# GROUND INVESTIGATION REPORT

Mearley Croft
Woone Lane
Clitheroe
Lancashire

Client: Beck Developments Limited

J11218A

October 2015


GEA Geotechnical & Environmental Associates

## Document Control

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|---|---|---|---|
| **Project title** | Mearley Croft, Woone Lane, Clitheroe, Lancs BB7 1BJ | **Project ref** | J11218A |
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| **Issue No** | **Status** | **Date** | **Approved for Issue** |
| 1 | Draft for comment | 17 October 2012 | |
| 2 | Final (amended scheme) | 2 October 2015 | |

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## CONTENTS

# EXECUTIVE SUMMARY

*This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.*

## BRIEF

This report presents the findings of a review of a site investigation carried out by Geotechnical and Environmental Associates Limited (GEA) on behalf of Beck Developments Limited, in respect of the construction of a new residential development. Since completion of a desk study and ground investigation by GEA in 2011 and 2012, the development proposals have been altered, and this report comprises a review of the historical and environmental setting of the site with respect to possible contaminative uses, discussion of the ground conditions, and extent of any contamination and information to assist with the design of spread foundations for the proposed structures.

## DESK STUDY FINDINGS

The desk study carried out by GEA in November 2011 indicated that the site has a potentially contaminative history and assessed that there was a moderate risk of there being a significant contaminant linkage at this site, which would result in a requirement for any remediation work.

## GROUND CONDITIONS

The investigation has found a variable thickness of made ground extending to depths of between 0.3 m and 2.0 m and generally comprises black and brown silty sandy clay and clayey sand with extraneous material including limestone gravel, cobbles of sandstone and brick, fragments of coal, ash, clinker, tile, plastic wood and slate. Beneath the made ground, stiff sandy gravelly clay is present, extending to depths of up to 5.45 m and considered to represent Glacial Till. Groundwater was not encountered during the investigation but was present in subsequent monitoring at a depth of roughly 1.5 m. The contamination analyses have indicated that the ash and clinker scattered through the made ground contains elevated concentrations of arsenic, lead, total PAH and species thereof that are of concern to a residential end use. Laboratory analysis has confirmed that fragments of cementitious sheeting encountered on site contain white (chrystile) asbestos.

## RECOMMENDATIONS

Shallow spread foundations could be used for Block Nos 7 to 10 with deep trench filled foundations expected to be used for Block Nos 1 to 6. Ground floor slabs suspended from the foundations are recommended where trench filled foundations are used but lightly loaded ground bearing slabs may be used where the Till is present at shallow depths.

NHBC guidelines should be followed in respect of minimum foundation depths, voids beneath ground floor slabs and restrictions on new planting.

Shallow soakaways are not considered to be a suitable means of disposing of surface water.

Pavements formed in the made ground may be designed on the basis of ‘less than 2 %’ but if formed within the Glacial Till then a CBR value of 5 % may be adopted.

Elevated concentrations of arsenic, lead and PAH contaminants have been measured such that importing clean material for gardens and soft landscaping is considered necessary.

# Part 1: INVESTIGATION REPORT

This section of the report details the objectives of the investigation, the work that has been carried out to meet these objectives and the results of the investigation. Interpretation of the findings is presented in Part 2.

## 1.0 INTRODUCTION

Geotechnical and Environmental Associates (GEA) has been instructed by Beck Developments Limited, to reinterpret the findings of a site investigation carried out previously at this site on Woone Lane, Clitheroe in Lancashire in the light of revised development proposals. The site investigation was carried out by GEA and comprised a desk study (report ref J11218, dated November 2011) and subsequent ground investigation (report ref J11218A Rep Issue 1, dated October 2012).

### 1.1 Proposed Development

Consideration is being given to the redevelopment of part of the site for residential purposes. The proposed development comprises ten new two-storey dwellings with associated infrastructure, gardens and landscaping. Development of the remainder of the site is now not proposed.

This report is specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

### 1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows.

- to review the environmental and historical settings of the site;
- to determine the ground conditions and their engineering properties
- to provide advice with respect to the design of spread foundations;
- to provide advice with respect to retaining walls;
- to provide advice with respect to pavement design;
- to provide an indication of the degree of soil contamination present; and
- to assess the risk that any such contamination may pose to the proposed development, its users or the wider environment and the effect it would have on the waste classification of spoil removed from site.

### 1.3 Scope of Work

In order to meet the above objectives, the previous desk study was reviewed along with a brief check of publicly available Environment Agency data, and an intrusive ground investigation was carried out which comprised, in summary, the following activities:

- a series of 12 mechanically excavated trial pits to a maximum depth of 2.90 m;

- four boreholes, advanced by open-drive methods to a maximum depth of 5.45 m;
- three boreholes, advanced by cable percussion methods to a maximum depth of 10.8 m;
- standard penetration tests (SPTs), carried out at regular intervals in the boreholes, to provide additional quantitative data on the strength of the soils;
- installation and monitoring of four standpipes for soil gas and groundwater;
- laboratory testing of selected soil samples for geotechnical purposes and for the presence of contamination; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

The investigation and previous report covered the whole of the site but this report, which reflects a smaller development proposal, covers the southwestern part of the site, a relatively small part of that investigated, and draws only on the data relevant to the reduced development. However for the sake of clarity the full fieldwork and laboratory data is included.

The report includes a contaminated land assessment which has been undertaken in accordance with the methodology presented in Contaminated Land Report (CLR) 11[1] and involves identifying, making decisions on, and taking appropriate action to deal with, land contamination in a way that is consistent with government policies and legislation within the United Kingdom. The risk assessment is thus divided into three stages comprising Preliminary Risk Assessment, Generic Quantitative Risk Assessment, and Site-Specific Risk Assessment.

### 1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

## 2.0 THE SITE

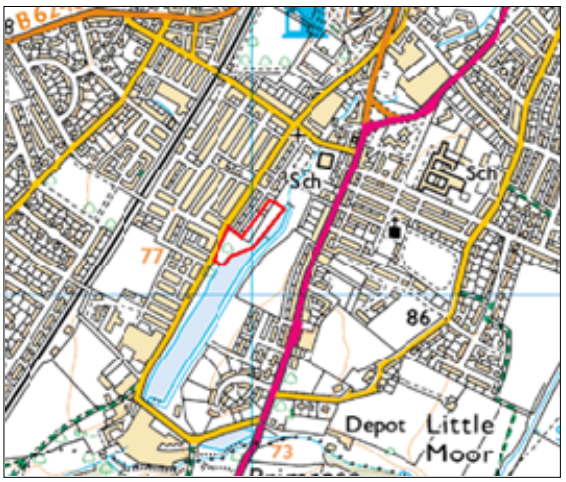
### 2.1 Site Description

The site was visited as part of the work carried out in 2011 and 2012 but has not been revisited as part of this reappraisal. It is located approximately 1.2 km southwest of Clitheroe town centre and fronts onto Woone Lane to the northwest. The site is bounded to the north by lock-up garages and various outbuildings that belong to houses that front onto Woone Lane.

1 *Model Procedures for the Management of Land Contamination* issued jointly by the Environment Agency and the Department for Environment, Food and Rural Affairs (DEFRA) Sept 2004

To the southeast, the site is bounded by Mearley Brook, which flows in a southwesterly direction. The northeastern boundary is formed by woodland and dilapidated buildings which are noted on historic maps as works.

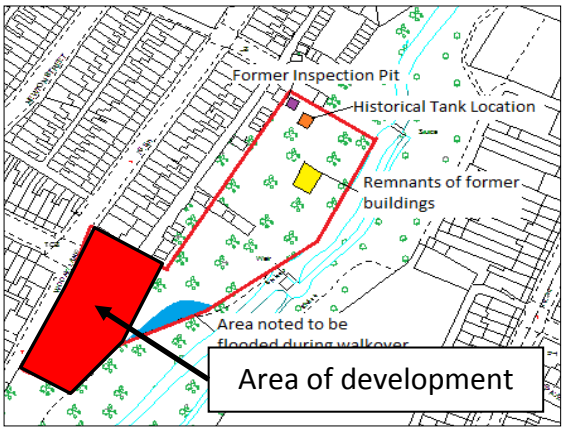
The remaining boundary to the southwest is open to woodland. The site is irregular in shape measuring 165 m southwest to northeast and 70 m northwest to southeast in maximum dimensions; it may additionally be located by National Grid Reference 373990, 441140 and is shown on the map extract, right.




When visited previously the site was in an overgrown and untidy state with fly tipped waste covering much of the surface. Part of the site to the rear of the houses that front onto Woone Lane was, at the time of walkover, being used to keep poultry.

The site slopes steeply down from Woone Lane towards Mearley Brook and the gradient reduces with increasing proximity to the brook.

It appears that the site was once accessed from Woone Lane as entrances for pedestrians and vehicles have been bricked up and 'Keep Out' and 'Deep Water' warning signs are displayed. Some remnants of former buildings were noted in the north of the site, including what appears to have been a vehicle inspection pit.




The fly tipped material noted at the site was generally observed to be demolition rubble; this rubble contained some fragments of corrugated cementious panels which may contain asbestos. The site contained numerous mature and semi-mature trees; the majority of these trees were noted to be ash.

At the time of investigation, Japanese Knotweed was observed to have covered a large part of both areas of the site although at the time of intrusive investigation the chickens had kept large areas free of growth. During subsequent monitoring visits new shoots were noted across much of the area formerly occupied by coups. In addition an extensive area of Himalayan Balsam plants was noted close to the area of the former vehicle inspection pit noted above.

From hereon the report will refer to 'the site' as being the solely the development area shown in red on the plan extract above. This area comprises the area that lies alongside Woone Lane but does not extend behind the existing terraced properties of Woone Lane. It is understood that the majority of trees in this area were cut down in this area during 2012 and 2013.

## 2.2 Site History

The site history was researched during the desk study and indicated that in 1847 the site was on the edge of Primrose Lodge mill reservoir. The site is shown to have been covered by woodland.

No significant changes to the site itself or its immediate surroundings were noted on subsequent maps up to the time of the desk study site walkover.

## 2.3 Other Information

The Geological Survey map of the area indicates the site is underlain by Glacial Till and Alluvium overlying the Clitheroe Limestone Formation and Hodder Mudstone Formation.

## 2.4 Preliminary Risk Assessment

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. The determination of contaminated sites is based on a "suitable for use" approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of a source-pathway-receptor approach.

### 2.4.1 Source

The findings of the desk study indicated that significant contamination is unlikely to present from the historical woodland use but scattered fly tipped material including what appeared to be asbestos containing material was noted during the walkover are potential contamination sources.

The environmental search revealed a number of pollution incidents to the nearby Mearley Brook although being several metres lower than the site is highly unlikely to have detrimentally affected the site. A single historical landfill is located 228 m to the southwest and possibly within influencing distance of the site.

### 2.4.2 Receptor

As the usage of the site will become residential with garden areas, the human health of end-users will be considered as a sensitive target. The site is underlain by a Glacial Till which is classified as non-productive strata and therefore groundwater is not considered to be a sensitive receptor. Mearley Brook, which is located at a lower elevation and less than 50 m from the site boundary, is considered to be a moderately sensitive receptor.

### 2.4.3 Pathway

End users of the site may be exposed to any potential near surface contamination in gardens and landscaped areas through direct soil and dust inhalation, consumption of homegrown produce, consumption of soil adhering to homegrown produce and skin contact with soils and dust.

The site is likely to be directly underlain by Glacial Till which is designated as unproductive strata, over the Clitheroe Limestone Formation and Hodder Mudstone Formation which are designated a Secondary 'A' Aquifers. Given the environmental setting of this site it is unlikely that potential near surface contamination will impact the aquifer but would instead migrate to the adjacent Mearley Brook via surface water run off or leaching. Buried services may be exposed to any contaminants present within the soil through direct contact and site workers will come into contact with the soils during construction works.

### 2.4.4 Preliminary Risk Appraisal

On the basis of the above it is considered that there is a low risk of there being a contaminant linkage at this site which would result in a requirement for major remediation work.

## 3.0 EXPLORATORY WORK

In order to meet the objectives described in Section 1.2, a series of 12 trial pits was advanced using a 3 tonne tracked mini-excavator to a maximum depth of 2.9 m; the JCB originally delivered to site could not gain access following a period of heavy rain. In addition, four boreholes were advanced to a maximum depth of 5.45 m using a tracked open-drive sampling rig and three boreholes were advanced to a maximum depth of 10.7 m using cable percussion equipment. The trial pits and shallow boreholes were advanced under the supervision of a geotechnical engineer from GEA. During the boring of the shallow boreholes, a continuous soil core was recovered and examined by the engineer and Standard Penetration Tests (SPTs) were carried out at regular intervals.

A selection of the samples recovered from the trial pits and boreholes was submitted to a soil mechanics laboratory for a programme of geotechnical testing and an analytical laboratory for a programme of contamination testing.

The borehole records and the results of the laboratory analyses are appended, together with a site plan indicating the exploratory positions. The Ordnance Datum (OD) levels shown on the borehole records have been interpolated from spot levels shown on a topographic survey of the site that was provided by the client.

### 3.1 Sampling Strategy

The sampling strategy was designed to provide an indication of the thickness of made ground and to provide parameters for foundation design in the proposed location of the new houses, along with determining the nature and consistency of the made ground in the areas planned as gardens and pavements.

A total of 24 samples recovered from the made ground was subjected to analysis for a range of common industrial contaminants and contamination indicative parameters although eight are relevant to this assessment. For this investigation the analytical suite for the soil included a range of metals, speciation of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), total cyanide and monohydric phenols. In addition, three samples of the cementitious sheeting roof material obtained from fragments lying on the ground were screened for the presence of asbestos.

The soil samples were largely selected from the upper 1.0 m of soil to provide a general view of the chemical conditions of the soils that are likely to be involved in a human exposure pathway and to provide advice in respect of re-use or for waste disposal classification. The contamination analyses were carried out at an MCERTs accredited laboratory with the majority of the testing suite accredited to MCERTS standards. Details of the MCERTs accreditation and test methods are included in the Appendix together with the analytical results.

# 4.0 GROUND CONDITIONS

A variable thickness of made ground is present across the site and was found to be underlain by firm becoming stiff gravelly clay representing Glacial Till.

## 4.1 Made Ground

The made ground was found to extend to depths of between 0.3 m and 2.0 m with the smallest thicknesses measured in Borehole Nos 1 and 2 closest to Woone Lane and the depth increasing to about 2.0 m in the eastern corner of the site. The made ground generally comprised black and brown silty sandy clay and clayey sand with extraneous material including limestone gravel, cobbles of sandstone and brick, fragments of coal, ash, clinker, tile, plastic wood, slate and tarmac. Scattered fragments of cementitious, possibly asbestos - cement board were observed on the surface across the site.

Evidence of potentially contaminated material was observed within these soils, in that ash and clinker, which commonly contain elevated concentrations of arsenic, copper, lead, nickel, zinc and Poly-aromatic hydrocarbons (PAH), was found as fragments scattered throughout the fill materials. No evidence of significant oil staining or spillage was observed in any of the exploratory locations. Samples of the made ground were analysed for a range of contaminants and the results are summarised in Section 4.4.

## 4.2 Glacial Till

Beneath the made ground, firm and stiff brown and greyish brown silty sandy clay with scattered limestone gravel was encountered and proved to the maximum depth investigated in that area of 5.45 m (68.95 mOD). Laboratory testing of these deposits has indicated that the material is of intermediate plasticity and therefore has low to medium volume change potential. The moisture content of samples of this material suggests that at relatively shallow depths, the material may be partially desiccated due to the numerous mature trees in this area however the relatively low plasticity index values and clay fraction values suggest that the results are also attributable to the nature of the Till and its limestone gravel content.

These soils were observed to be free of any evidence of soil contamination

## 4.3 Groundwater

Groundwater was not encountered during the investigation but was present in subsequent monitoring at a depth of roughly 1.5 m.

## 4.4 Soil Contamination

The table below sets out the values measured within eight samples of the made ground that have been analysed; all concentrations are in mg/kg unless otherwise stated.

| Determinant | Maximum concentration recorded (mg/kg) | Minimum concentration recorded (mg/kg) | Number of samples below detection limit |
|---|---|---|---|
| pH | 8.7 | 7.6 | - |
| Arsenic | **56** | 12 | None |
| Cadmium | 1.3 | 0.25 | None |

| Determinant | Maximum concentration recorded (mg/kg) | Minimum concentration recorded (mg/kg) | Number of samples below detection limit |
|---|---|---|---|
| Chromium | 40 | 8.9 | None |
| Copper | 160 | 17 | None |
| Mercury | 0.76 | <0.10 | 2 |
| Nickel | 62 | 10 | None |
| Lead | **290** | 74 | None |
| Selenium | 1.1 | <0.2 | 2 |
| Zinc | 330 | 74 | None |
| Total Cyanide | <0.5 | <0.5 | All |
| Total Phenols | <0.3 | <0.3 | All |
| Sulphide | 6.2 | 2.0 | None |
| Total TPH | 130 | <10 | 2 |
| Naphthalene | 2.2 | <0.1 | 2 |
| Benzo(a)pyrene | **9.8** | <0.1 | 1 |
| Total PAH | **110** | <2 | 1 |
| Total organic carbon % | 11 | 5.3 | None |

*Note:* Figure in **bold** indicates concentration in excess of risk-based soil guideline values, as discussed below

The contamination testing has indicated elevated concentrations of arsenic, lead and of benzo(a)pyrene as well as of total PAH. In addition white (chrysotile) asbestos was identified within two of the three samples of cementitious sheeting tested.

### 4.4.1 Generic Quantitative Risk Assessment

The use of a risk-based approach has been adopted to provide an initial screening of the test results to assess the need for subsequent site-specific risk assessments. To this end the table below indicates those contaminants of concern that have values in excess of a generic human health risk based guideline values which are either that of the CLEA[2] Soil Guideline Value where available, or is a Generic Screening Value calculated using the CLEA UK Version 1.06[3] software assuming a residential end use without plant uptake, or is based on the DEFRA Category 4 Screening values[4]. The key generic assumptions for this end use are as follows:

- that groundwater will not be a critical risk receptor;
- that the critical receptor for human health will be young female children aged zero to six years old;
- that the exposure duration will be six years;

[2] *Updated Technical Background to the CLEA Model (Science Report SC050021/SR3) Jan 2009* and Soil Guideline Value reports for specific contaminants; all DEFRA and Environment Agency.
[3] Contaminated Land Exposure Assessment (CL|EA) Software Version 1.06 Environment Agency 2009
[4] CL:AIRE (2013) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination* Final Project Report SP1010 and DEFRA (2014) *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination* Policy Companion Document SP1010

- that the critical exposure pathways will be direct soil and indoor dust ingestion, skin contact with soils and indoor dust, and inhalation of indoor and outdoor dust and vapours; and

- that the building type equates to a two-storey small terraced house.

It is considered that these assumptions are appropriate for this generic first assessment of this site. The tables of generic screening values derived by GEA and an explanation of how each value has been derived are included in the Appendix.

