

GEOENVIRONMENTAL APPRAISAL

of land at

Alric Drive, Barnsley

Client: Yorkshire Housing.

REPORT NO. D3184/1

MARCH 2011

Written by	Checked by
KD	AIL



CONTENTS

1	INTRODUCTION.....	1
1.1	Scope of Investigation	1
2	SITE RECONNAISSANCE	1
2.1	General.....	1
2.2	Topography and Site Features.....	1
2.3	Evidence of Present and Former Land Use	1
3	PREVIOUS INVESTIGATION.....	1
4	SITE WORKS AND LABORATORY TESTING.....	3
4.1	Conceptual Site Model	3
4.2	Summary of Investigation	3
4.3	Chemical Testing.....	3
4.4	Geotechnical Testing.....	3
5	GROUND CONDITIONS & MATERIAL PROPERTIES	3
5.1	General.....	3
5.2	Topsoil	3
5.3	Made Ground.....	3
5.4	Natural Soils	4
5.5	Rock Head	4
5.6	Excavation Stability	4
5.7	Groundwater	4
5.8	Hydrocarbon Contamination.....	4
5.9	Concrete in Aggressive Ground	4
5.10	Soakaway Tests	4
6	CHEMICAL TESTING RESULTS.....	5
6.1	Selection of Chemical Testing.....	5
6.2	Generic Assessment Criteria for Inorganic Contamination	5
6.3	Topsoil	6
6.4	Made Ground (Inorganic Contaminants)	6
6.5	Organic Contamination	7
7	ASSESSMENT OF CONTAMINATION RISKS.....	8
7.1	Summary of Contamination Sources.....	8
7.2	Hazard Assessment	8
7.3	Preliminary Options Appraisal	8
7.4	Remediation Strategy	9
8	HAZARDOUS GAS.....	9
8.1	Hazard Identification	9
9	FOUNDATIONS AND GEOTECHNICAL ISSUES	10
9.1	Introduction	10
9.2	Mining	10
9.3	Foundations	10
9.4	Floor Slabs.....	11
9.5	Excavations	11
9.6	Road Pavement Design.....	11

APPENDICES

Appendix A - Drawings

Drawing Number	Drawing Title
D3184/01	Site Location Plan
D3184/02	Exploratory Hole Location Plan
D3184/03	Conceptual Site Model

Appendix B - Exploratory Hole Records

Appendix C - Chemical Testing Results

Appendix D - Geotechnical Testing Results (Including Soakaway Test Results)

Appendix E - Dunelm Conditions of Offer, Notes on Limitations & Basis for Contract

1 INTRODUCTION

1.1 Scope of Investigation

Dunelm Geotechnical and Environmental Limited (Dunelm) carried out a Geoenvironmental Appraisal of land at Alric Drive, Barnsley on behalf of Yorkshire Housing.

It is proposed to develop the site with residential properties.

A desk top study report has previously been undertaken. Reference should be made to this report for details of the site's history and environmental setting. A summary of the desk top study is given in Section 3 of this report.

The objectives of this exploratory phase of investigation were as follows:

- To assess risks from ground contamination
- To provide recommendations for foundations

Conditions of offer and notes on limitations relevant to all Dunelm geoenvironmental investigations are described in Appendix E and should be read in conjunction with this report.

2 SITE RECONNAISSANCE

2.1 General

The centre of the site is located at OS Grid Ref 436720, 405720. The site is situated approximately 3km east of Barnsley town centre. The site location is shown in Drawing Number D318401 in Appendix A to this report.

2.2 Topography and Site Features

The site gently slopes in the northern area of the site. The southern perimeter of the site is formed by a steep slope.

The site boundaries currently comprise timber fences to around the whole perimeter.

No trees were noted on site.

2.3 Evidence of Present and Former Land Use

The site is presently disused and is covered mainly by rough grass. The site also comprises a tarmac covered area (previous road).

Fly tipped waste including, glass, cans, plastic, timber, brick and topsoil was noted in the southeast of the site.

3 PREVIOUS INVESTIGATION

Dunelm have examined the following reports: Desk Top Study Report – Alric Drive, Barnsley produced by Arc Environmental dated November 2010. A summary of the works undertaken is shown in the Table below together with the main findings.

Item	Main Findings
Site History	• 1854: Site undeveloped. • 1906: Sewerage farm located to the south of the site. • 1931: Site occupied by residential housing. Expansion of sewerage farm, now located directly south of the site. • 1961: Sewerage farm no longer shown. • 1994: Houses on site demolished. • 2010: No significant change.
Geology and Mining	• No drift deposits were recorded for the majority of the site with possible alluvial soils located in the very south of the site. • The solid geology underlying the site comprises Coal measures Strata • The site is underlain by workings in 10 seams at depths between 140m and 590m. • Site underlain by Oaks Rock sandstone unit. • Shallowest seam beneath the site: Swinton Pottery seam. • Swinton Pottery seam thought to lie within mudstone strata 7m below Oaks Rock Unit. • Further investigation required to determine the depth of the Swinton pottery seam.
Hydrology and Hydrogeology	• The nearest surface water feature is the River Dearne located 61m south of the site. • Site underlain by a Secondary A Aquifer. • The site does not lie within a source protection zone. • No surface abstractions within 1000m of the site. • There is a recorded groundwater abstraction located 254m southeast of the site. Water is abstracted for general washing from a well. • No discharge consents within 150m of the site. • Nearest recorded pollution incident located 24m southeast of the site, recorded as a minor incident relating to rubbish from a domestic property.
Hazardous Gas Sources	No radon protection measures required. There are a number of recorded landfill sites located within 1000m of the site as noted below: • Landfill located 2m southeast of site – no available information. • Landfill located 31m southeast of the site dating between 31.05.1985-15.05.1992, authorised wastes include inert and commercial. • Landfill located 98m southeast of the site dated 1st July 1985. Authorised wastes include: construction, demolition, excavated natural arisings, hardcore and rubble. • Landfill located 194m southeast of the site dating between 31.05.1985-15.05.1992, authorised wastes: inert waste. • Landfill located 210m south of the site dated 1st November 1977. Authorised wastes include nepheline syenite, refractory linings, bricks, sand, slag, boiler/flue cleanings. • Landfill located 217m southeast of the sit - no available information,

Further inspection has been made of the geological plans and has indicated that the site is underlain by the Oaks Rock sandstone unit which is shown to vary in thickness between 10m and 30m on the geological vertical section. The coal seams present beneath the Oaks Rock are the Swinton Pottery and the Newhill seam. The Swinton Pottery is recorded as thin and is therefore unlikely to have been worked; the seam is also anticipated to have over 10m of rock cover present above it. The Newhill seam is located over 800m west of the site and dips east beneath the site. Using information from the geological plan the Newhill seam is anticipated to lie at depths in excess of 50m bgl and therefore, should this seam have been worked then adequate rock cover would also be present.

4 SITE WORKS AND LABORATORY TESTING

4.1 Conceptual Site Model

A preliminary conceptual site model, including an assessment of potential pollutant linkages, has been determined based on the desk study information presented above.

The site has been occupied previously and it is possible that contamination is present associated with the site's previous use as housing however no specific contaminants have been identified. It is therefore recommended that the following suite of testing is adopted during the investigation:

- Heavy metals
- Poly Aromatic Hydrocarbons (PAH)
- pH and sulphate

The main receptors include future site residents, the underlying Minor Aquifer and the nearby River Dearne.

4.2 Summary of Investigation

The exploratory holes listed below were advanced during February 2011. Records for each of the exploratory holes noted are included in Appendix B and the locations are shown on Drawing Number D3184/02 in Appendix A.

- Trial pits TP1 to TP14
- Mini percussion boreholes MBH1 to MBH12
- Soakaway tests in MBH2, MBH4, MBH5 and MBH7

4.3 Chemical Testing

Appropriate samples were delivered to a suitably accredited laboratory with a schedule of testing drawn up by Dunelm. The laboratory test results are presented in Appendix C to this report and discussed in Section 6.

4.4 Geotechnical Testing

Samples of natural soil were delivered to a geotechnical laboratory with a schedule of testing drawn up by Dunelm. The geotechnical laboratory test results are presented in Appendix D to this report. Material properties assessed using the results are considered further in the following Section.

5 GROUND CONDITIONS & MATERIAL PROPERTIES

5.1 General

Strata encountered were generally similar beneath all parts of the site. Ground conditions are described in the following sections.

5.2 Topsoil

Topsoil ranging between 0.10m and 0.45m in thickness was recorded across the site. The topsoil contained occasional fragments of glass.

5.3 Made Ground

Made ground was encountered across the majority of the site and extended to depths between 0.4m and 1.3m bgl. The made ground generally consisted of sandy gravelly clay including occasional ash, brick, concrete and tile. The made ground contained a small proportion of metal, glass, plastic and timber. Localised granular materials were also recorded on site.

A buried obstruction consisting of tarmac was recorded within TP1 at 0.7m bgl.

5.4 Natural Soils

Drift deposits were encountered across the majority of the site and comprised firm and stiff sandy gravelly clays extending to depths between 1.0m and 3.4m bgl. The clay was noted to be locally soft within TP8 to a depth of 1.7m bgl.

SPT testing within the clays recorded 'N' values between 8 and 33 confirming the generally firm and stiff nature of the clay.

Moisture content testing within the clays recorded values between 10% and 19% with plasticity values ranging from 20 to 22 indicating low to intermediate plasticity clay with medium volume change potential.

