

Trinity Academy, Barnsley – Temporary School

Supplementary Geo-Environmental Assessment

March 2021

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Comments

13.1.3	Draft – to be updated upon completion of ground gas monitoring

Comments

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1. Introduction

1.1 Objectives and Brief

Waterman Infrastructure & Environment Limited ('Waterman') was instructed by Turner & Townsend to undertake a Supplementary Geoenvironmental Assessment for the Temporary School proposed as part of the redevelopment of the former playing field adjacent to the A6133 Broadway at the Keresforth Centre NHS Facility, Barnsley. The main objectives of the report are to:

- Provide an exploratory investigation as defined by BS10175 (2011+A2:2017);
- Develop a refined conceptual site model based on the investigation, including a decision record for the development of the model;
- Assist in discharging planning conditions relating to the investigation and remediation of contaminated land;
- Derive representative geotechnical parameters in accordance with Eurocode 7 and characterize the ground for the purposes of geotechnical design;
- Provide an assessment of suitable foundation types for the proposed development;
- Assess the suitability of materials arising in earthworks activities for re-use on site or disposal;
- Provide a preliminary waste classification of the likely waste soils;
- Provide an initial assessment of mining risk and advice relating to the stabilisation of shallow workings/shafts affecting the site;
- Investigate pavement design and provide CBR values at selected locations at formation level;
- Provide an assessment of hazardous gas risk in accordance with CIRIA Report C665 / BS8485 and preliminary recommendations relating to protective measures required in foundations (if any); and
- Allow feasible remediation options to be evaluated and determine the most appropriate remediation strategy to be developed.

This assessment has been undertaken in general accordance with the Land Contamination Risk Management (Environment Agency, October 2020) guidance and forms a decision record in relation to the assessment of the site. The report also provides a refined conceptual model based on the findings of the ground investigation, an evaluation of potential risks and recommendations relating to any necessary remediation.

The assessment was undertaken in accordance with the scope agreed between Waterman and Turner & Townsend, as documented in Waterman's fee letter, and with Waterman's standard Terms of Appointment. The benefit of this report is made to Turner & Townsend.

1.2 The Proposed Development

The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site and associated infrastructure including a hard surfaced car park, playground and access road.

The proposed development is presented on Watson Batty Architects Drawing Ref: TRNTY-WBA-NB-00-DR-A-PL-101 P1, included in Appendix A.

1.3 Limitations

The information contained in this report is based on the findings of the Preliminary Environmental Risk Assessment (Report Ref. WIE17125-100-R-1.2.1-RJM), the Coal Mining Risk Assessment (Report Ref. WIE17125-100-R-7-1-3-CMRA), and the Geoenvironmental Assessment for the permanent school (Report Ref: WIE17125-100-R-8.1.3-Geoenv), observations made on site, exploratory hole records, laboratory test results, groundwater monitoring and ground gas monitoring.

The ground conditions reported relate only to the point of excavation and do not necessarily guarantee a continuation of the ground conditions throughout the non-inspected area of the site. Whilst such exploratory holes would usually provide a reasonable indication as to the general ground conditions, these cannot be determined with complete certainty.

Waterman has endeavoured to assess all information provided to them during this investigation, but makes no guarantees or warranties as to the accuracy or completeness of this information.

The scope of this site investigation includes an assessment of the presence of asbestos containing materials in the ground at the site but not within buildings or structures or below ground structures (basements, buried service ducts and the like).

The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

2. Outline Conceptual Model

The outline conceptual model is contained in the Preliminary Environmental Risk Assessment (Ref. WIE17125-100-1.2.1-RJM) and is summarised below.

2.1 Anticipated Ground Conditions

The anticipated ground conditions are summarised in Table 1.

Table 1: Ground conditions

Stratum	Area Covered	Depth to Top of Stratum (m bgl)	Typical Description
Made Ground or Topsoil	Entire Site	0 to 1.0m – deeper in the west	Topsoil over colliery waste or soft brown clay with fragments of brick, concrete and pottery
Glacial Till	Entire Site	0.45 to 1.06	Soft to firm grey laminated sandy clay with silt partings and bands of medium-coarse gravel.
Pennine Middle Coal Measures Formation	Entire Site	1.5 to 2.7	Interbedded hard, grey siltstone with bands of soft mudstone, and black coal shale.

A large area in the west of the Site is indicated to be underlain by Made Ground on the BGS mapping.

A geological fault crosses the northern area of the Site trending from north east to south west and downthrowing to the south. The Barnsley Coal is indicated to subcrop beneath the north of the Site, to the north of the fault. The Barnsley Coal is shown to subcrop approximately 100m to the west of the Site, to the south of the fault. Based on the thickness of the Barnsley Coal Seam and its depth from surface, a risk of surface instability is presented should any workings be present.

The Barnsley Rider Coal is shown to subcrop beneath the eastern site boundary and, given the regional dip direction to the east, is not considered to be present beneath the vast majority of the Site, including the areas proposed for development.

Seams of the Pennine Lower Coal Measures are thought to be present at greater depth, including the Flockton Thick, Fenton, Parkgate, Thorncliffe and Silkstone coal seams. These deeper seams are also thought to have been worked in the vicinity of the Site, but any workings are unlikely to impact the proposed development due to their depth.

2.2 Mining

Located within the Yorkshire Coal Field; parts of the Site are located in a Coal Authority High Risk Development Area. A Coal Mining Risk Assessment (Reference WIE17125-100-R-7.1.3-CMRA, dated October 2020) was therefore completed for the Site as part of the Phase 1 works. This report indicates that the Barnsley Coal Seam sub-crops below the north of the Site and is likely to be present at shallow depth beneath a large proportion of the Site. The seam is recorded to have been worked beneath some areas of the Site, with suspected, but unrecorded, workings likely to be present beneath a larger area of the Site. These workings are likely to be at a sufficiently shallow depth that they present a risk of surface instability. Intrusive ground investigation, including rotary coring, was therefore recommended to positively confirm the depth and condition of the Barnsley Coal Seam below site down to a maximum 30m bgl.

The Coal Mining Risk Assessment identifies that remedial works have previously been undertaken in the area of the playing fields. These comprised the infilling of collapsed ground. It is considered that this may be associated with the collapse of a shallow mine entry in this area. Three roadways were noted to extend away from the base of the collapsed ground; however, these were not treated at the time of the remedial works.

The potential presence of further unrecorded mine entries in the western half of the site cannot be discounted and it is recommended that a watching brief for mining related features is maintained during construction works.

2.3 Unexploded Ordnance (UXO)

A UXO Risk Assessment has been prepared by 1st Line Defence (Report Ref: DA11373-00, Dated: 24/06/2020), which has assessed that there is an overall Low Risk from German and anti-aircraft unexploded ordnance at the site. There is an assessed Negligible Risk from Allied ordnance. The Risk Assessment recommends that a UXO Risk Management Plan is prepared for the Site and that Site Specific UXO Awareness Briefings are given to all personnel conducting intrusive works.

2.4 Potentially Significant Pollution Linkages

Potentially significant linkages between contamination hazard sources and relevant receptors are summarised below:

- The accumulation of ground gas and vapours associated with shallow mine workings were considered to pose a medium risk to site end users;
- Windbourne, potentially contaminated, dust and runoff from contaminated materials were considered to pose a medium risk to off site receptors, including nearby residents;
- Direct contact and ingestion, inhalation of dust, and the accumulation of ground gas as a result of potentially contaminated Made Ground being present was identified to pose a medium risk to construction workers;
- Potentially contaminated Made Ground was considered, through direct contact, to pose a medium risk to site structures and services;
- Construction materials stored on site were considered to pose a medium risk to surface water course 26m to the south of the Site, due to the potential for spills to migrate through surface run-off.

3. Methodology

The intrusive investigation was undertaken in general accordance with Eurocode 7, the Code of Practice for Ground Investigation BS 5930 (2015) and the Code of Practice for the Investigation of Potentially Contaminated Sites and its Investigation BS 10175 (2011).

The objectives of the investigation are to characterise the ground conditions, the hazard sources, pathways and receptors and to reduce uncertainties associated with the proposed redevelopment.

3.1 Design of Investigation

Sampling locations were carefully selected in order to characterise the features identified in the conceptual model and to target, as far as possible, potentially contaminated areas identified in the Preliminary Environmental Risk Assessment.

A summary of the investigation locations and features investigated is presented in Table 2: Ground Investigation Strategy.

Table 2: Ground investigation strategy

Layer / Target feature	Exploratory Holes	Monitoring Wells	Comments
Made Ground	All holes	-	No Made Ground of sufficient depth encountered to allow for the installation of monitoring standpipes.
Potential shallow mine workings	RC201, RC202, RC203, RC204	RC202, RC203, RC204	-
Area of remedial works and associated roadways	TT201, TT202, TT203, TT205, TT206	-	-
Areas of indicated fill on BGS maps	TT201 – TT212	-	-
Geotechnical design of proposed structure	RC101, RC102, RC103, RC104	RC101, RC102, RC103, RC104	-

3.2 Quality Control

A Waterman Geo-Environmental Engineer monitored the performance, quality of work and health and safety compliance throughout the investigation period. Samples were despatched in batches on a daily basis under a chain of custody procedure to Element who are a UKAS accredited laboratory, for subsequent chemical analysis. Where appropriate, samples were stored within cool boxes containing ice packs.

Soil samples taken for geotechnical testing were transported to Professional Soils Laboratory for analysis.

All contractors, including laboratories, used during this project have been approved by Waterman as a part of in-house Integrated Management System (BS ISO 9001, BS ISO 14001) procedure. This requires all third parties to demonstrate competence and a high standard of work during a regular audit scheme.

3.3 Health and Safety

All work carried out on site was in accordance with Groundtech Consulting Ltd's Construction Phase Health and Safety Plan (Ref: GRO-20063-1788, Dated: September 2020).

4. Fieldwork

The works were procured to Groundtech Consulting and the main activities and supervision, are shown in chronological order of the works undertaken in Table 3.

Table 3: Summary of fieldwork activities

Phase of Work.	Activity	Contractor	Date	Supervision
Service survey	Scanning for services	Groundtech Consulting	25th January 2021 – 1st February 2021	Waterman
Ground Investigation	4No. rotary boreholes to 20.0m bgl max. depth			
	13No. trial trenches to 4.0m bgl max. depth using a 21tn excavator			
Monitoring Well Installation	4No. monitoring wells to a maximum depth of 15.0m bgl			
Groundwater and Ground Gas Monitoring	Monitoring, sampling and analysis of four wells on six occasions		February – April 2021	

Note: m bgl = metres below ground level

4.1 Constraints

There were no restrictions to the location of boreholes at their proposed locations, however, due to wet ground it was necessary to use a tracked dumper to move the drilling rig to the location of the boreholes.

The locations of the exploratory holes excavated are shown in Waterman Drawing Ref: 17125-100-WIE-ZZ-XX-DR-V-80-003-P02 in Appendix A.

4.2 Soil Sampling

During excavation, samples for chemical analysis were placed on plastic sheeting to prevent cross-contamination of soil. Representative soil samples were obtained from the exposed strata and sealed in one litre plastic tubs with airtight lids, phials and glass jars containing preservatives, as appropriate. The soil samples taken were subject to screening by a photo ionisation detector (PID).

Disturbed and undisturbed samples were taken at regular intervals and retained for geotechnical and geo-environmental testing and logging.

4.3 Monitoring Wells

On completion of drilling, a 50mm diameter slotted HDPE standpipe with gas tap and bung was installed in four of the exploratory holes to enable future ground gas and groundwater monitoring and sampling. The response zone of the wells was within the shallow natural strata. The intake section comprised a slotted pipe with a geotextile sock. The boreholes are kept sealed by a lockable secure cap at ground level.

4.4 Groundwater Monitoring

Groundwater monitoring is to be carried out during six monitoring visits over a period of three months. Two monitoring visits have been completed to date. Prior to the monitoring being undertaken, each well was developed by high-rate pumping for 1h.

The presence of hydrocarbon free product on the groundwater was investigated using a free phase dip-meter using a disposable bailer, which did not show evidence of a hydrocarbon sheen on the surface.

There was insufficient water in the monitoring installations to allow groundwater samples to be obtained.

A set of groundwater monitoring results, including the model type and detection limits of the on-site equipment used for the fieldwork, is presented in Appendix C.

4.5 Ground Gas Monitoring

Ground gas monitoring is to be carried out during six monitoring visits over a period of three months. Two monitoring visits have been completed to date. The ground gas monitoring was undertaken when the barometric atmospheric pressure was 986mb to 1002mb. On each of the monitoring visits, the peak and steady concentration readings of methane, carbon dioxide and oxygen were recorded at each installed monitoring standpipe, together with borehole gas flow readings and atmospheric pressure. This was undertaken using an infrared gas analyser, gas flow data monitor and flame ionisation detector. Groundwater levels were also measured on each visit.

A set of ground gas monitoring results, including the model type and detection limits of the onsite equipment used for the fieldwork, is presented in Appendix C.

5. Results

Detailed logs of the strata encountered, together with records of the samples taken during both trial pitting and borehole installation and PID readings, are provided in Appendix B. A summary of the geological strata and manmade underground structures encountered is presented below.

5.1 Geological Strata

The strata encountered in the investigation were generally consistent with the anticipated geology identified in the Preliminary Environmental Risk Assessment, however, the indicated Made Ground on the BGS Geological Map was not encountered. A summary of the geological strata encountered is shown in Table 4.

Table 4: Geological strata encountered

Soil Type	Depth of Top of Stratum (m bgl)	Thickness (m)	Typical Description
Made Ground	0.0m	0.18 - 0.80m	Grass over dark grey to black sandy gravelly clayey Topsoil with gravel of sandstone, coal, ceramic, glass and siltstone. Soft to firm orange brown sandy gravelly Clay with gravel of coal, sandstone and siltstone present beneath the Topsoil in the south of the Site.
Glacial Till	0.30 - 0.80m	absent - 1.66m	Firm to stiff medium to high strength orange brown mottled grey sandy gravelly silty Clay. Gravel is angular to sub-rounded fine to medium of coal and sandstone.
Pennine Middle Coal Measures Formation	0.18 – 2.00m	>19.66m	Interbedded brown to grey sandstone and siltstone with bands of soft mudstone. Extremely to moderately strong brown to light grey fine to medium grained Sandstone highly weathered, recovered as slightly sandy slightly clayey angular to subangular fine to coarse gravel and tabular cobbles of sandstone. Open vertical fractures identified in the Sandstone in trial trenches in the east of the Site. Extremely weak to weak grey Mudstone and Siltstone, highly weathered with horizontal rough planar closely spaced discontinuities and small-scale bedding structures present.

5.2 Underground Structures and Obstructions

TT202 was located to identify and investigate an area of historical remedial works detailed in the Coal Mining Risk Assessment. Whilst TT202 did not identify the area of the infilled 18" diameter "shaft", it did reveal one of the roadways identified to extend from the shaft. The top of the tunnel was 2.1m bgl in the northeast elevation of the trench and at 3.0m bgl in the south west elevation of the trench, indicating the roadway to be sloping down to the south west. The tunnel was approximately 1.5m wide and the base of the tunnel not identified in the 4.0m deep trial trench. This feature was also identified in TT203, with the top of the roadway present at 0.6m bgl, covered by a number of large sandstone blocks. The base of the

roadway was not identified in the 3.4m deep trial trench. A number of trial trenches were terminated at shallow depths due to the presence of bedrock. These are detailed in the trial trench logs included within Appendix B.

