

CONTRACT NO. 11624

**REPORT ON A GROUND INVESTIGATION
CARRIED OUT AT
PILSWORTH ROAD, BURY**

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CARRIED OUT AT
PILSWORTH ROAD, BURY**

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REPORT ON A GROUND INVESTIGATION CARRIED OUT AT PILSWORTH ROAD, BURY

Executive Summary

DTS Raeburn Limited were commissioned by MJM Consulting Engineers on behalf of ASDA Stores Limited to carry out an intrusive investigation at the site of an existing ASDA food retail store, car park and petrol filling station (PFS) in Pilsworth Road, Bury, Greater Manchester. The aims of the investigation were to determine the ground conditions in the areas of a proposed extension to the northern side of the store, and a new PFS in the south eastern corner of the site, and to make recommendations with regard to the design of foundations for these structures. The investigation also included chemical laboratory testing to classify the soils for off site disposal. The investigation was based on the development proposals for the site and also took account of the findings of a geo-environmental desk study undertaken by DTS Raeburn in May 2003 (Report 11553). The following principal findings were established from the investigation:

- The areas under investigation are described in Section 2.0. The proposed store extension covers the eastern part of an existing service yard located to the north of the store building. Both the store and service yard were operational at the time of the investigation. The service yard is surfaced by concrete but also includes a brick footprint, possibly associated with a former building or extension. The area of the proposed PFS is currently occupied by car parking spaces, surfaced by tarmac which is in a relatively good condition.
- The intrusive investigation works comprised three cable percussion boreholes, each fitted with a gas and groundwater monitoring installation, and four trial pits (Section 5.0). The positions of the exploratory holes were selected to provide geotechnical information for the design of the proposed store extension and PFS, and also included some of the areas of ground risk as highlighted in the desk study. However, the positions were restricted by site activities.
- Section 7.0 details the ground conditions encountered. These comprised made ground to between 0.7 and 1.6m below ground level in the area of the proposed store extension, and between 0.4 and 1.8m at the proposed PFS site. The made ground included a thin layer of hydrocarbon-coated material in one trial pit only. The made ground overlay post-Glacial deposits, first proven by a layer of silty fine to medium sand which was underlain in some of the exploratory holes by firm to stiff sandy clay. Glacial Till was encountered beneath these deposits at depths between 2.6 and 3.6m below ground level, and reached the terminal depths of all of the boreholes (10m).
- Foundation design options are discussed in Section 8.1. It is understood that the existing store is supported by pad foundations. The use of pad foundations placed at a minimum depth of 2m below ground level would be feasible for the extension, but the design of foundations would be governed by the need to control settlement. Suggested net allowable bearing pressures are tabulated in the report. Care should also be taken to prevent softening of the foundation level by rainfall or frost action.
- Sulphate levels and pH values of the soil samples indicate the site to be in Design Class DS-1 of Special Digest 1 (BRE, 2001). The absence of mobile groundwater indicates an Aggressive Chemical Environment for Concrete (ACEC) Classification of AC-2s (Section 8.2).
- Gas monitoring results (Section 8.3 and Table 1) indicate the absence of methane but show the presence of carbon dioxide (CO₂) to a maximum of 4.8%. Gas protection measures are required if CO₂ concentrations exceed 5% by volume (BRE Report 212). However, they should be considered if CO₂ levels are between 1.5 and 5% by volume, and it is acknowledged that gas readings may vary from those recorded depending on conditions including air

pressures, gas emission and flow rates from the generation source. On the basis of these findings passive gas exclusion measures are recommended for the proposed store extension, which would be achieved by means of ventilation of the floor slab, a gas impermeable membrane within the floor slab and sealing of external service and utility entry points.

- Under the Landfill (England and Wales) Regulations 2002, the made ground encountered should fall under the non-hazardous waste classification. However, special provisions may be necessary for hydrocarbon 'hot spots' which may attract a higher premium to the other fill materials. Results of laboratory testing of the natural soils indicates low leachate concentrations, and hence these are likely to qualify for disposal as inert waste subject to the Landfill Operators' certification (Section 8.4).
- Attention is drawn to Section 9.0, in which the limitations and use of the report are presented.

REPORT ON A GROUND INVESTIGATION CARRIED OUT AT PILSWORTH ROAD, BURY

1.0 INTRODUCTION

DTS Raeburn Limited were commissioned by MJM Consulting Engineers on behalf of ASDA Stores Limited to carry out an intrusive investigation at the site of an existing ASDA food retail store, car park and petrol filling station (PFS) in Pilsworth Road, Bury, Greater Manchester. It is understood that the proposed development consists of an extension to the rear of the existing store, and the re-location of the PFS to the south eastern corner of the site. The aims of the investigation were to determine the ground conditions beneath the areas of the proposed store extension and PFS, and to make recommendations with regard to the design of foundations for these structures. The investigation also included chemical contamination laboratory testing to classify the soils encountered for disposal purposes. The investigation has been based upon the development proposals for the site and has also taken account of the findings of a geo-environmental desk study undertaken by DTS Raeburn (Report 11553, May 2003).

The scope of works included cable percussion boreholes and mechanically excavated trial pits to obtain samples of the underlying soils and groundwater for geotechnical and contamination testing. The investigation also included *in situ* tests and gas and groundwater monitoring to identify the presence and proportions of methane, carbon dioxide, hydrogen sulphide and oxygen within the soil gas, and the extent of groundwater. This report presents the factual information obtained together with recommendations for the design of foundations and options for the disposal of the soils off site.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

The site is located to the east of Bury adjacent to Junction 3 of the M66 as shown in Figures 1 and 2. The site is centred on National Grid Reference 381980, 409020. Access to the site is gained from Pilsworth Road, which passes underneath the M66 immediately to the north east of the site.

2.2 Site Description

The site has been described in some detail in the geo-environmental desk study report 11553. The full description has been omitted from this report to avoid repetition. However, the areas of the proposed store extension and PFS have been described for clarity and ease of reference, and are also indicated in Figure 3 which shows the existing site layout.

The proposed store extension covers the eastern part of the existing service yard, located on the northern side of the store building. At the time of the site investigation the service yard was surfaced by concrete which is in good condition. A brick footprint, possibly

associated with a former building or extension, was also observed in this area. Access to the service yard is gained from the south eastern corner through steel security gates. The yard is bounded to the north by a narrow grass verge and a high steel security fence.

The site of the proposed PFS is currently occupied by car parking spaces, and is located directly to the east of the existing PFS. This area is surfaced by tarmac which is in a relatively good condition, and lies roughly level.

The desk study research also indicates that Haweswater Aqueduct may lie culverted beneath the western part of the site. The exact route and current status of the culvert is not known and could not be inferred from visual observations made during either the desk study or the present investigation. However, it is thought that the aqueduct fed an operational pumping station located opposite the site to the north west. The pumping station was operational at the time of the investigation.

2.3 Surrounding Area

The site is located within Pilsworth Industrial Estate, which also contains a cinema complex, Mega Bowl complex, a public house and two commercial restaurants, all of which have associated car parking areas. Further details of these properties are contained within the desk study report. In addition, an operational pumping station and a small, shallow littered pond lie opposite the site to the south west, and an operational landfill site is located at about 300m to the north east of the site, at a higher elevation than the site itself.

3.0 GENERAL GEOLOGY

Reference to the British Geological Survey Sheet No. 85 (1:50,000 Solid and Drift Edition) of Manchester (Figure 4) indicates the site to be underlain by Glacial Sand and Gravel, overlying Glacial Till (present in the form of 'Boulder Clay'). The map also indicates the presence of alluvium at about 500m to the west of the site, which has been deposited linearly along the course of the River Roch. Further alluvial material may also lie adjacent a smaller river tributary located approximately 100m to the north of the site, although this is not shown in the Geological map. In addition, due to the known historical development and former levelling of the area, it is possible that the site is also underlain by a variable thickness of made ground.

The made ground and drift deposits are underlain by the solid Middle Coal Measures (of *Carboniferous* age). This formation is reported to consist of laterally discontinuous sandstones interbedded with frequent seams of coal. Information contained within a Coal Mining Report provided by the Coal Authority and included in the desk study report indicates that the site is at low risk with respect to mining subsidence and other associated hazards. However, active open-cast quarrying of sand and gravel is currently taking place approximately 800m to the north east of the site. It appears that the quarry is being used for landfill on completion of the extraction.

4.0 HYDROLOGY, HYDROGEOLOGY AND SITE SENSITIVITY

Recorded information on groundwater vulnerability and environment quality in the vicinity of the site is included in the desk study report 11553. This information has shown that the Glacial Sand and Gravel constitutes a **minor** aquifer, and that a surface water stream lies approximately 100m to the north of the site. This is a tributary of the River Roch which flows approximately 800m to the west of the site. In view of this information the site should be considered potentially sensitive with respect to the above watercourses, and possibly also with respect to the culverted Haweswater Aqueduct beneath the western part of the site.

The underlying Middle Coal Measures is also classified as a **minor** aquifer, but this is overlain by a layer of Glacial Till, which is classified as a **non**-aquifer and is typically of low permeability. In practice this material would be likely to reduce the sensitivity of the site with respect to the underlying Coal Measures. The site is also not considered sensitive with respect to licensed water abstractions or major ecological receptors, while site activities are unlikely to impact upon potable water supplies.

5.0 INVESTIGATION METHODOLOGY AND SAMPLING STRATEGY

The fieldwork comprised three cable percussion boreholes, each fitted with a gas and groundwater monitoring installation, and four mechanically excavated trial pits. The locations of the exploratory holes were selected with a view to providing sufficient geotechnical information for the design of the proposed store extension and PFS, and also included some of the main areas of ground risk present in the areas of the proposed development as highlighted in the desk study. Figure 5 indicates the positions of the exploratory holes. However, as the store was fully operational during the investigation, the positions of the boreholes and trial pits were necessarily restricted by the presence of vehicles in the area of the proposed PFS, and heavy goods vehicles and staff in the service yard where the store extension is proposed. In addition, the trial pit positions were selected with a view to facilitating the sampling of soils for disposal classification purposes.