5.5 Rock Head

Although not proved by coring, sandstone rock head was encountered within the majority of trial pits at depths of between 0.4m and 2.7m. Suspected sandstone was recorded within a small number of the mini boreholes at depths between 1.0m and 3.1m with SPT refusal recorded within the rest of the boreholes at depths between 2.16m and 3.35m bgl which may indicate the presence of rock.

5.6 Excavation Stability

During excavation of the trial pits, the side walls were observed to be generally stable with localised instability noted within granular deposits.

5.7 Groundwater

Groundwater was not encountered during this investigation. Subsequent groundwater monitoring is currently being undertaken and will be issued as an addendum.

5.8 Hydrocarbon Contamination

No visual or olfactory evidence of hydrocarbon contamination was noted during the investigation.

5.9 Concrete in Aggressive Ground

To enable buried concrete to be designed to resist sulfate attack, samples of made ground and natural strata from depths corresponding to the anticipated foundation depth have been tested for water-soluble sulfate and pH.

The maximum water-soluble sulfate concentration is 210mg/l and the lowest recorded pH value is 6.7.

Based on the above results, Design Sulfate Class DS-1 and ACEC Classification AC-1 would be appropriate for buried concrete at the site.

5.10 Soakaway Tests

Soakaway tests have been carried out in MBH2, MBH4, MBH5 and MBH7. The test results are presented in Appendix D.

Three of the soakaway tests were undertaken within clays recording a maximum water level drop of 0.03m within a three hour period, soakaways within the clay are not considered appropriate for the proposed development.

One of the soakaway tests was undertaken within the weathered sandstone rock and recorded a maximum water level drop of 0.1m within a three hour period. Although the soakaway test failed within the sandstone an assumed permeability in the order of 10^{-6} m/s may be considered for the weathered sandstone.

6 CHEMICAL TESTING RESULTS

6.1 Selection of Chemical Testing

This section represents the 'Hazard Identification' process required in accordance with CLR11.

Contaminants identified in association with the former site uses have been discussed in Section 4.1.

Laboratory test certificates are presented in Appendix C to this report. The test results are presented in the following sections.

6.2 Generic Assessment Criteria for Inorganic Contamination

Generic Assessment Criteria (GAC) appropriate to current UK practice for the assessment of inorganic contamination are shown in the table below. These criteria are dependent on the nature of the proposed development. In addition, some contaminants depend on other soil parameters as shown.

Generic Assessment Criteria for Human Health

<i>All values in mg/kg</i>	Residential	Residential without homegrown produce	Commercial	Allotments
Arsenic (inorganic)	32	35	640	43
Cadmium	10	83.6	230	1.8
Chromium	14.7	38.1	330	
Copper	4020	8370	1.09E+05	
Lead	168	235	5370	
Mercury	170	-	3600	80
Nickel	130	130	1,800	230
Selenium	350	595	13,000	120
Zinc	17200	46800	9.17E+05	

Soil Screening Values in *italic* are from Atkins ATRISKSOIL database, all other figures are Environment Agency Soil Guideline Values

Generic Assessment Criteria for Phytotoxic Effects on Plants

Contaminant	Maximum Permissible Concentration from MAFF <i>The Soil Code</i> (1998) (mg/kg)
Copper (soil pH 5.0-5.5)	80
Copper (soil pH 5.5-6.0)	100
Copper (soil pH 6.0-7.0)	135
Copper (soil pH >7.0 & CaCO ₃ > 5%)	200
Zinc (soil pH 5.0-7.0)	200
Zinc (soil pH >7.0 & CaCO ₃ > 5%)	300

6.3 Topsoil

A summary of the results of inorganic testing on topsoil samples is shown in the table below.

Inorganic Test Results - Topsoil

Contaminant	Units	No. of topsoil samples tested	No. of samples exceeding GAC	Generic Assessment Criteria	Max concentration
pH	-	3	0	<5	7.9
Arsenic	mg/kg	3	0	32	17
Cadmium	mg/kg	3	0	10	1.1
Chromium (Total)	mg/kg	3	0	14.7	72
Chromium (VI)	mg/kg	3	0	14.7	<1
Lead	mg/kg	3	0	168	84
Mercury	mg/kg	3	0	170	0.15
Nickel	mg/kg	3	0	130	22
Selenium	mg/kg	3	0	350	<0.5
Copper (GAC from MAFF)	mg/kg	3	1	135	210
Zinc (GAC from MAFF)	mg/kg	3	1	200	250

* The values in the Atkins ATRISKSOIL database

An initial assessment based on the above results indicated that the topsoil contained elevated concentrations of total chromium in all the samples.

DEFRA Publication *Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans – Chromium* (2002) states (section 5.18) that:

'it is expected that much of the chromium present in the soil will be as Cr(III) rather than Cr(VI). Therefore, in applying this health criteria value to land contamination it is important to obtain information on the oxidation state of chromium in the soil'. The report also notes that it can be difficult to determine whether chromium present in the soil will be as Cr(III) rather than Cr(VI).

Additional testing has been carried out on all samples to determine the concentration of chromium VI. The results show that no concentrations of chromium (VI) in excess of the detection limit (1 mg/kg) were recorded. It is therefore concluded that the total chromium concentration determined for the soil is likely to represent chromium III.

The above DEFRA report also notes that the Cr(VI) fraction in samples from the ambient environment (eg topsoil from undeveloped land as for this site) is generally less than that in the industrial environment. Given all of the above it is not considered that a significant risk exists in relation to chromium contamination in the topsoil.

One of the topsoil samples recorded elevated copper and zinc above the plant growth threshold. The levels recorded fall below the human health threshold but may pose a risk to zinc and copper sensitive plant species.

6.4 Made Ground (Inorganic Contaminants)

A summary of the results of inorganic testing on made ground samples is shown in the table below.

Inorganic Test Results – Made Ground

Contaminant	Units	No. of made ground samples tested	No. of samples exceeding GAC	Generic Assessment Criteria	Max concentration
pH	-	5	0	<5	7.6
Arsenic	mg/kg	5	0	32	27
Cadmium	mg/kg	5	0	10	1.5
Chromium (VI)	mg/kg	5	0	14.7	<1
Lead	mg/kg	5	0	168	160
Mercury	mg/kg	5	0	170	0.34
Nickel	mg/kg	5	0	130	44
Selenium	mg/kg	5	0	350	0.7
Copper	mg/kg	5	0	109000	65
Zinc	mg/kg	5	0	917000	400

All values from Atkins ATRISKSOIL database

All samples tested fall below the relevant guideline values.

6.5 Organic Contamination

The selection of hydrocarbon (organic) testing was based on the conceptual model and the assessment of potential contamination sources presented in earlier sections of this report.

Samples of topsoil and made ground were tested for selected polynuclear aromatic hydrocarbon (PAH) compounds.

An assessment of selected PAH compounds is shown in the following table together with Generic Assessment Criteria (GAC) from the LQM guidance.

Summary of Results for Polynuclear Aromatic Hydrocarbons

Contaminant	Generic Assessment Criteria (mg/kg)			No. of samples tested	No. of samples with value greater than GAC	Max concentration mg/kg	Comments
	Resi with plant uptake	Allot ments	Comm / Industrial				
Acenaphthene	210	34	85000	5	0	1.6	
Anthracene	2300	380	530000	5	0	6.6	
Benz(a)anthracene	3.1	2.5	90	5	2	17	MBH3-0.1m, TP10-0.1m
Benzo(a)pyrene	0.83	0.6	14	5	3	16	MBH3-0.1m, TP9-0.4m, TP10-0.1m
Benzo(b)fluoranthene	5.6	3.5	100	5	0	11	TP10-0.1m
Benzo(g,h,i)perylene	44	70	650	5	0	8.2	
Benzo(k)fluoranthene	8.5	6.8	140	5	0	6	
Chrysene	6.0	2.6	140	5	0	17	TP10-0.1m
Dibenz(a,h)anthracene	0.76	0.76	13	5	0	1.3	TP10-0.1m
Fluoranthene	260	52	23000	5	0	37	
Fluorene	160	27	64000	5	0	2.5	
Indeno(1,2,3,-cd)pyrene	3.2	1.8	60	5	0	8.4	TP10-0.1m
Napthalene	1.5	4.1	200	5	0	0.4	
Pyrene	560	110	5400	5	0	29	

All values from LQM/CIEH Generic Assessment Criteria 2nd Edition. Threshold based on 1% SOM

Results indicate a number of elevated PAH compounds in MBH3, TP9 and particularly in TP10 at 0.1m.

7 ASSESSMENT OF CONTAMINATION RISKS

7.1 Summary of Contamination Sources

Topsoil

Topsoil ranging between 0.10m and 0.45m in thickness was recorded across site. Limited testing has indicated that this material does not contain elevated concentrations of inorganic determinands compared to human health guideline values however, the topsoil has recorded copper and zinc in excess of the plant growth threshold values. The topsoil has also recorded elevated PAH compounds in two of the samples.

Made Ground

Made ground was encountered across the majority of the site and extended to depths between 0.4m and 1.3m bgl.

Testing has indicated that this made ground does not contain elevated concentrations of inorganic contaminants however, one sample contained elevated benz(a)anthracene and benzo(a)pyrene.