5.3 Potential Sources of Contamination

Historically, coal seams were present and mining activities were undertaken on-site. Evidence of historical mine workings has been encountered at the Site, with a suspected mine shaft encountered in TP110 during the initial phase of ground investigation in close proximity to the proposed temporary school. Further evidence of mining was encountered during this supplementary ground investigation, with a roadway being identified in TT202 and TT203 at shallow depth beneath the north of the Site and broken ground and voids being identified in RC201, RC202, RC203 and RC204 beneath the proposed temporary school building.

5.4 Chemical Analysis

The laboratory test results are presented in Appendix E.

5.5 Asbestos

Seven samples of Made Ground were screened for asbestos and no asbestos was recorded on-site. No visually identifiable asbestos containing materials was recorded during the ground investigation.

5.6 Visual and Olfactory Evidence of Contamination

Visual evidence of coal was observed within the Topsoil and shallow Made Ground across the Site.

Seepage of groundwater with a faint sheen was noted in trial trench TT203, possibly associated with the roadway identified in this trench.

Soil headspace analysis recorded a peak concentration of 1ppm in TP112. The relatively low soil headspace analysis concentrations indicates the volatile component of contamination is not significant.

5.7 Groundwater Levels

No groundwater strikes were observed during the ground investigation, other than the seepage noted at 3.1m bgl in TT203. Groundwater has also been identified in limited volumes during post-fieldwork monitoring and it has not been possible to obtain groundwater samples for chemical analysis.

Groundwater levels were monitored on two occasion during the site works and subsequent monitoring visits, the results of which are included in Appendix C. No groundwater was recorded during the two monitoring visits undertaken to date.

It should be noted that levels are likely to fluctuate dependant on the time of year and prevailing weather conditions.

5.8 Ground Gas

As part of the ground investigation, the installed boreholes have been monitored on two occasions at in order to detect the presence of ground gas. A further four monitoring visits are proposed. The design of the borehole installation resulted in gas concentrations being recorded from the shallow natural deposits (RC201) and suspected mine workings in RC202, RC203 and RC204.

During each monitoring visit, the following parameters were recorded:

- Methane (peak and steady state conditions);
- Carbon dioxide (peak and steady state conditions);
- Oxygen (lowest and steady state);
- Borehole gas flow rates; and
- Groundwater levels.

A set of ground gas results is included within Appendix C. Below Table 5 summarises the peak carbon dioxide and methane gas results recorded for each of the boreholes.

Table 5: Ground gas monitoring summary

Monitoring Point	Peak Gas Concentration (%)			Steady Gas Concentration (%)			Steady Gas Flow Rate (l/hr)
	CH_4	CO_2	O_2	CH_4	CO_2	O_2	
Round 1							
RC201	<0.1	<0.1	20.8	<0.1	<0.1	20.8	<0.1
RC202	<0.1	<0.1	20.7	<0.1	<0.1	20.7	<0.1
RC203	<0.1	0.9	19.6	<0.1	<0.1	20.8	<0.1
RC204	<0.1	0.8	19.7	<0.1	<0.1	20.7	-0.1
Round 2							
RC201	<0.1	<0.1	20.0	<0.1	<0.1	20.1	<0.1
RC202	<0.1	<0.1	20.6	<0.1	<0.1	20.7	<0.1
RC203	<0.1	1.2	16.7	<0.1	<0.1	20.5	<0.1
RC204	<0.1	0.9	17.6	<0.1	<0.1	20.5	<0.1

6. Geotechnical Testing

6.1 In-Situ Testing

6.1.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken at regular intervals in the shallow deposits within the boreholes to provide 'N' values for empirical assessment of strength and density parameters. Detailed results of the SPT tests and blow counts are included on the borehole logs included in Appendix B and a summary is presented in Table 6:

Table 6: Standard penetration test results

Stratum / Geological Origin	Range of SPT 'N' Values	Number of Tests	Comments	Derived Values Range of φ' or cu
Weathered Pennine Middle Coal Measures	>50	2	Extremely weak sandstone recovered as sandy clayey Gravel of sandstone	φ' = >43°

6.1.2 Hand Vane Tests

Hand vane tests were undertaken within the trial pits to provide strength parameters for the shallow soils. Detailed results of the hand vane tests are included on the trial pit logs included in Appendix B and a summary is presented in Table 7 below:

Table 7: Hand vane test results

Stratum / Geological Origin	Range of shear strength values	Number of Tests	Comments
Glacial Till	76 – 102kPa	4	High strength Clay

6.2 Laboratory Testing

Representative soil samples were scheduled for:

- Natural moisture content and plasticity index;
- Particle Size Distribution testing;
- Compaction Testing;
- Unconfined Compressive Strength Testing;
- Point Load Strength Testing; and,
- pH value and water soluble sulphate (SD1 Suite).

The results are summarised below and presented in Appendix D.

6.2.1 Natural Moisture Content and Plasticity Index

1No. sample of natural cohesive material was scheduled for moisture content and plasticity index determinations. The test results are included in Appendix D and are summarised in Table 8.

Table 8: Atterberg Limit test results

Stratum / Geological Origin	Sample Loc & Depth	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	% passing 425 microns	Comments
Glacial Till	TT212 at 1.0m	37	19	18	96	Cohesive

The modified plasticity index can be used as an indicator of volume change potential of the soil and is calculated as the plasticity index of the soil multiplied by the fraction of particles less than 425µm.

Table 9: Volume change potential

Stratum / Geological Origin	Range of Plasticity Indices % (Modified)	Volume Change Potential
Glacial Till	17	Low

6.2.2 Particle Size Distribution Testing

Particle Size Distribution (PSD) testing was undertaken on 1No. sample of the Glacial Till to allow the materials to be classified. The results of the PSD tests are presented within Appendix D and summarised within Table 10.

Table 10: Summary of Particle Size Distribution Test Results

Stratum / Geological Origin	Sample Loc & Depth	Cobbles (%)	Gravel (%)	Sand (%)	Silt / Clay (%)
Glacial Till	TT211 at 1.0m	0	4	18	78

6.2.3 2.5kg Dry Density / Moisture Content Relationship Testing

Dry Density / Moisture Content Relationship testing was undertaken on a total of 3No. samples of the shallow soils to assess the feasibility of re-compaction of material at the site. The results of the compaction tests are presented within Appendix D and summarised within Table 11 below.

Table 11: Dry Density / Moisture Content Relationship Results

Stratum / Geological Origin	Sample Loc & Depth	Maximum Dry Density (Mg/m³)	Initial Moisture Content %	Optimum Moisture Content %	> 95% of MDD?	<5% air voids?
Glacial Till	TT211 – 1.0m	1.81	18	15	Y	Y
Weathered Pennine Middle Coal Measures	TT205 – 0.5m	1.90	12	12	Y	Y
	TT206 – 0.5m	1.89	10	13	Y	N

The compaction data has been assessed by comparing the results against criteria commonly used in earthworks to achieve an adequate density for engineered fills. The criteria summarised in the above table indicate whether the samples could achieve in excess of 95% of maximum dry density (a requirement often included in highways specifications) and whether they could be compacted to less than 5% air voids ratio (a requirement applied where raft foundations are to be adopted).

6.2.4 Unconfined Compressive Strength

Unconfined Compressive Strength (UCS) tests were undertaken to inform an of the strength of the bedrock present beneath the Site. The results of the UCS tests are presented within Appendix D and are summarised in Table 12.

Table 12: Unconfined Compressive Strength Tests

Stratum	Unconfined Compressive Strength (MPa)	Comments
Pennine Middle Coal Measures	5.7 – 21.7	Weak Sandstone and Mudstone

The results of UCS testing should be utilised with caution as the in-situ strength characteristics of the rock are likely to be determined more by the aperture and spacing of discontinuities rather than the strength of the rock itself.

6.2.5 Point Load Strength

Where it was not possible to take a suitable sub-sample for UCS testing, Point Load Tests were undertaken to further inform an assessment of the strength of the bedrock present beneath the Site. The results of the Point Load tests are presented within Appendix D and summarised in Table 13.

Table 13: Point Load Strength Tests

Stratum	$I_{s(50)}$ (MPa)	Approximate unconfined compressive strength (MPa)	Comments
Pennine Middle Coal Measures	0.02 – 1.85	0.34 – 31.45	Extremely weak to medium strong, typically very weak Sandstone and Mudstone

A factor of 17 has been applied to the $I_{s(50)}$ to determine an approximate unconfined compressive strength from the Point Load test results (from Hoek and Bray 1982). As with the UCS results, the results of Point Load tests should be utilised with caution as the in-situ strength characteristics of the rock are likely to be determined more by the aperture and spacing of discontinuities rather than the strength of the rock itself.

6.2.6 pH Value and Water Soluble Sulphate (SD1 Suite)

The Aggressive Chemical Environment for Concrete classifications for the soil types identified at the site have been determined in accordance with BRE Special Digest 1:2005 (SD1). SD1 requires that sites are first identified as being in one of four categories based on natural ground / 'Brownfield' conditions and pyrite content. The site has been categorised as: Brownfield - pyritic.

The results of laboratory testing are included in Appendix D and summarised in Table 14.

Table 14: Summary of SD1 suite analysis

Stratum / Geological Origin	Characteristic Water Soluble Sulphate Value (mg/l SO_4)	Characteristic pH Value
Made Ground	27	7
Glacial Till	13	7

Stratum / Geological Origin	Characteristic Water Soluble Sulphate Value (mg/l SO_4)	Characteristic pH Value
Pennine Middle Coal Measures	78	7

As the characteristic value of sulphate is less than 3,000mg/l and the characteristic pH is greater than 5.5, the concentrations of magnesium, nitrate and chloride are not considered significant in determining the design sulphate class.

6.3 Excavations and Trench Shoring

All trenches should be excavated in accordance with CIRIA Report 97 'Trenching Practice'. Comments relating to the stability of excavations (i.e. trial trenches) and groundwater seepages are included in the logs in Appendix B and a summary of the stability is provided in Table 15.

Table 15: Stability of excavations and groundwater flows

Stratum / Geological Origin	Stability / Seepages	Comments
Made Ground	No seepages noted, other than seepage at 3.1m bgl in TT203. Trial trenches were generally stable, however, trench instability noted in east of site in sandstone with open fractures. Tunnel identified in TT202 and TT203 noted to be unstable. Instability and perched groundwater associated with historical mining features should be anticipated.	Shallow excavations (<1.2m) are likely to be stable in the short term. Excavations in soft/loose/water bearing strata likely to require shoring to maintain stability. Simple sump pumping may be required to control moderate groundwater seepages.
Glacial Till	No seepages or instability noted.	Shallow excavations (<1.2m) likely to be stable in the short term.

7. Generic Environmental Assessment Criteria

The information requirements for generic quantitative risk assessment will depend on:

- The substance being assessed;
- The receptors being considered;
- The pathways being considered; and
- The complexity of the site.

The outline conceptual model developed for the Site has identified potential contaminant linkages. These potential contaminant linkages have been investigated and the results assessed against generic assessment criteria. The generic assessment criteria selected for each potential contaminant linkage are summarised in Table 16 below:

Table 16: Generic assessment criteria

Source	Pathway	Receptor	Generic Assessment Criteria
Potential contamination in Made Ground and shallow soils from land uses surrounding the Site.	Dermal contact, inhalation and ingestion of contamination in shallow soils and windborne dust.	Future Site residents/users Off-site users	Generic Assessment Criteria for residential land use without plant uptake. Category 4 Screening Levels (C4SLs), LQM/CIEH S4ULs (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3060. All rights reserved), CL:AIRE (2009) PAH assessment using Benzo(a)pyrene surrogate marker assessment
Contamination in Made Ground, shallow soils, and shallow groundwater.	Migration through Glacial Till to nearby watercourses.	Secondary A Aquifers (Glacial Till and Pennine Coal Measures)	UK Drinking Water Standards and Environmental Quality Standards for freshwater
Ground gas from Worked Coal Seams Vapours from Worked Coal Seams	Ingress into structures. Risk of explosion and asphyxiation. Off-site migration of contamination.	Future Site residents/users Future on-site structures Off-site users Off-site structures	Preliminary Gas Screening Value determination and assessment in accordance with CIRIA C665 and BS8485:2015+A1:2019 and CL:AIRE Technical Bulletin 17 Semi-quantitative risk Assessment for vapours utilising PID measurements alongside soil and groundwater contamination results in accordance with CIRIA C682 and BS8576: 2013.
Potential contamination in Made Ground and shallow soils from land uses surrounding the Site.	Direct Contact	New water supply pipes	Water Regulations Advisory Scheme Information and Guidance Note UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites
Potential contamination in Made Ground and shallow soils from land uses	Contact with building foundations and buried services	Future on-Site structures and services.	BRE Special Digest 1: 2005 Concrete in Aggressive Ground.

Source	Pathway	Receptor	Generic Assessment Criteria
surrounding the Site.			
Potential contamination in Made Ground and shallow soils from land uses surrounding the Site. Windborne dust from stockpiled soils and bare earth surfaces during construction	Dermal contact, ingestion and inhalation	Construction Workers	Qualitative Risk Assessment

The generic assessment criteria used in this report are included in Appendix G.

7.1 Site Specific Information used to Support the Generic Risk Assessment

The site specific information used to support the generic risk assessment undertaken as part of this investigation are described in the sections below:

Human Health Risk

Future Site Users

The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site and associated, hard surfaced car park and playground, and access road. Given the proposed end use for the Site the contaminants will be assessed against the Residential without plant uptake land use. This will be a highly conservative assessment given the current proposed Development and will be used to give additional context to the contamination magnitudes recorded.

Construction Workers

A qualitative assessment of the risk to construction workers will be undertaken.

Off-site Residents and Users

Risks to off-site residents and users was assessed qualitatively through review of the recorded ground investigation information and the Site's and surrounding areas environmental setting.

Controlled Waters

Sensitive controlled water receptors identified include; a small watercourse 100m south-east and Secondary A Aquifers in Glacial Till and Pennine Middle Coal Measures strata. Groundwater and surface water abstractions are absent within a 1km radius of the Site.

Groundwater in the superficial and bedrock deposits are potentially in hydraulic continuity with the water course. Potable groundwater receptors are absent on-site or in the surrounding area, groundwater samples will therefore be assessed against the lowest value for each contaminant as given in the UK Drinking Water Standards (DWS) and the Environment Agency (EA) Environmental Quality Standards (EQS). The

assessment against the lowest values of the DWS and EQS will be used as an indication of the groundwater's contamination status given the small watercourse.

Re-use of Topsoil

Potential re-use of topsoil is possible and could pose a risk to future Site residents/users, off-site users, future on-Site and off-site structures, and construction workers. Testing for phytotoxic contaminants will be undertaken in accordance with methods specified in BS3882:2007.

Ground Gas

Potential receptors of ground gas generation are future Site residents/users, off-site users, future on-Site and off-site structures, and construction workers.

