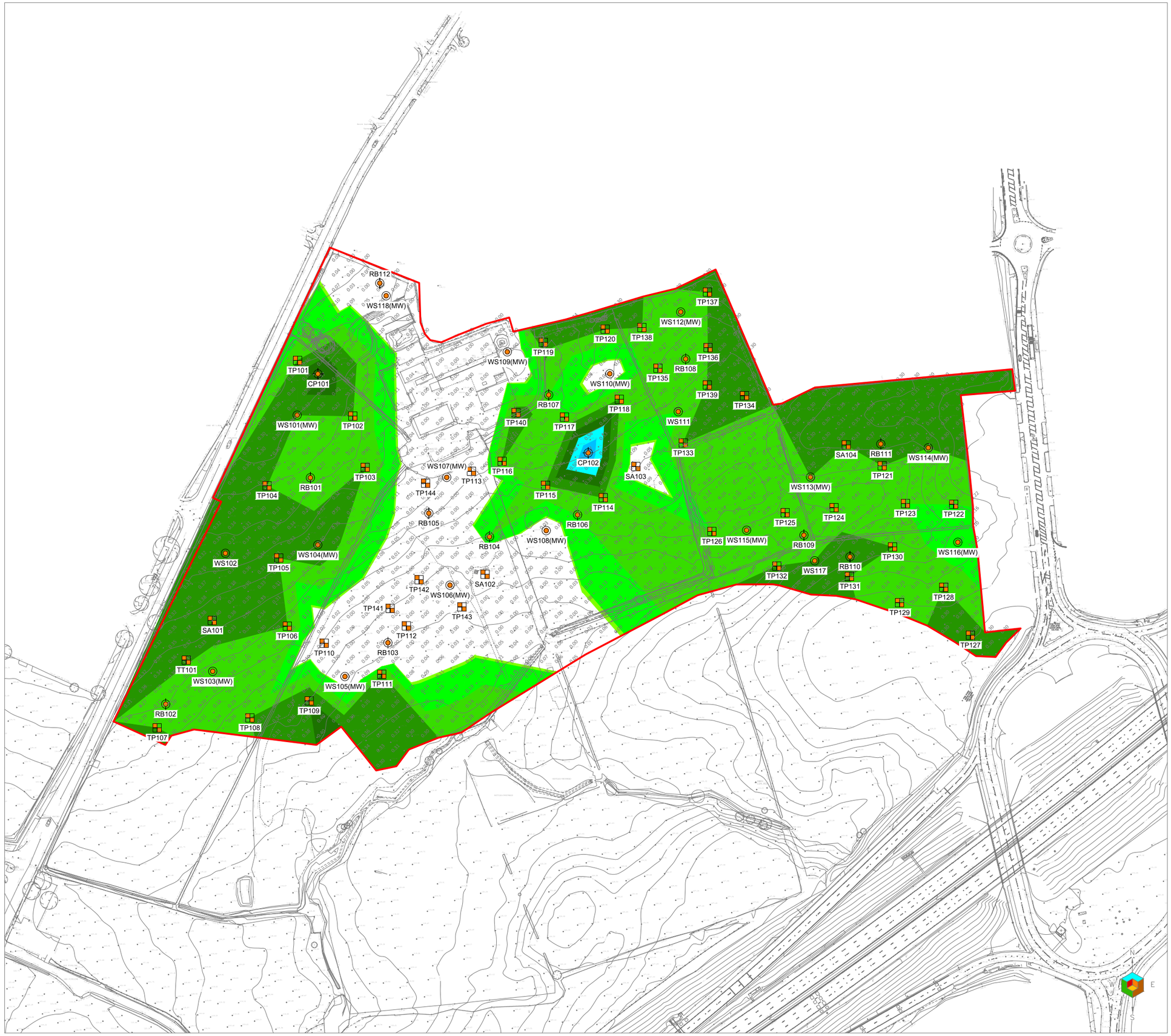
Job Title: South Heywood (Phase 4)

Drawing Title: Exploratory Hole Location Plan

e3p

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location

Topsoil Depth (m)

- Topsoil in Excess of 1.00m
- Depth of Topsoil Between 0.90 - 0.99m
- Depth of Topsoil Between 0.80 - 0.89m
- Depth of Topsoil Between 0.70 - 0.79m
- Depth of Topsoil Between 0.60 - 0.69m
- Depth of Topsoil Between 0.50 - 0.59m
- Depth of Topsoil Between 0.40 - 0.49m
- Depth of Topsoil Between 0.30 - 0.39m
- Depth of Topsoil Between 0.20 - 0.29m
- Depth of Topsoil Between 0.10 - 0.19m
- Depth of Topsoil Between 0.00 - 0.09m

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	14-06-2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 14-06-2019

Drawing No: 006

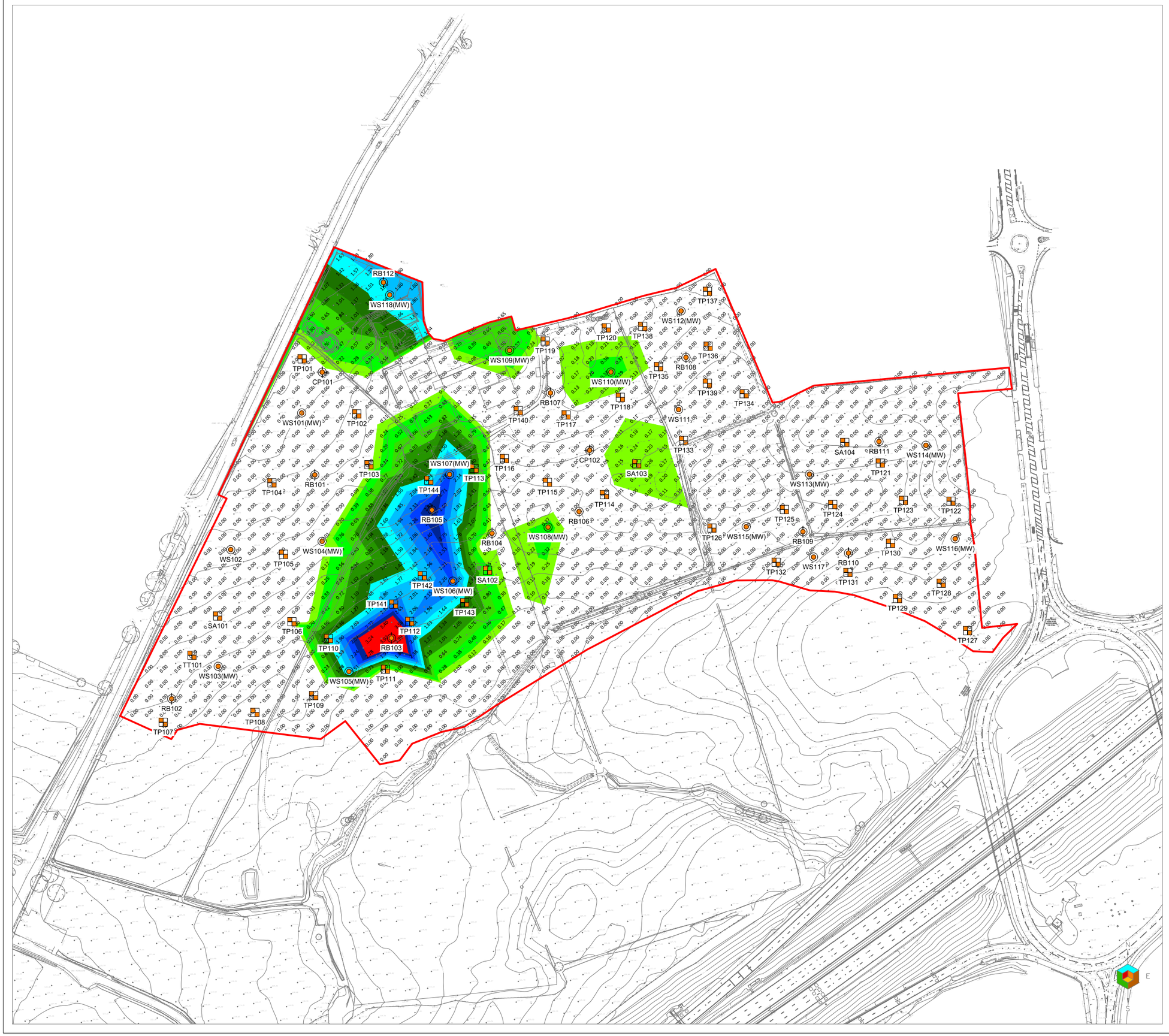
Scale: 1:2500 @ A3

Job Title: South Heywood (Phase 4)

Drawing Title: Depth of Topsoil Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location

Made Ground Depth (m)

- Made Ground in Excess of 3.00m
- Depth of Made Ground Between 2.70 - 2.99m
- Depth of Made Ground Between 2.40 - 2.69m
- Depth of Made Ground Between 2.10 - 2.39m
- Depth of Made Ground Between 1.80 - 2.09m
- Depth of Made Ground Between 1.50 - 1.79m
- Depth of Made Ground Between 1.20 - 1.49m
- Depth of Made Ground Between 0.90 - 1.19m
- Depth of Made Ground Between 0.60 - 0.89m
- Depth of Made Ground Between 0.30 - 0.59m
- Depth of Made Ground Between 0.01 - 0.29m
- Made Ground not Identified

Notes:

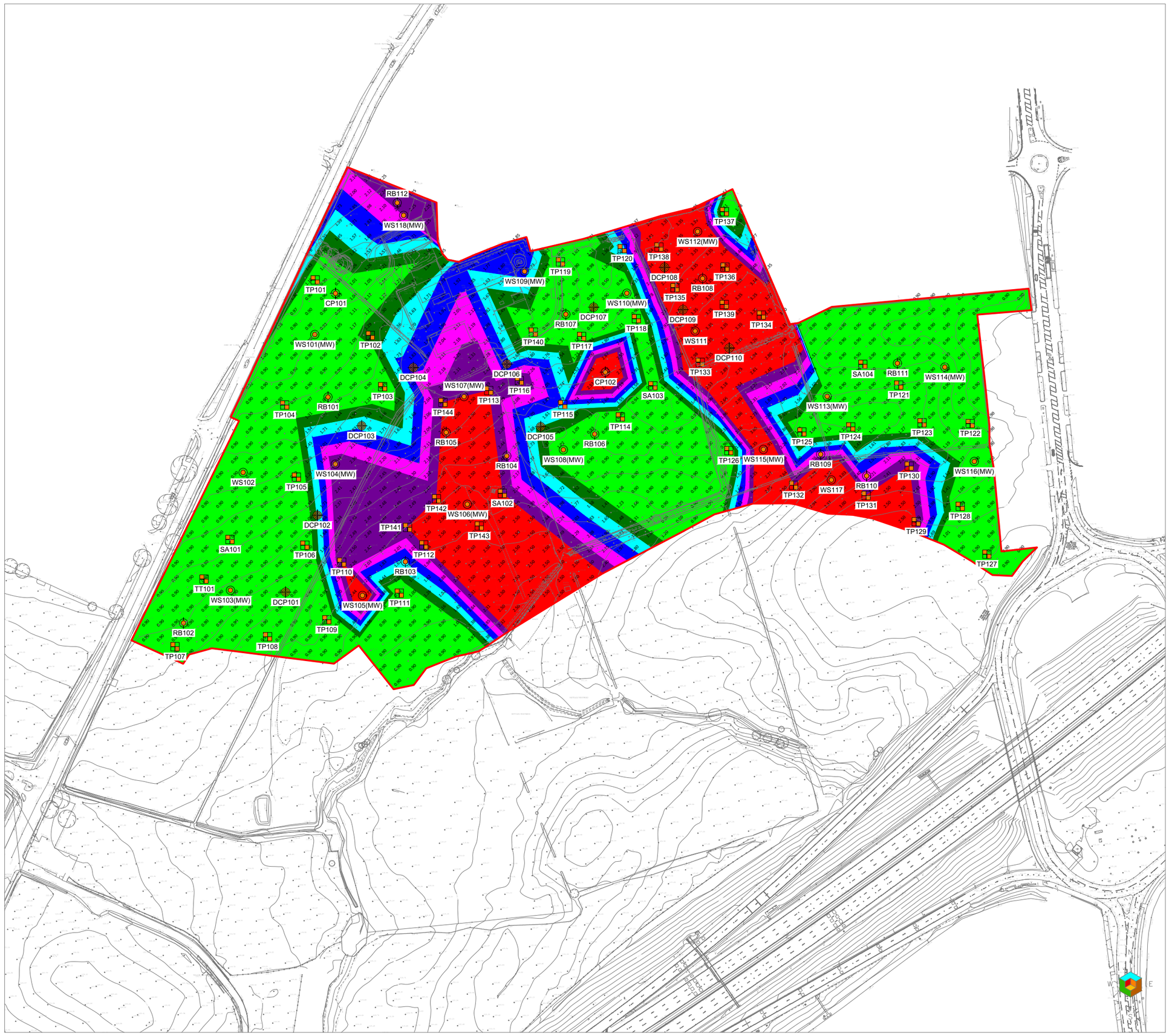
The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	18-06-2019	DRAFT	CB	NS

Client: Russell Homes	Job No: 13-223	Date: 18-06-2019
	Drawing No: 007	Scale: 1:2500 @ A3
Job Title: South Heywood (Phase 4)	Drawing Title: Depth of Made Ground Plan	

e3p
Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location
- DCP101 — Approximate Dynamic Cone Penetrometer Test Location

Shallow Spread Footings

- Depth to Founding Strata 0.00 - 1.24m
- Depth to Founding Strata 1.25 - 1.49m

Mass Trench Fill Footings

- Depth to Founding Strata 1.50 - 1.74m
- Depth to Founding Strata 1.75 - 1.99m
- Depth to Founding Strata 2.00 - 2.24m

Engineered Footings

- Depth to Founding Strata 2.25 - 2.49m
- Depth to Founding Strata >2.50m

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

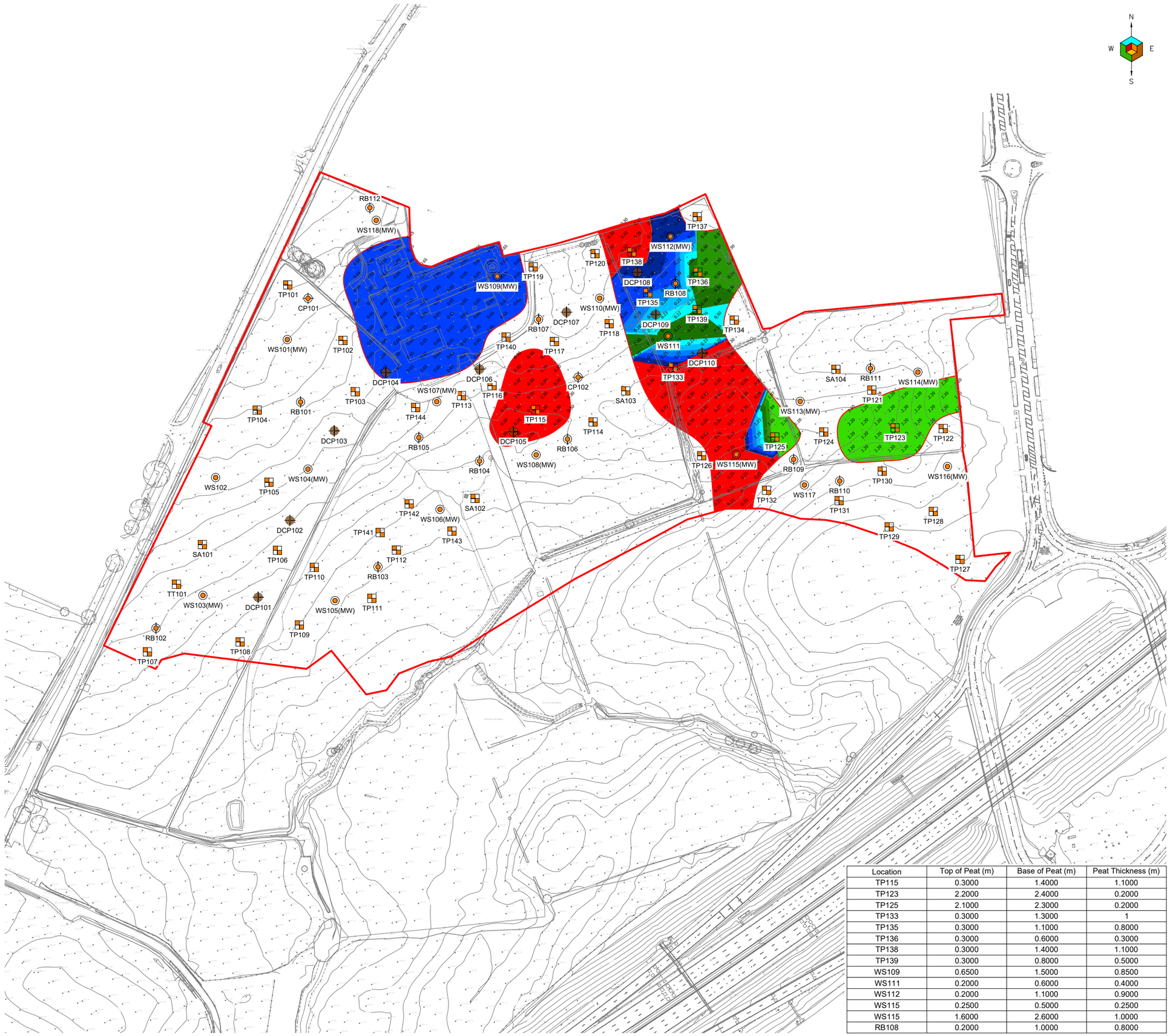
Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	18-06-2019	DRAFT	CB	NS

Client: Russell Homes	*Job No:* 13-223	*Date:* 18-06-2019
	Drawing No: 008	*Scale:* 1:2500 @ A3
Job Title: South Heywood (Phase 4)	*Drawing Title:* Depth to Founding Strata Plan	

e3p

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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



Location	Top of Peat (m)	Base of Peat (m)	Peat Thickness (m)
TP115	0.3000	1.4000	1.1000
TP123	2.2000	2.4000	0.2000
TP125	2.1000	2.3000	0.2000
TP133	0.3000	1.3000	1
TP135	0.3000	1.1000	0.8000
TP136	0.3000	0.6000	0.3000
TP138	0.3000	1.4000	1.1000
TP139	0.3000	0.8000	0.5000
WS109	0.6500	1.5000	0.8500
WS111	0.2000	0.6000	0.4000
WS112	0.2000	1.1000	0.9000
WS115	0.2500	0.5000	0.2500
WS115	1.6000	2.6000	1.0000
RB108	0.2000	1.0000	0.8000

Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location
- DCP101 — Approximate Dynamic Cone Penetrometer Test Location

Peat Thickness (m)

- Thickness of Peat in Excess of 1.00m
- Thickness of Peat Between 0.90 - 0.99m
- Thickness of Peat Between 0.80 - 0.89m
- Thickness of Peat Between 0.70 - 0.79m
- Thickness of Peat Between 0.60 - 0.69m
- Thickness of Peat Between 0.50 - 0.59m
- Thickness of Peat Between 0.40 - 0.49m
- Thickness of Peat Between 0.30 - 0.39m
- Thickness of Peat Between 0.20 - 0.29m
- Thickness of Peat Between 0.10 - 0.19m
- Thickness of Peat Between 0.00 - 0.09m
- 1.00 — Recorded Depth to Peat (m)

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	18-06-2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 18-06-2019

Drawing No: 009

Scale: 1:2500 @ A3

Job Title: South Heywood (Phase 4)

Drawing Title: Depth and Thickness of Peat Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.

Arley Seam

Arley Seam

ANGLE OF DIP
11.3°SW

ANGLE OF DIP
11.3°SW

ASSUME OUTCROP IS AT 125mAOD

GL AT 135mAOD
ASSUME OUTCROP IS
AT 125mAOD

ARLEY EXPECTED AT 36m OR 90mAOD
ARLEY SUB-CROP EXPECTED AT NE BOUNDARY

COAL AUTHORITY – PROBABLY SHALLOW WORKINGS

AREA OF KNOWN WORKINGS AT 24.00 - 27.00M WITH INSUFFICIENT ROCK COVER. DRILL AND GROUT REQUIRED

PROVEN WORKINGS

RB112
Rock - 6.00m
Barren to 30.00m

RB108
Rock - 19.70m
Barren - 30.00m

RB107
Rock - 16.40m
Barren - 30.00m

RB111
Rock - 18.90m
Terminated - 30.00m

Rock - 4.20m
Arley Coal - 25.10m
RB101

Rock - 20.40m
Terminated - 30.00m
RB105

Rock - 19.90m
Terminated - 30.00m
RB104

RB106
Rock - 20.30m
Barren - 30.00m

Rock - 24.10m
Terminated - 34.50m
RB109

RB110 Rock - 19.50m
Terminated - 30.00m

385408-001
385909.409013

385409-001
385983.409013

385408-001
385893.408989

385408-002
385797.408986

Rock - 32.50m
Terminated - 40.00m
BH404

40.00m Drift
BH402

RB103
Rock - 12.60m
Barren to 30.00m

Rock - 22.00m
Arley Coal - 27.50 - 29.50m
BH406

BH403
40.00m Drift

BH405
Rock - 23.50m
Arley Coal - 28.30 - 30.00m
(Drill and Grout)

BH401
40.00m Drift

Rock - 4.60m
Arley Coal - 19.90m
BH412

RB102

BH407
Rock - 18.00m
Arley Coal - 33.00 - 35.00m

BH410

BH411
Rock - 10.50m
Arley Coal - 15.20m

BH409
Rock - 12.00m
Barren

N
W
E
S

Key:

Location Symbols

- MS — Approximate Mine Shaft Location
- Approximate Location of Recorded Shallow Coal Mine Workings
- Approximate Location of Coal Seam
- Approximate Location of Concrete Blocks/Storage Shed
- 10.00m Departure Zone (Except for 385409-001 which is 8.00m)
- Approximate Location of Proven Mine Workings (No Unlicensed Open Cast)
- Approximate Trial Trench Location
- Area of Known Workings at 24.00 - 27.00m with Insufficient Rock Cover - Drill and Grout Required
- BH — Proposed 50m Borehole

Location	Top of Coal (m)	Base of Coal (m)	Coal Thickness (m)
RB101	25.10	25.90	0.80
RB102	17.40	17.60	0.20
RB102	19.00	21.00	2.00
BH405	28.30	30.00	1.70
BH406	27.50	29.50	2.00
BH407	33.00	35.00	2.00
BH411	15.20	16.00	0.80

Phase	Revision	Date	Issue	Drawn	Authorised
P1	R3	26.07.2019	REVISION	CB	NS
P1	R2	25.07.2019	REVISION	RW	NS
P1	R1	27.06.2019	REVISION	RW	NS
P1	-	19.06.2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 26.07.2019

Drawing No: 010

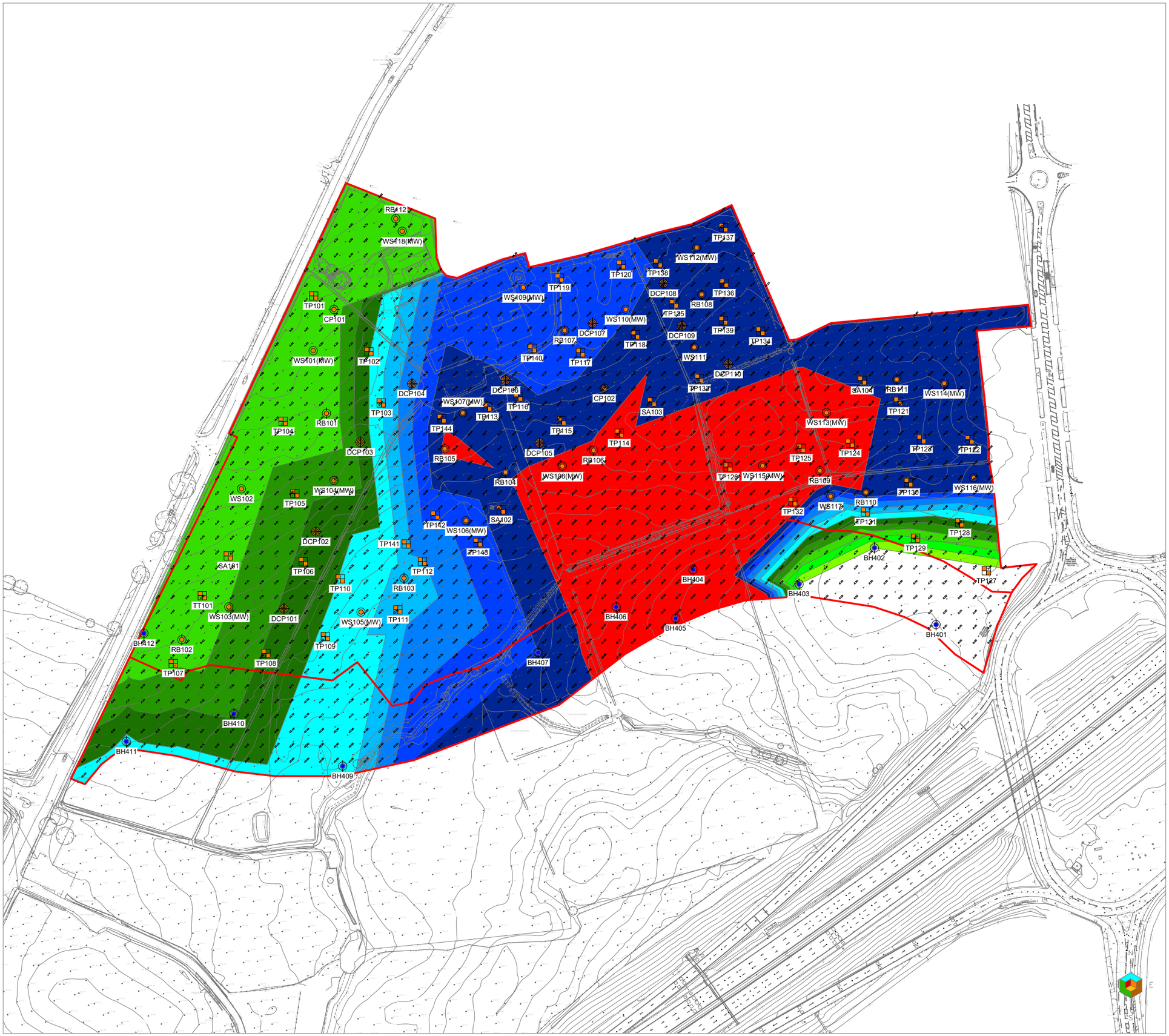
Scale: 1:2500 @ A3

Job Title: South Heywood (Phase 4)

Drawing Title: Coal Mining Issues Plan

e3p
Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

- WS101 — Approximate Window Sample Probehole Location
- WS101(MW) — Approximate Window Sample Probehole Location with Install
- TP101 — Approximate Trial Pit Location
- TT101 — Approximate Trial Trench Location
- CP101 — Approximate Cable Percussive Borehole Location
- RB101 — Approximate Rotary Borehole Location
- BH101 — Approximate Rotary Borehole Location

Bedrock Depth (m)

- Bedrock in Excess of 20.00m
- Depth to Bedrock Between 18.00 - 19.99m
- Depth to Bedrock Between 16.00 - 17.99m
- Depth to Bedrock Between 14.00 - 15.99m
- Depth to Bedrock Between 12.00 - 13.99m
- Depth to Bedrock Between 10.00 - 11.99m
- Depth to Bedrock Between 8.00 - 9.99m
- Depth to Bedrock Between 6.00 - 7.99m
- Depth to Bedrock Between 4.00 - 5.99m
- Depth to Bedrock Between 2.00 - 3.99m
- Depth to Bedrock Between 0.00 - 1.99m
- Bedrock Not Encountered

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	R2	15.07.2019	REVISION	RW	NS
P1	R1	10.07.2019	REVISION	CB	NS
P1	-	18.06.2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 15.07.2019

Drawing No: 012

Scale: 1:2500 @ A3

Job Title: South Heywood (Phase 4)

Drawing Title: Depth to Bedrock Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

RB101 — Approximate Rotary Borehole Location

BH101 — Approximate Rotary Borehole Location

Depth to Coal (m)

- Depth to Coal in Excess of 30.00m
- Depth to Coal Between 28.50 - 29.99m
- Depth to Coal Between 27.00 - 28.49m
- Depth to Coal Between 25.50 - 26.99m
- Depth to Coal Between 24.00 - 25.49m
- Depth to Coal Between 22.50 - 23.99m
- Depth to Coal Between 21.00 - 22.49m
- Depth to Coal Between 19.50 - 20.99m
- Depth to Coal Between 18.00 - 19.49m
- Depth to Coal Between 16.50 - 17.99m
- Depth to Coal Between 15.00 - 16.49m
- 1.00 — Recorded Thickness of Coal (m)

Location	Top of Coal (m)	Base of Coal (m)	Coal Thickness (m)
RB101	25.10	25.90	0.80
RB102	17.40	17.60	0.20
RB102	19.00	21.00	2.00
BH405	28.30	30.00	1.70
BH406	27.50	29.50	2.00
BH407	33.00	35.00	2.00
BH411	15.20	16.00	0.80

Notes:

The conjectured depth mapping has been completed using 3D modelling software to produce indicative assessments that at this time are the most accurate interpretation of the Ground Investigation data. However, the conjectured nature of the model, limitations and areas of uncertainty between two proven points and the intermediary area result in uncertainties that should be considered by the reader of a drawing and incorporated in any subsequent assessment.