7.2 Hazard Assessment

The results of the 'Hazard Identification' process for significant sources of contamination in accordance with CLR11 are summarised above. The following section describes the results of the 'Hazard Assessment' process in which unacceptable risks are identified. Pathways and receptors are considered below. Contamination sources and pollutant linkages are shown in the revised Conceptual Site Model presented as Drawing No. D3184/03 in Appendix A.

Pathways

The proposed end use of the development is residential. Potential contaminant pathways to humans therefore include:

- ingestion of soil (outdoors) / dust (indoors)
- skin contact with soil (outdoors) / dust (indoors)
- inhalation of dust (outdoors and indoors)
- consumption of vegetables & soil attached to vegetables
- contamination via buried water pipes

Drift deposits comprising clay were recorded across the majority of the site which provide a relatively impermeable barrier between the made ground and the underlying secondary aquifer. As no significant contamination has been encountered, and in view of the lack of groundwater abstractions it is considered that there is no significant risk to controlled water receptors beneath the site.

Receptors

Significant potential receptors are as follows:

- end users of the site (residents)
- plants in gardens / landscaped areas

Transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures and consequently this receptor group has not been considered further.

Based on the revised Conceptual Site Model, unacceptable risks have been identified and further action will be required as discussed in the following section.

7.3 Preliminary Options Appraisal

This section identifies feasible remediation options for each relevant pollutant linkage; it does not represent a detailed evaluation of all possible remedial options. In practice, as noted in CLR11, "there may be a number of ways to reduce or control unacceptable risks, all of which have advantages and limitations in particular cases".

Topsoil

The topsoil samples tested did not record elevated concentrations of inorganic determinands compared to human health thresholds however, did contain elevated concentrations of a number of PAH compounds as well as fragments of glass. In view of these results the topsoil is currently not suitable for re-use within garden and landscaped areas. The topsoil should therefore be removed from site, buried or subject to bioremediation to reduce the concentrations of PAH and screening.

The topsoil also contains plant sensitive zinc and copper. The elevated results were recorded in one sample and may not be representative of the topsoil as a whole. If the topsoil is to be re-used it is recommended that further testing is undertaken to determine if these levels are present across the site.

Made Ground

The made ground samples tested did not record elevated concentrations of inorganic determinands however, did contain elevated concentrations of a number of PAH compounds. In view of the results the made ground is currently not suitable as a near surface material and will require a capping layer within proposed garden and landscaped areas.

Where made ground is to remain on site it is recommended that a cover system should be placed in order to break pathways between the contamination source and future site users. This cover layer should be placed over proposed garden and soft landscaped areas, and other parts of the site that will not be covered by buildings, roads, or hardstanding.

The cover layer should comprise 450mm clean subsoil and 150mm clean topsoil. A no dig layer is recommended at the base of the cover layer in order to limit future excavation into the underlying material; this layer could be sourced from suitable site derived granular material or alternatively could be formed using a geotextile.

An alternative strategy would be to consider bioremediation to reduce the concentrations of PAH within the made ground.

It is recommended that further advice be sought from all statutory service bodies with respect to the ground conditions within which they will lay services.

7.4 Remediation Strategy

A Remediation Strategy may be required by the regulatory authorities prior to site redevelopment. The Remediation Strategy document would describe the objectives of the proposed remedial works; a Method Statement is normally required from the Contractor undertaking the works, describing how these objectives are to be met. Validation of the remediation works should be undertaken by a suitably qualified engineer.

8 HAZARDOUS GAS

8.1 Hazard Identification

Desk study information has indicated that the site could be affected by potential sources of gas including landfills within 250m of the site.

Given the above, gas monitoring wells were installed in three boreholes during the fieldwork. Details of the monitoring installations are shown on the exploratory hole records in Appendix B.

Once the monitoring period is complete, the complete set of monitoring results will be provided together with a gas risk assessment report with recommendations for gas protection measures for new structures. It is essential that the monitoring wells are protected from damage during re-development works such as site clearance or demolition.

9 FOUNDATIONS AND GEOTECHNICAL ISSUES

9.1 Introduction

The proposed development is understood to consist of residential properties.

Ground conditions encountered during this investigation comprised topsoil overlying made ground to a maximum depth of 1.3m bgl. The underlying natural ground consisted of firm and stiff clays with sandstone rock encountered at depths of between 0.4m and 3.1m.

9.2 Mining

No evidence has been found to indicate that the site is underlain by coal workings at shallow depth.

No evidence has been found to indicate that the site has been affected by quarrying.

9.3 Slopes

An assessment of slope stability was outside the scope of this report, however this issue should be considered once development proposals are finalised.

In addition, the developer should ensure that the slope stability is not compromised during development. Drainage should be sealed and routed away from the slope in order to prevent softening of the adjacent ground with associated instability. In addition, consideration should be given to planting of bushes (typically hawthorn) along the slope to prevent near surface slippages.

9.4 Foundations

Due to the heterogeneous nature of the made ground, unacceptable total and differential settlements may occur if foundations are placed on made ground. Therefore, foundations should be taken through made ground onto underlying natural ground of adequate bearing capacity.

It is considered that strip foundations should be suitable for the proposed structures.

Based on the visual description and laboratory testing, a safe bearing capacity of 100kN/m² has been determined for strip foundations 0.6m wide founding on the natural firm clays at depths of around 1.0m bgl. At this width of foundation and bearing pressure settlements should be less than 25mm.

Based on plasticity index results, all cohesive soils at the site should be regarded as being of medium volume change potential. Foundations should therefore be placed at a minimum depth of 0.9m below original or finished ground level, whichever is the lower.

Foundations near existing or proposed trees should be deepened and provided with appropriate heave precautions in accordance with NHBC Standards Chapter 4.2.

Parts of the site are underlain by rock at relatively shallow depth. Where rock is encountered at foundation level, consideration should be given to placing the whole of the foundation on rock in order to avoid the possibility of differential settlement; this may necessitate overdeepening of foundations.

Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.

Foundations should be taken below a line drawn up at 45° from the base of existing or proposed services or foundations.

It should be recognised that clay rich soils can deteriorate fairly rapidly on exposure, particularly in periods of wet weather and frost. It would be prudent to protect all exposed soils in foundation excavations with a concrete blinding layer, particularly if they are likely to remain open for extended period of time.

Prior to placing foundation concrete, obvious soft or loose spots should be removed and replaced with suitably recompacted hardcore or lean mix concrete. In addition, all excavations should be inspected to ensure that they fully penetrate areas of disturbed ground.

Sub-surface concrete should be Design Sulphate Class DS-1, with the site allocated an ACEC Classification of AC-1.

Further advice should be sought from Dunelm if unexpected ground conditions are encountered during redevelopment.

9.5 Floor Slabs

In accordance with NHBC guidelines, suspended floor slabs should be adopted where made ground exceeds 0.6m in thickness.

9.6 Excavations

Observations made during the fieldwork indicate that no significant groundwater flows would be anticipated in shallow excavations. However, the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities. Therefore, water levels significantly higher than those found during this investigation may be encountered.

Stability of pit sides during excavation was generally poor within granular material and shallow excavations within granular deposits are likely to require shoring. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97.

It is recommended that an adequate drainage system for surface water be installed by a competent contractor in order to prevent surface water ponding or collecting during and post construction, which may in turn lead to deterioration of the founding stratum.

Rock was encountered at depths from 1m and it is therefore likely that excavation to depths greater than this prove difficult in some areas.