The potential risk arising from ground gas to the development was assessed using the approach recommended in CIRIA C665, BS 8485:2015+A1:2019, and BS 8576: 2013.

Vapours

A semi-quantitative approach was used to assess risks from vapours in accordance with CIRIA C682. Concentrations of hydrocarbon vapours (ppm) have been recorded in monitoring wells using a PID. Soil headspace testing has been used to supplement the vapour monitoring along with analysis for VOCs and SVOCs in soil and groundwater samples.

Off-site structures

Risks to off-site structures from contamination in groundwater, ground gases and vapours was assessed through analysis of soil, groundwater, ground gas and vapour concentrations on-Site, assessment of the hydrogeological regime at the Site and potential for off-site migration of contamination, ground gas and vapour.

8. Quantitative Environmental Risk Assessment – Risk Estimation

8.1 Regulatory Context

This assessment has been undertaken in general accordance with the Land Contamination Risk Management (Environment Agency, October 2020) guidance. The environmental risk assessment includes the following:

- outline preliminary Conceptual Model, as detailed in the PERA;
- results of Intrusive Ground Investigation;
- confirmation of Generic Assessment Criteria used to assess risks;
- assessment of results against Generic Assessment Criteria;
- formulation of an updated Conceptual Model for the Site;
- identification of potentially unacceptable risks; and
- recommendations for further action.

This report forms a decision record for the contaminant linkages identified, the generic assessment criteria used to assess risks, the unacceptable risks identified and the proposed next steps in relation to the site. The report also provides an explanation of the refinement of the outline conceptual model following the ground investigation, the selection of criteria and assumptions, the evaluation of potential risks and the basis for the decision on what happens next.

The Site comprises a former playing field adjacent to the A6133 Broadway. The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site and associated, hard surfaced car park and playground, and access road.

The National Planning Policy Framework (NPPF) 2019 sets out Government planning policy for England and how this is expected to be applied to development. Paragraph 118 of Section 11 – Making effective use of land and paragraphs 170, 178, 179 and 183 of Section 15 – Conserving and enhancing the natural environment of the NPPF relate to contaminated land matters and state the following:

118. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land;

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

178. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

179. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

In order to assess the contamination status of the Site, with respect to the proposed end use, it is necessary to assess whether the Site could potentially be classified as "Contaminated Land", as defined in Part IIA of the Environmental Protection Act 1990 and Contaminated Land Statutory Guidance 2012. This is assessed by the identification and assessment of potential contaminant linkages. The linkage between the potential sources and potential receptors identified needs to be established and evaluated.

To fall within this definition, it is necessary that, as a result of the condition of the land, substances may be present in, on or under the land such that:

a) significant harm is being caused or there is a significant possibility of such harm being caused; or

b) significant pollution of controlled waters is being caused, or there is significant possibility of such pollution being caused.

It should be noted that DEFRA has advised (Ref. Section 4, DEFRA Contaminated Land Statutory Guidance 2012) Local Authorities that land should not be designated as "Contaminated Land" where:

a) the relevant substance(s) are already present in controlled waters;

b) entry into controlled waters of the substance(s) from land has ceased; and

c) it is not likely that that further entry will take place.

These exclusions do not necessarily preclude regulatory action under the Environmental Permitting (England and Wales) Regulations 2016, which make it a criminal offence to cause or knowingly permit a water discharge of any poisonous, noxious or polluting matter to controlled waters. In England and Wales, under The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009, a works notice may be served by the regulator requiring appropriate investigation and clean-up.

The potential contaminant linkages identified in Section 7 have been evaluated using the Generic Assessment Criteria described in Section 7 and Appendix G. The results of this evaluation are reported below:

8.2 Risk to Human Health

The soil laboratory results were assessed against the GAC for a residential land use without plant uptake. Contaminants in exceedance are included in Table 17.

Table 17: Summary of generic quantitative risk assessment for human health

Stratum	Contaminant	Location, depth (m bgl)	Concentration (MJ/kg)	Generic Assessment Criteria (MJ/kg)
Made Ground – Topsoil	Calorific Value	TT207 at 0.2m	3	2

Only one elevated concentration has been identified in the test results from the supplementary ground investigation for the Temporary School. A calorific value of 3.0MJ/kg in TT207 at 0.2m bgl when compared to the GAC of 2.0MJ/kg. This elevated concentration is likely associated with coal in the Made Ground at this location. No further elevated concentrations were recorded in the samples tested, however, given the significant mining heritage in the vicinity of the Site, it is considered likely that materials with high Calorific Value may be present on site.

The laboratory soil results from the area of the proposed Temporary School in the first phase of ground investigation identify the Made Ground in this area of the Site as containing elevated contaminant concentrations (beryllium and PAHs), which could pose a risk to future site users should they be allowed to come into direct contact with the Made Ground. In areas of proposed hardstanding future site users will be prevented from coming into direct contact with the contaminants in the Made Ground by a physical barrier, breaking the pollutant linkage and mitigating the risk. In areas of soft and hard landscaping, a cover layer of sufficient thickness will be required to mitigate the risk of future site users coming into direct contact with contaminants.

No asbestos was recorded in the Made Ground samples subject to testing.

No visual or olfactory evidence of contamination was observed in the site soils during the ground investigation for the Temporary School. Visual evidence of contamination of coal was observed within the Topsoil and Made Ground across the Site. This could potentially be the source of the exceedances recorded in the first phase of ground instigation. A faint sheen was noted on groundwater entering TP203, possibly associated with the roadway encountered at this location.

Soil headspace analysis of samples recorded low concentrations across the Site, between 0 ppm – 1.0ppm, and no Volatile Organic Compounds (VOC) and Semi-Volatile Organic Compounds (SVOC) were identified during the first phase of ground investigation. The risk due to the presence of volatiles is therefore considered to be low and no VOC or SVOC testing was undertaken as part of the supplementary ground investigation for the Temporary School.

8.2.1 Off-site users

The soil laboratory results have identified the Made Ground as containing contaminants above natural background concentrations. During construction works the contaminants could mobilise via wind entrainment and migrate off-site. To break the pollutant linkage and mitigate the risk, dust suppression methods will be required to limit the mobilisation of dust off-site. Suitable mitigation for these issues should be detailed in a Construction Environmental Management Plan (CEMP).

8.2.2 Risk to Construction Workers

The ground investigation has recorded soil contaminant concentrations above the natural levels in Made Ground. A potential risk to construction workers is therefore present. To mitigate the risk construction workers should wear appropriate Personal Protective Equipment (PPE) during any below ground works in order to mitigate potential effects from direct contact, dermal absorption, inhalation, and ingestion of any residual contaminants in soils and groundwater.

All construction workers should be subject to mandatory health and safety requirements under the Construction, Design and Management (CDM) Regulations 2015 and Control of Substances Hazardous to Health (COSHH) Regulations 2002, the Confined Space Regulations 1997, and Control of Asbestos Regulations 2012 (CAR 2012).

Whilst asbestos has not been detected in the seven samples tested and has not been identified in soils, construction workers should be asbestos awareness trained.

8.3 Risk to Controlled Waters

No groundwater samples were obtained for testing due to the lack of groundwater in the monitoring installations. The significant depth to groundwater (>15m) minimises the potential for leaching of the limited concentrations of contaminants identified in the shallow Made Ground to impact the Secondary A Aquifer in the underlying natural strata. The proposed development will comprise hardstanding across the majority of the Site. Thus, the potential for leaching of contaminants from Made Ground is likely to be reduced from the current site conditions. Therefore, the risk to groundwater as a result of the proposed Temporary School is considered to be low.

The nearest surface water is a small watercourse approximately 100m south east of the Site. Given this distance, the risk to surface water is also considered to be low.

8.4 Risk to Ecological Systems/Vegetation

Assessment of soils laboratory analysis against phytotoxic contaminant threshold criteria reported no exceedances.

8.5 Risk to Structures

8.5.1 Risk to Water Supply Pipes

Contaminants have been recorded in the soil on-site. The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. The local water company should be contacted at the appropriate time to confirm the most appropriate material for drinking water supply pipes.

8.6 Ground Gas

Two rounds of ground gas monitoring have been completed to date, between February and March 2021. Ground gas monitoring results from the two monitoring rounds completed indicate the following peak ground gas concentrations and flow rates:

- Methane – <0.1%;

- Carbon dioxide – 1.2%;
- Flow rate – 0.1/hr.

Methane was recorded below the equipment's detection Limit (<0.1). The relatively low methane concentrations indicate no microbial degradation of low quantities of organic material in the soil is occurring.

Calculation of the Gas Screening Value (GSV) from the available ground gas monitoring data gives a methane GSV of 0.0001l/hr and carbon dioxide GSV of 0.0012l/hr. The methane and carbon dioxide GSVs are consistent with a Characterisation Situation 1 (CS1) ground gas regime classification, in which the ground gas risk is low and mitigation measures in proposed structures would not be required.

However, given the presence of a potential source of ground gas beneath the Site (shallow mine workings), it may be prudent to allow for the installation of gas protection measures in accordance with Characteristic Situation 2 at this stage.

The Preliminary Environmental Risk Assessment identifies the Site to be partially within an area of elevated radon levels (between 1% and 3%). Correspondingly, basic protective measures may be required in the proposed development. The approach should be confirmed with the Building Control Officer.

8.7 Vapour

A review of the lines of evidence used to assess whether a significant vapour regime is present on-site records the following;

- Soil headspace analysis of samples recorded low concentrations across the Site between 0 ppm – 1.0ppm; and,
- No shallow groundwater encountered during the ground investigation.

The vapour lines of evidence as detailed above show that a significant vapour regime is largely absent. The implementation of vapour protection measures in the proposed Development is not considered to be required.

9. Geotechnical Assessment

9.1 Proposed Development

The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site with associated infrastructure including a hard surfaced car park, playground and access road. No basements are proposed.

The proposed development is presented on Watson Batty Architects Drawing Ref: TRNTY-WBA-NB-00-DR-A-PL-101 P1, included in Appendix A.

If development proposals change, it may be necessary to revise the conclusions and recommendations made in this report and Waterman should be contacted to provide further advice.

9.2 Mining

The ground investigation confirmed the presence of the Barnsley Coal Seam as follows:

- RC201 records zones of no recovery at 2m to 2.36m, 3m to 3.48m, 4.5m to 4.70m, 6m to 6.40m, 7.50m to 7.78m, 9m to 9.75m, and at 10.50m to 11.50m. These are interpreted to be the result of weathered or weak rock being further weakened by the drilling resulting in no core being obtained. A void between 12m and 12.30m and broken ground between 12.30m and 13.50m are interpreted as suspected mine workings;
- RC202 records zones of no recovery at 2m to 2.20m, 3m to 3.38m, 4.50m to 5.15m, 6.0m to 6.73m, 7.5m to 8.10m, 9m to 9.22m, and at 10.5m to 11.17m. These are interpreted to indicate the presence of weathered or weak rock. A zone of no recovery at 12m to 13.05m and broken ground between 13.05m and 13.50m are interpreted as suspected mine workings. Intact coal is present between 14m and 15m;
- RC203 records zones of no recovery at 1.50m to 1.80m, 4m to 4.7m, 5.50m to 6.33m, and at 7.50m to 7.83m. These are interpreted to indicate the presence of weathered or weak rock. A void between 15m and 16.27m, broken ground between 16.27m and 16.5m, and 17.15m and 17.84m, and a zone of no recovery between 16.50m and 17.15m are interpreted as suspected mine workings. This indicates a working height of 2.84m, the largest found during the ground investigation;
- RC204 records zones of no recovery at 2m to 2.25m, 3m to 4.17m, 4.5m to 5.23m, 6m to 6.86m, 7.50m to 7.85m, 10.50m to 10.99m, 13.50m to 14.26m, and at 15m to 15.58m. These are interpreted to indicate the presence of weathered or weak rock. A void is identified at 16.50m to 17.90m and broken ground is recorded between 17.90m and 18.40m, these are interpreted as suspected mine workings.
- TT202 was located to identify and investigate an area of historical remedial works detailed in the Coal Mining Risk Assessment in the north of the Site. Whilst TT202 did not identify the area of the infilled 18" diameter "shaft", it did reveal one of the roadways identified to extend from the shaft. The top of the roadway was 2.1m bgl in the northeast elevation of the trench and at 3.0m bgl in the south west elevation of the trench, indicating the roadway to be sloping down to the south west. The roadway was approximately 1.5m wide and the base was not identified in the 4.0m deep trial trench. This feature was also identified in TT203, with the top of the roadway present at 0.6m bgl, covered by a number of large sandstone blocks. The base of the roadway was not identified in the 3.4m deep trial trench.

All of the suspected mine workings and intact coal are thought to be associated with the Barnsley Coal Seam.

The greatest thickness of no recovery, broken ground or void associated with the Barnsley Coal seam was 2.84m beneath the Site in RC203 (at the eastern end of the proposed Temporary School), from 15m to 17.84m bgl. Based on a likely propagation of voids to 10 times worked seam thickness through rock, as per CIRIA C758D, voids could migrate upwards by nearly 30m.

There is an insufficient thickness of rock cover to arrest the upward migration of voids from the Barnsley Coal Seam and therefore workings are considered to constitute a risk of surface instability.

Therefore, it is recommended further investigation is undertaken below the footprint of the proposed building, which should take the form of Primary Consolidation Grouting to confirm the presence of workings or otherwise, with Secondary Grouting should workings be identified.

A mine shaft was identified in trial pit TP110 close to the position of the Temporary School during the first phase of ground investigation. The shaft was found to be uncapped and to have a diameter of approximately 2.5m. The shaft backfill was present from approximately 0.5m below ground level and comprised of Colliery Spoil.

The mine shaft should be fully investigated and appropriately treated, most likely by construction of a reinforced concrete cap.

The roadway identified beneath the north of the Site is not considered to pose a risk to the proposed Temporary School. However, its presence should be appropriately mitigated in the design of the access road and hardstanding proposed in this area of the Site.

The remedial works to be implemented to both the shallow mine workings and mine shaft should be agreed with The Coal Authority, with appropriate permissions and licenses obtained.

9.3 Characteristic Values

Based upon the ground investigation data and a review of the derived values summarised in Section 6, characteristic values can be assigned to each strata. EC7 defines the characteristic value of a soil or rock as a cautious estimate of the value affecting the occurrence of the limit state. The characteristic values to be used in design are highlighted in Table 18:

Table 18: Characteristic values for geotechnical design

Stratum / Geological Origin	Strength / Density Descriptor	Range of Derived Values	Characteristic Undrained Strength (cu - kPa)	Characteristic Unconfined Compressive Strength (UCS - MPa)	Characteristic Angle of Shearing Resistance (φ' - °)
Glacial Till	High strength Clay	cu = 76 – 102kPa	75kPa	-	-
Weathered Pennine Middle Coal Measures	Extremely weak sandstone recovered as sandy clayey Gravel of sandstone	φ' = >43°	-	-	φ' = 30°
Pennine Middle Coal Measures	Extremely weak to medium strong, typically very weak Sandstone and Mudstone	UCS = 0.34 – 31.45, typically 1 – 5MPa	-	2MPa	-

The imposed permanent and variable actions (loads) are not currently known. Horizontal actions are not considered in detail here and these should be checked as part of detailed geotechnical design.