Where contaminant concentrations are measured at concentrations below the generic screening value it is considered that they pose an acceptable level of risk and thus further consideration of these contaminant concentrations is not required. However, where concentrations are measured in excess of these generic screening values there is considered to be a potential that they could pose an unacceptable risk and thus further action will be required which could include;

- additional testing to zone the extent of the contaminated material and thus reduce the uncertainty with regard to its potential risk;

- site specific risk assessment to refine the assessment criteria and allow an assessment to be made as to whether the concentration present would pose an unacceptable risk at this site; or

- soil remediation or risk management to mitigate the risk posed by the contaminant to a degree that it poses an acceptable risk.

The concentration ranges of the contaminants of concern highlighted by a comparison of the measured concentrations against the generic screening values are tabulated below. This assessment is based upon the potential for risk to human health, which at this site is considered to be the critical risk receptor.

| Contaminant of Concern | Maximum concentration recorded (mg/kg) | Minimum concentration recorded (mg/kg) | Mean concentration (mg/kg) | Generic Risk-Based Screening Value |
|---|---|---|---|---|
| Arsenic | 56 | 12 | 23.5 | 37 |
| Lead | 290 | 74 | 181 | 200 |
| Benzo(a)pyrene | 4.9 | <0.1 | 3.9 | 5.0 |
| Total PAH | **110** | <2 | 34 | 71.4 |

The elevated concentrations have been recorded in three samples of the made ground recovered from Trial Pit Nos 1 and 3 at 0.9 m depth and 0.3 m depth respectively and from Borehole No 1 at 0.2 m from ash and clinker rich material. The significance of these results is discussed further in Part 2 of the report.

## 4.5 Soil Gas

The results of the five rounds of gas monitoring undertaken indicated very high concentrations of methane and elevated concentrations of carbon dioxide within boreholes close to Mearley Brook on the part of the site that is not going to be developed. The results from Borehole No 2, on the site that is to be developed, suggest that normal aerobic conditions prevail with no evidence of gas migration from either the lower part of the site or from the historic landfill southwest of the site.

# Part 2: DESIGN BASIS REPORT

This section of the report provides an interpretation of the findings detailed in Part 1, in the form of a ground model, and then provides advice and recommendations with respect to foundation options and contamination issues.

## 5.0 INTRODUCTION

It is understood that consideration is being given to the construction of ten new two-storey dwellings in three blocks In addition new paths, car parking and small gardens are to be provided with each house. It is anticipated that the proposed development is likely to impose relatively light to moderate loadings.

## 6.0 GROUND MODEL

The previous desk study indicates that the site does not have a potentially contaminative history. On the basis of the fieldwork, the ground conditions at this site can be characterised as follows.

- A variable thickness of made ground is present to depths of between 0.3 m and 2.0 m;
- the made ground generally comprises black and brown silty sandy clay and clayey sand with extraneous material including limestone gravel, cobbles of sandstone and brick, fragments of coal, ash, clinker, tile, plastic wood and slate;
- beneath the made ground stiff sandy gravelly clay is present and was proved to extend to depths of up to 5.45 m;
- groundwater has been measured at approximately 1.5 m;
- the contamination analyses have indicated that the ash and clinker scattered through the made ground contains elevated concentrations of arsenic, lead, total PAH and species thereof that that are of concern to a residential end use; and
- laboratory analysis has confirmed that fragments of corrugated cementitious boarding contain white (chrystile) asbestos.

## 7.0 ADVICE AND RECOMMENDATIONS

The competent natural soils encountered at shallow depths should provide suitable bearing strata for the support of the anticipated light loads by means of spread foundations.

### 7.1 Spread Foundations

Moderate width strip or pad foundations bearing on the firm Glacial Till should be placed at a minimum depth of 1.25 m, assuming that no restrictions are applied on planting of shrubs in the vicinity of foundations, and that a no planting zone is applied in accordance with Table 4 of NBHC Standards Chapter 4.2 (2014). If trees are excluded within the zone of influence

shown in Table 2 of the NHBC guidance, the minimum depth can be reduced to 0.9 m, subject also to the further advice on new tree and shrub planting as detailed in the NHBC guidelines. Medium volume change potential has been adopted to remain conservative given the proximity of the more mature trees. The foundations may be designed to apply a net allowable bearing pressure of 150 kN/m$^2$. This value incorporates an adequate factor of safety against bearing capacity failure and should ensure that settlement remains within normal tolerable limits. The recommended bearing pressure takes account of the variable nature of the soils and any foundations should be nominally reinforced where they span clay and granular material to protect against differential settlement.

If trees are to be planted in close proximity to the new buildings founding depths should be deepened in accordance with NHBC guidelines and using the mature height of the tree. Medium shrinkability clay should be assumed.

The deeper made ground in the vicinity of Plot Nos 1 to 4 will prohibit shallow foundations but with the Glacial Till present at between 1.8 m and 2.0 m then consideration could be given to trench filled foundations bearing within the Glacial Till. A similar bearing pressure to the above may be adopted and the same restrictions in respect of NHBC guidelines will need to be provided for.

Since the plot layout has changed since the original investigation it would be prudent to undertake further investigation in between Plot Nos 4 and 5 to confirm the thickness of made ground and to determine whether shallow or trench-filled foundations will be necessary.

## 7.2 Retaining Walls

In order to level the site or to reduce its gradient, a retaining wall is proposed to be located roughly mid-slope. It is understood that consideration is being given to either traditional gravity or gabion basket retaining walls. The following parameters are suggested for the design of these retaining walls.

| Stratum | Bulk Density (kg/m$^3$) | Effective Cohesion (c′ – kN/m$^2$) | Effective Friction Angle (ϕ′ – degrees) |
|---|---|---|---|
| Made ground | 1700 | Zero | 27 |
| Glacial Till | 1950 | Zero | 25 |

## 7.3 Excavations

On the basis of the observations made on site, it is anticipated that shallow and moderate depth excavations within the Glacial Till are likely to remain stable in the short and medium term. Groundwater ingress may be expected in the medium to long term but conventional sump pumping techniques should be able to control such inflows.

However, if deeper excavations are necessary or if excavations are to remain open for prolonged periods it is recommended that provision be made for battered side slopes or lateral support. Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements.

## 7.4 Ground Floor Slabs

For Block Nos 7 to 10, where trees will have been removed, the floor slabs may need to be suspended over a void in accordance with NHBC guidelines.

For the remaining blocks, where deep trench filled foundations are necessary then fully suspended floor slabs should be adopted.

## 7.5 Pavement Design

Pavements formed in the made ground should be designed on a California Bearing Ratio (CBR) value of 'less than 2 %'. Formation levels should be subject to a proof rolling exercise and any soft spots revealed should be excavated and replaced with suitably compacted granular fill or lean mix concrete. .

Where pavements are to be formed within the Glacial Till then a CBR value of 5 % may be adopted.

## 7.6 Effect of Sulphates

Low concentrations of soluble sulphate have been measured within the made ground and natural soils.

It is suggested that in the natural soils, buried concrete could be designed in accordance with Class DS-1 conditions of Table C2 of BRE Special Digest 1: SD1 Third Edition (2005). The measured pH conditions are mildly alkaline and on the basis of static groundwater conditions being assumed for buried concrete an ACEC classification of AC-1s may be adopted.

In any case, the guidelines contained in the above digest should be followed in the design of foundation concrete.

## 7.7 Disposal of Surface Water

The depth and nature of the cohesive essentially impermeable Glacial Till indicate that shallow soakaway drainage will not be possible for this site and surface water should be directed into the main pumped drainage system or indeed into Mearley Brook if the appropriate consents can be obtained.

## 7.8 Contamination Risk Assessment

The desk study findings indicate the site not to have had a potentially contaminative history as the site has apparently been woodland as far back as records are available. The results of the chemical analyses have indicated elevated concentrations of arsenic, lead and PAH within the samples of the made ground tested. The source of the contamination is considered to be the ash and clinker rich made ground. In addition fragments of cementitious asbestos sheeting were observed across the site surface.

The proposed residential end-usage of the site with domestic gardens represents a risk to end users from the contaminants measured. These risks, as well as groundwater and site workers are further assessed below.

### 7.8.1 End Users

Elevated concentrations of arsenic PAH and its carcinogenic constituent species have been measured within the made ground and are considered to represent typical post-war ash and clinker-rich made ground. The use of such material was widespread in capping cohesive deposits during the 1960s and 1970s as it was an economical use of waste material. The affected material is of variable thickness and is widespread over the areas of the site proposed for gardens. The measured concentrations pose a risk to human health and it is therefore recommended that the affected material is removed from these relatively small areas and replaced or covered with certified clean imported material.

If covered, a cover of imported subsoil and topsoil of 600 mm in thickness should be specified to ensure successful plant growth, in accordance with recommendations from BRE[5]. It may be possible to reduce the final thickness of cover required, but this will need to be determined once final levels have been established and the concentrations of potential contaminants within the imported material are known.

In addition the presence of cementitious asbestos roofing has been confirmed and this material requires removal. Further there remains the potential for localised zones of oil stained soils to be present arising from illegal disposal; it would be prudent to allow a contingency for localised 'dig and dump' to deal with such pockets of contamination.

### 7.8.2 Groundwater

Groundwater has not been encountered within the investigation and is considered to be protected by the thickness of essentially impermeable Glacial Till. Further the risk posed to surface waters will be eliminated if the made ground is removed from garden areas and areas of soft landscaping.

### 7.8.3 Site Workers

Concentrations of potentially carcinogenic PAH have been measured in the soils that contain ash and clinker and chrysotile asbestos has been identified within the fragments of sheeting scattered over the site. Site workers should be made aware of the contamination and a programme of working should be identified to protect workers handling any soil. This would typically avoiding skin contact with the soil and providing facilities for workers to wash prior to consuming food or smoking in clean designated areas. In addition specialist advice should be sought in respect of the removal and disposal of the asbestos-cement fragments and boards. This may typically involve the hand-picking and double bagging of fragments during an initial site walkover during the early stages of site preparation. The method of site working should be in accordance with guidelines set out by HSE[6] and CIRIA[7] and the requirements of the Local Authority Environmental Health Officer.

### 7.8.4 Services

Consideration will need to be given to the protection of buried plastic services if they are to be laid within the made ground which contains ash and clinker. Such protective measures could comprise the over digging of the service trenches and their backfilling with clean material or the adoption of barrier pipe to provide protection for potable water supplies. Details of the proposed protection measures for buried services will in any case need to be approved by the EHO and the relevant service authority prior to the adoption of any scheme.

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5 BRE (2004) *Cover systems for land regeneration. Thickness of cover systems for contaminated land.* BRE pub 465

6 HSE (1992) HS(G)66 *Protection of workers and the general public during the development of contaminated land* HMSO

7 CIRIA (1996) *A guide for safe working on contaminated sites* Report 132, Construction Industry Research and Information Association

It should be noted that it is possible that even if such ash and clinker rich material is to be removed from service trenches that barrier pipe may be required or that additional testing will need to be carried out to satisfy the Water Authority.

### 7.8.5 Invasive Species

Whilst the widespread presence of Japanese Knotweed and more localised presence of Himalayan Balsam were identified during the site investigation fieldwork, it is understood that the species have been eradicated by others and is therefore outside the scope of this report.

## 7.9 Waste Disposal

Under the European Waste Directive, waste is classified as being either Hazardous or Non-Hazardous and landfills receiving waste are classified as accepting hazardous or non-hazardous wastes or the non-hazardous sub-category of inert waste in accordance with the Waste Directive. Waste classification is a staged process and this investigation represents the preliminary sampling exercise of that process. Once the extent and location of the waste that is to be removed has been defined, further sampling and testing may be necessary. The results from this ground investigation should be used to help define the sampling plan for such further testing, which could include WAC leaching tests where the totals analysis indicates the soil to be a hazardous waste or inert waste from a contaminated site. It should however be noted that the Environment Agency guidance WM3[8] states that landfill WAC analysis, specifically leaching test results, must not be used for waste classification purposes.

Any spoil arising from excavations or landscaping works, which is not to be re-used in accordance with the CL:AIRE[9] guidance, will need to be disposed of to a licensed tip. Waste going to landfill is subject to landfill tax at either the standard rate of £82.60 per tonne (about £150 per $m^3$) or at the lower rate of £2.60 per tonne (roughly £5 per $m^3$). However, the classifications for tax purposes and disposal purposes differ and currently all made ground and topsoil is taxable at the 'standard' rate and only naturally occurring soil and stones, which are accurately described as such in terms of the 2011 Order, would qualify for the 'lower rate' of landfill tax.

Based upon on the technical guidance provided by the Environment Agency it is considered likely that the soils encountered during this ground investigation, as represented by the eight chemical analyses carried out, would be generally classified as follows;

| Soil Type | Waste Classification (Waste Code) | WAC Testing Required Prior to Landfill Disposal? | Comments |
|---|---|---|---|
| Made ground | Non-hazardous (17 05 04) | No | |
| Glacial Till | Inert (17 05 04) | Should not be required but confirm with receiving landfill | |

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process must be physical, thermal, chemical or biological, including sorting. It must change the characteristics of the waste in order to reduce its volume, hazardous nature, facilitate handling or enhance recovery. The waste producer can carry out the treatment but they will need to provide documentation to prove that this has been carried out. Alternatively, the treatment can be carried out by an approved contractor. The

8 Environment Agency 2015. *Guidance on the classification and assessment of waste.* Technical Guidance WM3 First Edition
9 CL:AIRE March 2011. *The Definition of Waste: Development Industry Code of Practice* Version 2

Environment Agency has issued a position paper[10] which states that in certain circumstances, segregation at source may be considered as pre-treatment and thus excavated material may not have to be treated prior to landfilling if the soils can be segregated onsite prior to excavation by sufficiently characterising the soils insitu prior to excavation.

The above opinion with regard to the classification of the excavated soils is provided for guidance only and should be confirmed by the receiving landfill once the soils to be discarded have been identified.
The local waste regulation department of the Environment Agency (EA) should be contacted to obtain details of tips that are licensed to accept the soil represented by the test results. The tips will be able to provide costs for disposing of this material but may require further testing.

## 8.0 OUTSTANDING RISKS AND ISSUES

This section of the report aims to highlight areas where further work is required as a result of limitations on the scope of this investigation, or where issues have been identified by this investigation that warrant further consideration. The scope of risks and issues discussed in this section is by no means exhaustive, but covers the main areas where additional work may be required.

The ground is a heterogeneous natural material and variations will inevitably be present between the locations at which it is investigated. This report has provided an assessment of the ground conditions based on the discrete points at which the ground was sampled and thus the ground conditions should be subject to review during the groundworks to ensure that any variations from the Ground Model are properly assessed by a suitably qualified person.

The site does not have a potentially contaminative history and on the basis of the investigation and the proposed development it has been assessed that the risk of significant areas of gross soil contamination being present is relatively low. As shown by the test results, there remains a potential for localised areas of contamination to be present within the fill material. If during groundworks any zones of odorous, discoloured or suspect materials are encountered it is recommended that further investigation be carried out and that the risk assessment should be reviewed.

Asbestos containing cementitious sheet fragments have been observed on site and there is thus a potential for pockets of asbestos containing material (ACM) to be present in the made ground particularly if localised disposal has been carried out. Should any suspected ACM be encountered during the works it should either be removed as an asbestos waste or covered or damped down to prevent dusting pending further analyses.

10 Environment Agency 23 Oct 2007 *Regulatory Position Statement Treating non-hazardous waste for landfill - Enforcing the new requirement*

# APPENDIX

Borehole Records

Trial Pit Records

SPT results

**Laboratory Test Results**
: Index Properties
: Particle Size Distribution Test Results
: Sulphate Analyses
: Chemical Analyses

Gas Monitoring Results

Site Specific Screening Criteria

Site Plan

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Number**<br>**BH01** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Percussive lined open-drive sampler (terrier rig) | | 75.40 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>03/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.30) | Made Ground (Cement asbestos board noted amongst rubble and rubbish at the surface beneath which was dark brown humic very sandy clay) | | |
| 0.20 | D1 | | | 75.10 | 0.30 | | | |
| 0.60 | D2 | | | | | Stiff pale brown, occasionally grey, silty sandy CLAY with scattered gravel and occasional cobbles of sandstone and limestone; gravel is fine medium and coarse, sub angular to angular; slightly desiccated to 0.5 m | | |
| 0.90 | D3 | | | | | | | |
| 1.00-1.45 | SPT(C) N=34 | | 10,8/7,8,10,9 | | | | | |
| 1.20 | D4 | | | | | | | |
| 1.50-1.95 | SPT(C) N=43 | | 5,7/8,13,11,11 | | | | | |
| 1.50 | D5 | | | | | | | |
| 2.00 | D6 | | | | | | | |
| | | | | | (4.15) | | | |
| 2.50 | D7 | | | | | | | |
| 3.00-3.45 | SPT(C) N=30 | | 3,5/7,7,8,8 | | | | | |
| 3.00 | D8 | | | | | | | |
| 3.60 | D9 | | | | | | | |
| 4.00-4.45 | SPT N=26 | | 3,5/6,5,7,8 | | | | | |
| | | | | 70.95 | 4.45 | Complete at 4.45m | | |

**Remarks**
Sample ACM1 was taken from close to Borehole No 1.
Sampling barrel refusal occurred at 1.5 m; CPT undertaken and smaller barrel used from 2.0 m to 4.0 m.
Groundwater not encountered.

