# Proposed Retail Development
# Barnsley Road, Goldthorpe

## Phase II Geo-Environmental Assessment

## For

## Dearne Estates (Goldthorpe) Ltd.

| Report Ref | Issue | Prepared by | Date | Reviewed by | Date |
|---|---|---|---|---|---|
| 14013Q/SI | 1 | A. Bradley | 04.12.14 | A. Coverdale | 04.12.14 |
| | 2 | A. Bradley | 15.01.16 | A. Cooper | 16.01.15 |

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## CONTENTS



### Figures



### Appendices

## Executive Summary

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| Site Investigation | The investigation has involved:<br>• Inspection of a previous Phase I geo-environmental assessment.<br>• 8 mini percussion boreholes to a maximum depth of 2.02m.<br>• 11 trial pits to a maximum depth of 2.35m.<br>• 3 rotary open hole boreholes to a maximum depth of 31m.<br>• Infiltration tests were carried out in 3 of the trial pits.<br>• Installation of ground gas monitoring wells.<br>• Geotechnical and contamination related testing.<br>• Preliminary ground gas and groundwater monitoring. |
| Current Use | The site is currently unoccupied grazing land, which is roughly triangular and levels fall from approximately 42m in the southeast to approx. 36m in the west. |
| Ground Conditions | The site has a relatively thin cover of gravelly organic clay (topsoil) overlying firm sandy gravelly clay or medium dense clayey gravelly sand/sandy gravel. Beneath the natural soils were interbedded siltstones, sandstone and mudstones at shallow depths of between 0.45m and 1.70m bgl.<br><br>In all of the 3 boreholes drilled on the site, intact coal seams were encountered at depths of between 24.3m and 26.2m with full flush returns to maximum depth of 31.00m. The seams were proven to be between 0.20m and 0.80m in thickness. |
| Groundwater | During both the site works and during the first round of monitoring no groundwater has been encountered. During the second monitoring visit standing water was recorded to be between 0.41m and 0.84m bgl, however, with a single well (BH6) was identified to be wet at base. It is assumed at this stage that the water is associated with infiltration from the surface. |
| Gas Monitoring | Ground gas monitoring has been carried out on 6 occasions and the results of the monitoring indicates that combustible ground gas (methane) is present at low concentrations, with carbon dioxide recorded at maximum concentration of 2.2%. The results suggest a CIRIA C665 Characteristic Situation 1, where no precautions are required. |
| Contamination | Information obtained during the desk study indicated a low to medium risk of contamination. No physical evidence of contamination was encountered during the intrusive works and the results of the laboratory chemical analysis indicate low determinand concentrations which do not exceed the generic assessment criteria for human health.<br><br>Given the results of the laboratory analysis, the risk to the wider environment is considered to be low to negligible. |

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|---|---|
| Appraisal | Remediation – Based on the contamination assessment no remediation is required to facilitate development, however, if topsoil is imported it should be suitably validated to ensure there is no risk to end users.<br><br>Mining – The site is considered to be stable with respect to mining.<br><br>Foundations and Floor Slabs – Conventional pad and strip foundations should terminate at a minimum 0.9m depth within the residual soils or bedrock. However, based on the potential for differing founding strata across each plot, foundations should be extended to found on similar strata across the plots and therefore it would be prudent to extend all foundations onto the underlying bedrock where a bearing capacity of 200kN/$m^2$ is considered appropriate.<br><br>Depending on loadings a ground bearing floor slabs may be considered following the removal of the made ground (topsoil) suitable following re-engineering of the made ground within the footprint of each plot.<br><br>External Works – A CBR value of 3% should be adopted at this stage for design.<br><br>Gas precautions – No gas recorded to date but basic gas protection measures should be assumed until completion of the monitoring programme.<br><br>Water Supply Pipes – UKWIR analysis has not been undertaken as part of this assessment. It is recommended that the results of the assessment are provided to the water supply company so that the correct pipe material can be selected. Our preliminary assessment indicates that no special precautions are required with respect to water supply pipes.<br><br>Drainage - Based on the results of the infiltration tests carried out within the silty sandstone and interbedded coal measures strata the calculated infiltration rate is considered to be between 1.6 x $10^{-6}$ m/s and 3.43 x $10^{-6}$ m/s. Based on the calculated infiltration rates the use of soakaways are not considered practically feasible.<br><br>Sulphate attack on buried concrete – Buried concrete should be designed to BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-1 for both the made ground and natural soils. |

# 1 INTRODUCTION

1.1 3e Consulting Engineers Ltd (3e) were commissioned by Dearne Estates (Goldthorpe) Limited to carry out a Phase II geo-environmental assessment of land located off Barnsley Road in Goldthorpe, South Yorkshire. The proposed development for a proposed commercial development, as shown on the layout provided in **Appendix A**.

1.2 A Phase I geo-environmental assessment of the site was completed by 3e Consulting Engineers in April 2014 (ref: 14013). It is recommended that the report is read in conjunction with this assessment.

1.3 The objectives of this assessment were:

- To investigate near surface soil and groundwater conditions.
- To determine the potential risks posed by any ground or groundwater contamination and provide recommendations on remedial measures to manage such risks.
- To assess the risk posed by hazardous ground gas.
- To provide advice relating to geotechnical issues associated with the site.
- To provide foundation recommendations.

1.4 Fieldwork was undertaken between 6th and 11th November 2014 and comprised eight mini percussive boreholes, eleven trial pits in which three infiltration tests were undertaken and three rotary open holed boreholes with associated sampling and testing. In addition, infiltration tests were carried out in three of the trial pits to assess the suitability of soakaways for surface water disposal. It should be noted that since the fieldworks were undertaken an Aldi store and associated infrastructure has been constructed on the western portion of the site. It is understood that some construction related activities were carried out on the remaining eastern portion of the site including the site welfare compound and materials storage areas.

1.5 This report presents the factual information available during this appraisal, interpretation of the data obtained at the time of the site works and recommendations relevant to the scope of works outlined above. It has been assumed in the production of this report that the site is to be redeveloped for a commercial end use.

1.6 The comments and opinions presented in this report are based on the findings of the intrusive investigation carried out by 3e and the results of laboratory analysis. Responsibility cannot be accepted for any conditions not revealed by this investigation and which have not been taken into account by this report. Any diagram or opinion relating to site geology, contamination or other spatially variable features between or beyond investigation positions is conjectural and provided for guidance only. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary. Evaluation of ground gas and groundwater is based on observations made at the time of the investigation and any monitoring visits, but it should be noted that levels and quality may vary due to seasonal and other effects.

1.7 This report has been prepared for the sole use of Dearne Estates (Goldthorpe) Limited and TJ Morris Limited. No other third party may rely upon or reproduce the contents of this report without the written approval of 3e. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and 3e do not owe them any Duty of Care or Skill.

## 2 THE SITE

### Location and Description

2.1 The site, centred on National Grid Reference 445010, 404280, is located on the west side of Goldthorpe, approximately 1km from the village centre.

2.2 At the time of the site investigation works the site was unoccupied grazing land, which was roughly triangular and levels fall from approximately 42m in the southeast to approx. 36m in the west. During visits in 2014 to the site there has been no evidence of potential contamination sources was not encountered.

2.3 The boundaries were marked by hedgerows and wooden fencing. The site lies at a lower level than the land to the north, east and south which rise towards the east.

2.4 The adjacent land use is as follows:

- North: Dearne Valley Parkway (A635), beyond which lies open farm land.
- South: Barnsley Road, beyond which lies open farm land.
- East: Residential development.
- West: Hollygrove Roundabout.

## 3 PHASE I GEO-ENVIRONMENTAL ASSESSMENT

3.1 A Phase I geo-environmental assessment of the site was completed by 3e Consulting Engineers in April 2013 (ref: 14013). It is recommended that the report is read in conjunction with this assessment. Relevant information from the Phase I geo-environmental assessment is summarised in the following section:

*Site History*

3.2 In summary, the site has no history of previous contaminative use and has remained undeveloped. No significant contaminative industry has historically operated adjacent to the site apart from a brick works some 250m to SW, which was present between 1905 and 1962.

*Geology and Mining*

3.3 Geological information indicates the site is likely to be underlain by Carboniferous Middle Coal Measures, anticipated to be sandstone. The site lies in a faulted block, with the Shafton coal seam conjectured to crop some 500m to the south. According to a NERC publication of the Barnsley Coal Field the Shafton seam is between 1m and 2m thick.

3.4 The historical borehole records indicate bedrock depth at approximately 1.9m, which consists of bands of sandstone and mudstone to at least 4.4m depth.

3.5 The Coal Authority record workings beneath the site in 5 seams of coal between 280m and 810m depth. The Coal Authority also believes that the site is in an area where coal exists at or close to the surface which may have been worked at some time in the past.

3.6 A single mine entry is recorded on the northern site boundary which was filled by Barnsley MBC during the construction of the Dearne Valley Parkway. It should be noted that other unrecorded mine entries may be present.

3.7 A supplementary interpretative report was obtained from the Coal Authority for the recorded shaft. The report indicates the shaft to be immediately to the north of the site, is 2m wide and 27m deep. Based on this record it can be anticipated that this shaft would have been sunk to exploit the Shafton Coal seam.

*Watercourses and Groundwater*

3.8 Thurnscoe Dike is recorded to be 182m to the north of the site.

3.9 The underlying strata are classified as a Secondary A aquifer and there are no groundwater abstractions located within 1km of the site.

3.10 The site does not lie within a fluvial flood plain considered to be at risk of flooding.

*Landfill Sites, Pollution Controls and Industrial Land Use*

3.11 There are no recorded landfill sites within 250m of the site.

3.12 There is a registered waste transfer site located 189m to the north of the site, which has now been cancelled.

3.13 There are no pollution preventions controls or recorded pollution incidents within 250m of the site.

**Conceptual Site Model**

3.14 Based on the information available, it was concluded that the main sources of contamination on the site are associated with current and historic activities including made ground from the construction of the adjacent highways and potential ground gas from any made ground and potential coal workings.

3.15 The assessment indicates that the risk to human health from the contamination can be largely mitigated by use of appropriate PPE during construction and by the use of hardstand or soil capping throughout the proposed development.

3.16 Overall the assessment indicates a low environmental risk until proved otherwise.

**Ground Gas Risk Assessment**

3.17 Radon protection measures are not required in the construction of new dwellings.

3.18 The assessment indicates a low to medium risk of ground gas associated coal and historic mining.

## 4 METHOD OF INVESTIGATION

### Fieldwork

4.1 The intrusive works comprised eight mini percussive boreholes sunk to a maximum depth of 2.02m below existing ground level (bgl), eleven trial pits to a maximum depth of 2.35m bgl and three rotary open hole boreholes to a maximum depth of 31.0m bgl. The site works were carried out between on the 6th and 11th November 2014. The exploratory holes were located across the site to provide general coverage making allowance for potential archaeological features and buried utilities.

4.2 A copy of the exploratory hole records are included as **Appendix B** and the locations are shown on **Figure 2** (Exploratory Hole Location Plan).

4.3 The mini percussion boreholes were sunk in order to determine soil profile and to allow ground gas and groundwater monitoring wells to be installed. Disturbed samples and, where possible, undisturbed open drive tube samples were recovered for soil descriptions and laboratory testing. Standard penetration tests (SPT) were carried out to provide an assessment of the in situ strength of the cohesive strata and the relative density of the granular and cohesive natural deposits and bedrock.

4.4 The trial pits were excavated in order to determine the soil profile. Disturbed samples were recovered as appropriate for soil descriptions and laboratory testing. In addition, infiltration tests were carried out in three of the trial pits to assess the suitability of soakaways for surface water disposal in accordance with the methodology set out in BRE 365. Copies of the infiltration test data are included as **Appendix D**.

4.5 The rotary open holes were positioned to give the best possible coverage of the overall site and provide some specific information at key locations including the adoptable access road, foodstore and in close proximity to the treated mine shaft, to assess the depth and condition of coal seams within influencing depth beneath the site.

4.6 Gas/groundwater monitoring wells, comprising slotted 19mm diameter HDPE pipe within a granular filter were installed in five of the boreholes (WS01, WS03, WS04, WS06 and WS07) to a maximum depth of approximately 1.7m below ground level (bgl). The wells were sealed using bentonite and a lockable cover was fitted at the surface. To date, the wells have

been monitored on two occasions for methane, carbon dioxide and oxygen using a portable infra-red gas monitor. The rate of gas flow from the boreholes was also recorded using a portable flow meter and the groundwater levels were recorded using a portable dip meter. The results of the ground gas monitoring are presented in **Appendix C**.

4.7 Fieldwork and soil descriptions were carried out in general accordance with BS5930:1999, "Code of Practice for Site Investigations".

**Laboratory Chemical Testing**

4.8 The results of the chemical analysis are included as **Appendix E**. The analyses were carried out at an MCERTS registered and UKAS accredited laboratory.

4.9 In order to provide a preliminary assessment of contamination, eight samples of made ground and four samples of the underlying natural soil were screened for the following determinands:

- Arsenic
- Boron
- Cadmium
- Chromium
- Lead
- Mercury
- Nickel
- Selenium
- Copper
- Zinc
- Speciated polyaromatic hydrocarbons (PAH)
- Water soluble sulphate
- pH
- Total organic carbon (TOC)
- Organic Matter Content

4.10 In addition, eight samples of the underlying natural soil were scheduled for water soluble sulphate and pH determinations to assess the potential for sulphate attack on buried concrete.

**Laboratory Geotechnical Testing**

4.11 Geotechnical related testing was carried out to determine the physical characteristics of the soils and comprised the following:

- Twelve Atterberg limits determinations to confirm field descriptions and classify cohesive soils.

4.12 The results of the geotechnical test results are included as **Appendix F**.

## 5 RESULTS OF THE INVESTIGATION

### Soil Profile

5.1 Detailed descriptions of the materials encountered together with observations of groundwater behaviour, visible contamination, the results of in situ testing and sampling information are given on the exploratory hole records included as **Appendix B**. A summary of the ground conditions encountered is presented below.