5.1 Cable Percussion Boreholes

Three cable percussion boreholes (BH 1 to BH 3) were drilled to 10 metres below ground level on 31st July to 4th August 2003. The purpose of the boreholes was to provide geotechnical information at depth and facilitate sampling, installation, monitoring and testing of groundwater and soil gas. Standard cable percussion boring equipment was used to produce 150mm diameter boreholes.

Disturbed samples were taken at close intervals during boring in order to give a comprehensive record of strata encountered. Standard Penetration Tests (SPTs) were also carried out at frequent intervals during drilling in order to allow an assessment of the in-situ density or stiffness of the ground. This test is fully described as Part 9 in BS1377:1990. The number of blows required to drive the initial 150mm distance was recorded together with the number of blows of four successive 75mm drives which are summated to give the 'N' value. This has been correlated empirically with the density, shear strength and compressibility of soils. In gravelly or hard soils, or where cobbles or

boulders were expected, the split tube sampler was replaced with a 60° apex cone. Where a penetration of 300mm was not achieved due to the density of the material encountered, the test result is expressed in the form a/b , where a is the blow count and b is the actual penetration achieved.

Due attention was maintained during boring to determine whether groundwater existed through the strata penetrated.

Clean drilling techniques were employed at the site and included casing through the made ground in each borehole to avoid any cross-contamination from the made ground into the underlying soils. On completion, all three boreholes were fitted with gas and groundwater monitoring installations, which included a bentonite seal at the base of the made ground. This is discussed further in Section 5.4.

5.2 Trial Pits

Four trial pits (TP 1 to TP 4) were excavated on 31st July 2003, to depths of between 2.1m (TP 2) and 3.0m (TP 4) below ground level using a JCB 3CX hydraulic excavator. The trial pits were excavated to facilitate environmental sampling and to provide a visual appreciation of the underlying materials. After detailed examination, measurement and sampling, the pits were backfilled with materials arising. The material was compacted as much as possible by tamping with the machine bucket in order to minimise post-reinstatement settlement.

5.3 Soil Sampling for laboratory analysis

Soil samples for contamination testing were taken from various horizons within the made ground and natural strata of the trial pits using a stainless steel trowel, which was cleaned prior to the collection of each sample. Due attention was paid to ensure that the soils collected were as representative as possible of the material being sampled. The samples were collected in glass jars and temporarily stored in cool boxes with freeze packs, in order to maintain low temperatures during transfer to the laboratory.

During drilling of the boreholes, undisturbed¹ soil cores 100mm in diameter and 450mm long were taken at appropriate depth intervals in cohesive soils for geotechnical laboratory testing.

5.4 Borehole Installations

Gas and groundwater monitoring installations were fitted into all of the cable percussion boreholes. The installations comprised a 50mm diameter plastic tube extending to depths of between 4.0m and 10.0m below ground level within the natural strata. The tube was perforated along differing lengths and the response zones were surrounded with clean pea gravel. The upper sections, which included the extent of the made ground encountered in each borehole, comprised a bentonite seal in order to prevent the downward migration of contamination from the made ground. The bentonite was overlain by concrete securing a protective cover and gas control valve.

¹ The word 'undisturbed' is used here in a relative sense to refer to samples recovered in an open-drive tube. It is impossible to recover a strictly undisturbed sample, but the degree of disturbance may be reduced by careful field practice.

The depth to groundwater and the concentrations of carbon dioxide, methane and oxygen within the boreholes were recorded on two occasions following installation, between 21st August and 16th September 2003. The barometric pressure was also noted during the gas monitoring.

5.5 Records of field work

Detailed records of the cable percussion boreholes (including penetration test data), and trial pits have been produced in accordance with British Standard BS 5930:1999, and are included as Appendix 1. Details of the borehole installations are given on the respective borehole logs. Gas and groundwater monitoring results are provided in Table 1 which is presented immediately after the report text.

6.0 LABORATORY TESTING

6.1 Geotechnical Testing

Selected soil samples from the cable percussion boreholes and trial pits were tested in accordance with the recommendations of British Standard BS 1377:1990 to assist with the geotechnical appraisal of the site and the design of foundations for the proposed store extension and PFS.

A) Classification Tests

i) Natural water content

The natural water content was determined for seven soil samples. The water content is the mass of water expressed as a percentage for the mass of dry soil.

ii) Plasticity Limits

Determinations were made of the liquid and plastic limits for two specimens of fine-grained soils for the purpose of engineering classification and correlation with other soil properties.

B) Shear Strength and Compressibility Related Tests

i) Quick Undrained Multi-stage Triaxial

Quick undrained multi-stage shear strength tests were performed on specimens prepared from five undisturbed core samples of natural soil, for use in total stress solubility analysis.

ii) Oedometer Consolidation Tests

Oedometer consolidation tests were carried out on specimens prepared from five undisturbed core samples of natural soil for use in settlement prediction.

6.2 Contamination Testing

Contamination testing was carried out on selected samples of made ground and natural soils taken from across the site. The contamination testing regime included sufficient testing to classify the soils for off-site disposal, and also included targeted testing associated with the potential contaminant sources identified in the desk study report 11553. The testing also and also took account of visual observations during the logging of the samples, and covered both inorganic and organic determinants.

i) Inorganic Testing

The soil samples were analysed for a suite of common elements and compounds to classify them for disposal purposes. These determinants comprised sulphide, cyanide, sulphate (water soluble where appropriate), elemental sulphur, arsenic, cadmium, total chromium, hexavalent chromium, selenium, copper, lead, mercury, nickel, zinc, water soluble boron and pH.

ii) Organic Testing

The soil samples were also tested for total phenols and polynuclear aromatic hydrocarbons (PAH). Targeted testing was also undertaken for Total Petroleum Hydrocarbons (TPH), speciated as Petrol Range Organics (PRO, C₄-C₁₂), Diesel Range Organics (DRO, C₁₀-C₄₀) and Mineral Oil (MO, saturated hydrocarbons in the range C₁₀-C₄₀).

It is evident and noteworthy that there is an overlap between this carbon ranges, in particular for Diesel Range Organics and Mineral Oil. This can lead to a conservative estimate of TPH in test samples. In addition, DRO tests cover a broad range of organic substances within the specified carbon bands other than those of diesel origin. This may include naturally occurring organic material. The tests are therefore not necessarily indicative of diesel oil and the results of testing for MO are usually taken into account in determining whether the sample is of petroleum hydrocarbon origin. The speciated TPH tests also included BTEX compounds (benzene, toluene, ethyl-benzene and xylene).

6.3 Records of Laboratory Tests

All of the geotechnical and contamination laboratory test results are presented in Appendices 2 and 3 respectively.

7.0 GROUND CONDITIONS AND STRATA ENCOUNTERED

The ground conditions encountered in the boreholes and trial pits have been interpreted as MADE GROUND, overlying Post-Glacial deposits consisting of sandy clay and clayey or silty sand. These deposits overlay Glacial clay till (proved in all of the boreholes but not reached in Trial Pits 1 or 3).

7.1 Made Ground

In the area of the proposed PFS (represented by Borehole 1 and Trial Pits 1 and 2), MADE GROUND comprising ballast with occasional inclusions of brick and scrap metal, underlain by a layer of brick dust, was proved in both Borehole 1 and Trial Pit 1. The findings of the desk study report 11553 showed that a building was formerly located in

this area, indicating that the made ground encountered may be associated with an infilled former basement or cellar. This supposition is supported by the fact that made ground was almost completely absent from Trial Pit 2 (which was positioned outside the former building footprint) except for a thin layer of reworked natural material.

In the area of the proposed store extension (as represented by Boreholes 2 and 3, and Trial Pits 3 and 4), made ground was proved to depths between 0.7 and 1.6m below ground level. The constituents of the made ground were not consistent in the boreholes and trial pits in this area, but included ballast, brick, ash, broken concrete, rare scrap metal and reworked natural sands and gravels. A thin layer of hardcore, apparently coated by residual hydrocarbon was encountered in Trial Pit 3 only, between 0.6 and 0.75m below ground level. No visual or olfactory evidence of hydrocarbon contamination was noted in any of the other boreholes or trial pits.

7.2 Post-Glacial Deposits

These materials were proven to depths between 2.6m (Borehole 2) and 3.6m (Borehole 1) below ground level, although they were not fully penetrated in Trial Pits 1 or 3. In addition, they appeared to be completely absent from Trial Pit 2, located in the south eastern corner of the proposed PFS site. The evidence from the boreholes and trial pits is that the upper horizon of these deposits is defined by a layer of loose to medium dense silty fine to medium SAND, which also included gravel of quartzite in Trial Pit 3. In some of the exploratory holes this stratum was underlain by a layer of firm to stiff sandy CLAY. A slight organic odour was noted within these horizons in some of the boreholes and trial pits, most notably Trial Pit 3.

7.3 Glacial Till

This material was proven to the terminal depths of all of the boreholes (10m below ground level) and comprised stiff dark grey-brown CLAY, locally laminated and/or including gravel of quartzite. Results of *in situ* and laboratory testing indicate that the material becomes very stiff with increasing depth below ground level.

7.4 Groundwater

No groundwater strikes were encountered during the drilling/excavation of any of the boreholes or trial pits, although slight seepages were noted within the post-Glacial deposits in Trial Pit 3. In addition, some of the soils at depth were damp in Boreholes 1 and 3. Subsequent monitoring of the borehole installations revealed a perched accumulation of perched water within the Glacial Till in Borehole 1. The installations in Boreholes 2 and 3 were targeted at the shallower post-Glacial material and were found to be dry throughout the monitoring period.