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH01

| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Number**<br>**BH02** |
|---|---|---|---|
| **Excavation Method**<br>Percussive lined open-drive sampler (terrier rig) | **Dimensions** | **Ground Level (mOD)**<br>74.40 | **Client**<br>Beck Developments Limited | **Job Number**<br>J11218A |
| | **Location** | **Dates**<br>03/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.10 | D1 | | | 74.10 | (0.30)<br>0.30 | Made Ground (Black and dark brown very sandy clay with roots and rootlets) | | |
| 0.50 | D2 | | | | (0.60) | Stiff pale brown, becoming brownish grey by 1.9 m silty sandy CLAY with scattered gravel of sandstone and limestone; gravel is fine medium and coarse, sub angular to angular | | |
| 0.90<br>1.00-1.45 | D3<br>SPT N=30 | | 3,6/7,7,8,8 | 73.50 | 0.90 | Stiff grey silty sandy gravelly CLAY, gravel is fine medium and coarse, sub angular to angular of limestone and sandstone | | |
| 1.30 | D4 | | | | | | | |
| 1.70 | D5 | | | | | | | |
| 2.00-2.45 | SPT N=23 | | 2,4/6,5,6,6 | | | | | |
| 2.20 | D6 | | | | | | | |
| 2.70 | D7 | | | | | | | |
| 3.00-3.45 | SPT N=23 | | 4,4/4,6,7,6 | | (4.55) | | | |
| 3.20 | D8 | | | | | | | |
| 4.00-4.45 | SPT N=39 | | 11,7/15,8,6,10 | | | | | |
| 4.20 | D9 | | | | | | | |
| 5.00-5.45 | SPT N=46 | | 6,12/15,13,9,9 | 68.95 | 5.45 | Complete at 5.45m | | |

**Remarks**
Groundwater not encountered.
50 mm combined gas and groundwater standpipe installed to a deoth of 5.0 m with a resonse zone from 1.0 m to 5.0 m

| Scale (approx) | Logged By |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH02

GEA Geotechnical & Environmental Associates
Widbury Barn
Widbury Hill
Ware,Herts
SG12 7QE

**Site**
Mearley Croft, Clitheroe, Lancashire

**Number**
**BH03**

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Percussive lined open-drive sampler (terrier rig) | | 74.60 | Beck Developments Limited | J11218A |
| | **Location** | **Dates** 03/07/2012 | **Engineer** | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.50 | D1 | | | | | Made Ground (Brown silty sandy clay with abundant limestone gravel, scattered fragments of brick to 0.5 m, fragments of coal and ash to 1.8 m cobble jammed in the end of the sampling tube to 2.0 m) | | |
| 1.00-1.45 | SPT N=13 | | 5,3/3,3,4,3 | | (2.00) | | | |
| 1.80 | D2 | | | | | | | |
| 2.00-2.45 | SPT(C) N=25 | | 1,4/8,4,6,7 | 72.60 | 2.00 | Stiff pale brown, becoming brownish grey by 1.9 m silty sandy CLAY with scattered gravel of sandstone and limestone; gravel is fine medium and coarse, sub angular to angular | | |
| 2.30 | D3 | | | | (1.00) | | | |
| 2.80 | D4 | | | | | | | |
| 3.00-3.45 | SPT(C) N=22 | | 2,4/4,6,6,6 | 71.60 | 3.00 | Stiff grey silty sandy gravelly CLAY, gravel is fine medium and coarse, sub angular to angular of limestone and sandstone | | |
| 3.30 | D5 | | | | | | | |
| 3.80 | D6 | | | | (1.45) | | | |
| 4.00-4.45 | SPT N=24 | | 3,3/3,4,10,7 | | | | | |
| | | | | 70.15 | 4.45 | Complete at 4.45m | | |

**Remarks**
Groundwater not encountered.
Sample ACM2 was taken from close to Borehole No 3.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH03

| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Number**<br>**BH04** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Percussive lined open-drive sampler (terrier rig) | | 71.80 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>03/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.40) | Made Ground (Black and very dark brown very sandy clay with fragments of wood, brick, slate, sandstone, ash and clinker) | | |
| 0.20 | D1 | | | 71.40 | 0.40 | | | |
| 0.60 | D2 | | | | (0.50) | 'Stiff' brown and occasionally orange-brown silty sandy CLAY with scattered shell fragments | | |
| 1.00-1.45 | SPT N=1 | | 0,0/0,0,0,1 | 70.90 | 0.90 | Soft, occasionally very soft grey and black clayey sandy SILT with scattered shell fragments | | |
| | | | | | (0.80) | | | |
| 1.60 | D3 | | | 70.10 | 1.70 | Soft pale greyish brown silty very sandy CLAY with layers of clayey sand | | |
| 2.00-2.45 | SPT N=2 | | 0,0/0,0,1,1 | | | | | |
| | | | | | (1.49) | | | |
| 2.60 | D4 | | | | | | | |
| 3.00-3.19 | SPT 50/35 | | 2,5/50 | 68.61 | 3.19 | Complete at 3.19m | | |

**Remarks**
Groundwater was not encoutered within the casing on completion of the borehole but collapse had occurred in withdrawal of the casing; observation of the soils retrieved suggests groundwater ingress between 2.0 m and 3.0 m.
Sample ACM3 was taken from close to Borehole No 4.

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH04

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Borehole Number**<br>**BH05** |
|---|---|---|---|

| **Boring Method** | **Casing Diameter** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Cable percussion | 150mm cased to 9.00m | 71.70 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>13/07/2012 | **Engineer** | **Sheet**<br>1/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 71.60 | 0.10 | Made Ground (Tarmac) | | |
| 0.10 | D1 | | | | | | Made Ground (Brown and dark bown sandy very gravelly clay fragments of brick, concrete, ash and clinker) | | |
| 0.20-1.50 | B4 | | | | | | | | |
| 0.50 | D2 | | | | | | | | |
| | | | | | | | | | ▼1 |
| | | | | | | | | | ▽1 |
| 1.50 | D3 | | | Slow(1) at 1.50m, rose to 1.30m in 20 mins. | | (3.40) | | | |
| 1.50 | W21 | | | | | | | | |
| 1.50-1.95 | C5 | | | | | | | | |
| 1.50-1.54 | SPT(C) 25*/25 | | | 25/50 | | | | | |
| | 50/16 | | | | | | | | |
| 1.50-3.00 | B7 | | | | | | | | |
| 2.50-2.95 | SPT(C) N=55 | | | 7,9/10,11,15,19 | | | | | |
| 2.50-2.95 | C6 | | | | | | | | |
| | | | | | 68.20 | 3.50 | | | |
| 3.50-3.95 | SPT N=19 | | | 3,4/4,5,5,5 | | | Medium dense grey gravelly SAND | | |
| 3.50-3.95 | S8 | | | | | | | | |
| 3.50-4.50 | B9 | | | | | (1.05) | | | |
| | | | | | 67.15 | 4.55 | | | |
| 4.50-4.95 | SPT N=43 | | | 7,9/10,10,11,12 | | | Stiff dark greyish brown silty sandy CLAY with sand partings and scattered sub-angular medium gravel | | |
| 4.50-4.95 | S10 | | | | | | | | |
| 4.50-5.50 | B11 | | | | | | | | ▼2 |
| 5.50-5.95 | U12 | | | | | | | | |
| 6.00-6.45 | SPT N=76 | | | 9,14/19,19,12,26 | | | | | |
| 6.00-6.45 | S13 | | | | | | | | |
| 6.00-7.50 | B14 | | | medium(2) at 6.30m, rose to 4.95m in 20 mins. | | | | | ▽2 |
| | | | | | | (5.65) | | | |
| 7.50-7.88 | SPT 71/225 | | | 9,14/21,24,26 | | | | | |
| 7.50-7.95 | S15 | | | | | | | | |
| 7.50-9.00 | B16 | | | | | | | | |
| 9.00-9.45 | U17 | | | | | | | | |
| 9.00-10.20 | B20 | | | | | | | | |
| 9.70-9.72 | SPT 25*/20 | | | 25/50 | | | | | |
| | 50/1 | | | | | | | | |

**Remarks**
50 mm combined gas and groundwater monitoring standpipe installed to a depth of 5.0 m with a response zone from 5.0 m to 1.0 m.
Chiselling on brick and concrete from 1.5 m to 1.7 m for 30 minutes.
Excavating from 1.50m.

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH05

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Borehole Number**<br>**BH05** |
|---|---|---|---|

| **Boring Method** | **Casing Diameter** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Cable percussion | 150mm cased to 9.00m | 71.70 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>13/07/2012 | **Engineer** | **Sheet**<br>2/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| 9.70-10.00<br>10.10-10.10<br>10.10-70.75 | S18<br>SPT 25*/0<br>S19 | | | 25/50 | 61.50 | 10.20 | Complete at 10.20m | | |

**Remarks**
50 mm combined gas and groundwater monitoring standpipe installed to a depth of 5.0 m with a response zone from 5.0 m to 1.0 m.
Chiselling on brick and concrete from 1.5 m to 1.7 m for 30 minutes.

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH05

| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Borehole Number**<br>**BH06** |
|---|---|---|---|
| **Boring Method**<br>Cable percussion | **Casing Diameter**<br>150mm cased to 9.00m | **Ground Level (mOD)**<br>71.90 | **Client**<br>Beck Developments Limited | **Job Number**<br>J11218A |
| | **Location** | **Dates**<br>14/07/2012 | **Engineer** | **Sheet**<br>1/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| 0.10<br>0.20-1.50<br>0.50 | D1<br>B4<br>D2 | | | | | (1.50) | Made Ground (Black slightly gravelly sand, clayey in places and with fragments of glass, brick and pockets of clay, fragment of polystyrene at 1.5 m) | | |
| 1.50<br>1.50-1.95<br>2.00 | D3<br>U5<br>D6 | | | 6 blows | 70.40 | 1.50 | Soft brown and black very silty CLAY with pockets of organic silt | | |
| 2.50-2.95<br>3.00 | U7<br>D8 | | | 4 blows | | (2.90) | | | ▼1 |
| 3.50-3.95<br>3.50<br>3.50-3.95<br>3.50-4.00 | SPT N=0<br>W1<br>S9<br>B10 | | | 1,0/0,0,0,0<br>Water strike(1) at 3.56m, rose to 3.15m in 20 mins. | | | | | ▽1 |
| 4.50-4.95<br>4.50-4.95<br>4.50-5.10 | SPT(C) N=29<br>C11<br>B12 | | | 3,4/6,15,4,4 | 67.50 | 4.40 | Stiff dark greyish brown silty sandy CLAY with sand partings and abundant sub-angular medium gravel and occasional cobbles<br><br>Cobble obstruction encountered | | |
| 5.40-5.49<br>5.40 | SPT(C) 13*/75<br>50/15<br>C13 | | | 13/50 | | | | | |
| 6.50-6.95<br>6.50-6.95<br>6.50-7.00 | SPT N=35<br>S14<br>B15 | | | 5,7/7,8,8,12 | | | | | |
| 7.50<br>8.00 | D16<br>U18 | | | | | (6.40) | | | |
| 8.50-8.95<br>8.50-8.95<br>8.50-10.00 | SPT N=43<br>S19<br>B20 | | | 4,8/10,10,11,12 | | | | | |
| 10.00-10.27 | SPT 50/115 | | | 4,8/12,38 | | | | | |

**Remarks**
Soft site surface required the rig to be winched into position taking 45 minutes and off the position on completion taking 1 hour. Services inspection pit excavated to a depth of 1.2 m. Chiselling from 10.7 m to 10.8 m for 1 hour.
50 mm combined gas and groundwater standpipe installed to a depth of 4.0 m with a response zone from 1.0 m to 4.0 m.
Excavating from 1.50m.

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH06

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Borehole Number**<br>**BH06** |
|---|---|---|---|

| **Boring Method** | **Casing Diameter** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Cable percussion | 150mm cased to 9.00m | 71.90 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>14/07/2012 | **Engineer** | **Sheet**<br>2/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| 10.00<br>10.00-10.80 | S21<br>B22 | | | | 61.10 | 10.80 | Complete at 10.80m | | |

**Remarks**

| **Scale (approx)** | **Logged By** |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH06

| | | | |
|---|---|---|---|
| GEA Geotechnical & Environmental Associates<br>Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | | **Borehole Number**<br>**BH07** |
| **Boring Method**<br>Cable percussion | **Casing Diameter**<br>150mm cased to 9.00m | **Ground Level (mOD)**<br>70.50 | **Client**<br>Beck Developments Limited | **Job Number**<br>J11218A |
| | **Location** | **Dates**<br>13/07/2012-<br>14/07/2012 | **Engineer** | **Sheet**<br>1/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| 0.10<br>0.20-1.50<br>0.50 | D1<br>B4<br>D2 | | | | | (1.00) | Made Ground (Soft silty clay with occasional brick fragments, limestone gravel and pockets of slightly peaty clay) | | |
| | | | | | 69.50 | 1.00 | Soft brown and black very silty CLAY with pockets of grey organic silt | | |
| 1.50<br>1.50-1.95 | D3<br>U5 | | | | | | | | |
| 2.00 | D6 | | | | | | | | ▼1 |
| 2.30 | W1 | | | Water strike(1) at 2.30m, rose to 2.15m in 20 mins. | | | | | ▽1 |
| 2.50<br>2.50-2.95<br>2.50-3.45 | S7<br>SPT N=0<br>B9 | | | 0,0/0,0,0,0 | | (3.40) | | | |
| 3.50 | U8 | | | | | | | | ▼2 |
| | | | | Water strike(2) at 4.30m, rose to 3.17m in 20 mins. | | | | | ▽2 |
| | | | | | 66.10 | 4.40 | | | |
| 4.50-4.95<br>4.50-4.95<br>4.50-5.50 | C10<br>SPT(C) N=38<br>B11 | | | 4,9/10,10,11,7 | | | Dense silty sandy GRAVEL with occasional cobbles, gravel is sub-angular | | |
| | | | | | | (1.10) | | | |
| | | | | | 65.00 | 5.50 | | | |
| 5.50-5.95<br>5.50-6.00 | U12<br>B13 | | | | | | Stiff dark greyish brown silty sandy CLAY with sand partings and abundant sub-angular medium gravel and occasional cobbles | | |
| 6.00-6.45<br>6.00-7.50 | S14<br>B15 | | | | | | | | |
| 6.45-6.90 | SPT N=35 | | | 4,7/8,8,9,10 | | | | | |
| 7.50<br>7.50-9.00 | U16<br>B19 | | | | | | | | |
| 8.00-8.27<br>8.00-8.40 | SPT 50/117<br>S18 | | | 9,13/17,33 | | (5.00) | | | |
| 9.50-9.53<br>9.50<br>9.50-10.50 | SPT(C) 25*/25<br>C20<br>B22 | | | 25/50 | | | | | |

**Remarks**
Soft site surface required the rig to be winched off the position on completion taking 30 minutes. Services inspection pit excavated to a depth of 1.2 m. Chiselling from 10.3 m to 10.5 m for 30 minutes.
50 mm combined gas and groundwater standpipe installed to a depth of 4.0 m with a response zone from 1.0 m to 4.0 m.
Excavating from 1.50m.

| Scale (approx) | Logged By |
|---|---|
| 1:50 | MC |

**Figure No.**
J11218A.BH07

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Borehole Number**<br>**BH07** |
|---|---|---|---|

| **Boring Method** | **Casing Diameter** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| Cable percussion | 150mm cased to 9.00m | 70.50 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>13/07/2012-<br>14/07/2012 | **Engineer** | **Sheet**<br>2/2 |

| Depth (m) | Sample / Tests | Casing Depth (m) | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|---|
| 10.30-10.30<br>10.30 | SPT(C) 25*/0<br>C21 | | | 25/50 | 60.00 | 10.50 | Complete at 10.50m | | |

| **Remarks** | **Scale (approx)** | **Logged By** |
|---|---|---|
| | 1:50 | MC |
| | **Figure No.** | J11218A.BH07 |

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP01** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 73.60 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.50 | D1 | | | | (1.80) | Made Ground (Brown and dark brown, occasionally black sandy clay with scattered fragments of brick, tile, glass, plastic, concrete; rare fragments of wood and tarmac) | | |
| 0.90 | D2 | | | | | | | |
| 2.00 | D3 | | | 71.80 | 1.80 | Firm greyish brown silty sandy CLAY, slightly friable with shell fragments | | |
| | | | | | (0.90) | | | |
| | | | | 70.90 | 2.70 | Complete at 2.70m | | |

**Plan**

**Remarks**

Groundwater not encountered

| **Scale (approx)** | **Logged By** | **Figure No.** |
|---|---|---|
| 1:50 | MC | J11218A.TP01 |

| | | | |
|---|---|---|---|
| GEA Geotechnical & Environmental Associates<br>Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | | **Trial Pit Number**<br>**TP02** |
| **Excavation Method**<br>3 t Mini Excavator | **Dimensions**<br>2.5 m x 0.45 m | **Ground Level (mOD)**<br>75.20 | **Client**<br>Beck Developments Limited | **Job Number**<br>J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.40 | D1 | | | | (0.80) | Made Ground (Black and dark brown very sandy clay with scattered fragments of sandstone up to cobble size, fragments of brick, roof slate, ash and clinker along with roots to 75 mm diameter) | | |
| 1.00 | D2 | | | 74.40 | 0.80 | 'Stiff' pale brown very sandy CLAY with scattered gravel and rare sandstone cobbles (evidence of desiccation observed but becoming less so by 1.9 m) | | |
| 1.40 | D3 | | | | (1.40) | | | |
| 1.80 | D4 | | | | | | | |
| 2.10 | D5 | | | 73.00 | 2.20 | Complete at 2.20m | | |

**Plan**

**Remarks**

Groundwater not encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP02 |

GEA Geotechnical & Environmental Associates

Widbury Barn
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SG12 7QE

| Site | Trial Pit Number |
|---|---|
| Mearley Croft, Clitheroe, Lancashire | TP03 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 72.50 | Beck Developments Limited | J11218A |
| | **Location** | **Dates** 02/07/2012 | **Engineer** | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | | (0.70) | Made Ground (Black and dark brown friable very sandy clay with abundant roots, rare bricks, ash, clinker, pottery, glass and slate) | | |
| 0.50 | D1 | | | 71.80 | 0.70 | | | |
| 1.00 | D2 | | | | (1.10) | 'Stiff' pale brown and occasionally orange-brown very sandy CLAY (evidence of desiccation observed); sandstone boulder at 1.1 m and became very gravelly and cobbley at 1.5 m | | |
| 1.30 | D3 | | | | | | | |
| 1.60 | D4 | | | 70.70 | 1.80 | Complete at 1.80m | | |

**Plan**

**Remarks**

Groundwater not encountered.
Difficulty in ecavation beyond 1.8 m due to cobbles.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP03 |

GEA Geotechnical & Environmental Associates

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Widbury Hill
Ware,Herts
SG12 7QE

| Site | Trial Pit Number |
|---|---|
| Mearley Croft, Clitheroe, Lancashire | TP04 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.0 m x 0.45 . | 70.00 | Beck Developments Limited | J11218A |
| | **Location** | **Dates** 02/07/2012 | **Engineer** | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | D1 | | Fast(1) at 1.20m. | 69.00 | (1.00) 1.00 | Made Ground (Very dark grey humic sandy clay with roots and rootlets to 0.7 m) | | |
| | | | | 68.60 | (0.40) 1.40 | Soft black silty SAND interbedded with brown sandy clay | | ▽1 |
| | | | | 67.70 | (0.90) 2.30 | Soft black organic clayey sandy SILT with occasional layers of brown sand | | |
| | | | | | | Complete at 2.30m | | |

**Plan**

**Remarks**

Fast groundwater ingress at 1.2 m.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP04 |

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP05** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 70.50 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.05 | D1 | | | 70.40 | 0.10 | Made Ground (Black and dark brown very clayey sand with fragments of wire, wood and fragments of cement asbestos sheeting) | | |
| 0.50 | D2 | | | | (1.00) | Soft very dark brown and black silty CLAY with scattered shell fragments, roots and layers or pockets of brown silty sandy clay | | |
| | | | Seepage(1) at 1.20m. | 69.40 | 1.10 | Soft dark grey organic SILT with layers and pockets of grey claye silt and pale brown fine silty sand | | ▽1 |
| | | | | | (1.80) | | | |
| | | | Medium(2) at 2.90m. | 67.60 | 2.90 | Complete at 2.90m | | ▽2 |

**Plan**

**Remarks**

Groundwater encountered as a seepage at 1.2 m and as a medium inflow at 2.9 m.