9.3.1 Rock Mass Strength and Shallow Foundations

Spread foundations on rock may be designed using the method of presumed bearing pressures. The method is based on the relationships outlined in BS EN 1997-1: 2004 which assume that the structure can tolerate settlement equal to 0.5% of the maximum foundation width.

An empirical relationship between the Point Load Index $Is_{(50)}$ and the unconfined compressive strength (UCS) has been used as part of this assessment. The mean unconfined compressive strength is taken to be 17 times the Point Load Index ($Is_{(50)}$), taken from Hoek and Bray (1982). This value is broadly consistent with the range suggested by the International Society of Rock Mechanics (ISRM), where on average the unconfined compressive strength is 20-25 times the point load strength. This value is again corroborated by a study carried out by Rusnak & Mark (2007).

The test results suggest that the Pennine Middle Coal Measures is extremely weak to medium strong, typically very weak Sandstone and Mudstone. Point Load strengths should be utilised with caution as the in-situ strength characteristics of the rock are likely to be determined more by the aperture and spacing of discontinuities than by the strength of the rock itself due to the very closely spaced discontinuities. To address the factor of rock mass strength highlighted by BS EN 1997-1:2004, assessment of discontinuity spacing has also been carried out.

A classification-based process outlined in BS EN 1997-1:2004 assigns a group class G1-G4 based on the type of rock. The Pennine Middle Coal Measures sequence beneath the Site can be broadly classified as Group 2. Depending on the rock grouping, a specific relationship between UCS (MPa) and mean discontinuity spacing (mm) can be utilised to estimate the presumed bearing resistance.

Assessment of the Pennine Middle Coal Measures based on field descriptions, lab test data and discontinuity spacing indicates that the sandstone encountered at shallow founding depths across the Site provides a presumed bearing resistance of approximately 0.5MPa. This assessment assumes square pad foundations bearing onto the weak sandstone for settlements not exceeding 0.5% of the total foundation width.

To prevent differential settlement, foundations on rock should be placed *entirely* on rock and not partially on rock and partially on unconsolidated materials or Made Ground. It may be necessary to deepen foundations locally to facilitate this.

Given the presence of the Barnsley Coal Seam at relatively shallow depth beneath the Site, the foundation designer should consider the influence of foundation loads on potential shallow mine workings. Appropriate rock cover should be present between the base of shallow foundations and underlying coal seams. Consideration should be given to the use of a raft slab. Coal Authority approval should be gained for the design as part of the Permitting process.

Design bearing resistance and settlement should be checked as part of detailed geotechnical design.

9.4 Piled Foundations

For foundation loads significantly in excess of the design bearing resistance estimated above or where the presence of shallow mine workings precludes the use of shallow foundations, piled foundations could be utilised. It is recommended that the advice of a specialist piling contractor should be obtained to confirm

the suitability of piling and the most appropriate pile type. However, based on the ground investigation information, end bearing piles would key into the Pennine Middle Coal Measures bedrock present from approximately 2m below ground level or would be extended to between 15m and 25m below ground level to extend through the worked Barnsley Coal Seam.

Given the presence of the Barnsley Coal Seam at relatively shallow depth beneath the Site, the pile design should consider the influence of piling on potential shallow mine workings. Appropriate rock cover should be present between the termination depth of piled foundations and underlying coal seams. The piling contractor should seek Coal Authority approval for their design as part of the Permitting process.

The final design of the piles will be the responsibility of the piling contractor. An allowance for probing of pile positions and/or drilling of obstructions should be allocated. The carrying capacity of the actual pile groups will in part depend on the number, type and size of pile chosen by the contractor and the quality of workmanship. Where cast in situ concrete piles are proposed, the roughness of the rock socket will influence the carrying capacity of the pile.

The piles should be designed based on the requirements of Eurocode 7 and guidance such as CIRIA Report 181, Piled Foundations in Weak Rock.

During detailed pile design the choice of factors of safety should ensure that appropriate safe working loads and settlement tolerances are met.

Subject to any piling trials, an acceptable percentage of piles should be load tested to at least twice working load. All piles should be integrity tested.

Consideration should be given to the re-use of pile arisings if bored piles are used. It may be possible to re-use pile arisings subject to risk assessment; however, certainty of use and volume should be confirmed in accordance with the requirements of CLAIRE guidance.

Given the proximity of existing structures, the effects of noise and vibration (e.g. from piling plant) should be addressed as part of the Contractor's method statement.

9.5 Shrinkability / Volume Change Potential

Glacial Till has been shown to have a low shrinkability.

Foundations placed on shrinkable soils should be deepened where necessary to accommodate the effects of trees and hedgerows. Where foundations are beyond the influence of existing and proposed planting (i.e. 1.5 times the mature tree height), the minimum founding depth in soils of a low volume change potential would be 0.75m below existing or proposed ground level (whichever is lower).

Foundations within the zone of influence of existing or proposed trees should be deepened as necessary in accordance with recommendations provided in NHBC Chapter 4 – Building Near Trees. If trees are present within influencing distance of proposed foundations, a tree survey should be undertaken to identify appropriate founding depths.

9.6 Design Class for Concrete

Based on the characteristic values derived from SD1 testing, the Design Sulphate (DS) and Aggressive Chemical Environment for Concrete (ACEC) classifications are considered to be:

- Concrete in contact with Made Ground: DS-1 AC-1;
- Concrete in contact with Glacial TIll: DS-1 AC-1;

- Concrete in contact with Pennine Middle Coal Measures: DS-1 AC-1.

This is based on the site characterisation as “Brownfield-pyritic” and the assumption of mobile groundwater.

9.7 Earthworks / Pavement Design

Earthworks cut is anticipated to be limited as part of the Temporary School development, however, the results of compaction testing undertaken on samples of the shallow soils (from the first and second phase of ground investigation) indicate that the Made Ground and Glacial Till could generally be recompacted to achieve >95% of MDD and <5% air voids.

Based upon the results obtained, Made Ground, Glacial Till and the shallow Weathered Pennine Middle Coal Measures could potentially be used as an engineered fill, subject to other suitability considerations. Made Ground may require treatment prior to re-use due to it generally being wet of Optimum Moisture Content. It should be noted that suitability for compaction is highly dependent on the initial moisture content of the material to be compacted. PSD results indicate that the Made Ground would be classified as Class 2C and the Glacial Till would be classified as Class 2A/2B in accordance with the Specification for Highway Works.

The presence of a roadway at shallow depth in the north of the Site has been confirmed in the ground investigation. An access road and hardstanding are proposed in this area of the Site and it is recommended that the presence of the roadway and any unidentified shallow mining features is considered as part of the detailed design of the surfacing in this area. Where present at shallow depth it may be necessary to excavate the roadway and fill the resulting void with engineered fill, placed in accordance with an Earthworks Specification. The installation of geogrid reinforcement in the construction of the access road and hardstanding to mitigate the potential for collapse associated with the roadway and any unidentified mining features to impact site end users should be considered.

It would be sensible to subject proposed earthworks materials to a confirmatory testing regime where they were required to achieve a compaction specification as a general fill. Site won materials are unlikely to prove suitable as a structural fill, being generally cohesive in nature, but may be suitable for use as a general fill below areas of non-structural infrastructure.

Construction plant should be provided with an adequate working platform in line with the requirements of BRE report, “BR 470: Working Platforms for Tracked Plant”. Further advice should be sought from the temporary works designer.

Subgrade strength may vary considerably across the site, especially where affected by variations in moisture content. During construction, the in-situ CBR value must be checked against the Design CBR value, to confirm design requirements are being met, in accordance with CD225 or Local Authority guidance.

9.8 Floor Slabs

Given that there is limited Made Ground in the vicinity of the proposed school building, no identified risk of heave and ground conditions are likely to be relatively uniform across the proposed building footprint, ground bearing floor slabs are potentially viable for the proposed development.

The design of floor slabs should only be finalised when the updated gas monitoring has been completed and assessed, as the recommendations of the gas monitoring report will influence the final choice of floor slab design. The above advice is provided for guidance only at this stage.

9.9 Groundwater / Stability of Excavations

Comments relating to the stability of excavations (i.e. trial pits) and groundwater seepages are included in the logs in Appendix B. No groundwater was encountered during the ground investigation, other than a seepage in trial trench TT203 at 3.1m bgl possibly associated with the roadway identified in this exploratory hole.

No groundwater has been recorded during the monitoring undertaken to date.

It should be noted that levels are likely to fluctuate dependant on the time of year and prevailing weather conditions. Groundwater levels should be reviewed on completion of the groundwater monitoring visits.

Based on observations made during fieldwork, shallow excavations (<1.2m) are likely to be stable in the short term. However, should deeper Made Ground be encountered, particularly where this is associated with historical mining features, such as the roadway identified in the north of the Site, then some instability should be expected, and appropriate mitigation measures utilised.

Consideration should be given to the re-use of arisings from foundation trenches / drainage runs etc. Where contamination has been encountered, it may be possible to reuse foundation arisings; however, certainty of use and volume should be confirmed in accordance with the requirements of CL:AIRE guidance. Waterman Supplementary Ground Investigation Report should be consulted with regards to suitability for re-use of materials.

In line with BS6031, all excavations should be examined daily by a competent person to ensure that they remain safe. Where the sides cannot be sloped back to a safe angle, as approved by a competent and experienced person, their continued stability should not be taken for granted. Vertical or steep faces should be provided with support unless instructed otherwise by a competent person.

10. Conclusions and Risk Evaluation

10.1 Environmental Assessment

Following the implementation of the ground investigation, the contaminant linkages identified during the Preliminary Environmental Risk Assessment have been re-evaluated and reclassified in relation to the additional information obtained. The results of the reassessment are summarised in Table 19 below:

Table 19: Estimation of environmental risks associated with the subject site

Receptor	Potential sources	Pathway	Risk	Justification/Mitigation
Human Health				
Future Site Users	Potential contamination in Made Ground and shallow soils from land uses surrounding the Site.	Dermal contact and inhalation of dust from contaminated soils during works Contact with potential contamination in shallow soils in areas of soft landscaping.	**Low**	Elevated contaminant concentrations are present in the Made Ground on-site as beryllium and PAH exceeded the GAC in testing undertaken during the first phase of ground investigation. In areas of proposed hardstanding the direct pathway to future Site users will be removed breaking the contaminant linkage. In areas of hard and soft landscaping potential remains for future Site users to come into contact with Made Ground. In these areas a cover layer of suitable thickness and of suitable for use material will be installed. The thickness of the clean cover layer will be dependent on the type and magnitude of the contaminants recorded and will be established in the Remediation Strategy. Upon implementation of the cover layer in areas of soft landscaping the risk to future Site users will be mitigated and no further remedial measures will be required.
Worked Coal Seams (Ground gas and vapours)	Worked Coal Seams (Ground gas and vapours)	Accumulation in confined spaces, leading to inhalation.	**Medium**	A significant ground gas or vapour regime is absent on-site. The Site is designated as Characteristic Situation 1 (No Special Gas Measures). However, given the presence of a potential source of ground gas beneath the Site (shallow mine workings), it may be prudent to allow for the installation of gas protection measures in accordance with Characteristic Situation 2 at this stage.
Off-Site Users and nearby residents	Potential contamination in Made Ground and shallow soils.	Windborne, potentially contaminated construction dust.	**Medium**	Elevated contaminant concentrations have been recorded in the Made Ground during the first phase of ground investigation. During

Receptor	Potential sources	Pathway	Risk	Justification/Mitigation
		Runoff from stockpiled soils.		construction, these contaminants may become mobilised by wind entrainment and migrate off-site. Residential and public land uses are present in the surrounding area. During construction good working practices for dust suppression should be employed to limit dust creation and migration as far as practically possible. Where suitable dust suppression is employed the risk to off-site users would be mitigated.
Construction Workers	Potential contamination in Made Ground, shallow soils, and shallow groundwater.	Dermal contact and ingestion. Dust inhalation. Ground gas and vapour accumulation in trenches and confined spaces, leading to inhalation followed by asphyxiation and risk of explosion.	**Medium**	The ground investigation has recorded elevated contaminant concentrations. To mitigate the risk construction workers should wear appropriate Personal Protective Equipment (PPE) during any below ground works in order to mitigate potential effects from direct contact, dermal absorption, inhalation, and ingestion of any residual contaminants in soils and groundwater. All construction workers should be subject to mandatory health and safety requirements under the Construction, Design and Management (CDM) Regulations 2018 and Control of Substances Hazardous to Health (COSHH) Regulations 2002, the Confined Space Regulations 1997, and Control of Asbestos Regulations 2012 (CAR 2012).
Construction workers and nearby residents.	Unexploded Ordnance	Direct contact	**Low**	No UXO was encountered during the ground investigation. However, an UXO Risk Management Plan will be prepared for the Site. Site Specific UXO Awareness Briefings will be provided to all personnel conducting works.
Property				
Site structures and services	Contamination in Made Ground, shallow soils, and shallow groundwater.	Direct contact with building foundations and buried services leading to chemical attack.	**Medium**	Foundations and building at the new development will be designed to resist any contamination identified by the ground investigation, which will mitigate the risk to future structures.
Off-Site Structures	Contamination in Made Ground, shallow soils, and	Direct contact with building foundations and buried services	**Low**	Elevated contaminant concentrations are present in the Made Ground on-site as beryllium and PAH exceeded

Receptor	Potential sources	Pathway	Risk	Justification/Mitigation
	shallow groundwater.	leading to chemical attack.		the GAC in two locations during the first phase of ground investigation. The ground investigation has identified the lateral migration of contaminants as being limited. The risk to off-site structures is low.
Controlled Waters				
Secondary A Aquifer and surface watercourse 100m south of the Site	Contamination in Made Ground, shallow soils, and shallow groundwater.	Migration through Glacial Till to nearby watercourses. Runoff from stockpiled soils.	**Low**	Due to the depth to groundwater, no groundwater samples were obtained during monitoring. The significant depth to groundwater indicates the risk to the groundwater to be low.
Secondary A Aquifer and surface watercourse 100m south of the Site	Construction materials stored on-Site as part of development works.	Spills to ground, and the nearby watercourse.	**Medium**	Due to the depth to groundwater, no groundwater samples were obtained during monitoring. The significant depth to groundwater indicates the risk to the groundwater to be low. However, a CEMP should be prepared for the demolition and construction works on-Site, detailing measures to minimise the potential spills that could pose a risk to controlled waters.

The potential contaminant linkages described above can be managed by design of appropriate mitigation measures during the redevelopment of the site.

10.2 Ground Gas

Based on the available monitoring data, the site is considered to be: Characteristic Situation 1 (No Special Gas Measures). Given the presence of a potential source of ground gas beneath the Site (shallow mine workings), it may be prudent to allow for the installation of gas protection measures in accordance with Characteristic Situation 2 at this stage.

The Preliminary Environmental Risk Assessment identifies the Site to be partially within an area of elevated radon levels (between 1% and 3%). Correspondingly, basic protective measures may be required in the proposed development. The approach should be confirmed with the Building Control Officer.

Any recommendations relating to gas protective measures in foundations should be considered provisional until issue of our hazardous gas risk assessment at the end of the monitoring period.