8.0 RECOMMENDATIONS

For the proposed development the following guidance has been given based on the findings of the investigation.

8.1 Structural Foundations

It is understood that the existing store is constructed on pad foundations, although the depth of the foundations was not known at the time of writing. The findings of the exploratory holes and laboratory tests have revealed that the use of pad foundations would be feasible for the proposed store extension and PFS, but that the design of the foundations would be governed by the need to control settlement.

Table A below shows the net allowable bearing pressures² for square pad foundations, which should be placed at a minimum depth of 2 metres below ground level. These values have been calculated for a maximum settlement of 25mm and a minimum factor of safety of 3.0 against bearing capacity failure.

Table A Suggested net allowable bearing pressures for square pad foundations

Foundation breadth (m)	1.5	2.0	2.5	3.0
Net allowable bearing pressure (kPa)	145	110	90	75

Care should also be taken to prevent softening of the foundation level by rainfall or frost action, in order to prevent the occurrence of increased settlement. This may be achieved in one of three ways:

- (a) pour the concrete immediately after exposing the foundation level; *or*
- (b) if concreting has to be delayed, lay 75mm of site concrete over the foundation level; *or*
- (c) leave the last 150mm of soil in place, and remove it only when concreting is about to begin.

8.2 Buried Concrete

Results of testing for sulphate concentrations (acid and water soluble) and pH values indicate that the site is in Design Class DS-1 of Special Digest 1 (BRE, 2001). The absence of mobile groundwater at the site indicates an Aggressive Chemical Environment for Concrete (ACEC) Classification of AC-1s.

8.3 Ground Gas Exclusion Measures

Gas monitoring results of the borehole installations indicate the absence of methane (CH₄) in all three installations. Concentrations of carbon dioxide (CO₂) were detected to a

² The net allowable bearing pressure is the increase in vertical stress permitted at foundation level. The applied net foundation pressure may be obtained closely by assessing the structural load at ground level and dividing it by the plan area of the foundation. This approximation is justified by the fact that the weight of buried concrete and backfill is roughly balanced by the weight of excavated soil.

maximum of 4.8%, with associated depleted oxygen (O₂) levels to a minimum of 13.2%. However, both monitoring visits were taken at relatively high barometric pressures of over 1000mb.

According to BRE Report 212 'Construction of New Buildings on Gas Contaminated Ground', gas exclusion measures are required if CO₂ concentrations exceed 5% by volume, and should be considered if they exceed 1.5%.

It is however acknowledged that that gas readings are dependent on atmospheric conditions including air pressures, gas emission and flow rates from the generation source. Therefore, results may be obtained at other periods which vary from those recorded. On the basis of these findings it is recommended that passive gas exclusion measures should be provided beneath the extension to prevent the accumulation of carbon dioxide. These would be achieved by means of ventilation of the ground floor slab and a gas impermeable membrane within the floor slab and sealing external service and utility entry points.

8.4 Off site disposal options

Under the Landfill Directive (England and Wales) Regulations 2002, the results of laboratory testing indicate that the made ground encountered would generally fall under the non-hazardous waste classification. However, special provisions may be necessary for localised hydrocarbon 'hot spots' including that encountered in Trial Pit 3, which may attract a higher premium to the other fill materials.

Results of leachability testing of the natural soils encountered indicates low leachate concentrations in all of the samples tested (below UK Water Supply Quality Standards). These soils should therefore qualify for disposal as inert waste subject to the Landfill Operators' certification.

9.0 LIMITATIONS AND USE OF THIS REPORT

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations and conclusions contained in this report.

- a) This report has been prepared at the request of MJM Consulting Engineers to provide advice to ASDA Stores Limited ('the Client') pursuant to their appointment of DTS Raeburn Limited in connection with the site investigation;
- b) Except for ASDA Stores Limited, no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions contained in this report;
- c) All work carried out in preparing this report has used, and is based upon DTS Raeburn's professional knowledge and understanding of the current (August 2003) relevant English, Scottish and European Community standards and codes, technology and legislation. Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. Following delivery of this report, DTS Raeburn will have no obligation to advise the Client of any such changes or of their effects. It may therefore be

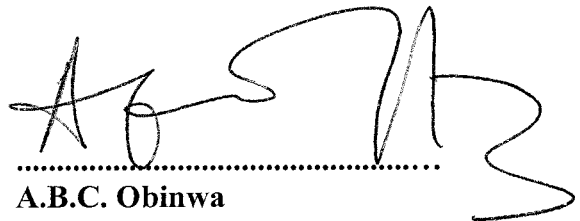
necessary to review the opinions, advice, recommendations and conclusions of this report following future changes to legislation;

- d) DTS Raeburn acknowledge that they are being retained, in part, because of their knowledge and experience with respect to geotechnical and environmental matters. DTS Raeburn will consider and analyse all information provided in the context of their knowledge and experience and all other relevant information known to DTS Raeburn. To the extent that the information provided to DTS Raeburn is not inconsistent and/or incompatible therewith, DTS Raeburn shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of all such information and shall have no obligation to verify the accuracy and completeness of such information;
- e) The content of this report represents the professional opinion of experienced geotechnical and environmental specialists. DTS Raeburn does not provide related legal advice and the advice of lawyers will be required in this regard;
- f) The lack of evidence of the presence of hazardous materials, voids or obstructive features at the subject property does not guarantee the absence of such materials, rather it indicates only that none was found as a result of the services provided.

For DTS RAEBURN Ltd



.....
S. E. Johnson
Geoenvironmental Engineer



.....
A.B.C. Obinwa
Director of Engineering

11624 / September 2003

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DTS RAEBURN LIMITED

GAS AND GROUNDWATER MONITORING RESULTS

Pilsworth Road, Bury
E11624

TABLE 1

Date	Atmospheric Pressure (mb)	Borehole	Groundwater Level (mbgl)	Flow Rate (l/hr)	Gas Concentration (% by volume)		
					CH ₄	CO ₂	O ₂
		Standard Calibration In air			0.0	0.0	19.7
21/08/2003	1003	BH1	1.94	0.0	0.0	1.0	14.7
21/08/2003	1002	BH2	Dry	0.0	0.0	3.3	17.6
21/08/2003	1002	BH3	Dry	0.0	0.0	4.8	13.2
		Standard Calibration In air			0.0	0.0	19.7
16/09/2003	1014	BH1	1.72	0.0	0.0	0.8	16.4
16/09/2003	1014	BH2	Dry	0.0	0.0	1.8	18.1
16/09/2003	1014	BH3	Dry	0.0	0.0	4.3	14.0



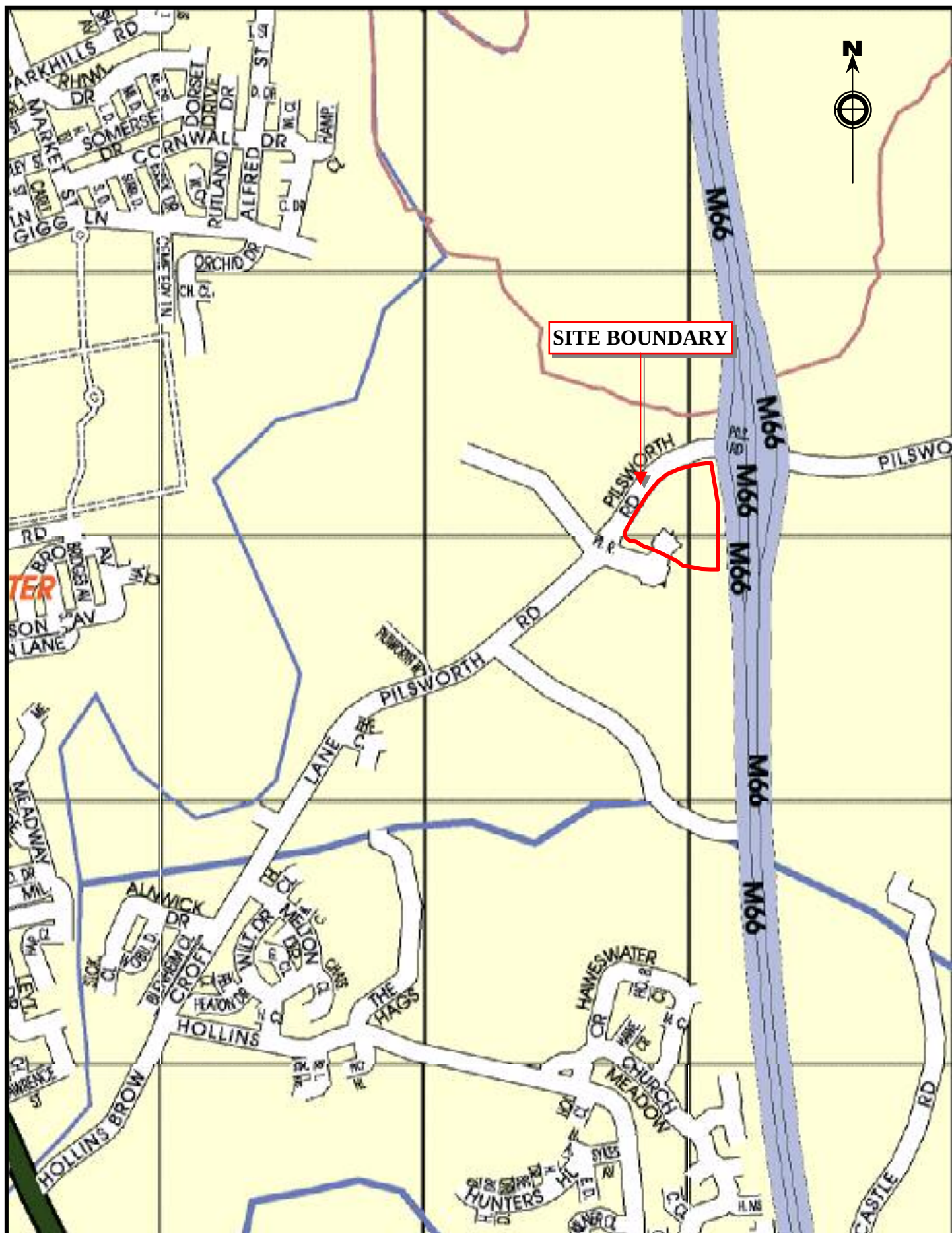
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FIGURE 2