Phase	Revision	Date	Issue	Drawn	Authorised
P1	R1	10-07-2019	REVISION	CB	NS
P1	-	19-06-2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 10-07-2019

Drawing No: 013

Scale: 1:2500 @ A3

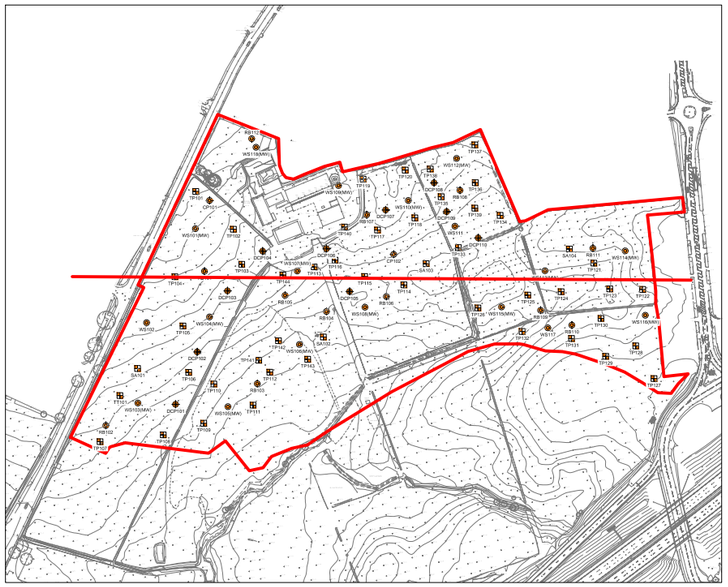
Job Title: South Heywood (Phase 4)

Drawing Title: Depth and Thickness of Coal Plan

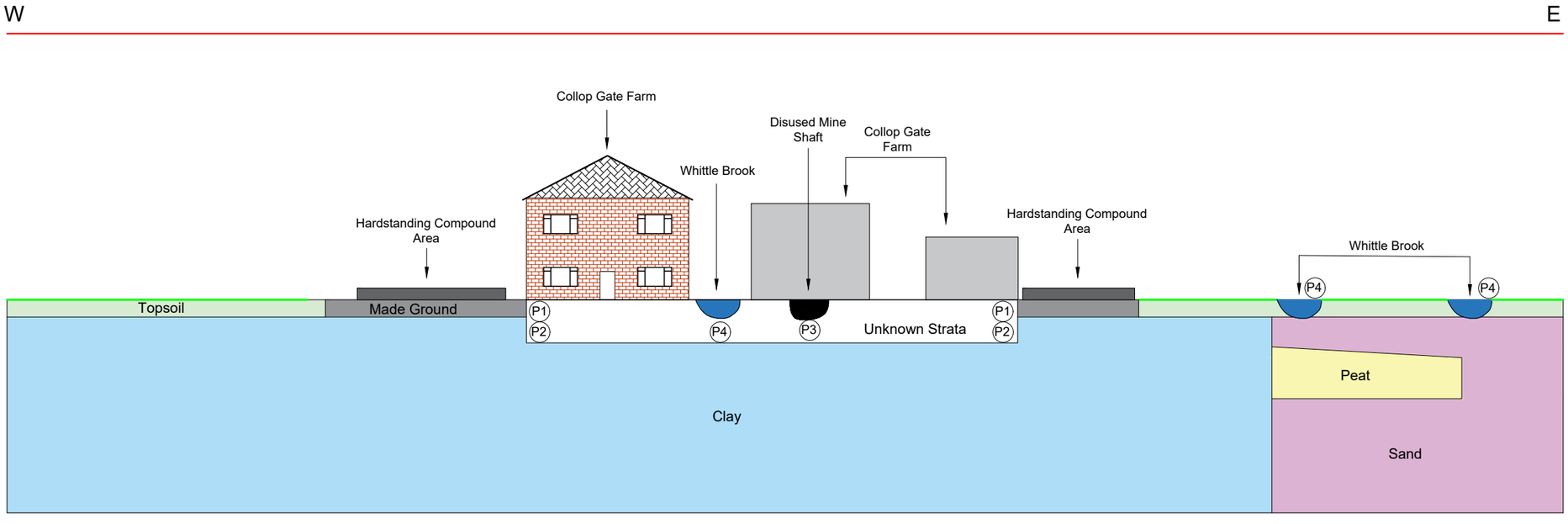
Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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.

ID	PATHWAY	RECEPTOR	CONTAM.
1	Dermal Ingestion	Future Users	Heavy Metals in Made Ground
2	Inhalation of Dust	Future Users	ACM in Made Ground
3	Inhalation of Gas	Future Users, Buildings	Alluvium, Peat and Made Ground
4	Surface Run Off and Migration	Secondary A Aquifer, Whittle Brook	Made Ground
5	Sulphate Attack on Concrete	Building Structure	Made Ground
6	Ingestion of Tainted Water Supply	Future Users and Pipes	Made Ground
7	Direct Contact - Plant Uptake	Flora	Phytotoxic Contamination in Made Ground



Key:



Notes:

P1	-	19-06-2019	DRAFT	CB	NS
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Russell Homes

Job No: 13-223

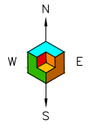
Date: 19-06-2019

Drawing No: 014

Scale: NTS @ A3

Job Title: South Heywood (Phase 4)

Drawing Title: Conceptual Site Model



Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Minimum Width of Strip Footings

Type of Ground (Including Engineered Fill)	Condition of Ground	Total Load of Load-Bearing Walling more than (kN/linear metre)					
		20	30	40	50	60	70
		Minimum Width of Strip Foundation (mm)					
Gravel Sand	Medium Dense to Dense	250	300	400	500	600	650
Clay Sandy Clay	Stiff	250	300	400	500	600	650
Clay Sandy Clay	Firm	300	350	450	600	750	850

Summary of Heave Precaution Requirements

Volume Change Potential	Required Foundation Depth (m)	Minimum Void Dimensions for Foundations, Ground Beams & Suspended In-Situ Concrete Ground Floors		Minimum Void Dimensions Under Pre-Cast Concrete & Suspended Timber Floors
		Thickness of Void Former Against Side of Foundation of Ground Beam (mm)	Thickness of Void Former on Underside of Edge Beam & Floor Slab (mm)	Void Dimension (mm)
Low Volume Change Potential (<20%)	>2.00	No Special Precautions		200
	2.00-2.50	-	50	
Medium Volume Change Potential (20-40%)	1.50-2.00	25	50	250
	2.00-2.50	25	100	
	>2.50	Engineer Design		Engineer Design
High Volume Change Potential (>40%)	1.50-2.00	25	75	300
	2.00-2.50	35	150	
	>2.50	Engineer Design		Engineer Design

Key:

Anticipated Foundation Types

Colours indicate depth to anticipated founding stratum with letters indicating potential footing types.

- **TS** — Traditional Strip Foundations. Minimum depth 900mm below proposed Final Finished Level. Maximum safe bearing pressure limited to 100kN/m2
- **MT** — Mass Trench Fill Foundations. Minimum depth 1250mm below proposed Final Finished Level. Maximum safe bearing pressure limited to 100kN/m2
- **V** — Vibro Stone Ground Compaction. In accordance with NHBC Chapter 4.2
- **P** — Piled Foundations. Where the maximum foundation depth exceeds 2.50m a piled foundation option rather than a trench fill / deep reinforced strip foundations may be adopted. Column or line loads supported by ground beams.
- **R** — Raft Foundations. Maximum safe bearing pressure limited to 50kN/m2 on approved engineered granular fill. Raft foundations to be designed by a structural engineer in accordance with Chapter 4.5 of NHBC 2013. Raft foundations are considered suitable to mitigate against potential influence of clay heave / desiccation in accordance with Section 4.2, sub section D7E.
- **S/TB** — Traditional Strip / Trench Block Foundations. Traditional strip founded at 450mm below current level with build up in Trench Block and subsequent backfill to development level.

Depth to Target Founding Strata

- Footings 0.75 - 0.90m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 0.90 - 1.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.25 - 1.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2

→ Viable for Shallow Strip Foundations

- Footings 1.50 - 1.75m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 1.75 - 2.00m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.00 - 2.25m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Footings 2.25 - 2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2

→ Viable for Trench Fill Foundations

Engineered Foundation Solutions (Piled or Ground Improvement)

- Footings >2.50m Deep. From Final Finished Level. In accordance with NHBC Chapter 4.2
- Where orange circle is shown, ground conditions would allow for improvement by the construction of Vibratory Replacement Stone Columns (VRSC) to ensure a new Allowable Bearing Pressure of 125kN/m2 is achieved at 600mm below piling platform. However, where plots are underlain by cohesive soils, the reinforced strip (bearing on the VRSC) will need to be deepened in accordance with the associated tree influences identified on the drawing.

Requirement for Mitigation of Volumetric Instability in Clay

- Where pale blue circle is shown, **Plots may require deepening of foundations to mitigate volumetric instability within clay soil and heave precautions.**
- Low volume change potential clay. Heave precautions required to underside of cast in-situ floor slab (with no sub-floor void) within conjected zone of tree influence. Heave precautions not required to foundation.

Items Considered	
Bearing Capacity	E3P Report - 13-223-R1
Trees	TBC
Historical	E3P Report - 13-223-R1
Groundwater Table	E3P Report - 13-223-R1
FFL	TBC
Contamination	E3P Report - 13-223-R1
Remediation	E3P Report - 13-223-R1
Volume Change Potential	TBC
Root Protection Areas	TBC

E3P Designers Residual Risk Assessment

Designers Statement of declaration

E3P realises its obligations as a design organisation to avoid forseeable risks to those constructing our designs. In accordance with our statutory duties under CDM 2015, E3P has taken all reasonably practicable steps to eliminate hazards, taking into account other design considerations, from out designs.
E3P utilise a number of processes and documents to decide on the final design. This design risk assessment profile forms part of the overall E3P design process.

Where hazards remain, then details have been provided below on the significant residual risks from those hazards. To assist other project team members our designer has provided information needed to identify and manage remaining significant risks for this project, along with justification for the final design choice.

Additional Information:

Underground Services

No allowance has been made in the foundation design to accommodate the presence or installation of underground services except where specifically noted. It is assumed that the design for the installation of underground services has or will take into account the house/retaining wall foundations as detailed on this plan and in accompanying schedule. Foundation depths should comply with BS813-1:1995.

Deep Excavations

Deep excavations will be necessary on this site. A full risk assessment and agreed method statement must be produced prior to the construction phase.

Trench Stability

The contractor should be aware that due to the nature of the ground conditions, it is likely that there is the potential for unstable trenches. The contractor should allow within their tender for temporary means of support and safe methods of working. Particular reference is made to excavations immediately adjacent to existing road/footway/verge/boundary features & structures.

Construction Issues

The contractor is deemed to have considered all construction issues identified in E3P drawings and should have priced for the work accordingly.

CDM Regulations

Preparatory works such as reducing ground levels and deep excavations should be carefully considered and carried out in such a manner as to comply with the current CDM (2015) regulations, particularly for excavations close to the site boundary, existing structures & roads.

Construction of foundations

It has been assumed at the design stage that foundations will be constructed prior to the construction of roads and the installation of drainage and services. If roads, footways or verges exist on the site prior to foundation construction, temporary support is required during excavation.

Insitu Suspended Slabs

Where the depth of unsuitable material exceeds 600mm, suspended ground floor slabs are required. Reinforced insitu suspended concrete slabs may be used, unless influenced by vegetation (e.g Heave Zone).

New Planting

No allowance has been made for deepening of foundations due to new planting, Planting proposals to be submitted to E3P for consideration.

Saplings

Unless stated otherwise all saplings within the site and its boundary are to be removed prior to construction. For advice seek appropriate tree care specialist. Permission may be required prior to removal. Should any saplings remain then E3P should be informed prior to excavating foundations.

Geology

Ground below foundations to have a net allowable bearing pressure of circa 75kN/m^2 at 1.00m bgl in natural sandy CLAY and SAND deposits. Foundations may require deepening due to varying bearing strata. Foundations must not be found in different materials as this may result in differential settlement. Foundations must not be founded in Made Ground. E3P to be informed if ground conditions differ from that anticipated. If in any doubt contact E3P.

Foundation Concrete

Concrete to trench fill or traditional strip footings to be GEN1 to BS 8500, compacted by vibration. Reinforced concrete to be RC35, compacted by vibration. Top of concrete foundations to suit construction Health & Safety requirements.

Gas/Radon Precautions

Gas precautions to be confirmed. Radon protection is not required.

Foundation Schedule

Numbers at corners of plots to be used when
referring to foundation schedule. (Pending Revised Layout & Levels)

Heave Precaution

Heave precautions should be used where:

- The clay is moderate or high plasticity;
- Where the foundation is within the zone of influence of trees; and,
- Where the foundation depth determined in accordance with NHBC 2013 Clause D6 is greater than 1.50m based on the appropriate tree height.

Heave precautions are required within the proposed development.

N.B: This Foundation Zoning Plan is subject to change pending completion of the site wide earthworks programme.

Foundation Options

Due to the variable ground conditions across the site, this would suggest that the proposed development may be constructed on a combination of traditional strip foundations, mass trench fill and vibro ground improvement to support a shallow reinforced strip footing.

The use of Vibro Stone Columns, which would bear on the underlying firm to stiff clays and medium dense sands at circa 3.0-4.0m bgl, would allow the construction of shallow reinforced strip foundations to be cast 600mm below formation level. The suitability of VSC would depend on the presence of organic materials / peat, which have until this point, not been identified on the site. In the event that peat is identified at a thickness of >200mm, driven pile foundations may be required.

Local deepening of foundations will be required with tree influences as indicated. For a deep strip / mass trench fill, the structural design would need to account for differential settlement of foundations bearig on cohesive and granular soils. This is an indicative plan and will be amended upon receipt of the final development layout.

Residual Risks

Foreseeable Risks That Cannot be Avoided	*Applicable (Y/N)*	*Action to Reduce Risk*	Justification for Design Decision
Deep Excavations	Y	Identify locations on drawing and depths on schedule	Lesser risk than other alternatives
Trench Collapse	Y	Risk highlighted on drawing	Lesser risk than other alternatives
Use of Working Platform for Pile/Vibro Operations	Y	Compliance with working platform directive required	Pile/Vibro foundation less risky than other alternatives

Phase	Revision	Date	Issue	Drawn	Authorised
P1	-	19-06-2019	DRAFT	CB	NS

Client: Russell Homes

Job No: 13-223

Date: 19-06-2019

Drawing No: 015

Scale: NTS @ A1

Job Title: South Heywood (Phase 4)

Drawing Title: Conceptual Foundation Zoning Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
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.



Key:

Location Symbols

WS101(MW) Approximate Window Sample Probehole Location with Install

Gas Assessment

- CS4/Red
- CS2/Amber 1
- CS1/Green

Notes:

P1	-	26-07-2019	DRAFT	CB	NS
Phase	Revision	Date	Issue	Drawn	Authorised

Client: Russell Homes

Job No: 13-223

Date: 26-07-2019

Drawing No: 016

Scale: N.T.S

Job Title: South Heywood (Phase 4)

Drawing Title: Gas Assessment Plan

Environmental Engineering Partnerships Ltd
City Heliport & Business Centre
Eccles, Manchester, M30 7RU
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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

APPENDIX IV
PHOTOGRAPHS





PLATE 1 – VIEW OF SITE FACING NORTH



PLATE 2 – HARDSTANDING STORAGE AREA



PLATE 3 – CAPPED MINE SHAFT



PLATE 4 – VIEW OF SITE FACING EAST



PLATE 5 – TRIAL TRECHES FOR WESTERN MOST SHAFT



PLATE 6 – TP107 EXCAVATION



PLATE 7 – TP136 EXCAVATION



PLATE 8 – TP143 ARISINGS

APPENDIX V
E3P EXPLORATORY HOLE LOGS



Trial Pit Log

TrialPit No: TP101
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385863.00 - 409156.00 Level: 132.53	Date 29/04/2019
Location: South Heywood		Dimensions (m): 2.20 × 0.50 Depth 2.60	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	132.23		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.40	HVP	61				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.90	HVP	68				
	1.20	ES					
	1.40	HVP	78	1.40	131.13		Stiff high strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.90	HVP	106				
	2.40	HVP	103				
				2.60	129.93		End of Pit at 2.60m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP102
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385900.00 - 409119.00 Level: 129.90	Date 29/04/2019
Location: South Heywood		Dimensions (m): 2.00 x 0.50 Depth 2.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	129.60		Dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
				0.90	129.00		Orangey light brown slightly clayey fine to medium SAND with occasional gravel. Gravel is fine to coarse, sub-angular mudstone.
	1.00	HVP	77				Stiff high strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.20	ES					
	2.00	HVP	91				
				2.40	127.50		End of Pit at 2.40m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP103
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385908.00 - 409084.00 Level: 128.56	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.80 x 0.50 Depth 2.80	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	128.26		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.40	HVP	59				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.90	HVP	62				
	1.00	ES					
	1.40	HVP	68				
	1.90	HVP	75	1.90	126.66		Stiff high strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	2.40	HVP	80				
				2.80	125.76		End of Pit at 2.80m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP104
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385842.00 - 409072.00 Level: 129.82	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.30 x 0.50 Depth 1.90	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
				0.30	129.52		
	0.40	HVP	45				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.90	ES					
	0.90	HVP	69				
	1.40	HVP	75	1.40	128.42		Stiff high strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
				1.90	127.92		End of Pit at 1.90m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP105
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385850.00 - 409023.00 Level: 127.26	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.10 × 0.50 Depth 2.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	126.96		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.70	ES					Dark yellowy brown slightly gravelly clayey fine to medium SAND. Gravel is coarse sub-angular shale.
	1.80	HVP	44	1.70	125.56		Firm medium strength orangey brown mottled grey slightly sandy CLAY with occasional gravel. Gravel is fine to coarse sub-angular of mudstone.
	2.30	HVP	77	2.30	124.96		Stiff high strength orangey brown mottled grey slightly sandy CLAY with occasional gravel. Gravel is fine to coarse sub-angular of mudstone.
				2.50	124.76		End of Pit at 2.50m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP106
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385856.00 - 408977.00 Level: 124.92	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 2.00, 1.20 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	124.62		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.40	HVP	43				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. Becoming stiff high strength from 2.0m bgl.
	1.00	HVP	49				
	1.20	ES					
	1.40	HVP	61				
	2.00	HVP	77	2.00	122.92		End of Pit at 2.00m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP107
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385768.00 - 408909.00 Level: 124.35	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.00 × 0.50 Depth 2.10	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	124.05		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	59				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.00	HVP	73				
	1.10	ES					
	1.50	HVP	75				
				1.80	122.55		Reddish brown slightly gravelly fine to medium SAND. Gravel is fine to coarse sub-angular mudstone.
				2.10	122.25		End of Pit at 2.10m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP108
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385831.00 - 408916.00 Level: 122.34	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.30 × 0.50, Depth 2.20	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30	122.04		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.70	ES		1.30	121.04		Dark reddish brown very clayey gravelly fine to medium SAND. Gravel is fine to coarse of angular to sub-angular mudstone.
	1.40	HVP	39	2.20	120.14		Soft low strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. Becoming firm medium strength from 1.9m bgl.
	1.90	HVP	43				End of Pit at 2.20m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP109
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385870.00 - 408927.00 Level: 122.05	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.20 x 0.50 Depth 2.60	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	ES		0.40	121.65		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.80	ES					Light brown gravelly fine to medium SAND. Gravel is fine to coarse sub-angular to sub-rounded mudstone.
	1.20	HVP	47	1.10	120.95		Firm medium strength dark orangish brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.70	HVP	51				
	2.20	HVP	54				
				2.60	119.45		End of Pit at 2.60m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP110
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385881.00 - 408966.00 Level: 122.81	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 1.60 — 1.30 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.05	ES		0.10	122.71		MADE GROUND: Soft dark brown slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.40	ES					MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete.
				1.60	121.21		End of Pit at 1.60m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP111
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385919.00 - 408945.00 Level: 120.65	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.10 x 0.50 Depth 2.30	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	120.35		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.60	ES					Dark bluey grey sandy GRAVEL. Gravel is fine to coarse angular to sub-angular shale (coal-like).
	0.90	HVP	61	0.80	119.85		Firm medium strength orangey brown mottled grey very sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.50	HVP	60				
	1.90	HVP	65				
				2.30	118.35		End of Pit at 2.30m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP112
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385936.00 - 408978.00 Level: 121.17	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 2.10 — 1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	120.87		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	1.20	ES		2.10	119.07		MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete.
							End of Pit at 2.10m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP113
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385980.00 - 409082.00 Level: 125.13	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 1.20, 1.30 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	124.93		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.60	ES		1.20	123.93		MADE GROUND: Firm dark grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete. Large boulder of concrete present at 0.7m bgl.
							End of Pit at 1.20m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP114
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386068.00 - 409064.00 Level: 124.24	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 2.30, 1.30 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	123.94		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.40	ES					
	0.60	HVP	44				Firm medium strength dark grey slightly sandy CLAY.
	0.90	HVP	46	0.80	123.44		Firm medium strength dark orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.50	HVP	55				
	2.00	HVP	59				
				2.30	121.94		End of Pit at 2.30m

1
2
3
4
5

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP115
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386030.00 - 409072.00 Level: 124.12	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 1.90 — 1.20 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	123.82		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.00	ES					Soft dark brown compressible PEAT.
▼ 1.50				1.40	122.72		Dark grey coarse SAND.
				1.90	122.22		End of Pit at 1.90m

Remarks: 1. Complete. 2. Water strike encountered at 1.5m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP116
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386000.00 - 409088.00 Level: 124.94	Date 30/04/2019
Location: South Heywood		Dimensions (m): Depth 2.30, 1.30 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	124.64		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.00	ES					Soft black slightly gravelly CLAY. Gravel is fine to coarse angular to sub-angular mudstone.
▼ 2.00				2.30	122.64		End of Pit at 2.30m

1 2 3 4 5

Remarks: 1. Complete. 2. Water strike encountered at 2.0m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP117
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386042.00 - 409118.00 Level: 126.84	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.30 x 0.50 Depth 2.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	126.64		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.30	HVP	46				Firm medium strength dark orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.90	ES					
	1.00	HVP	61				
▼ 1.35				1.30	125.54		Dark reddish brown slightly clayey coarse SAND.
				2.40	124.44		End of Pit at 2.40m

Remarks: 1. Complete. 2. Water strike encountered at 1.35m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP118
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386079.00 - 409130.00 Level: 126.67	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.40 — 1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	126.37		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	53				Firm medium strength dark orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. Becoming stiff high strength from 1.5m bgl.
	0.80	ES					
	1.00	HVP	62				
	1.50	HVP	78				
▼ 1.80							
	2.00	HVP	84				
				2.40	124.27		End of Pit at 2.40m