10.3 Geotechnical Assessment

10.3.1 Proposed Development

The Site is proposed to provide a temporary secondary school. This development will include a temporary school building in the south of the Site with associated infrastructure, including a hard surfaced car park, playground, and access road. No basements are proposed.

The proposed development is presented on Watson Batty Architects Drawing Ref: TRNTY-WBA-NB-00-DR-A-PL-101 P1, included in Appendix A.

If development proposals change, it may be necessary to revise the conclusions and recommendations made in this report and Waterman should be contacted to provide further advice.

10.3.2 Mining

The ground investigation confirmed the presence of the Barnsley Coal Seam as follows:

- RC201 records zones of no recovery at 2m to 2.36m, 3m to 3.48m, 4.5m to 4.70m, 6m to 6.40m, 7.50m to 7.78m, 9m to 9.75m, and at 10.50m to 11.50m. These are interpreted to be the result of weathered or weak rock being further weakened by the drilling resulting in no core being obtained. A void between 12m and 12.30m and broken ground between 12.30m and 13.50m are interpreted as suspected mine workings;
- RC202 records zones of no recovery at 2m to 2.20m, 3m to 3.38m, 4.50m to 5.15m, 6.0m to 6.73m, 7.5m to 8.10m, 9m to 9.22m, and at 10.5m to 11.17m. These are interpreted to indicate the presence of weathered or weak rock. A zone of no recovery at 12m to 13.05m and broken ground between 13.05m and 13.50m are interpreted as suspected mine workings. Intact coal is present between 14m and 15m;
- RC203 records zones of no recovery at 1.50m to 1.80m, 4m to 4.7m, 5.50m to 6.33m, and at 7.50m to 7.83m. These are interpreted to indicate the presence of weathered or weak rock. A void between 15m and 16.27m, broken ground between 16.27m and 16.5m, and 17.15m and 17.84m, and a zone of no recovery between 16.50m and 17.15m are interpreted as suspected mine workings. This indicates a working height of 2.84m, the largest found during the ground investigation;
- RC204 records zones of no recovery at 2m to 2.25m, 3m to 4.17m, 4.5m to 5.23m, 6m to 6.86m, 7.50m to 7.85m, 10.50m to 10.99m, 13.50m to 14.26m, and at 15m to 15.58m. These are interpreted to indicate the presence of weathered or weak rock. A void is identified at 16.50m to 17.90m and broken ground is recorded between 17.90m and 18.40m, these are interpreted as suspected mine workings.
- TT202 was located to identify and investigate an area of historical remedial works detailed in the Coal Mining Risk Assessment in the north of the Site. Whilst TT202 did not identify the area of the infilled 18" diameter "shaft", it did reveal one of the roadways identified to extend from the shaft. The top of the roadway was 2.1m bgl in the northeast elevation of the trench and at 3.0m bgl in the south west elevation of the trench, indicating the roadway to be sloping down to the south west. The roadway was approximately 1.5m wide and the base was not identified in the 4.0m deep trial trench. This feature was also identified in TT203, with the top of the roadway present at 0.6m bgl, covered by a number of large sandstone blocks. The base of the roadway was not identified in the 3.4m deep trial trench.

All of the suspected mine workings and intact coal are thought to be associated with the Barnsley Coal Seam.

The greatest thickness of no recovery, broken ground or void associated with the Barnsley Coal seam was 2.84m beneath the Site in RC203 (at the eastern end of the proposed Temporary School), from 15m to 17.84m bgl. Based on a likely propagation of voids to 10 times worked seam thickness through rock, as per CIRIA C758D, voids could migrate upwards by nearly 30m.

There is an insufficient thickness of rock cover to arrest the upward migration of voids from the Barnsley Coal Seam and therefore workings are considered to constitute a risk of surface instability.

Therefore, it is recommended further investigation is undertaken below the footprint of the proposed building, which should take the form of Primary Consolidation Grouting to confirm the presence of workings or otherwise, with Secondary Grouting should workings be identified.

A mine shaft was identified in trial pit TP110 close to the position of the Temporary School during the first phase of ground investigation. The shaft was found to be uncapped and to have a diameter of approximately 2.5m. The shaft backfill was present from approximately 0.5m below ground level and comprised of Colliery Spoil.

The mine shaft should be fully investigated and appropriately treated, most likely by construction of a reinforced concrete cap.

The roadway identified beneath the north of the Site is not considered to pose a risk to the proposed Temporary School. However, its presence should be appropriately mitigated in the design of the access road and hardstanding proposed in this area of the Site.

The remedial works to be implemented to both the shallow mine workings and mine shaft should be agreed with The Coal Authority, with appropriate permissions and licenses obtained.

10.3.3 Rock Mass Strength and Shallow Foundations

Spread foundations on rock may be designed using the method of presumed bearing pressures. The method is based on the relationships outlined in BS EN 1997-1: 2004 which assume that the structure can tolerate settlement equal to 0.5% of the maximum foundation width.

An empirical relationship between the Point Load Index $Is_{(50)}$ and the unconfined compressive strength (UCS) has been used as part of this assessment. The mean unconfined compressive strength is taken to be 17 times the Point Load Index ($Is_{(50)}$), taken from Hoek and Bray (1982). This value is broadly consistent with the range suggested by the International Society of Rock Mechanics (ISRM), where on average the unconfined compressive strength is 20-25 times the point load strength. This value is again corroborated by a study carried out by Rusnak & Mark (2007).

The test results suggest that the Pennine Middle Coal Measures is extremely weak to medium strong, typically very weak Sandstone and Mudstone. Point Load strengths should be utilised with caution as the in-situ strength characteristics of the rock are likely to be determined more by the aperture and spacing of discontinuities than by the strength of the rock itself due to the very closely spaced discontinuities. To address the factor of rock mass strength highlighted by BS EN 1997-1:2004, assessment of discontinuity spacing has also been carried out.

A classification-based process outlined in BS EN 1997-1:2004 assigns a group class G1-G4 based on the type of rock. The Pennine Middle Coal Measures sequence beneath the Site can be broadly classified as Group 2. Depending on the rock grouping, a specific relationship between UCS (MPa) and mean discontinuity spacing (mm) can be utilised to estimate the presumed bearing resistance.

Assessment of the Pennine Middle Coal Measures based on field descriptions, lab test data and discontinuity spacing indicates that the sandstone encountered at shallow founding depths across the Site provides a presumed bearing resistance of approximately 0.5MPa. This assessment assumes square pad foundations bearing onto the weak sandstone for settlements not exceeding 0.5% of the total foundation width.

To prevent differential settlement, foundations on rock should be placed *entirely* on rock and not partially on rock and partially on unconsolidated materials or Made Ground. It may be necessary to deepen foundations locally to facilitate this.

Given the presence of the Barnsley Coal Seam at relatively shallow depth beneath the Site, the foundation designer should consider the influence of foundation loads on potential shallow mine workings. Appropriate rock cover should be present between the base of shallow foundations and underlying coal seams. Consideration should be given to the use of a raft slab. Coal Authority approval should be gained for the design as part of the Permitting process.

Design bearing resistance and settlement should be checked as part of detailed geotechnical design.

10.3.4 Piled Foundations

For foundation loads significantly in excess of the design bearing resistance estimated above or where the presence of shallow mine workings precludes the use of shallow foundations, piled foundations could be utilised. It is recommended that the advice of a specialist piling contractor should be obtained to confirm the suitability of piling and the most appropriate pile type. However, based on the ground investigation information, end bearing piles would key into the Pennine Middle Coal Measures bedrock present from approximately 2m below ground level or would be extended to between 15m and 25m below ground level to extend through the worked Barnsley Coal Seam.

Given the presence of the Barnsley Coal Seam at relatively shallow depth beneath the Site, the pile design should consider the influence of piling on potential shallow mine workings. Appropriate rock cover should be present between the termination depth of piled foundations and underlying coal seams. The piling contractor should seek Coal Authority approval for their design as part of the Permitting process.

The final design of the piles will be the responsibility of the piling contractor. An allowance for probing of pile positions and/or drilling of obstructions should be allocated. The carrying capacity of the actual pile groups will in part depend on the number, type and size of pile chosen by the contractor and the quality of workmanship. Where cast in situ concrete piles are proposed, the roughness of the rock socket will influence the carrying capacity of the pile.

The piles should be designed based on the requirements of Eurocode 7 and guidance such as CIRIA Report 181, Piled Foundations in Weak Rock.

During detailed pile design the choice of factors of safety should ensure that appropriate safe working loads and settlement tolerances are met.

Subject to any piling trials, an acceptable percentage of piles should be load tested to at least twice working load. All piles should be integrity tested.

Consideration should be given to the re-use of pile arisings if bored piles are used. It may be possible to re-use pile arisings subject to risk assessment; however, certainty of use and volume should be confirmed in accordance with the requirements of CLAIRE guidance.

Given the proximity of existing structures, the effects of noise and vibration (e.g. from piling plant) should be addressed as part of the Contractor's method statement.

10.3.5 Shrinkability / Volume Change Potential

Glacial Till has been shown to have a low shrinkability.

Foundations placed on shrinkable soils should be deepened where necessary to accommodate the effects of trees and hedgerows. Where foundations are beyond the influence of existing and proposed planting (i.e. 1.5 times the mature tree height), the minimum founding depth in soils of a low volume change potential would be 0.75m below existing or proposed ground level (whichever is lower).

Foundations within the zone of influence of existing or proposed trees should be deepened as necessary in accordance with recommendations provided in NHBC Chapter 4 – Building Near Trees. If trees are present within influencing distance of proposed foundations, a tree survey should be undertaken to identify appropriate founding depths.

10.3.6 Design Class for Concrete

Based on the characteristic values derived from SD1 testing, the Design Sulphate (DS) and Aggressive Chemical Environment for Concrete (ACEC) classifications are considered to be DS-1 AC-1. This is based on the site characterisation as “Brownfield-pyritic” and the assumption of mobile groundwater.

10.3.7 Earthworks / Pavement Design

Earthworks cut is anticipated to be limited as part of the Temporary School development, however, the results of compaction testing undertaken on samples of the shallow soils (from the first and second phase of ground investigation) indicate that the Made Ground and Glacial Till could generally be recompacted to achieve >95% of MDD and <5% air voids.

Based upon the results obtained, Made Ground, Glacial Till and the shallow Weathered Pennine Middle Coal Measures could potentially be used as an engineered fill, subject to other suitability considerations. Made Ground may require treatment prior to re-use due to it generally being wet of Optimum Moisture Content. It should be noted that suitability for compaction is highly dependent on the initial moisture content of the material to be compacted. PSD results indicate that the Made Ground would be classified as Class 2C and the Glacial Till would be classified as Class 2A/2B in accordance with the Specification for Highway Works.

The presence of a roadway at shallow depth in the north of the Site has been confirmed in the ground investigation. An access road and hardstanding are proposed in this area of the Site and it is recommended that the presence of the roadway and any unidentified shallow mining features is considered as part of the detailed design of the surfacing in this area. Where present at shallow depth it may be necessary to excavate the roadway and fill the resulting void with engineered fill, placed in accordance with an Earthworks Specification. The installation of geogrid reinforcement in the construction of the access road and hardstanding to mitigate the potential for collapse associated with the roadway and any unidentified mining features to impact site end users should be considered.

It would be sensible to subject proposed earthworks materials to a confirmatory testing regime where they were required to achieve a compaction specification as a general fill. Site won materials are unlikely to prove suitable as a structural fill, being generally cohesive in nature, but may be suitable for use as a general fill below areas of non-structural infrastructure.

Construction plant should be provided with an adequate working platform in line with the requirements of BRE report, “BR 470: Working Platforms for Tracked Plant”. Further advice should be sought from the temporary works designer.

Subgrade strength may vary considerably across the site, especially where affected by variations in moisture content. During construction, the in-situ CBR value must be checked against the Design CBR

value, to confirm design requirements are being met, in accordance with CD225 or Local Authority guidance.

10.3.8 Floor Slabs

Given that there is limited Made Ground in the vicinity of the proposed school building, no identified risk of heave and ground conditions are likely to be relatively uniform across the proposed building footprint, ground bearing floor slabs are potentially viable for the proposed development.

The design of floor slabs should only be finalised when the updated gas monitoring has been completed and assessed, as the recommendations of the gas monitoring report will influence the final choice of floor slab design. The above advice is provided for guidance only at this stage.

10.3.9 Groundwater / Stability of Excavations

Comments relating to the stability of excavations (i.e. trial pits) and groundwater seepages are included in the logs in Appendix B. No groundwater was encountered during the ground investigation, other than a seepage in trial trench TT203 at 3.1m bgl possibly associated with the roadway identified in this exploratory hole.

No groundwater has been recorded during the monitoring undertaken to date.

It should be noted that levels are likely to fluctuate dependant on the time of year and prevailing weather conditions. Groundwater levels should be reviewed on completion of the groundwater monitoring visits.

Based on observations made during fieldwork, shallow excavations (<1.2m) are likely to be stable in the short term. However, should deeper Made Ground be encountered, particularly where this is associated with historical mining features, such as the roadway identified in the north of the Site, then some instability should be expected, and appropriate mitigation measures utilised.

Consideration should be given to the re-use of arisings from foundation trenches / drainage runs etc. Where contamination has been encountered, it may be possible to reuse foundation arisings; however, certainty of use and volume should be confirmed in accordance with the requirements of CL:AIRE guidance. Waterman Supplementary Ground Investigation Report should be consulted with regards to suitability for re-use of materials.

In line with BS6031, all excavations should be examined daily by a competent person to ensure that they remain safe. Where the sides cannot be sloped back to a safe angle, as approved by a competent and experienced person, their continued stability should not be taken granted for. Vertical or steep faces should be provided with support unless instructed otherwise by a competent person.