Street Plan
Not to Scale

E11624: Pilsworth Road, Bury
Prepared for: ASDA Stores Ltd

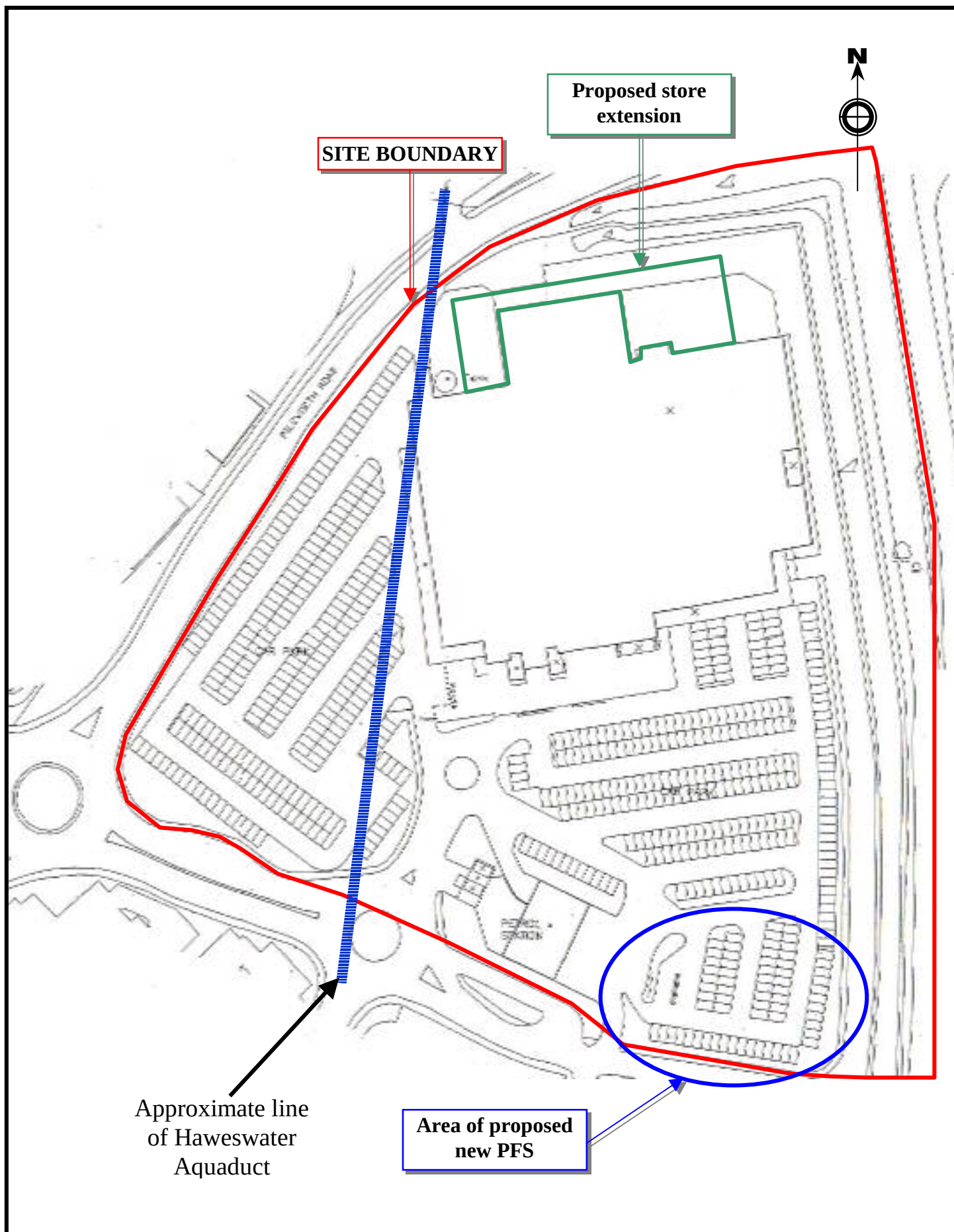
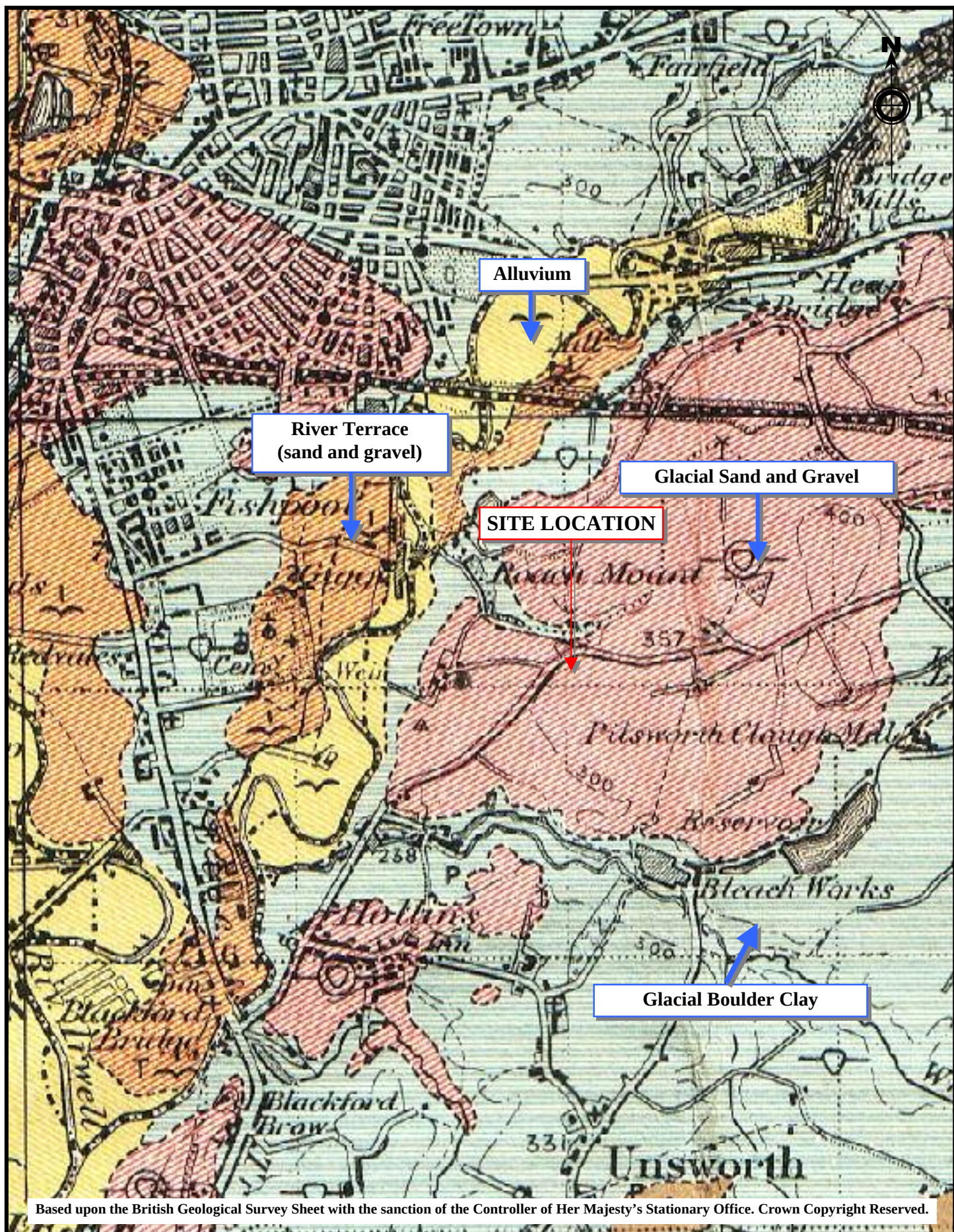