*Made Ground*

5.2 The entire site was covered in a thin veneer of gravelly organic clay (topsoil) encountered to depths of between 0.24m and 0.40m below ground level (bgl). Within TP03 there was some possible made ground which comprised reworked residual soils and 'topsoil' between 0.30m and 0.60m bgl. This may have resulted from historic on site activities and the supervising archaeologist recorded the disturbance in the strata during the excavation of the trial pit, as it was located close to a subsurface feature identified during a recent geophysical survey. Also within TP05 some coal gravel was found to be mixed with 'topsoil' at the base of the strata.

*Natural Deposits*

5.3 The made ground is generally underlain by residual soil (completely weathered bedrock) comprising firm sandy gravelly clays, medium dense clayey sands or gravels overlying interbedded siltstones, mudstones and sandstones or silty sandstone bedrock, which were present at between 0.70m and 1.7m bgl across the site.

5.4 Across the site within residual soils, either sandy gravelly clay or sandy gravel had SPT 'N' values N35, with the SPT 'N' values in and weathered sandstone, siltstone and mudstone bedrock between N22 and N68.

5.5 Exploratory holes were terminated within bedrock.

**Coal Seams and Mineworkings**

5.6 In all of the 3 boreholes drilled on the site, intact coal seams were encountered at depths of between 24.3m and 26.2m with full flush returns to maximum depth of 31.0m. The seams were proven to be between 0.2m and 0.8m in thickness.

**Groundwater**

5.7 No groundwater was encountered during the intrusive investigation.

5.8 During both the site works and during the first round of monitoring no groundwater was recorded. During the second monitoring visit standing water was recorded to be between 0.41m and 0.84m bgl, however, with a single well (BH6) was identified to be wet at base. It is assumed at this stage that the water is associated with infiltration from the surface. The results of the groundwater monitoring are presented in **Appendix C**.

5.9 It should be noted that groundwater levels vary seasonally and that a higher water table than recorded could occur.

**Infiltration Testing**

5.10 Infiltration tests were carried out in TP1, TP2 and TP3 where bedrock was encountered beneath the superficial residual soils. The results of the tests are enclosed in **Appendix D**. Based on the results of the testing the calculated infiltration rate is considered to be between $1.6 \times 10^{-6}$ m/s and $3.43 \times 10^{-6}$ m/s.

**Physical Evidence of Contamination**

5.11 No visual and olfactory evidence of significant contamination was encountered within the made ground or the natural deposits.

**Gas Monitoring**

5.12 The results of the ground gas monitoring carried out on six occasions between November 2014 and February 2015 are summarised in the following table:

| Location | $CH_4$ (% v/v) | $CO_2$ (% v/v) | $O_2$ (% v/v) | Maximum Flow (l/hr) | Barometric Pressure (mb) | Maximum GSV* | |
|---|---|---|---|---|---|---|---|
| | | | | | | $CO_2$ | $CH_4$ |
| WS01 | 0.0 | 0.0 - 2.2 | 16.1 - 20.9 | 0.0 | 999 - 1037 | <0.07 | <0.07 |
| WS03 | 0.0 | 0.0 - 1.9 | 15.7 - 20.7 | 0.0 | | | |
| WS04 | 0.0 | 0.1 - 1.3 | 16.2 - 20.8 | 0.0 | | | |
| WS06 | 0.0 | 0.0 - 1.2 | 14.8 - 21.1 | 0.0 | | | |
| WS07 | 0.0 | 0.5 - 1.9 | 17.8 - 20.4 | 0.0 | | | |

* CIRIA 665 Gas Screening Value

5.13 No methane was recorded and carbon dioxide is present at levels less than 5% and zero flow being recorded during the monitoring giving CIRIA Gas Screening Value (GSV) were less than <0.07l/hr. The results to date indicate a CIRIA 665 site Characteristic Situation 1, where no precautions are required.

**Contamination Related Testing**

5.14 The results of the contamination related testing undertaken on eight samples of made ground and four of natural soil, are included as **Appendix E**.

5.15 Generally, the results have been assessed using the LQM/CIEH Suitable for Use Levels (S4ULs) for Human Health Risk Assessment (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3170; All rights reserved).

5.16 Where no S4UL is available, reference is made to published CLEA Soil Guidelines Values (SGVs) for standard land uses, or generic levels derived using the CLEA model (v1.06). For the purpose of this report, all S4ULs or SGVs will be referred to as Generic Assessment Criteria (GAC).

5.17 With respect to the assessment of the site, as the site is proposed to be developed retail use, therefore, the most appropriate values are considered to be the GACs for a commercial end use. Based on the laboratory results, an SOM of 1% has been used in the assessment.

5.18 A summary of the contamination related testing undertaken in samples of made ground and the natural soil are presented below.

| MADE GROUND AND NATURAL SOILS | | | | | |
|---|---|---|---|---|---|
| Determinand | Maximum conc. mg/kg | Minimum conc. mg/kg | No of Samples Tested | Generic Assessment Criteria (GAC) (1) mg/kg | No of Samples Exceeding GAC |
| Arsenic | 23 | 8.9 | 12 | 640 | 0 |
| Boron | 1.3 | 0.6 | 12 | 240000 | 0 |
| Cadmium | 0.5 | <0.2 | 12 | 190 | 0 |
| Chromium | 64 | 38 | 12 | 8600 | 0 |
| Lead | 54 | 18 | 12 | 2330(2) | 0 |
| Mercury | <0.5 | - | 12 | 1100 | 0 |
| Selenium | 1.5 | 1.2 | 12 | 12000 | 0 |
| Copper | 35 | 7.7 | 12 | 68000 | 0 |
| Nickel | 29 | 19 | 12 | 980 | 0 |
| Zinc | 114 | 60 | 12 | 730000 | 0 |
| Total PAH | | | | | |
| Naphthalene | 0.07 | <0.01 | 12 | 190 | 0 |
| Flourene | <0.01 | - | 12 | 63000 | 0 |
| Benzo(a)pyrene | 0.47 | <0.01 | 12 | 35 | 0 |
| Dibenz(ah)anthracene | 0.07 | <0.01 | 12 | 3.5 | 0 |

Notes
(1) LQM/CIEH S4UL for commercial/industrial end use unless otherwise stated
(2) DEFRA, SP1010: Category 4 Screening Levels

5.19 Of the determinands tested none were recorded to be elevated above the generic assessment criteria for a commercial end use.

*Sulphate and pH Determinations*

5.20 Eight samples of made ground and twelve samples of natural soil were scheduled for water soluble sulphate and pH determinations to assess the potential for sulphate attack on buried concrete.

5.21 Within the made ground, water soluble sulphate concentrations varied between 498mg/l and <10mg/l with pH values between 6.9 and 7.5 These results indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-1 is adopted on the site. Within the natural soils, water soluble sulphate concentrations varied between 63mg/l and <10mg/l with pH values between 5.9 and 7.9. These results indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC-1 is adopted on the site.

## Modified Site Conceptual Model

5.22 From the information gathered during the desk study, it was concluded that potential contamination sources include imported made ground on the site from the site adjacent highway construction works.

5.23 The intrusive works identified made ground up to 0.6m thick but generally 0.3m, generally comprising gravelly organic clay (topsoil) with localised areas where intermixing of the residual soil and 'topsoil' or thin layers of deposited coal gravel at the base of the 'topsoil' layer. Physical evidence of contamination was not encountered.

5.24 The results of the ground gas monitoring indicate that methane is low with carbon dioxide present at levels less than 5%. Gas screening values are less than 0.07l/hr but elevated carbon dioxide indicates CIRIA C665 Characteristic Situation 1.

*Pathways and receptors*

5.25 Based on the results of the laboratory chemical analysis, the risk to human health from contamination on the site is considered to be low.

5.26 With respect to potential environmental receptors, the following pathways are considered:

- Vertical migration to Secondary A Aquifer – Given the results of the chemical analysis and low permeability soils the risk to the underlying aquifer is considered to be negligible.
- Adjacent property – Given the results of the chemical analysis the risk to adjacent property is considered to be negligible.

## Pollutant Linkage Assessment

5.27 In view of the low determinand concentrations, increases in hard cover associated with the retail buildings and areas of hardstanding including pavement and hard landscaping, together with the distance to any surface water receptors, the pollutant linkage assessment indicates that the site poses a negligible risk to humans and a negligible risk to the wider environment.

## Geotechnical Related Testing

5.28 The results of the geotechnical testing are presented in **Appendix F**.

*Classification Tests*

5.29 Twelve Atterberg limits determinations were made on the shallow natural residual clay deposits and interbedded siltstone, sandstone and mudstone bedrock at depths of between 0.6m and 1.6m.

5.30 The samples recorded plasticity indices between 16% and 33% which indicates low to medium volume change potential within the clays across the site. A single sample of interbedded siltstone and sandstone (TP05 1.20m) was recorded to be non-plastic.

## 6 DISCUSSION

6.1 Development proposals include a commercial development. This investigation was carried out to provide geotechnical information with respect to foundations for the proposed development and contamination related testing to outline potential constraints.

### Contamination Assessment

6.2 Information obtained during the desk study indicated a low to medium risk of contamination. No physical evidence of contamination was encountered during the intrusive works and the results of the laboratory chemical analysis indicate low determinand concentrations which do not exceed the generic assessment criteria for human health.

6.3 Given the results of the laboratory analysis, the risk to the wider environment is considered to be low to negligible.

### Remediation

6.4 Based on the above assessment no remediation is required to facilitate development, however, if topsoil is imported it should be suitably validated to ensure there is no risk to end users.

### Disposal of Materials

6.5 Waste classification testing has not been carried out, however, the results of the chemical analyses allow an initial assessment and suggest that generally, the made ground is considered to be suitable for disposal as inert waste.

6.6 It is recommended that the results of the investigation are made available to the waste carrier/receiver in order to determine the waste classification and costs for offsite disposal.

### Water Supply Pipes

6.7 UKWIR analysis has not been undertaken as part of this assessment. It is recommended that the results of the assessment are provided to the water supply company

so that the correct pipe material can be selected. Our preliminary assessment indicates that no special precautions are required with respect to water supply pipes.

**Mining Assessment**

6.8 The Coal Authority indicate that the site is not in the zone of likely physical influence on the surface from recorded past underground workings; however they note that there is close or at the surface that may have been worked in the past. A single mine entry is recorded within the site or within 20m of the site boundary.

6.9 A single coal seam was depths of between 24.3m and 26.2m depth during the intrusive investigation. However, based on the seam thickness, depth of the seam and subsequent rock cover, site is considered to be stable with respect to coal mining.

**Foundations and Floor Slabs**

6.10 The proposed development includes a commercial development.

6.11 The site has a relatively thin cover of gravelly organic clay (topsoil) overlying firm sandy gravelly clay or medium dense clayey gravelly sand/sandy gravel. Beneath the natural soils were interbedded siltstones, sandstone and mudstones at shallow depths of between 0.45m and 1.70m bgl.

6.12 The made ground is considered unsuitable as a conventional foundations due to the potential for unacceptable total and/or differential settlement. Foundations should therefore extend into the underlying natural deposits which generally comprise either clay, sand or gravel overlying coal measures strata. Based on the results of in-situ testing across the site, it is estimated that conventional pad and strip foundations could terminate at a minimum 0.9m depth within the residual soils or bedrock. However, based on the potential for differing founding strata across each plot foundations should be extended to found on similar strata across the plots and therefore it would be prudent to extend all foundations onto the underlying bedrock where a bearing capacity of 200kN/$m^2$ is considered appropriate.

6.13 Heave precautions will be required for foundations within influencing distance of trees, where clay is present in the vicinity of the foundations.

6.14 Depending on loadings a ground bearing floor slabs may be considered following the removal of the made ground (topsoil) suitable following re-engineering of the made ground within the footprint of each plot.

**Gas Protection Measures**

6.15 Radon protection measures are not required for the proposed development.

6.16 The results of the gas monitoring results indicate that no combustible ground gas (methane) is present, with carbon dioxide was recorded at a maximum concentration of 2.2%. The results indicate a CIRIA C665 Characteristic Situation 1.

**Excavations and Dewatering**

6.17 If man entry is proposed into excavations, the use of support to excavation sides is recommended, in line with health and safety guidelines.

6.18 Significant groundwater ingress into shallow excavations is not anticipated. In light of the relatively shallow depth of bedrock, hydraulic breakers maybe required in excavations, particularly for deeper drainage.

**External Works**

6.19 A CBR value of 3% should be adopted at this stage for design on the natural sand or clay, subject to confirmation following site clearance.

6.20 It is recommended that in-situ plate load tests are carried out to verify the CBR at formation level.

**Surface Water Disposal**

6.21 Based on the results of the infiltration tests carried out within the silty sandstone and interbedded coal measures strata the calculated infiltration rate is considered to be between $1.6 \times 10^{-6}$ m/s and $3.43 \times 10^{-6}$ m/s. Based on the calculated infiltration rates the use of soakaways are not considered practically feasible.

**Sulphate Attack on Buried Concrete**

6.22 These results of the chemical analysis indicate a BRE Special Digest 1:2005 Design Sulphate Class DS-1 with an ACEC site classification AC1 is adopted on the site for both the made ground and natural soils; buried concrete should be designed accordingly.