| **Scale (approx)** | **Logged By** | **Figure No.** |
|---|---|---|
| 1:50 | MC | J11218A.TP05 |

| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP06** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 72.00 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.30 | D1 | | | | (0.50) | Made Ground (Dark brown humic sandy clay with scattered roots, gravel and rare fragments of brick and glass) | | |
| | | | | 71.50 | 0.50 | | | |
| 0.70 | D2 | | | | (0.40) | Soft pale brown very sandy CLAY with scattered shell fragments and pockets of orange-brown sand | | |
| | | | | 71.10 | 0.90 | Grey and greyish brown very clayey SAND, layers of black organic silt between 1.1 m and 1.5 m | | |
| | | | Medium(1) at 1.50m. | | (1.40) | | | ▽1 |
| | | | | 69.70 | 2.30 | Complete at 2.90m | | |

**Plan**

**Remarks**

Groundwater ingress at 1.5 m; side collapse observed below 1.5 m; pit terminated at 2.3 m due to the collapse.

| **Scale (approx)** | **Logged By** | **Figure No.** |
|---|---|---|
| 1:50 | MC | J11218A.TP06 |

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Widbury Barn
Widbury Hill
Ware,Herts
SG12 7QE

| Site | Trial Pit Number |
|---|---|
| Mearley Croft, Clitheroe, Lancashire | TP07 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 72.30 | Beck Developments Limited | J11218A |
| | **Location** | **Dates** 02/07/2012 | **Engineer** | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| | | | | 72.20 | 0.10 | Made Ground (Black and dark brown very clayey sand with fragments of wood) | | |
| 0.30 | D1 | | | | | Soft black and dark brown very sandy CLAY with scattered shell fragments, rootlets and pockets of orange-brown sand | | |
| | | | | | (1.30) | | | |
| 1.00 | D2 | | | | | | | ▽1 |
| | | | Fast but brief(1) at 1.20m. | 70.90 | 1.40 | Soft bluish grey and black clayey sandy SILT with pockets of pale brown sand, shells and shell fragments and pockets of grey sandy clay | | |
| | | | | | (0.90) | | | |
| | | | seepage(2) at 2.30m. | 70.00 | 2.30 | Complete at 2.30m | | ▽2 |

**Plan**

**Remarks**

Pit sides stable during excavation.
Fast but brief ingress of groundwater at a depth of 1.2 m, further seepages at 2.3 m.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP07 |

| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP08** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 71.40 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.30 | D1 | | | | (0.50) | Made Ground (Surface of cobbles and boulders of brick and sandstone; black and dark brown clayey sand with pockets of brick, plastic, roots, rootlets, ash and clinker, part of a paint brush; slight hydrocarbon odour at 0.3 m) | | |
| 0.80 | D2 | | | 70.90 | 0.50 | Soft becoming firm dark orange-brown and dark grey mottled very sandy CLAY, roots present to a depth of 0.8 m | | |
| | | | | | (0.90) | | | |
| | | | | 70.00 | 1.40 | Soft bluish grey and black clayey sandy SILT with pockets of pale brown sand, shells and shell fragments and pockets of grey sandy clay | | |
| | | | | | (1.00) | | | |
| | | | | 69.00 | 2.40 | Complete at 2.40m | | |

**Plan**

**Remarks**

Groundwater not encountered.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP08 |

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP09** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.0 m x 0.45 m | 71.70 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.20 | D1 | | | | (0.40) | Made Ground (Black and dark brown friable sandy clay with abundant fragments of ash and clinker, pockets of pale brown sand, bricks and fragments of brick, tile and slate) | | |
| | | | | 71.30 | 0.40 | | | |
| 0.90 | D2 | | | | (1.10) | Firm becoming stiff by 0.8 m dark greyish brown and occasionally dark orange-brown mottled very sandy CLAY with rare shell fragments | | ▽1 |
| | | | seepages(1) at 1.20m. | | | | | |
| | | | | 70.20 | 1.50 | Greenish brown clayey SAND | | |
| | | | | | (0.50) | | | |
| | | | | 69.70 | 2.00 | | | |
| | | | | | | Complete at 2.30m | | |

**Plan**

**Remarks**

Pit sides collapsed below 1.5 m; excavation terminated at 2.0 m. Groundwater encountered at 1.2 m as three ingresses.

| **Scale (approx)** | **Logged By** | **Figure No.** |
|---|---|---|
| 1:50 | MC | J11218A.TP09 |

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP10** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.0 m x 0.45 m | 71.30 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.60 | D1 | | | | (1.60) | Made Ground (Black and dark brown very silty clay with abundant fragments of ash, brick, concrete and occasionally tile) | | ▽1 ▽2 |
| | | | Medium seepage(1) at 1.40m.<br>Medium (2) at 1.60m. | 69.70 | 1.60 | | | |
| 1.80 | D2 | | | | (1.00) | Soft black and bluish grey clayey sandy organic SILT with scattered shell fragments | | ▽3 |
| | | | Fast(3) at 2.50m. | 68.70 | 2.60 | | | |
| | | | | | | Complete at 2.60m | | |

**Plan**

**Remarks**

Pits remained stable for the period that the pit was left open; 2 hours. Groundwater encountered as madium seepage at 1.4 m and 1.6 m and as a fast inflow at 2.5 m.

| **Scale (approx)** | **Logged By** | **Figure No.** |
|---|---|---|
| 1:50 | MC | J11218A.TP10 |

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SG12 7QE

| Site | Trial Pit Number |
|---|---|
| Mearley Croft, Clitheroe, Lancashire | TP11 |

| Excavation Method | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.5 m x 0.45 m | 71.20 | Beck Developments Limited | J11218A |
| | **Location** | **Dates** 02/07/2012 | **Engineer** | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.40 | D1 | | | | (1.00) | Made Ground (Black sandy clay with scattered fragments of glass, plastic, wire, wood, roots, rootlets and plastic coated wire) | | |
| 1.10 | D2 | | | 70.20 | 1.00 | | | |
| 1.40 | D3 | | | | (0.80) | Firm becoming soft by 1.3 m greyish brown and occasionally orange-brown mottled very sandy CLAY | | |
| | | | Seepage(1) at 1.80m. | 69.40 | 1.80 | | | ▽1 |
| | | | | | (0.40) | Greenish grey clayey silty SAND | | |
| | | | | 69.00 | 2.20 | | | |
| | | | | | | Complete at 2.20m | | |

**Plan**

**Remarks**

Groundwater encountered as a seepage at 1.8 m.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP11 |

| Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware,Herts<br>SG12 7QE | **Site**<br>Mearley Croft, Clitheroe, Lancashire | **Trial Pit Number**<br>**TP12** |
|---|---|---|---|

| **Excavation Method** | **Dimensions** | **Ground Level (mOD)** | **Client** | **Job Number** |
|---|---|---|---|---|
| 3 t Mini Excavator | 2.0 m x 0.45 m | 72.00 | Beck Developments Limited | J11218A |
| | **Location** | **Dates**<br>02/07/2012 | **Engineer** | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.10 | D1 | | | 71.85 | (0.15) 0.15 | Made Ground (Black peaty sandy clay with fragments of brick, ash and plastic) | | |
| | | | | | (0.30) | | | |
| | | | | 71.55 | 0.45 | Made Ground (Black and brown clayey sand with brick fragments) | | |
| 0.70 | D2 | | | | (0.75) | Firm pale brown sandy CLAY | | |
| 1.00 | D3 | | seepage(1) at 1.10m. | 70.80 | 1.20 | Black and bluish grey organic clayey SAND with shell fragments | | ▽1 |
| | | | | | (0.70) | | | |
| | | | | 70.10 | 1.90 | | | |
| | | | | | (0.20) | Firm greyish brown silty sandy CLAY with shell fragments | | |
| | | | | 69.90 | 2.10 | Complete at 2.10m | | |

**Plan**

**Remarks**

Groundwater encountered as a seepage at 1.1 m.

| Scale (approx) | Logged By | Figure No. |
|---|---|---|
| 1:50 | MC | J11218A.TP12 |

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Widbury Barn
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Ware,Herts
SG12 7QE

# Standard Penetration Test Results

**Site** : Mearley Croft, Clitheroe, Lancashire

**Client** : Beck Developments Limited

**Engineer** :

**Job Number** J11218A

**Sheet** 1 / 1

| Borehole Number | Base of Borehole (m) | End of Seating Drive (m) | End of Test Drive (m) | Test Type | Seating Blows per 75mm | | Blows for each 75mm penetration | | | | Result | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1 | 2 | 1 | 2 | 3 | 4 | | |
| BH01 | 1.00 | 1.15 | 1.45 | CPT | 10 | 8 | 7 | 8 | 10 | 9 | N=34 | |
| BH01 | 1.50 | 1.65 | 1.95 | CPT | 5 | 7 | 8 | 13 | 11 | 11 | N=43 | |
| BH01 | 3.00 | 3.15 | 3.45 | CPT | 3 | 5 | 7 | 7 | 8 | 8 | N=30 | |
| BH01 | 4.00 | 4.15 | 4.45 | SPT | 3 | 5 | 6 | 5 | 7 | 8 | N=26 | |
| BH02 | 1.00 | 1.15 | 1.45 | SPT | 3 | 6 | 7 | 7 | 8 | 8 | N=30 | |
| BH02 | 2.00 | 2.15 | 2.45 | SPT | 2 | 4 | 6 | 5 | 6 | 6 | N=23 | |
| BH02 | 3.00 | 3.15 | 3.45 | SPT | 4 | 4 | 4 | 6 | 7 | 6 | N=23 | |
| BH02 | 4.00 | 4.15 | 4.45 | SPT | 11 | 7 | 15 | 8 | 6 | 10 | N=39 | Gravel in STL Split spoon |
| BH02 | 5.00 | 5.15 | 5.45 | SPT | 6 | 12 | 15 | 13 | 9 | 9 | N=46 | |
| BH03 | 1.00 | 1.15 | 1.45 | SPT | 5 | 3 | 3 | 3 | 4 | 3 | N=13 | |
| BH03 | 2.00 | 2.15 | 2.45 | CPT | 1 | 4 | 8 | 4 | 6 | 7 | N=25 | |
| BH03 | 3.00 | 3.15 | 3.45 | CPT | 2 | 4 | 4 | 6 | 6 | 6 | N=22 | |
| BH03 | 4.00 | 4.15 | 4.45 | SPT | 3 | 3 | 3 | 4 | 10 | 7 | N=24 | |
| BH04 | 1.00 | 1.15 | 1.45 | SPT | 0 | 0 | 0 | 0 | 0 | 1 | N=1 | |
| BH04 | 2.00 | 2.15 | 2.45 | SPT | 0 | 0 | 0 | 0 | 1 | 1 | N=2 | |
| BH04 | 3.00 | 3.15 | 3.19 | SPT | 2 | 5 | 50 | | | | 50/35mm | |
| BH05 | 1.50 | 1.53 | 1.54 | CPT | 25 | | 50 | | | | 25*/25mm | |
| BH05 | 2.50 | 2.65 | 2.95 | CPT | 7 | 9 | 10 | 11 | 15 | 19 | 50/16mm N=55 | |
| BH05 | 3.50 | 3.65 | 3.95 | SPT | 3 | 4 | 4 | 5 | 5 | 5 | N=19 | |
| BH05 | 4.50 | 4.65 | 4.95 | SPT | 7 | 9 | 10 | 10 | 11 | 12 | N=43 | |
| BH05 | 6.00 | 6.15 | 6.45 | SPT | 9 | 14 | 19 | 19 | 12 | 26 | N=76 | |
| BH05 | 7.50 | 7.65 | 7.88 | SPT | 9 | 14 | 21 | 24 | 26 | | 71/225mm | |
| BH05 | 9.70 | 9.72 | 9.72 | SPT | 25 | | 50 | | | | 25*/20mm | |
| BH05 | 10.10 | 10.10 | 10.10 | SPT | 25 | | 50 | | | | 50/1mm 25*/0mm | |
| BH06 | 3.50 | 3.65 | 3.95 | SPT | 1 | 0 | 0 | 0 | 0 | 0 | N=0 | |
| BH06 | 4.50 | 4.65 | 4.95 | CPT | 3 | 4 | 6 | 15 | 4 | 4 | N=29 | |
| BH06 | 5.40 | 5.48 | 5.49 | CPT | 13 | | 50 | | | | 13*/75mm | Pushing cobble down the borehole |
| BH06 | 6.50 | 6.65 | 6.95 | SPT | 5 | 7 | 7 | 8 | 8 | 12 | 50/15mm N=35 | |
| BH06 | 8.50 | 8.65 | 8.95 | SPT | 4 | 8 | 10 | 10 | 11 | 12 | N=43 | |
| BH06 | 10.00 | 10.15 | 10.27 | SPT | 4 | 8 | 12 | 38 | | | 50/115mm | |
| BH07 | 2.50 | 2.65 | 2.95 | SPT | 0 | 0 | 0 | 0 | 0 | 0 | N=0 | |
| BH07 | 4.50 | 4.65 | 4.95 | CPT | 4 | 9 | 10 | 10 | 11 | 7 | N=38 | |
| BH07 | 6.45 | 6.60 | 6.90 | SPT | 4 | 7 | 8 | 8 | 9 | 10 | N=35 | |
| BH07 | 8.00 | 8.15 | 8.27 | SPT | 9 | 13 | 17 | 33 | | | 50/117mm | |
| BH07 | 9.50 | 9.53 | 9.53 | CPT | 25 | | 50 | | | | 25*/25mm | |
| BH07 | 10.30 | 10.30 | 10.30 | CPT | 25 | | 50 | | | | 25*/0mm | |

| | | | | | |
|---|---|---|---|---|---|
| **Project Name:** | Mearley Croft, Clitheroe, Lancashire | | | **Samples Received:** | 19/07/2012 |
| | | | | **Project Started:** | 01/08/2012 |
| **Client:** | GEA | | | **Testing Started:** | 06/08/2012 |
| **Project No:** | J11218A | **Our job/report no:** | 13119 | **Date Reported:** | 13/08/2012 |

**K4 SOILS**

| Borehole No: | Sample No: | Depth (m) | Description | Moisture content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Passing 0.425 mm (%) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| BH01 | D3 | 0.90 | Greyish brown slightly gravelly CLAY with occasional roots and rootlets (gravel is fm and angular to sub-angular) | 18 | | | | | |
| BH01 | D4 | 1.20 | Greyish brown slightly silty gravelly CLAY (gravel is fm and angular to sub-angular) | 12 | | | | | |
| BH01 | D5 | 1.50 | Brownish grey gravelly CLAY (gravel is fm and angular to sub-rounded) | 11 | 26 | 13 | 13 | 60 | |
| BH01 | D6 | 2.00 | Grey silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 12 | | | | | |
| BH01 | D7 | 2.50 | Grey silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 11 | | | | | |
| BH01 | D8 | 3.00 | Grey gravelly CLAY with traces of rootlets (gravel is fmc and angular to sub-angular) | 10 | 25 | 12 | 13 | 58 | |
| BH01 | D9 | 3.60 | Grey gravelly CLAY (gravel is fmc and angular to sub-angular) | 9.5 | | | | | |
| BH02 | D2 | 0.50 | Greyish brown gravelly CLAY with occasional roots (gravel is fmc and angular to sub-angular) | 32 | 52 | 26 | 26 | 59 | |
| BH02 | D3 | 0.90 | Greyish brown silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 20 | | | | | |
| BH02 | D4 | 1.30 | Greyish brown silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 12 | | | | | |
| BH02 | D5 | 1.70 | Greyish brown silty gravelly CLAY (gravel is fmc and angular to sub-angular) | 13 | 29 | 15 | 14 | 61 | |
| BH02 | D6 | 2.20 | Grey slightly silty gravelly CLAY (gravel is fm and angular to sub-angular) | 14 | | | | | |
| BH02 | D7 | 2.70 | Grey gravelly CLAY (gravel is fmc and angular to sub-angular) | 9.6 | | | | | |
| BH02 | D8 | 3.20 | Grey silty gravelly CLAY (gravel is fmc and angular to sub-angular) | 10 | 25 | 12 | 13 | 63 | |
| BH02 | D9 | 4.20 | Grey gravelly CLAY (gravel is fmc and angular to sub-angular) | 8.5 | | | | | |
| BH03 | D3 | 2.30 | Greyish brown slightly gravelly CLAY (gravel is fmc and angular to sub-rounded) | 14 | 51 | 24 | 27 | 69 | |
| BH03 | D4 | 2.80 | Grey gravelly CLAY (gravel is fmc and angular to sub-angular) | 10 | | | | | |
| BH06 | D6 | 2.00 | Dark grey slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 50 | 56 | 31 | 25 | 95 | |
| BH06 | B15 | 6.50 | Grey slightly gravelly CLAY (gravel is fmc and sub-angular to angular) | 19 | 29 | 14 | 15 | 93 | |

UKAS TESTING 2519

## Summary of Test Results

BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.

BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.

BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

**Checked and Approved**

Initials: K.P

Date: 13/08/2012

| | | | |
|---|---|---|---|
| **Project Name:** | Mearley Croft, Clitheroe, Lancashire | **Samples Received:** | 19/07/2012 |
| | | **Project Started:** | 01/08/2012 |
| **Client:** | GEA | **Testing Started:** | 06/08/2012 |
| **Project No:** | J11218A **Our job/report no:** 13119 | **Date Reported:** | 13/08/2012 |

**K4 SOILS**

| Borehole No: | Sample No: | Depth (m) | Description | Moisture content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | Passing 0.425 mm (%) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| BH07 | U5 | 1.50 | Dark grey silty/sandy CLAY | 81 | 91 | 51 | 40 | 100 | |
| TP3 | D3 | 1.00 | Greyish brown silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 17 | 30 | 17 | 13 | 75 | |
| TP5 | D2 | 0.50 | Dark grey slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 60 | 64 | 38 | 26 | 90 | |
| TP8 | D2 | 0.80 | Dark grey slightly peaty slightly gravelly CLAY with occasional shell fragments (gravel is fine) | 51 | 65 | 37 | 28 | 97 | |
| TP10 | D2 | 1.80 | Dark grey clayey PEAT with shell fragments | 81 | 97 | 51 | 46 | 100 | |
| TP11 | D2 | 1.10 | Grey CLAY | 41 | 54 | 27 | 27 | 100 | |

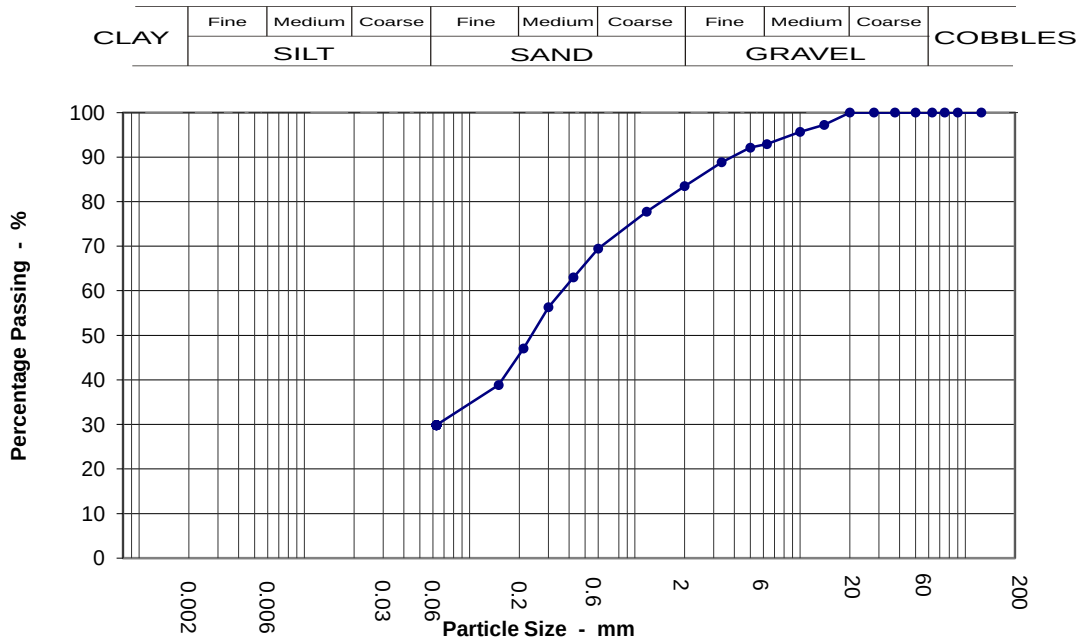
UKAS TESTING 2519

## Summary of Test Results

BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method.
BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index.
BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.