FIGURE 3

Site Plan
 Not to Scale

E11624: Pilsworth Road, Bury
 Prepared for: ASDA Stores Limited



DTS RAE BURN LTD

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

Moor Lane, Witton, Birmingham B6 7HG

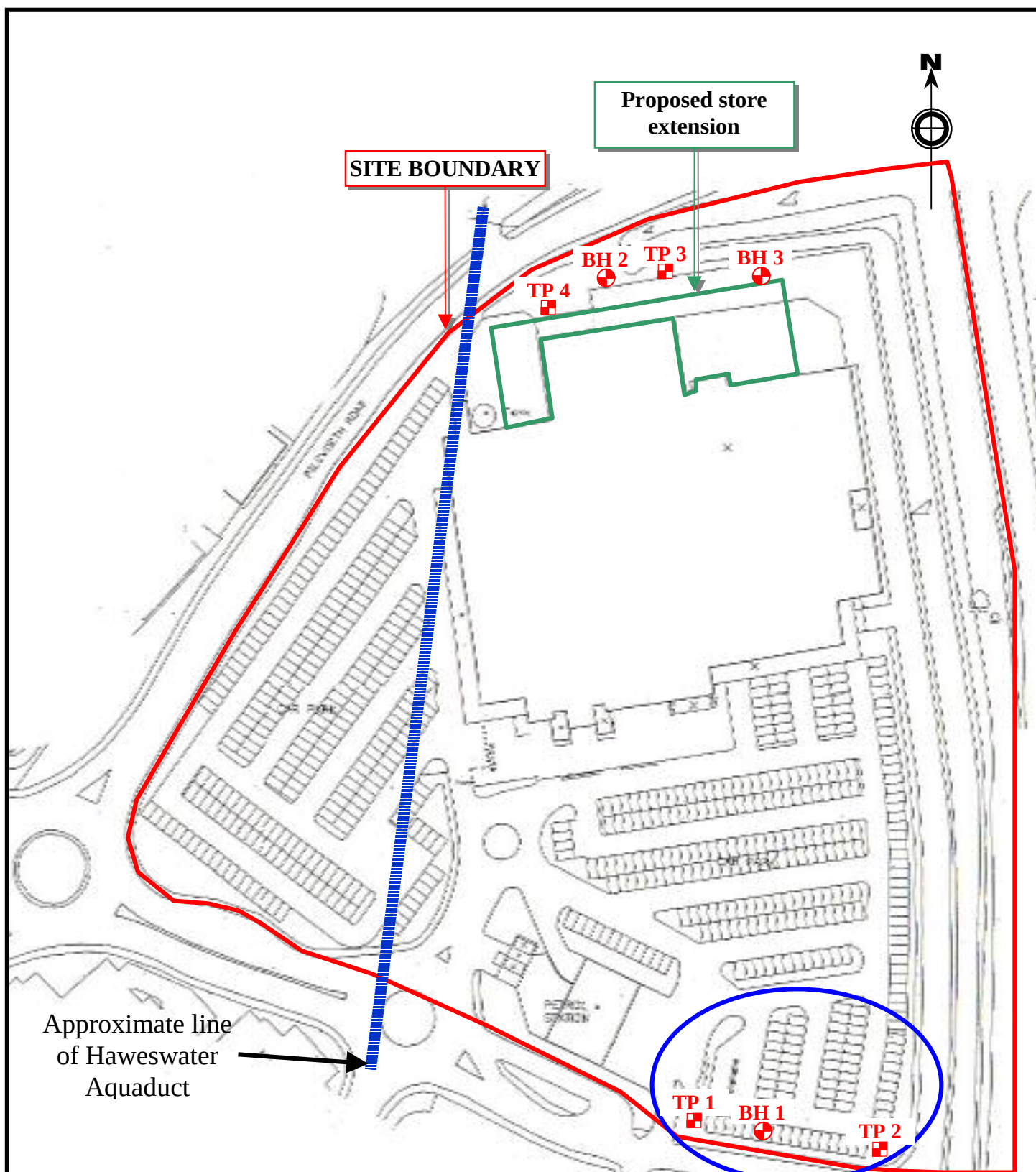
Tel: +44(0)121 344 3826

Fax: +44(0)121 344 4754

FIGURE 4

Extract from British Geological Survey Sheet 85
Solid and Drift Edition

E11624: Pilsworth Road, Bury
Prepared for: ASDA Stores Ltd



KEY



Cable Percussion Boreholes (BH1-BH3)



Trial Pits (TP1-TP4)

DTS RAE BURN LTD

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FIGURE 5

Site Plan Indicating Exploratory Hole Locations
Not to Scale

E11624: Pilsworth Road, Bury
Prepared for: ASDA Stores Limited

APPENDIX 1

Exploratory Hole Records (7 pages)

DTS RAEBURN Ltd.

RECORD OF BORING

CONTRACT: E11624

CLIENT: ASDA Stores Limited
SITE: Pilsworth Road, Bury

NATIONAL GRID REF:
GROUND SURFACE LEVEL:

DATE STARTED: 31/07/2003
DATE COMPLETED: 31/07/2003

BOREHOLE: 01

TYPE OF BORING: Cable Percussion

HOLE DIAMETER: 150 mm

LINING TUBES TO: 10.00 m

INCLINATION: Vertical

VERTICAL SCALE:

DESCRIPTION OF STRATA	LEGEND	DEPTH (m)	LEVEL (m AOD)	REMARKS & GROUNDWATER	IN-SITU PENETRATION TEST	SAMPLES		CHISELLING DETAILS	BACKFILL & STANDPIPE
						REF	DEPTH (m)		
MADE GROUND: Tarmac (Drillers description)		0.10 0.20							
MADE GROUND: Compact mudstone (Drillers description)		0.50							
MADE GROUND: Soft sandy ash and stone (Drillers description)		1.20			N=43 (6,9,10,11,12)	S	0.80 1.00 1.40 1.50 1.70		
MADE GROUND: Black sandy subrounded fine to coarse gravel with some cobbles of ballast and occasional brick		1.70			N=21 (3,6,6,7,4,4)	S	2.00 2.40 2.50		
MADE GROUND: Loose to medium dense brown silty fine to medium sand with rare sand and fine gravel of brick dust		3.60			N=24 (3,3,5,7,6,6)	C	2.90 3.00 3.40 3.60		
Medium dense brown and orange-brown silty fine to medium SAND. Becoming very clayey below 3.0m		5.90					4.00 4.40 5.00 5.30 5.50		
Firm grey-brown and orange sandy slightly gravelly CLAY. Gravel is subrounded fine to medium of quartzite		7.00					8 blows 11 12 6.50 7.00 7.40		
Probably firm becoming stiff dark brown slightly sandy CLAY		9.20					13 blows 14 15 9.00 9.40 9.60		
Stiff dark grey-brown thinly laminated CLAY		10.00					28 blows 18 17 10.00		
Stuff to very stiff dark grey-brown slightly gravelly CLAY. Gravel is subrounded fine to medium of quartzite					N=33 (1,4,5,7,9,12)	C			
End of Borehole at 10.00 m									

Checked By:

Drawn By:

■ = Undisturbed Sample ● D = Small Disturbed Sample
 ● B = Bulk Disturbed Sample ● W = Water Sample

S = SPT
 C = CPT

DTS RAEBURN Ltd.

RECORD OF BORING

CONTRACT: E11624

CLIENT: ASDA Stores Limited
SITE: Pilsworth Road, Bury

NATIONAL GRID REF:
GROUND SURFACE LEVEL:
DATE STARTED: 04/08/2003
DATE COMPLETED: 04/08/2003

BOREHOLE: 02

TYPE OF BORING: Cable Percussion

HOLE DIAMETER: 150 mm
LINING TUBES TO: 9.00 m
INCLINATION: Vertical
VERTICAL SCALE:

DESCRIPTION OF STRATA	LEGEND	DEPTH (m)	LEVEL (m AOD)	REMARKS & GROUNDWATER	IN-SITU PENETRATION TEST	SAMPLES		CHISELLING DETAILS	BACKFILL & STANDPIPE
						REF	DEPTH (m)		
Grass over TOPSOIL (Drillers description)		0.20							
MADE GROUND: Dark brown very sandy clay (reworked topsoil) with occasional fragments of plastic wire and cement		0.70				B01	0.50		
							1.00		
Probably loose orange-brown gravelly fine to coarse SAND with many pockets of soft to firm dark grey-black clay. Slight organic odour		1.80			20 blows	B02	1.45		
						B03	1.50		
							2.00		
					N=8 (2,3,2,3,2,1)	B04	2.45		
Firm grey-brown CLAY with much orange-brown fine to coarse sand		3.00					3.00		
Stiff dark grey-brown slightly sandy CLAY					42 blows	B05	3.45		
						B06	3.50		
							4.00		
					38 blows	B07	4.50		
						B08	4.50		
							5.00		
					32 blows	B09	5.45		
						B10	5.50		
							6.00		
					38 blows	B11	6.45		
						B12	6.50		
							7.00		
						B13	7.45		
						B14	7.50		
							8.00		
					48 blows	B15	8.45		
						B16	8.50		
							9.00		
						B17	9.45		
					N=23 (4,5,6,6,6,5)		9.45		
							10.00		
End of Borehole at 10.00 m		10.00		Borehole dry during drilling	N=28 (6,7,6,7,7,8)	B18	10.45		

Checked By:

Drawn By:

■ = Undisturbed Sample ● D = Small Disturbed Sample S = SPT
 ● B = Bulk Disturbed Sample ● W = Water Sample C = CPT

DTS RAE BURN Ltd.

RECORD OF BORING

CONTRACT: E11624

CLIENT: ASDA Stores Limited
SITE: Pilsworth Road, Bury

NATIONAL GRID REF:
GROUND SURFACE LEVEL:

DATE STARTED: 01/08/2003
DATE COMPLETED: 01/08/2003

BOREHOLE: 03

TYPE OF BORING: Cable Percussion

HOLE DIAMETER: 150 mm

LINING TUBES TO: 10.00 m

INCLINATION: Vertical

VERTICAL SCALE:

DESCRIPTION OF STRATA	LEGEND	DEPTH (m)	LEVEL (m AOD)	REMARKS & GROUNDWATER	IN-SITU PENETRATION TEST	SAMPLES		CHISELLING DETAILS	BACKFILL & STANDPIPE
						REF	DEPTH (m)		
Reinforced CONCRETE (Drillers description)		0.30							
MADE GROUND: Loose ash fill (Drillers description)		0.60							
MADE GROUND: Grey and dark grey slightly silty fine to coarse sand, including lenses of ash with occasional subrounded fine to coarse gravel and rare cobbles of ballast and broken concrete		1.60			N=24 (3,3,5,6,6,7)	B01	0.60		
		2.60				B02	1.00		
Medium dense grey-brown slightly silty slightly gravelly fine to coarse SAND		2.60			N=23 (2,4,3,8,6,6)	B03	1.60		
Stiff dark grey-brown thinly laminated slightly sandy CLAY		3.40				B04	2.00		
		3.40			12 blows	B05	2.60		
		4.90				B06	3.00		
		4.90			18 blows	B07	3.40		
		6.00				B08	4.50		
Stiff brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to quartzite		6.00			13 blows	B09	4.90		
		7.90				B10	6.00		
		8.30				B11	6.40		
Probably medium dense brown and orange-brown silty fine to medium SAND		8.30				B12	7.50		
		9.20				B13	7.90		
Stiff grey-brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of quartzite		9.20			N=39 (3,4,7,12,9,11)	B14	8.30		
		10.00		soils damp between 8.3m and 9.2m but no free groundwater encountered		B15	8.60		
		10.40			23 blows	B15	9.00		
		10.40				B15	9.40		
		10.40				B15	10.00		
		10.40				B15	10.40		