# Figures




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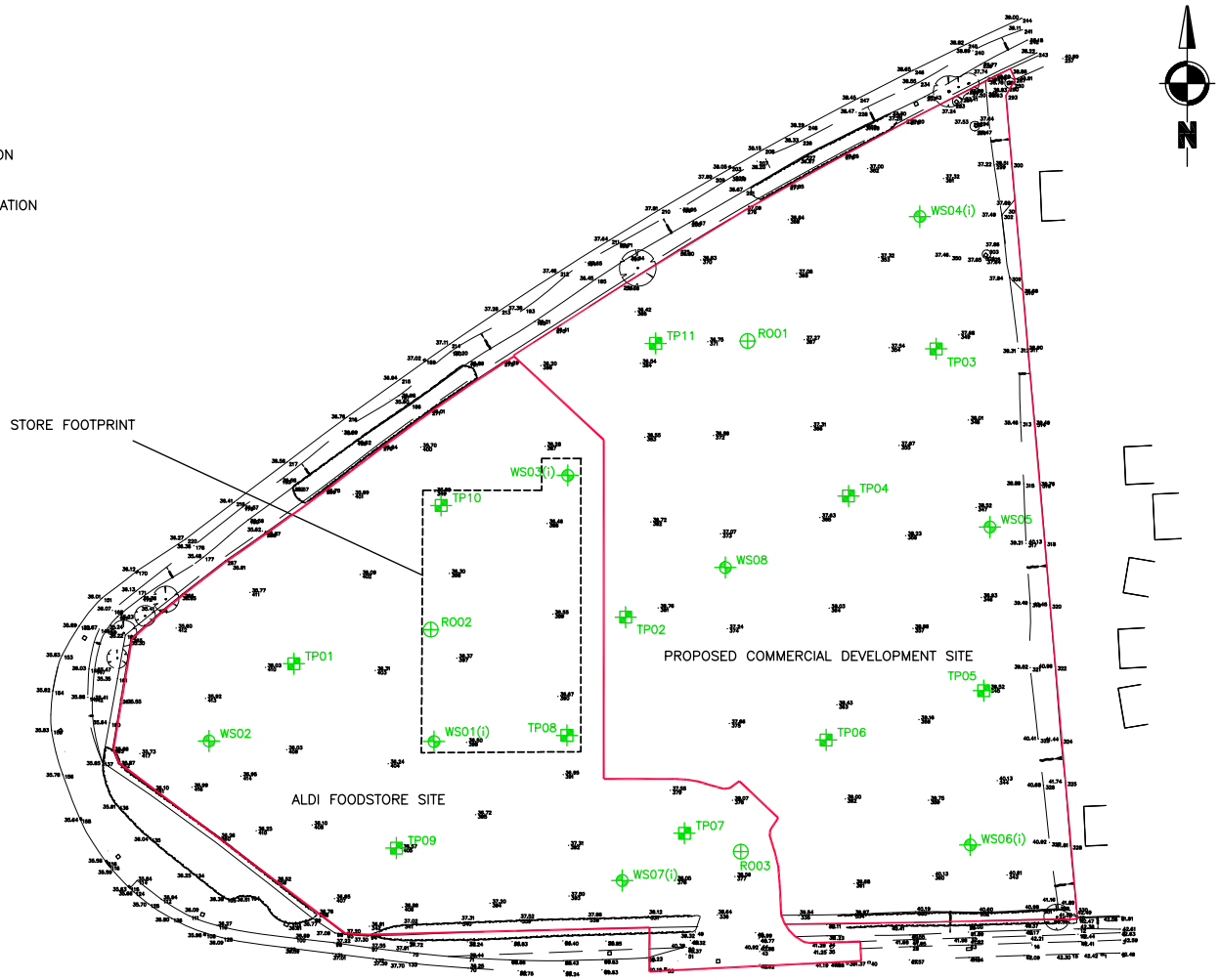
| | | | |
|---|---|---|---|
| Project | Barnsley Road, Goldthorpe<br>For Dearne Estates (Goldthorpe) Ltd. | | |
| Title | Site Location Plan | | |
| Scale<br>1:25,000 | Drawn<br>AHC | Checked<br>ACV | Date<br>Apr '14 |
| Job No.<br>14013 | Drawing No.<br>Fig 1 | | Rev<br>0 |

KEY

MINI PERCUSSIVE BOREHOLE LOCATION

ROTARY PERCUSSIVE BOREHOLE LOCATION

TRIAL PIT/SOAKAWAY TEST LOCATION





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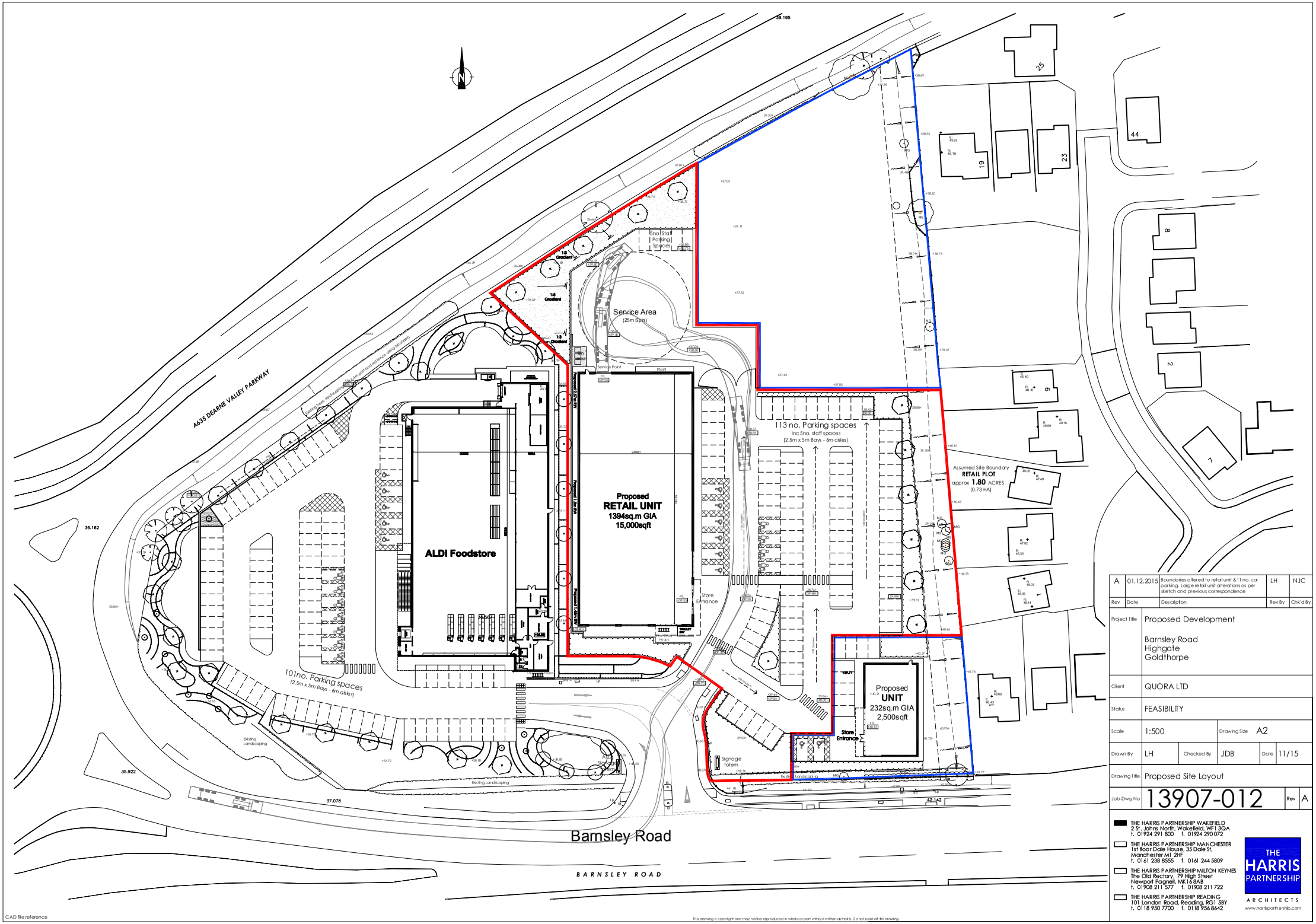
| Project | Barnsley Road, Goldthorpe<br>For Dearne Estates (Goldthorpe) Ltd. | | | |
| Title | Exploratory Hole Location Plan | | | |
| Scale | 1:1000 | Drawn AJB | Checked AHC | Date Jan '16 |
| Job No. | 14013 | Drawing No. Figure 2 | | Rev 2 |

# Appendix A

Proposed Development Plan




| Rev | Date | Description | Rev By | Chk'd By |
|---|---|---|---|---|
| A | 01.12.2015 | Boundaries altered to retail unit & 11 no. car parking. Large retail unit alterations as per sketch and previous correspondence | LH | NJC |

| | |
|---|---|
| Project Title | Proposed Development<br>Barnsley Road<br>Highgate<br>Goldthorpe |
| Client | QUORA LTD |
| Status | FEASIBILITY |
| Scale | 1:500 |
| Drawing Size | A2 |
| Drawn By | LH |
| Checked By | JDB |
| Date | 11/15 |
| Drawing Title | Proposed Site Layout |
| Job-Dwg No | 13907-012 |
| Rev | A |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THE HARRIS PARTNERSHIP
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CAD file reference

# Appendix B

Exploratory Hole Records

consulting engineers
4 Calder Close
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Wakefield
WF4 3BA

Tel. 01924 240420

# Trial Pit Log

# TP01

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.35) 0.35 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | |
| 0.60 | D | | | | (0.30) 0.65 | Brown mottled grey sandy gravelly CLAY (Highly weathered Coal Measures). | | | |
| 1.10 | D | | | | (0.75) 1.40 | Brown and grey clayey GRAVEL and COBBLES of flaggy sandstone and siltstone (Weathered Coal Measures). | 1.0 | | |
| | | | | | 1.45 | Moderately weak brown/grey silty fine SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.45m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:

Length:

Width:

Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.
3. Soakaway test undertaken in trial pit.

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Tel. 01924 240420

# Trial Pit Log

# TP02

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | |
| 0.60 | D | | | | (0.40) 0.70 | Brown mottled grey clayey gravelly SAND (Highly weathered Coal Measures). | | | |
| 1.20 | D | | | | (0.90) 1.60 | Brown and grey interbedded and thinly laminated SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 1.0 | | |
| 1.70 | D | | | | (0.15) 1.75 | Weak grey occasionally brown thinly laminated silty fine SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.75m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.
3. Soakaway test undertaken in trial pit.

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Wakefield
WF4 3BA

Tel. 01924 240420

# Trial Pit Log

# TP03

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare brick (TOPSOIL). | | | |
| 0.40 | D | | | | (0.30) 0.60 | MADE GROUND: Reworked brown organic gravelly CLAY (Topsoil) and brown mottled grey gravelly CLAY | | | |
| 0.80 | D | | | | (0.40) 1.00 | Brown mottled grey sandy gravelly CLAY (Highly weathered Coal Measures). | | | |
| 1.20 | D | | | | (1.25) 2.25 | Very weak brown and grey interbedded and thinly laminated SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 1.0<br>2.0 | | |
| | | | | | (0.10) 2.35 | Weak grey occasionally brown and grey thinly laminated silty fine SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 2.35m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.
3. Soakaway test undertaken in trial pit.

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Tel. 01924 240420

# Trial Pit Log

# TP04

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare brick (TOPSOIL). | | | |
| | | | | | (0.25) 0.55 | Brown mottled grey clayey gravelly SAND (Highly weathered Coal Measures). | | | |
| 0.70 | D | | | | (0.80) 1.35 | Brown mottled grey sandy gravelly CLAY (Highly weathered Coal Measures). | 1.0 | | |
| 1.50 | D | | | | (0.45) 1.80 | Very weak grey flaggy sandy siltstone recovered as COBBLES with clay partings (Weathered Coal Measures). | | | |
| | | | | | (0.45) 2.25 | Very weak grey and brown thinly laminated SILTSTONE and SANDSTONE with ironstained partings (Coal Measures). | 2.0 | | |
| | | | | | (0.15) 2.40 | Weak grey/brown flaggy sandy SILTSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 2.25m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP05

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.40) 0.40 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| | | | | | (0.08) 0.48 | MADE GROUND: Coal GRAVEL and reworked brown organic gravelly CLAY (Topsoil). | | | |
| 0.60 | D | | | | (0.32) 0.80 | Grey mottled brown firm very sandy gravelly CLAY (Highly weathered Coal Measures). | | | |
| | | | | | 0.85 | Very weak brown flaggy silty SANDSTONE with clay partings (Coal Measures). | | | |
| 1.20 | D | | | | (1.25) | Very weak grey thinly laminated silty fine SANDSTONE and SILTSTONE with some clay partings (Coal Measures). | 1.0 | | |
| | | | | | 2.10 | | 2.0 | | |
| | | | | | (0.10) 2.20 | Moderatley weak grey/brown sandy flaggy SILTSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 2.2m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP06

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.31) 0.31 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| | | | | | (0.14) 0.45 | Brown firm sandy CLAY (Highly weathered Coal Measures). | | | |
| 0.50 | D | | | | (1.15) 1.60 | Grey mottled brown clayey Gravel and COBBLES of silty sandstone (Weathered Coal Measures). | 1.0 | | |
| 1.20 | D | | | | | | | | |
| | | | | | (0.55) 2.15 | Brown and grey interbedded and thinly laminated SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 2.0 | | |
| | | | | | 2.20 | Moderatley weak grey/brown sandy flaggy SILTSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 2.2m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP07

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.33) 0.33 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| 0.60 | D | | | | (0.52) 0.85 | Grey mottled brown firm very sandy gravelly CLAY (Highly weathered Coal Measures).<br>0.50 70mm diameter land drain. | | | |
| | | | | | (0.10) 0.95 | Very weak grey silty flaggy SANDSTONE (Coal Measures). | | | |
| | | | | | (0.60) 1.55 | Brown and grey interbedded and thinly laminated SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 1.0 | | |
| | | | | | 1.60 | Moderatley weak grey sandy flaggy SILTSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.6m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:

Length:

Width:

Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP08

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.29) 0.29 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | |
| 0.70 | D | | | | (0.51) 0.80 | Grey mottled brown firm very sandy gravelly CLAY (Highly weathered Coal Measures). | | | |
| 1.20 | D | | | | (0.75) 1.55 | Grey mottled brown clayey GRAVEL and COBBLES of siltstone, sandstone and mudstone (Weathered Coal Measures). | 1.0 | | |
| | | | | | 1.60 | Moderatley weak grey silty flaggy SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.6m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:

Length:

Width:

Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP09

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.31) 0.31 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| | | | | | (0.29) 0.60 | Firm brown mottled grey very sandy gravelly CLAY. Gravel of subangular sandstone and siltstone (Highly weathered Coal Measures). | | | |
| 0.80 | D | | | | (0.60) 1.20 | Stiff grey mottled brown very sandy gravelly CLAY. Gravel and cobbles of flaggy silty sandstone (Weathered Coal Measures). | 1.0 | | |
| | | | | | (0.15) 1.35 | Moderatley weak grey flaggy silty SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.35m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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# Trial Pit Log