**Checked and Approved**
Initials: K.P
Date: 13/08/2012

| K4 SOILS | PARTICLE SIZE DISTRIBUTION<br>BS 1377 : Part 2 : 1990 : Clause 9 | Our Report No: | 13119 |
|---|---|---|---|
| | | Project No: | J11218A |
| Location | Mearley Croft, Clitheroe, Lancashire | Borehole / Trial Pit No: | BH05 |
| | | Depth | 3.50 m |
| Visual Soil Description | Dark grey slightly gravelly sandy CLAY (gravel is fm and sub-angular to sub-rounded) | Sample Type/No | B - 9 |




| Sieving | | Sedimentation | |
|---|---|---|---|
| Particle Size mm | % Passing | Particle Size mm | % Passing |
| 125 | 100 | | |
| 90 | 100 | | |
| 75 | 100 | | |
| 63 | 100 | | |
| 50 | 100 | | |
| 37.5 | 100 | | |
| 28 | 100 | | |
| 20 | 100 | | |
| 14 | 97 | | |
| 10 | 96 | | |
| 6.3 | 93 | | |
| 5 | 92 | | |
| 3.35 | 89 | | |
| 2 | 83 | | |
| 1.18 | 78 | | |
| 0.6 | 69 | | |
| 0.425 | 63 | | |
| 0.3 | 56 | | |
| 0.212 | 47 | | |
| 0.15 | 39 | | |
| 0.063 | 30 | | |

| Test Method | |
|---|---|
| BS 1377 : Part 2 : 1990 | |
| Sieving | Clause |
| Sedimentation | N/A |
| Suitable Amount Of Sample Received | Yes |

| Sample Proportions | |
|---|---|
| Cobbles | 0.0 |
| Gravel | 16.5 |
| Sand | 53.6 |
| Silt & Clay | 29.8 |
| | |

| Grading Analysis | |
|---|---|
| D100 | 125.0 |
| D60 | 0.4 |
| D10 | |
| Uniformity Coefficient | N/A |

**K4 SOILS LABORATORY**
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU.
E-mail: k4soils@aol.com

**Approved Signatories:**
K.Phaure(Tech.Mgr) J.Phaure(Lab.Mgr)

Test results relate only to the sample numbers shown above

**Checked and Approved**
Initials: kp
Date: 13/08/2012

UKAS TESTING

| | | | |
|---|---|---|---|
| **Client name & address:** | | **Samples Received** | 19/07/2012 |
| GEA | | **Project Started** | 01/08/2012 |
| **Project Name:** | Mearley Croft, Clitheroe, Lancashire | **Testing Started** | 02/08/2012 |
| **Project No:** | J11218A **Our Job / report no:** 13119 | **Date Reported:** | 13/08/2012 |
| **Sample description:** | | **Sample no/ type:** | U |
| Dark grey slightly gravelly silty sandy CLAY (gravel is fmc and angular to sub-angular) | | | |

**K4 SOILS**

**BH no:** BH06

**Depth (m):** 1.50

## Test details

Depth within original sample m : 1.60 Orientation within original sample : Vertical

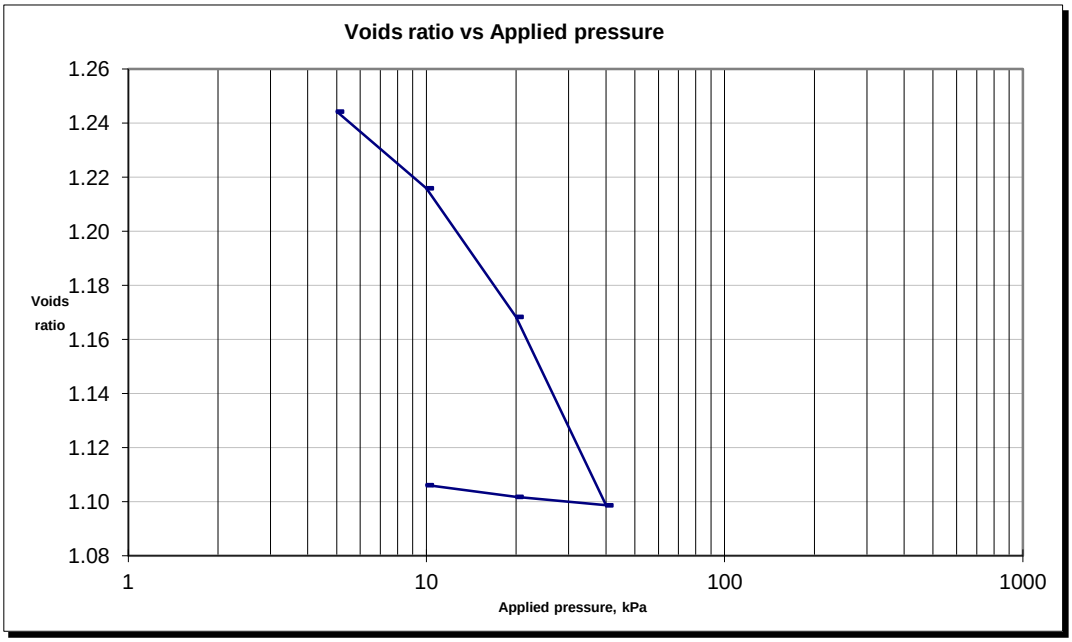
Lab Vane 11kpa

## Specimen details

| | | Initial | Final |
|---|---|---|---|
| Height | mm : | 19 | 17.6 |
| Diameter | mm : | 75 | - |
| Bulk density | Mg/m3 : | 1.70 | 1.76 |
| Moisture content | % : | 45 | 38 |
| Dry density | Mg/m3 : | 1.17 | 1.27 |
| Voids Ratio | : | 1.28 | 1.11 |
| Degree of saturation | % : | 93.6 | - |
| Particle density | Mg/m3 : | 2.68 | - |
| Swelling pressure | kPa : | 0 | - |

## Consolidation Stage

| Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN | Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5 | 1.2442 | 0.62 | 3.368 | 11 | | | | |
| 2 | 10 | 1.2159 | 0.40 | 2.527 | 12 | | | | |
| 3 | 20 | 1.1683 | 0.44 | 2.147 | 13 | | | | |
| 4 | 40 | 1.0986 | 0.41 | 1.607 | 14 | | | | |
| 5 | 20 | 1.1017 | 0.60 | 0.074 | 15 | | | | |
| 6 | 10 | 1.1061 | 0.66 | 0.206 | 16 | | | | |
| 7 | | | | | 17 | | | | |
| 8 | | | | | 18 | | | | |
| 9 | | | | | 19 | | | | |
| 10 | | | | | 20 | | | | |




# One-Dimensional Consolidation Test

BS 1377 : Part 5 : Clause 3 & 4 : 1990

Determination of the one-dimensional consolidation properties

UKAS TESTING 2519

**Approved by**

Initials : kp

Date : 13/08/2012

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford WD18 9RU

| | | | |
|---|---|---|---|
| **Client name & address:** | **Samples Received** | 19/07/2012 | **K4 SOILS** |
| GEA | **Project Started** | 01/08/2012 | |
| **Project Name:** Mearley Croft, Clitheroe, Lancashire | **Testing Started** | 02/08/2012 | |
| **Project No:** J11218A **Our Job / report no:** 13119 | **Date Reported:** | 13/08/2012 | |
| **Sample description:** | **Sample no/ type:** | U | **BH no:** BH06 |
| Dark grey silty fine sandy CLAY with rare gravel and traces of glass (gravel is fine) | | | **Depth (m):** 2.50 |

## Test details

Depth within original sample m : 2.60 Orientation within original sample : Vertical

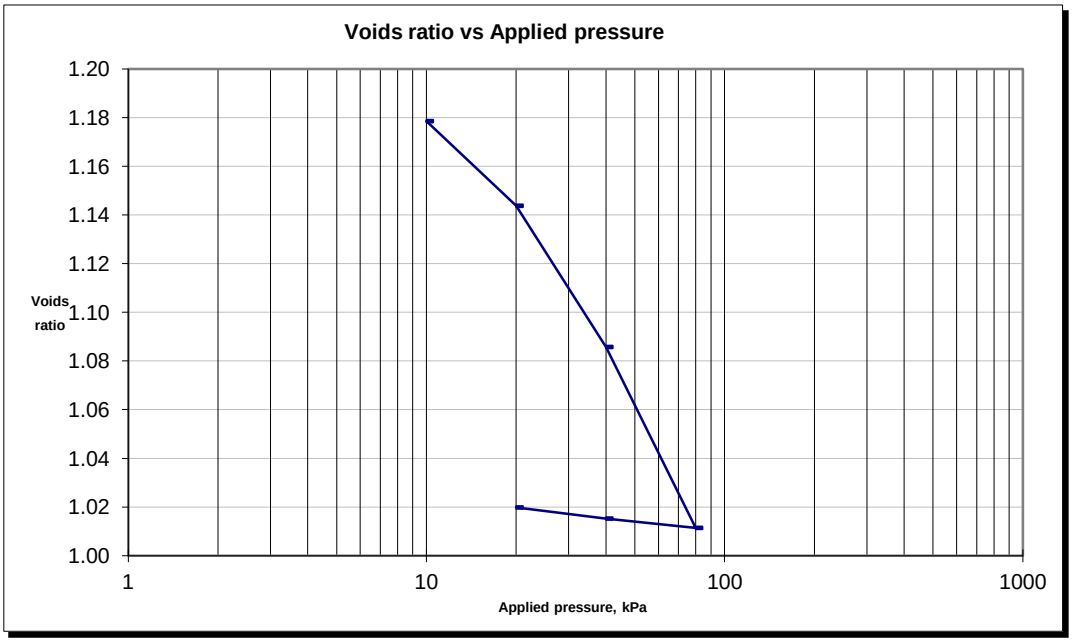
Lab Vane 12kpa

## Specimen details

| | | Initial | Final |
|---|---|---|---|
| Height | mm : | 19 | 16.8 |
| Diameter | mm : | 75 | - |
| Bulk density | Mg/m3 : | 1.77 | 1.85 |
| Moisture content | % : | 47 | 36 |
| Dry density | Mg/m3 : | 1.20 | 1.36 |
| Voids Ratio | : | 1.28 | 1.02 |
| Degree of saturation | % : | 100.6 | - |
| Particle density | Mg/m3 : | 2.74 | - |
| Swelling pressure | kPa : | 0 | - |

## Consolidation Stage

| Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN | Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | 1.1786 | 0.68 | 4.368 | 11 | | | | |
| 2 | 20 | 1.1438 | 0.23 | 1.596 | 12 | | | | |
| 3 | 40 | 1.0858 | 0.39 | 1.353 | 13 | | | | |
| 4 | 80 | 1.0114 | 0.46 | 0.891 | 14 | | | | |
| 5 | 40 | 1.0153 | 0.06 | 0.048 | 15 | | | | |
| 6 | 20 | 1.0198 | 0.61 | 0.113 | 16 | | | | |
| 7 | | | | | 17 | | | | |
| 8 | | | | | 18 | | | | |
| 9 | | | | | 19 | | | | |
| 10 | | | | | 20 | | | | |




UKAS TESTING 2519

# One-Dimensional Consolidation Test

BS 1377 : Part 5 : Clause 3 & 4 : 1990

Determination of the one-dimensional consolidation properties

**Approved by**

Initials : kp

Date : 13/08/2012

| | | | |
|---|---|---|---|
| **Client name & address:** | | **Samples Received** | 19/07/2012 |
| GEA | | **Project Started** | 01/08/2012 |
| **Project Name:** | Mearley Croft, Clitheroe, Lancashire | **Testing Started** | 02/08/2012 |
| **Project No:** | J11218A **Our Job / report no:** 13119 | **Date Reported:** | 13/08/2012 |
| **Sample description:** | | **Sample no/ type:** | U |
| Very soft dark grey silty/sandy CLAY | | | |

**K4 SOILS**

**BH no:** BH07

**Depth (m):** 1.50

## Test details

Depth within original sample m : 1.60 Orientation within original sample : Vertical

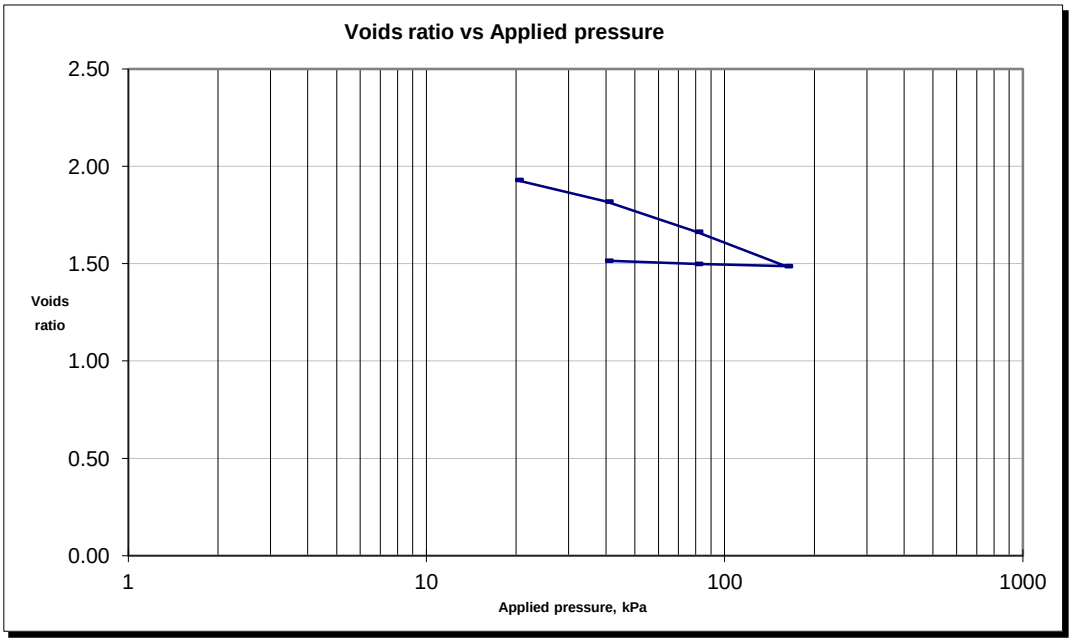
Lab Vane 9kpa

## Specimen details

| | | Initial | Final |
|---|---|---|---|
| Height | mm : | 19 | 14.8 |
| Diameter | mm : | 75 | - |
| Bulk density | Mg/m3 : | 1.53 | 1.70 |
| Moisture content | % : | 79 | 54 |
| Dry density | Mg/m3 : | 0.86 | 1.10 |
| Voids Ratio | : | 2.19 | 1.49 |
| Degree of saturation | % : | 98.3 | - |
| Particle density | Mg/m3 : | 2.74 | - |
| Swelling pressure | kPa : | 0 | - |

## Consolidation Stage

| Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN | Stage number | Applied Pressure kPa | Voids Ratio | Coefficient of Consolidation m2/year | Coefficient of Compressibility m2/MN |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 20 | 1.9299 | 1.47 | 4.121 | 11 | | | | |
| 2 | 40 | 1.8189 | 1.41 | 1.893 | 12 | | | | |
| 3 | 80 | 1.6640 | 1.28 | 1.374 | 13 | | | | |
| 4 | 160 | 1.4872 | 1.04 | 0.830 | 14 | | | | |
| 5 | 80 | 1.4986 | 1.53 | 0.057 | 15 | | | | |
| 6 | 40 | 1.5151 | 1.72 | 0.165 | 16 | | | | |
| 7 | | | | | 17 | | | | |
| 8 | | | | | 18 | | | | |
| 9 | | | | | 19 | | | | |
| 10 | | | | | 20 | | | | |




UKAS TESTING 2519

# One-Dimensional Consolidation Test

BS 1377 : Part 5 : Clause 3 & 4 : 1990

Determination of the one-dimensional consolidation properties

**Approved by**

Initials : kp

Date : 13/08/2012

| Project Name: | Mearley Croft, Clitheroe, Lancashire | | |
|---|---|---|---|
| Client: | GEA | Project no: | J11218A |
| | | Our job no: | 13119 |

K4 SOILS

| Borehole No: | Sample No: | Depth m | Description | pH | Sulphate content (g/l) |
|---|---|---|---|---|---|
| BH01 | D3 | 0.90 | Greyish brown slightly gravelly CLAY with occasional roots and rootlets (gravel is fm and angular to sub-angular) | 7.8 | 0.17 |
| BH01 | D7 | 2.50 | Grey silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 7.8 | 0.38 |
| BH02 | D4 | 1.30 | Greyish brown silty slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 7.6 | 0.16 |
| BH03 | D3 | 2.30 | Greyish brown slightly gravelly CLAY (gravel is fmc and angular to sub-rounded) | 7.9 | 0.16 |
| BH05 | D10 | 4.50 | Dark grey slightly sandy gravelly CLAY gravel is fm and sub-angular) | 8.0 | 0.27 |
| BH06 | B10 | 3.50 | Dark grey slightly gravelly slightly peaty CLAY (gravel is fm and sub-angular) | 7.9 | 0.16 |
| BH06 | D16 | 7.50 | Dark grey slightly sandy slightly gravelly silty CLAY (gravel is fm and sub-angular) | 8.0 | 0.32 |
| BH07 | D6 | 2.00 | Dark grey slightly peaty CLAY | 7.9 | 0.35 |
| BH07 | B10 | 5.50 | Dark grey slightly sandy slightly gravelly CLAY (gravel is fmc and sub-angular to sub-rounded) | 7.8 | 0.30 |
| BH07 | C20 | 9.50 | Dark grey slightly sandy slightly gravelly CLAY (gravel is fmc and sub-angular to sub-rounded) | 8.0 | 0.23 |
| TP2 | D4 | 1.80 | Brown slightly gravelly silty CLAY (gravel is fm and sub-angular) | 8.0 | 0.06 |
| TP5 | D2 | 0.50 | Dark grey slightly gravelly CLAY (gravel is fm and angular to sub-angular) | 7.9 | 0.21 |
| TP11 | D3 | 1.40 | Dark grey slightly peaty CLAY | 8.0 | 0.15 |