End of Borehole at 10.40 m
Checked By: Drawn By:

■ = Undisturbed Sample ● D = Small Disturbed Sample S = SPT
● B = Bulk Disturbed Sample ● W = Water Sample C = CPT

DTS RAEBURN LTD

RECORD OF TRIAL PITTING

CONTRACT: E11624

CLIENT: ASDA Stores Limited
SITE: Pilsworth Road, Bury

NATIONAL GRID REF:
GROUND SURFACE LEVEL:

DATE STARTED: 31/07/2003
DATE COMPLETED: 31/07/2003

TRIAL PIT: 1

Sheet 1 of 1

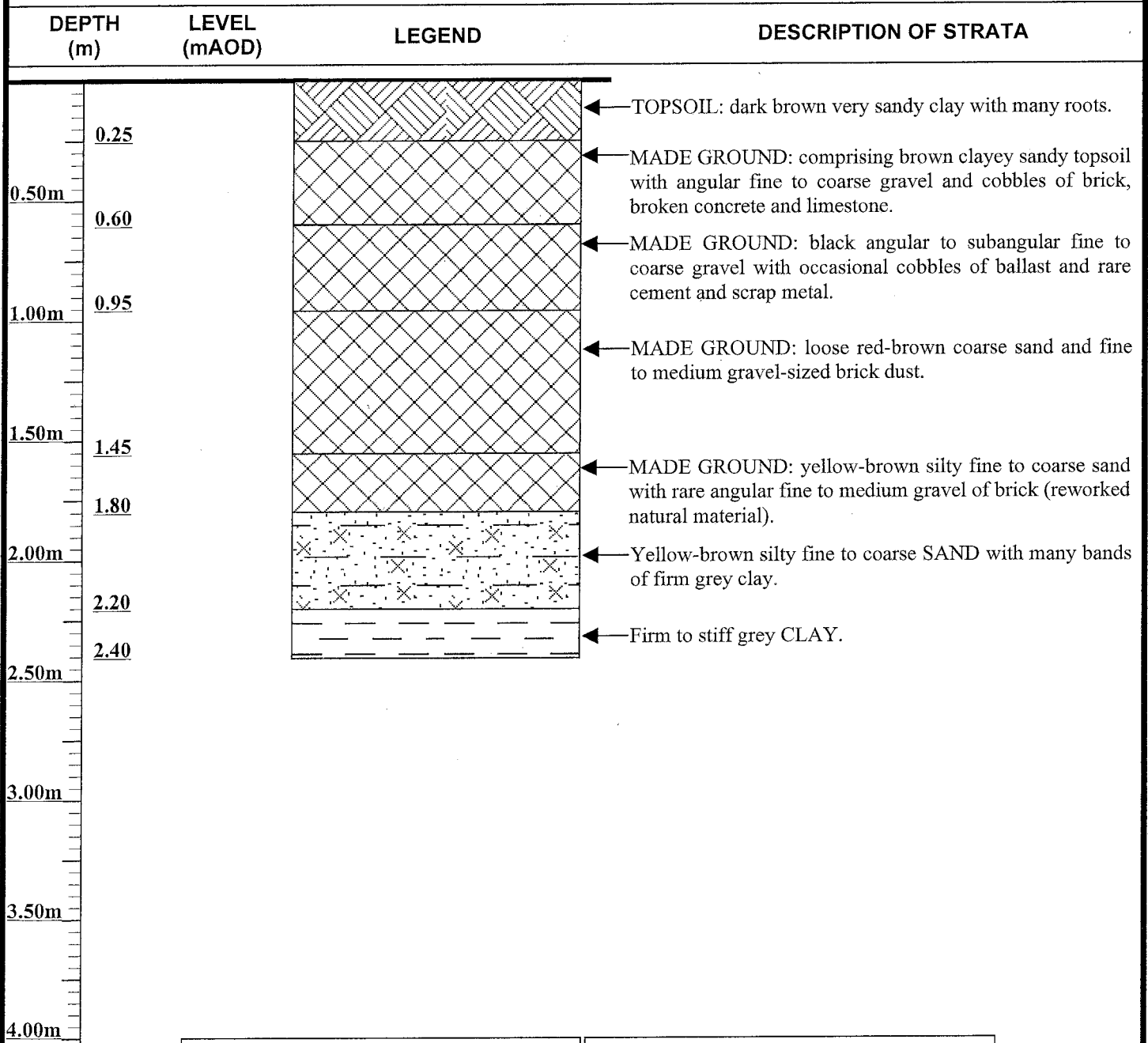
EXCAVATED: Using a JCB 3CX

LENGTH: 2.50m

WIDTH: 0.75m

DEPTH: 2.40m

VERTICAL SCALE: 1:25



REMARKS

- Excavation rate steady
- Excavation unstable above 1.8m, stable below
- No groundwater encountered
- No unusual odours noticed in pit
- Trial pit terminated at 2.40m.

SAMPLES

- | | | |
|---|-------|-------|
| 1 | 0.10m | GJ |
| 2 | 0.40m | B, GJ |
| 3 | 0.70m | B |
| 4 | 1.20m | B |
| 5 | 1.70m | B |
| 6 | 2.00m | B, GJ |
| 7 | 2.40m | B |

Drawn By:

Checked By:

DTS RAE BURN LTD

RECORD OF TRIAL PITTING

CONTRACT: E11624

CLIENT: ASDA Stores Limited

SITE: Pilsworth Road, Bury

NATIONAL GRID REF:

GROUND SURFACE LEVEL:

DATE STARTED: 31/07/2003

DATE COMPLETED: 31/07/2003

TRIAL PIT: 2

Sheet 1 of 1

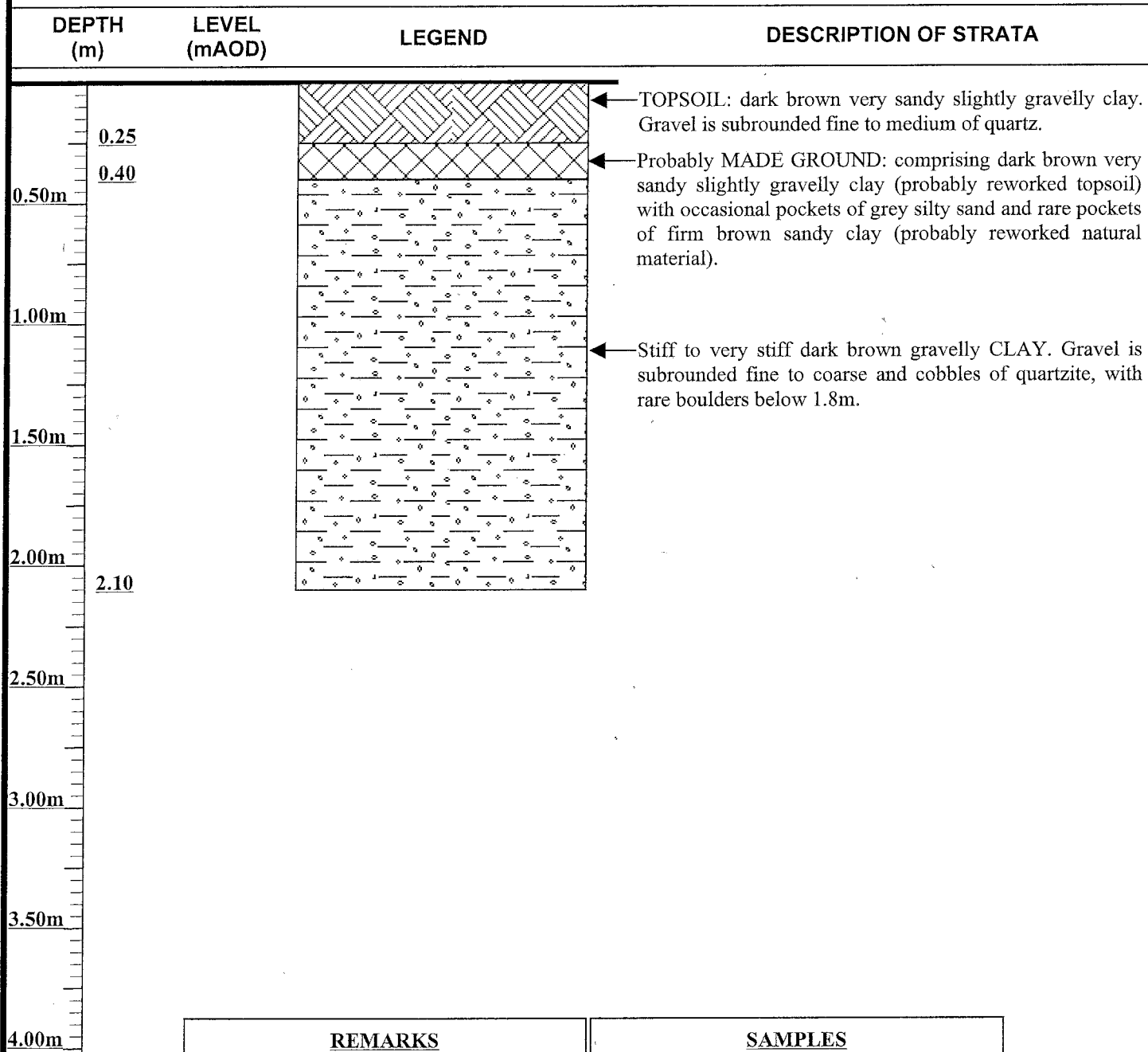
EXCAVATED: Using a JCB 3CX

LENGTH: 2.50m

WIDTH: 0.75m

DEPTH: 2.10m

VERTICAL SCALE: 1:25



REMARKS

- 1 Excavation rate steady
- 2 Excavation relatively stable
- 3 No groundwater encountered
- 4 No unusual odours noticed in pit
- 5 Trial pit terminated at 2.10m.