11. Recommendations

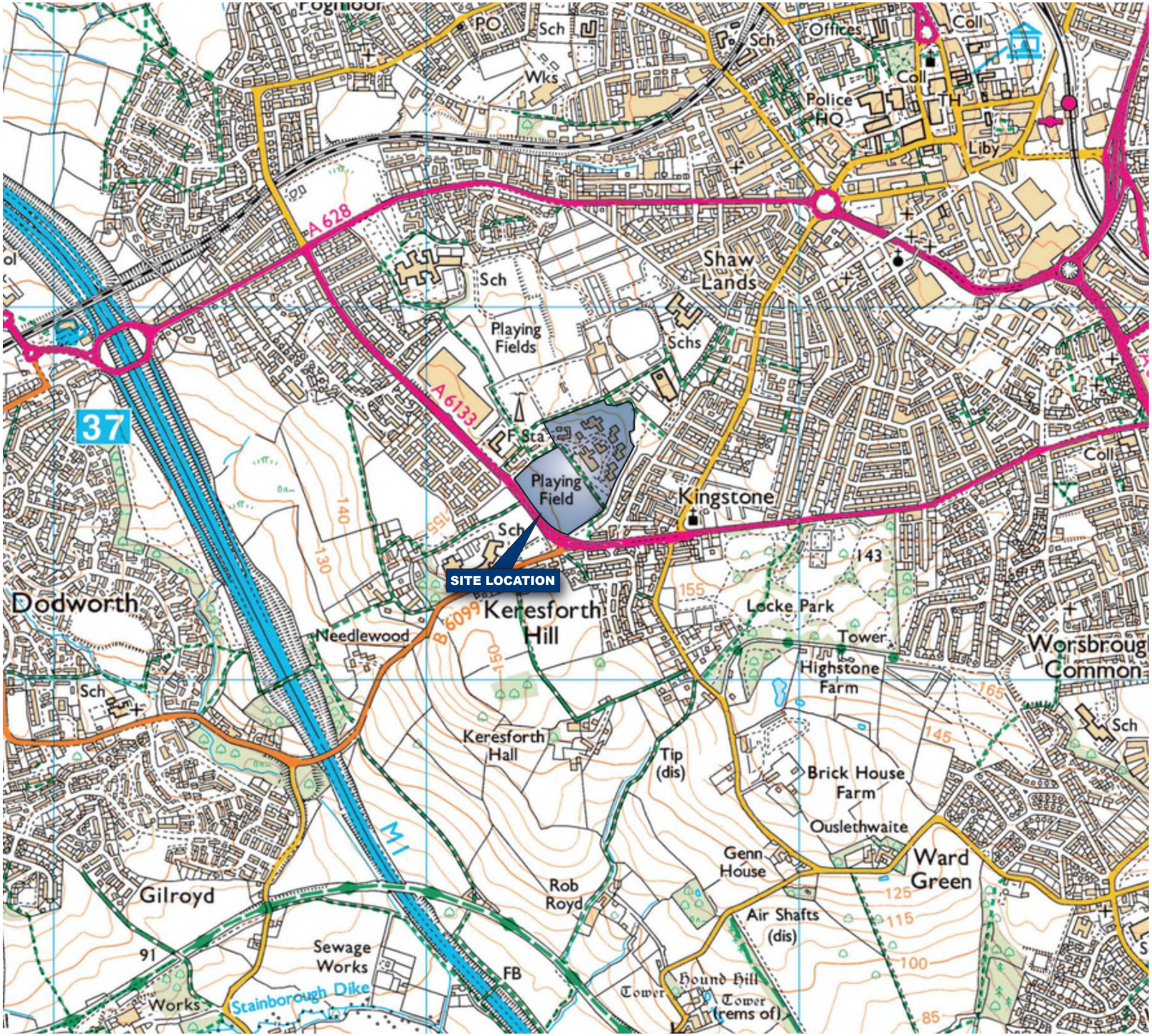
The following actions are recommended to address the potentially unacceptable risks that remain:

- A programme of mine workings investigation and treatment should be undertaken below the footprint of the proposed Temporary School, which should take the form of Primary Consolidation Grouting to confirm the presence of workings or otherwise, with Secondary Grouting should workings be identified;
- Consideration of the use of geogrid reinforcement in the construction of the access road and hardstanding to mitigate the potential for collapse associated with the former roadway and any unidentified mining features to impact site end users should be considered;
- A Remediation Strategy should be prepared outlining the mitigation measures to ensure the Site meets the appropriate standards for its intended use following redevelopment;
- An appropriate cover system should be installed in soft landscaping areas to break the contamination receptor linkage. Material/topsoil imported to Site should be certified suitable for use prior to importation and use on-site;
- A Materials Management Plan should be produced by the Contractor to ensure that materials that may be excavated during their works (including pile arisings) may be suitable for re-use on the Site. The re-use of materials should be identified and designated under the CL:AIRE Definition of Waste: Code of Practice (DoWCoP), i.e. the earthworks phase of the development should be planned and managed such that re-use of suitable site-won arisings is maximised and waste is minimised;
- Following completion of the proposed Development a Verification Report should be produced detailing the remedial measures undertaken during construction to break the potentially active pollutant linkages;
- Construction works should be undertaken in accordance with the Control of Asbestos Regulations 2012;
- A Construction Environmental Management Plan (CEMP) should be prepared including measures for managing waste during development work, and techniques for suppressing dust;
- All fuels and chemicals to be stored on-site during construction works should be stored and bunded in line with EA best practice and guidance;
- Construction workers should be provided with Personal Protective Equipment (PPE) for use as necessary when interacting with soils and groundwater beneath the Site. Workers should also adopt appropriate hygiene practices;
- Below-ground structures should utilise the appropriate concrete classes to prevent aggressive ground conditions. The use of barrier water pipes at the completed Development (as per UKWIR project steering group guidance) should be agreed with the relevant water authorities; and,
- Appropriate UXO mitigation should be employed during below ground works, such as piling.

APPENDICES

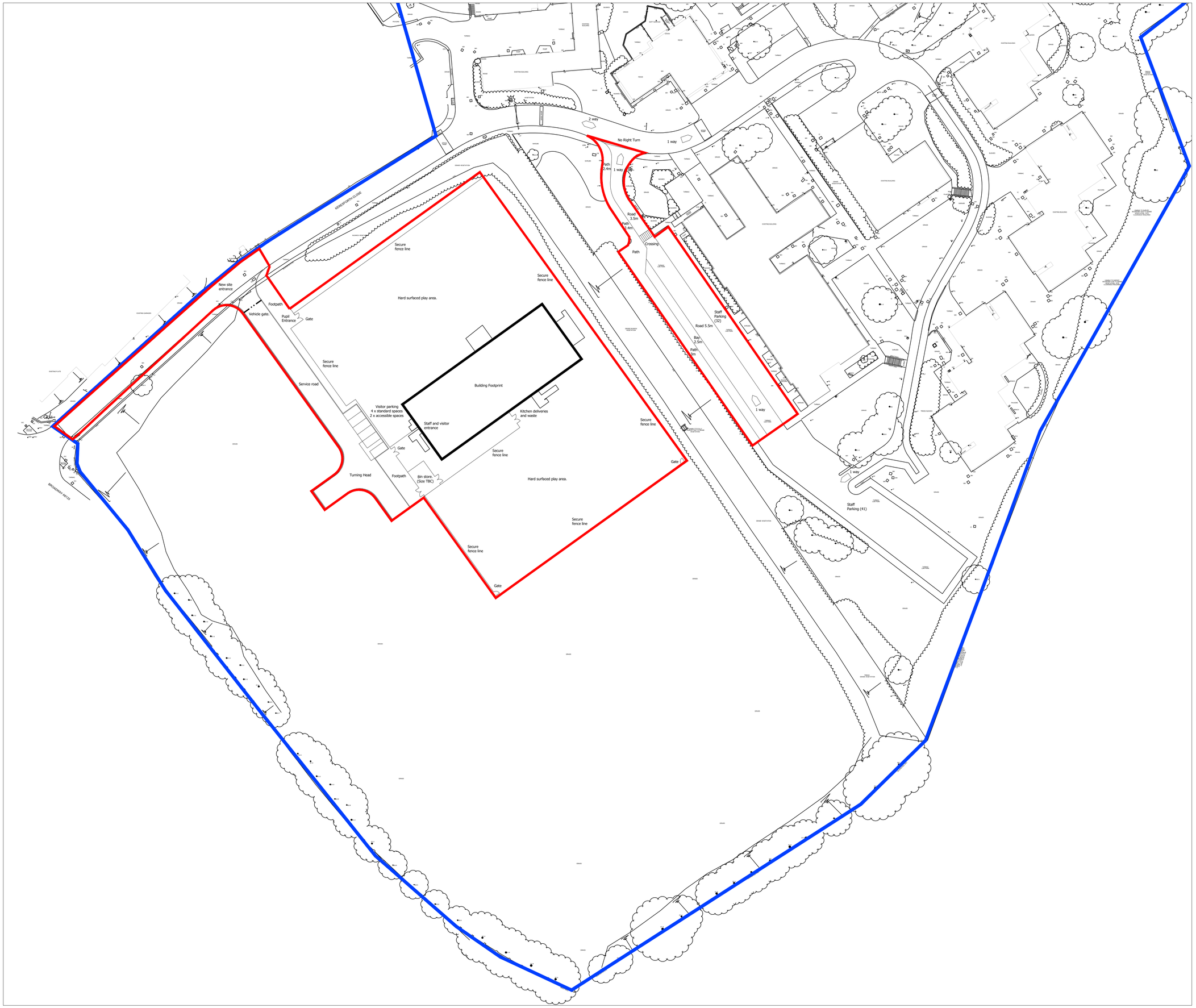
Appendix A Site Plans

- **Site Location Plan (Waterman Ref: WIE17125-103_GR_PRA_A1A)**
- **Site Plan (Watson Batty Ref: TRNTY-WBA-NB-00-DR-A-PL_101-P1)**
- **Ground Investigation Plan (17125-100-WIE-ZZ-XX-DR-V-80-003-P02)**



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Project Details	WIE17125-103: Keresforth Academy
Figure Title	Figure A1: Site Location Plan
Figure Ref	WIE17125-103_GR_PRA_A1A
Date	June 2020
File Location	\\s-lncs\wiel\projects\wie17125\103\graphics\pra\issued figures



N

1:500 SCALE BAR

0 5 10 20 30 Metres

Revision: P1 Date: 10/12/2020 Drawn: PB Checked: MS

Suitability: PL Planning

Trinity Academy Temporary School

Proposed Block Plan

Location:
Land at Keresforth Close
Barnsley
S70 6RS

Client:
The Department for Education

UPRN	Originator	Zone	Level	Type	Role	Number	Revision
TRNTY	WBA	NB	00	DR	A	PL_101	P1

Date: 10/12/2020 Drawn: PB Checked: MS Scale: 1:500 @A1 Int Job No: 3766_015_XXX
CAD REF:

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FUTURE BUILT

Note: Do not Scale from this drawing. All dimensions to be checked on site.



This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.

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GENERAL NOTES

- LOCATION OF MINESHAFT
- TREATED CIRCULAR HOLE 18" DIAMETER
- PROPOSED ROTARY CORE BOREHOLE
- PROPOSED TRIAL TRENCH

Rev	Date	Description	By
P02	23.12.20	ADD PROPOSED LOCATIONS	DC
P01	15.12.20	PRELIMINARY ISSUE	DC

Amendments

Project

TRINITY ACADEMY BARNSLEY

Title

EXPLORATORY HOLE LOCATION PLAN (PROPOSED LAYOUT)

Client

2nd Floor South Central 11 Peter Street Manchester M2 5QR
t 0161 839 8392
mail@watermangroup.com www.watermangroup.com

Status: PRELIMINARY

Designed By	Checked By	Waterman Ref
AM	AM	WIE17125-100
Drawn By	**Date**	**Scales @ A3**
DC	DECEMBER 2020	1:1500

Project - Originator - Volume - Level - Type - Role - Number: 17125-100-WIE-ZZ-XX-DR-V-80-003

Revision: P02

20F040_A, A3-Wat-BS-S, Proposed

Appendix B Groundtech Consulting Draft Factual Report

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 1 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
		0.10	ES								MG: Grass over dark grey to black slightly sandy slightly gravelly slightly clayey topsoil. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of glass, sandstone, ceramic, coal, siltstone.	
								0.30	148.22			
		0.40	ES								Firm grey brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular fine to coarse of sandstone and siltstone.	
		0.60	D									
		0.80	ES									
		1.00	B					1.00	147.52			1
		1.00	D								Extremely weak grey mottled brown Mudstone residually weathered recovered as slightly gravelly clay. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone.	
								2.00	146.52			2

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 2 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											NO RECOVERY.
			NR								
								2.36	146.16		
			NI								Weak brown orange fine to medium SANDSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities weathered brown orange horizontally fractured and cross bedding.
		2.00 - 3.00		64	50	36					*Between 2.36m and 2.44m bgl recovered as angular medium to coarse gravel with low cobble content.*
											Between 2.45m and 2.5m bgl becomes very close.
			5								*Between 2.63m and 2.65m bgl becomes sub horizontal (30 degrees).*
											Between 2.65m and 2.68m bgl becomes stepped.
			NI								*Between 2.95m and 3.0m bgl recovered as angular medium to coarse gravel with low cobble content.*
								3.00	145.52		NO RECOVERY.
			NR								
								3.48	145.04		Weak grey fine to medium SANDSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities weathered brown orange horizontally fractured and cross bedding.
		3.00 - 4.50		68	9	0					*Between 3.48m and 3.93m bgl recovered as angular medium to coarse gravel with low cobble content.*
			NI								
			1								

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 3 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NI								Weak grey fine to medium SANDSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities weathered brown orange horizontally fractured and cross bedding. *Between 3.99m and 4.26m bgl recovered as angular medium to coarse gravel with low cobble content.*
			2								*Becomes very closely spaced from 4.26m to 4.34m bgl.*
			NI								*Between 4.34m and 4.5m bgl recovered as angular medium to coarse gravel with low cobble content.*
								4.50	144.02		
			NR								NO RECOVERY.
								4.70	143.82		Extremely weak fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities cross bedding. *Between 4.7m and 5.07m bgl recovered as angular to subangular coarse gravel with low cobble content.*
			NI								
			2								*Between 5.07m and 5.13m bgl becomes closely spaced.*
			NI								*Between 5.13m and 5.17m bgl becomes clayey and recovered as angular to subangular coarse gravel with low cobble content.*
		4.50 - 6.00	4	87	44	0					*Between 5.24m and 5.37m bgl becomes closely spaced.*
			NI								*Between 5.37m and 5.44m bgl recovered as slightly clayey angular to subangular coarse gravel with low cobble content.*
			3								*Between 5.5m and 5.55m bgl becomes closely spaced.*
			NI								*Between 5.6m and 5.67m bgl becomes clayey and recovered as angular to subangular coarse gravel with low cobble content.*
			4								*Between 5.73m and 5.77m bgl becomes closely spaced.*
								6.00	142.52		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 4 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											NO RECOVERY.
			NR								
								6.40	142.12		
			3								Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities cross bedding.
			NI								*Between 6.5m and 6.6m bgl angular medium to coarse gravel with low cobble content.*
			2								
		6.00 - 7.50		73	58	7					
			NI								*Between 6.8m and 6.86m bgl becomes weathered red brown and angular medium to coarse gravel with low cobble content.*
											Between 6.86m and 6.95m bgl weathered orange brown.
			9								*Between 7.05m and 7.08m bgl becomes clayey.*
											Between 7.22m and 7.24m bgl becomes clayey.
								7.50	141.02		NO RECOVERY.
			NR								
								7.78	140.74		Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities cross bedding.
			2								
			NI								*Recovered as angular to subangular fine to*

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 5 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
		7.50 - 9.00	1	81	52	36					Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities cross bedding.	
			NI								*Recovered as angular to subangular fine to medium gravel of siltstone between 7.96m and 7.98m bgl.*	
			2								*Recovered as angular to subangular fine to coarse gravel and cobbles of siltstone between 8.08m and 8.19m bgl.*	
			NI								*Recovered as angular to subangular fine to coarse gravel and cobbles of siltstone between 8.28m and 8.40m bgl.*	
			4								*Sub-horizontal (45°) discontinuity at 8.75m bgl.*	
			NI								*Recovered as angular to subangular fine to coarse gravel of siltstone between 8.88m and 9.0m bgl.*	
								9.00	139.52			9
		9.00 - 10.50	NR	50	33	0					NO RECOVERY.	
								9.75	138.77			
			1								Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities.	
			NI								*Recovered as subangular cobble of siltstone between 9.83m and 9.88m bgl.*	
			3									
			NI									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

GROUNDTECH CONSULTING

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 6 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
			3								Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities. *Recovered as slightly clayey angular to subangular fine to medium gravel between 9.98m and 10.0m bgl.*	
			NI								*Recovered as angular to subangular fine to coarse gravel between 10.2m and 10.34m bgl.*	
			2									
								10.50	138.02		NO RECOVERY.	
			NR									11
		10.50 - 12.00		30	11	0						
								11.50	137.02		Weak to moderately strong fine grained SILTSTONE moderately weathered with horizontal smooth planar closely spaced discontinuities. *Recovered as angular to subangular fine to coarse gravel and cobbles between 11.5m and 11.66m bgl.*	
			NI									
			1								*Recovered as clayey angular to subangular fine to coarse gravel of siltstone with coal fragments between 11.75m and 11.88m bgl. (Broken Ground).*	
			NI									
			1								*Recovered as subangular cobble of siltstone between 11.92m and 12.0m bgl.*	
			NI									
								12.00	136.52			12

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 7 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											VOID - Suspected workings.
								12.30	136.22		Grey to black angular to subangular fine to coarse gravel of mudstone and coal. (Broken Ground).
								12.50	136.02		Black angular to subangular fine to coarse gravel of coal. (Broken Ground).
								13.50	135.02		Grey SILTSTONE with occasional bands of mudstone.