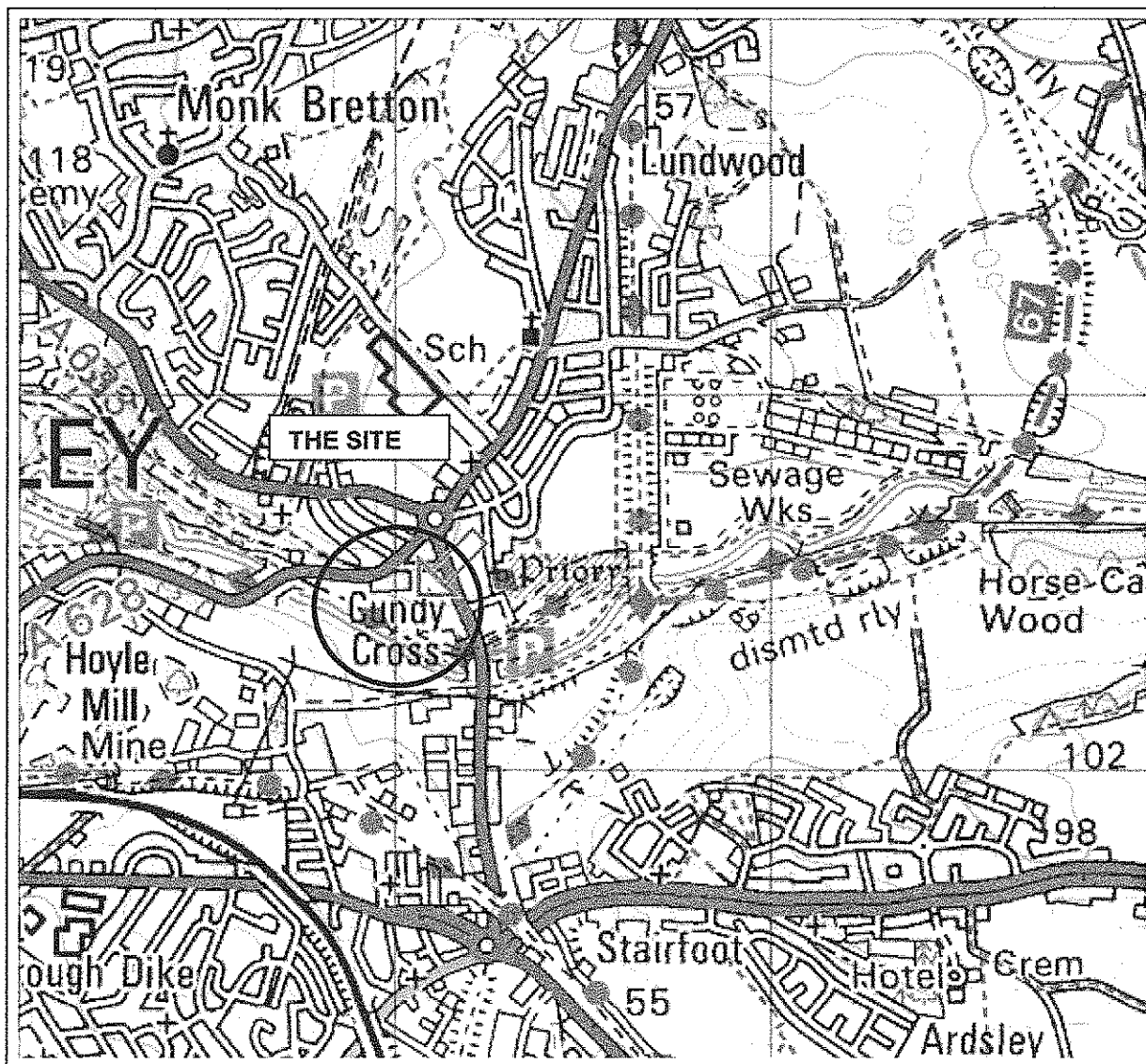
9.7 Road Pavement Design

A CBR value of 3% should be assumed for highway construction within natural firm clays. This is based on visual inspection and the results of plasticity index testing.

Where the granular made ground is re-engineered it is considered that a CBR value of 5% should be achievable, however, this should be verified by insitu CBR testing on site and confirmed with the adopting authority. Where cohesive made ground is present a CBR value of <2% should be assumed.

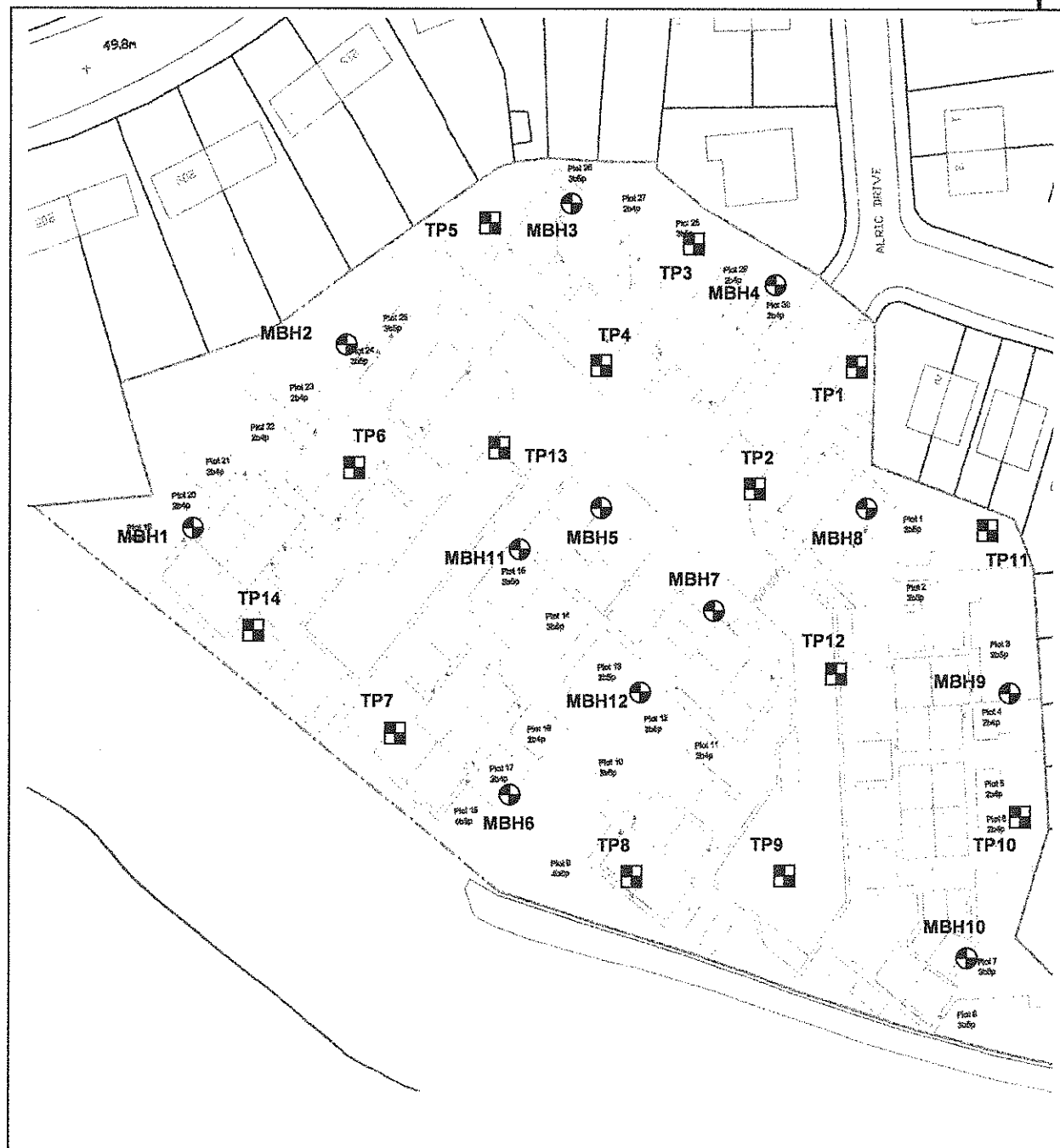
Appendix A

Drawings



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	Contract: Alric Drive, Barnsley			Contract No: D3184
	Client: Yorkshire Housing			
TEL: 0191 378 3151 FAX: 0191 378 3157	Drawing Title: Site Location Plan			
Drawing No: D3184/01	Date: February 2011	Scale: NTS	Status: Final	Drawn by: KD



Contract:
Alric Drive, Barnsley

Contract No:
D3184

Client:
Yorkshire Housing

TEL: 0191 378 3151
FAX: 0191 378 3157

Drawing Title:
Exploratory Hole Location Plan

Drawing No:
D3184/02

Date:
March 2011

Scale:
NTS

Status:
Final

Drawn by:
KD

West

Site boundary



East

Site boundary

Topsoil and Made Ground

Firm and Stiff Clays

Coal Measures Strata

Potential Contamination linkages:

A – Ingestion / Inhalation / Dermal contact of determinants within made ground

B – Gas emissions migrating from off site. Eg: surrounding landfills and made ground.