SAMPLES

- | | | |
|----|-------|-----|
| 8 | 0.15m | GJ |
| 9 | 0.35m | B |
| 10 | 0.60m | CBR |
| 11 | 0.70m | GJ |
| 12 | 1.50m | B |
| 13 | 2.05m | B |

Drawn By:

Checked By:

DTS RAEBURN LTD

RECORD OF TRIAL PITTING

CONTRACT: E11624

CLIENT: ASDA Stores Limited

SITE: Pilsworth Road, Bury

NATIONAL GRID REF:

GROUND SURFACE LEVEL:

DATE STARTED: 31/07/2003

DATE COMPLETED: 31/07/2003

TRIAL PIT: 3

Sheet 1 of 1

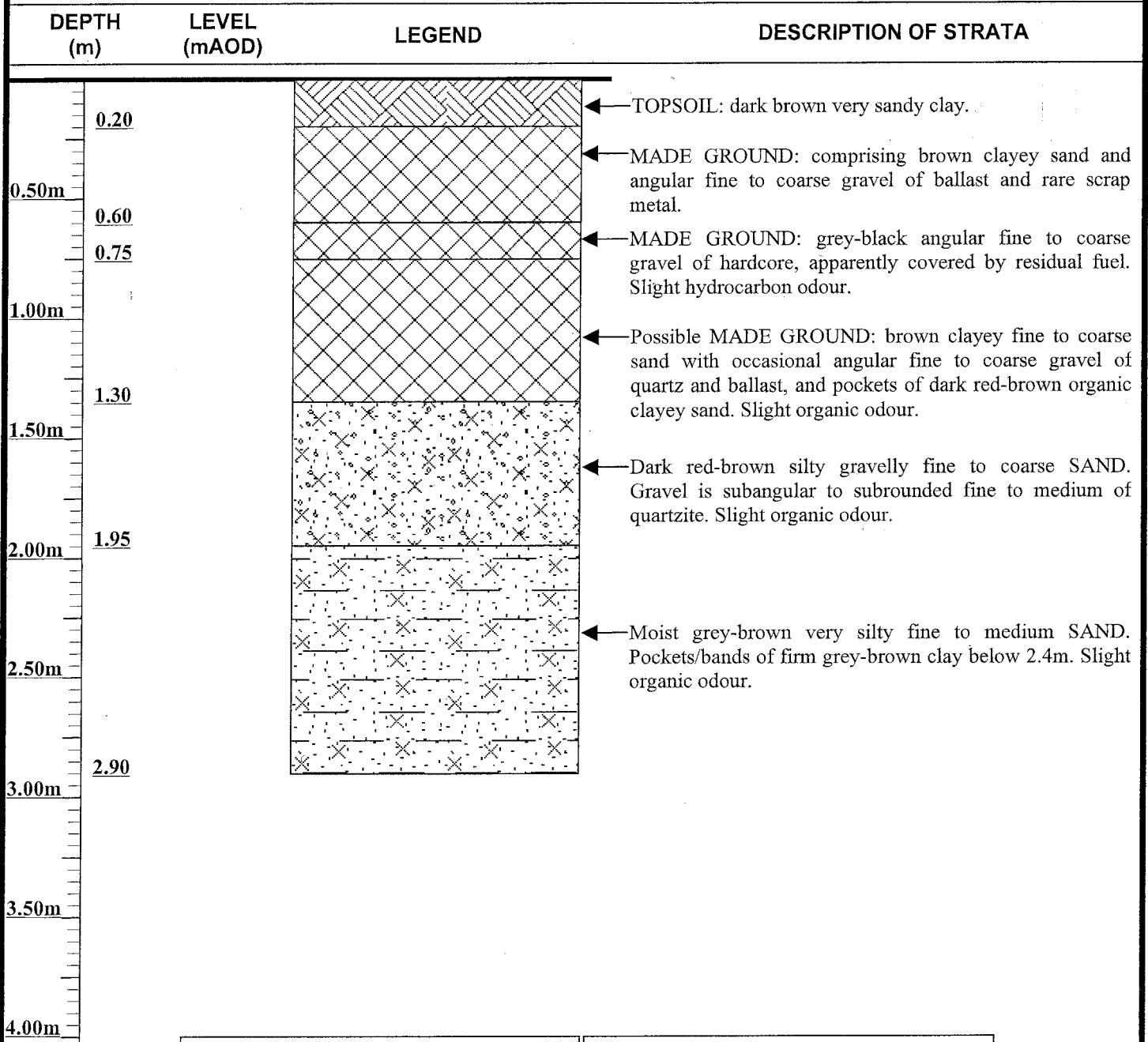
EXCAVATED: Using a JCB 3CX

LENGTH: 2.50m

WIDTH: 0.75m

DEPTH: 2.90m

VERTICAL SCALE: 1:25



REMARKS

- Excavation rate steady
- Excavation relatively stable to 2.4m, unstable below
- Slight groundwater ingress below 2.4m
- Slight hydrocarbon odour 0.6-0.75m, slight organic odour 0.75-2.9m
- Trial pit terminated at 2.90m due to collapse.

SAMPLES

14	0.10m	GJ
15	0.40m	B
16	0.65m	GJ
17	1.00m	B, GJ
18	1.60m	B
19	2.15m	B
20	2.80m	B

Drawn By:

Checked By:

DTS RAEBURN LTD

RECORD OF TRIAL PITTING

CONTRACT: E11624

CLIENT: ASDA Stores Limited

SITE: Pilsworth Road, Bury

NATIONAL GRID REF:

GROUND SURFACE LEVEL:

DATE STARTED: 31/07/2003

DATE COMPLETED: 31/07/2003

TRIAL PIT: 4

Sheet 1 of 1

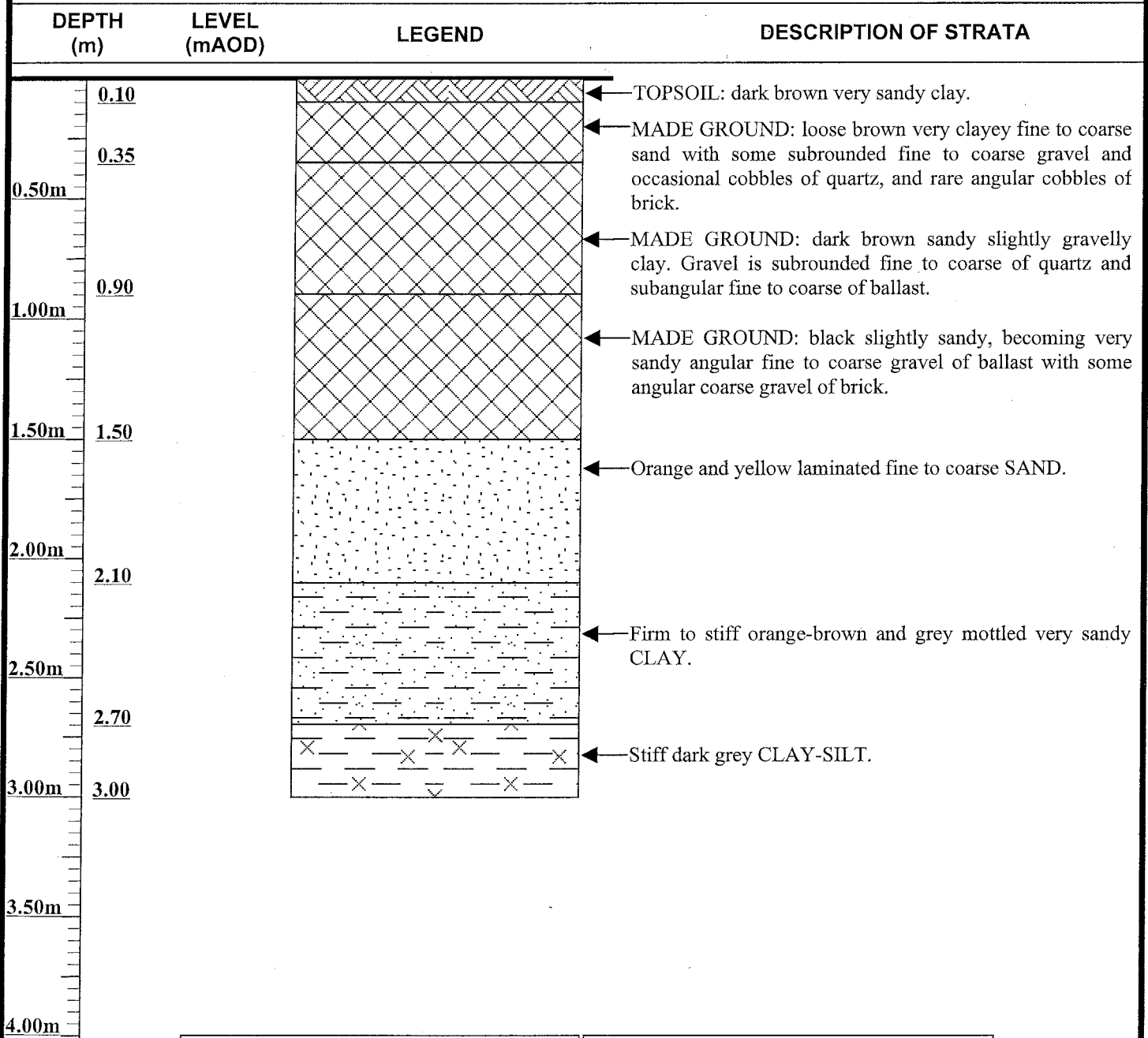
EXCAVATED: Using a JCB 3CX

LENGTH: 2.50m

WIDTH: 0.75m

DEPTH: 3.00m

VERTICAL SCALE: 1:25



REMARKS

- 1 Excavation rate steady
- 2 Excavation relatively stable
- 3 Soils damp below 2.1m, but no free groundwater encountered
- 4 No unusual odours noticed in pit
- 5 Trial pit terminated at 3.00m.