Date 13/08/2012

## Summary of Test Results

BS 1377 : Part 3 :Clause 5 : 1990

Determination of sulphate content of soil and ground water : gravimetric method

Checked and Approved

Initials : kp

Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| Login Batch No | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemtest LIMS ID | | | | | AH57651 | AH57652 | AH57653 | AH57654 | AH57655 | AH57656 |
| Sample ID | | | | | TP1 | TP1 | TP2 | TP3 | TP4 | TP5 |
| Sample No | | | | | D1 | D2 | D1 | D1 | D1 | D1 |
| Sampling Date | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| Depth | | | | | 0.50m | 0.90m | 0.40m | 0.30m | 0.40m | 0.05m |
| *Matrix* | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | | | | |
| 2030 | Moisture | | % | n/a | 7.63 | 18 | 15.6 | 27.4 | 24.5 | 24.6 |
| | Stones content (>50mm) | | % | n/a | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 2040 | Soil colour | | | n/a | brown | brown | brown | brown | brown | brown |
| | Soil texture | | | n/a | sand | sand | sand | sand | loam | loam |
| | Other material | | | n/a | stones | stones | stones | stones | none | stones |
| 2010 | pH | | | M | 8.7 | 8.3 | 8.3 | 7.8 | 8.1 | 7.9 |
| 2300 | Cyanide (total) | 57125 | mg kg-¹ | M | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| 2325 | Sulfide (Easily Liberatable) | 18496258 | mg kg-¹ | M | 5.5 | 3.9 | 5.1 | 2.6 | 3.7 | 3.2 |
| 2625 | Total Organic Carbon | | % | M | 7.4 | 6.2 | 5.3 | 8.9 | 5.6 | 8.7 |
| 2220 | Chloride (extractable) | 16887006 | g l-¹ | M | 0.011 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2430 | Sulfate (total) as SO4 | | mg kg-¹ | M | 1300 | 100 | 1300 | 200 | 1400 | 2900 |
| 2450 | Arsenic | 7440382 | mg kg-¹ | M | 12 | 16 | 21 | 23 | 19 | 17 |
| | Cadmium | 7440439 | mg kg-¹ | M | 0.25 | 0.70 | 0.63 | 1.2 | 1.8 | 1.7 |
| | Chromium | 7440473 | mg kg-¹ | M | 8.9 | 15 | 22 | 25 | 23 | 23 |
| | Copper | 7440508 | mg kg-¹ | M | 17 | 57 | 160 | 98 | 87 | 86 |
| | Mercury | 7439976 | mg kg-¹ | M | <0.10 | 0.23 | 0.33 | 0.76 | 1.1 | 0.59 |
| | Nickel | 7440020 | mg kg-¹ | M | 10 | 19 | 55 | 41 | 38 | 31 |
| | Lead | 7439921 | mg kg-¹ | M | 74 | 290 | 140 | 250 | 250 | 400 |
| | Selenium | 7782492 | mg kg-¹ | M | <0.20 | <0.20 | 0.25 | 0.85 | 0.95 | 0.93 |
| | Zinc | 7440666 | mg kg-¹ | M | 110 | 240 | 160 | 260 | 250 | 400 |
| 2670 | TPH >C5-C6 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C6-C7 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C7-C8 | | mg kg-¹ | M | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

All tests undertaken between 30/07/2012 and 07/08/2012

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Login Batch No** | | | | | **210266** | | | | | | |
| Chemtest LIMS ID | | | | | AH57657 | AH57658 | AH57659 | AH57660 | AH57661 | AH57662 |
| Sample ID | | | | | TP6 | TP7 | TP8 | TP9 | TP10 | TP11 |
| Sample No | | | | | D1 | D1 | D1 | D1 | D1 | D1 |
| Sampling Date | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| Depth | | | | | 0.30m | 0.30m | 0.30m | 0.20m | 0.60m | 0.40m |
| *Matrix* | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | | | | |
| 2030 | Moisture | | % | n/a | 22.9 | 24.7 | 16.7 | 18.8 | 20.4 | 21.3 |
| | Stones content (>50mm) | | % | n/a | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 2040 | Soil colour | | | n/a | brown | brown | black | red | brown | brown |
| | Soil texture | | | n/a | loam | loam | sand | sand | sand | sand |
| | Other material | | | n/a | stones | none | stones | stones | none | none |
| 2010 | pH | | | M | 7.9 | 7.9 | 8.1 | 8.0 | 8.2 | 7.9 |
| 2300 | Cyanide (total) | 57125 | mg kg-¹ | M | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| 2325 | Sulfide (Easily Liberatable) | 18496258 | mg kg-¹ | M | 3.1 | 3.3 | 7.7 | 5.3 | 4.6 | 4.9 |
| 2625 | Total Organic Carbon | | % | M | 6.7 | 12 | 7.8 | 29 | 2.8 | 12 |
| 2220 | Chloride (extractable) | 16887006 | g l-¹ | M | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2430 | Sulfate (total) as SO4 | | mg kg-¹ | M | 2600 | 2900 | 800 | 2900 | 800 | 1000 |
| 2450 | Arsenic | 7440382 | mg kg-¹ | M | 28 | 18 | 17 | 95 | 20 | 25 |
| | Cadmium | 7440439 | mg kg-¹ | M | 1.7 | 1.5 | 1.1 | 0.39 | 1.2 | 1.1 |
| | Chromium | 7440473 | mg kg-¹ | M | 31 | 19 | 14 | 22 | 19 | 25 |
| | Copper | 7440508 | mg kg-¹ | M | 150 | 74 | 64 | 140 | 78 | 100 |
| | Mercury | 7439976 | mg kg-¹ | M | 0.89 | 1.1 | 0.29 | 0.16 | 0.35 | 0.37 |
| | Nickel | 7440020 | mg kg-¹ | M | 38 | 33 | 20 | 60 | 33 | 38 |
| | Lead | 7439921 | mg kg-¹ | M | 730 | 230 | 200 | 170 | 210 | 500 |
| | Selenium | 7782492 | mg kg-¹ | M | 0.62 | 0.95 | 0.57 | 0.83 | 0.57 | 0.68 |
| | Zinc | 7440666 | mg kg-¹ | M | 700 | 220 | 200 | 340 | 240 | 490 |
| 2670 | TPH >C5-C6 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C6-C7 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C7-C8 | | mg kg-¹ | M | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Login Batch No** | | | | | **210266** | | | | | | |
| Chemtest LIMS ID | | | | | AH57663 | AH57664 | AH57665 | AH57666 | AH57667 | AH57668 |
| Sample ID | | | | | TP12 | BH1 | BH2 | BH3 | BH3 | BH4 |
| Sample No | | | | | D1 | D1 | D1 | D1 | D2 | D1 |
| Sampling Date | | | | | 2/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 |
| Depth | | | | | 0.10m | 0.20m | 0.10m | 0.50m | 1.80m | 0.20m |
| *Matrix* | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | | | | |
| 2030 | Moisture | | % | n/a | 53.8 | 32.2 | 27.9 | 11.8 | 16.6 | 22.4 |
| | Stones content (>50mm) | | % | n/a | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 2040 | Soil colour | | | n/a | black | brown | brown | brown | black | brown |
| | Soil texture | | | n/a | sand | sand | sand | loam | sand | sand |
| | Other material | | | n/a | none | none | stones | stones | stones | stones |
| 2010 | pH | | | M | 6.4 | 7.6 | 7.7 | 8.1 | 8.1 | 7.7 |
| 2300 | Cyanide (total) | 57125 | mg kg-¹ | M | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| 2325 | Sulfide (Easily Liberatable) | 18496258 | mg kg-¹ | M | 2.9 | 2.4 | 2.0 | 6.2 | 4.0 | 5.5 |
| 2625 | Total Organic Carbon | | % | M | 31 | 8.3 | 7.0 | 5.4 | 11 | 6.5 |
| 2220 | Chloride (extractable) | 16887006 | g l-¹ | M | 0.011 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2430 | Sulfate (total) as SO4 | | mg kg-¹ | M | 2700 | 1600 | 800 | 1900 | 700 | 1300 |
| 2450 | Arsenic | 7440382 | mg kg-¹ | M | 4.6 | 56 | 20 | 20 | 20 | 23 |
| | Cadmium | 7440439 | mg kg-¹ | M | 0.21 | 1.3 | 0.94 | 0.82 | 0.86 | 1.8 |
| | Chromium | 7440473 | mg kg-¹ | M | 9.9 | 40 | 26 | 16 | 18 | 19 |
| | Copper | 7440508 | mg kg-¹ | M | 34 | 93 | 66 | 36 | 80 | 46 |
| | Mercury | 7439976 | mg kg-¹ | M | 0.13 | 0.49 | 0.27 | <0.10 | 0.37 | 0.16 |
| | Nickel | 7440020 | mg kg-¹ | M | 7.8 | 62 | 48 | 31 | 36 | 29 |
| | Lead | 7439921 | mg kg-¹ | M | 120 | 260 | 150 | 90 | 190 | 440 |
| | Selenium | 7782492 | mg kg-¹ | M | 0.72 | 1.1 | 0.97 | 0.27 | 0.35 | 0.28 |
| | Zinc | 7440666 | mg kg-¹ | M | 130 | 330 | 210 | 170 | 170 | 1300 |
| 2670 | TPH >C5-C6 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C6-C7 | | mg kg-¹ | U | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C7-C8 | | mg kg-¹ | M | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Login Batch No** | | | | | **210266** | | | | | | |
| Chemtest LIMS ID | | | | | AH57670 | AH57671 | AH57673 | AH57675 | AH57677 | AH57678 |
| Sample ID | | | | | BH5 | BH5 | BH6 | BH6 | BH7 | BH7 |
| Sample No | | | | | E2 | E3 | E1 | E3 | E1 | E2 |
| Sampling Date | | | | | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided |
| Depth | | | | | 0.50m | 1.50m | 0.10m | 1.50m | 0.10m | 0.50m |
| *Matrix* | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | | | | |
| 2030 | Moisture | | % | n/a | 14.7 | 12.1 | 27.6 | 24.5 | 30.2 | 33.2 |
| | Stones content (>50mm) | | % | n/a | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| 2040 | Soil colour | | | n/a | brown | brown | brown | brown | brown | brown |
| | Soil texture | | | n/a | sand | loam | sand | loam | clay | clay |
| | Other material | | | n/a | stones | stones | stones | stones | stones | stones |
| 2010 | pH | | | M | 8.5 | 10.6 | 7.9 | 7.7 | 8.0 | 7.9 |
| 2300 | Cyanide (total) | 57125 | mg kg-¹ | M | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 | <0.50 |
| 2325 | Sulfide (Easily Liberatable) | 18496258 | mg kg-¹ | M | 5.9 | 4.9 | 1.8 | 3.8 | 4.6 | 4.2 |
| 2625 | Total Organic Carbon | | % | M | 4.3 | 7.0 | 12 | 9.1 | 5.8 | 5.9 |
| 2220 | Chloride (extractable) | 16887006 | g l-¹ | M | 0.016 | 0.032 | <0.010 | <0.010 | <0.010 | <0.010 |
| 2430 | Sulfate (total) as SO4 | | mg kg-¹ | M | 1100 | 900 | 1800 | 1000 | 800 | 700 |
| 2450 | Arsenic | 7440382 | mg kg-¹ | M | 7.5 | 11 | 12 | 68 | 30 | 42 |
| | Cadmium | 7440439 | mg kg-¹ | M | 0.55 | 0.54 | 0.57 | 1.2 | 1.00 | 1.3 |
| | Chromium | 7440473 | mg kg-¹ | M | 9.8 | 14 | 15 | 41 | 26 | 34 |
| | Copper | 7440508 | mg kg-¹ | M | 170 | 41 | 39 | 140 | 130 | 160 |
| | Mercury | 7439976 | mg kg-¹ | M | <0.10 | 0.10 | <0.10 | 0.56 | 0.57 | 0.77 |
| | Nickel | 7440020 | mg kg-¹ | M | 12 | 15 | 16 | 39 | 31 | 41 |
| | Lead | 7439921 | mg kg-¹ | M | 410 | 470 | 430 | 470 | 420 | 510 |
| | Selenium | 7782492 | mg kg-¹ | M | <0.20 | <0.20 | <0.20 | 0.60 | 0.53 | 0.70 |
| | Zinc | 7440666 | mg kg-¹ | M | 410 | 410 | 450 | 480 | 460 | 480 |
| 2670 | TPH >C5-C6 | | mg kg-¹ | U | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] |
| | TPH >C6-C7 | | mg kg-¹ | U | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] |
| | TPH >C7-C8 | | mg kg-¹ | M | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

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AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57651 | AH57652 | AH57653 | AH57654 | AH57655 | AH57656 |
| | | | | | TP1 | TP1 | TP2 | TP3 | TP4 | TP5 |
| | | | | | D1 | D2 | D1 | D1 | D1 | D1 |
| | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| | | | | | 0.50m | 0.90m | 0.40m | 0.30m | 0.40m | 0.05m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2670 | TPH >C8-C10 | | mg kg-1 | M | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C10-C12 | | mg kg-1 | M | 1.2 [1,2] | 0.83 [1,2] | 0.23 [1,2] | 0.25 [1,2] | 0.68 [1,2] | 0.62 [1,2] |
| | TPH >C12-C16 | | mg kg-1 | M | 5.4 [1,2] | 3.8 [1,2] | 2.3 [1,2] | 1.9 [1,2] | 2.5 [1,2] | 3.2 [1,2] |
| | TPH >C16-C21 | | mg kg-1 | M | 13 [1,2] | 11 [1,2] | 6.2 [1,2] | 5.2 [1,2] | 9.3 [1,2] | 16 [1,2] |
| | TPH >C21-C35 | | mg kg-1 | M | 40 [1,2] | 52 [1,2] | 13 [1,2] | 11 [1,2] | 21 [1,2] | 66 [1,2] |
| | Total Petroleum Hydrocarbons | | mg kg-1 | U | 60 [1,2] | 69 [1,2] | 22 [1,2] | 18 [1,2] | 34 [1,2] | 86 [1,2] |
| 2700 | Naphthalene | 91203 | mg kg-1 | M | < 0.1 | 0.74 | 0.5 | 0.66 | 0.82 | 0.9 |
| | Acenaphthylene | 208968 | mg kg-1 | M | < 0.1 | 1.2 | 0.33 | 0.34 | 0.27 | 0.6 |
| | Acenaphthene | 83329 | mg kg-1 | M | < 0.1 | 0.47 | 0.16 | 0.28 | 0.27 | 0.47 |
| | Fluorene | 86737 | mg kg-1 | M | < 0.1 | 0.39 | 0.11 | < 0.1 | 0.11 | 0.3 |
| | Phenanthrene | 85018 | mg kg-1 | M | 2.3 | 3.4 | 0.73 | 1.1 | 2.2 | 3.7 |
| | Anthracene | 120127 | mg kg-1 | M | 0.39 | 0.8 | 0.17 | 0.26 | 0.67 | 1 |
| | Fluoranthene | 206440 | mg kg-1 | M | 5.3 | 7.7 | 1.5 | 2.3 | 5.9 | 10 |
| | Pyrene | 129000 | mg kg-1 | M | 5.4 | 7.3 | 1.6 | 2.4 | 5.4 | 9.7 |
| | Benzo[a]anthracene | 56553 | mg kg-1 | M | 3.3 | 3.9 | 0.93 | 0.19 | 3.6 | 5.9 |
| | Chrysene | 218019 | mg kg-1 | M | 3.7 | 4.7 | 1.1 | 1.6 | 3.8 | 7 |
| | Benzo[b]fluoranthene | 205992 | mg kg-1 | M | 4.6 | 3.5 | 1 | 1.3 | 2.9 | 6.7 |
| | Benzo[k]fluoranthene | 207089 | mg kg-1 | M | 2.1 | 2.2 | 0.67 | 1.2 | 3.1 | 5.7 |
| | Benzo[a]pyrene | 50328 | mg kg-1 | M | 4.1 | 7.9 | 3.3 | 2.1 | 6.7 | 11 |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-1 | M | < 0.1 | 0.43 | 0.43 | 0.15 | 0.7 | 0.96 |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-1 | M | < 0.1 | 3.8 | 1.1 | 0.98 | 2.9 | 5.3 |
| | Benzo[g,h,i]perylene | 191242 | mg kg-1 | M | < 0.1 | 3.4 | 0.96 | 0.56 | 2.7 | 5.1 |
| | Total (of 16) PAHs | | mg kg-1 | M | 31 | 52 | 15 | 15 | 42 | 74 |
| 2800 | Naphthalene | 91203 | mg kg-1 | M | | | | | | |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
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All tests undertaken between 30/07/2012 and 07/08/2012

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St Albans Herts
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# LABORATORY TEST REPORT