# TP10

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.28) 0.28 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| 0.60 | D | | | | (1.42) | Firm brown mottled grey very sandy slightly gravelly CLAY. Gravel of medium subangular siltstone, sandstone and mudstone (Highly weathered Coal Measures). | 1.0 | | |
| 1.60 | D | | | | 1.70 | | | | |
| | | | | | (0.10) 1.80 | Moderately weak grey/brown silty flaggy SANDSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.8m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions
Stability:
Length:
Width:
Orientation:

General Remarks
1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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Tel. 01924 240420

# Trial Pit Log

# TP11

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Key: B = Large Disturbed Sample; D = Small Disturbed Sample; W = Water Sample; HSV = Hand Shear Vane; CBR = Mexecone; ES = Environmental Sample

Plant: CAT 432 Backhoe
Date: 11/11/2014
Logged By: AJB

| Samples | | Tests | | | Strata Details | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Depth (m) | HSV (kPa) | CBR (%) | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend |
| | | | | | (0.24) 0.24 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | |
| 0.50 | D | | | | (0.61) 0.85 | Brown and grey very clayey gravelly SAND. Gravel of medium subangular sandstone and siltstone (Highly weathered Coal Measures). | | | |
| 1.20 | D | | | | (0.60) 1.45 | Brown and grey very sandy clayey GRAVEL of flaggy silty sandstone and siltstone (Weathered Coal Measures). | 1.0 | | |
| 1.50 | D | | | | (0.40) 1.85 | Moderatley weak brown/grey thinly laminated sandy SILTSTONE (Coal Measures). | | | |
| | | | | | | *End of Exploratory Hole at 1.85m* | | | |

| Groundwater Observations | | |
|---|---|---|
| No. | Struck (m) | Remarks |
| | | No Groundwater Encountered |

Stability / Dimensions

Stability:
Length:
Width:
Orientation:

General Remarks

1. Trial pits terminated on hard dig.
2. No groundwater encountered.

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Tel. 01924 240420

# Mini-Percussive Log

# WS01

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.33) 0.33 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | | | |
| 0.40 | D | | (1.12) | Dense grey mottled brown clayey very sandy GRAVEL of sandstone and siltstone (Highly weathered Coal Measures). | | | | | |
| 0.90 | D | | | | | | | | |
| 1.00 | C | N35 (4/3/4/7/11/13) | 1.45 | | 1.0 | | | | |
| | | | | *End of Exploratory Hole at 1.45m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on hard strata.<br>2. Monitoring well installed.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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Tel. 01924 240420

# Mini-Percussive Log

# WS02

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.29) 0.29 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | | | |
| 0.40 | D | | (0.16) 0.45 | Grey mottled brown slightly clayey gravelly SAND. Gravel of medium subangular sandstone (Highly weathered Coal Measures). | | | | | |
| 0.50 | D | | | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | | | | | |
| 1.00 | C | N68 (5/6/6/6/14/42) | (1.00) 1.45 | | 1.0 | | | | |
| | | | | *End of Exploratory Hole at 1.45m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2.Borehole backfilled with arisings.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS03

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | | | |
| 0.35 | D | | (0.15) 0.45 | Grey mottled brown slightly clayey gravelly SAND. Gravel of medium subangular sandstone (Highly weathered Coal Measures). | | | | | |
| 0.90 | D | | | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | | | | | |
| 1.00 | C | N24 (4/4/4/4/5/11) | (1.13) | | 1.0 | | | | |
| 1.30 | D | | | | | | | | |
| 1.60 | C | N50/40mm (25/-/50/-/-/-) | 1.58 (0.12) 1.70 | Hard grey/brown flaggy silty SANDSTONE (Coal Measures). | | | | | |
| | | | | *End of Exploratory Hole at 1.7m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2. Monitoring well installed.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS04

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.31) 0.31 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal and brick (TOPSOIL). | | | | | |
| | | | (0.09) 0.40 | Brown gravelly SAND. Gravel of medium subangular sandstone (Highly weathered Coal Measures). | | | | | |
| 0.60 | D | | | Stiff light brown and grey slightly sandy CLAY (Highly weathered Coal Measures). | | | | | |
| 0.90 | D | | (1.00) | | | | | | |
| 1.00 | C | N35 (9/11/11/8/8/8) | | | 1.0 | | | | |
| | | | 1.40 | | | | | | |
| 1.50 | D | | (0.30) | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | | | | | |
| 1.70 | D | | 1.70 | | | | | | |
| 1.80 | C | N50/50mm (18/18/50/-/-/-) | (0.32) | Weak grey/brown flaggy silty SANDSTONE (Coal Measures). | | | | | |
| | | | 2.02 | | 2.0 | | | | |
| | | | | *End of Exploratory Hole at 2.02m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2. Monitoring well installed.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS05

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: ⭳ = Water Strike Depth & No.
⭳ = Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare brick (TOPSOIL). | | | | | |
| 0.35 | D | | (0.15) 0.45 | Grey mottled brown very clayey SAND (Highly weathered Coal Measures). | | | | | |
| 0.60 | D | | (1.00) 1.45 | Very weak grey MUDSTONE with some siltstone and ironstone laminations (Coal Measures). | 1.0 | | | | |
| 1.00 | C | N63 (5/5/10/15/18/20) | | *End of Exploratory Hole at 1.45m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2.Borehole backfilled with arisings.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS06

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone (TOPSOIL). | | | | | |
| 0.30 | D | | (0.15) 0.45 | Grey and brown clayey SAND (Highly weathered Coal Measures). | | | | | |
| 0.60 | D | | (0.35) 0.80 | Light brown and grey very sandy slightly gravelly CLAY. Gravel of medium sunanglar sandstone (Highly weathered Coal Measures). | | | | | |
| 1.00 | C | N22 (4/4/4/4/7/7) | (0.96) 1.76 | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 1.0 | | | | |
| 1.10 | D | | | | | | | | |
| 1.60 | C | N50/85mm (25/-/40/10/-/-) | | | | | | | |
| | | | | *End of Exploratory Hole at 1.76m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2. Monitoring well installed.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS07

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | | | |
| 0.40 | D | | (0.20) 0.50 | Brown clayey sandy GRAVEL of siltstone and sandstone (Highly weathered Coal Measures). | | | | | |
| 0.60 | D | | | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | | | | | |
| 1.00 | C | N41 (9/9/9/8/11/13) | (1.00) 1.50 | | 1.0 | | | | |
| 1.50 | C | N50/75mm (25/-/50/-/-/-) | (0.23) 1.73 | Grey flaggy silty SANDSTONE (Coal Measures). | | | | | |
| | | | | *End of Exploratory Hole at 1.725m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | 1. Borehole terminated on refusal.<br>2. Monitoring well installed.<br>3. No groundwater encountered. |
| | | No Groundwater Encountered | | | | | |

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# Mini-Percussive Log

# WS08

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: White Rose Drilling

Key: = Water Strike Depth & No.
= Resting Water Depth & No.
D = Small Disturbed Sample
B = Large Disturbed Sample
ES = Environmental Sample
W = Water Sample
HSV = Hand Shear Vane (kPa)
S / C = Split Spoon / Cone
N = SPT N Value

Plant: Mini Percussive Rig
Date: 07/11/2014
Logged By: AJB

| Samples/Tests | | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Type | Results | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| 0.10 | D | | (0.30) 0.30 | Brown organic gravelly CLAY. Gravel of angular and subangular sandstone, siltstone and rare coal (TOPSOIL). | | | | | |
| 0.40 | D | | (0.30) 0.60 | Light brown slightly clayey slightly gravelly SAND (Highly weathered Coal Measures). | | | | | |
| 0.80 | D | | (1.00) 1.60 | Interbedded thinly laminated grey and brown SILTSTONE, SANDSTONE and MUDSTONE (Coal Measures). | 1.0 | | | | |
| 1.00 | C | N26 (7/6/6/6/6/8) | | | | | | | |
| 1.40 | D | | | | | | | | |
| 1.60 | C | N50/50mm (9/16/50/-/-/-) | (0.14) 1.74 | Grey flaggy silty SANDSTONE (Coal Measures). | | | | | |
| | | | | *End of Exploratory Hole at 1.735m* | | | | | |

| Groundwater Observations | | | Window Sample Run | | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | Remarks | From (m) | To (m) | Dia. (mm) | Recovery (%) | |
| | | No Groundwater Encountered | | | | | 1. Borehole terminated on refusal.<br>2.Borehole backfilled with arisings.<br>3. No groundwater encountered. |

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# Rotary Borehole Log

# RO01

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | 0.20 | TOPSOIL (Driller's Description). | | | | | |
| | | | | | (1.60) | Light brown sandy CLAY (Driller's Description). | 1.0 | | | | |
| | | | | | 1.80 | | | | | | |
| | | | | | (0.40) | Weathered brown SILTSTONE (Driller's Description). | 2.0 | | | | |
| | | | | | 2.20 | Grey MUDSTONE (Driller's Description). | | | | | |
| | | | | | | | 3.0 | | | | |
| | | | | | (3.80) | | 4.0 | | | | |
| | | | | | | | 5.0 | | | | |
| | | | | | 6.00 | | 6.0 | | | | |
| | | | | | (0.40) | Grey SANDSTONE (Driller's Description). | | | | | |
| | | | | | 6.40 | Grey MUDSTONE (Driller's Description). | | | | | |
| | | | | | | | 7.0 | | | | |
| | | | | | | | 8.0 | | | | |
| | | | | | | | 9.0 | | | | |
| | | | | | | | 10.0 | | | | |
| | | | | | | | 11.0 | | | | |
| | | | | | | | 12.0 | | | | |

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| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

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# Rotary Borehole Log

# RO01

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | (19.40) | Grey MUDSTONE (Driller's Description). *(continued)* | 13.0<br>14.0<br>15.0<br>16.0<br>17.0<br>18.0<br>19.0<br>20.0<br>21.0<br>22.0<br>23.0<br>24.0 | | | | |

*Continued next page...*

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

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# Rotary Borehole Log

# RO01

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | | Grey MUDSTONE (Driller's Description). *(continued)* | 25.0 | | | | |
| | | | | | 25.80 | | | | | | |
| | | | | | (0.60) | COAL (Driller's Description). | 26.0 | | | | |
| | | | | | 26.40 | Grey MUDSTONE (Driller's Description). | | | | | |
| | | | | | | | 27.0 | | | | |
| | | | | | | | 28.0 | | | | |
| | | | | | (3.80) | | | | | | |
| | | | | | | | 29.0 | | | | |
| | | | | | 30.20 | | 30.0 | | | | |
| | | | | | | *End of Exploratory Hole at 30.2m* | | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

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# Rotary Borehole Log

# RO02

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | 0.25 | TOPSOIL (Driller's Description). | | | | | |
| | | | | | (1.65) 1.90 | Light brown sandy CLAY (Driller's Description). | 1.0 | | | | |
| | | | | | (1.30) 3.20 | Light grey SANDSTONE (Driller's Description). | 2.0 3.0 | | | | |
| | | | | | (14.90) | Light grey MUDSTONE (Driller's Description). | 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 | | | | |

*Continued next page...*

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

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# Rotary Borehole Log

# RO02

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | | Light grey MUDSTONE (Driller's Description). *(continued)* | 13.0 | | | | |
| | | | | | | | 14.0 | | | | |
| | | | | | | | 15.0 | | | | |
| | | | | | | | 16.0 | | | | |
| | | | | | | | 17.0 | | | | |
| | | | | | 18.10 | | 18.0 | | | | |
| | | | | | (0.50) 18.60 | Dark grey/black MUDSTONE (Driller's Description). | | | | | |
| | | | | | | Grey MUDSTONE (Driller's Description). | 19.0 | | | | |
| | | | | | | | 20.0 | | | | |
| | | | | | | | 21.0 | | | | |
| | | | | | (5.70) | | 22.0 | | | | |
| | | | | | | | 23.0 | | | | |
| | | | | | | *Continued next page...* | 24.0 | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

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# Rotary Borehole Log

# RO02

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | 24.30 | | | | | | |
| | | | | | (0.80) | COAL (Driller's Description). | | | | | |
| | | | | | 25.10 | Grey MUDSTONE (Driller's Description). | 25.0 | | | | |
| | | | | | | | 26.0 | | | | |
| | | | | | | | 27.0 | | | | |
| | | | | | (5.90) | | 28.0 | | | | |
| | | | | | | | 29.0 | | | | |
| | | | | | | | 30.0 | | | | |
| | | | | | 31.00 | | 31.0 | | | | |
| | | | | | | *End of Exploratory Hole at 31m* | | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA

Tel. 01924 240420

# Rotary Borehole Log

# RO03

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | 0.20 | TOPSOIL (Driller's Description). | | | | | |
| | | | | | (2.70) | Light brown sandy CLAY (Driller's Description). | 1.0<br>2.0 | | | | |
| | | | | | 2.90 | Light grey MUDSTONE (Driller's Description). | 3.0<br>4.0<br>5.0<br>6.0<br>7.0<br>8.0<br>9.0 | | | | |
| | | | | | (14.20) | | 10.0<br>11.0 | | | | |
| | | | | | | *Continued next page...* | 12.0 | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA

Tel. 01924 240420

# Rotary Borehole Log

# RO03

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | | Light grey MUDSTONE (Driller's Description). *(continued)* | 13.0 | | | | |
| | | | | | | | 14.0 | | | | |
| | | | | | | | 15.0 | | | | |
| | | | | | | | 16.0 | | | | |
| | | | | | 17.10 | | 17.0 | | | | |
| | | | | | (0.45) 17.55 | Dark grey MUDSTONE (Driller's Description). | | | | | |
| | | | | | | Light grey MUDSTONE (Driller's Description). | 18.0 | | | | |
| | | | | | | | 19.0 | | | | |
| | | | | | | | 20.0 | | | | |
| | | | | | | | 21.0 | | | | |
| | | | | | (8.65) | | 22.0 | | | | |
| | | | | | | | 23.0 | | | | |
| | | | | | | *Continued next page...* | 24.0 | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

consulting engineers
4 Calder Close
Calder Park
Wakefield
WF4 3BA

Tel. 01924 240420

# Rotary Borehole Log

# RO03

Site Name: Barnsley Road, Goldthorpe
Client: Dearne Estates (Goldthorpe) Ltd.
Project No: 14013