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 8 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Grey SILTSTONE with occasional bands of mudstone.

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 9 of 10

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Grey SILTSTONE with occasional bands of mudstone.

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 27/01/2021 - 28/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433330.27 N405553.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC201	CP+RC	148.52m AoD	LH	1:10	Sheet 10 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Grey SILTSTONE with occasional bands of mudstone.
								20.00	128.52		End of Borehole at 20.000m

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 12.0m bgl. 5. Rotary open hole drilling carried out from 12.0m to 20.0m bgl. 6. Void encountered between 11.5m and 12.3m bgl, supected workings. 7. Broken ground with mudstone and coal remnants encountered between 12.3m and 12.5m bgl. 8. Broken coal encountered between 12.5m and 13.5m bgl 9. Water flush lost between 11.5m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 4.5m bgl, 1.5m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 1 of 10

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		0.05	ES								MG: Grass over dark grey to black slightly sandy slightly gravelly slightly clayey topsoil. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of glass, sandstone, ceramic, coal, siltstone.
								0.40	148.05		
		0.50	ES								MADE GROUND: Firm brown mottled grey slightly sandy slightly gravelly reowrked clay. Sand is fine to medium. Gravel is angular to subangular fine to coarse of coal, sandstone and siltstone.
								0.80	147.65		
		0.85	D								Firm brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular fine to coarse of sandstone and siltstone.
		0.90	ES								
		1.10	B								
								1.50	146.95		Brown Sandstone.
								2.00	146.45		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 2 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											NO RECOVERY.
			NR								
								2.20	146.25		Weak orange brown fine to medium SANDSTONE moderately weathered with horizontal to sub horizontal (20 degrees) smooth planar to undulating closely spaced discontinuities weathered orange brown. *Between 2.20m and 2.34m bgl becomes clayey and recovered as angular to subangular medium to coarse gravel with low cobble content.* *Between 2.45m and 2.48m bgl recovered as angular to subangular medium to coarse gravel with low cobble content.* *Between 2.56m and 3.0m bgl recovered as angular to subangular medium to coarse gravel with low cobble content.*
			NI								
			1								
			NI								
		2.00 - 3.00	1	80	19	11					
			NI								
								3.00	145.45		NO RECOVERY.
			NR								
								3.38	145.07		Weak orange brown fine to medium SANDSTONE moderately weathered with horizontal to sub horizontal (20 degrees) smooth planar to undulating closely spaced discontinuities weathered orange brown. *Between 3.38m and 3.75m bgl recovered as angular to subangular medium to coarse gravel with low cobble content.*
		3.00 - 4.50	NI	80	16	0					
								3.75	144.70		Weak light brown grey fine grained SANDSTONE extremely weathered with horizontal rough to smooth planar closely spaced discontinuities and cross bedding. *Between 4.31m and 4.5m bgl recovered as slightly clayey angular to subangular fine to coarse gravel with low cobble content.*
			1								

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 3 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NI								Weak light brown grey fine grained SANDSTONE extremely weathered with horizontal rough to smooth planar closely spaced discontinuities and cross bedding.
			2					4.50	143.95		
		4.50 - 6.00	NR	56	20	0					NO RECOVERY.
			NI					5.15	143.30		Weak grey brown fine grained SANDSTONE moderately weathered with horizontal smooth planar to undulating very closely spaced with cross bedding and occasionally weathered orange brown. *Between 5.15m and 5.5m bgl recovered as angular to subangular gravel with low cobble content.*
			10								*Becomes closely spaced and clayey infilling on surfacing from 5.75m and 5.83m bgl.*
			NI								*Between 5.83m and 6.0m bgl recovered as angular to subangular gravel with low cobble content.*
								6.00	142.45		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 4 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY.
		6.00 - 7.50	NI	48	0	0		6.73	141.72		Very weak dark grey SILTSTONE completely weathered recovered as slightly clayey angular to subrounded gravel with low cobble content.
								7.50	140.95		NO RECOVERY.

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 5 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY.
								8.10	140.35		
			NI								Weak dark grey MUDSTONE moderately weathered with horizontal smooth planar to undulating very closely spaced occasionally weathered orange brown. *Between 8.1m and 8.35m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of mudstone and siltstone with low cobble content.*
		7.50 - 9.00	5	60	27	7					
			NI								*Between 8.62m and 8.64m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of mudstone and siltstone.*
			1								*Becoming closely spaced and vertically fractured from 8.64m to 8.74m bgl.*
			NI								*Between 8.75m and 9.0m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of mudstone and siltstone with low cobble content.*
								9.00	139.45		
			NR								NO RECOVERY.
								9.22	139.23		
			1								Weak grey fine grained SILTSTONE with bands of mudstone moderately weathered with horizontal to sub horizontal (35 degrees) smooth planar closely spaced discontinuities. and horizontal fractured.
			NI								*Between 9.3m and 9.37m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of mudstone and siltstone with low cobble content.*
			3								*Between 9.37m and 9.39m bgl very closely spaced.*
		9.00 - 10.50		85	15	0					*Between 9.52m and 9.6m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of siltstone with low cobble content.*
			NI								
			3								

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 6 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NI								Weak grey fine grained SILTSTONE with bands of mudstone moderately weathered with horizontal to sub horizontal (35 degrees) smooth planar closely spaced discontinuities. and horizontal fractured.
								10.50	137.95		NO RECOVERY.
			NR								
		10.50 - 12.00		55	29	0		11.17	137.28		Weak grey fine grained SILTSTONE with bands of mudstone moderately weathered with horizontal to sub horizontal (35 degrees) smooth planar closely spaced discontinuities. and horizontal fractured.
			1								*Between 11.17m and 11.35m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of siltstone with low cobble content.*
			NI								*Between 11.38m and 11.45m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of siltstone with low cobble content.*
			4								*Between 11.66m and 11.74m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of siltstone with low cobble content.*
			~~NI~~								*Becomes clayey from 11.7m to 11.74m bgl.*
			1					11.74	136.71		Weak to medium strong grey SILTSTONE moderately weathered with horizontal smooth planar discontinuities.
			NI								*Between 11.8m and 11.88m bgl recovered as slightly clayey angular to subrounded fine to*
			2					12.00	136.45		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 7 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Weak to medium strong grey SILTSTONE moderately weathered with horizontal smooth planar discontinuities. *Between 11.8m and 11.88m bgl recovered as slightly clayey angular to subrounded fine to coarse gravel of siltstone with low cobble content.* NO RECOVERY.
			NR								
		12.00 - 13.50		30	0	0					
											13
								13.05	135.40		
			NI								Weak dark grey SILTSTONE recovered as angular to subangular coarse gravel with low cobble content. (Broken Ground).
								13.50	134.95		Grey Mudstone.
								14.00	134.45		
											14

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 8 of 10

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
											Intact black anthracite COAL.	
								15.00	133.45		Grey Mudstone.	15
												16

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 9 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Grey Mudstone.
								16.50	131.95		Grey SILTSTONE.

17

18

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 25/01/2021 - 26/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433341.78 N405537.54
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC202	CP+RC	148.45m AoD	LH	1:10	Sheet 10 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Grey SILTSTONE.
								20.00	128.45		End of Borehole at 20.000m

19

20

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 13.5m bgl. 5. Rotary open hole drilling carried out from 13.5m to 20.0m bgl. 6. Void encountered between 10.8m and 11.0m bgl, supected workings. 7. Broken ground consiting of siltstone cobbles encountered between 12.0m and 13.5m bgl. 8. Intact coal encountered between 14.0m and 15.0m bgl 9. Water flush lost between 10.8m and 13.5m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 13.5m bgl, 11.0m plain, 2.5m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 1 of 10

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	ES								MG: Grass over dark grey to black slightly sandy slightly gravelly slightly clayey topsoil. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of glass, sandstone, ceramic, coal, siltstone.
		0.40 0.40 - 0.50 0.45	B ES D					0.35	146.69		Medium strong orange brown fractured SANDSTONE highly weathered recovered as slightly clayey angular to subangular coarse gravel and cobbles.
			NR					1.50	145.54		NO RECOVERY.
			NI					1.80	145.24		Weak orange brown fine to medium grained SANDSTONE moderately weathered with horizontal smooth planar to undulating closely spaced discontinuities. Weathering dark orange brown with small scale cross bedding present.

1

2

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 2 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Weak orange brown fine to medium grained SANDSTONE moderately weathered with horizontal smooth planar to undulating closely spaced discontinuities. Weathering dark orange brown with small scale cross bedding present.
			1								
		1.50 - 2.50	NI	70	23	23					*Recovered as subangular fine to coarse gravel and cobbles of sandstone between 1.8m and 2.1m bgl.*
											Recovered as subangular cobbles of sandstone between 2.2m and 2.37m bgl.
			2								*Vertical discontinuities present between 2.37m and 2.50m bgl.*
			NR								*NO RECOVERY between 2.5m and 2.72m bgl.*
			NI								*Recovered as orange brown subangular cobbles of sandstone between 2.72m and 3.02m bgl.*
			2								*Vertical discontinuities present between 3.02m and 3.23m bgl.*
		2.50 - 4.00	NI	37	21	12					*Recovered as orange brown subangular to subrounded cobbles of sandstone between 3.23m and 3.51m bgl.*
			2								*Discontinuities are medium spaced to very closely spaced between 3.51m and 3.72m bgl.*
			NI								*Recovered as angular cobbles of sandstone between 3.72m and 3.82m bgl.*
			1								
								4.00	143.04		

3

4

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 3 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY between 4.0m and 4.7m bgl.
		4.00 - 5.50	1 NI 1 NI 3	53	30	23		4.70 5.50	142.34 141.54		Moderately strong yellow to orange brown fine to medium grained SANDSTONE partially weathered with horizontal to sub horizontal (10°) smooth planar to rough stepped very closely to closely spaced discontinuities. Weathering dark orange brown on surfaces. *Recovered as angular cobbles of sandstone between 4.75m and 4.79m bgl.* *Recovered as subangular cobbles between 4.96m and 5.21m bgl.*
											NO RECOVERY between 5.50m and 6.33m bgl.

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 4 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											NO RECOVERY between 5.50m and 6.33m bgl.
			NR								
								6.33	140.71		Weak grey SILTSTONE highly weathered with horizontal smooth undulating extremely closely spaced discontinuities. *Residually weathered, recovered as subangular to subrounded medium to coarse gravel of siltstone between 6.33m and 6.49m bgl.*
			NI								
			1								
			NI					6.53	140.51		*Recovered as subangular coarse gravel between 6.51m and 6.53m bgl.*
			2								Moderately strong grey fine to medium grained SANDSTONE partially to moderately weathered with horizontal smooth planar to smooth undulating very closely to closely spaced discontinuities. Weathering orange brown around discontinuities.
			NI								
		5.50 - 7.50		58	39	19					*Recovered as subrounded cobbles between 6.6m and 6.7m bgl.*
											7
			10								
								7.38	139.66		Weak grey SILTSTONE highly weathered with horizontal smooth undulating extremely closely to very closely spaced discontinuities.
			NI					7.50	139.54		*Recovered as subangular coarse gravel of siltstone between 7.45m and 7.5m bgl.*
											NO RECOVERY.
			NR								
								7.83	139.21		Extremely weak to very weak dark grey MUDSTONE moderately weathered with horizontal to sub-horizontal (45°) smooth to rough planar to stepped very closely spaced to closely spaced discontinuities.
			NI								
			2								
											8

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 5 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NI								Extremely weak to very weak dark grey MUDSTONE moderately weathered with horizontal to sub-horizontal (45°) smooth to rough planar to stepped very closely spaced to closely spaced discontinuities. Occasional brown bands and gravel infilling fractures. Weathering orange brown on surfaces.
			1								*Recovered as subangular to subrounded fine to coarse gravel of mudstone between 7.83m and 7.93m bgl.*
			NI								*Sub-horizontal (45°) discontinuity between 7.93m and 7.97m bgl.*
			5								*Recovered as slightly clayey subangular fine to coarse gravel of mudstone between 7.97m and 8.08m bgl.*
		7.50 - 9.00		78	49	0					*Recovered as angular fine to coarse gravel and cobbles of mudstone between 8.14m and 8.20m bgl*
			NI								*Recovered as angular cobble between 8.54m and 8.57m bgl.*
			5								
			NI								*Recovered as subrounded cobble between 8.94m and 9.0m bgl.*
											NO RECOVERY between 9.0m and 9.17m bgl.
			NR								
			NI								*Recovered as angular to subangular fine to coarse gravel and cobbles between 9.17m and 9.22m bgl.*
			4								
		9.00 - 10.50		88	68	32					
			NI								*Recovered as angular to subangular fine to coarse gravel and cobbles of mudstone between 9.50m and 9.55m bgl.*
			1								
			NI								*Recovered as clayey angular to subangular fine to coarse gravel and cobbles of mudstone between 9.62m and 9.71m bgl.*

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 6 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
			12								Extremely weak to very weak dark grey MUDSTONE moderately weathered with horizontal to sub-horizontal (45°) smooth to rough planar to stepped very closely spaced to closely spaced discontinuities. Occasional brown bands and gravel infilling fractures. Weathering orange brown on surfaces.	
											Core split by (45°) discontinuity between 9.99m and 10.07m bgl.	
											Core split by (45°) discontinuities between 10.20m and 10.35m bgl.	
			NR								*NO RECOVERY between 10.50m and 10.65m bgl.*	
			5								*Discontinuities are horizontal to sub-horizontal (30°) and sub-vertical (80°) between 10.65m and 10.99m bgl.*	
			NI								*Recovered as subangular to subrounded coarse gravel and cobbles of mudstone between 10.99m and 11.05m bgl.*	11
			1					11.05	135.99		Moderately strong dark grey SILTSTONE partially weathered with horizontal rough planar to undulating closely spaced discontinuities.	
		10.50 - 12.00	NI	90	70	59		11.15	135.89		Very weak to weak dark grey MUDSTONE partially to weathered with horizontal to sub-horizontal (50°) smooth planar to rough undulating closely spaced to medium spaced discontinuities with some clay infilling and dark brown staining at discontinuity surfaces. Becoming moderately strong close to discontinuities.	
			1								*Recovered as slightly clayey angular to subangular fine to coarse gravel and cobbles of mudstone between 11.15m and 11.28m bgl.*	
			NI								*Grey subangular to subrounded fine to coarse gravel of siltstone between 11.41m and 11.47m bgl.*	
			2									
			1									12

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 7 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								Very weak to weak dark grey MUDSTONE partially to weathered with horizontal to sub-horizontal (50°) smooth planar to rough undulating closely spaced to medium spaced discontinuities with some clay infilling and dark brown staining at discontinuity surfaces. Becoming moderately strong close to discontinuities.
			NI								*NO RECOVERY between 12.0m and 12.23m bgl.*
			5								*Grey subrounded fine to coarse gravel of siltstone between 12.23m and 12.30m bgl.*
		12.00 - 13.50		84	66	39					
			NI								*Recovered as angular to subangular fine to coarse gravel and cobbles between 13.03m and 13.11m bgl.*
			2								
			NI								*Recovered as soft to firm grey silty slightly gravelly clay between 13.31m and 13.38m bgl. Gravel is angular fine to medium of siltstone.*
			2								
			NI								*Discontinuities are very closely spaced between 13.48m and 13.50m bgl.*
			3								*Recovered as subangular to subrounded grey brown cobbles of siltstone between 13.50m and 13.58m bgl.*
											Moderately weathered with horizontal to sub-horizontal (45°) closely spaced discontinuities. Weathering dark orange brown at discontinuity surfaces. Small white salt like crystals present within discontinuities, possible iron pyrite.