1 2 3 4 5

Remarks: 1. Complete. 2. Water strike encountered at 1.8m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP119
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386028.00 - 409168.00 Level: 127.18	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50 Depth 2.30	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.35	126.83		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.00	ES					Light grey slightly clayey fine to medium SAND.
				2.30	124.88		End of Pit at 2.30m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP120
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386070.00 - 409177.00 Level: 127.73	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.60, 1.40 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	127.43		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.20	ES		1.20	126.53		Dark reddish brown slightly clayey coarse SAND.
	1.50	HVP	46				Firm medium strength dark orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
▼ 2.10	2.00	HVP	53				
	2.50	HVP	67	2.60	125.13		End of Pit at 2.60m

Remarks: 1. Complete. 2. Water strike encountered at 2.1m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP121
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386256.00 - 409085.00 Level: 125.58	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.30, 1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	125.28		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.00	ES					Orangey light brown slightly clayey fine to medium SAND with occasional gravel. Gravel is fine to coarse, sub-angular mudstone.
				2.30	123.28		End of Pit at 2.30m

1
2
3
4
5

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP122
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386304.00 - 409059.00 Level: 127.62	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50, Depth 2.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	127.42		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.30	HVP	46				Firm medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.90	ES					
	1.30	HVP	48				
	2.30	HVP	53				
				2.50	125.12		End of Pit at 2.50m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP123
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386272.00 - 409060.00 Level: 125.58	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.30 x 0.50 Depth 2.70	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20	125.38		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.30	HVP	64				Firm medium strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.00	ES					
	1.30	HVP	69				
				2.20	123.38		Soft dark brown compressible PEAT.
				2.40	123.18		Firm orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
				2.70	122.88		End of Pit at 2.70m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP124
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386224.00 - 409057.00 Level: 123.97	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.40 — 1.30 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	123.77		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	44				Firm medium strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	0.80	ES					
	1.00	HVP	50				
▼ 1.20							
	1.50	HVP	60				
				2.40	121.57		End of Pit at 2.40m

1 2 3 4 5

Remarks: 1. Complete. 2. Water strike encountered at 1.2m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP125
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386191.00 - 409054.00 Level: 123.35	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50 Depth 2.70	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	123.15		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.90	ES					Firm orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
▼ 2.20				2.10	121.25		Soft dark brown compressible PEAT.
				2.30	121.05		Firm orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
				2.70	120.65		End of Pit at 2.70m

1 2 3 4 5

Remarks: 1. Complete. 2. Water strike encountered at 2.2m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP126
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386141.00 - 409041.00 Level: 124.85	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.40, 1.40 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	124.65		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.10	ES					Dark orangey brown slightly clayey coarse SAND.
				2.40	122.45		End of Pit at 2.40m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP127
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386315.00 - 408971.00 Level: 130.69	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.30 — 1.30 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	130.39		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	153				Very stiff very high strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.00	ES					
	1.00	HVP	167				
	1.50	HVP	173				
	2.00	HVP	177				
				2.30	128.39		End of Pit at 2.30m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP128
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386297.00 - 409004.00 Level: 129.54	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.60 — 1.30 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	129.24		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	53				Firm medium strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. A very sandy band is present 1.3m to 1.6m bgl. Becoming stiff high strength from 2.0m bgl.
	1.00	ES					
	1.00	HVP	59				
	1.50	HVP	71				
	2.00	HVP	98				
				2.60	126.94		End of Pit at 2.60m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP129
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386268.00 - 408993.00 Level: 130.31	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.20 x 0.50 Depth 2.20	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	130.11		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.10	ES		2.20	128.11		Reddish brown slightly gravelly coarse SAND. Gravel is fine to coarse of angular to sub-rounded sandstone.
							End of Pit at 2.20m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP130
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386263.00 - 409031.00 Level: 127.20	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50 Depth 2.20	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30	126.90		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.20	ES		2.20	125.00		Light greyish brown coarse SAND. End of Pit at 2.20m
▼ 1.60							

Remarks: 1. Complete. 2. Water strike encountered at 1.6m bgl.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP131
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386234.00 - 409011.00 Level: 128.74	Date 01/05/2019
Location: South Heywood		Dimensions (m): Depth 2.50, 0.50 x 1.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	128.44		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.20	ES		2.50	126.24		Light greyish brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-angular mudstone.
							End of Pit at 2.50m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP132
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386185.00 - 409018.00 Level: 124.55	Date 01/05/2019
Location: South Heywood		Dimensions (m): 1.30 x 0.50 Depth 1.90	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	124.25		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.90	ES		1.90	122.65		Light greyish brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse angular to sub-angular mudstone.
							End of Pit at 1.90m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP133
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386122.00 - 409101.00 Level: 124.29	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.40, 1.20 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	123.99		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
▼ 1.00	1.00	ES		1.30	122.99		Soft dark brown compressible PEAT.
				2.40	121.89		Dark grey slightly clayey coarse SAND.
							End of Pit at 2.40m

Remarks: 1. Complete. 2. Water strike encountered at 1.0m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: TP134
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386163.00 - 409132.00 Level: 124.58	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.40 x 0.50 Depth 2.10	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	124.28		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	1.40	ES					Dark grey slightly clayey coarse SAND.
▼ 2.00				2.10	122.48		End of Pit at 2.10m

Remarks: 1. Complete. 2. Water strike encountered at 2.0m bgl.

Stability: Collapse at water strike.

Trial Pit Log

TrialPit No: TP135
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386105.00 - 409151.00 Level: 126.39	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.10, 1.40 x 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	126.09		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
							Soft dark brown compressible PEAT.
	1.20	ES		1.10	125.29		Dark grey slightly clayey coarse SAND.
				2.10	124.29		End of Pit at 2.10m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP136
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386139.00 - 409165.00 Level: 125.33	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.40, 1.20 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	125.03		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
				0.60	124.73		Soft dark brown compressible PEAT.
	0.80	ES		2.40	122.93		Dark grey slightly clayey coarse SAND.
							End of Pit at 2.40m

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP137
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386138.00 - 409202.00 Level: 127.33	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.30 × 0.50 Depth 2.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	127.03		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.40	HVP	48				Firm medium strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	1.00	ES					
	1.40	HVP	53				
▼ 2.10				1.60	125.73		Dark grey slightly clayey GRAVEL. Gravel is fine to coarse of sub-angular to sub-rounded mudstone and sandstone.
				2.40	124.93		End of Pit at 2.40m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP138
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386094.00 - 409178.00 Level: 126.93	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.50, 1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	126.63		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.70	ES					Soft dark brown compressible PEAT.
1.10				1.40	125.53		Dark grey slightly clayey coarse SAND.
				2.50	124.43		End of Pit at 2.50m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP139
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386138.00 - 409140.00 Level: 124.73	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.30 x 0.50 Depth 1.90	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
				0.30	124.43		Soft dark brown compressible PEAT.
				0.80	123.93		Dark grey slightly clayey coarse SAND.
				1.90	122.83		End of Pit at 1.90m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP140
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386010.00 - 409121.00 Level: 128.62	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 2.50 — 1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.30	ES		0.35	128.27		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
	0.50	HVP	53				Firm medium strength orangey brown mottled light grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. Becoming stiff high strength from 2.0m bgl.
	1.00	ES					
	1.00	HVP	62				
	1.50	HVP	70				
	2.00	HVP	77				
				2.50	126.12		End of Pit at 2.50m

1
2
3
4
5

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: TP141
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385925.00 - 408989.00 Level: 122.01	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.30 × 0.50 Depth 2.20	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	121.81		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.40	ES					MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete.
				2.20	119.81		End of Pit at 2.20m

Remarks: 1. Complete.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP142
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385944.00 - 409009.00 Level: 122.65	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50, Depth 1.80	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	122.45		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.50	ES					MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete. Boulders are occasional of concrete and rebar.
				1.80	120.85		End of Pit at 1.80m

Remarks: 1. Complete. 2. Difficulty digging.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP143
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385973.00 - 408990.00 Level: 121.09	Date 02/05/2019
Location: South Heywood		Dimensions (m): 1.20 × 0.50 Depth 1.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	120.89		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.80	ES					MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete. Boulders are occasional of concrete and rebar.
				1.40	119.69		End of Pit at 1.40m

Remarks: 1. Complete. 2. Difficulty digging.

Stability: Side wall collapse.

Trial Pit Log

TrialPit No: TP144
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385949.00 - 409074.00 Level: 126.25	Date 02/05/2019
Location: South Heywood		Dimensions (m): Depth 1.60 — 1.20 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	125.95		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
	0.60	ES		1.60	124.65		MADE GROUND: Firm grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded mudstone with cobbles of brick and concrete.
							End of Pit at 1.60m

Remarks: 1. Complete.

Stability: Side wall collapse.

Borehole Log

Borehole No. **WS101**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385865E - 409116N	Hole Type WS
Location:	South Heywood		Level:	131.16 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	131.16		Soft dark brown black slightly sandy CLAY (Topsoil) with frequent rootlets.
		0.40	PP	68.67				Stiff medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone. Becoming firm low strength from 2.0m bgl and then stiff medium strength from 3.0m bgl.
		0.90	PP	68.67				
		1.00	SPT	N=8 (1,2/2,2,2,2)				
		1.20	ES					
		1.40	PP	68.67				
		1.90	PP	71.12				
		2.00	SPT	N=8 (2,2/2,2,2,2)				
		2.40	PP	71.12				
		2.90	PP	49.05				
		3.00	SPT	N=10 (2,2/3,3,2,2)				
		3.40	PP	53.96	3.30	130.86		Stiff medium strength dark brown slightly sandy gravelly CLAY. Gravel is coarse of sub-angular mudstone.
		3.90	PP	61.31				
		4.00	SPT	N=13 (3,3/3,4,3,3)				
		4.90	PP	58.86				
		5.00	SPT	N=13 (3,3/3,3,3,4)				
					5.45	127.86		End of Borehole at 5.45m

Remarks

1. Complete.

Borehole Log

Borehole No. **WS102**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385817E - 409024N	Hole Type WS
Location:	South Heywood		Level:	128.52 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.40	128.52		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		0.50	PP	49.05				Stiff medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
		0.90	PP	53.96				
		1.00	SPT	N=10 (2,2/3,3,2,2)				
		1.20	PP	56.41				
		1.30	ES					
		1.40	PP	56.41				
		2.00	SPT	N=9 (2,2/3,2,2,2)	2.10	128.12		Very stiff very high strength dark brown slightly sandy gravelly CLAY. Gravel is coarse of sub-angular mudstone.
		2.10	PP	68.67				
		2.80	PP	73.58				
		3.00	SPT	N=45 (3,5/45 for 250mm)				
					3.45	126.42		End of Borehole at 3.45m

Remarks

1. Refused on very stiff clay.

Borehole Log

Borehole No. **WS103**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385808E - 408944N	Hole Type WS
Location:	South Heywood		Level:	124.46 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	124.46		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		0.50	PP	56.41	0.40	124.26		Light grey brown gravelly fine to coarse SAND. Gravel is fine to coarse sub-angular to sub-rounded mudstone.
		1.00	SPT	N=11 (2,3/3,2,3,3)				Stiff medium strength orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
		1.10	ES					
		1.10	PP	58.86				
		1.80	PP	71.12				
		2.00	SPT	N=12 (2,2/3,3,3,3)				
		2.10	PP	49.05	2.10	124.06		Very stiff very high strength dark brown very sandy silty CLAY.
		2.80	PP	51.50				
		3.00	SPT	50 (3,7/50 for 250mm)				
					3.45	122.36		End of Borehole at 3.45m

Remarks

1. Refused on very stiff clay.

Borehole Log

Borehole No. **WS104**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385879E - 409029N	Hole Type WS
Location:	South Heywood		Level:	126.97 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.40	126.97		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		0.90	ES					Reddish brown slightly clayey fine to medium SAND.
	1.20	1.00	SPT	N=0 (1,1/0,0,0,0)	1.10	126.57		Stiff medium strength dark brown slightly sandy gravelly CLAY. Gravel is coarse of sub-angular mudstone. Becoming firm low strength from 3.0m bgl.
		2.00	SPT	N=10 (1,3/2,3,2,3)				
		3.00	SPT	N=7 (3,2/3,2,1,1)				
					3.45	125.87		End of Borehole at 3.45m

Remarks

1. Refused on very stiff clay.

Borehole Log

Borehole No. **WS105**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385897E - 408941N	Hole Type WS
Location:	South Heywood		Level:	121.42 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.10	121.42		MADE GROUND: Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets and occasional gravel of medium sub-angular brick.
		1.00	SPT	N=13 (3,3/3,3,3,4)				MADE GROUND: Stiff medium strength grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded of mudstone, shale, brick and sandstone.
		1.20	ES					
		1.20	PP	41.69				
		1.70	PP	46.60				
		2.00	SPT	N=1 (2,3/1,0,0,0)	1.80	121.32		Very soft extremely low strength black slightly gravelly CLAY. Gravel is coarse angular of coal with rare organic material (Peat).
		2.60	PP	49.05	2.60	119.62		Firm low strength dark brown slightly sandy gravelly CLAY. Gravel is coarse of sub-angular mudstone. Becoming stiff medium strength from 4.0m bgl and then very stiff high strength from 5.0m bgl.
		3.00	SPT	N=6 (2,2/1,2,2,1)				
		3.30	PP	36.79				
		3.80	PP	31.88				
		4.00	SPT	N=11 (3,3/3,2,3,3)				
	4.30							
		4.70	PP	61.31				
		5.00	SPT	N=30 (4,5/7,7,8,8)				
					5.45	118.82		End of Borehole at 5.45m

Remarks

1. Complete.

Borehole Log

Borehole No. **WS106**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385968E - 409002N	Hole Type WS
Location:	South Heywood		Level:	121.42 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.20	121.42		MADE GROUND: Soft dark brown black slightly sandy gravelly CLAY (topsoil) with frequent rootlets. Gravel is coarse angular to sub-angular of brick.
		1.00	SPT	N=10 (3,5/6,2,1,1)				MADE GROUND: Stiff medium strength grey slightly sandy very gravelly clay. Gravel is fine to coarse angular to sub-rounded of mudstone, shale, brick and sandstone. Becoming very stiff high strength from 2.0m bgl.
		1.30	ES					
		1.70	PP	81.75				
		2.00	SPT	N=39 (5,10/39 for 250mm)				
					2.45	121.22		End of Borehole at 2.45m

Remarks

1. Refused on cobble.

Borehole Log

Borehole No. **WS107**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385966E - 409075N	Hole Type WS
Location:	South Heywood		Level:	126.22 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	126.22		MADE GROUND: Dark brown slightly clayey fine to medium sand (topsoil). Gravel is fine to medium angular to sub-rounded of sandstone and brick.
		0.80	ES					MADE GROUND: Very stiff high strength dark brown gravelly clay. Gravel is fine to coarse angular to sub-angular brick, mudstone and concrete.
		1.00	SPT	N=48 (1,1/48 for 275mm)				
					1.45	126.12		End of Borehole at 1.45m

Remarks

1. Refused on cobble.

Borehole Log

Borehole No. **WS107 A**

Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords:	Hole Type WS
Location: South Heywood		Level:	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10			MADE GROUND: Dark brown slightly clayey fine to medium sand (topsoil). Gravel is fine to medium angular to sub-rounded of sandstone and brick.
								MADE GROUND: Stiff medium strength dark brown gravelly clay. Gravel is fine to coarse angular to sub-angular brick, mudstone and concrete. Becoming very stiff high strength from 2.0m bgl.
					2.45			End of Borehole at 2.45m

1 2 3 4 5 6 7 8 9 10

Remarks

1. Refused on cobble.

Borehole Log

Borehole No. **WS108**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386033E - 409039N	Hole Type WS
Location:	South Heywood		Level:	123.53 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	123.53		MADE GROUND: Dark brown slightly gravelly fine to medium sand (topsoil). Gravel is fine to medium sub-angular brick and sandstone with occasional rootlets.
		0.30	ES		0.45	123.43		MADE GROUND: Dark brown slightly clayey gravelly sand. Gravel is fine to coarse angular to sub-angular brick, concrete, timber and mudstone.
		0.80	PP	130.80				Stiff medium strength light brown mottled grey sandy CLAY.
		1.00	SPT	N=8 (1,2/2,2,2,2)				
		1.20	PP	118.54				
	▼ 2.00							
		2.00	ES		2.00	123.08		Firm low strength brown slightly gravelly sandy CLAY. Gravel is fine to medium sub-angular to sub-rounded mudstone and sandstone.
		2.00	SPT	N=11 (1,3/3,2,3,3)				
		2.20	PP	102.19				
		3.00	SPT	N=7 (2,2/2,1,2,2)				
					3.45	121.53		Medium dense brown slightly gravelly fine to coarse SAND. Gravel is fine to medium sub-rounded mudstone and quartz.
		4.00	SPT	N=12 (3,4/4,2,3,3)				
					4.45	120.08		End of Borehole at 4.45m

Remarks

1. Refused on cobble.

Borehole Log

Borehole No. **WS109**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386007E - 409159N	Hole Type WS
Location:	South Heywood		Level:	129.01 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	129.01		MADE GROUND: Dark brown slightly gravelly fine to medium sand (topsoil). Gravel is fine to medium sub-angular brick and sandstone with occasional rootlets.
					0.65	128.91		MADE GROUND: Firm dark brown sandy CLAY with occasional brick fragments.
		0.90	ES					Soft dark brown compressible PEAT.
		1.00	SPT	N=11 (2,3/3,2,3,3)				
	▼ 1.70	1.60	ES		1.50	128.36		Loose grey brown fine to medium SAND.
		2.00	SPT	N=10 (3,4/3,2,3,2)				
		3.00	SPT	N=11 (2,3/3,3,3,2)				
					3.45	127.51		End of Borehole at 3.45m

1
2
3
4
5
6
7
8
9
10

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS110**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386076E - 409144N	Hole Type WS
Location:	South Heywood		Level:	127.59 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	127.59		MADE GROUND: Dark brown slightly gravelly fine to medium sand (topsoil). Gravel is fine to medium sub-angular to sub-rounded brick and sandstone with occasional rootlets.
					0.45	127.49		MADE GROUND: Firm dark brown sandy CLAY with occasional brick fragments.
		0.70	PP	49.05				
		1.00	ES		1.00	127.14		Stiff medium strength light brown mottled grey sandy CLAY.
		1.00	SPT	N=9 (2,3/3,2,2,2)				
		1.20	ES					Firm low strength brown sandy CLAY.
		1.60	PP	69.49				
		2.00	SPT	N=6 (1,1/2,1,1,2)				
	2.50				2.40	126.59		Medium dense brown sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded sandstone and mudstone.
		3.00	SPT	N=26 (5,8/6,5,8,7)				
					3.45	125.19		End of Borehole at 3.45m

Remarks

1. Refused on gravel.

Borehole Log

Borehole No. **WS111**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386122E - 409119N	Hole Type WS
Location:	South Heywood		Level:	124.63 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.20	124.63		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
					0.60	124.43		Soft dark brown compressible PEAT.
		1.00	SPT	N=0 (1,0/0,0,0,0)				Loose dark greyish brown clayey fine to medium SAND. Becoming medium dense from 3.0m bgl.
		1.30	ES					
		2.00	SPT	N=6 (1,0/1,2,2,1)				
	2.40							
		3.00	SPT	N=24 (3,5/5,4,7,8)				
					3.45	124.03		End of Borehole at 3.45m

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS112**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386123E - 409186N	Hole Type WS
Location:	South Heywood		Level:	126.72 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	126.72		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Soft dark brown compressible PEAT.
		1.00	SPT	N=8 (2,2/2,2,2,2)	1.10	126.52		Loose light greyish brown coarse SAND. Becoming medium dense from 3.0m bgl.
	1.90	1.20	ES					
		2.00	SPT	N=10 (3,2/3,2,2,3)				
		3.00	SPT	N=15 (3,2/4,4,3,4)				
					3.45	125.62		End of Borehole at 3.45m

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS113**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386211E - 409075N	Hole Type WS
Location:	South Heywood		Level:	126.05 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	01/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	126.05		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		1.00	SPT	N=15 (2,3/4,4,3,4)				Medium dense dark reddish brown slightly gravelly SAND. Gravel is fine angular to sub-rounded sandstone.
		1.20	ES					
		2.00	SPT	N=16 (3,4/3,4,4,5)				
		3.00	SPT	N=19 (3,4/5,5,4,5)				
					3.45	125.75		End of Borehole at 3.45m

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS114**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386290E - 409094N	Hole Type WS
Location:	South Heywood		Level:	127.37 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	01/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	127.37		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		1.00	SPT	N=11 (2,3/3,3,3,2)				Medium dense dark reddish brown slightly gravelly SAND. Gravel is fine angular to sub-rounded sandstone. Becoming loose from 2.0m bgl.
		1.30	ES					
		2.00	SPT	N=9 (2,2/2,2,3,2)				
	2.80	3.00	SPT	N=11 (3,3/3,3,2,3)				
					3.45	127.07		End of Borehole at 3.45m

Remarks

1. Terminated due to collapse.

Borehole Log

Borehole No. **WS115**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386168E - 409039N	Hole Type WS
Location:	South Heywood		Level:	123.64 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	01/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.25	123.64		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
					0.50	123.39		Soft dark brown compressible PEAT.
		0.70	ES					Stiff medium strength light greyish brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
		1.00	SPT	N=8 (2,2/2,3,2,1)				
					1.60	123.14		Soft dark brown compressible PEAT.
		2.00	SPT	N=9 (1,2/2,3,2,2)				
					2.60	122.04		Stiff light greyish brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
	3.10	3.00	SPT	N=9 (2,2/3,2,2,2)	2.90	121.04		Loose dark reddish brown coarse SAND. Becoming medium dense from 4.0m bgl.
		4.00	SPT	N=14 (3,3/2,3,4,5)				
					4.45	120.74		End of Borehole at 4.45m

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS116**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386310E - 409031N	Hole Type WS
Location:	South Heywood		Level:	128.79 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	01/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.05	ES		0.10	128.79		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		0.50	PP	53.14				Stiff medium strength light greyish brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
		0.80	ES					
		1.00	SPT	N=8 (2,2/2,2,2,2)				
		1.60	PP	73.58	1.70	128.69		Stiff medium strength dark brown slightly silty CLAY.
		2.00	SPT	N=10 (2,3/2,3,2,3)				
		2.50	PP	89.92				
		3.00	SPT	N=16 (3,3/4,4,4,4)				
		3.50	PP	89.92				
		4.00	SPT	N=15 (3,3/3,4,4,4)				
		4.50	PP	94.01				
		5.00	SPT	N=14 (3,3/4,3,3,4)				
					5.45	127.09		End of Borehole at 5.45m

Remarks

1. Complete.

Borehole Log

Borehole No. **WS117**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	386213E - 409018N	Hole Type WS
Location:	South Heywood		Level:	126.09 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	01/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	126.09		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		1.00 1.00	ES SPT	N=9 (2,2/3,2,2,2)				Loose dark reddish brown coarse SAND.
		2.00	SPT	N=7 (2,1/2,2,2,1)	1.90	125.79		Loose dark brown slightly silty SAND.
		3.00	SPT	N=10 (2,2/2,2,3,3)				
					3.45	124.19		End of Borehole at 3.45m

Remarks

1. Terminated due to sand collapse.

Borehole Log

Borehole No. **WS118**

Sheet 1 of 1

Project Name:	Phase 4	Project No. 13223	Co-ords:	385925E - 409197N	Hole Type WS
Location:	South Heywood		Level:	133.47 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	02/05/2019	Logged By E Fearn

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	133.47		MADE GROUND: Stone/ Asphalt.
		1.00	SPT	N=33 (4,7/9,9,6,9)				MADE GROUND: Stiff dark brown slightly gravelly clay. Gravel is fine to medium sub-angular of brick.
					1.80	133.37		Stiff medium strength brown sandy CLAY.
		2.00	SPT	N=13 (2,3/3,3,3,4)				
		3.00	SPT	N=15 (1,2/4,3,4,4)				
		4.00	SPT	N=14 (1,2/3,3,3,5)				
					4.50	131.67		Stiff medium strength brown CLAY.
		5.00	SPT	N=16 (2,2/4,4,4,4)				
					5.45	128.97		End of Borehole at 5.45m

Remarks

1. Complete.

Trial Pit Log

TrialPit No: SA101
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385805.00 - 408981.00 Level: 126.32	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.40 x 0.50 Depth 3.10	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
				0.40	125.92		Firm orangey brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse sub-angular of mudstone.
				3.10	123.22		End of Pit at 3.10m

1
2
3
4
5

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No SA102
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 385989.00 - 409012.00 Level: 122.24	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.50 × 0.50 Depth 2.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.40	121.84		MADE GROUND: Soft dark brown slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
				1.00	121.24		Light greyish brown slightly gravelly clayey fine to medium SAND. Gravel is fine to coarse sub-angular mudstone.
▼ 1.40				2.40	119.84		Light greyish brown clayey fine to medium SAND.
							End of Pit at 2.40m

Remarks: 1. Complete. 2. Water strike encountered at 1.4m bgl.

Stability: Stable.

Trial Pit Log

TrialPit No: SA103
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386090.00 - 409085.00 Level: 124.25	Date 30/04/2019
Location: South Heywood		Dimensions (m): 1.60 × 0.50 Depth 2.40	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	123.95		MADE GROUND: Soft dark brown black slightly sandy clay (topsoil) with occasional gravel. Gravel is fine to coarse sub-angular brick.
				0.80	123.45		Dark brown coarse SAND with occasional gravel. Gravel is fine to coarse sub-angular mudstone.
				2.40	121.85		Grey very clayey fine to medium SAND. End of Pit at 2.40m

1
2
3
4
5

Remarks: 1. Complete.

Stability: Stable.

Trial Pit Log

TrialPit No: SA104
Sheet 1 of 1

Project Name: Phase 4	Project No. 13223	Co-ords: 386232.00 - 409099.00 Level: 126.90	Date 30/04/2019
Location: South Heywood	Dimensions (m): Depth 1.50	1.40 × 0.50	Scale 1:24
Client: Russell Homes			Logged E Fearn

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
				0.30	126.60		Dark reddish brown coarse SAND.
				1.50	125.40		End of Pit at 1.50m

Remarks: 1. Complete.

Stability: Side wall collapse.