Ground Level:
Easting:
Northing:

Contractor: Infosoil

Key:
= Water Strike Depth & No.
TCR = Total Core Recovery
SCR = Solid Core Recovery
RQD = Rock Quality Designation
FI = Fracture Index

Plant: Hands England
Dates: 06/11/2014 to 06/11/2014
Logged By: JB

Method: Rotary Open Hole
Flush: Watermist

| Core Data | | | Fractures | | Strata Details | | | | | Well | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Core Run (m) | TCR (%) | SCR (%) | RQD (%) | F.I. | Depth (m) (Thickness) | Strata Description | Depth (m) | Level (AOD) | Legend | Strike | Log |
| | | | | | | Light grey MUDSTONE (Driller's Description). *(continued)* | 25.0 | | | | |
| | | | | | 26.20 | | 26.0 | | | | |
| | | | | | 26.40 | COAL (Driller's Description). | | | | | |
| | | | | | | Light grey MUDSTONE (Driller's Description). | 27.0 | | | | |
| | | | | | (4.60) | | 28.0 | | | | |
| | | | | | | | 29.0 | | | | |
| | | | | | | | 30.0 | | | | |
| | | | | | 31.00 | | 31.0 | | | | |
| | | | | | | *End of Exploratory Hole at 31m* | | | | | |

| Groundwater Observations | | | | Flush Returns | | | General Remarks |
|---|---|---|---|---|---|---|---|
| No. | Struck (m) | 20min Level (m) | Remarks | From | To | Returns (%) | 1. Borehole drilled in watermist flush.<br>2. No loss of flush.<br>3. Backfilled with arisings, |
| | | | No Groundwater Encountered | | | | |

# Appendix C

Gas and Groundwater Monitoring Results

## Gas monitoring record

3e Consulting Engineers Ltd
4 Calder Close
Calder Park
Wakefield
WF4 3BA

**Job no:** 14013
**Site:** Barnsley Road, Goldthorpe
**Date:** 11-Nov-14
**Weather:** Overcast and breezy
**Pressure Trend:** Falling

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 2.2 | 17.3 | 999 | 0.0 | Dry | |
| WS3 | 0.0 | 1.9 | 17.6 | | 0.0 | Dry | |
| WS4 | 0.0 | 1.2 | 16.2 | | 0.0 | Wet at base | |
| WS6 | 0.0 | 1.2 | 16.1 | | 0.0 | Dry | |
| WS7 | 0.0 | 1.0 | 17.8 | | 0.0 | Dry | |

**Date:** 24-Nov-14
**Weather:** Sunny with clouds
**Pressure Trend:** Rising

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 2.1 | 16.1 | 1029 | 0.0 | 0.45 | |
| WS3 | 0.0 | 1.9 | 15.7 | | 0.0 | 0.41 | |
| WS4 | 0.0 | 0.1 | 20.2 | | 0.0 | 0.84 | |
| WS6 | 0.0 | 0.5 | 17.3 | | 0.0 | Wet at base | |
| WS7 | 0.0 | 1.6 | 18.0 | | 0.0 | 0.50 | |

**Date:** 11-Dec-14
**Weather:** Overcast and windy
**Pressure Trend:** Falling

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 0.1 | 20.6 | 1007 | 0.0 | 0.46 | |
| WS3 | 0.0 | 0.2 | 20.2 | | 0.0 | 0.68 | |
| WS4 | 0.0 | 0.1 | 20.8 | | 0.0 | 0.52 | |
| WS6 | 0.0 | 0.7 | 14.8 | | 0.0 | Wet at base | |
| WS7 | 0.0 | 0.6 | 20.4 | | 0.0 | 0.86 | |

**Date:** 19-Dec-14
**Weather:** Sunny and breezy
**Pressure Trend:** Rising

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 0.0 | 20.7 | 1014 | 0.0 | 0.51 | |
| WS3 | 0.0 | 0.0 | 20.7 | | 0.0 | 0.59 | |
| WS4 | 0.0 | 0.2 | 20.7 | | 0.0 | 0.69 | |
| WS6 | 0.0 | 0.1 | 20.7 | | 0.0 | Wet at base | |
| WS7 | 0.0 | 0.9 | 20.3 | | 0.0 | 0.65 | |

**Date:** 16-Jan-15
**Weather:** Sunny and breezy
**Pressure Trend:** Rising

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 1.2 | 20.1 | 1005 | 0.0 | 0.61 | |
| WS3 | 0.0 | 0.9 | 20.3 | | 0.0 | 1.27 | |
| WS4 | 0.0 | 1.3 | 20.3 | | 0.0 | 1.04 | |
| WS6 | 0.0 | 1.1 | 20.2 | | 0.0 | Wet at base | |
| WS7 | 0.0 | 1.9 | 20.3 | | 0.0 | 1.37 | |

**Date:** 02-Feb-15
**Weather:** Sunny and breezy
**Pressure Trend:** Rising

| BH No | Methane (%v/v) | Carbon dioxide (%v/v) | Oxygen (%v/v) | Barometric Pressure (mb) | Flow (l/hr) | Water level (m bgl) | Remarks |
|---|---|---|---|---|---|---|---|
| WS1 | 0.0 | 0.6 | 20.9 | 1037 | 0.0 | 0.53 | |
| WS3 | 0.0 | 0.6 | 19.4 | | 0.0 | 1.11 | |
| WS4 | 0.0 | 0.5 | 20.1 | | 0.0 | 0.79 | |
| WS6 | 0.0 | 0.0 | 21.1 | | 0.0 | Wet at base | |
| WS7 | 0.0 | 0.5 | 20.7 | | 0.0 | 1.30 | |

# Appendix D

Infiltration Tests

**CALCULATIONS/SKETCHES**

| PROJECT | Barnsley Road, Goldthorpe | | | | |
|---|---|---|---|---|---|
| JOB No | 140136 | PREPARED BY | AJB | Test Ref. | TP1 |
| DATE | 11-Nov-14 | CHECKED BY | AHC | REV | 0 |

consulting engineers

## Calculation of soil infiltration rate in accordance with BRE Digest 365

Length of trial pit = $L_{TP}$ = 1.700 *m*
Width of trial pit = $W_{TP}$ = 0.300 *m*
Effective Depth = $D_{TP}$ = 0.080 *m* *(measured below incoming invert)*

75% Effective Depth of trial pit = $D_{75}$ = ( $D_{TP}$ x 0.75 ) = 0.060 *m*
50% Effective Depth of trial pit = $D_{50}$ = ( $D_{TP}$ x 0.50 ) = 0.040 *m*
25% Effective Depth of trial pit = $D_{25}$ = ( $D_{TP}$ x 0.25 ) = 0.020 *m*

Pit Voids = PV = 100 % *(For open pits, PV = 100%. For stone filled pits, PV = 30%)*

Time to fall from 75% to 25% effective depth = $T_1$ = 148 *mins*

Volume of water escaping during this test between $D_{75}$ and $D_{25}$
= $V_{TP75\_25}$ = ( $L_{TP}$ x $W_{TP}$ x ($D_{75}$ - $D_{25}$) x PV) = 0.020 *cu m.*

The mean surface area through which the above volume escapes, is the *wetted area.*
Only 50% of the effective depth is allowed in the calculation.

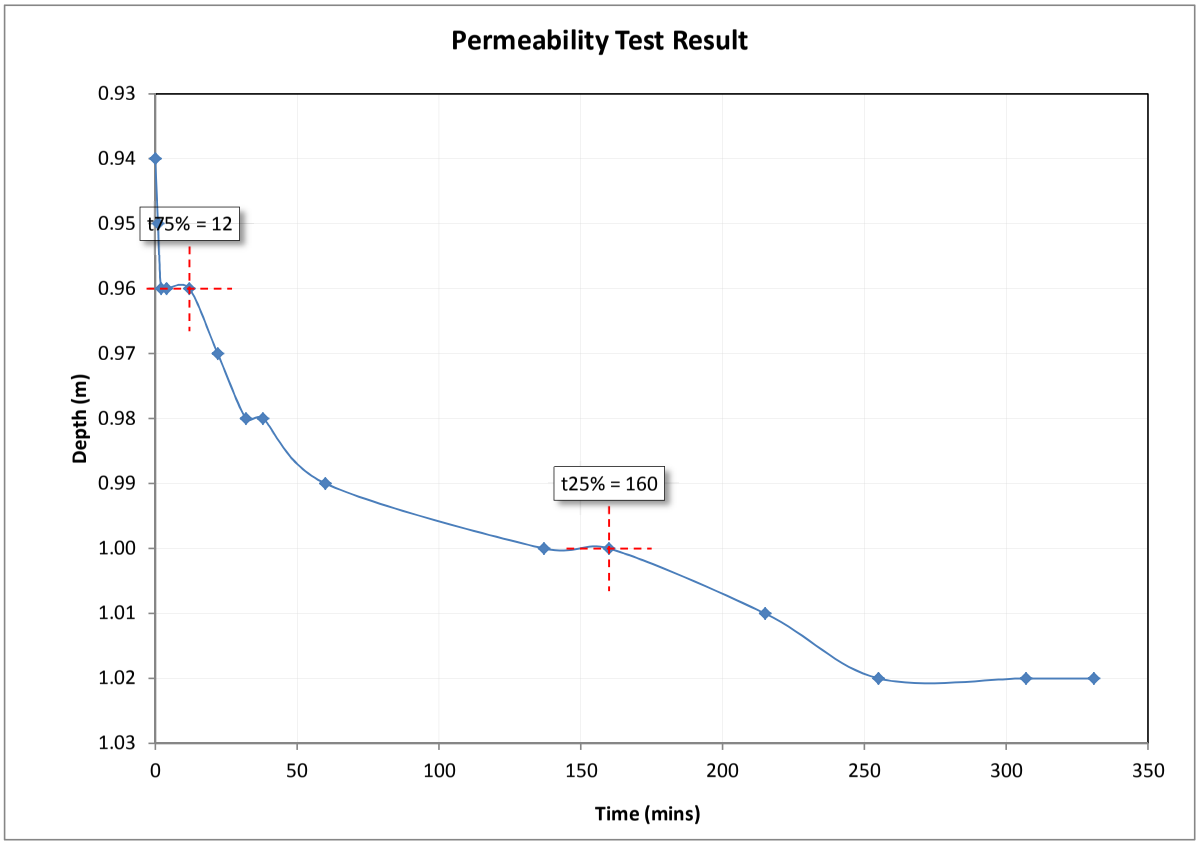
*ie* $A_{P50}$ = (Wet Base Area + 50% of Wet Sides Area)
$A_{P50}$ = ($L_{TP}$ x $W_{TP}$) + (2$L_{TP}$+2$W_{TP}$) x $D_{50}$
$A_{P50}$ = 0.510 + 0.160
$A_{P50}$ = 0.670 *sq m*

Soil Infiltration Rate = f = $\frac{V_{TP75\_25}}{A_{P50} \times 60 \times T_L}$ *m/s*

**Soil Infiltration Rate = f = 3.43E-06 *m/s***

| Trial Pit: | TP1 |
|---|---|

| Time (mins) | Water Depth (bgl) |
|---|---|
| 0 | 0.94 |
| 1 | 0.95 |
| 2 | 0.96 |
| 4 | 0.96 |
| 12 | 0.96 |
| 22 | 0.97 |
| 32 | 0.98 |
| 38 | 0.98 |
| 60 | 0.99 |
| 137 | 1.00 |
| 160 | 1.00 |
| 215 | 1.01 |
| 255 | 1.02 |
| 307 | 1.02 |
| 331 | 1.02 |




| | |
|---|---|
| Total Fall (m): | 0.08 |
| 75% Depth (m) | 0.96 |
| 50% Depth (m) | 0.98 |
| 25% Depth (m) | 1.00 |
| Effective Range 75% - 25% (m) | 0.04 |

| | |
|---|---|
| Time to fall to 75% Depth (mins) | 12 |
| Time to fall to 25% Depth (mins) | 160 |
| Time from 75% to 25% Depth (mins) | 148 |

**CALCULATIONS/SKETCHES**

| PROJECT | Barnsley Road, Goldthorpe | | | | |
|---|---|---|---|---|---|
| JOB No | 14013 | PREPARED BY | AJB | Test Ref. | TP2 |
| DATE | 11-Nov-14 | CHECKED BY | AHC | REV | 0 |

consulting engineers

## Calculation of soil infiltration rate in accordance with BRE Digest 365

Length of trial pit = $L_{TP}$ = 1.800 *m*
Width of trial pit = $W_{TP}$ = 0.300 *m*
Effective Depth = $D_{TP}$ = 0.030 *m* *(measured below incoming invert)*

75% Effective Depth of trial pit = $D_{75}$ = ( $D_{TP}$ x 0.75 ) = 0.023 *m*
50% Effective Depth of trial pit = $D_{50}$ = ( $D_{TP}$ x 0.50 ) = 0.015 *m*
25% Effective Depth of trial pit = $D_{25}$ = ( $D_{TP}$ x 0.25 ) = 0.008 *m*

Pit Voids = PV = 100 % *(For open pits, PV = 100%. For stone filled pits, PV = 30%)*

Time to fall from 75% to 25% effective depth = $T_1$ = 140 *mins*

Volume of water escaping during this test between $D_{75}$ and $D_{25}$
= $V_{TP75\_25}$ = ( $L_{TP}$ x $W_{TP}$ x ($D_{75}$ - $D_{25}$) x PV) = 0.008 *cu m.*