Contract:
Ailric Drive, Barnsley

Client:
Yorkshire Housing

Drawing Title:
Conceptual Site Model

TEL: 0191 3783151
FAX: 0191 3783157

Date:
March 2011

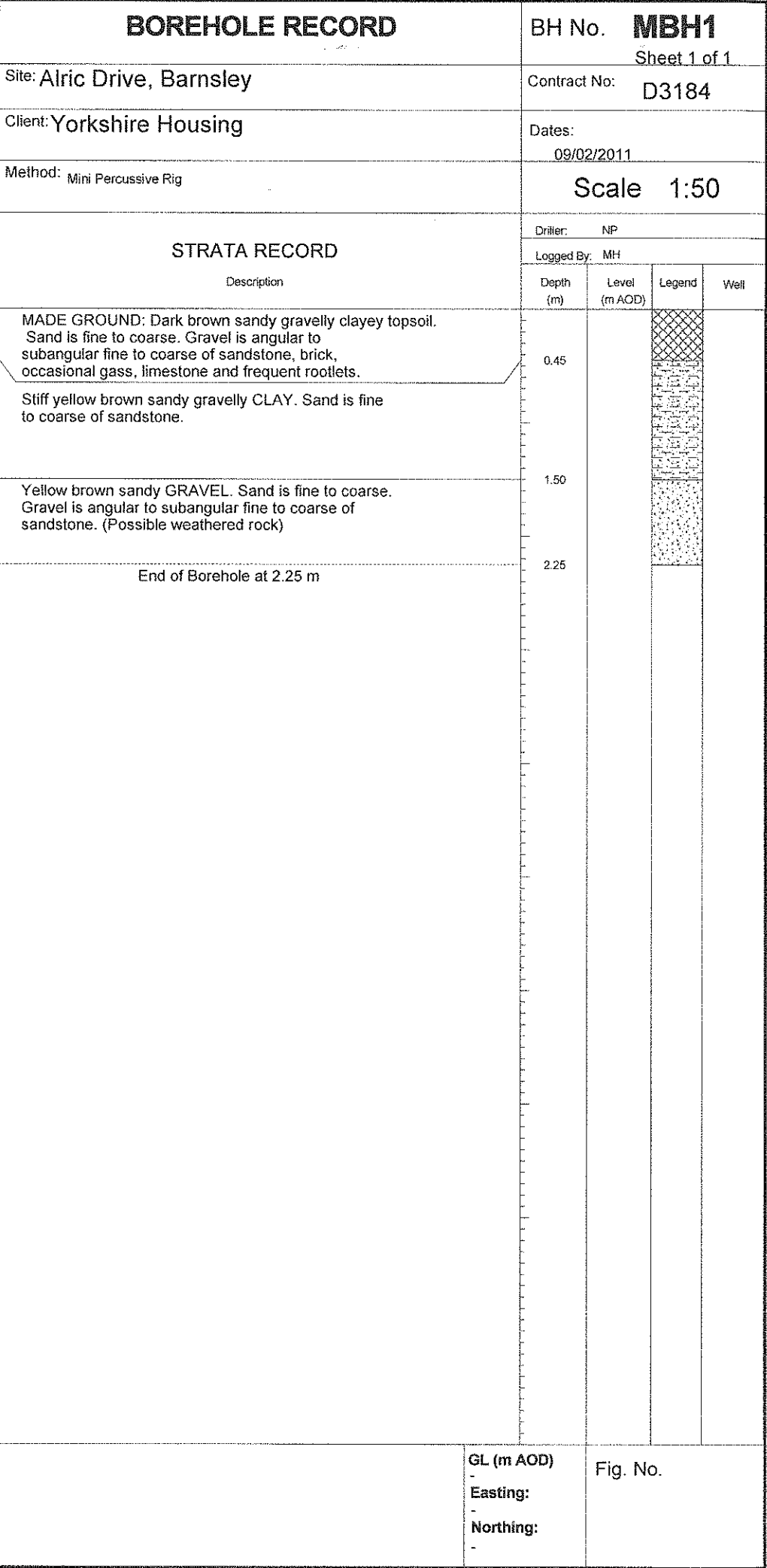
Scale:
NTS

Status:
Prelim

Drawn by:
KD

Drawing No:
D3184/03

Appendix B
Exploratory Hole Records





BOREHOLE RECORD

BH No. **MBH2**
Sheet 1 of 1

Site: Alric Drive, Barnsley

Contract No: **D3184**

Client: Yorkshire Housing

Dates:
09/02/2011

Method: Mini Percussive Rig

Scale 1:50

SAMPLE DETAILS

STRATA RECORD

Driller: NP

Logged By: MH

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
D	0.10			MADE GROUND. Dark brown clayey sandy gravelly topsoil.				
J	0.20			Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, glass, brick and occasional plastic.	0.45			
D	0.70			Firm yellow brown slightly sandy very gravelly CLAY.				
			1	Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone.	1.00			
D	1.20 - 1.65	N=19		Yellow brown sandy GRAVEL. Sand is fine to coarse.				
D	1.50	(5,5,4,5,5,5)		Gravel is angular to subrounded fine to coarse of sandstone. (Possible weathered rock).				
D	1.80	40/85mm						
		Abandoned	2	End of Borehole at 2.00 m	2.00			
			3					
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

1. No groundwater encountered.

GL (m AOD)

Easting:

Northing:

Fig. No.





BOREHOLE RECORD

BH No. **MBH4**
 Sheet 1 of 1
 Contract No: **D3184**
 Dates: **09/02/2011**
 Scale **1:50**

Site: **Alric Drive, Barnsley**

Client: **Yorkshire Housing**

Method: **Mini Percussive Rig**

SAMPLE DETAILS

STRATA RECORD

Type Depth From - To(m) N (cu)

J 0.10
 J 0.30
 D 0.50 - 0.95
 J 0.65
 D 1.20 - 1.65
 D 1.40
 D 1.75
 D 2.00 - 2.39

N=17
 (9,5,3,4,5
 .5)

N=11
 (2,3,2,3,3
 .3)

52/235mm
 (3,4,7,9,1
 1,25)

Groundwater
 (Casing)

Description

MADE GROUND: Dark brown very sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, coal, glass, sandstone and limestone.

MADE GROUND: Brown slightly clayey sand and gravel. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, ash, coal, clinker, mudstone, occasional plastic and glass.

MADE GROUND: Yellow brown cobble of sandstone.

MADE GROUND: Black dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of ash, coal, clinker, brick, sandstone and mudstone.

Firm yellow brown mottled grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone.

Stiff yellow sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone.

Becoming very stiff from 2.20m

End of Borehole at 2.25 m

Driller: **NP**

Logged By: **MH**

Depth (m)

Level (m AOD)

Legend

Well

0.20

0.50

0.55

1.10

1.55

2.25

Remarks and Water Observations

1. No groundwater encountered.
2. Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

Easting:

Northing:

Fig. No.



BOREHOLE RECORD

BH No. **MBH5**
 Sheet 1 of 1
 Contract No: **D3184**
 Dates: **09/02/2011**
 Scale **1:50**

Site: **Alric Drive, Barnsley**
 Client: **Yorkshire Housing**
 Method: **Mini Percussive Rig**

SAMPLE DETAILS

STRATA RECORD

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
J	0.10			MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse with ash. Gravel is angular to subangular fine to coarse of sandstone, mudstone, limestone, coal, brick.	0.35			
B	0.55			MADE GROUND: Dark brown-brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, mudstone and occasional brick.	0.95			
B	1.10							
D	1.20 - 1.65	N=24 (3,4,4,6,7,7)	1					
B	1.40							
B	1.60			Stiff light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone.				
D	2.00 - 2.45	N=33 (4,4,7,7,9,10)	2	Very stiff from 1.5m.				
B	2.50							
D	3.00 - 3.45	53/235mm (4,4,5,8,15,25)	3					
				End of Borehole at 3.40 m	3.40			
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

1. No groundwater encountered.
2. Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

Easting:

Northing:

Fig. No.



BOREHOLE RECORD

BH No. **MBH6**
Sheet 1 of 1

Site: Alric Drive, Barnsley

Contract No: **D3184**

Client: Yorkshire Housing

Dates:
10/02/2011

Method: Mini Percussive Rig

Scale 1:50

SAMPLE DETAILS

STRATA RECORD

Driller: NP

Logged By: MH

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
J	0.20			MADE GROUND. Dark brown clayey sandy gravelly topsoil. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, sandstone, coal, tarmac and clinker. (Rootlets noted).	0.15			
J	0.50							
D	1.00		1	MADE GROUND. Dark brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone, brick, coal and concrete.	1.20			
D	1.20 - 1.65	N=14 (5,5,3,4,3,4)						
D	1.50			Firm yellow brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of sandstone and occasional coal.	1.80			
D	1.80 - 2.25	61/235mm (5,6,8,9,19,25)	2					
	1.80			Stiff yellow brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone.	2.25			
				End of Borehole at 2.25 m				
			3					
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

1. No groundwater encountered.
2. Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

Easting:

Northing:

Fig. No.



BOREHOLE RECORD

BH No. **MBH7**
Sheet 1 of 1

Site: Alric Drive, Barnsley

Contract No: **D3184**

Client: Yorkshire Housing

Dates:
10/02/2011

Method: Mini Percussion Rig

Scale 1:50

SAMPLE DETAILS

STRATA RECORD

Driller: NP

Logged By: MH

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
D	0.20			MADE GROUND. Dark brown clayey sandy gravelly topsoil. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, sandstone and coal. Rootlets noted.	0.25			
D	0.50							
D	1.00			MADE GROUND. Light brown yellow brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone, brick, sandstone and occasional glass.	0.80			
D	1.20 - 1.65	N=15 (2,3,3,4,4,4)	1		1.10			
D	1.50			MADE GROUND. Dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and limestone. Occasional glass noted.				
D	2.00 - 2.45	N=31 (4,7,7,8,7,9)	2	Firm yellow brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and coal.	2.00			
D	2.50							
D	2.80 - 3.25	59/238mm (9,9,9,11,14,25)	3	Stiff yellow very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and occasional coal.	3.25			
				End of Borehole at 3.25 m				
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

1. No groundwater encountered.
2. Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

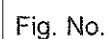
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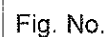
-

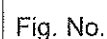
Northing:

-

Fig. No.









BOREHOLE RECORD

BH No. **MBH11**

Sheet 1 of 1

Site: Alric Drive, Barnsley

Contract No: **D3184**

Client: Yorkshire Housing

Dates:
10/02/2011

Method: Mini Percussive Rig

Scale 1:50

SAMPLE DETAILS

STRATA RECORD

Driller: NP

Logged By: MH

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
D	0.20			MADE GROUND. Dark brown very sandy gravelly CLAY. Sand is fine to coarse with ash. Gravel is angular to subangular fine to coarse of sandstone and occasional coal.	0.30			
D	0.50				0.60			
D	1.00		1	MADE GROUND. Brown sandy gravelly CLAY. Sand is fine to coarse and contains occasional ash. Gravel is angular to subangular fine to coarse of brick, clinker, sandstone, limestone and occasional brick.	1.10			
D	1.20 - 1.65	N=15 (3,3,3,4,4,4)		MADE GROUND. Brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and occasional coal.				
D	1.80							
D	2.00 - 2.45	N=23 (5,4,5,6,6,6)	2	Firm light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and occasional coal. Becoming stiff at 1.8m.				
D	2.50							
D	3.00 - 3.45	63/235mm (6,6,9,11,18,25)	3	End of Borehole at 3.15 m	3.15			
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

- No groundwater encountered.
- Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

Easting:

Northing:

Fig. No.