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**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57657 | AH57658 | AH57659 | AH57660 | AH57661 | AH57662 |
| | | | | | TP6 | TP7 | TP8 | TP9 | TP10 | TP11 |
| | | | | | D1 | D1 | D1 | D1 | D1 | D1 |
| | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| | | | | | 0.30m | 0.30m | 0.30m | 0.20m | 0.60m | 0.40m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2670 | TPH >C8-C10 | | mg kg-1 | M | < 0.1 [1,2] | < 0.1 [1,2] | 8.2 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C10-C12 | | mg kg-1 | M | 0.70 [1,2] | 0.46 [1,2] | 86 [1,2] | 0.49 [1,2] | 1.1 [1,2] | 0.84 [1,2] |
| | TPH >C12-C16 | | mg kg-1 | M | 3.9 [1,2] | 2.3 [1,2] | 1800 [1,2] | 2.6 [1,2] | 5.7 [1,2] | 3.2 [1,2] |
| | TPH >C16-C21 | | mg kg-1 | M | 23 [1,2] | 8.5 [1,2] | 2500 [1,2] | 3.9 [1,2] | 38 [1,2] | 17 [1,2] |
| | TPH >C21-C35 | | mg kg-1 | M | 61 [1,2] | 21 [1,2] | 890 [1,2] | 4.4 [1,2] | 120 [1,2] | 39 [1,2] |
| | Total Petroleum Hydrocarbons | | mg kg-1 | U | 89 [1,2] | 32 [1,2] | 5200 [1,2] | 11 [1,2] | 170 [1,2] | 60 [1,2] |
| 2700 | Naphthalene | 91203 | mg kg-1 | M | 1.2 | 1.2 | | < 0.1 | 2.3 | 0.61 |
| | Acenaphthylene | 208968 | mg kg-1 | M | 0.96 | 1.2 | | < 0.1 | 1.4 | 1.1 |
| | Acenaphthene | 83329 | mg kg-1 | M | 0.33 | 0.52 | | < 0.1 | 2.3 | < 0.1 |
| | Fluorene | 86737 | mg kg-1 | M | 0.39 | 0.26 | | < 0.1 | 2 | 0.45 |
| | Phenanthrene | 85018 | mg kg-1 | M | 5.3 | 2.6 | | < 0.1 | 18 | 5.6 |
| | Anthracene | 120127 | mg kg-1 | M | 1.4 | 0.71 | | 0.44 | 5.6 | 1.3 |
| | Fluoranthene | 206440 | mg kg-1 | M | 14 | 5.8 | | 0.99 | 30 | 12 |
| | Pyrene | 129000 | mg kg-1 | M | 13 | 5.8 | | 0.72 | 23 | 9.9 |
| | Benzo[a]anthracene | 56553 | mg kg-1 | M | 6.4 | 3.1 | | 0.38 | 14 | 4.8 |
| | Chrysene | 218019 | mg kg-1 | M | 7.3 | 3.6 | | 0.61 | 16 | 5.9 |
| | Benzo[b]fluoranthene | 205992 | mg kg-1 | M | 4.9 | 3.5 | | 0.62 | 13 | 4.8 |
| | Benzo[k]fluoranthene | 207089 | mg kg-1 | M | 5.2 | 2.2 | | 0.13 | 6.6 | 2.3 |
| | Benzo[a]pyrene | 50328 | mg kg-1 | M | 9.7 | 6.2 | | 0.46 | 14 | 5.5 |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-1 | M | 0.9 | 0.77 | | 0.24 | 2.1 | 0.9 |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-1 | M | 5.2 | 2.9 | | 0.42 | 9.5 | 3.9 |
| | Benzo[g,h,i]perylene | 191242 | mg kg-1 | M | 5.3 | 3 | | 0.25 | 9.8 | 3.7 |
| | Total (of 16) PAHs | | mg kg-1 | M | 81 | 43 | | 5.3 | 170 | 63 |
| 2800 | Naphthalene | 91203 | mg kg-1 | M | | | 0.3 | | | |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57663 | AH57664 | AH57665 | AH57666 | AH57667 | AH57668 |
| | | | | | TP12 | BH1 | BH2 | BH3 | BH3 | BH4 |
| | | | | | D1 | D1 | D1 | D1 | D2 | D1 |
| | | | | | 2/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 |
| | | | | | 0.10m | 0.20m | 0.10m | 0.50m | 1.80m | 0.20m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2670 | TPH >C8-C10 | | mg kg-¹ | M | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] | < 0.1 [1,2] |
| | TPH >C10-C12 | | mg kg-¹ | M | < 0.1 [1,2] | 0.80 [1,2] | 0.43 [1,2] | 0.53 [1,2] | < 0.1 [1,2] | 0.52 [1,2] |
| | TPH >C12-C16 | | mg kg-¹ | M | < 0.1 [1,2] | 5.9 [1,2] | 2.2 [1,2] | 1.9 [1,2] | < 0.1 [1,2] | 2.8 [1,2] |
| | TPH >C16-C21 | | mg kg-¹ | M | 3.7 [1,2] | 38 [1,2] | 8.6 [1,2] | 3.9 [1,2] | 0.71 [1,2] | 19 [1,2] |
| | TPH >C21-C35 | | mg kg-¹ | M | 2.2 [1,2] | 87 [1,2] | 18 [1,2] | 3.4 [1,2] | 0.16 [1,2] | 37 [1,2] |
| | Total Petroleum Hydrocarbons | | mg kg-¹ | U | < 10 [1,2] | 130 [1,2] | 29 [1,2] | < 10 [1,2] | < 10 [1,2] | 60 [1,2] |
| 2700 | Naphthalene | 91203 | mg kg-¹ | M | < 0.1 | 1.3 | 2.2 | 0.46 | < 0.1 | 0.24 |
| | Acenaphthylene | 208968 | mg kg-¹ | M | < 0.1 | 1.1 | 0.3 | 0.43 | < 0.1 | 0.62 |
| | Acenaphthene | 83329 | mg kg-¹ | M | < 0.1 | 0.83 | 0.5 | 0.41 | < 0.1 | 0.26 |
| | Fluorene | 86737 | mg kg-¹ | M | < 0.1 | 1.2 | 0.42 | 0.69 | < 0.1 | 0.26 |
| | Phenanthrene | 85018 | mg kg-¹ | M | 0.32 | 10 | 4.4 | 0.61 | 0.33 | 7.5 |
| | Anthracene | 120127 | mg kg-¹ | M | 0.11 | 3.6 | 1.3 | 0.4 | 0.2 | 0.8 |
| | Fluoranthene | 206440 | mg kg-¹ | M | 1.6 | 20 | 7 | 1.4 | 0.25 | 13 |
| | Pyrene | 129000 | mg kg-¹ | M | 1.2 | 16 | 5.6 | 1.1 | 0.22 | 10 |
| | Benzo[a]anthracene | 56553 | mg kg-¹ | M | 0.18 | 8.3 | 2.7 | 0.63 | 0.14 | 3.1 |
| | Chrysene | 218019 | mg kg-¹ | M | 0.19 | 10 | 3.3 | 0.61 | 0.15 | 3 |
| | Benzo[b]fluoranthene | 205992 | mg kg-¹ | M | < 0.1 | 7.5 | 2.5 | 0.66 | < 0.1 | 4.7 |
| | Benzo[k]fluoranthene | 207089 | mg kg-¹ | M | < 0.1 | 5.8 | 1.8 | 0.43 | < 0.1 | 3.1 |
| | Benzo[a]pyrene | 50328 | mg kg-¹ | M | < 0.1 | 9.8 | 3.4 | 0.52 | < 0.1 | 5.7 |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-¹ | M | < 0.1 | 1.1 | 0.66 | < 0.1 | < 0.1 | 0.86 |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-¹ | M | < 0.1 | 6.4 | 2.2 | 0.41 | < 0.1 | 4 |
| | Benzo[g,h,i]perylene | 191242 | mg kg-¹ | M | < 0.1 | 2.2 | 1.7 | 0.28 | < 0.1 | 4.5 |
| | Total (of 16) PAHs | | mg kg-¹ | M | 3.6 | 110 | 40 | 9 | < 2 | 62 |
| 2800 | Naphthalene | 91203 | mg kg-¹ | M | | | | | | |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57670 | AH57671 | AH57673 | AH57675 | AH57677 | AH57678 |
| | | | | | BH5 | BH5 | BH6 | BH6 | BH7 | BH7 |
| | | | | | E2 | E3 | E1 | E3 | E1 | E2 |
| | | | | | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided |
| | | | | | 0.50m | 1.50m | 0.10m | 1.50m | 0.10m | 0.50m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2670 | TPH >C8-C10 | | mg kg-1 | M | 1.3 [1 3] | 0.47 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] | < 0.1 [1 3] |
| | TPH >C10-C12 | | mg kg-1 | M | 1.3 [1 3] | 0.56 [1 3] | 0.75 [1 3] | 0.65 [1 3] | 0.72 [1 3] | 0.58 [1 3] |
| | TPH >C12-C16 | | mg kg-1 | M | 2.9 [1 3] | 2.2 [1 3] | 2.9 [1 3] | 5.8 [1 3] | 2.3 [1 3] | 2.4 [1 3] |
| | TPH >C16-C21 | | mg kg-1 | M | 19 [1 3] | 5.0 [1 3] | 11 [1 3] | 28 [1 3] | 9.5 [1 3] | 9.4 [1 3] |
| | TPH >C21-C35 | | mg kg-1 | M | 250 [1 3] | 110 [1 3] | 28 [1 3] | 34 [1 3] | 17 [1 3] | 24 [1 3] |
| | Total Petroleum Hydrocarbons | | mg kg-1 | U | 270 [1 3] | 120 [1 3] | 42 [1 3] | 69 [1 3] | 30 [1 3] | 36 [1 3] |
| 2700 | Naphthalene | 91203 | mg kg-1 | M | < 0.1 | < 0.1 | 13 | 3.4 | 0.84 | 4.2 |
| | Acenaphthylene | 208968 | mg kg-1 | M | < 0.1 | < 0.1 | 2.3 | 1 | 1.1 | 1.1 |
| | Acenaphthene | 83329 | mg kg-1 | M | < 0.1 | < 0.1 | 7.3 | 1.5 | 0.77 | 0.32 |
| | Fluorene | 86737 | mg kg-1 | M | < 0.1 | < 0.1 | 6 | 1 | 0.5 | 0.4 |
| | Phenanthrene | 85018 | mg kg-1 | M | 1.1 | 1.6 | 32 | 10 | 5.4 | 5.6 |
| | Anthracene | 120127 | mg kg-1 | M | 0.46 | 0.62 | 7.7 | 2.6 | 2.2 | 2.2 |
| | Fluoranthene | 206440 | mg kg-1 | M | 2.6 | 3.5 | 31 | 14 | 15 | 15 |
| | Pyrene | 129000 | mg kg-1 | M | 2.2 | 3 | 24 | 11 | 12 | 12 |
| | Benzo[a]anthracene | 56553 | mg kg-1 | M | 1.2 | 1.5 | 12 | 5.5 | 7.8 | 7.4 |
| | Chrysene | 218019 | mg kg-1 | M | 1.6 | 1.9 | 15 | 6.4 | 9.3 | 9 |
| | Benzo[b]fluoranthene | 205992 | mg kg-1 | M | 2.1 | 1.9 | 11 | 4.6 | 7.7 | 7.8 |
| | Benzo[k]fluoranthene | 207089 | mg kg-1 | M | 0.64 | 1.3 | 9.3 | 3.4 | 3.8 | 4 |
| | Benzo[a]pyrene | 50328 | mg kg-1 | M | 1.1 | 0.46 | 12 | 5.8 | 9.3 | 8.5 |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-1 | M | 0.28 | < 0.1 | 2.2 | 0.89 | 1.8 | 1.2 |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-1 | M | 0.91 | < 0.1 | 7.7 | 3.9 | 7 | 6 |
| | Benzo[g,h,i]perylene | 191242 | mg kg-1 | M | 1.4 | < 0.1 | 7.1 | 4.1 | 7.6 | 6.2 |
| | Total (of 16) PAHs | | mg kg-1 | M | 16 | 16 | 200 | 79 | 92 | 91 |
| 2800 | Naphthalene | 91203 | mg kg-1 | M | | | | | | |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57651 | AH57652 | AH57653 | AH57654 | AH57655 | AH57656 |
| | | | | | TP1 | TP1 | TP2 | TP3 | TP4 | TP5 |
| | | | | | D1 | D2 | D1 | D1 | D1 | D1 |
| | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| | | | | | 0.50m | 0.90m | 0.40m | 0.30m | 0.40m | 0.05m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2800 | Acenaphthylene | 208968 | mg kg-¹ | N | | | | | | |
| | Acenaphthene | 83329 | mg kg-¹ | M | | | | | | |
| | Fluorene | 86737 | mg kg-¹ | M | | | | | | |
| | Phenanthrene | 85018 | mg kg-¹ | M | | | | | | |
| | Anthracene | 120127 | mg kg-¹ | M | | | | | | |
| | Fluoranthene | 206440 | mg kg-¹ | M | | | | | | |
| | Pyrene | 129000 | mg kg-¹ | M | | | | | | |
| | Benzo[a]anthracene | 56553 | mg kg-¹ | M | | | | | | |
| | Chrysene | 218019 | mg kg-¹ | M | | | | | | |
| | Benzo[b]fluoranthene | 205992 | mg kg-¹ | M | | | | | | |
| | Benzo[k]fluoranthene | 207089 | mg kg-¹ | N | | | | | | |
| | Benzo[a]pyrene | 50328 | mg kg-¹ | M | | | | | | |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-¹ | N | | | | | | |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-¹ | M | | | | | | |
| | Benzo[g,h,i]perylene | 191242 | mg kg-¹ | M | | | | | | |
| | Total (of 16) PAHs | | mg kg-¹ | N | | | | | | |
| 2920 | Phenols (total) | | mg kg-¹ | N | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

All tests undertaken between 30/07/2012 and 07/08/2012

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57657 | AH57658 | AH57659 | AH57660 | AH57661 | AH57662 |
| | | | | | TP6 | TP7 | TP8 | TP9 | TP10 | TP11 |
| | | | | | D1 | D1 | D1 | D1 | D1 | D1 |
| | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| | | | | | 0.30m | 0.30m | 0.30m | 0.20m | 0.60m | 0.40m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2800 | Acenaphthylene | 208968 | mg kg-¹ | N | | | 0.6 | | | |
| | Acenaphthene | 83329 | mg kg-¹ | M | | | 1.4 | | | |
| | Fluorene | 86737 | mg kg-¹ | M | | | 1.3 | | | |
| | Phenanthrene | 85018 | mg kg-¹ | M | | | 10 | | | |
| | Anthracene | 120127 | mg kg-¹ | M | | | 3.2 | | | |
| | Fluoranthene | 206440 | mg kg-¹ | M | | | 14 | | | |
| | Pyrene | 129000 | mg kg-¹ | M | | | 13 | | | |
| | Benzo[a]anthracene | 56553 | mg kg-¹ | M | | | 6.9 | | | |
| | Chrysene | 218019 | mg kg-¹ | M | | | 5.9 | | | |
| | Benzo[b]fluoranthene | 205992 | mg kg-¹ | M | | | 8.7 | | | |
| | Benzo[k]fluoranthene | 207089 | mg kg-¹ | N | | | 4.1 | | | |
| | Benzo[a]pyrene | 50328 | mg kg-¹ | M | | | 7 | | | |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-¹ | N | | | 1.3 | | | |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-¹ | M | | | 5.2 | | | |
| | Benzo[g,h,i]perylene | 191242 | mg kg-¹ | M | | | 5.8 | | | |
| | Total (of 16) PAHs | | mg kg-¹ | N | | | 89 | | | |
| 2920 | Phenols (total) | | mg kg-¹ | N | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57663 | AH57664 | AH57665 | AH57666 | AH57667 | AH57668 |
| | | | | | TP12 | BH1 | BH2 | BH3 | BH3 | BH4 |
| | | | | | D1 | D1 | D1 | D1 | D2 | D1 |
| | | | | | 2/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 | 3/7/2012 |
| | | | | | 0.10m | 0.20m | 0.10m | 0.50m | 1.80m | 0.20m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2800 | Acenaphthylene | 208968 | mg kg-¹ | N | | | | | | |
| | Acenaphthene | 83329 | mg kg-¹ | M | | | | | | |
| | Fluorene | 86737 | mg kg-¹ | M | | | | | | |
| | Phenanthrene | 85018 | mg kg-¹ | M | | | | | | |
| | Anthracene | 120127 | mg kg-¹ | M | | | | | | |
| | Fluoranthene | 206440 | mg kg-¹ | M | | | | | | |
| | Pyrene | 129000 | mg kg-¹ | M | | | | | | |
| | Benzo[a]anthracene | 56553 | mg kg-¹ | M | | | | | | |
| | Chrysene | 218019 | mg kg-¹ | M | | | | | | |
| | Benzo[b]fluoranthene | 205992 | mg kg-¹ | M | | | | | | |
| | Benzo[k]fluoranthene | 207089 | mg kg-¹ | N | | | | | | |
| | Benzo[a]pyrene | 50328 | mg kg-¹ | M | | | | | | |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-¹ | N | | | | | | |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-¹ | M | | | | | | |
| | Benzo[g,h,i]perylene | 191242 | mg kg-¹ | M | | | | | | |
| | Total (of 16) PAHs | | mg kg-¹ | N | | | | | | |
| 2920 | Phenols (total) | | mg kg-¹ | N | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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Tyttenhanger House
Coursers Road
St Albans Herts
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FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 24 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**07 August 2012**

| | | | | | 210266 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | AH57670 | AH57671 | AH57673 | AH57675 | AH57677 | AH57678 |
| | | | | | BH5 | BH5 | BH6 | BH6 | BH7 | BH7 |
| | | | | | E2 | E3 | E1 | E3 | E1 | E2 |
| | | | | | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided | Not Provided |
| | | | | | 0.50m | 1.50m | 0.10m | 1.50m | 0.10m | 0.50m |
| | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| 2800 | Acenaphthylene | 208968 | mg kg-¹ | N | | | | | | |
| | Acenaphthene | 83329 | mg kg-¹ | M | | | | | | |
| | Fluorene | 86737 | mg kg-¹ | M | | | | | | |
| | Phenanthrene | 85018 | mg kg-¹ | M | | | | | | |
| | Anthracene | 120127 | mg kg-¹ | M | | | | | | |
| | Fluoranthene | 206440 | mg kg-¹ | M | | | | | | |
| | Pyrene | 129000 | mg kg-¹ | M | | | | | | |
| | Benzo[a]anthracene | 56553 | mg kg-¹ | M | | | | | | |
| | Chrysene | 218019 | mg kg-¹ | M | | | | | | |
| | Benzo[b]fluoranthene | 205992 | mg kg-¹ | M | | | | | | |
| | Benzo[k]fluoranthene | 207089 | mg kg-¹ | N | | | | | | |
| | Benzo[a]pyrene | 50328 | mg kg-¹ | M | | | | | | |
| | Dibenzo[a,h]anthracene | 53703 | mg kg-¹ | N | | | | | | |
| | Indeno[1,2,3-cd]pyrene | 193395 | mg kg-¹ | M | | | | | | |
| | Benzo[g,h,i]perylene | 191242 | mg kg-¹ | M | | | | | | |
| | Total (of 16) PAHs | | mg kg-¹ | N | | | | | | |
| 2920 | Phenols (total) | | mg kg-¹ | N | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

* Accreditation status

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Coursers Road
St Albans Herts
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FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 27 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

**Report Date**
**07 August 2012**

| Login Batch No | | | | | 210266 | | |
|---|---|---|---|---|---|---|---|
| Chemtest LIMS ID | | | | | AH57672 | AH57676 | AH57680 |
| Sample ID | | | | | BH5 | BH6 | BH7 |
| Sample No | | | | | W1 | W1 | W1 |
| Sampling Date | | | | | 13/7/2012 | Not Provided | Not Provided |
| Depth | | | | | 1.50m | 3.50m | 2.30m |
| *Matrix* | | | | | *WATER* | *WATER* | *WATER* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | |
| 1010 | pH | PH | | U | 7.7 | 7.7 | 7.9 |
| 1020 | Electrical Conductivity | EC | µS cm-¹ | U | 360 | 370 | 350 |
| 1220 | Chloride | 16887006 | mg l-¹ | U | 17 | 17 | 16 |
| | Ammonia (free) | 7664417 | mg l-¹ | U | < 0.01 | < 0.01 | < 0.01 |
| | Nitrate | 14797558 | mg l-¹ | U | 0.81 | 1.7 | 0.89 |
| 1325 | Sulfide | 18496258 | mg l-¹ | U | <0.050 | <0.050 | <0.050 |
| 1610 | Total Organic Carbon | TOC | mg l-¹ | N | 3.2 | 3.3 | 2.9 |
| 1220 | Sulfate | 14808798 | mg l-¹ | U | 72 | 73 | 72 |
| 1450 | Arsenic | 7440382 | µg l-¹ | U | 4.2 | 4.1 | 3.0 |
| | Cadmium | 7440439 | µg l-¹ | U | <0.08 | <0.08 | <0.08 |
| | Chromium | 7440473 | µg l-¹ | U | 7.8 | 6.2 | 5.2 |
| | Mercury | 7439976 | µg l-¹ | U | <0.5 | <0.5 | <0.5 |
| | Nickel | 7440020 | µg l-¹ | U | 2.0 | 1.9 | 1.2 |
| | Lead | 7439921 | µg l-¹ | U | 1.1 | 1.4 | <1.0 |
| 1670 | TPH (Aqueous Phase) | | µg l-¹ | U | <10 [2] | 39 [3] | <10 [3] |
| 1920 | Phenols (total) | | mg l-¹ | N | < 0.03 | < 0.03 | < 0.03 |