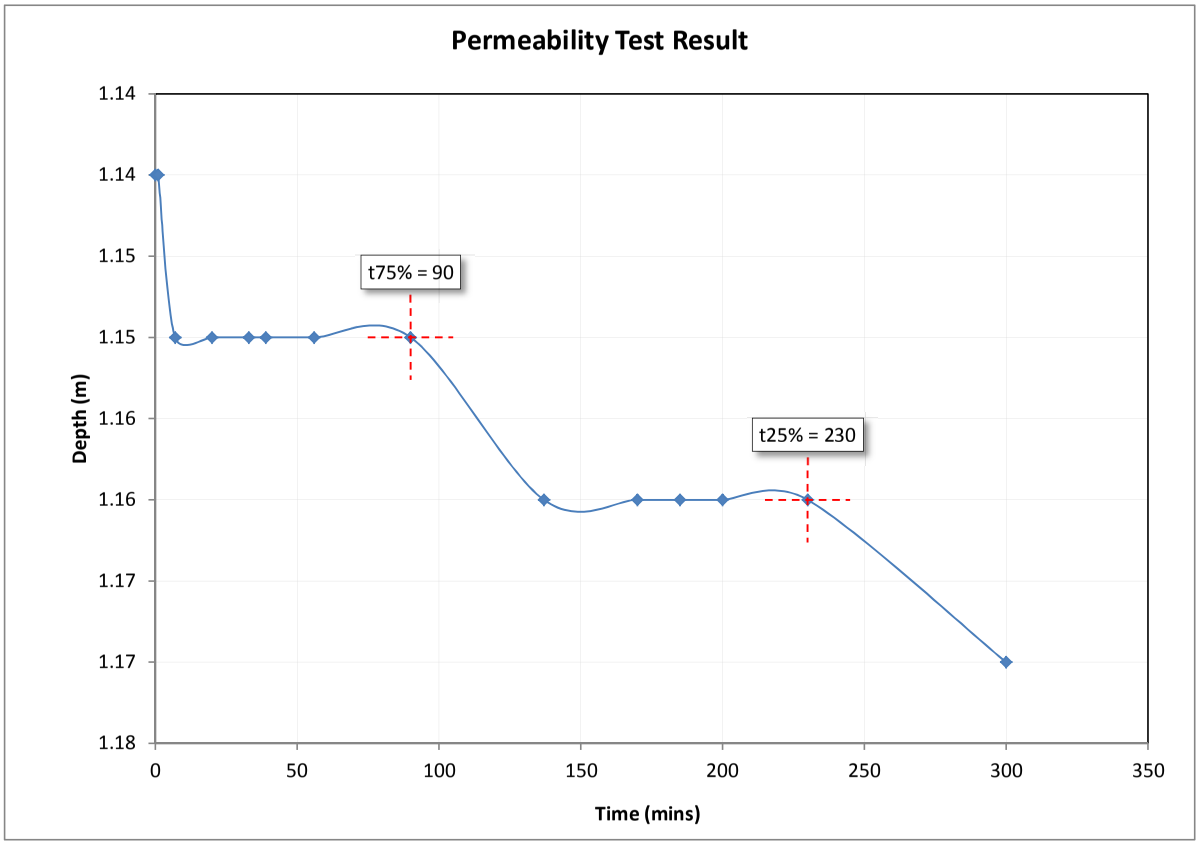
The mean surface area through which the above volume escapes, is the *wetted area.*
Only 50% of the effective depth is allowed in the calculation.

*ie* $A_{P50}$ = (Wet Base Area + 50% of Wet Sides Area)
$A_{P50}$ = ($L_{TP}$ x $W_{TP}$) + (2$L_{TP}$+2$W_{TP}$) x $D_{50}$
$A_{P50}$ = 0.540 + 0.063
$A_{P50}$ = 0.603 *sq m*

Soil Infiltration Rate = f = $\frac{V_{TP75\_25}}{A_{P50} \times 60 \times T_L}$ *m/s*

**Soil Infiltration Rate = f = 1.60E-06 *m/s***

| Trial Pit: | TP2 |
|---|---|
| **Time (mins)** | **Water Depth (bgl)** |
| 0 | 1.14 |
| 1 | 1.14 |
| 7 | 1.15 |
| 20 | 1.15 |
| 33 | 1.15 |
| 39 | 1.15 |
| 56 | 1.15 |
| 90 | 1.15 |
| 137 | 1.16 |
| 170 | 1.16 |
| 185 | 1.16 |
| 200 | 1.16 |
| 230 | 1.16 |
| 300 | 1.17 |




| | |
|---|---|
| Total Fall (m): | 0.03 |
| 75% Depth (m) | 1.15 |
| 50% Depth (m) | 1.16 |
| 25% Depth (m) | 1.16 |
| Effective Range 75% - 25% (m) | 0.01 |

| | |
|---|---|
| Time to fall to 75% Depth (mins) | 90 |
| Time to fall to 25% Depth (mins) | 230 |
| Time from 75% to 25% Depth (mins) | 140 |

**CALCULATIONS/SKETCHES**

| PROJECT | Barnsley Road, Goldthorpe | | | | |
|---|---|---|---|---|---|
| JOB No | 14013 | PREPARED BY | AJB | Test Ref. | TP3 |
| DATE | 11-Nov-14 | CHECKED BY | AHC | REV | 0 |

consulting engineers

## Calculation of soil infiltration rate in accordance with BRE Digest 365

Length of trial pit = $L_{TP}$ = 1.900 *m*
Width of trial pit = $W_{TP}$ = 0.300 *m*
Effective Depth = $D_{TP}$ = 0.030 *m* *(measured below incoming invert)*

75% Effective Depth of trial pit = $D_{75}$ = ( $D_{TP}$ x 0.75 ) = 0.023 *m*
50% Effective Depth of trial pit = $D_{50}$ = ( $D_{TP}$ x 0.50 ) = 0.015 *m*
25% Effective Depth of trial pit = $D_{25}$ = ( $D_{TP}$ x 0.25 ) = 0.008 *m*

Pit Voids = PV = 100 % *(For open pits, PV = 100%. For stone filled pits, PV = 30%)*

Time to fall from 75% to 25% effective depth = $T_1$ = 132 *mins*

Volume of water escaping during this test between $D_{75}$ and $D_{25}$
= $V_{TP75\_25}$ = ( $L_{TP}$ x $W_{TP}$ x ($D_{75}$ - $D_{25}$) x PV) = 0.009 *cu m.*

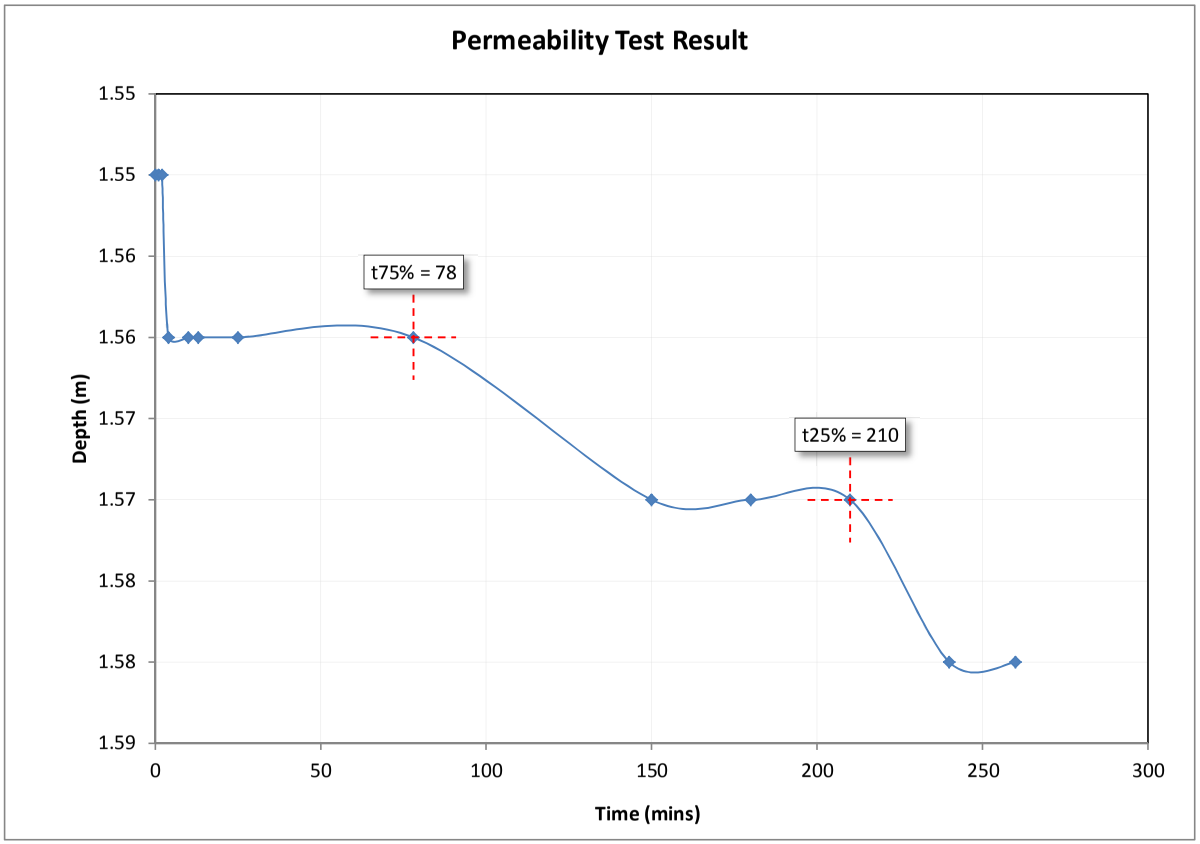
The mean surface area through which the above volume escapes, is the *wetted area.*
Only 50% of the effective depth is allowed in the calculation.

*ie* $A_{P50}$ = (Wet Base Area + 50% of Wet Sides Area)
$A_{P50}$ = ($L_{TP}$ x $W_{TP}$) + (2$L_{TP}$+2$W_{TP}$) x $D_{50}$
$A_{P50}$ = 0.570 + 0.066
$A_{P50}$ = 0.636 *sq m*

Soil Infiltration Rate = f = $\frac{V_{TP75\_25}}{A_{P50} \times 60 \times T_L}$ *m/s*

**Soil Infiltration Rate = f = 1.70E-06 *m/s***

| Trial Pit: | TP3 |
|---|---|
| Time (mins) | Water Depth (bgl) |
| 0 | 1.55 |
| 1 | 1.55 |
| 2 | 1.55 |
| 4 | 1.56 |
| 10 | 1.56 |
| 13 | 1.56 |
| 25 | 1.56 |
| 78 | 1.56 |
| 150 | 1.57 |
| 180 | 1.57 |
| 210 | 1.57 |
| 240 | 1.58 |
| 260 | 1.58 |




| | |
|---|---|
| Total Fall (m): | 0.03 |
| 75% Depth (m) | 1.56 |
| 50% Depth (m) | 1.57 |
| 25% Depth (m) | 1.57 |
| Effective Range 75% - 25% (m) | 0.01 |

| | |
|---|---|
| Time to fall to 75% Depth (mins) | 78 |
| Time to fall to 25% Depth (mins) | 210 |
| Time from 75% to 25% Depth (mins) | 132 |

# Appendix E

Laboratory Chemical Test Results

2531

# ANALYTICAL TEST REPORT

**Contract no:** 53441

**Contract name:** Barnsley Road, Goldthorpe

**Client reference:** 14013

**Clients name:** 3E Consulting Engineers

**Clients address:** 4 Calder Close
Calder Park
Wakefield
WF4 3BA

**Samples received:** 11 November 2014

**Analysis started:** 11 November 2014

**Analysis completed** 18 November 2014

**Report issued:** 18 November 2014

**Notes:**
Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, withour prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

**Key:**
U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing

**Approved by:**

| | | |
|---|---|---|
| Karan Campbell<br>Director | John Campbell<br>Director | Dave Bowerbank<br>Customer Services Co-ordinator |

# Chemtech Environmental Limited

# SAMPLE INFORMATION

**MCERTS (Soils):**

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

| Lab ref | Sample id | Depth (m) | Sample description | Material removed | % Removed | % Moisture |
|---|---|---|---|---|---|---|
| 53441-1 | WS 1 | 0.10 | Loamy Clay | - | - | 16.4 |
| 53441-2 | WS 1 | 0.40 | Clay | - | - | 15.1 |
| 53441-3 | WS 1 | 0.90 | Clay | - | - | 8.5 |
| 53441-4 | WS 2 | 0.10 | Loamy Clay | - | - | 18.7 |
| 53441-5 | WS 2 | 1.20 | Clay | - | - | 12.5 |
| 53441-6 | WS 3 | 0.10 | Loamy Clay | - | - | 16.3 |
| 53441-7 | WS 3 | 0.35 | Silty Clay | - | - | 11.9 |
| 53441-8 | WS 3 | 0.90 | Clay | - | - | 8.0 |
| 53441-9 | WS 4 | 0.10 | Loam | - | - | 12.5 |
| 53441-10 | WS 4 | 0.60 | Clay | - | - | 17.6 |
| 53441-11 | WS 4 | 0.90 | Silty Clay | - | - | 15.4 |
| 53441-12 | WS 5 | 0.10 | Loamy Clay | - | - | 17.2 |
| 53441-13 | WS 5 | 0.60 | Clay | - | - | 9.5 |
| 53441-14 | WS 6 | 0.10 | Loamy Clay | - | - | 18.4 |
| 53441-15 | WS 6 | 1.10 | Clay | - | - | 13.2 |
| 53441-16 | WS 7 | 0.10 | Loamy Clay | - | - | 16.5 |
| 53441-17 | WS 7 | 0.40 | Clay | - | - | 21.4 |
| 53441-18 | WS 8 | 0.10 | Loamy Clay | - | - | 25.9 |
| 53441-19 | WS 8 | 0.40 | Silty Clay | - | - | 13.8 |
| 53441-20 | WS 8 | 0.80 | Silty Clay | - | - | 11.4 |