Borehole Log

Borehole No. **CP101**

Sheet 1 of 2

Project Name:	Phase 4	Project No. 13223	Co-ords:	385879E - 409144N	Hole Type CP
Location:	South Heywood		Level:	131.56 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.50	131.56		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
								Firm low strength brown sandy boulder CLAY. Becoming stiff medium strength from 5.0m bgl.
		2.00	SPT	N=6 (1,0/1,1,2,2)				
		3.00	SPT	N=8 (1,1/2,2,2,2)				
		5.00	SPT	N=12 (2,3/4,4,2,2)	5.10	131.06		Grey weathered MUDSTONE.
		6.00	SPT	N=40 (6,6/8,10,10,12)				
		8.00	SPT	N=37 (6,8/8,9,10,10)				
		9.00	SPT	N=50 (6,8/10,18,21,1)				

1
2
3
4
5
6
7
8
9
10

Remarks

1. Complete.

Borehole Log

Borehole No. **CP101**

Sheet 2 of 2

Project Name:	Phase 4	Project No. 13223	Co-ords:	385879E - 409144N	Hole Type CP
Location:	South Heywood		Level:	131.56 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	29/04/2019	Logged By

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.00	SPT	N=50 (7,10/50 for 230mm)				Grey weathered MUDSTONE.
					10.45	126.46		End of Borehole at 10.45m

Remarks

1. Complete.

Borehole Log

Borehole No. **CP102**

Sheet 1 of 2

Project Name:	Phase 4	Project No. 13223	Co-ords:	386061E - 409091N	Hole Type CP
Location:	South Heywood		Level:	125.19 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2018	Logged By

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.70	125.19		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
		1.00	SPT	N=3 (1,0/1,0,1,1)				Soft very low strength brown sandy boulder CLAY. Becoming firm low strength from 3.0m bgl and then stiff medium strength from 6.5m bgl.
		3.00	SPT	N=5 (1,0/1,1,1,2)				
		6.00	SPT	N=9 (1,1/2,2,2,3)				
		6.50	SPT	N=15 (2,3/3,4,4,4)				
		8.00	SPT	N=14 (1,2/3,4,4,3)	8.00	124.49		Medium dense gravelly fine to coarse SAND. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and mudstone.
		9.50	SPT	N=14 (2,2/3,3,4,4)				

Remarks

1. Complete.

Borehole Log

Borehole No. **CP102**

Sheet 2 of 2

Project Name:	Phase 4	Project No. 13223	Co-ords:	386061E - 409091N	Hole Type CP
Location:	South Heywood		Level:	125.19 m AOD	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2018	Logged By

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Medium dense gravelly fine to coarse SAND. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and mudstone.
					10.60	117.19		
								Stiff medium strength brown SILT.
		11.00	SPT	N=11 (1,2/2,3,3,3)				
					11.70	114.59		
								Stiff medium strength brown sandy gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded of sandstone and mudstone.
		12.50	SPT	N=14 (1,2/3,3,4,4)				
					13.80	113.49		
		14.00	SPT	N=18 (2,3/4,4,5,5)				Medium dense GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded of mudstone and sandstone.
		15.50	SPT	N=22 (3,4/4,5,6,7)				
					15.95	111.39		End of Borehole at 15.95m

Remarks

1. Complete.

Borehole Log

Borehole No. **RB101**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385874.00 - 409074.00	Hole Type BH
Location: South Heywood		Level: 129.30	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	129.10		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					4.20	125.10		Brown SANDSTONE.
					4.70	124.60		Grey SANDSTONE with MUDSTONE bands.
					8.80	120.50		Dark grey SANDSTONE.
					9.90	119.40		Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB101**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385874.00 - 409074.00	Hole Type BH
Location: South Heywood		Level: 129.30	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Grey SANDSTONE with MUDSTONE bands.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB101**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385874.00 - 409074.00	Hole Type BH
Location: South Heywood		Level: 129.30	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.00	105.30		Black SHALE with coal traces.
					25.10	104.20		COAL.
					25.90	103.40		Grey MUDSTONE with SANDSTONE bands.
					30.00	99.30		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

Borehole Log

Borehole No. **RB102**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385777.00 - 408922.00	Hole Type BH
Location: South Heywood		Level: 125.03	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	124.83		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					4.60	120.43		Brown weak SANDSTONE.
					7.90	117.13		Grey SANDSTONE.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB102**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385777.00 - 408922.00	Hole Type BH
Location: South Heywood		Level: 125.03	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.60	112.43		Strong grey SANDSTONE with MUDSTONE bands.
					17.40	107.63		COAL.
					17.60	107.43		Grey SANDSTONE.
					19.00	106.03		Dark grey/black SHALE with COAL.
					19.90	105.13		

Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No.
RB102
Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385777.00 - 408922.00	Hole Type BH
Location: South Heywood		Level: 125.03	Scale 1:50
Client: Russell Homes		Dates: 29/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								COAL.
					21.00	104.03		Grey MUDSTONE with SANDSTONE bands.
					30.00	95.03		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

Borehole Log

Borehole No. **RB103**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385926.00 - 408963.00	Hole Type BH
Location: South Heywood		Level: 121.38	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	121.18		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. MADE GROUND: Black/brown CLAY (fill).
					4.50	116.88		Brown CLAY with SAND and GRAVEL bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB103**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385926.00 - 408963.00	Hole Type BH
Location: South Heywood		Level: 121.38	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.60	108.78		Grey MUDSTONE.
					14.00	107.38		Strong grey SANDSTONE with weaker MUDSTONE bands.
					19.70	101.68		Grey MUDSTONE.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB103**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385926.00 - 408963.00	Hole Type BH
Location: South Heywood		Level: 121.38	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.60	100.78		Grey SANDSTONE with MUDSTONE bands.
					30.00	91.38		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No.
RB104
Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385995.00 - 409035.00	Hole Type BH
Location: South Heywood		Level: 126.06	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	125.86		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					7.50	118.56		Brown SAND and GRAVEL with CLAY bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB104**

Sheet 2 of 3

Project Name:	Phase 4	Project No. 13223	Co-ords:	385995.00 - 409035.00	Hole Type BH
Location:	South Heywood		Level:	126.06	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					19.90	106.16		Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB104**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385995.00 - 409035.00	Hole Type BH
Location: South Heywood		Level: 126.06	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.30	105.76		Grey MUDSTONE.
								Grey SANDSTONE with MUDSTONE bands.
					28.30	97.76		Dark grey MUDSTONE.
					30.00	96.06		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No. **RB105**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385954.00 - 409050.00	Hole Type BH
Location: South Heywood		Level: 124.98	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	124.78		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. MADE GROUND: Brick fill.
					3.00	121.98		Brown CLAY with SAND and GRAVEL bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No.
RB105
Sheet 2 of 3

Project Name:	Phase 4	Project No. 13223	Co-ords:	385954.00 - 409050.00	Hole Type BH
Location:	South Heywood		Level:	124.98	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019 -	Logged By

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.
RB105
Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385954.00 - 409050.00	Hole Type BH
Location: South Heywood		Level: 124.98	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.40	104.58		Grey MUDSTONE.
					21.90	103.08		Grey SANDSTONE with MUDSTONE bands.
					30.00	94.98		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No.
RB106
Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386054.00 - 409049.00	Hole Type BH
Location: South Heywood		Level: 124.06	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	123.86		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					4.50	119.56		Brown SAND and GRAVEL.
					8.50	115.56		Brown CLAY.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB106**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386054.00 - 409049.00	Hole Type BH
Location: South Heywood		Level: 124.06	Scale 1:50
Client: Russell Homes		Dates: 30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					11.60	112.46		Brown SAND and GRAVEL with CLAY bands.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB106**

Sheet 3 of 3

Project Name:	Phase 4	Project No. 13223	Co-ords:	386054.00 - 409049.00	Hole Type BH
Location:	South Heywood		Level:	124.06	Scale 1:50
Client:	Russell Homes		Dates:	30/04/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.30	103.76		Grey MUDSTONE.
					22.10	101.96		Grey SANDSTONE.
					28.20	95.86		Grey MUDSTONE.
					30.00	94.06		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No. **RB107**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386034.00 - 409130.00	Hole Type BH
Location: South Heywood		Level: 126.78	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	126.58		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					2.70	124.08		SAND and GRAVEL with CLAY bands.
					8.40	118.38		CLAY with SAND and GRAVEL beds.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB107**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386034.00 - 409130.00	Hole Type BH
Location: South Heywood		Level: 126.78	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					16.40	110.38		Grey CLAY MUDSTONE.
					19.30	107.48		Grey SANDSTONE with MUDSTONE bands.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No.
RB107
Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386034.00 - 409130.00	Hole Type BH
Location: South Heywood		Level: 126.78	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					22.40	104.38		Grey MUDSTONE with dark grey bands and SANDSTONE bands.
					30.00	96.78		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No.
RB108
Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386127.00 - 409154.00	Hole Type BH
Location: South Heywood		Level: 125.64	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	125.44		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. PEAT.
					1.00	124.64		SAND and CLAY bands.
					5.50	120.14		SAND and GRAVEL with CLAY bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB108**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386127.00 - 409154.00	Hole Type BH
Location: South Heywood		Level: 125.64	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.20	113.44		Grey CLAY with SAND and GRAVEL bands.
					19.70	105.94		Grey SANDSTONE.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB108**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386127.00 - 409154.00	Hole Type BH
Location: South Heywood		Level: 125.64	Scale 1:50
Client: Russell Homes		Dates: 01/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					23.20	102.44		Grey MUDSTONE with SANDSTONE bands.
					30.00	95.64		End of borehole at 30.00 m

Remarks
1. Complete.

Borehole Log

Borehole No.
RB109
Sheet 1 of 4

Project Name: Phase 4	Project No. 13223	Co-ords: 386206.00 - 409036.00	Hole Type BH
Location: South Heywood		Level: 123.42	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20	123.22		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets. Brown CLAY.
					3.00	120.42		Brown SAND with CLAY and GRAVEL bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB109**

Sheet 2 of 4

Project Name: Phase 4	Project No. 13223	Co-ords: 386206.00 - 409036.00	Hole Type BH
Location: South Heywood		Level: 123.42	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					17.60	105.82		Grey CLAY.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB109**

Sheet 3 of 4

Project Name: Phase 4	Project No. 13223	Co-ords: 386206.00 - 409036.00	Hole Type BH
Location: South Heywood		Level: 123.42	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					24.10	99.32		Grey MUDSTONE.
					24.60	98.82		Grey SANDSTONE.
					26.80	96.62		Strong grey SANDSTONE.
					28.20	95.22		Grey SANDSTONE with MUDSTONE bands.
					29.20	94.22		Dark grey MUDSTONE.
								Continued on next sheet

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

Borehole Log

Borehole No. **RB109**

Sheet 4 of 4

Project Name: Phase 4	Project No. 13223	Co-ords: 386206.00 - 409036.00	Hole Type BH
Location: South Heywood		Level: 123.42	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					31.50	91.92		End of borehole at 31.50 m

Remarks
1. Complete.

Borehole Log

Borehole No. **RB110**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386237.00 - 409021.00	Hole Type BH
Location: South Heywood		Level: 127.55	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	127.15		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets.
								Brown SAND with CLAY bands.
					8.90	118.65		Grey CLAY.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB110**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386237.00 - 409021.00	Hole Type BH
Location: South Heywood		Level: 127.55	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					19.50	108.05		Grey MUDSTONE.
								Continued on next sheet

11 12 13 14 15 16 17 18 19 20

Remarks
1. Complete.

Borehole Log

Borehole No. **RB110**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386237.00 - 409021.00	Hole Type BH
Location: South Heywood		Level: 127.55	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					23.20	104.35		Grey SANDSTONE with MUDSTONE bands.
					30.00	97.55		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

Borehole Log

Borehole No. **RB111**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386258.00 - 409097.00	Hole Type BH
Location: South Heywood		Level: 127.15	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.40	126.75		Soft dark brown black slightly sandy CLAY (topsoil) with frequent rootlets and organic material.
								SAND and CLAY.
					4.90	122.25		SAND and GRAVEL with CLAY bands.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB111**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386258.00 - 409097.00	Hole Type BH
Location: South Heywood		Level: 127.15	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.00	115.15		Grey CLAY.
					18.90	108.25		Grey MUDSTONE.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB111**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 386258.00 - 409097.00	Hole Type BH
Location: South Heywood		Level: 127.15	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					26.20	100.95		Grey SANDSTONE with MUDSTONE bands.
					30.00	97.15		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

Borehole Log

Borehole No. **RB112**

Sheet 1 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385921.00 - 409205.00	Hole Type BH
Location: South Heywood		Level: 133.48	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.10	133.38		MADE GROUND: Stone. MADE GROUND: Fill
					1.80	131.68		Brown sandy CLAY.
					4.50	128.98		Firm brown CLAY.
					5.90	127.58		Brown SANDSTONE.
					6.60	126.88		Brown MUDSTONE with SANDSTONE bands.
								Continued on next sheet

1 2 3 4 5 6 7 8 9 10

Remarks
1. Complete.

Borehole Log

Borehole No. **RB112**

Sheet 2 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385921.00 - 409205.00	Hole Type BH
Location: South Heywood		Level: 133.48	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					12.50	120.98		Grey MUDSTONE with SANDSTONE bands.
					17.60	115.88		Grey SANDSTONE.
								Continued on next sheet

Remarks
1. Complete.

Borehole Log

Borehole No. **RB112**

Sheet 3 of 3

Project Name: Phase 4	Project No. 13223	Co-ords: 385921.00 - 409205.00	Hole Type BH
Location: South Heywood		Level: 133.48	Scale 1:50
Client: Russell Homes		Dates: 02/05/2019 -	Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.10	113.38		Grey MUDSTONE with SANDSTONE bands.
					27.20	106.28		Dark grey MUDSTONE.
					29.10	104.38		Grey MUDSTONE.
					30.00	103.48		End of borehole at 30.00 m

21 22 23 24 25 26 27 28 29 30

Remarks
1. Complete.

APPENDIX VI
CHEMICAL TESTING RESULTS



Nicola Sellars
e3p
Office 4
Heliport Business Park
Eccles
Liverpool Road
Manchester
M30 7RU

t: 0161 707 9612

e: nsellars@e3p.co.uk

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

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

Analytical Report Number : 19-40039

Project / Site name:	South Heywood Phase 4	**Samples received on:**	03/05/2019
Your job number:	13-223	**Samples instructed on:**	03/05/2019
Your order number:	13-223-EF	**Analysis completed by:**	13/05/2019
Report Issue Number:	1	**Report issued on:**	13/05/2019
Samples Analysed:	2 leachate samples - 40 soil samples		

Signed:

Rexona Rahman
Head of Customer Services
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215395	1215396	1215397	1215398	1215399
Sample Reference				WS101	WS102	WS103	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.30	0.10	0.20	0.05
Date Sampled				29/04/2019	29/04/2019	29/04/2019	29/04/2019	29/04/2019
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	%	N/A	NONE	12	9.2	13	12	9.3
Total mass of sample received	kg	0.001	NONE	0.46	0.41	0.42	0.44	0.42
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	5.4	7.4	-	-	7.9
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	1	-	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	260	990	-	-	2000
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	50	48	-	-	1500
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.025	0.024	-	-	0.76
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	24.8	24.1	-	-	764
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	< 1.0
Total Sulphur	mg/kg	50	MCERTS	110	610	-	-	870
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	5.5	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.24	< 0.05	< 0.05	< 0.05	0.20
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.20	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.16	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.79	1.3	0.43	0.58
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.20	0.28	0.11	0.11
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.9	2.1	0.63	0.87
Pyrene	mg/kg	0.05	MCERTS	< 0.05	1.8	2.0	0.59	0.77
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.1	1.2	0.37	0.51
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.1	1.1	0.30	0.42
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.4	1.3	0.39	0.46
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.46	0.49	0.12	0.27
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.2	1.1	0.36	0.44
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.60	0.52	< 0.05	0.23
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.24	0.16	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.74	0.66	< 0.05	0.31
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	11.5	12.5	3.30	5.17

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215395	1215396	1215397	1215398	1215399
Sample Reference				WS101	WS102	WS103	WS104	WS105
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.30	0.10	0.20	0.05
Date Sampled				29/04/2019	29/04/2019	29/04/2019	29/04/2019	29/04/2019
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	5.6	15	14	-	6.2
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	64	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	0.63	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.4	-	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	14	-	-	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	43	39	-	32
Lead (aqua regia extractable)	mg/kg	1	MCERTS	12	59	67	-	29
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	13	12	-	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.3	< 1.0	< 1.0	-	1.2
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	23	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	34	58	55	-	73
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	-	< 1.0	-	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	-	6.4	-	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	-	19	-	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	-	59	-	29
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	-	17	-	13
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	-	100	-	44
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	Absent	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215400	1215401	1215402	1215403	1215404
Sample Reference				WS105	WS106	WS107	WS109	WS111
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.30	0.80	0.90	1.30
Date Sampled				29/04/2019	29/04/2019	30/04/2019	30/04/2019	30/04/2019
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	%	N/A	NONE	11	8.1	14	18	13
Total mass of sample received	kg	0.001	NONE	0.42	0.46	0.52	0.36	0.54
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	6.3	7.4
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	1800	270
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	100	110
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	0.050	0.057
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	50.2	57.4
Sulphide	mg/kg	1	MCERTS	-	-	-	< 1.0	39
Total Sulphur	mg/kg	50	MCERTS	-	-	-	2900	780
Total Organic Carbon (TOC)	%	0.1	MCERTS	5.2	-	1.8	11	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.33	1.0	0.23	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.30	0.76	1.2	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.19	0.23	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.50	1.3	1.9	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.45	1.2	1.8	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.27	0.76	1.0	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.30	0.54	1.0	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.38	0.80	1.2	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.11	0.24	0.61	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.28	0.67	1.1	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.32	0.48	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.42	0.59	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	2.59	7.57	12.1	< 0.80	< 0.80

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215400	1215401	1215402	1215403	1215404
Sample Reference				WS105	WS106	WS107	WS109	WS111
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.30	0.80	0.90	1.30
Date Sampled				29/04/2019	29/04/2019	30/04/2019	30/04/2019	30/04/2019
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	25	9.4	9.6	2.6	5.2
Barium (aqua regia extractable)	mg/kg	1	MCERTS	210	170	260	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.2	0.81	1.0	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.7	0.8	0.4	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	5.1	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	81	52	47	21	18
Lead (aqua regia extractable)	mg/kg	1	MCERTS	75	58	49	2.1	7.6
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.7	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	21	28	6.0	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	2.1	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	34	21	32	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	91	100	11	37
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	4.3	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	7.6	19	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	28	52	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	9.1	200	160	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	26	40	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	11	260	290	< 10	< 10
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215405	1215406	1215407	1215408	1215409
Sample Reference				WS112	WS112	WS114	WS115	WS116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.30	0.20	0.80
Date Sampled				30/04/2019	30/04/2019	01/05/2019	01/05/2019	01/05/2019
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	%	N/A	NONE	16	15	14	27	12
Total mass of sample received	kg	0.001	NONE	0.37	0.47	0.53	0.40	0.50
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	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	6.7	-	7.4
Total Cyanide	mg/kg	1	MCERTS	1	-	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	190	-	190
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	40	-	31
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	0.020	-	0.016
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	20.1	-	15.7
Sulphide	mg/kg	1	MCERTS	-	-	< 1.0	-	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	-	77	-	70
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	0.7	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	< 1.0	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.41	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	0.24	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.46	-	< 0.05	0.50	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.42	-	< 0.05	0.47	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.27	-	< 0.05	0.30	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.28	-	< 0.05	0.31	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.32	-	< 0.05	0.38	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.14	-	< 0.05	0.12	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.27	-	< 0.05	0.30	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	2.16	-	< 0.80	3.03	< 0.80

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215405	1215406	1215407	1215408	1215409
Sample Reference				WS112	WS112	WS114	WS115	WS116
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10	1.20	1.30	0.20	0.80
Date Sampled				30/04/2019	30/04/2019	01/05/2019	01/05/2019	01/05/2019
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	18	-	2.7	17	7.0
Barium (aqua regia extractable)	mg/kg	1	MCERTS	180	-	-	140	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.93	-	-	1.2	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5	-	< 0.2	0.4	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	-	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	8.8	-	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	42	-	9.5	38	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	78	-	5.2	62	8.3
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	-	11	23	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	34	-	-	37	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	94	-	16	70	29
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	-	< 1.0	-	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	-	< 4.0	-	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	-	< 10	-	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	-	< 10	-	< 10
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215410	1215411	1215412	1215413	1215414
Sample Reference				WS117	TP101	TP105	TP107	TP109
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.20	0.70	1.10	0.30
Date Sampled				01/05/2019	29/04/2019	30/04/2019	30/04/2019	30/04/2019
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	%	N/A	NONE	9.4	13	12	12	12
Total mass of sample received	kg	0.001	NONE	0.40	0.41	0.46	0.53	0.45
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	6.9	-	7.8
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	390	-	1400
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	110	-	700
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	0.055	-	0.35
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	54.7	-	352
Sulphide	mg/kg	1	MCERTS	-	-	< 1.0	-	3.3
Total Sulphur	mg/kg	50	MCERTS	-	-	210	-	950
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	< 1.0	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.29	< 0.05	1.1
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.40	0.52	< 0.05	< 0.05	0.58
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.12	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.75	2.0	< 0.05	< 0.05	0.23
Pyrene	mg/kg	0.05	MCERTS	0.67	1.8	< 0.05	< 0.05	0.22
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.43	1.1	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.36	1.1	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.44	1.6	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.19	0.50	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.43	1.2	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.20	0.66	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.19	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.24	0.90	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	4.11	11.7	< 0.80	< 0.80	2.12

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215410	1215411	1215412	1215413	1215414
Sample Reference				WS117	TP101	TP105	TP107	TP109
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.20	0.70	1.10	0.30
Date Sampled				01/05/2019	29/04/2019	30/04/2019	30/04/2019	30/04/2019
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	5.6	14	6.0	4.5	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	65	87	-	140	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.52	0.68	-	0.66	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	0.5	< 0.2	< 0.2	0.4
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	12	-	21
Copper (aqua regia extractable)	mg/kg	1	MCERTS	27	69	14	16	43
Lead (aqua regia extractable)	mg/kg	1	MCERTS	34	71	13	9.4	59
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	8.7	13	8.7	20	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.3	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	16	26	-	20	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	46	77	25	36	78
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	3.7	< 2.0	< 2.0	-
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	26	< 4.0	< 4.0	-
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	43	< 1.0	< 1.0	-
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	96	< 1.0	< 1.0	-
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	-
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	170	< 10	< 10	-
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215415	1215416	1215417	1215418	1215419
Sample Reference				TP110	TP111	TP113	TP114	TP114
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.60	0.60	0.20	0.40
Date Sampled				30/04/2019	30/04/2019	30/04/2019	30/04/2019	30/04/2019
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	%	N/A	NONE	7.9	18	12	15	10
Total mass of sample received	kg	0.001	NONE	0.45	0.42	0.44	0.37	0.48
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	4.8	7.7	7.8	6.9
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	7100	430	720	160
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	270	64	120	28
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.14	0.032	0.058	0.014
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	136	32.1	57.7	14.1
Sulphide	mg/kg	1	MCERTS	-	< 1.0	< 1.0	1.6	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	4300	280	560	87
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.28	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.95	< 0.05	< 0.05	1.5	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.23	< 0.05	< 0.05	0.37	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.2	0.30	< 0.05	2.7	< 0.05
Pyrene	mg/kg	0.05	MCERTS	1.7	0.29	< 0.05	2.7	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.91	< 0.05	< 0.05	1.2	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.83	< 0.05	< 0.05	1.4	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.0	< 0.05	< 0.05	1.6	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.53	< 0.05	< 0.05	0.83	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.93	< 0.05	< 0.05	1.6	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.48	< 0.05	< 0.05	0.72	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.23	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.57	< 0.05	< 0.05	0.86	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	10.3	0.87	< 0.80	15.7	< 0.80

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215415	1215416	1215417	1215418	1215419
Sample Reference				TP110	TP111	TP113	TP114	TP114
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.60	0.60	0.20	0.40
Date Sampled				30/04/2019	30/04/2019	30/04/2019	30/04/2019	30/04/2019
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	8.3	36	12	11	1.4
Barium (aqua regia extractable)	mg/kg	1	MCERTS	140	-	-	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.84	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.3	0.4	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	14	22	15	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	45	35	35	39	11
Lead (aqua regia extractable)	mg/kg	1	MCERTS	54	61	59	59	7.8
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.8	< 0.3	0.6	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	20	11	16	14	16
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	25	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	91	25	48	78	31
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	-
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	-
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	7.0	-
TPH (C12 - C16)	mg/kg	4	MCERTS	7.1	< 4.0	< 4.0	7.6	-
TPH (C16 - C21)	mg/kg	1	MCERTS	34	< 1.0	< 1.0	34	-
TPH (C21 - C35)	mg/kg	1	MCERTS	120	< 1.0	< 1.0	160	-
TPH (C35 - C40)	mg/kg	10	MCERTS	13	< 10	< 10	42	-
TPH Total C5 - C40	mg/kg	10	MCERTS	180	< 10	< 10	260	-
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	Absent	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215420	1215421	1215422	1215423	1215424
Sample Reference				TP115	TP117	TP119	TP120	TP123
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.10	0.20	1.20	0.10
Date Sampled				30/04/2019	02/05/2019	02/05/2019	01/05/2019	01/05/2019
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	%	N/A	NONE	77	11	12	14	16
Total mass of sample received	kg	0.001	NONE	0.33	0.39	0.39	0.50	0.42
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	Not-detected	-	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	-	-	6.9	6.9
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	250	860
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	47	42
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	0.024	0.021
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	23.6	21.2
Sulphide	mg/kg	1	MCERTS	-	-	-	1.4	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	-	-	110	510
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	-	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.34	0.32	< 0.05	0.50
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.82	0.72	< 0.05	1.2
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.77	0.70	< 0.05	1.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.34	0.28	< 0.05	0.57
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.45	0.38	< 0.05	0.53
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.56	0.45	< 0.05	0.70
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.28	0.25	< 0.05	0.41
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.49	0.39	< 0.05	0.69
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.25	0.20	< 0.05	0.27
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.29	0.27	< 0.05	0.37
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	4.59	3.96	< 0.80	6.46