BOREHOLE RECORD

BH No. **MBH12**

Sheet 1 of 1

Site: Alric Drive, Barnsley

Contract No: **D3184**

Client: Yorkshire Housing

Dates:
10/02/2011

Method: Mini Percussive Rig

Scale **1:50**

SAMPLE DETAILS

STRATA RECORD

Driller: NP

Logged By: MH

Type	Depth From - To(m)	N (cu)	Groundwater (Casing)	Description	Depth (m)	Level (m AOD)	Legend	Well
D	0.20			MADE GROUND. Dark brown slightly sandy very gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, glass, sandstone, concrete, limestone and occasional plastic.				
D	0.50				0.55			
D	1.00			Firm yellow brown very sandy slightly gravelly CLAY. Sand is fine to coarse. gravel is angular to subangular fine to coarse of sandstone and occasional coal.				
D	1.20 - 1.65	N=19 (3,4,3,4,6,6)	1					
D	1.80							
D	2.00 - 2.45	N=22 (4,5,6,5,5,6)	2					
D	2.50			Stiff dark brown slightly sandy very gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and coal.	2.40			
D	2.80				2.90			
D	3.00 - 3.45	49/235mm Abandoned	3	Stiff very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and occasional coal.	3.35			
				End of Borehole at 3.35 m				
			4					
			5					
			6					
			7					
			8					

Remarks and Water Observations

1. No groundwater encountered.
2. Borehole terminated due to SPT refusal on possible rock.

GL (m AOD)

Easting:

Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP1**
Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Groundwater

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Description	Depth (m)	Level (mAOD) PID (spn)	Legend	Well
B	0.10m		MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, sandstone, limestone, tile and concrete. Frequent rootlets noted.	0.15			
B	0.50m		MADE GROUND: Brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and plastic. Metal fragments and whole bricks noted.	0.70 0.75			
			MADE GROUND: Tarmac.				
			End of Trial Pit at 0.75 m				

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

Easting:

Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP2**
Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Groundwater

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Description	Depth (m)	Level (mAOD) PID (perm)	Legend	Well
B	0.10m		MADE GROUND: Dark sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick, glass and limestone. Occasional coal (frequent rootlets).	0.20			
B	0.40m		MADE GROUND: Brown very sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of concrete, brick, glass, occasional ash, sandstone, limestone, mudstone (rootlets) and coal.	0.60			
B	0.75m		MADE GROUND: Black/brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of ash, concrete, limestone, sandstone, coal and occasional brick.	0.90			
B	1.20m		Stiff light brown mottled grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone.				
B	2.10m						
			End of Trial Pit at 3.05 m	3.05			

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

Easting:

Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP3**

Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:

D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Groundwater	Description	Depth (m)	Level (mAOD) PID (depth)	Legend	Well
B	0.10m			MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and limestone. Occasional brick and rootlets noted.	0.30			
B	0.40m			MADE GROUND: Yellow brown sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of limestone.	0.60			
B	0.70m			MADE GROUND: Dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone and brick.	0.95			
B	1.20m			Soft brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is sub-angular fine to coarse of sandstone and limestone.	1.30			
B	1.50m			Stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone	2.20			
B	2.30m			Moderately weathered SANDSTONE recovered as brown sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse. End of Trial Pit at 2.30 m	2.30			

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP4**
 Sheet 1 of 1
 Contract No: **D3184**
 Dates: 10/02/2011
 Scale 1:25

Site : Alric Drive, Barnsley
 Client : Yorkshire Housing
 Method : JCB 3X

SAMPLE DETAILS			Groundwater	STRATA RECORD		Logged By: MH			
Type	Depth From - To(m)	Vane Results kN/m ²		Description	Depth (m)	Level (mAOD) PID (ppm)	Legend	Well	
B	0.10m			MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and mudstone. Frequent rootlets and glass.	0.15				
B	0.50m			MADE GROUND: Brown very sandy very gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick, occasional ash, clinker, tile and glass.					
					0.90				
B	1.50m			Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and occasional coal.					
					2.00				
				Yellow/light brown moderately weathered SANDSTONE recovered as sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.					
B	2.50m				2.60				
				End of Trial Pit at 2.60 m					

Remarks and Water Observations

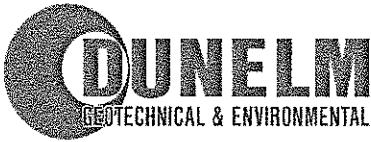
1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.

			TRIAL PIT RECORD		TP No. TP5 Sheet 1 of 1		
			Site : Alric Drive, Barnsley		Contract No: D3184		
			Client : Yorkshire Housing		Dates: 10/02/2011		
			Method : JCB 3X		Scale 1:25		
SAMPLE DETAILS			Groundwater	STRATA RECORD		Logged By: MH	
Type	Depth From - To(m)	Vane Results kN/m ²		Description	Depth (m)	Level (mAOD) PID (pdm)	Legend
B	0.05m		MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of sandstone, limestone and mudstone. Occasional brick (rootlets noted). MADE GROUND: Dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone and brick. Occasional glass noted. Brown clayey slightly gravelly SAND. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone. Occasional coal. Stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone (Possible completely weathered rock). Moderately weathered SANDSTONE recovered as brown slightly sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular. End of Trial Pit at 2.10 m	0.10			
B	0.20m			0.45			
B	0.60m			1.30			
B	1.50m			1.95			
B	2.00m			2.10			
Remarks and Water Observations				GL (m AOD)		Fig. No.	
1. No groundwater encountered. 2. Trial pit remained stable.				- Easting: - Northing: -			



TRIAL PIT RECORD

TP No. **TP6**
 Sheet 1 of 1
 Contract No: **D3184**
 Dates: 10/02/2011
 Scale 1:25

Site : Alric Drive, Barnsley
 Client : Yorkshire Housing
 Method : JCB 3X

SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m²
B	0.10m	
B	0.40m	
B	1.00m	
B	1.90m	

Groundwater

STRATA RECORD

Description

MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and limestone. Occasional brick (rootlets).

MADE GROUND: Brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and glass. Occasional ash, clinker and rootlets noted.

Brown clayey very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone (Possible highly weathered rock).

Light yellow brown moderately weathered SANDSTONE recovered as sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.

End of Trial Pit at 2.00 m

Logged By: MH

Depth (m)	Level (mAOD) PID (m)	Legend	Well
0.20			
0.50			
1.70			
2.00			

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP7**
Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m ²	Groundwater
B	0.10m		
B	0.30m		
B	1.50m		

STRATA RECORD

Description	Depth (m)	Level (mAOD) PID (psm)	Legend	Well
MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and limestone.	0.20			
MADE GROUND: Dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, mudstone and glass. Occasional ash. Occasional metal fragments and rootlets.	0.40			
Yellow brown highly weathered SANDSTONE recovered as slightly sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.				
End of Trial Pit at 2.20 m	2.20			

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit unstable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP8**
Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Groundwater

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Description	Depth (m)	Level (mAOD) PID (cm)	Legend	Well
B	0.10m		MADE GROUND: Dark brown sandy clayey gravelly topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and rootlets. Occasional glass.	0.15			
B	0.30m		MADE GROUND: Dark brown slightly clayey very sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone, brick, ash, clinker and wooden fragments.	0.55			
B	0.75m		MADE GROUND: Dark brown very sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and mudstone. Occasional ash, cloth and metal fragments noted.	0.90			
B	1.50m		Soft very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone.	1.70			
B	2.00m		Yellow brown highly weathered SANDSTONE recovered as sand and gravel. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of sandstone and occasional coal.	2.60			
B	3.00m		Yellow brown moderately weathered SANDSTONE recovered as sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.	3.25			
			End of Trial Pit at 3.25 m				

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

Easting:

Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP9**

Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

STRATA RECORD

Logged By: **MH**

Type	Depth From - To(m)	Vane Results kNm ²	Groundwater	Description	Depth (m)	Level (mAOD) PID (ppm)	Legend	Well
B	0.10m			MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. (Frequent roots and rootlets noted).	0.20			
B	0.40m			MADE GROUND: Black/brown clayey sandy gravel. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of sandstone, mudstone, tile, glass, ash and clinker.	0.60			
B	1.00m			MADE GROUND: Black/dark brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of sandstone, limestone, metal fragments, clinker, ash, brick, glass, fencing and timber.	1.30			
B	1.70m			Firm brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone (possible weathered rock).	1.60			
B	3.00m			Light brown moderately weathered SANDSTONE recovered as slightly clayey sand and gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.	3.30			
				End of Trial Pit at 3.30 m				

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit unstable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP10**

Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:

D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Groundwater	Description	Depth (m)	Level (mAOD) PID (cm)	Legend	Well
B	0.30m			MADE GROUND: Dark brown very sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone ash and brick. Rootlets noted.	0.10			
B	0.50m			MADE GROUND: Brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, ash, coal, tile, glass, brick, cans, felt and textiles.	0.40			
B	1.00m			MADE GROUND: Dark brown slightly sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of glass, brick, ash, sandstone and plastics.	0.90			
B	1.50m			Firm yellow brown (some grey) sandy very gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, brick and coal.	1.20			
B	2.50m			Brown light brown highly weathered SANDSTONE recovered as sand and gravel. Sand is fine to coarse. Gravel is angular to sub-rounded of sandstone and occasional coal.				
				End of Trial Pit at 3.15 m	3.15			

Remarks and Water Observations

1. No groundwater but wet in sand and gravel strata.
2. Trial pit slightly unstable in granular deposits.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP11**

Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Type	Depth From - To(m)	Vane Results kN/m ²
------	-----------------------	--------------------------------------

Groundwater

STRATA RECORD

Description

Logged By: MH

Depth (m)	Level (mAOD) PID (open)	Legend	Well
--------------	----------------------------------	--------	------

B 0.10m

B 0.30m

B 0.50m

MADE GROUND: Dark brown sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone, brick and glass. Rootlets noted.