# Chemtech Environmental Limited

# SOILS

| **Lab number** | | | 53441-1 | 53441-2 | 53441-3 | 53441-4 | 53441-5 | 53441-6 |
|---|---|---|---|---|---|---|---|---|
| **Sample id** | | | WS 1 | WS 1 | WS 1 | WS 2 | WS 2 | WS 3 |
| **Depth (m)** | | | 0.10 | 0.40 | 0.90 | 0.10 | 1.20 | 0.10 |
| **Date sampled** | | | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 |
| **Test** | **Method** | **Units** | | | | | | |
| Arsenic (total) | CE127 M | mg/kg As | 19 | 14 | - | 20 | - | 19 |
| Boron (water soluble) | CE063 M | mg/kg B | 1.0 | 0.8 | - | 1.0 | - | 1.0 |
| Cadmium (total) | CE127 M | mg/kg Cd | 0.4 | <0.2 | - | 0.5 | - | 0.5 |
| Chromium (total) | CE127 M | mg/kg Cr | 56 | 58 | - | 64 | - | 46 |
| Copper (total) | CE127 M | mg/kg Cu | 31 | 20 | - | 35 | - | 28 |
| Lead (total) | CE127 M | mg/kg Pb | 52 | 29 | - | 54 | - | 45 |
| Mercury (total) | CE127 M | mg/kg Hg | <0.5 | <0.5 | - | <0.5 | - | <0.5 |
| Nickel (total) | CE127 M | mg/kg Ni | 24 | 27 | - | 27 | - | 26 |
| Selenium (total) | CE127 M | mg/kg Se | 1.4 | 1.4 | - | 1.5 | - | 1.4 |
| Zinc (total) | CE127 M | mg/kg Zn | 95 | 82 | - | 114 | - | 105 |
| pH | CE004 M | units | 7.2 | 7.5 | 7.3 | 7.2 | 6.7 | 7.1 |
| Sulphate (2:1 water soluble) | CE061 M | mg/l $SO_4$ | 498 | 28 | 38 | 24 | 36 | 14 |
| Total Organic Carbon (TOC) | CE072 M | % w/w C | 4.53 | 1.01 | - | 5.32 | - | 3.83 |
| Estimate of OMC (calculated from TOC) | CE072 | % w/w | 7.81 | 1.74 | - | 9.17 | - | 6.60 |
| **PAH** | | | | | | | | |
| Naphthalene | CE087 | mg/kg | 0.04 | <0.01 | - | 0.07 | - | 0.04 |
| Acenaphthylene | CE087 | mg/kg | <0.01 | <0.01 | - | <0.01 | - | <0.01 |
| Acenaphthene | CE087 | mg/kg | <0.01 | <0.01 | - | <0.01 | - | <0.01 |
| Fluorene | CE087 | mg/kg | <0.01 | <0.01 | - | <0.01 | - | <0.01 |
| Phenanthrene | CE087 | mg/kg | 0.14 | <0.01 | - | 0.18 | - | 0.11 |
| Anthracene | CE087 | mg/kg | 0.16 | <0.01 | - | 0.04 | - | 0.02 |
| Fluoranthene | CE087 | mg/kg | 0.25 | <0.01 | - | 0.33 | - | 0.26 |
| Pyrene | CE087 | mg/kg | 0.20 | <0.01 | - | 0.29 | - | 0.23 |
| Benzo(a)anthracene | CE087 | mg/kg | 0.10 | <0.01 | - | 0.20 | - | 0.16 |
| Chrysene | CE087 | mg/kg | 0.12 | <0.01 | - | 0.19 | - | 0.16 |
| Benzo(b)fluoranthene | CE087 | mg/kg | 0.14 | <0.01 | - | 0.23 | - | 0.21 |
| Benzo(k)fluoranthene | CE087 | mg/kg | 0.07 | <0.01 | - | 0.10 | - | 0.10 |
| Benzo(a)pyrene | CE087 | mg/kg | 0.10 | <0.01 | - | 0.14 | - | 0.14 |
| Indeno(123cd)pyrene | CE087 | mg/kg | 0.07 | <0.01 | - | 0.10 | - | 0.11 |
| Dibenz(ah)anthracene | CE087 | mg/kg | <0.01 | <0.01 | - | <0.01 | - | <0.01 |
| Benzo(ghi)perylene | CE087 | mg/kg | 0.07 | <0.01 | - | 0.12 | - | 0.12 |
| PAH (total of USEPA 16) | CE087 | mg/kg | 1.45 | <0.16 | - | 2.00 | - | 1.65 |

# Chemtech Environmental Limited

# SOILS

| **Lab number** | | | 53441-7 | 53441-8 | 53441-9 | 53441-10 | 53441-11 | 53441-12 |
|---|---|---|---|---|---|---|---|---|
| **Sample id** | | | WS 3 | WS 3 | WS 4 | WS 4 | WS 4 | WS 5 |
| **Depth (m)** | | | 0.35 | 0.90 | 0.10 | 0.60 | 0.90 | 0.10 |
| **Date sampled** | | | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 |
| **Test** | **Method** | **Units** | | | | | | |
| Arsenic (total) | CE127 M | mg/kg As | 16 | - | 16 | 16 | - | 23 |
| Boron (water soluble) | CE063 M | mg/kg B | 0.6 | - | 0.9 | 0.7 | - | 1.0 |
| Cadmium (total) | CE127 M | mg/kg Cd | 0.2 | - | 0.4 | <0.2 | - | 0.4 |
| Chromium (total) | CE127 M | mg/kg Cr | 45 | - | 47 | 55 | - | 52 |
| Copper (total) | CE127 M | mg/kg Cu | 15 | - | 26 | 11 | - | 27 |
| Lead (total) | CE127 M | mg/kg Pb | 22 | - | 45 | 18 | - | 47 |
| Mercury (total) | CE127 M | mg/kg Hg | <0.5 | - | <0.5 | <0.5 | - | <0.5 |
| Nickel (total) | CE127 M | mg/kg Ni | 29 | - | 24 | 24 | - | 24 |
| Selenium (total) | CE127 M | mg/kg Se | 1.2 | - | 1.2 | 1.2 | - | 1.5 |
| Zinc (total) | CE127 M | mg/kg Zn | 74 | - | 93 | 68 | - | 103 |
| pH | CE004 M | units | 7.8 | 7.8 | 7.1 | 7.6 | 7.8 | 6.9 |
| Sulphate (2:1 water soluble) | CE061 M | mg/l $SO_4$ | <10 | 15 | 15 | 42 | 49 | 19 |
| Total Organic Carbon (TOC) | CE072 M | % w/w C | 0.41 | - | 3.63 | 0.26 | - | 4.75 |
| Estimate of OMC (calculated from TOC) | CE072 | % w/w | 0.71 | - | 6.26 | 0.45 | - | 8.19 |
| **PAH** | | | | | | | | |
| Naphthalene | CE087 | mg/kg | <0.01 | - | 0.05 | <0.01 | - | 0.05 |
| Acenaphthylene | CE087 | mg/kg | <0.01 | - | <0.01 | <0.01 | - | <0.01 |
| Acenaphthene | CE087 | mg/kg | <0.01 | - | 0.01 | <0.01 | - | <0.01 |
| Fluorene | CE087 | mg/kg | <0.01 | - | <0.01 | <0.01 | - | <0.01 |
| Phenanthrene | CE087 | mg/kg | <0.01 | - | 0.20 | <0.01 | - | 0.09 |
| Anthracene | CE087 | mg/kg | <0.01 | - | 0.07 | <0.01 | - | 0.02 |
| Fluoranthene | CE087 | mg/kg | <0.01 | - | 0.64 | <0.01 | - | 0.20 |
| Pyrene | CE087 | mg/kg | <0.01 | - | 0.60 | <0.01 | - | 0.17 |
| Benzo(a)anthracene | CE087 | mg/kg | <0.01 | - | 0.47 | <0.01 | - | 0.11 |
| Chrysene | CE087 | mg/kg | <0.01 | - | 0.42 | <0.01 | - | 0.12 |
| Benzo(b)fluoranthene | CE087 | mg/kg | <0.01 | - | 0.62 | <0.01 | - | 0.14 |
| Benzo(k)fluoranthene | CE087 | mg/kg | <0.01 | - | 0.21 | <0.01 | - | 0.07 |
| Benzo(a)pyrene | CE087 | mg/kg | <0.01 | - | 0.47 | <0.01 | - | 0.07 |
| Indeno(123cd)pyrene | CE087 | mg/kg | <0.01 | - | 0.31 | <0.01 | - | 0.06 |
| Dibenz(ah)anthracene | CE087 | mg/kg | <0.01 | - | 0.07 | <0.01 | - | <0.01 |
| Benzo(ghi)perylene | CE087 | mg/kg | <0.01 | - | 0.33 | <0.01 | - | 0.06 |
| PAH (total of USEPA 16) | CE087 | mg/kg | <0.16 | - | 4.46 | <0.16 | - | 1.16 |

# Chemtech Environmental Limited

# SOILS

| Lab number | | | 53441-13 | 53441-14 | 53441-15 | 53441-16 | 53441-17 | 53441-18 |
|---|---|---|---|---|---|---|---|---|
| Sample id | | | WS 5 | WS 6 | WS 6 | WS 7 | WS 7 | WS 8 |
| Depth (m) | | | 0.60 | 0.10 | 1.10 | 0.10 | 0.40 | 0.10 |
| Date sampled | | | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 | 07/11/2014 |
| **Test** | **Method** | **Units** | | | | | | |
| Arsenic (total) | CE127 M | mg/kg As | - | 21 | - | 15 | - | 16 |
| Boron (water soluble) | CE063 M | mg/kg B | - | 1.2 | - | 1.2 | - | 1.3 |
| Cadmium (total) | CE127 M | mg/kg Cd | - | 0.4 | - | 0.4 | - | 0.4 |
| Chromium (total) | CE127 M | mg/kg Cr | - | 42 | - | 38 | - | 54 |
| Copper (total) | CE127 M | mg/kg Cu | - | 31 | - | 28 | - | 25 |
| Lead (total) | CE127 M | mg/kg Pb | - | 50 | - | 42 | - | 41 |
| Mercury (total) | CE127 M | mg/kg Hg | - | <0.5 | - | <0.5 | - | <0.5 |
| Nickel (total) | CE127 M | mg/kg Ni | - | 25 | - | 27 | - | 23 |
| Selenium (total) | CE127 M | mg/kg Se | - | 1.5 | - | 1.3 | - | 1.2 |
| Zinc (total) | CE127 M | mg/kg Zn | - | 99 | - | 89 | - | 90 |
| pH | CE004 M | units | 5.9 | 7.2 | 6.8 | 7.5 | 7.7 | 7.5 |
| Sulphate (2:1 water soluble) | CE061 M | mg/l $SO_4$ | 39 | 14 | 63 | <10 | <10 | 14 |
| Total Organic Carbon (TOC) | CE072 M | % w/w C | - | 5.01 | - | 3.39 | - | 3.13 |
| Estimate of OMC (calculated from TOC) | CE072 | % w/w | - | 8.64 | - | 5.84 | - | 5.40 |
| **PAH** | | | | | | | | |
| Naphthalene | CE087 | mg/kg | - | 0.07 | - | 0.05 | - | 0.05 |
| Acenaphthylene | CE087 | mg/kg | - | <0.01 | - | <0.01 | - | <0.01 |
| Acenaphthene | CE087 | mg/kg | - | <0.01 | - | <0.01 | - | <0.01 |
| Fluorene | CE087 | mg/kg | - | <0.01 | - | <0.01 | - | <0.01 |
| Phenanthrene | CE087 | mg/kg | - | 0.16 | - | 0.13 | - | 0.12 |
| Anthracene | CE087 | mg/kg | - | 0.03 | - | 0.02 | - | 0.02 |
| Fluoranthene | CE087 | mg/kg | - | 0.32 | - | 0.24 | - | 0.22 |
| Pyrene | CE087 | mg/kg | - | 0.29 | - | 0.20 | - | 0.20 |
| Benzo(a)anthracene | CE087 | mg/kg | - | 0.19 | - | 0.14 | - | 0.17 |
| Chrysene | CE087 | mg/kg | - | 0.19 | - | 0.14 | - | 0.13 |
| Benzo(b)fluoranthene | CE087 | mg/kg | - | 0.23 | - | 0.20 | - | 0.15 |
| Benzo(k)fluoranthene | CE087 | mg/kg | - | 0.10 | - | 0.05 | - | 0.08 |
| Benzo(a)pyrene | CE087 | mg/kg | - | 0.16 | - | 0.11 | - | 0.10 |
| Indeno(123cd)pyrene | CE087 | mg/kg | - | 0.09 | - | 0.08 | - | 0.08 |
| Dibenz(ah)anthracene | CE087 | mg/kg | - | <0.01 | - | <0.01 | - | <0.01 |
| Benzo(ghi)perylene | CE087 | mg/kg | - | 0.11 | - | 0.07 | - | 0.08 |
| PAH (total of USEPA 16) | CE087 | mg/kg | - | 1.93 | - | 1.43 | - | 1.40 |