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215420	1215421	1215422	1215423	1215424
Sample Reference				TP115	TP117	TP119	TP120	TP123
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.10	0.20	1.20	0.10
Date Sampled				30/04/2019	02/05/2019	02/05/2019	01/05/2019	01/05/2019
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	16	17	15	4.5	21
Barium (aqua regia extractable)	mg/kg	1	MCERTS	110	160	150	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.57	0.67	1.0	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.4	0.4	< 0.2	0.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-	19	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	30	41	53	17	52
Lead (aqua regia extractable)	mg/kg	1	MCERTS	9.5	80	70	8.2	97
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.4	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	15	15	17	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	3.1	< 1.0	< 1.0	< 1.0	1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	13	28	32	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	78	96	160	32	91
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	4.4	7.4	< 1.0	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	250	14	20	< 1.0	< 1.0
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	250	20	29	< 10	< 10
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215425	1215426	1215427	1215428	1215429
Sample Reference				TP123	TP124	TP125	TP126	TP129
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.90	1.10	0.10
Date Sampled				01/05/2019	01/05/2019	01/05/2019	01/05/2019	01/05/2019
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	%	N/A	NONE	16	21	26	13	9.8
Total mass of sample received	kg	0.001	NONE	0.48	0.54	0.40	0.46	0.39
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	-	-	-	-	-
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	-	6.6	4.8	6.3	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	340	740	310	-
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	61	260	42	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.030	0.13	0.021	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	30.3	131	20.9	-
Sulphide	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
Total Sulphur	mg/kg	50	MCERTS	-	430	970	160	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	0.5	-	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	-	< 1.0	< 1.0	< 1.0	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.37
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.58
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.51
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.24
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.24
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.20
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.19
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	< 0.80	2.47

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215425	1215426	1215427	1215428	1215429
Sample Reference				TP123	TP124	TP125	TP126	TP129
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.80	0.90	1.10	0.10
Date Sampled				01/05/2019	01/05/2019	01/05/2019	01/05/2019	01/05/2019
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	3.3	< 1.0	4.3	8.2	6.6
Barium (aqua regia extractable)	mg/kg	1	MCERTS	28	-	-	-	75
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.25	-	-	-	0.56
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	9.7	6.1	17	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	10	10	5.9	19	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.8	9.1	5.2	19	25
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	9.7	8.2	6.5	17	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	6.1	-	-	-	21
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	17	17	14	44	39
Petroleum Hydrocarbons								
TPH (C5 - C6)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	-	< 1.0
TPH (C6 - C8)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	< 0.1
TPH (C8 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	< 0.1
TPH (C10 - C12)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	-	< 2.0
TPH (C12 - C16)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	-	< 4.0
TPH (C16 - C21)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
TPH (C21 - C35)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	18
TPH (C35 - C40)	mg/kg	10	MCERTS	< 10	< 10	< 10	-	< 10
TPH Total C5 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	-	20
Pesticide and Herbicide Screen								
Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215430	1215431	1215432	1215433	1215434
Sample Reference				TP131	TP134	TP137	TP138	TP142
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.20	1.00	0.70	0.50
Date Sampled				01/05/2019	02/05/2019	02/05/2019	02/05/2019	02/05/2019
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	%	N/A	NONE	17	15	12	69	16
Total mass of sample received	kg	0.001	NONE	0.53	0.37	0.51	0.31	0.48
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	Chrysotile
Asbestos in Soil	Type	N/A	ISO 17025	-	Not-detected	-	-	Detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	0.001
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	0.001
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.6	-	7.1	-	-
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	170	-	220	-	-
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	24	-	45	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.012	-	0.023	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	12.2	-	22.6	-	-
Sulphide	mg/kg	1	MCERTS	< 1.0	-	1.0	-	-
Total Sulphur	mg/kg	50	MCERTS	140	-	110	-	-
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	6.7	-	-	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.79	0.48
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.21
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.24	< 0.05	< 0.05	1.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.39
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.67	< 0.05	< 0.05	2.7
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.63	< 0.05	< 0.05	2.5
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.31	< 0.05	< 0.05	1.3
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.35	< 0.05	< 0.05	1.2
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.46	< 0.05	< 0.05	1.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.18	< 0.05	< 0.05	0.90
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.38	< 0.05	< 0.05	1.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.21	< 0.05	< 0.05	0.45
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.25	< 0.05	< 0.05	0.71
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	3.68	< 0.80	< 0.80	15.3

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

Lab Sample Number				1215430	1215431	1215432	1215433	1215434
Sample Reference				TP131	TP134	TP137	TP138	TP142
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.20	1.00	0.70	0.50
Date Sampled				01/05/2019	02/05/2019	02/05/2019	02/05/2019	02/05/2019
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	< 1.0	13	4.3	22	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	-	140	-	68	240
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.92	-	0.40	1.0
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.4	< 0.2	0.5	1.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	6.0	-	15	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	43	17	17	69
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.7	66	9.2	16	59
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	0.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	5.9	17	18	12	22
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	2.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	31	-	11	30
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	11	72	29	32	130

Petroleum Hydrocarbons

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

Pesticide and Herbicide Screen

Pesticides/Herbicides Screen in Soil	P/A	N/A	NONE	-	-	-	-	-

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039
Project / Site name: South Heywood Phase 4
Your Order No: 13-223-EF

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 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
1215434	TP142	0.50	124	Loose Fibres	**Chrysotile**	0.001	**0.001**

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

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4

Your Order No: 13-223-EF

Lab Sample Number				1215435	1215436			
Sample Reference				TP143	TP144			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.80	0.60			
Date Sampled				02/05/2019	02/05/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
General Inorganics								
pH	pH Units	N/A	ISO 17025	8.1	8.0			
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0			
Total Phenols								
Total Phenols (monohydric)	µg/l	1	ISO 17025	< 1.0	< 1.0			
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01			
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01			
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01			
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01			
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2			
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1.1	ISO 17025	5.4	2.7			
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08			
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0			
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.9	2.8			
Copper (dissolved)	µg/l	0.7	ISO 17025	48	33			
Lead (dissolved)	µg/l	1	ISO 17025	5.3	3.8			
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5			
Nickel (dissolved)	µg/l	0.3	ISO 17025	8.2	2.7			
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0			
Zinc (dissolved)	µg/l	0.4	ISO 17025	14	8.6			

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 19-40039

Project / Site name: South Heywood Phase 4

Your Order No: 13-223-EF

Lab Sample Number				1215435	1215436			
Sample Reference				TP143	TP144			
Sample Number				None Supplied	None Supplied			
Depth (m)				0.80	0.60			
Date Sampled				02/05/2019	02/05/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
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	10	NONE	< 10	< 10			
Petroleum Hydrocarbons								
TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0			
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10			
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10			

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 19-40039

Project / Site name: South Heywood Phase 4

* 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 *
1215395	WS101	None Supplied	1.20	Brown clay and sand with gravel and vegetation.
1215396	WS102	None Supplied	0.30	Brown loam and clay with gravel and vegetation.
1215397	WS103	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1215398	WS104	None Supplied	0.20	Brown loam and clay with gravel and vegetation.
1215399	WS105	None Supplied	0.05	Brown loam and clay with gravel and vegetation.
1215400	WS105	None Supplied	1.20	Brown clay and sand with gravel and vegetation.
1215401	WS106	None Supplied	0.30	Brown clay and sand with gravel and vegetation.
1215402	WS107	None Supplied	0.80	Brown clay and sand with gravel and vegetation.
1215403	WS109	None Supplied	0.90	Brown clay and sand with gravel and vegetation.
1215404	WS111	None Supplied	1.30	Brown clay and sand.
1215405	WS112	None Supplied	0.10	Brown loam and clay with gravel.
1215406	WS112	None Supplied	1.20	Brown clay and sand with gravel.
1215407	WS114	None Supplied	1.30	Brown clay and sand with gravel.
1215408	WS115	None Supplied	0.20	Brown loam and clay with gravel.
1215409	WS116	None Supplied	0.80	Brown clay and sand with gravel.
1215410	WS117	None Supplied	0.20	Brown loam and clay with gravel.
1215411	TP101	None Supplied	0.20	Brown loam and clay with gravel.
1215412	TP105	None Supplied	0.70	Brown loam and clay with gravel and vegetation.
1215413	TP107	None Supplied	1.10	Brown clay and sand with gravel and vegetation.
1215414	TP109	None Supplied	0.30	Brown loam and clay with gravel and vegetation.
1215415	TP110	None Supplied	0.40	Brown loam and clay with gravel and vegetation.
1215416	TP111	None Supplied	0.60	Brown loam and clay with gravel and vegetation.
1215417	TP113	None Supplied	0.60	Brown loam and clay with gravel.
1215418	TP114	None Supplied	0.20	Brown loam and clay with gravel and vegetation.
1215419	TP114	None Supplied	0.40	Grey clay and sand.
1215420	TP115	None Supplied	1.00	Black loam with peat.
1215421	TP117	None Supplied	0.10	Brown loam and clay with gravel.
1215422	TP119	None Supplied	0.20	Brown loam and clay with gravel.
1215423	TP120	None Supplied	1.20	Brown clay and sand.
1215424	TP123	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1215425	TP123	None Supplied	1.00	Grey sand.
1215426	TP124	None Supplied	0.80	Grey clay and sand.
1215427	TP125	None Supplied	0.90	Brown loam and sand.
1215428	TP126	None Supplied	1.10	Brown sandy clay with gravel.
1215429	TP129	None Supplied	0.10	Brown loam and clay with gravel.
1215430	TP131	None Supplied	1.20	Grey sand.
1215431	TP134	None Supplied	0.20	Brown loam and clay with vegetation and gravel
1215432	TP137	None Supplied	1.00	Brown clay and sand.
1215433	TP138	None Supplied	0.70	Black loam with peat.
1215434	TP142	None Supplied	0.50	Brown clay and sand with gravel.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 19-40039

Project / Site name: South Heywood Phase 4

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	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
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
BTEX and MTBE in leachates (Monoaromatics)	Determination of BTEX and MTBE in leachates by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
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
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
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
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
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	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
Pesticides and Herbicides in soil screening	In-house method	In-house method		W	NONE
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number : 19-40039

Project / Site name: South Heywood Phase 4

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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
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 based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total 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
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 based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests""	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
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 based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
TPH1 (Leachates)	Determination of dichloromethane extractable hydrocarbons in leachate 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.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

APPENDIX VII
ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA



Constituent	Origin of Risk Assessment Value
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs - methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide - Total	2014 LQM/CIEH S4ULs
Phenols - Total.	2014 LQM/CIEH S4ULs
Naphthalene	General Assessment Criteria (GAC) developed by CIEH / LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene[	
Chrysene	
Benzo(b/k)Fluoranthene [iii]	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C_5-C_6 (aliphatic)	
TPH C_6-C_8 (aliphatic)	
TPH C_8-C_{10} (aliphatic)	
TPH C_{10}-C_{12} (aliphatic)	
TPH C_{12}-C_{16} (aromatic)	
TPH C_{16}-C_{21} (aromatic)	
TPH C_{21}-C_{35} (aromatic)	

APPENDIX VIII
GEOTECHNICAL TESTING RESULTS



LABORATORY REPORT

4043

Contract Number: PSL19/2833

Report Date: 31 May 2019

Client's Reference: 13-223-32353-EF

Client Name: E3P
Heliport Business Park
Liverpool Road
Eccles
Manchester
M30 7RU

For the attention of: Elizabeth Fearn/Nicola Sellars

Contract Title: South Heywood Phase 4

Date Received: 8/5/2019
Date Commenced: 8/5/2019
Date Completed: 31/5/2019

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:

R Gunson (Director)	A Watkins (Director)	R Berriman (Quality Manager)
L Knight (Senior Technician)	S Eyre (Senior Technician)	S Royle (Laboratory Manager)

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

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS101		Tub	3.00	3.45	Brown slightly gravelly sandy CLAY.
WS102		Tub	1.00	1.45	Brown slightly gravelly very sandy CLAY.
WS103		Tub	1.00	1.45	Brown slightly gravelly very sandy CLAY.
WS104		Tub	2.00	2.45	Brown slightly gravelly very sandy CLAY.
WS105		Tub	2.00	2.45	Dark brown slightly gravelly slightly sandy organic CLAY.
WS106		Tub	1.00	1.45	Brown gravelly sandy CLAY.
WS108		Tub	2.00	2.45	Brown slightly gravelly very sandy CLAY.
WS116		Tub	1.00	1.45	Brown slightly gravelly very sandy CLAY.
WS102		Liner	1.50	2.00	Firm brown slightly gravelly very sandy CLAY.
TP113		Bulk	0.60		Brown very gravelly very sandy CLAY.
TP130		Bulk	1.20		Brown slightly gravelly clayey silty SAND.
CP101		Liner	1.00	1.45	Stiff brown slightly gravelly very sandy CLAY.
CP101		Liner	4.00	4.45	Brown slightly gravelly very sandy CLAY.

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
WS101		Tub	3.00	3.45	15			40	19	21	93	Intermediate plasticity CI.
WS102		Tub	1.00	1.45	14			29	14	15	94	Low plasticity CL.
WS103		Tub	1.00	1.45	13			33	17	16	97	Low plasticity CL.
WS104		Tub	2.00	2.45	15			37	18	19	91	Intermediate plasticity CI.
WS105		Tub	2.00	2.45	69			129	53	76	98	Extremely high plasticity ME.
WS106		Tub	1.00	1.45	19			38	20	18	86	Intermediate plasticity CI.
WS108		Tub	2.00	2.45	16			31	15	16	96	Low plasticity CL.
WS116		Tub	1.00	1.45	16			35	17	18	96	Intermediate plasticity CI.

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

UKAS TESTING 4043

PSL Professional Soils Laboratory

South Heywood Phase 4

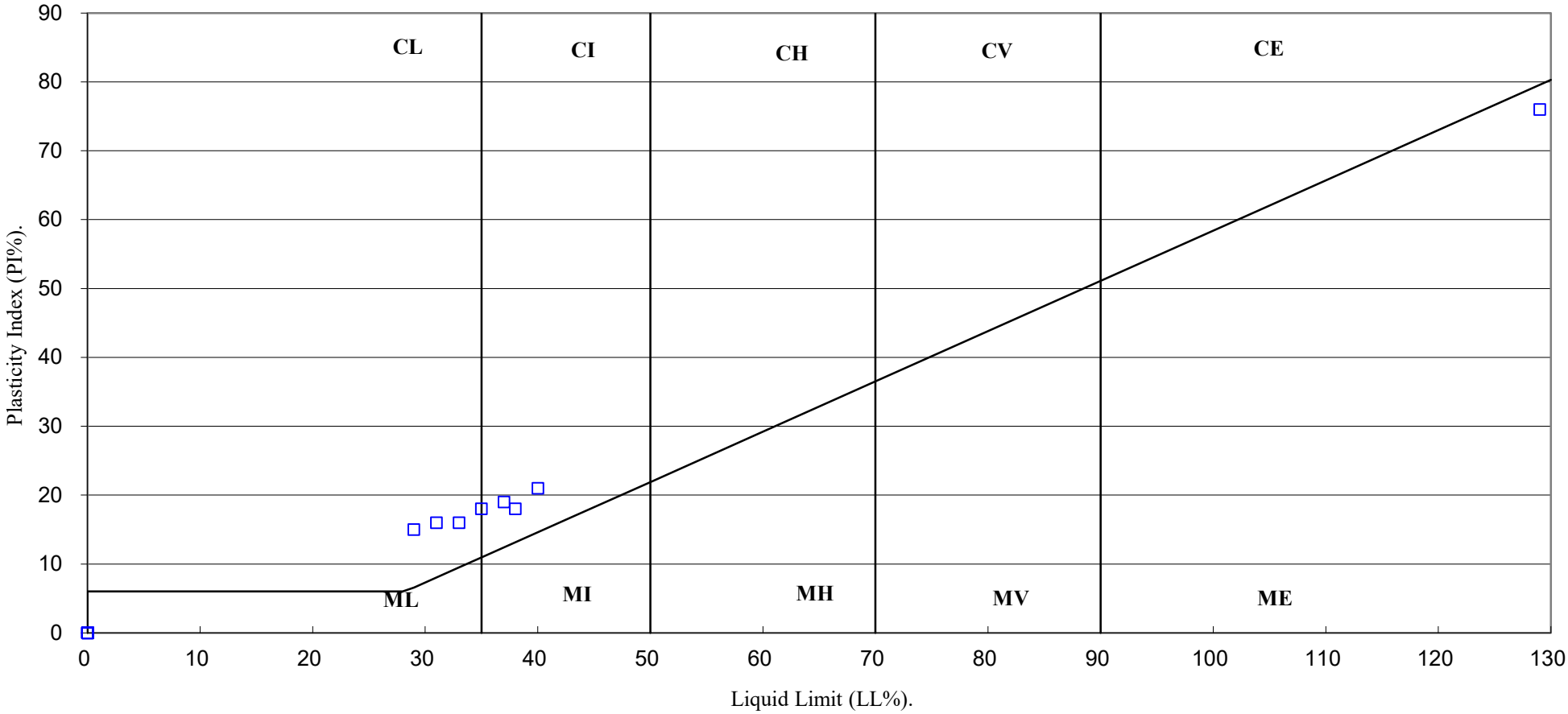
Contract No:

PSL19/2833

Client Ref:

13-223-32353-EF

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043	PSL Professional Soils Laboratory	South Heywood Phase 4	**Contract No:** PSL19/2833 **Client Ref:** 13-223-32353-EF

PARTICLE SIZE DISTRIBUTION TEST

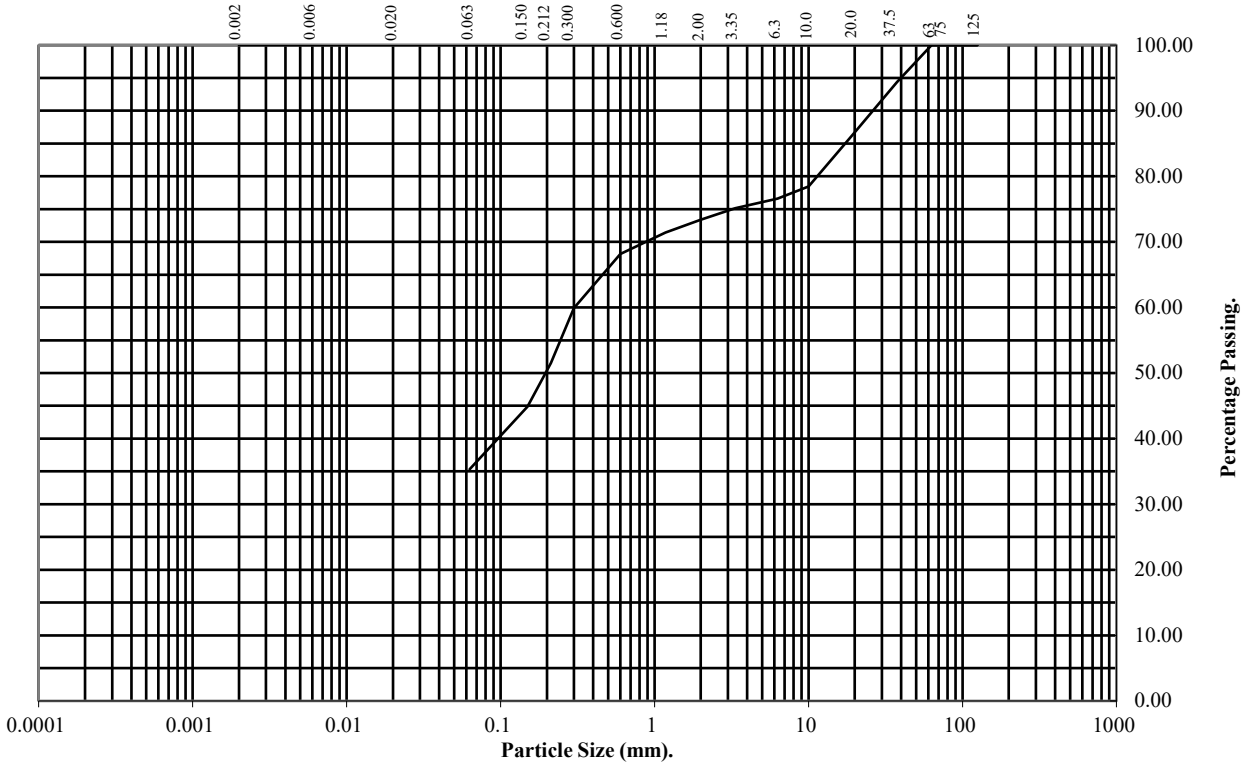
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP113 **Top Depth (m):** 0.60

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

Sample Type: Bulk



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	94
20	87
10	78
6.3	77
3.35	75
2	73
1.18	71
0.6	68
0.3	60
0.212	52
0.15	45
0.063	35

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	38
Silt/Clay	35

Remarks:

See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

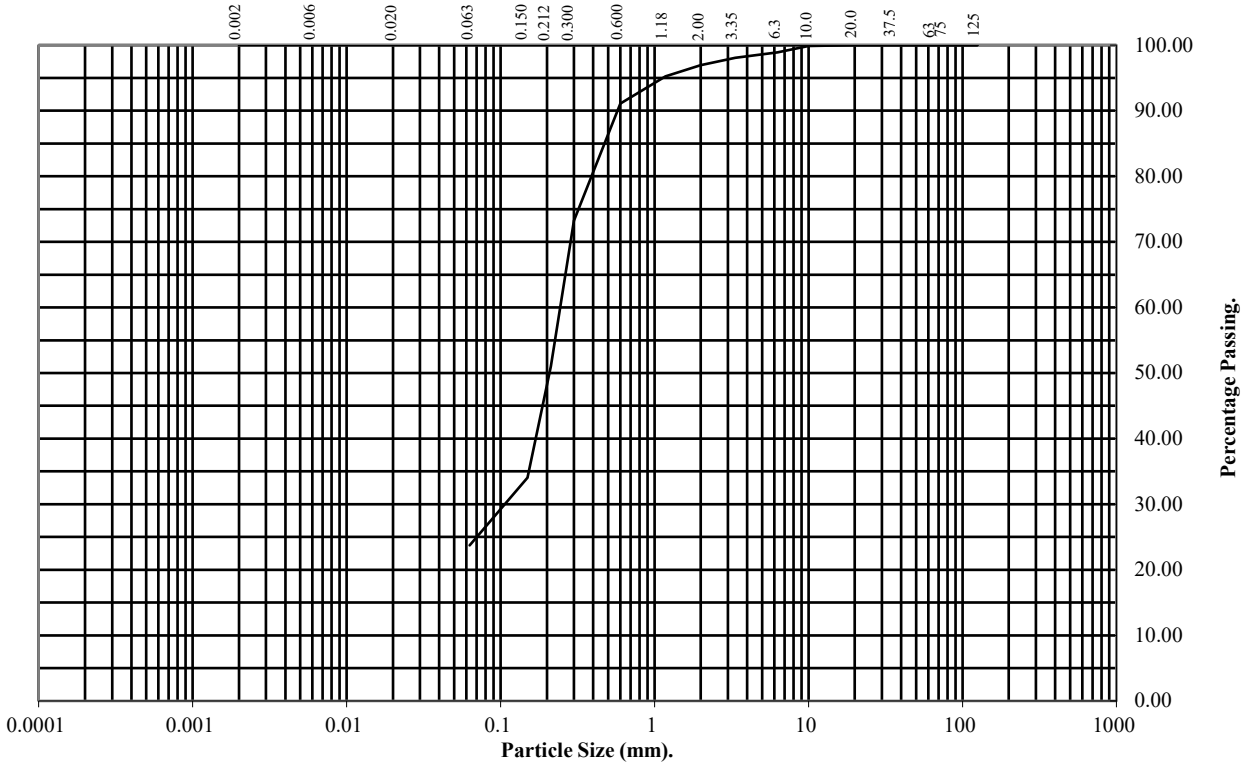
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP130 **Top Depth (m):** 1.20

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

Sample Type: Bulk



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	98
2	97
1.18	95
0.6	91
0.3	73
0.212	51
0.15	34
0.063	24

Soil Fraction	Total Percentage
Cobbles	0
Gravel	3
Sand	73
Silt/Clay	24

Remarks:

See Summary of Soil Descriptions

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

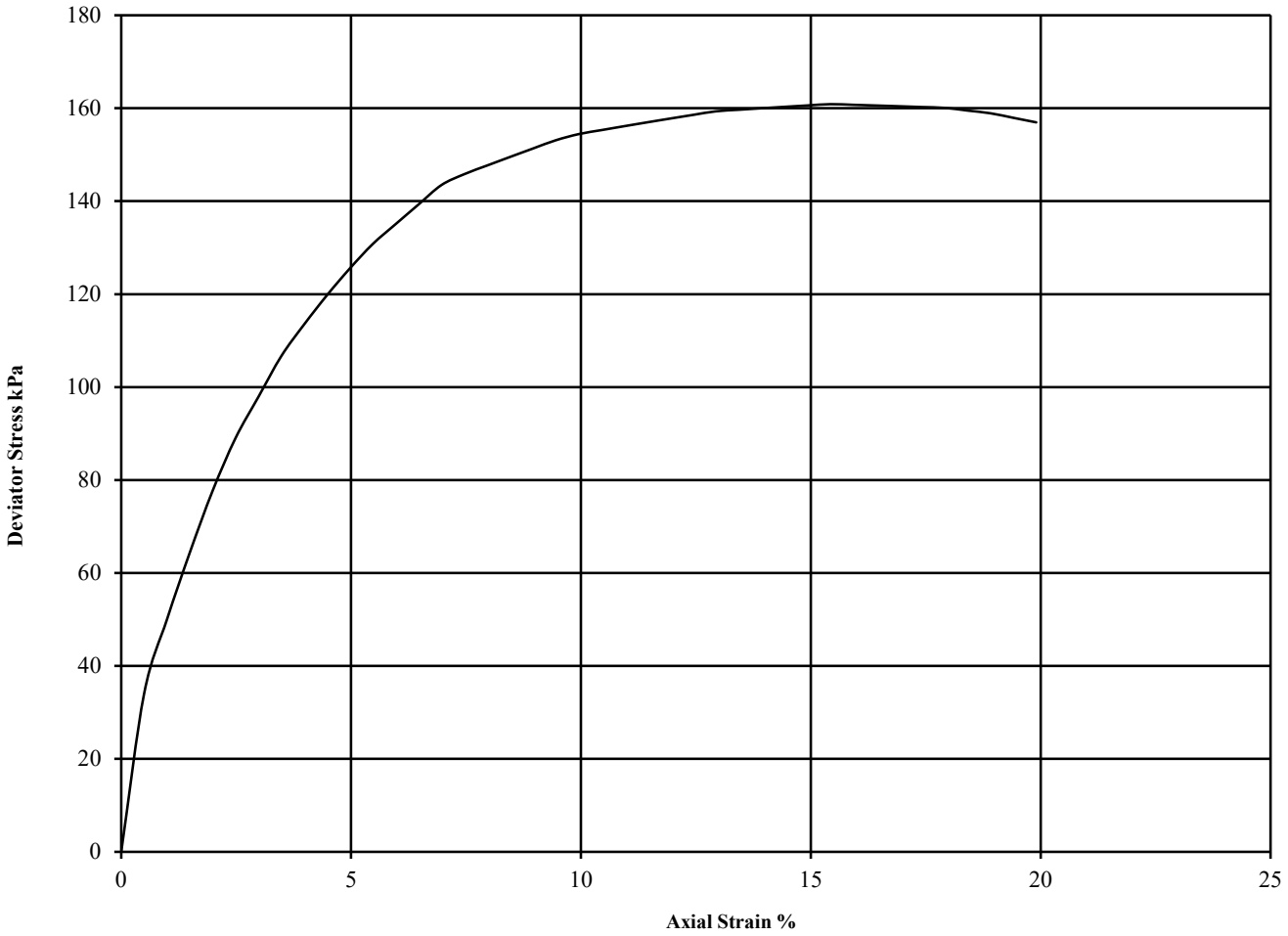
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: CP101 **Top Depth (m):** 1.00