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14

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 8 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			3								Very weak to weak dark grey MUDSTONE partially to weathered with horizontal to sub-horizontal (50°) smooth planar to rough undulating closely spaced to medium spaced discontinuities with some clay infilling and dark brown staining at discontinuity surfaces. Becoming moderately strong close to discontinuities.
			5								*Discontinuities are extremely close to very close between 13.99m and 14.06m bgl.*
		13.50 - 15.00		100	66	32					
			NI								*Recovered as slightly clayey angular to subangular fine to coarse gravel and cobbles between 14.51m and 14.72m bgl.*
			3								*Clay infilling discontinuities from 14.78m bgl.*
			NI					15.00	132.04		*Recovered as subangular cobbles between 14.97m and 15.0m bgl.*
		15.00 - 16.50		15	0	0					VOID - suspected workings.

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 9 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
			NR								VOID - suspected workings.	
								16.27	130.77			
			NI								Black angular to subangular fine to coarse gravel and cobbles of anthracite coal with firm grey gravelly silty clay. Gravel is subangular to subrounded fine to coarse of siltstone. (Broken Ground)	
								16.50	130.54			
			NR								NO RECOVERY.	17
		16.50 - 18.00		56	10	6		17.15	129.89			
			NI								Black anthracite coal and grey siltstone recovered as slightly clayey angular to subangular fine to coarse gravel. (Broken Ground).	
								17.44	129.60			
											Firm slightly gravelly silty clay. Gravel is angular to subangular fine to coarse of anthracite coal and siltstone. (Broken Ground).	
								17.66	129.38			
			1								Extremely weak grey SILTSTONE moderately weathered with horizontal rough planar to undulating closely spaced discontinuities.	
								17.76	129.28			
			NI					17.84	129.20		Firm slightly gravelly silty clay. Gravel is angular to subangular fine to coarse of anthracite coal and siltstone. (Broken Ground).	
			1								*Recovered as light grey angular to subangular fine to coarse gravel of siltstone between 17.84m*	18
								18.00	129.04			

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 28/01/2021 - 29/01/2021
Location: BARNSLEY	Contractor:	Co-ords: E433370.88 N405582.95
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC203	CP+RC	147.04m AoD	CH	1:10	Sheet 10 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Firm slightly gravelly silty clay. Gravel is angular to subangular fine to coarse of anthracite coal and siltstone. (Broken Ground).
											Recovered as light grey angular to subangular fine to coarse gravel of siltstone between 17.84m and 17.95m bgl.
											Moderately strong light grey SILTSTONE partially weathered with horizontal smooth planar closely spaced discontinuities. Grey SILTSTONE
								20.00	127.04		End of Borehole at 20.000m

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 1.5m bgl. 4. Rotary coring undertaken from 1.5m to 18.0m bgl. 5. Rotary open hole drilling carried out from 18.0m to 20.0m bgl. 6. Water flush lost at 4.0m bgl and void encountered between 4.9m and 5.1m bgl within fractured sandstone. 7. Loosely filled suspected workings encountered between 15.2m and 17.0m bgl with broken mudstone and coal fragments. 9. Water flush lost at 15.2m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 7.0m bgl, 4.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 01/02/2021
Location: BARNSLEY	Contractor:	Co-ords: E433382.55 N405566.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 1 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
		0.20 0.20	D ES								MG: Grass over dark grey to black slightly sandy slightly gravelly slightly clayey topsoil. Sand is fine to medium. Gravel is angular to subrounded fine to coarse of glass, sandstone, ceramic, coal, siltstone.	
								0.34	146.60			
		0.50 0.50	D ES								Firm orange brown slightly gravelly sandy CLAY. Sand is medium. Gravel is angular to subangular fine to coarse of sandstone and occasional ironstone.	
		1.00 1.00 1.00 - 1.50	B D ES									1
		1.50	D									
		~~2.00~~	~~D~~					2.00	144.94			2

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 01/02/2021
Location: BARNSLEY	Contractor:	Co-ords: E433382.55 N405566.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 2 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description	
			NR								NO RECOVERY.	
								2.25	144.69			
		2.00 - 3.00	NI	75	26	0					Weak orange brown fine to medium grained SANDSTONE moderately weathered, recovered as subangular to subrounded medium to coarse gravel.	
								2.60	144.34			
			9								Moderately strong light orange brown to grey fine to medium grained SANDSTONE highly weathered with horizontal rough planar to stepped extremely closely to very closely spaced discontinuities. Weathering dark orange brown.	
			NI								*Recovered as subangular cobbles of sandstone between 2.86m and 3.0m bgl.*	
								3.00	143.94		NO RECOVERY between 3.0m and 4.17m bgl.	3
		3.00 - 4.50		22	8	0						4

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 01/02/2021
Location: BARNSLEY	Contractor:	Co-ords: E433382.55 N405566.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 3 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY between 3.0m and 4.17m bgl.
			NI					4.17	142.77		Moderately strong light orange brown to grey fine to medium grained SANDSTONE highly weathered with horizontal rough planar to stepped extremely closely to very closely spaced discontinuities. Weathering dark orange brown.
			3								*Recovered as subangular cobbles of sandstone between 4.17m and 4.37m bgl. Discontinuities are very closely spaced between 4.37m and 4.50m bgl.*
			NR					4.50	142.44		NO RECOVERY.
		4.50 - 6.00	NI	51	38	38		5.23	141.71		Moderately strong orange brown medium grained SANDSTONE moderately weathered with horizontal to sub-horizontal (45°) and sub-vertical (80°) rough undulating to stepped medium spaced discontinuities. Sub-vertical discontinuities split core.
			2								*Recovered as subangular coarse gravel and cobbles of sandstone between 5.23m and 5.36m bgl.*
			NI								
			2								
								6.00	140.94		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 01/02/2021
Location: BARNSLEY	Contractor:	Co-ords: E433382.55 N405566.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 4 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY.
		6.00 - 7.50		42	38	28					
			NI					6.86	140.08		Weak to medium strong orange brown to light grey fine to medium grained SANDSTONE partially weathered with horizontal smooth planar to stepped very closely to medium spaced discontinuities. *Recovered as subangular to subrounded medium to coarse gravel of sandstone between 6.86m and 6.93m bgl.*
			3								
			1								
								7.50	139.44		NO RECOVERY.
			NR								
			1					7.85	139.09		Moderately strong light grey fine grained SANDSTONE partially to moderately weathered with horizontal smooth undulating to stepped extremely close to
			NI								

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

Rotary Core Log

Project Name: TRINITY ACADEMY	Client: WATERMAN I&E	Date: 01/02/2021
Location: BARNSLEY	Contractor:	Co-ords: E433382.55 N405566.70
Project No. : 20063	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 5 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		7.50 - 9.00	11	76	52	0					Moderately strong light grey fine grained SANDSTONE partially to moderately weathered with horizontal smooth undulating to stepped extremely close to closely spaced discontinuities. Weathering orange brown occasionally. *Recovered as orange brown subrounded coarse gravel of sandstone between 7.9m and 8.0m bgl.*
			NI								*Recovered as gravelly slightly clayey subangular to subrounded cobbles of sandstone between 8.56m and 8.70m bgl.*
			1					8.70	138.24		Very weak light grey fine grained SANDSTONE highly weathered with horizontal rough planar to undulating extremely closely to very closely spaced discontinuities with clay infilling.
			NI								
			2								
			NI								
			3					8.88	138.06		*Recovered as clayey angular to subangular fine to medium gravel between 8.73m and 8.76m bgl.* *Recovered as clayey angular to subangular fine to medium gravel between 8.83m and 8.85m bgl.*
		9.00 - 10.50	NR	78	43	26					Weak to medium strong light grey fine grained SANDSTONE partially weathered with horizontal smooth undulating to rough stepped very closely to closely spaced discontinuities. Rarely weathering orange brown.
			3								
			NI								*Recovered as angular cobbles between 9.53m and 9.62m bgl.*
			1								
			1								*Discontinuities are medium spaced between 9.66m and 9.95m bgl.*

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

Rotary Core Log

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Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 6 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			2								Weak to medium strong light grey fine grained SANDSTONE partially weathered with horizontal smooth undulating to rough stepped very closely to closely spaced discontinuities. Rarely weathering orange brown.
			NI								*Recovered as slightly gravelly angular to subangular cobbles between 10.1m and 10.43m bgl. Core split by vertical fractures.*
								10.43	136.51		
								10.50	136.44		Firm grey gravelly clay. Gravel is subangular to subrounded fine to medium of mudstone. NO RECOVERY.
			NR								
								10.99	135.95		Very weak to medium strong grey SILTSTONE moderately to highly weathered with horizontal to sub-horizontal (10°) (45°) and vertical (90°) rough planar to smooth stepped very closely to closely spaced discontinuities.
			1								
			NI								
			2								
		10.50 - 12.00	NI	68	38	7					*Recovered as subangular to subrounded cobbles of siltstone between 11.8m and 11.16m bgl.*
											Recovered as coarse gravel of siltstone between 11.24m and 11.26m bgl.
			5								
			NI								*Recovered as subangular to subrounded cobbles of siltstone between 11.58m and 11.78m bgl.*
			1								
			NI								
			1								
			NI								*Recovered as subangular to subrounded*

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12

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

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Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 7 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								Very weak to medium strong grey SILTSTONE moderately to highly weathered with horizontal to sub-horizontal (10°) (45°) and vertical (90°) rough planar to smooth stepped very closely to closely spaced discontinuities.
			NI								*Recovered as subangular to subrounded cobbles of siltstone between 11.95m and 12.0m bgl.*
											NO RECOVERY between 12.0m and 12.20m bgl.
			3								*Recovered as angular to subangular cobbles of siltstone between 12.20m and 12.42m bgl.*
			NI								*Extremely close discontinuities between 12.58m and 12.59m bgl.*
		12.00 - 13.50	1	86	39	24					
			NI								*Recovered as angular to subangular fine to coarse gravel of siltstone between 12.83m and 12.86m bgl.*
			1								*Recovered as angular to subangular fine to coarse gravel and cobbles of siltstone between 12.91m and 12.97m bgl.*
			NI								*Core split by vertical fractures and small white salt like crystals present within discontinuities, possible iron pyrite.*
			4								*Recovered as angular to subangular fine to coarse gravel and cobbles of siltstone between13.18m and 13.26m bgl.*
			NI								*Recovered as angular to subangular fine to coarse gravel and cobbles of siltstone between13.42m and 13.5m bgl.*
			4								NO RECOVERY.
			NI					13.50	133.44		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

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Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 8 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			NR								NO RECOVERY.
								14.26	132.68		
			NI								Very weak to weak grey SILTSTONE moderately weathered with horizontal to sub-horizontal (30°) rough planar closely to medium spaced discontinuities.
			2								*Recovered as firm grey clay between 14.26m and 14.31m bgl.*
		13.50 - 15.00	NI	49	26	20					*Recovered as subrounded cobbles of siltstone between 14.50m and 14.55m bgl.*
			1								
			NI								*Recovered as subrounded cobbles of siltstone between 14.76m and 15.0m bgl.*
								15.00	131.94		NO RECOVERY.
			NR								
		15.00 - 16.50		61	20	17					
								15.58	131.36		Very weak to weak grey SILTSTONE moderately weathered with horizontal to sub-horizontal (30°) rough planar closely spaced discontinuities.
			NI								*Recovered as angular to subangular coarse gravel and cobbles of siltstone between 15.58m and 16.19m bgl. Vertical fractures splitting core.*

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

1. Service clearance undertaken. 2. Hand dug pit excavated to 1.2m bgl. 3. Dynamic Sampling carried out to 2.0m bgl. 4. Rotary coring undertaken from 2.0m to 16.5m bgl. 5. Rotary open hole drilling carried out from 16.5m to 20.0m bgl. 6. Water flush lost between 4.7m and 6.0m bgl due to heavily fractured sandstone. 7. Poor flush returns from 12.0m bgl. 8. Void encountered between 16.5m and 17.9m bgl, supected workings. 9. Broken ground with coal remnants encountered between 17.9m and 18.4m bgl. 10. Groundwater strikes not encountered. 11. 50mm standpipe installed to 15.0m bgl, 12.0m plain, 3.0m slotted.

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Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 9 of 10

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
			3					16.50	130.44		Very weak to weak grey SILTSTONE moderately weathered with horizontal to sub-horizontal (30°) rough planar closely spaced discontinuities.
								17.90	129.04		VOID - suspected workings.
											Black angular to subangular fine to coarse gravel of anthracite coal. (Broken Ground).

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

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Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
RC204	CP+RC	146.94m AoD	CH	1:10	Sheet 10 of 10

Well	Water	Depth (m)	Type /Fl	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Black angular to subangular fine to coarse gravel of anthracite coal. (Broken Ground).
								18.40	128.54		Grey SILTSTONE.
								20.00	126.94		End of Borehole at 20.000m

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Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

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RC202 2.0 – 4.5m



RC202 4.5 – 7.5m



RC202 7.5 – 10.5m



RC202 10.5 – 13.5m



RC201 2.0 – 4.5m



RC201 4.5 – 7.5m



RC201 7.5 – 10.5m



RC201 10.5 – 12m



RC203 1.5 – 3.5m



RC203 3.5 – 9.0



RC203 9.0 - 12.0m



RC203 12.0 – 15.0m



RC203 15.0 – 18.0



RC204 2.0 - 6.0m