# Chemtech Environmental Limited

# SOILS

| **Lab number** | | | 53441-19 | 53441-20 |
|---|---|---|---|---|
| **Sample id** | | | WS 8 | WS 8 |
| **Depth (m)** | | | 0.40 | 0.80 |
| **Date sampled** | | | 07/11/2014 | 07/11/2014 |
| **Test** | **Method** | **Units** | | |
| Arsenic (total) | CE127 M | mg/kg As | 8.9 | - |
| Boron (water soluble) | CE063 M | mg/kg B | 0.7 | - |
| Cadmium (total) | CE127 M | mg/kg Cd | <0.2 | - |
| Chromium (total) | CE127 M | mg/kg Cr | 53 | - |
| Copper (total) | CE127 M | mg/kg Cu | 7.7 | - |
| Lead (total) | CE127 M | mg/kg Pb | 20 | - |
| Mercury (total) | CE127 M | mg/kg Hg | <0.5 | - |
| Nickel (total) | CE127 M | mg/kg Ni | 19 | - |
| Selenium (total) | CE127 M | mg/kg Se | 1.2 | - |
| Zinc (total) | CE127 M | mg/kg Zn | 60 | - |
| pH | CE004 M | units | 7.9 | 6.9 |
| Sulphate (2:1 water soluble) | CE061 M | mg/l $SO_4$ | 14 | 52 |
| Total Organic Carbon (TOC) | CE072 M | % w/w C | 0.38 | - |
| Estimate of OMC (calculated from TOC) | CE072 | % w/w | 0.66 | - |
| **PAH** | | | | |
| Naphthalene | CE087 | mg/kg | <0.01 | - |
| Acenaphthylene | CE087 | mg/kg | <0.01 | - |
| Acenaphthene | CE087 | mg/kg | <0.01 | - |
| Fluorene | CE087 | mg/kg | <0.01 | - |
| Phenanthrene | CE087 | mg/kg | <0.01 | - |
| Anthracene | CE087 | mg/kg | <0.01 | - |
| Fluoranthene | CE087 | mg/kg | <0.01 | - |
| Pyrene | CE087 | mg/kg | <0.01 | - |
| Benzo(a)anthracene | CE087 | mg/kg | <0.01 | - |
| Chrysene | CE087 | mg/kg | <0.01 | - |
| Benzo(b)fluoranthene | CE087 | mg/kg | <0.01 | - |
| Benzo(k)fluoranthene | CE087 | mg/kg | <0.01 | - |
| Benzo(a)pyrene | CE087 | mg/kg | <0.01 | - |
| Indeno(123cd)pyrene | CE087 | mg/kg | <0.01 | - |
| Dibenz(ah)anthracene | CE087 | mg/kg | <0.01 | - |
| Benzo(ghi)perylene | CE087 | mg/kg | <0.01 | - |
| PAH (total of USEPA 16) | CE087 | mg/kg | <0.16 | - |

# Chemtech Environmental Limited

# METHOD DETAILS

| METHOD | SOILS | METHOD SUMMARY | SAMPLE | STATUS | LOD | UNITS |
|---|---|---|---|---|---|---|
| CE127 | Arsenic (total) | Aqua regia digest, ICP-MS | Dry | M | 1 | mg/kg As |
| CE063 | Boron (water soluble) | Hot water extract, ICP-OES | Dry | M | 0.5 | mg/kg B |
| CE127 | Cadmium (total) | Aqua regia digest, ICP-MS | Dry | M | 0.2 | mg/kg Cd |
| CE127 | Chromium (total) | Aqua regia digest, ICP-MS | Dry | M | 1 | mg/kg Cr |
| CE127 | Copper (total) | Aqua regia digest, ICP-MS | Dry | M | 1 | mg/kg Cu |
| CE127 | Lead (total) | Aqua regia digest, ICP-MS | Dry | M | 1 | mg/kg Pb |
| CE127 | Mercury (total) | Aqua regia digest, ICP-MS | Dry | M | 0.5 | mg/kg Hg |
| CE127 | Nickel (total) | Aqua regia digest, ICP-MS | Dry | M | 1 | mg/kg Ni |
| CE127 | Selenium (total) | Aqua regia digest, ICP-MS | Dry | M | 0.3 | mg/kg Se |
| CE127 | Zinc (total) | Aqua regia digest, ICP-MS | Dry | M | 5 | mg/kg Zn |
| CE004 | pH | Based on BS 1377, pH Meter | Wet | M | - | units |
| CE061 | Sulphate (2:1 water soluble) | Aqueous extraction, ICP-OES | Dry | M | 10 | mg/l $SO_4$ |
| CE072 | Total Organic Carbon (TOC) | Removal of IC by acidification, Carbon Analyser | Dry | M | 0.1 | % w/w C |
| CE072 | Estimate of OMC (calculated from TOC) | Calculation from Total Organic Carbon | Dry | | 0.1 | % w/w |
| CE087 | PAH (speciated) | Solvent extraction, GC-MS | Wet | | 0.01 | mg/kg |

# Chemtech Environmental Limited

# DEVIATING SAMPLE INFORMATION

**Comments**
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

**Key**

| | |
|---|---|
| N | No (not deviating sample) |
| Y | Yes (deviating sample) |
| A | Sampling date not provided |
| B | Sampling time not provided (waters only) |
| C | Sample exceeded holding time(s) |
| D | Sample not received in appropriate containers |
| E | Headspace present in sample container |
| F | Sample not chemically fixed (where appropriate) |
| G | Sample not cooled |
| H | Other (specify) |

| Lab ref | Sample id | Depth (m) | Deviating | Tests (Reason for deviation) |
|---|---|---|---|---|
| 53441-1 | WS 1 | 0.10 | N | |
| 53441-2 | WS 1 | 0.40 | N | |
| 53441-3 | WS 1 | 0.90 | N | |
| 53441-4 | WS 2 | 0.10 | N | |
| 53441-5 | WS 2 | 1.20 | N | |
| 53441-6 | WS 3 | 0.10 | N | |
| 53441-7 | WS 3 | 0.35 | N | |
| 53441-8 | WS 3 | 0.90 | N | |
| 53441-9 | WS 4 | 0.10 | N | |
| 53441-10 | WS 4 | 0.60 | N | |
| 53441-11 | WS 4 | 0.90 | N | |
| 53441-12 | WS 5 | 0.10 | N | |
| 53441-13 | WS 5 | 0.60 | N | |
| 53441-14 | WS 6 | 0.10 | N | |
| 53441-15 | WS 6 | 1.10 | N | |
| 53441-16 | WS 7 | 0.10 | N | |
| 53441-17 | WS 7 | 0.40 | N | |
| 53441-18 | WS 8 | 0.10 | N | |
| 53441-19 | WS 8 | 0.40 | N | |
| 53441-20 | WS 8 | 0.80 | N | |

# Appendix F

Laboratory Geotechnical Test Results

PSL
Professional Soils Laboratory

# LABORATORY REPORT

UKAS TESTING
4043

**Contract Number: PSL14/6004**

Client's Reference: 14013 Report Date: 01 December 2014

Client Name: 3E Consulting Engineers Ltd
4 Calder Close
Calder Park
Wakefield
WF4 3BA

**For the attention of: Andrew Hampson**

Contract Title: Barnsley Road, Goldthorpe

Date Received: 17/11/2014
Date Commenced: 17/11/2014
Date Completed: 01/12/2014

**Notes:** **Observations and Interpretations are outside the UKAS Accreditation**

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

Checked and Approved Signatories:

R Gunson (Director)
A Watkins (Director)
M Beastall (Laboratory Manager)

D Lambe (Senior Technician)
S Royle (Senior Technician)



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# SUMMARY OF LABORATORY SOIL DESCRIPTIONS

| Hole Number | Sample Number | Sample Type | Depth m | Description of Sample |
|---|---|---|---|---|
| TP2 | | | 1.20 | Brown gravelly sandy silty CLAY. |
| TP3 | | | 0.80 | Brown gravelly sandy silty CLAY. |
| TP4 | | | 0.70 | Brown mottled grey slightly gravelly sandy silty CLAY. |
| TP5 | | | 1.20 | Brown GRAVEL of mudstone. |
| TP6 | | | 1.20 | Brown gravelly slightly sandy silty CLAY. |
| TP7 | | | 0.60 | Brown mottled grey slightly gravelly sandy silty CLAY. |
| TP8 | | | 0.70 | Brown gravelly sandy silty CLAY. |
| TP8 | | | 1.20 | Brown mottled grey gravelly sandy silty CLAY. |
| TP9 | | | 0.80 | Brown mottled grey slightly gravelly sandy silty CLAY. |
| TP10 | | | 0.60 | Brown slightly gravelly sandy silty CLAY. |
| TP10 | | | 1.60 | Dark brown slightly gravelly sandy silty CLAY. |
| TP11 | | | 1.20 | Brown very gravelly sandy silty CLAY. |
| | | | | |
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| | | | | |
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| | | | | |
| | | | | |

PSL
Professional Soils Laboratory

| Compiled by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| | 01/12/14 | | 01/12/14 | | 01/12/14 |

BARNSLEY ROAD, GOLDTHORPE.

Contract No: PSL14/6004

Client Ref: 14013

# SUMMARY OF SOIL CLASSIFICATION TESTS

**(B.S. 1377 : PART 2 : 1990)**

| Hole Number | Sample Number | Sample Type | Depth m | Moisture Content % Clause 3.2 | Bulk Density $Mg/m^3$ Clause 7.2 | Dry Density $Mg/m^3$ Clause 7.2 | Particle Density $Mg/m^3$ Clause 8.2 | Liquid Limit % Clause 4.3/4.4 | Plastic Limit % Clause 5.3 | Plasticity Index % Clause 5.4 | % Passing .425mm | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TP2 | | | 1.20 | 15 | | | | 38 | 20 | 18 | 82 | Intermediate plasticity CI. |
| TP3 | | | 0.80 | 30 | | | | 58 | 25 | 33 | 77 | High plasticity CH. |
| TP4 | | | 0.70 | 17 | | | | 39 | 20 | 19 | 92 | Intermediate plasticity CI. |
| TP5 | | | 1.20 | 10 | | | | | NP | | | |
| TP6 | | | 1.20 | 16 | | | | 56 | 25 | 31 | 84 | High plasticity CH. |
| TP7 | | | 0.60 | 25 | | | | 38 | 21 | 17 | 90 | Intermediate plasticity CI. |
| TP8 | | | 0.70 | 17 | | | | 49 | 23 | 26 | 84 | Intermediate plasticity CI. |
| TP8 | | | 1.20 | 14 | | | | 37 | 20 | 17 | 77 | Intermediate plasticity CI. |
| TP9 | | | 0.80 | 16 | | | | 36 | 19 | 17 | 90 | Intermediate plasticity CI. |
| TP10 | | | 0.60 | 25 | | | | 37 | 20 | 17 | 91 | Intermediate plasticity CI. |
| TP10 | | | 1.60 | 20 | | | | 40 | 21 | 19 | 90 | Intermediate plasticity CI. |
| TP11 | | | 1.20 | 11 | | | | 35 | 19 | 16 | 72 | Intermediate plasticity CI. |
| | | | | | | | | | | | | |
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| | | | | | | | | | | | | |

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

PSL
Professional Soils Laboratory

| Compiled by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|
| | 01/12/14 | | 01/12/14 | | 01/12/14 |

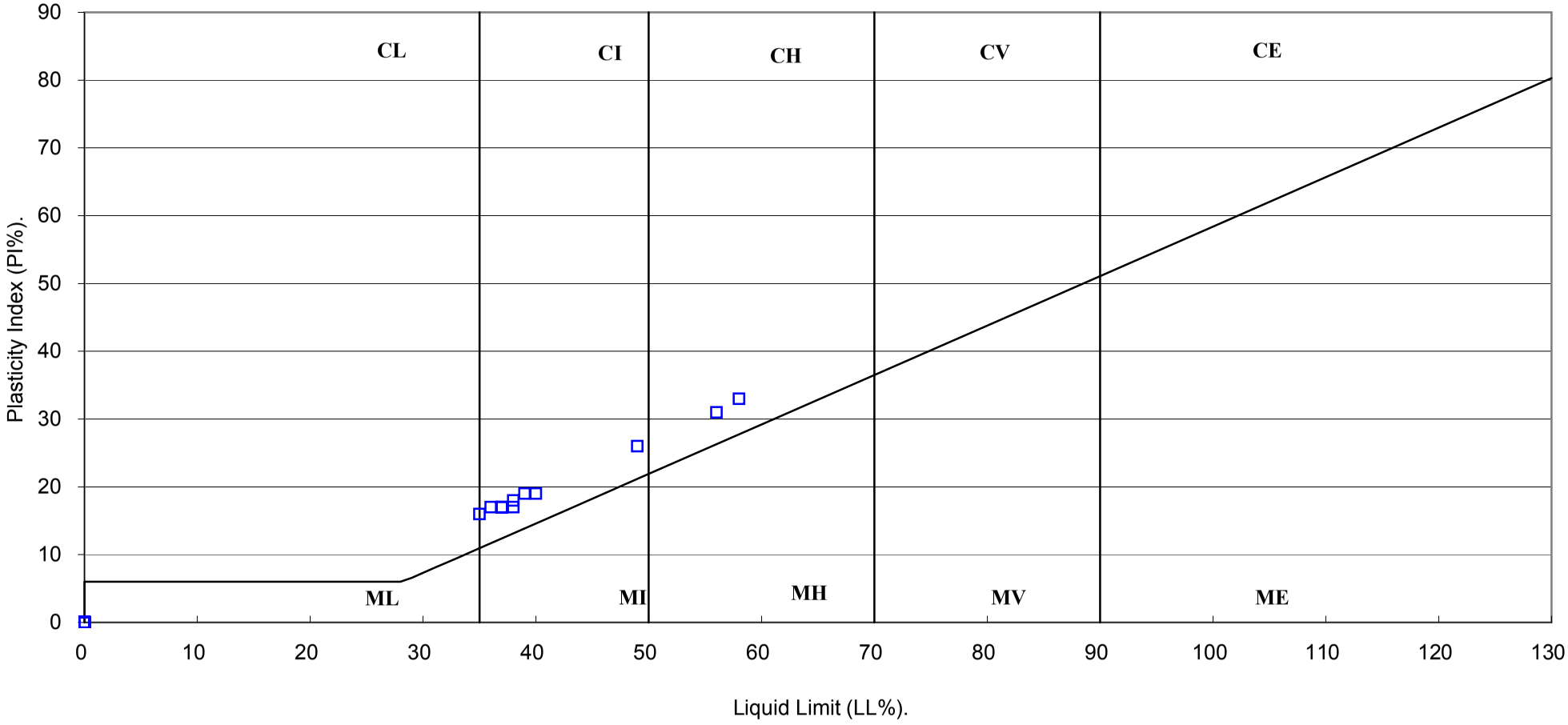
**BARNSLEY ROAD, GOLDTHORPE.**

**Contract No:** **PSL14/6004**

**Client Ref:** **14013**

# PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

**(B.S.5930 : 1999)**




| PSL Professional Soils Laboratory | Compiled by | Date | Checked by | Date | Approved by | Date |
|---|---|---|---|---|---|---|
| | | 01/12/14 | | 01/12/14 | | 01/12/14 |
| | BARNSLEY ROAD, GOLDTHORPE. | | | | Contract No: | PSL14/6004 |
| | | | | | Client Ref: | 14013 |