Sample Number: **Base Depth (m):** 1.45

Sample Type Liner



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34
1	17	2.12	1.81	24.5	161	80	15.4	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

South Heywood Phase 4

Contract No: PSL19/2833

Client Ref: 13-223-32353-EF

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

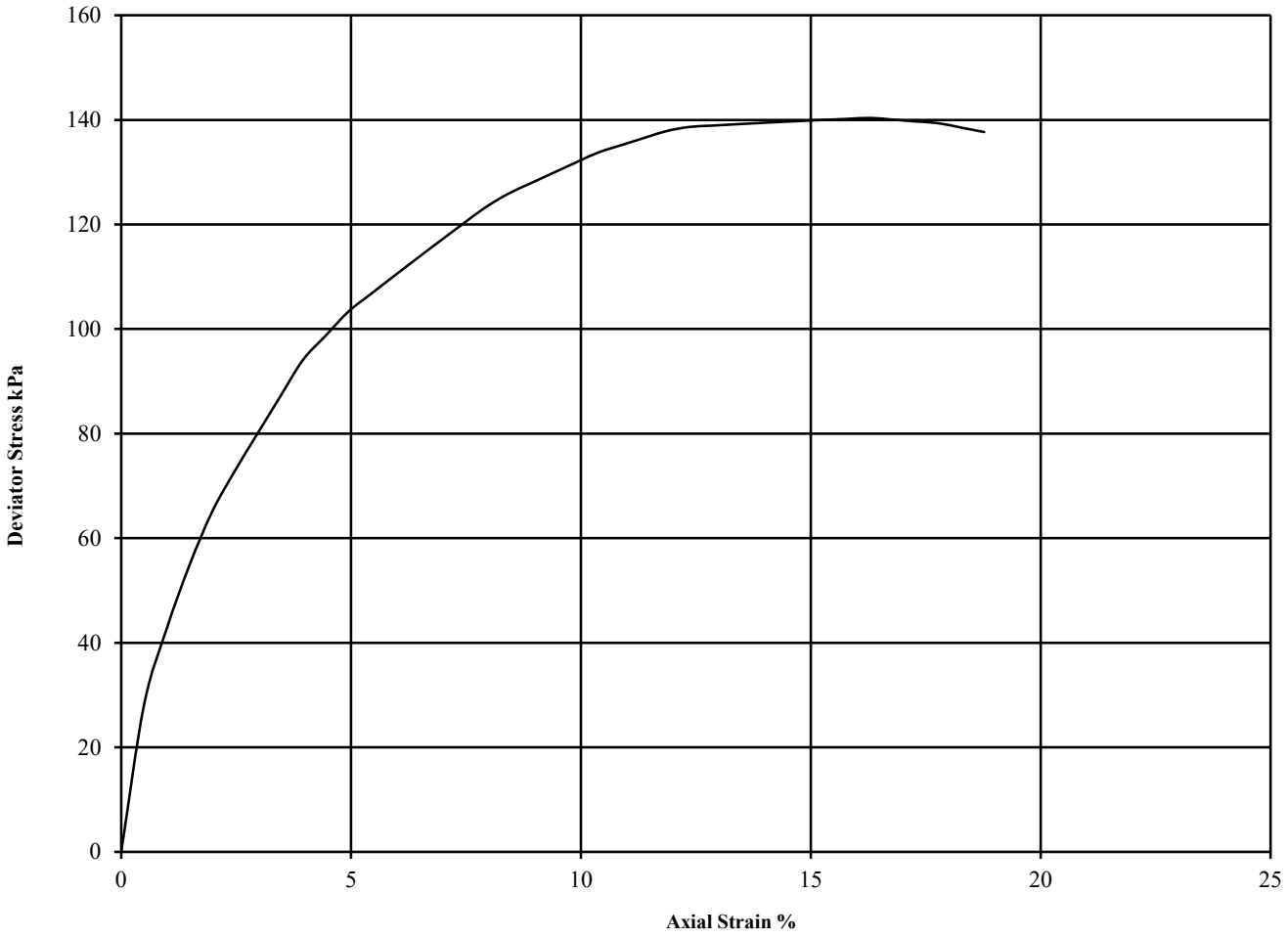
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: WS102 **Top Depth (m):** 1.50

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

Sample Type Liner



Diameter (mm):		82	Height (mm):		166	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.41
1	16	2.15	1.86	35	140	70	16.3	Plastic	See summary of soil descriptions

UKAS TESTING 4043

PSL Professional Soils Laboratory

South Heywood Phase 4

Contract No: PSL19/2833

Client Ref: 13-223-32353-EF

ONE DIMENSIONAL CONSOLIDATION TEST

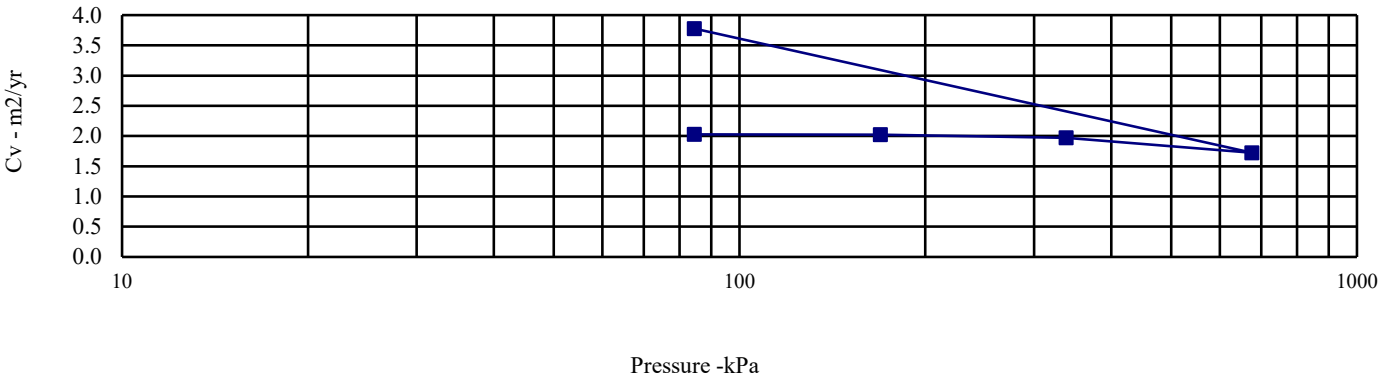
BS 1377: Part 5: 1990: Clause 3

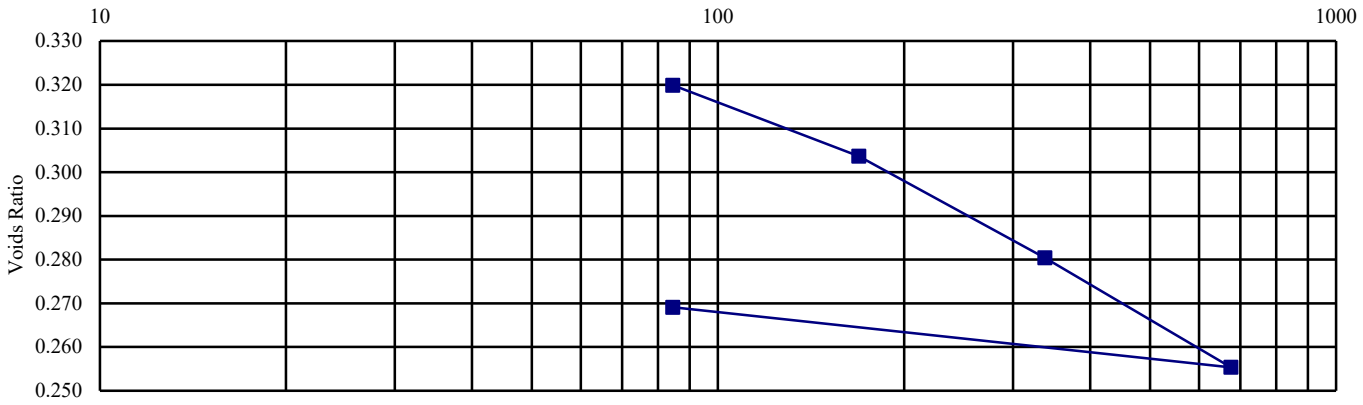
Hole Number: **CP101** **Top Depth (m):** **4.00**

Sample Number: **Base Depth (m) :** **4.45**

Sample Type: **Liner**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	14						
Bulk Density (Mg/m3):	2.22	0	84.5	0.416	2.027	Method used to determine CV:	T90
Dry Density (Mg/m3):	1.94	84.5	169	0.146	2.021		
Voids Ratio:	0.368	169	338	0.106	1.972	Nominal temperature during test ' C:	20
Degree of saturation:	103.7	338	676	0.058	1.724		
Height (mm):	19.77	676	84.5	0.019	3.777	Remarks: See summary of soil descriptions	
Diameter (mm)	75.098						
Particle Density (Mg/m3): Assumed	2.65						





UKAS TESTING 4043	PSL Professional Soils Laboratory	**South Haywood Phase 4**	**Contract No:** PSL19/2833 **Client Ref:** 13-223-32353-EF

ONE DIMENSIONAL CONSOLIDATION TEST

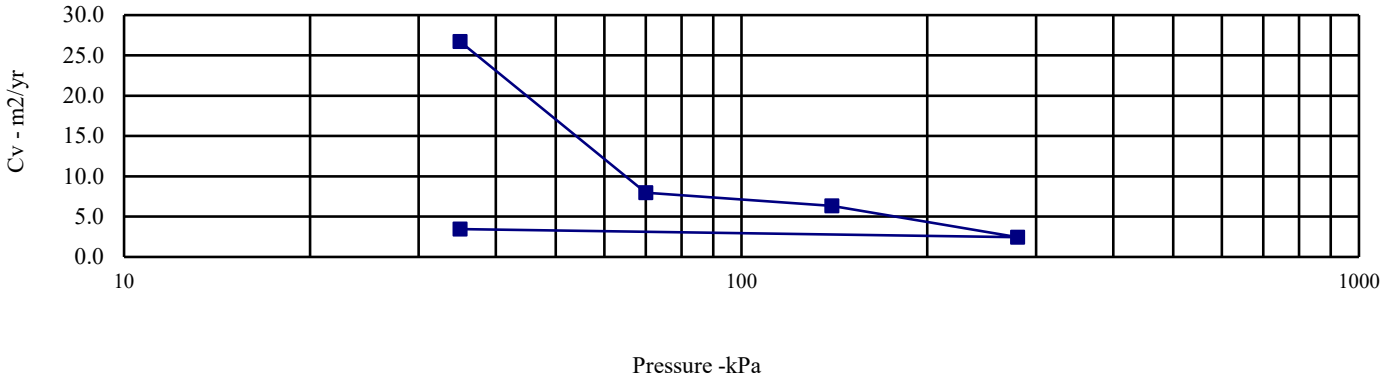
BS 1377: Part 5: 1990: Clause 3

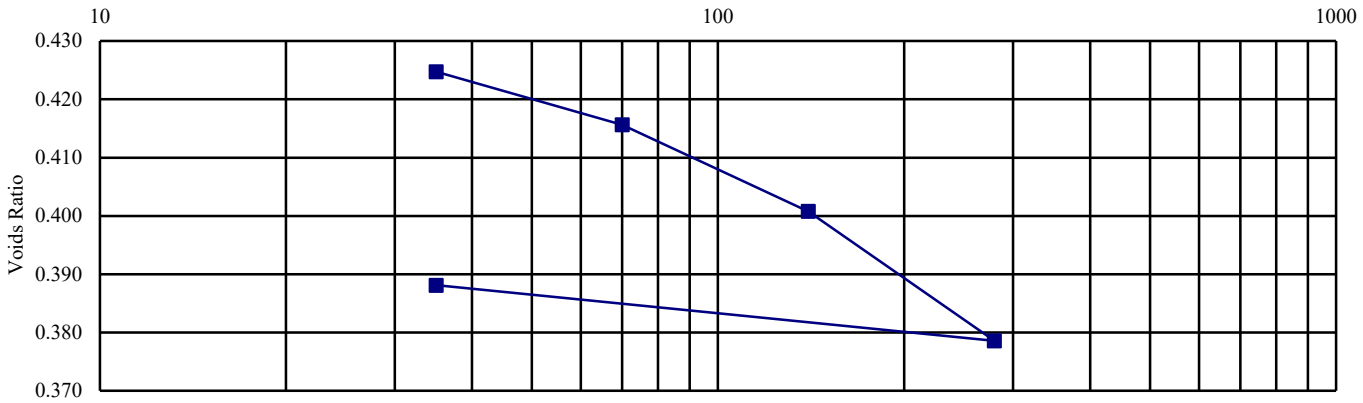
Hole Number: **WS102** **Top Depth (m):** **1.50**

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

Sample Type: **Liner**

Initial Conditions		Pressure Range kPa		Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	16						
Bulk Density (Mg/m3):	2.13	0	35	0.322	26.723	Method used to determine CV:	T90
Dry Density (Mg/m3):	1.84	35	70	0.182	7.958		
Voids Ratio:	0.441	70	140	0.150	6.342	Nominal temperature during test ' C:	20
Degree of saturation:	95.6	140	280	0.113	2.452		
Height (mm):	19.676	280	35	0.028	3.442	Remarks: See summary of soil descriptions	
Diameter (mm)	75.005						
Particle Density (Mg/m3): Assumed	2.65						





APPENDIX IX
DYNAMIC CONE PENETROMETER TEST CERTIFICATES

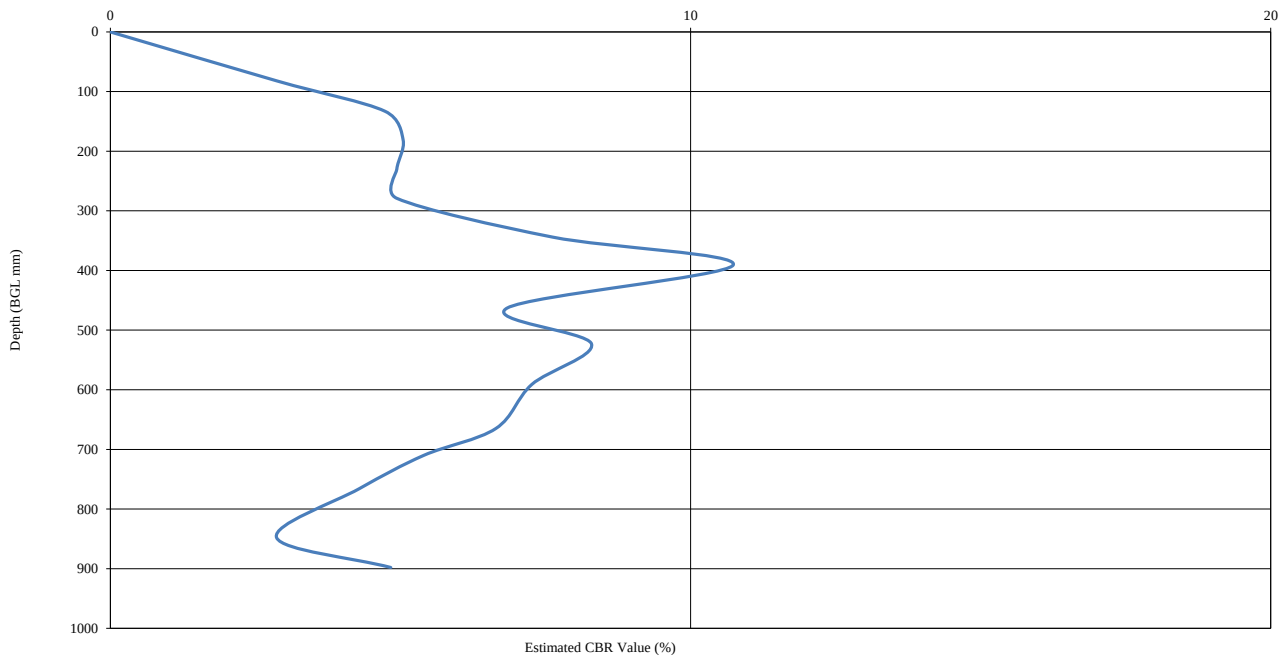


Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP 101	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	898		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	279	5	5	55.80	4.30
279	463	11	6	30.67	8.10
463	898	21	10	43.50	5.60

Comments

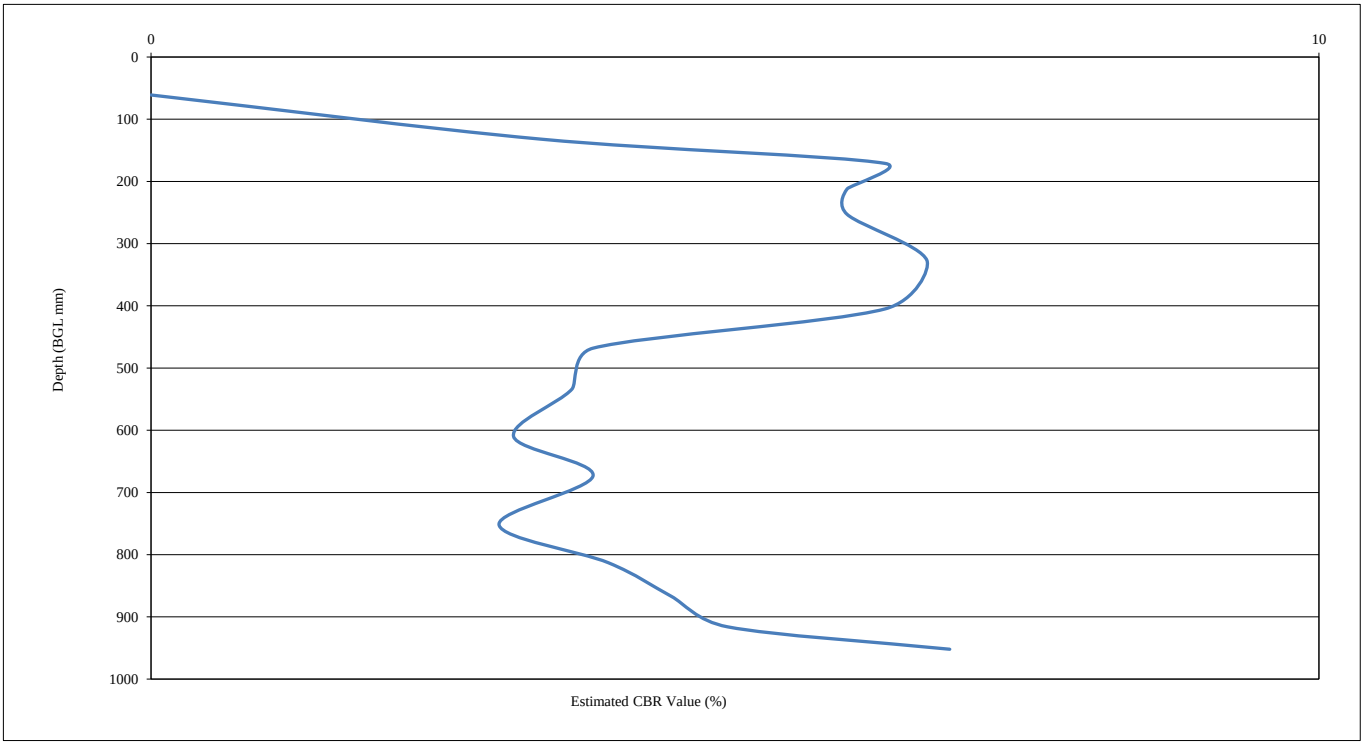
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP102	**Easting:**	0
Initial Depth (mm BGL):	0	**Northing:**	0
Final Depth (mm BGL):	952		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	171	2	2	85.50	2.74
171	405	8	6	39.00	6.28
405	673	12	4	67.00	3.55
673	952	17	5	55.80	4.30

Comments

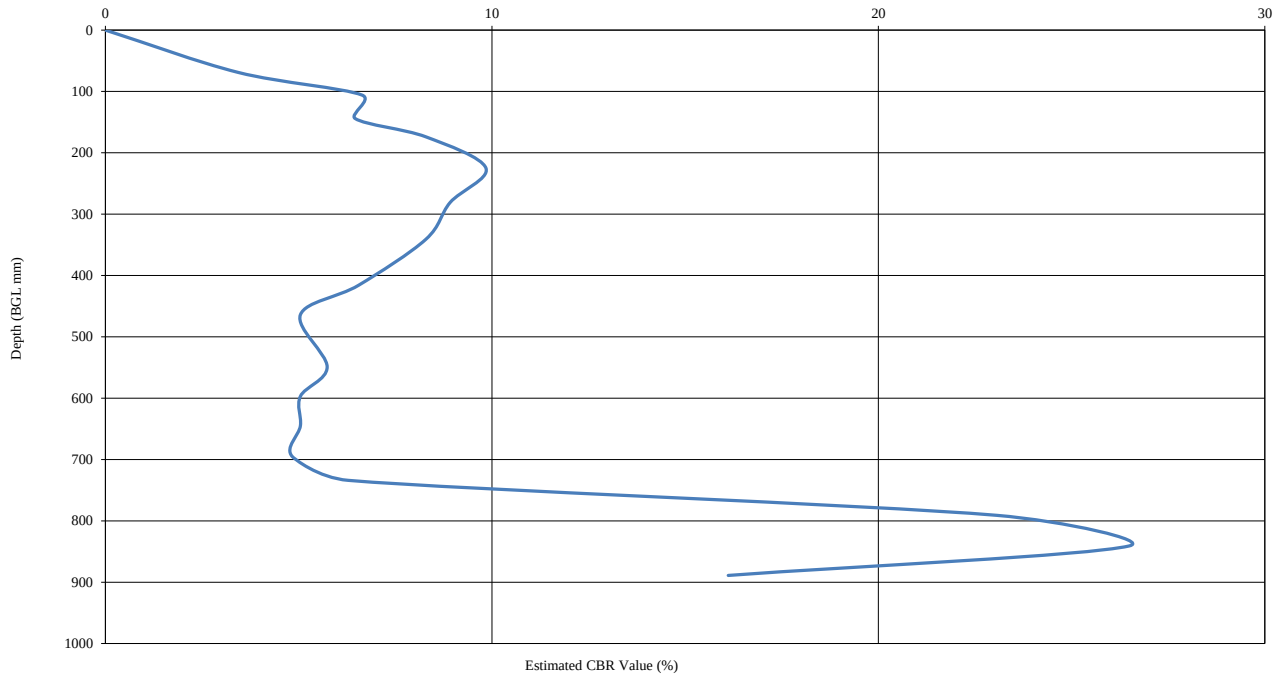
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP103	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	889		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	144	3	3	48.00	5.05
144	464	13	10	32.00	7.75
464	695	18	5	46.20	5.25
695	889	32	14	13.86	18.76

Comments

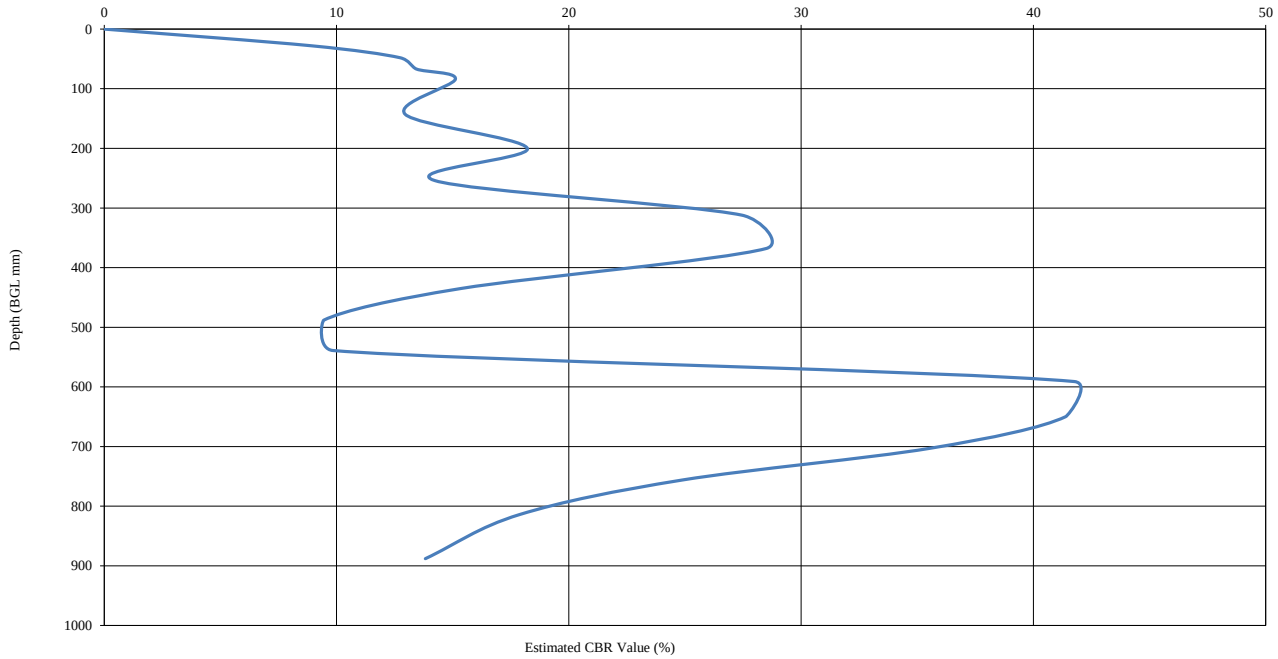
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP104	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	888		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	143	7	7	20.43	12.45
143	254	14	7	15.86	16.27
254	488	32	18	13.00	20.07
488	814	67	35	9.31	28.55