MADE GROUND: Brown grey sandy gravel. Sand is fine to coarse. Gravel is angular to sub-rounded of limestone, brick, sandstone and glass. Occasional ash and metal fragments noted.

Stiff light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and coal.

B 1.60m

Stiff brown mottled grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone and coal.

End of Trial Pit at 1.70 m

0.15

0.40

1.40

1.70

Remarks and Water Observations

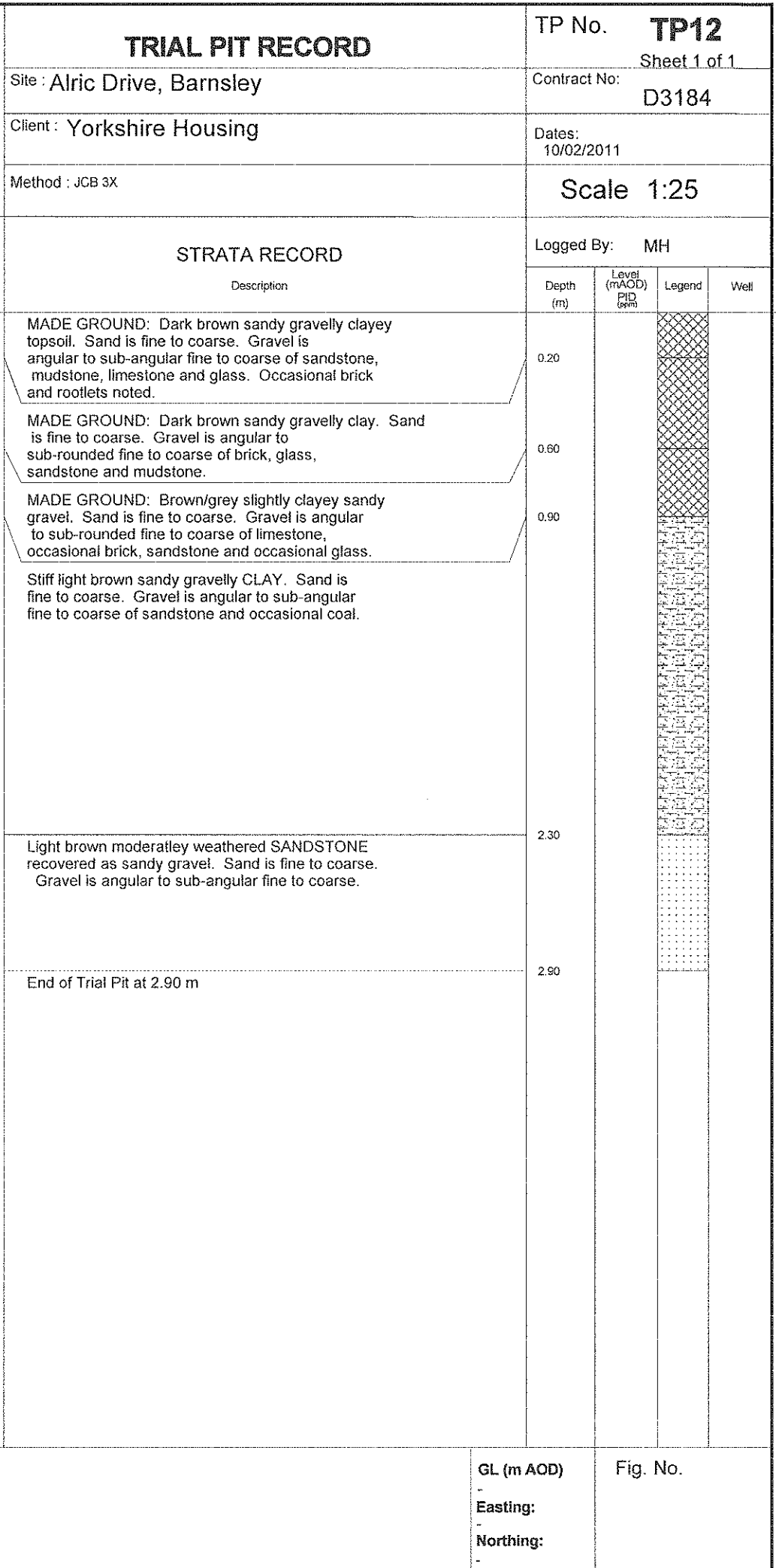
1. No groundwater encountered.
2. Trial pit remained stable.
3. Trial pit terminated due to possibility of services.

GL (m AOD)

Easting:

Northing:

Fig. No.





TRIAL PIT RECORD

TP No. **TP13**

Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:

D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Groundwater	Description	Depth (m)	Level (mAOD) PID (gpm)	Legend	Well
B	0.10m			MADE GROUND: Dark brown very sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone, coal and occasional brick. Frequent rootlets.	0.25			
B	0.35m			MADE GROUND: Light yellow sandy gravel. Sand is fine to coarse. Gravel is angular to sub-rounded fine to coarse of limestone.	0.45			
B	0.60m			MADE GROUND: Black/dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick, glass, ash, occasional clinker, sandstone, limestone, metal and plastic fragments.	0.90			
B	1.20m			Stiff light brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone				
B	2.90m			Brown moderately weathered SANDSTONE recovered as slightly sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.	2.70			
				End of Trial Pit at 3.00 m	3.00			

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit remained stable.

GL (m AOD)

- Easting:

- Northing:

Fig. No.



TRIAL PIT RECORD

TP No. **TP14**
Sheet 1 of 1

Site : Alric Drive, Barnsley

Contract No:
D3184

Client : Yorkshire Housing

Dates:
10/02/2011

Method : JCB 3X

Scale 1:25

SAMPLE DETAILS

Groundwater

STRATA RECORD

Logged By: MH

Type	Depth From - To(m)	Vane Results kN/m ²	Description	Depth (m)	Level (mAOD) PID (ppm)	Legend	Well
B	0.10m		MADE GROUND: Dark brown very sandy gravelly clayey topsoil. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of sandstone, limestone and coal. Occasional brick and frequent rootlets.	0.20			
B	0.40m		MADE GROUND: Dark brown/brown sandy gravelly clay. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse of brick and sandstone. Occasional ash and clinker. Occasional rootlets.	0.60			
B	1.00m		Yellow brown highly weathered SANDSTONE recovered as sandy gravel. Sand is fine to coarse. Gravel is angular to sub-angular fine to coarse.	1.90			
End of Trial Pit at 1.90 m							

Remarks and Water Observations

1. No groundwater encountered.
2. Trial pit unstable in sands and gravel

GL (m AOD)

- Easting:

- Northing:

Fig. No.

Appendix C
Chemical Testing Results



2139

Certificate of Analysis

Date: 22/02/2011

Certificate Number: 11-46593

Client: Dunelm Geotechnical & Environmental Ltd
Kingfisher House
St. John's Road
Meadowfield
Durham
DH7 8TZ

Our Reference: 11-46593

Client Reference: D3184

Contract Title: Alric Drive, Barnsley

Description: 11 soil samples

Date Received: 15/02/2011

Date Started: 16/02/2011

Date Completed: 22/02/2011

Test Procedures: Identified by prefix DETSn, details available upon request.

Notes: Observations and interpretations are outside the scope of UKAS accreditation
* denotes test not included in laboratory scope of accreditation
denotes test that holds MCERT accreditation, however, MCERTS accreditation is only implied if the report carries the MCERTS logo
\$ denotes tests completed by an approved subcontractor
I/S denotes insufficient sample to carry out test
U/S denotes that the sample is not suitable for testing
DETSM denotes tests carried out by DETS Midlands laboratory
Solid samples will be disposed 1 month and liquids 2 weeks after the date of issue of this test certificate
Asbestos subsamples will be kept for 6 months

Approved By:



Authorised Signatories: Rob Brown
Business Manager

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Summary of Chemical Analysis Soil Samples