[1]The sample container/fill level was not appropriate for the specified analysis - these results may be compromised and will not be accredited (UKAS/MCerts)
[2]The stability time for this analyte has been exceeded - these results may be compromised and will not be accredited (UKAS/MCerts)
[3]No sampling date was specified, stability times for this analyte may have been exceeded and these results may be compromised and will not be accredited (UKAS/MCerts)

All tests undertaken between 30/07/2012 and 07/08/2012

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer

# LABORATORY TEST REPORT

**Results of analysis of 3 samples**
**received 30 July 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest

**Report Date**
**07 August 2012**

| Login Batch No | | | 210267 | | |
|---|---|---|---|---|---|
| Chemtest LIMS ID | | | AH57681 | AH57682 | AH57683 |
| Sample ID | | | | | |
| Sample Description | | | ACM1 | ACM2 | ACM3 |
| SOP↓ | Determinand↓ | CAS No↓ | | | |
| 2185 | Actinolite | | Not detected | Not detected | Not detected |
| | Amosite | | Not detected | Not detected | Not detected |
| | Anthophyllite | | Not detected | Not detected | Not detected |
| | Chrysotile | | Not detected | Detected | Detected |
| | Crocidolite | | Not detected | Not detected | Not detected |
| | Tremolite | | Not detected | Not detected | Not detected |
| | Material | | concrete | cement | cement |

All tests undertaken between 02-Aug-2012 and 2-Aug-2012

**Signed**

**Albert Vella**
**Senior Environmental Surveyor**

UKAS TESTING
2183

*Notes to accompany report:*

- *The in-house procedure SOP 2185 is in accordance with the requirements of Appendix 2 of the Analyst Guide (HSG248)*
- *The results relate only to the items tested as supplied by the client*
- *Comments and interpretations are not UKAS accredited*
- *Amosite is alternatively termed 'brown asbestos'*
- *Chrysotile is alternatively termed 'white asbestos'*
- *Crocidolite is alternatively termed 'blue asbestos'*
- *Samples associated with asbestos in building surveys are retained for sixmonths (HSG 264 refers)*
- *Comments or interpretations are beyond the scope of UKAS accreditation*

GEA
Tyttenhanger House
Coursers Road
St Albans Herts
AL4 0PG

FAO M Cooper / M Plimmer / B O'Gorman

# LABORATORY TEST REPORT

**Results of analysis of 5 samples received 8 August 2012**

**J11218A PO4 - Mearley Croft, Clitheroe**

Chemtest
The right chemistry to deliver results

**Report Date**
**16 August 2012**

| **Login Batch No** | | | | | **210747** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chemtest LIMS ID | | | | | AH60655 | AH60656 | AH60657 | AH60658 | AH60659 |
| Sample ID | | | | | TP5 | TP6 | TP7 | TP9 | TP12 |
| Sample No | | | | | D1 | D1 | D1 | D1 | D1 |
| Sampling Date | | | | | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 | 2/7/2012 |
| Depth | | | | | 0.05m | 0.30m | 0.30m | 0.20m | 0.10m |
| *Matrix* | | | | | *SOIL* | *SOIL* | *SOIL* | *SOIL* | *SOIL* |
| SOP↓ | Determinand↓ | CAS No↓ | Units↓ | * | | | | | |
| 2120 | Sulfate (2:1 water soluble) as SO4 | 14808798 | g l-¹ | M | 0.03 | <0.01 | <0.01 | 0.07 | 0.03 |

All tests undertaken between 08/08/2012 and 13/08/2012

* Accreditation status

***This report should be interpreted in conjuction with the notes on the accompanying cover page.***

GEA Geotechnical & Environmental Associates

Tyttenhanger House
Coursers Road
St Albans
AL4 0PG

# Generic Risk-Based Soil Screening Values

**Site** Mearley Croft, Woone Lane, Clitheroe, Lancashire

**Client** Beck Developments Limited

**Engineer**

**Job Number** J11218A

**Sheet** 1

**Proposed End Use** Residential with plant uptake

**Soil pH** 8

**Soil Organic Matter content %** 6.0

| Contaminant | Screening Value mg/kg | Data Source |
|---|---|---|
| ***Metals*** | | |
| Arsenic | 37 | C4SL |
| Cadmium | 26 | C4SL |
| Chromium (III) | 3000 | LQM/CIEH |
| Chromium (VI) | 21 | C4SL |
| Copper | 2,330 | LQM/CIEH |
| Lead | 200 | C4SL |
| Elemental Mercury | 1 | SGV |
| Inorganic Mercury | 170 | SGV |
| Nickel | 97 | LQM/CIEH |
| Selenium | 350 | SGV |
| Zinc | 3,750 | LQM/CIEH |
| ***Hydrocarbons*** | | |
| Benzene | 0.87 | C4SL |
| Toluene | 610 | SGV |
| Ethyl Benzene | 350 | SGV |
| Xylene | 230 | SGV |
| Aliphatic C5-C6 | 110 | LQM/CIEH |
| Aliphatic C6-C8 | 370 | LQM/CIEH |
| Aliphatic C8-C10 | 110 | LQM/CIEH |
| Aliphatic C10-C12 | 540 | LQM/CIEH |
| Aliphatic C12-C16 | 3000 | LQM/CIEH |
| Aliphatic C16-C35 | 76,000 | LQM/CIEH |
| Aromatic C6-C7 | See Benzene | LQM/CIEH |
| Aromatic C7-C8 | See Toluene | LQM/CIEH |
| Aromatic C8-C10 | 151 | LQM/CIEH |
| Aromatic C10-C12 | 346 | LQM/CIEH |
| Aromatic C12-C16 | 593 | LQM/CIEH |
| Aromatic C16-C21 | 770 | LQM/CIEH |
| Aromatic C21-C35 | 1230 | LQM/CIEH |
| PRO ($C_5$ –$C_{10}$) | 1352 | Calc |
| DRO ($C_{12}$ –$C_{28}$) | 80,363 | Calc |
| Lube Oil ($C_{28}$ –$C_{44}$) | 77,230 | Calc |
| **TPH** | **1000** | Trigger for speciated testing |

| Contaminant | Screening Value mg/kg | Data Source |
|---|---|---|
| ***Anions*** | | |
| Soluble Sulphate | 500 mg/l | Structures |
| Sulphide | 50 | Structures |
| Chloride | 400 | Structures |
| ***Others*** | | |
| Organic Carbon (%) | 6 | Methanogenic potential |
| Total Cyanide | 140 | WRAS |
| Total Mono Phenols | 420 | SGV |
| ***PAH*** | | |
| Naphthalene | 12.40 | C4SL exp & LQM/CIEH |
| Acenaphthylene | 850 | LQM/CIEH |
| Acenaphthene | 1,000 | LQM/CIEH |
| Fluorene | 780 | LQM/CIEH |
| Phenanthrene | 380 | LQM/CIEH |
| Anthracene | 9,200 | LQM/CIEH |
| Fluoranthene | 670 | LQM/CIEH |
| Pyrene | 1,600 | LQM/CIEH |
| Benzo(a) Anthracene | 8.7 | C4SL exp & LQM/CIEH |
| Chrysene | 14 | C4SL exp & LQM/CIEH |
| Benzo(b) Fluoranthene | 10.5 | C4SL exp & LQM/CIEH |
| Benzo(k) Fluoranthene | 15.0 | C4SL exp & LQM/CIEH |
| Benzo(a) pyrene | 5.00 | C4SL |
| Indeno(1 2 3 cd) Pyrene | 6.2 | C4SL exp & LQM/CIEH |
| Dibenzo(a h) Anthracene | 1.35 | C4SL exp & LQM/CIEH |
| Benzo (g h i) Perylene | 71 | C4SL exp & LQM/CIEH |
| **Screening value for PAH** | **71.4** | B(a)P / 0.15 |
| ***Chlorinated Solvents*** | | |
| 1,1,1 trichloroethane (TCA) | 53.1 | LQM/CIEH |
| tetrachloroethane (PCA) | 2.4 | LQM/CIEH |
| tetrachloroethene (PCE) | 4.5 | LQM/CIEH |
| trichloroethene (TCE) | 0.598 | LQM/CIEH |
| 1,2-dichloroethane (DCA) | 0.014 | LQM/CIEH |
| vinyl chloride (Chloroethene) | 0.00329 | LQM/CIEH |
| tetrachloromethane (Carbon tetra | 0.089 | LQM/CIEH |
| trichloromethane (Chloroform) | 3.86 | LQM/CIEH |

*Notes*

Concentrations measured below the above values may be considered to represent 'uncontaminated conditions' which pose 'LOW' risk to human health. Concentrations measured in excess of these valuesindicate a potential risk which require further, site specific risk assessment.

SGV - Soil Guideline Value, derived from the CLEA model and published by Environment Agency 2009

LQM/CIEH - Generic Assessment Criteria for Human Health Risk Assessment 2nd edition (2009)derived using CLEA 1.04 model 2009

C4SL - Defra Category 4 Screening value based on Low Level of Toxicological Risk

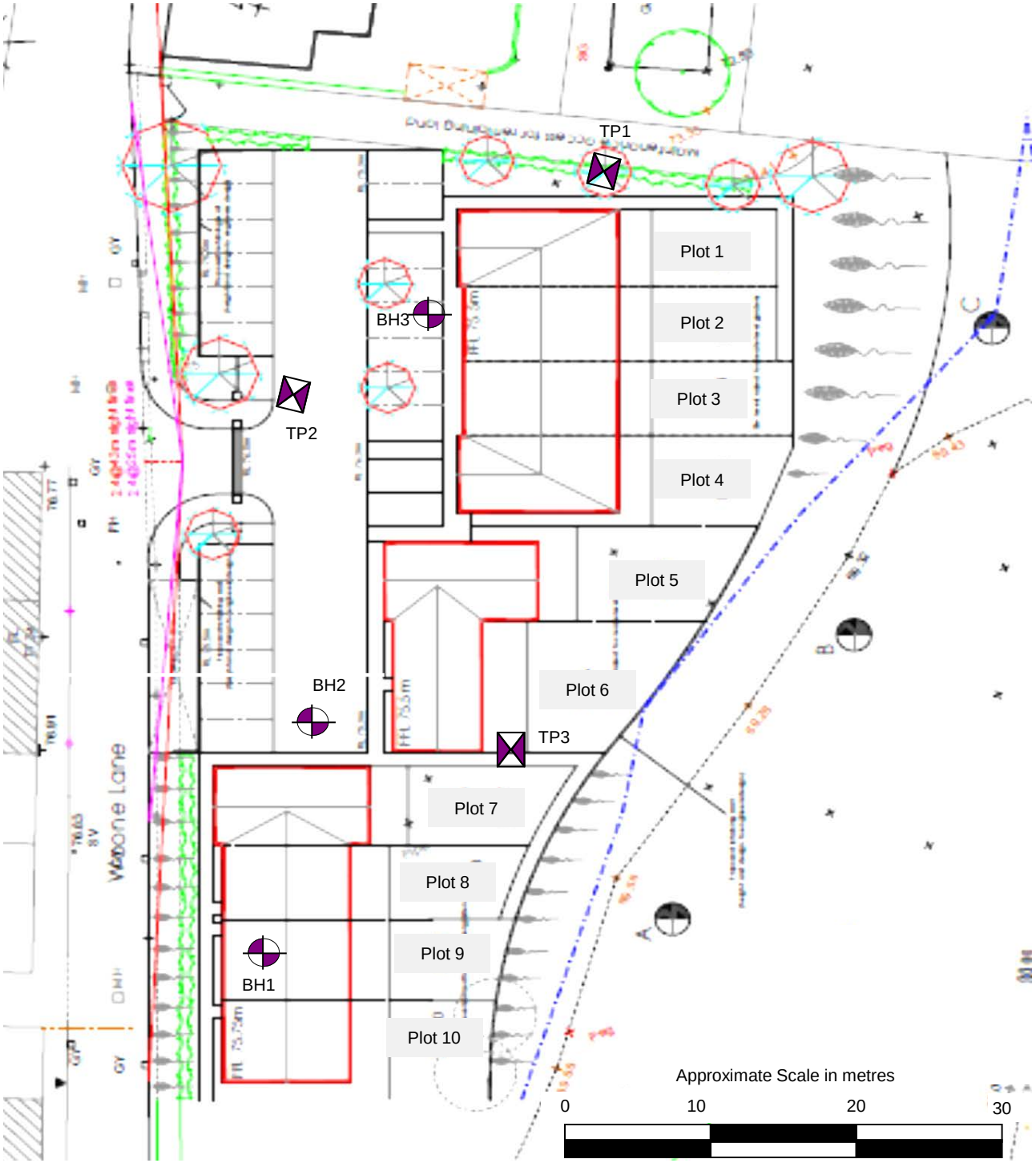
C4SL exp & LQM/CIEH calculated using C4SL revisions to exposure assessment but LQM/CIEH health croiteria values

Calc - sum of nearest available carbon range specified including BTEX for PRO fraction

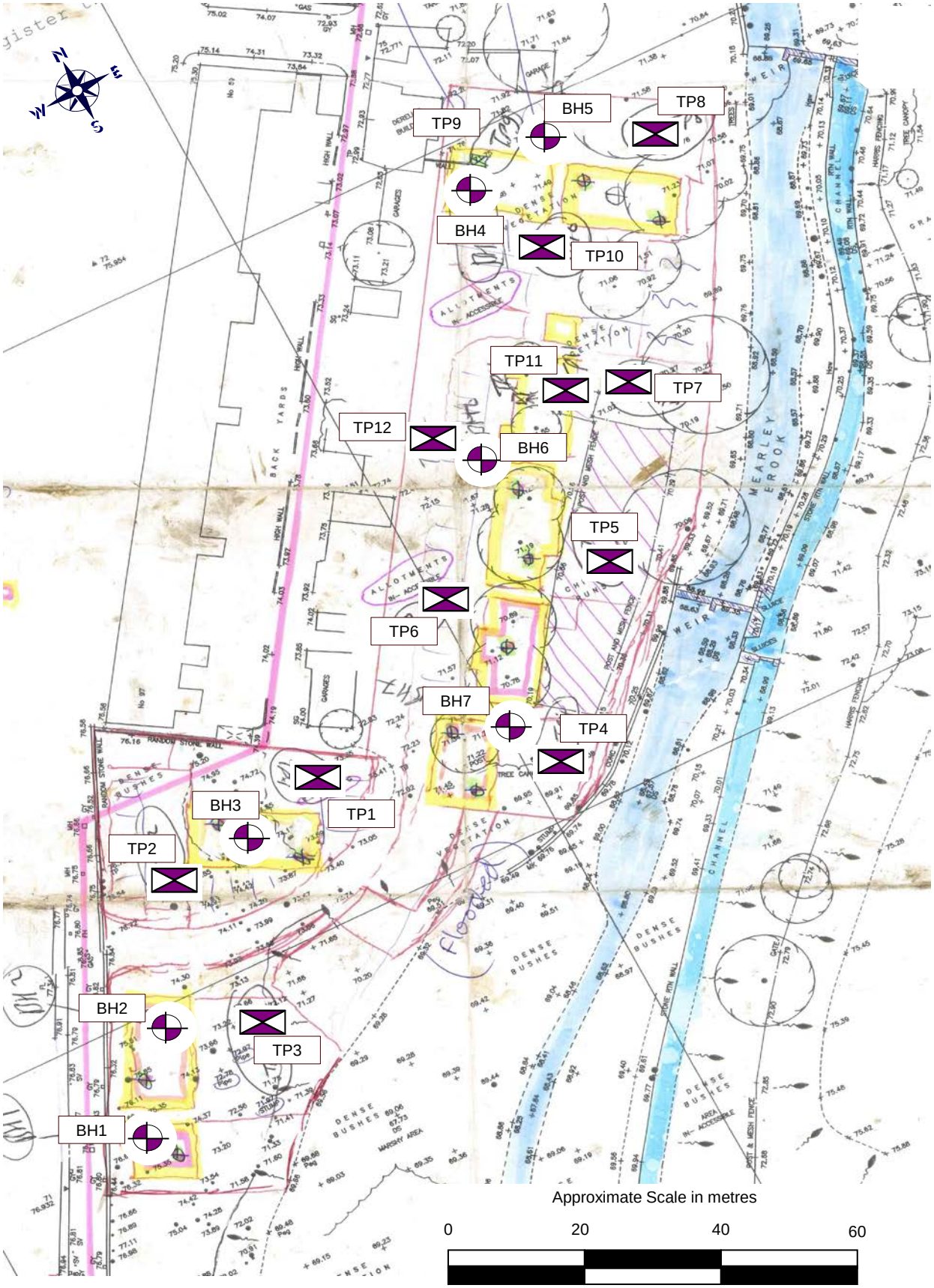
B(a)P / 0.15 - GEA experince indicates that Benzo(a) pyrene (one of the most common and most carcenogenic of the PAHs) rarely exceeds 15% of the total PAH concentration, hence this Total PAH threshold is regarded as being conservative

| | | |
|---|---|---|
| GEA Geotechnical & Environmental Associates | Widbury Barn<br>Widbury Hill<br>Ware<br>Herts SG12 7QE | **Site Plans** |

| | | |
|---|---|---|
| **Site** | Mearley Croft, Woone Lane, Clitheroe, Lancashire BB7 1BJ | **Job Number** J11218A |
| **Client** | Beck Developments Limited | **Sheet** 1 / 2 |
| **Engineer** | | |



| | | |
|---|---|---|
| GEA Geotechnical & Environmental Associates<br>Widbury Barn<br>Widbury Hill<br>Ware<br>Herts SG12 7QE | | **Site Plans** |
| **Site** | Mearley Croft, Woone Lane, Clitheroe, Lancashire BB7 1BJ | **Job Number** J11218A |
| **Client** | Beck Developments Limited | **Sheet** 2 / 2 |
| **Engineer** | | |



Geotechnical & Environmental Associates (GEA)
is an engineer-led and client-focused independent specialist providing a complete range of geotechnical and contaminated land investigation, analytical and consultancy services to the property and construction industries.

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