Comments

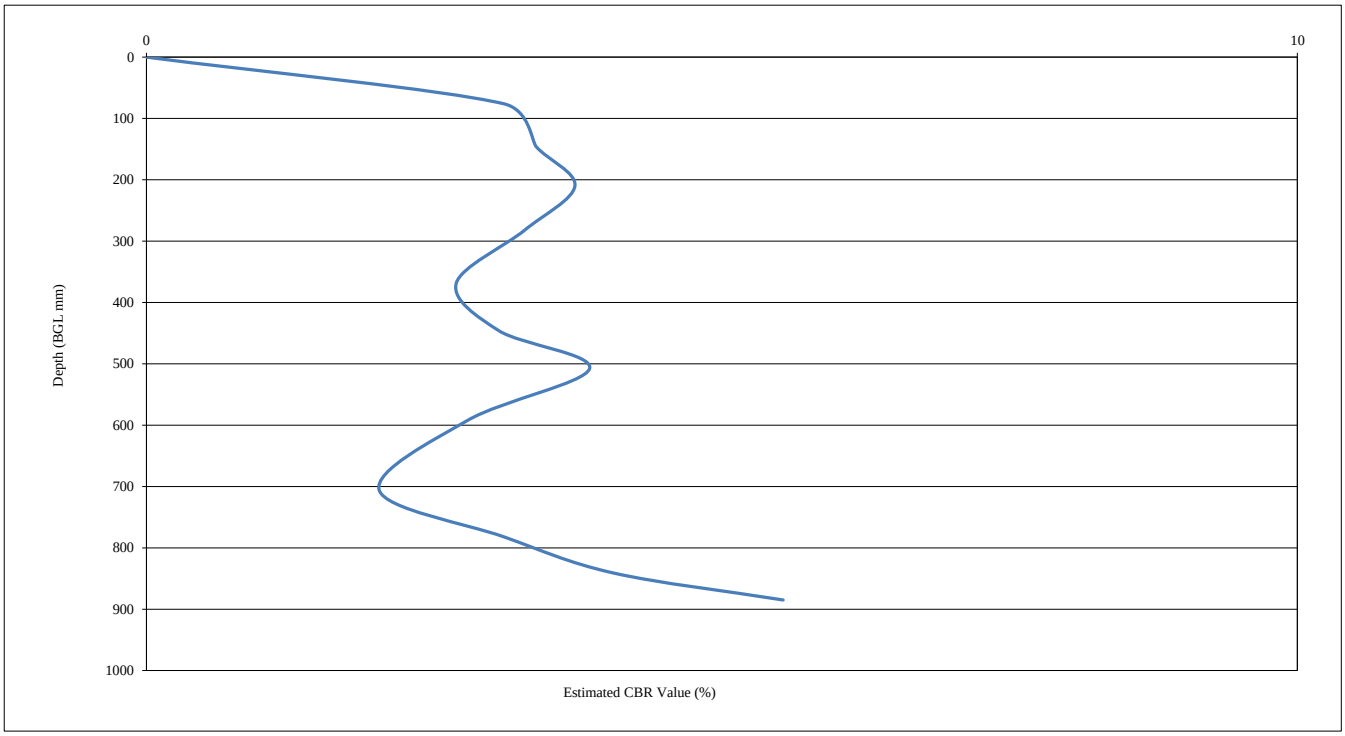
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP105	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	885		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	146	2	2	73.00	3.24
146	369	5	3	74.33	3.18
369	706	9	4	84.25	2.78
706	885	12	3	59.67	4.01

Comments

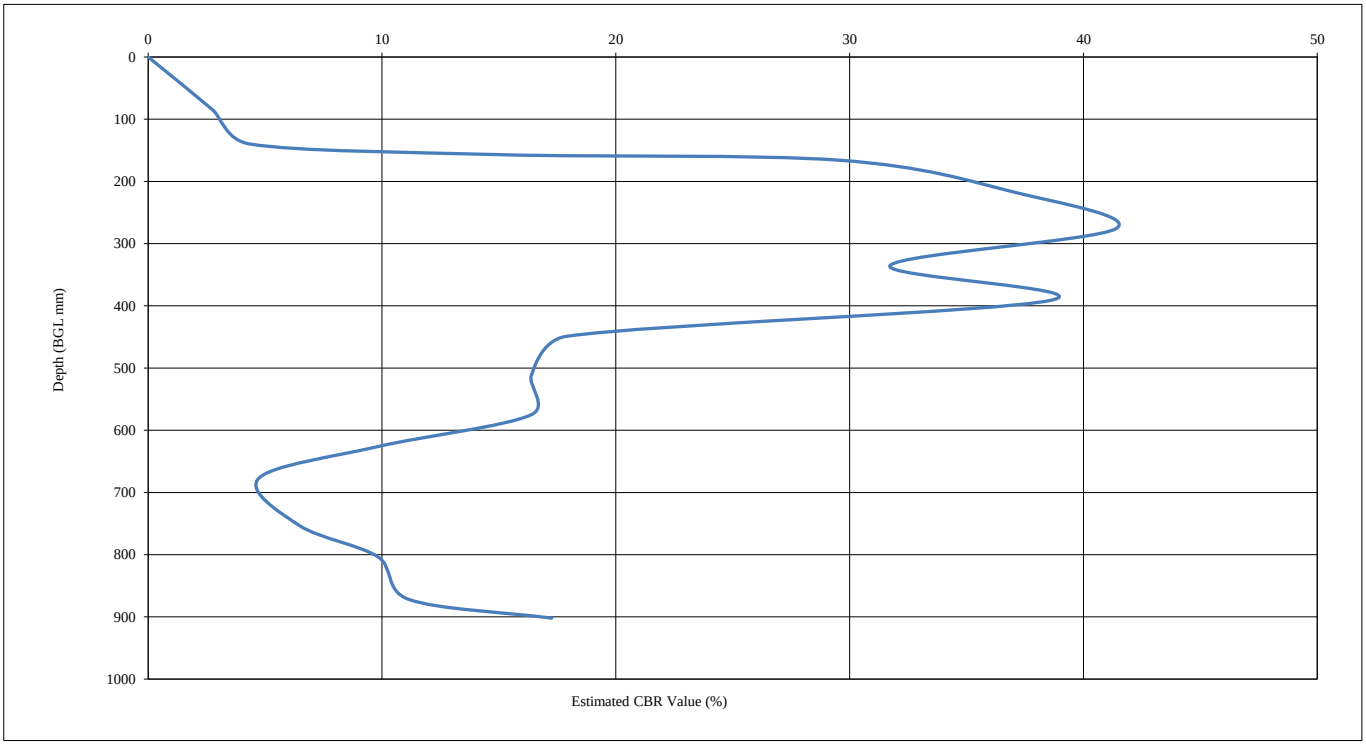
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP106	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	902		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	140	2	2	70.00	3.39
140	512	43	41	9.07	29.35
512	902	59	16	24.38	10.33

Comments

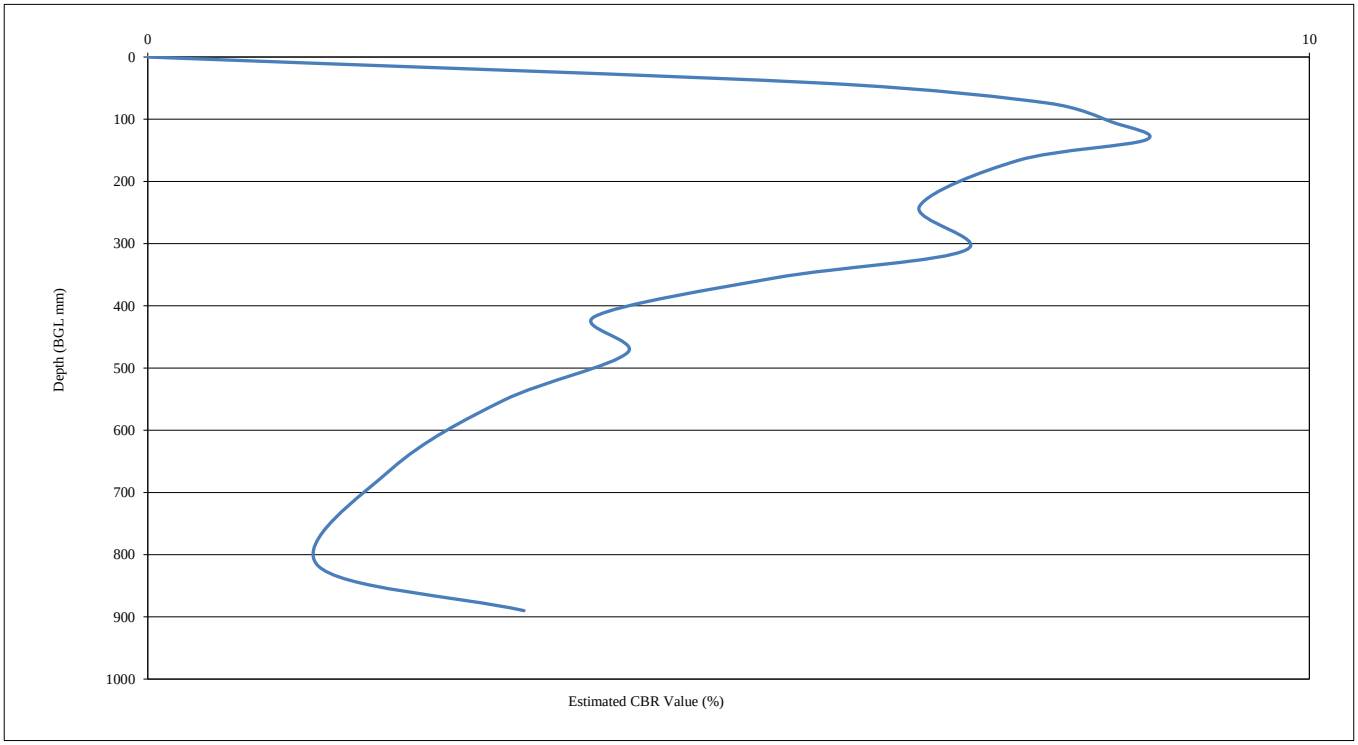
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP107	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	890		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	240	7	7	34.29	7.20
240	475	12	5	47.00	5.16
475	890	16	4	103.75	2.23

Comments

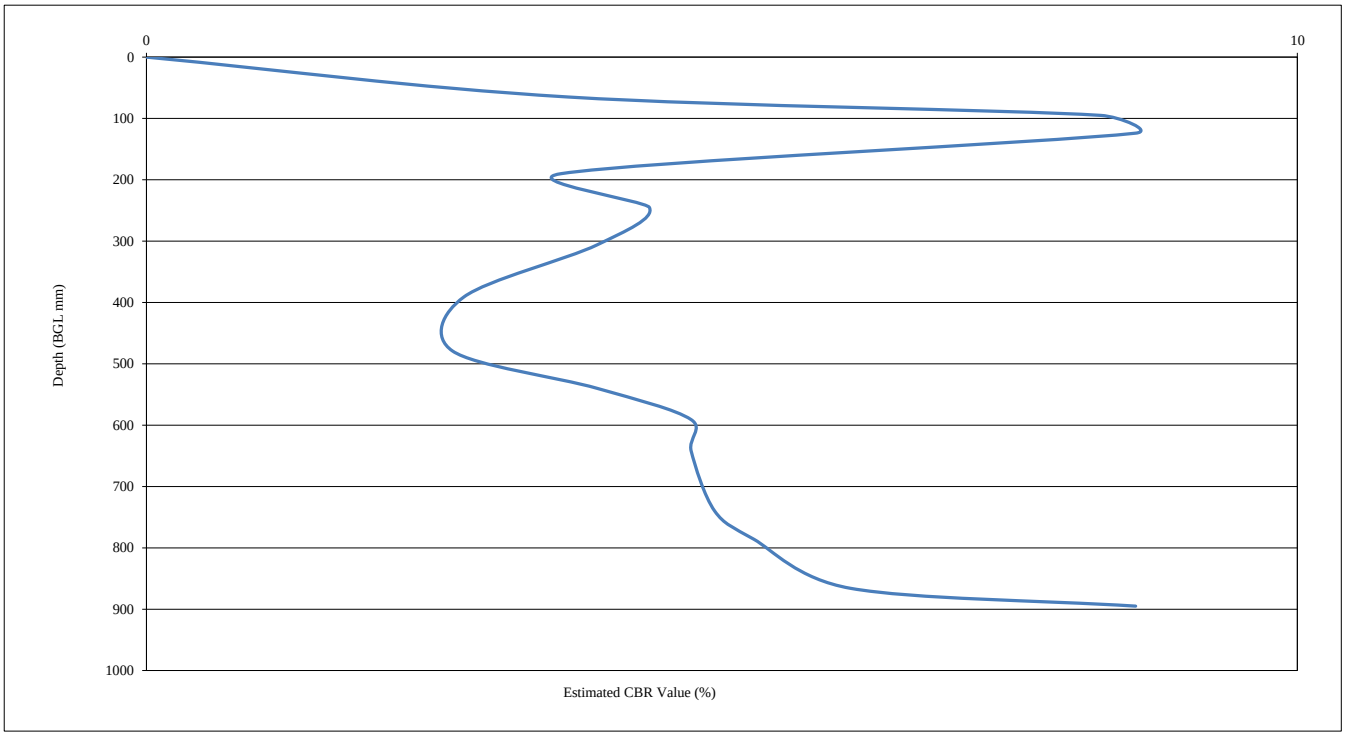
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP108	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	895		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	245	5	5	49.00	4.94
245	479	8	3	78.00	3.02
479	642	11	3	54.33	4.43
642	895	17	6	42.17	5.79

Comments

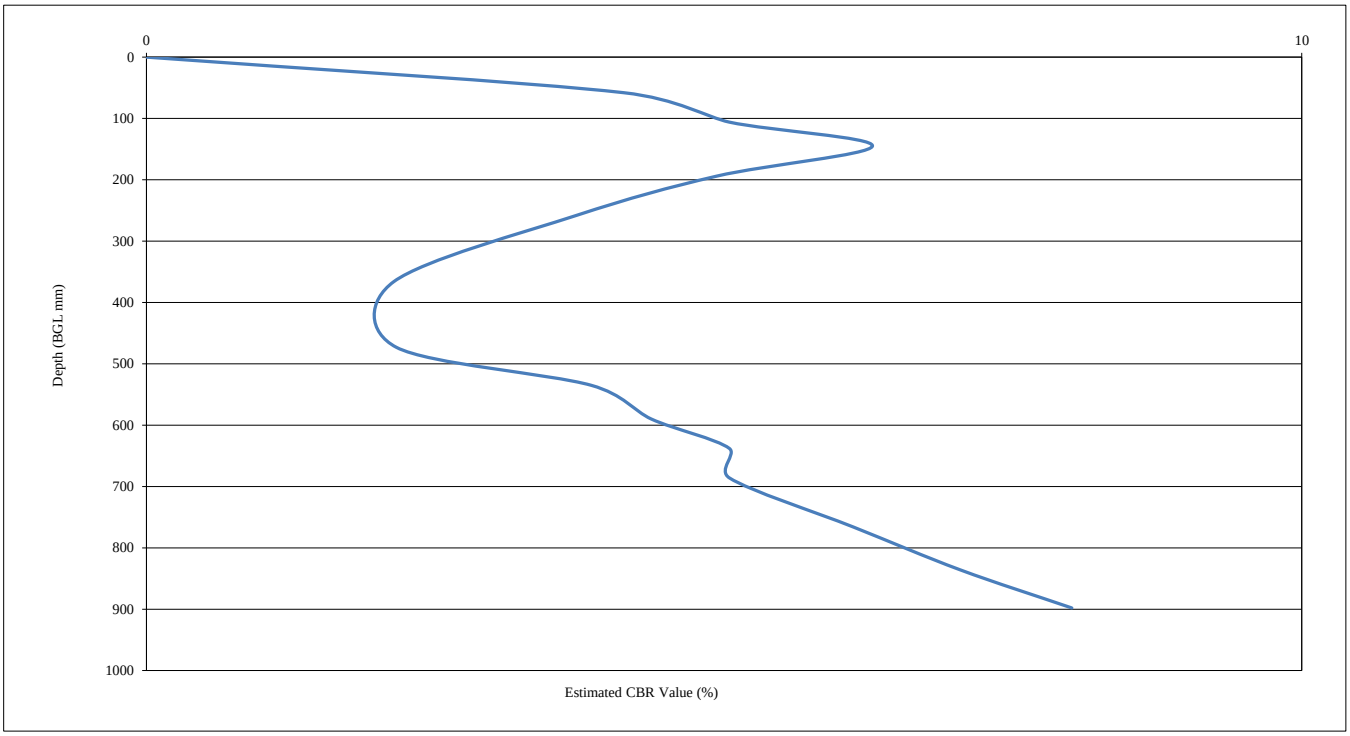
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP109	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	898		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	145	3	3	48.33	5.01
145	473	7	4	82.00	2.86
473	638	10	3	55.00	4.37
638	898	17	7	37.14	6.62

Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	uth Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP110	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	879		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	111	2	2	55.50	4.33
111	422	8	6	51.83	4.65
422	531	10	2	54.50	4.41
531	879	19	9	38.67	6.34

Comments

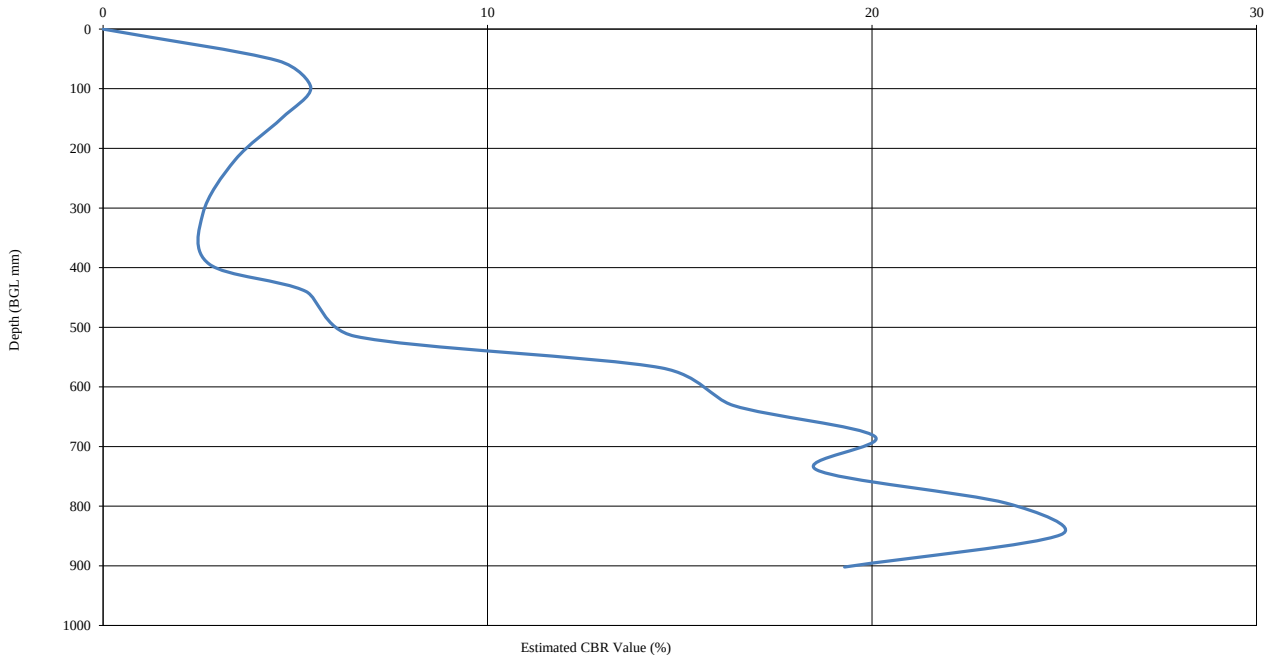
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP111	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	902		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	394	6	6	65.67	3.62
394	515	9	3	40.33	6.06
515	631	16	7	16.57	15.53
631	739	24	8	13.50	19.29
739	902	38	14	11.64	22.55

Comments

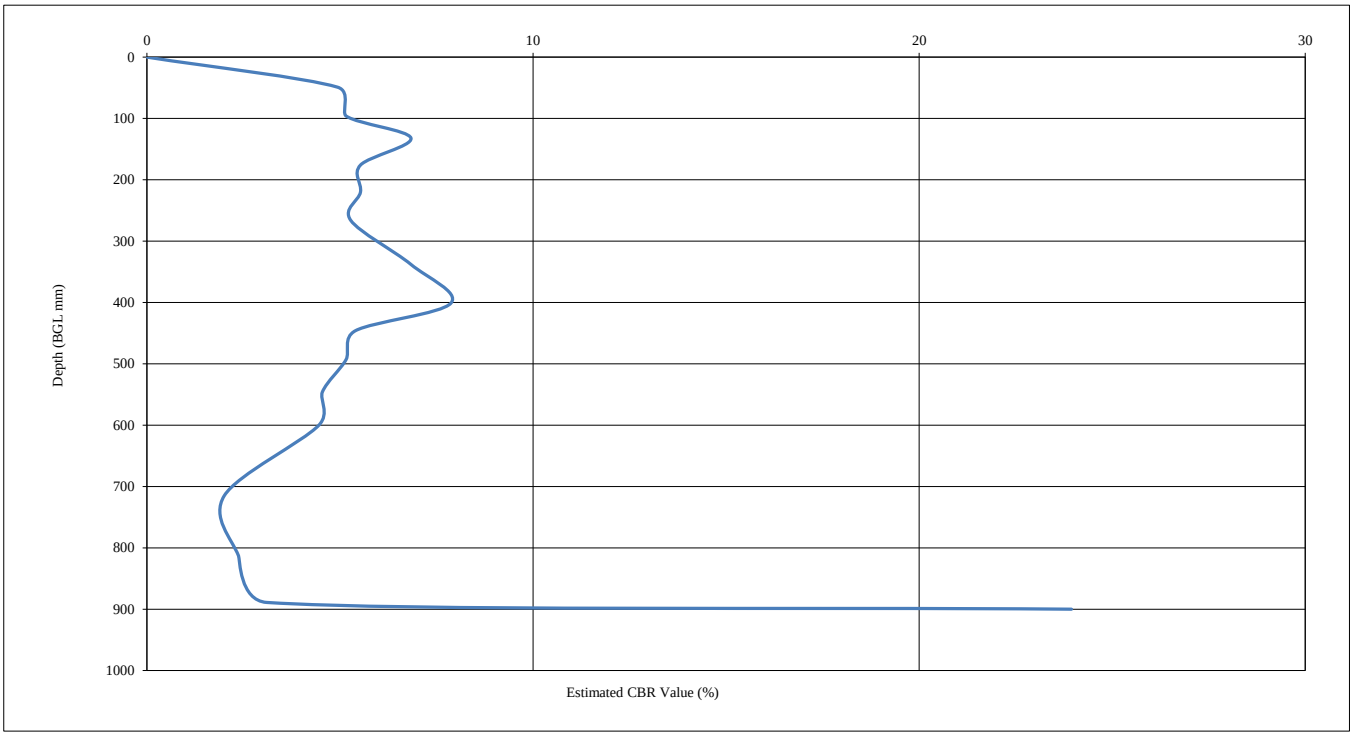
Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

Determination of Dynamic Cone Penetrometer - Estimated CBR Value (%)

In Accordance with TRL Report PR/INT/277/04

Site Name	South Heywood Phase 4	**Test Date:**	13/05/2019
Site Ref	13-223	**Test Location:**	Heywood
Test No.:	DCP112	**Easting:**	
Initial Depth (mm BGL):	0	**Northing:**	
Final Depth (mm BGL):	900		

Estimated California Bearing Ratio Graph



Start Depth (mm) BGL	Finish Depth (mm) BGL	No. of Blows	Blows Per Layer	DCP mm/Blows	Ave Estimated Layer (CBR %)
0	176	4	4	44.00	5.53
176	401	10	6	37.50	6.55
401	600	14	4	49.75	4.86
600	813	16	2	106.50	2.17
813	900	18	2	43.50	5.60

Comments

Site Engineer:	Checked By:	Date:	Approved By:	Date:
TP	NS	01/07/2019	MD	01/07/2019