Our Ref: 11-46593
Client Ref: D3184
Contract Title: Alric Drive, Barnsley

			Lab No.	311502	311503	311504	311505	311506	311507
			Sample ID	MBH3	MBH3	MBH4	MBH5	MBH10	TP9
			Depth	0.10	0.30	0.65	0.10	0.55	0.10
			Sample Ref						
			Sample Type						
Test	Units	DETSxx							
Arsenic	mg/kg	DETS 042#	12	19	27	17	8.4	10	
Cadmium	mg/kg	DETS 042#	1.1	1.1	1.5	0.9	1	0.7	
Chromium	mg/kg	DETS 042#	72	25	110	22	18	40	
Hexavalent Chromium	mg/kg	DETSC2204	< 1	< 1	< 1	< 1	< 1	< 1	
Copper	mg/kg	DETS 042#	210	65	59	41	18	26	
Lead	mg/kg	DETS 042#	84	100	120	82	25	48	
Mercury	mg/kg	DETS 081#	< 0.05	0.21	0.28	0.15	0.05	0.09	
Nickel	mg/kg	DETS 042#	19	24	44	22	24	18	
Selenium	mg/kg	DETS 042#	< 0.5	< 0.5	0.7	< 0.5	< 0.5	< 0.5	
Zinc	mg/kg	DETS 042#	250	200	400	140	84	90	
Sulphate Aqueous Extract as SO4	mg/l	DETS 076#	78	44	210	110	32	43	
pH		DETS 008#	10.0	7.9	9.3	10.0	8.5	7.9	
Acenaphthene	mg/kg	DETS 050	< 0.1						
Acenaphthylene	mg/kg	DETS 050	< 0.1						
Anthracene	mg/kg	DETS 050	0.9						
Benzo(a)anthracene	mg/kg	DETS 050	3.4						
Benzo(a)pyrene	mg/kg	DETS 050	3.9						
Benzo(b)fluoranthene	mg/kg	DETS 050	2.5						
Benzo(k)fluoranthene	mg/kg	DETS 050	1.5						
Benzo(g,h,i)perylene	mg/kg	DETS 050	2.2						
Chrysene	mg/kg	DETS 050	4.4						
Dibenzo(a,h)anthracene	mg/kg	DETS 050	0.5						
Fluoranthene	mg/kg	DETS 050	8.6						
Fluorene	mg/kg	DETS 050	< 0.1						
Indeno(1,2,3-c,d)pyrene	mg/kg	DETS 050	2.4						
Naphthalene	mg/kg	DETS 050	< 0.1						
Phenanthrene	mg/kg	DETS 050	1.9						
Pyrene	mg/kg	DETS 050	6.6						
PAH	mg/kg	DETS 050	39						

Summary of Chemical Analysis Soil Samples

Our Ref: 11-46593
Client Ref: D3184
Contract Title: Alric Drive, Barnsley

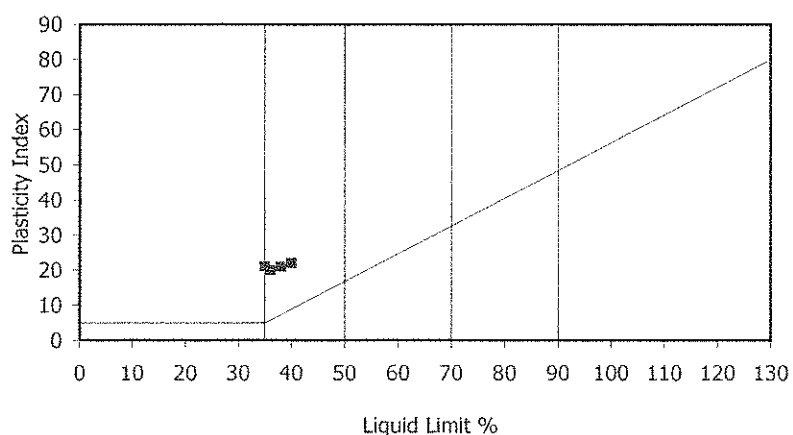
			Lab No.	311508	311509	311510	311511	311512
			Sample ID	TP9	TP10	TP10	TP6	TP2
			Depth	0.40	0.50	0.10	0.40	0.75
			Sample Ref					
			Sample Type					
Test	Units	DETSxx						
Arsenic	mg/kg	DETS 042#		25			15	18
Cadmium	mg/kg	DETS 042#		1.4			1.2	1.1
Chromium	mg/kg	DETS 042#		35			32	26
Hexavalent Chromium	mg/kg	DETS C2204		< 1			< 1	< 1
Copper	mg/kg	DETS 042#		58			58	42
Lead	mg/kg	DETS 042#		160			59	72
Mercury	mg/kg	DETS 081#		0.34			0.15	0.14
Nickel	mg/kg	DETS 042#		31			22	26
Selenium	mg/kg	DETS 042#		0.6			0.7	< 0.5
Zinc	mg/kg	DETS 042#		220			210	180
Sulphate Aqueous Extract as SO4	mg/l	DETS 076#		43			24	24
pH		DETS 008#		7.6			7.9	8.1
Acenaphthene	mg/kg	DETS 050	< 0.1			1.6	< 0.1	< 0.1
Acenaphthylene	mg/kg	DETS 050	< 0.1			0.4	< 0.1	< 0.1
Anthracene	mg/kg	DETS 050	0.5			6.6	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	DETS 050	2.8			17	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	DETS 050	3.6			16	< 0.1	0.3
Benzo(b)fluoranthene	mg/kg	DETS 050	2.7			11	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	DETS 050	1.5			6	< 0.1	< 0.1
Benzo(g,h,i)perylene	mg/kg	DETS 050	2.4			8.2	< 0.1	< 0.1
Chrysene	mg/kg	DETS 050	3.6			17	< 0.1	< 0.1
Dibenzo(a,h)anthracene	mg/kg	DETS 050	0.3			1.3	< 0.1	< 0.1
Fluoranthene	mg/kg	DETS 050	6.1			37	< 0.1	1.2
Fluorene	mg/kg	DETS 050	< 0.1			2.5	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	DETS 050	2.2			8.4	< 0.1	< 0.1
Naphthalene	mg/kg	DETS 050	< 0.1			0.4	< 0.1	< 0.1
Phenanthrene	mg/kg	DETS 050	0.9			20	< 0.1	< 0.1
Pyrene	mg/kg	DETS 050	5.2			29	< 0.1	0.9
PAH	mg/kg	DETS 050	32			180	< 1.6	2.6

Appendix D
Geotechnical Testing Results

ALRIC
D3184



Page 1 of 1

[illegible]

		Liquid Limit
CE	Extremely high plasticity CLAY	>90%
ME	Extremely high plasticity SILT	
CV	Very high plasticity CLAY	70 - 90%
MV	Very high plasticity SILT	
CH	High plasticity CLAY	50 - 70%
MH	High plasticity SILT	
CI	Intermediate plasticity CLAY	35 - 50%
MI	Intermediate plasticity SILT	
CL	Low plasticity CLAY	<35%
ML	Low plasticity SILT	

Comments

Prepared:

Date:

Checked:

Date:

Approved:

Date:

SOAKAWAY RECORD SHEET	
Site:	Alric Drive, Barnsley
Job No:	D3184
Trial pit No:	MBH2
Size of Soakaway pit	
Diameter (m)	0.1
Depth (m)	2.0

TEST 1	
Time (min)	Depth (m)
0	1.00
0.5	1.00
1	1.00
2	1.00
3	1.00
4	1.00
5	1.01
6	1.01
7	1.01
8	1.01
9	1.01
10	1.01
15	1.01
20	1.05
25	1.05
30	1.10
40	1.10
50	1.10
60	1.10
90	1.10
120	1.10
180	1.10

SOAKAWAY RECORD SHEET	
Site:	Alric Drive, Barnsley
Job No:	D3184
Trial pit No:	MBH4
Size of Soakaway pit	
Diameter (m)	0.1
Depth (m)	2.3

TEST 1	
Time (min)	Depth (m)
0	0.90
0.5	0.90
1	0.90
2	0.90
3	0.90
4	0.90
5	0.90
6	0.90
7	0.90
8	0.90
9	0.90
10	0.90
15	0.90
20	0.90
25	0.90
30	0.90
40	0.90
50	0.90
60	0.90
90	0.90
120	0.90
180	0.91

SOAKAWAY RECORD SHEET	
Site:	Alric Drive, Barnsley
Job No:	D3184
Trial pit No:	MBH5
Size of Soakaway pit	
Diameter (m)	0.1
Depth (m)	3.6

TEST 1	
Time (min)	Depth (m)
0	1.15
0.5	1.15
1	1.15
2	1.15
3	1.15
4	1.15
5	1.15
6	1.15
7	1.15
8	1.15
9	1.15
10	1.15
15	1.15
20	1.15
25	1.15
30	1.16
40	1.16
50	1.16
60	1.17
90	1.18
120	1.18

SOAKAWAY RECORD SHEET	
Site:	Alric Drive, Barnsley
Job No:	D3184
Trial pit No:	MBH7
Size of Soakaway pit	
Diameter (m)	0.1
Depth (m)	2.8

TEST 1	
Time (min)	Depth (m)
0	1.60
0.5	1.60
1	1.60
2	1.60
3	1.60
4	1.60
5	1.60
6	1.60
7	1.60
8	1.60
9	1.60
10	1.60
15	1.60
20	1.62
25	1.62
30	1.62
40	1.62
50	1.62
60	1.62
90	1.62
120	1.63
180	1.63

Appendix E

Notes on Limitations

Dunelm Conditions of Offer, Notes on Limitations & Basis for Contract

These conditions accompany our tender and supercede any previous conditions issued. The firm will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of the firm. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from the firm. A charge may be levied against such approval, the same to be made at the discretion of the firm.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, soil gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

The firm cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. The firm are not responsible for the action negligent or otherwise of subcontractors or third parties.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2001 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, the firm cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by the firm in the course of investigation is the property of the firm, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. The firm reserves the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning the firm, you understand and accept that you/your agent have a contractual relationship with the firm & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Dunelm are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete. Dunelm have not allowed for subsequent reinstatement as a result of settlement. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming the firm agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. We will also apply the right to claim any associated legal costs incurred with recovery of late payments. The firm is exempt from the CIS Scheme. The firm offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. The company are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by the firm, and we give notice that consequential loss as a direct or indirect result of the firms activities or omission of the same are excluded.