APPENDIX X
BRE365 SOAKAWAY TEST CERTIFICATES



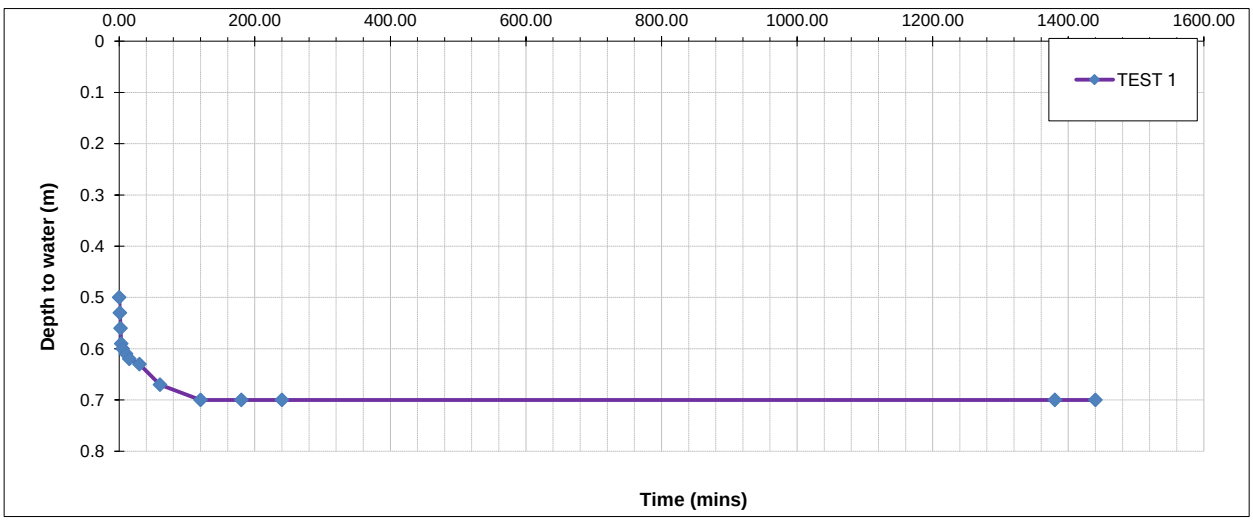
Site:	South Heywood Phase 4		**Trial Pit Number:**	SA101
Job Number:	13-223		**Length:**	1.40 m
Date of Test:	30/04/2019		**Width:**	0.50 m
			Depth:	3.10 m
			Groundwater Level:	N/A m

The test did not reach the 25% or 75% effective storage depth over the monitoring period; as such the test has failed.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.5				
1.00	0.53				
2.00	0.56				
3.00	0.59				
5.00	0.6				
10.00	0.61				
15.00	0.62				
30.00	0.63				
60.00	0.67				
120.00	0.7				
180.00	0.7				
240.00	0.7				
1380.00	0.7				
1440.00	0.7				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	2.60		
75% Effective Storage Depth	m	1.95		
(i.e. depth below GL)	m	1.15		
25% Effective Storage Depth	m	0.65		
(i.e. depth below GL)	m	2.45		
Effective Storage Depth 75%-25%	m	1.30		
Time to fall to 75% effective depth	mins	N/A		
Time to fall to 25% effective depth	mins	N/A		
V (75%-25%)	m3	0.91		
a (50%)	m2	5.64		
t (75%-25%)	mins	#VALUE!		
SOIL INFILTRATION RATE	m/s	**N/A**		

DESIGN SOIL INFILTRATION RATE, f	**N/A**



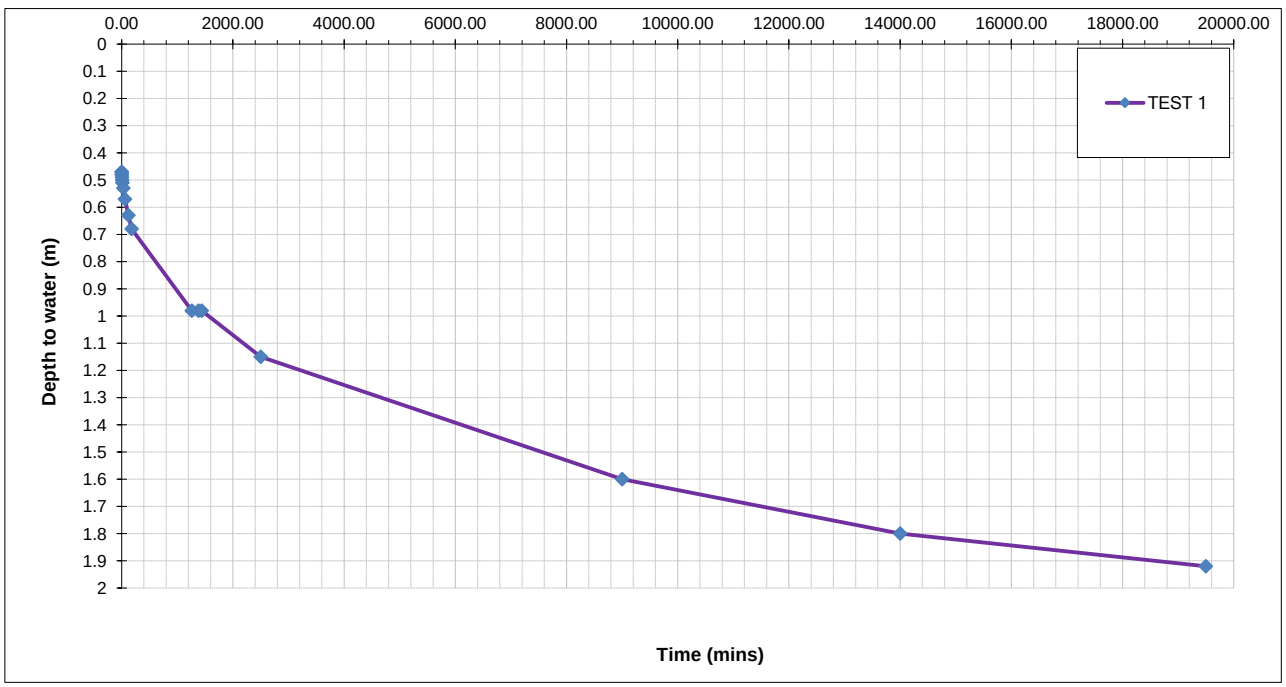
Site:	South Heywood Phase 4	**Trial Pit Number:**	SA102	
Job Number:	13-223	**Length:**	1.50	m
Date of Test:	30/04/2019	**Width:**	0.50	m
		Depth:	2.40	m
		Groundwater Level:	N/A	m

The test did not reach the 25% effective storage depth over the monitoring period; as such the data has been extrapolated.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.47				
1.00	0.47				
2.00	0.48				
3.00	0.48				
5.00	0.49				
10.00	0.5				
15.00	0.51				
30.00	0.53				
60.00	0.57				
120.00	0.63				
180.00	0.68				
1260.00	0.98				
1380.00	0.98				
1440.00	0.98				
2500.00	1.15				
9000.00	1.60				
14000.00	1.80				
19500.00	1.92				

Effective Storage Depth	m	1.93		
75% Effective Storage Depth	m	1.45		
(i.e. depth below GL)	m	0.95		
25% Effective Storage Depth	m	0.48		
(i.e. depth below GL)	m	1.92		
Effective Storage Depth 75%-25%	m	0.97		
Time to fall to 75% effective depth	mins	1150.00		
Time to fall to 25% effective depth	mins	19500.00		
V (75%-25%)	m3	0.72		
a (50%)	m2	4.61		
t (75%-25%)	mins	18350.00		
SOIL INFILTRATION RATE	m/s	**1.43E-07**		

DESIGN SOIL INFILTRATION RATE, f	**1.43E-07**



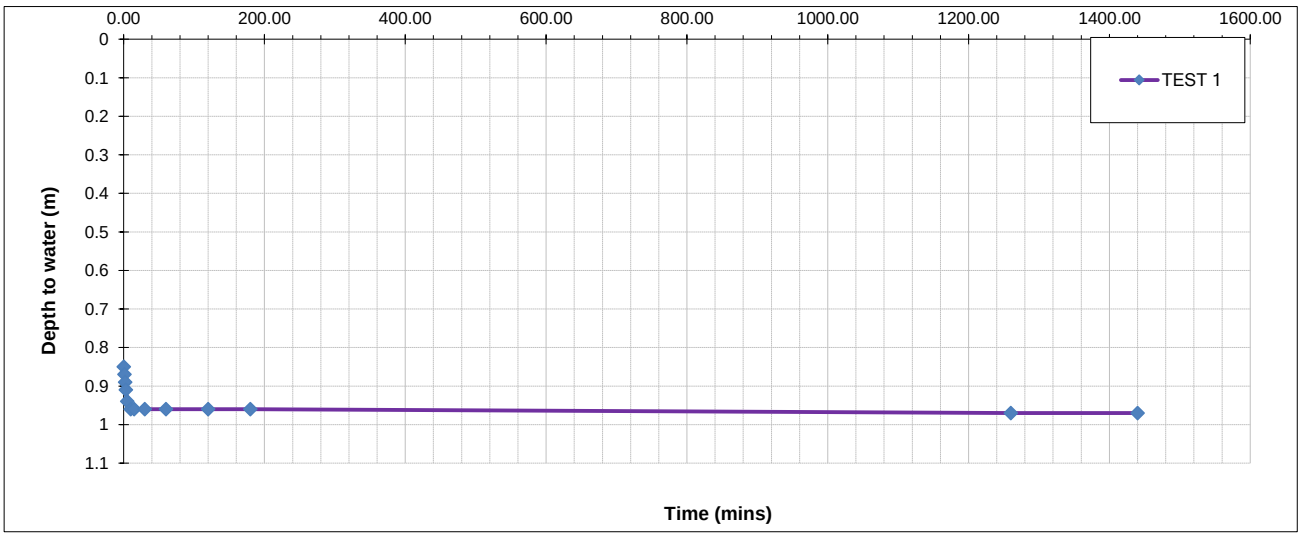
Site:	South Heywood Phase 4		**Trial Pit Number:**	SA103
Job Number:	13-223		**Length:**	1.60 m
Date of Test:	30/04/2019		**Width:**	0.50 m
			Depth:	2.40 m
			Groundwater Level:	N/A m

The test did not reach the 25% or 75% effective storage depth over the monitoring period; as such the test has failed.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.85				
1.00	0.87				
2.00	0.89				
3.00	0.91				
5.00	0.94				
10.00	0.96				
15.00	0.96				
30.00	0.96				
60.00	0.96				
120.00	0.96				
180.00	0.96				
1260.00	0.97				
1440.00	0.97				

		TEST 1	TEST 2	TEST 3
Effective Storage Depth	m	1.55		
75% Effective Storage Depth	m	1.16		
(i.e. depth below GL)	m	1.24		
25% Effective Storage Depth	m	0.39		
(i.e. depth below GL)	m	2.01		
Effective Storage Depth 75%-25%	m	0.78		
Time to fall to 75% effective depth	mins	N/A		
Time to fall to 25% effective depth	mins	N/A		
V (75%-25%)	m3	0.62		
a (50%)	m2	4.06		
t (75%-25%)	mins	N/A		
SOIL INFILTRATION RATE	m/s	**N/A**		

DESIGN SOIL INFILTRATION RATE, f **N/A**



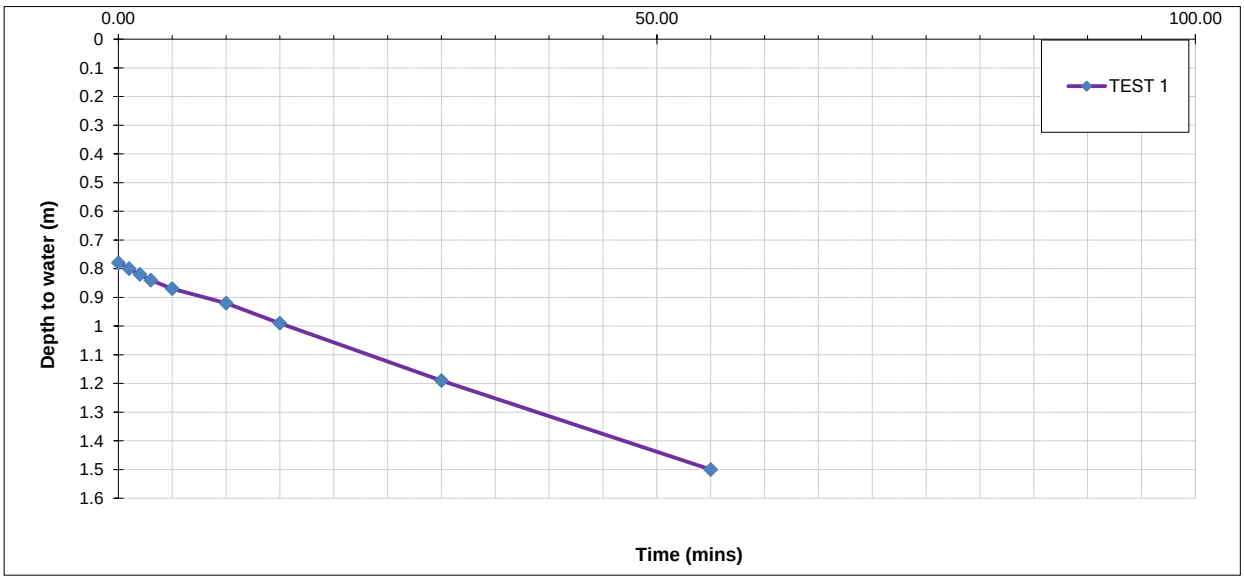
Site:	South Heywood Phase 4		**Trial Pit Number:**	SA104
Job Number:	13-223		**Length:**	1.40 m
Date of Test:	30/04/2019		**Width:**	0.50 m
			Depth:	1.50 m
			Groundwater Level:	N/A m

The test did not reach the 25% effective storage depth over the monitoring period; as such the data has been extrapolated.

TEST 1		TEST 2		TEST 3	
Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)	Time(min)	Depth to Water (m)
0.00	0.78				
1.00	0.8				
2.00	0.82				
3.00	0.84				
5.00	0.87				
10.00	0.92				
15.00	0.99				
30.00	1.19				
55.00	1.5				

Effective Storage Depth	m	0.72		
75% Effective Storage Depth	m	0.54		
(i.e. depth below GL)	m	0.96		
25% Effective Storage Depth	m	0.18		
(i.e. depth below GL)	m	1.32		
Effective Storage Depth 75%-25%	m	0.36		
Time to fall to 75% effective depth	mins	13.00		
Time to fall to 25% effective depth	mins	42.00		
V (75%-25%)	m3	0.25		
a (50%)	m2	2.07		
t (75%-25%)	mins	29.00		
SOIL INFILTRATION RATE	m/s	**7.00E-05**		

DESIGN SOIL INFILTRATION RATE, f	**7.00E-05**



APPENDIX XI

COAL MINING CONSULTANTS REPORT AND ABANDONMENT PLANS



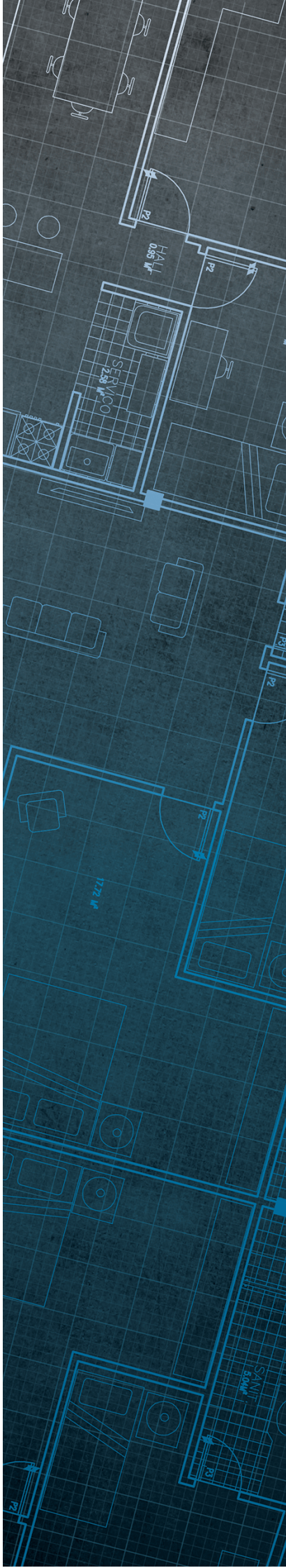
The Coal Authority

Consultants

Coal Mining Report

South Heywood Phase 4
Heywood
Rochdale
OL10 2LR

Date of enquiry:	**21 March 2019**
Date enquiry received:	**21 March 2019**
Issue date:	**21 March 2019**
Our reference:	**51002059407001**
Your reference:	**13223/NS/31888**



Consultants

Coal Mining Report

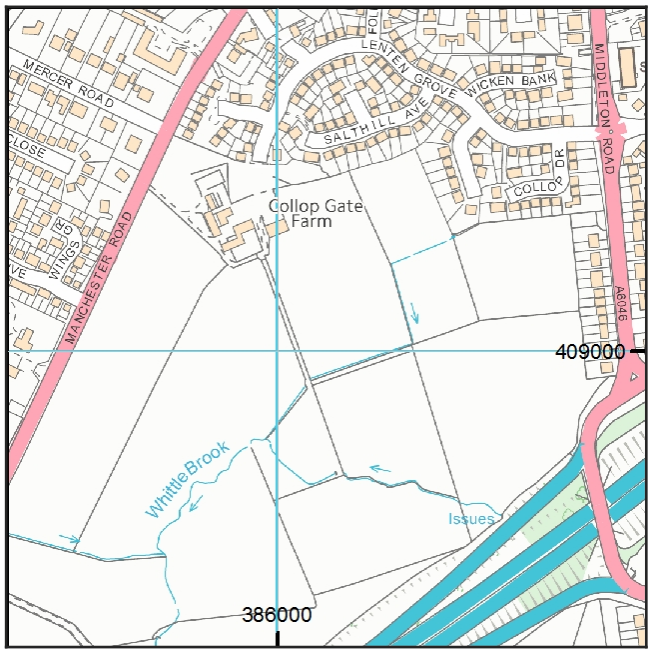
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

E3P

Enquiry address

South Heywood Phase 4
Heywood
Rochdale
OL10 2LR



Approximate position of property

Reproduced by permission of Ordnance Survey on behalf of HMSO. © Crown copyright and database right 2018. All rights reserved.

Ordnance Survey Licence number: 100020315

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

@coalauthority
/company/the-coal-authority
/thecoalauthority
/thecoalauthority

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	ARLEY	Coal	3XOC	19	Beneath Property	11.3	South-West	140	1900

Probable unrecorded shallow workings

Yes.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

Entry type	Reference	Grid reference	Treatment description	Mineral	Conveyancing details
Shaft	385408-001	385893 408989		Coal	
Shaft	385408-002	385797 408986		Coal	
Shaft	385409-001	385983 409013	This shaft was capped at ground level by the National Coal Board in 1978	Coal	
Shaft	385409-002	385909 409032		Coal	

Abandoned mine plan catalogue numbers

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

16820	4609	

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

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Copyright © 2019 The Coal Authority

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
None recorded within 50 metres of the enquiry boundary.

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

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.

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

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.

Copyright © 2019 The Coal Authority

The Coal Authority

Summary of findings

Reproduced by permission of Ordnance Survey on behalf of HMSO.
© Crown copyright and database right 2018. All rights reserved.
Ordnance Survey Licence number: 100020315
Map data

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

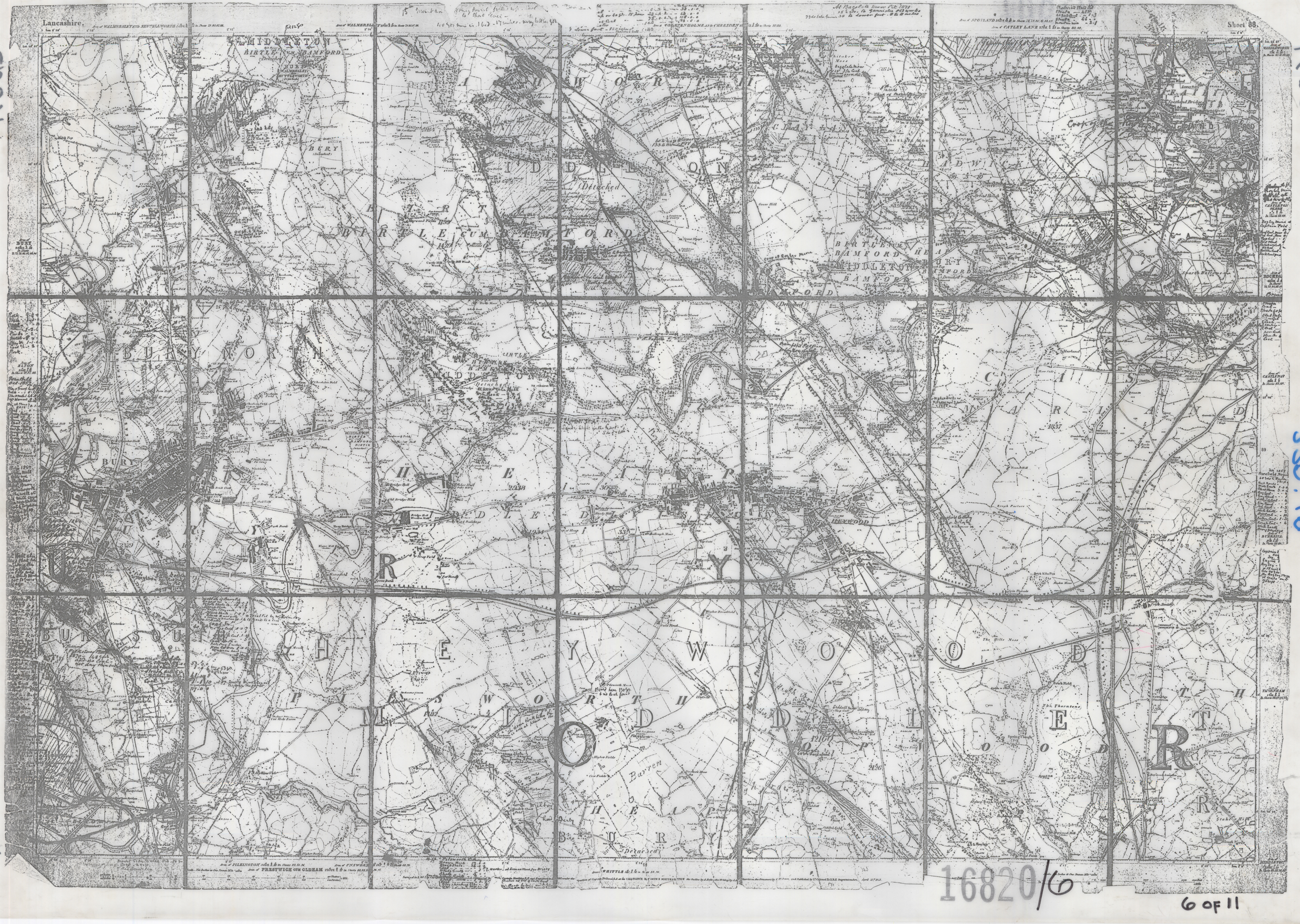
Key

Approximate position of the enquiry boundary shown

Disused mine shaft



How to contact us
0345 762 6848 (UK)
+44 (0)1623 637 000 (International)
www.groundstability.com



16820/6
6 OF 11

The Coal Authority

Catalogue No.: 16820 Sheet Info: 6 OF 11

Date: 05/07/2019

Scale: 1 TO 10560 (6 INCH TO 1 MILE)

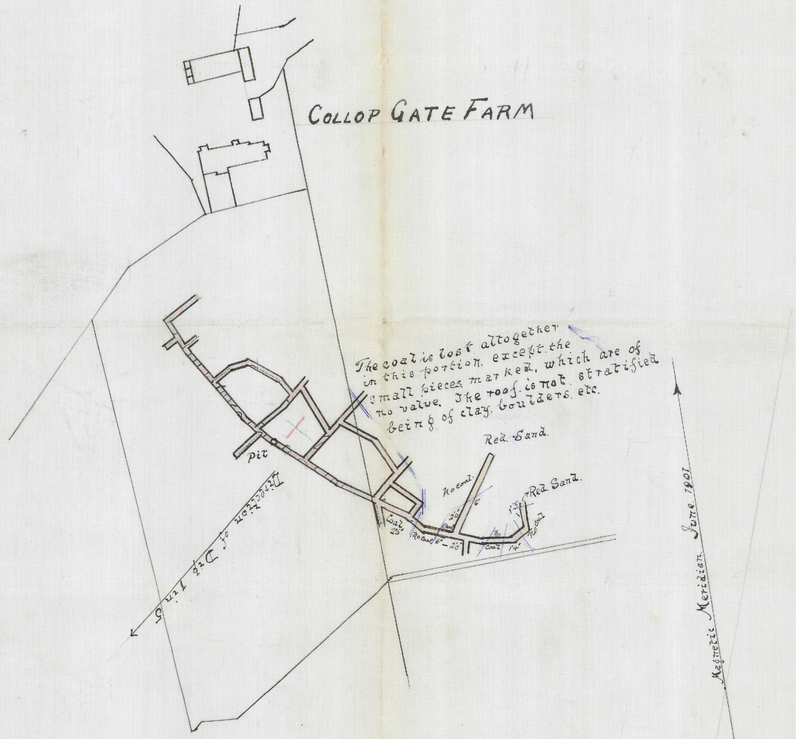
Database Right and Copyright, The Coal Authority 2003, Unauthorised Use Prohibited

Andrew Moore - The Coal Authority,200 Lichfield Lane,Mansfield,Notts,NG18 4RG,UK

All rights reserved. No part of any image supplied may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the Authority. By accepting and using this image you agree to be bound, without limitation or qualification, by the terms and conditions for the use of the Coal Authority Scanning Services which can be viewed at: www.coal.gov.uk/services/history/tc

HOPWOOD COLLIERY HEYWOOD

ROYLEY MINE



Section of Strata	Yds	ft	ins
Surface Soil.		2	6
Sandy Clay and Gravel	10	2	6
Grey Shale.	8	1	0
Black Shale.	6	1	0
COAL		1	11
Soft Dirty coal		.	7
COAL		2	0
DEPTH	27	2	6

The portions colored grey represent old workings.

Scale 30 yards to an Inch

This is an accurate plan of the Mine

W. W. Hilton.
Swadlincote
May 24th 1904

4609

4609

The Coal Authority

Catalogue No.: 4609 Sheet Info:

Date: 05/07/2019

Scale: 30 YARDS TO 1 INCH (1 TO 1080)

Database Right and Copyright, The Coal Authority 2003, Unauthorised Use Prohibited

Andrew Moore - The Coal Authority,200 Lichfield Lane,Mansfield,Notts,NG18 4RG,UK

All rights reserved. No part of any image supplied may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the Authority. By accepting and using this image you agree to be bound, without limitation or qualification, by the terms and conditions for the use of the Coal Authority Scanning Services which can be viewed at: www.coal.gov.uk/services/history/tc

The Coal Authority, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire NG18 4RG www.coal.gov.uk