SAMPLES

21	0.05m	GJ
22	0.20m	B
23	0.55m	B
24	1.00m	B, GJ
25	1.70m	B
26	2.20m	B
27	2.85m	B

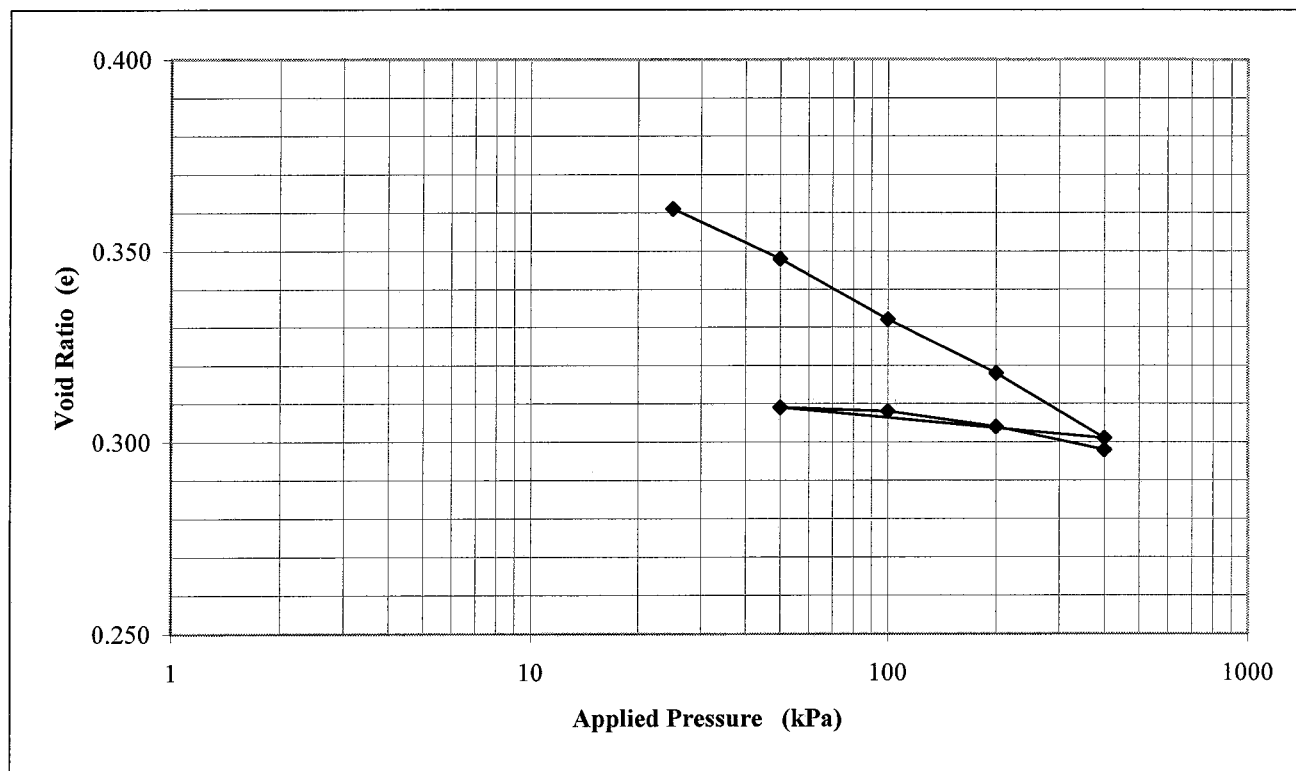
Drawn By:

Checked By:

APPENDIX 2

Geotechnical Laboratory Test Results (11 pages)

TERRA TEK Site Investigation & Laboratory Services		Site Pilsworth Road, Bury		Contract No B8456		Indicates test not carried out								
Client DTS Raeburn Limited														
Hole ID	Depth m	Sample No	Sample Type	Non Engineering Sample Description	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	>425um %	Particle Density Mg/m³				
TP 1	2.40		B	Soft grey CLAY	13	23	13	10	4	?				
TP 2	0.60		B	Firm to stiff grey CLAY	10	?	?	?	?	?				
TP 2	1.50		B	Firm grey CLAY with occasional fine to medium gravel	13	25	14	11	2	?				
TP 3	1.60		B	Brown clayey SAND with much fine to coarse gravel	15	?	?	?	?	?				
TP 3	2.15		B	Grey silty SAND	11	?	?	?	?	?				
TP 4	1.70		B	Light brown SAND	12	?	?	?	?	?				
TP 4	2.20			Light brown silty SAND	23	?	Non-Plastic	?	0	?				
Originator	Checked & Approved	SUMMARY OF INDEX PROPERTIES BS1377 : Part 2 : 1990										Appendix 2 Figure 1		
802												Terra Tek Sheet 1 of 1		

Contract Name **Pilsworth Road, Bury**Number **B8456**Sample Details **BH 1**Type **U100**Start Depth (m) **5.50**Sample Number **BS451**Test Specimen **Specimen taken 50 mm below the top of the U100 tube by vertical extrusion with horizontal orientation.**

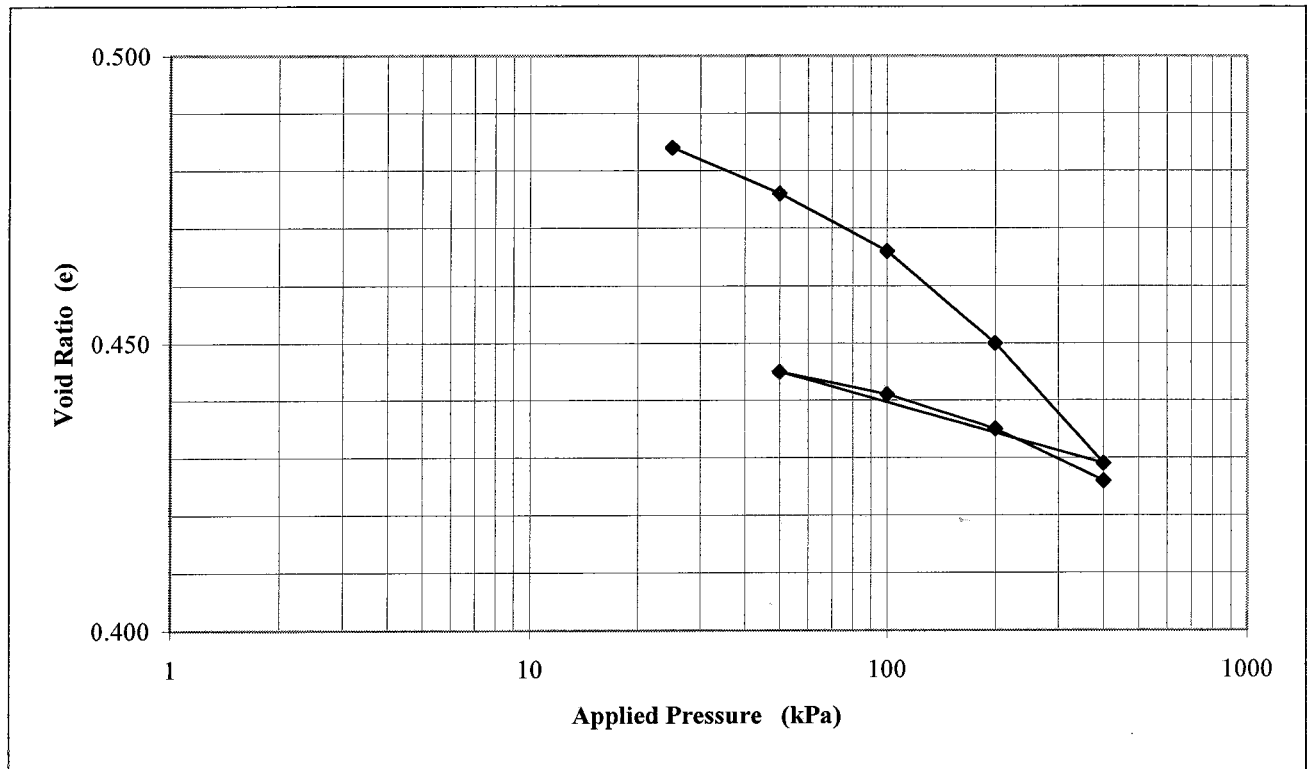
Sample and Test Details					Laboratory Coefficients Sq. Root Time Method	
			Pressure (kPa)	Void Ratio	M_v (m^2/MN)	C_v ($m^2/year$)
Laboratory Temperature	(°C)	20 ± 2				
Initial Height	(mm)	19.35				
Area	(mm ²)	4414	2		0.353	0.66
Particle Density (Assumed)	2.68		25	0.361	0.360	0.88
			50	0.348	0.129	1.00
			100	0.332	0.105	1.62
			200	0.318	0.067	2.81
			400	0.301	0.019	10.65
Moisture Content	(%)	13				
Bulk Density	(Mg/m ³)	2.21	50	0.309	0.029	2.28
Dry Density	(Mg/m ³)	1.95	100	0.308	0.029	5.60
Void Ratio	(e)	0.372	200	0.304	0.022	5.74
Saturation	(%)	93.6	400	0.298		

Results
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to BS 1377 : 1990 : Part 5 : Clause 3

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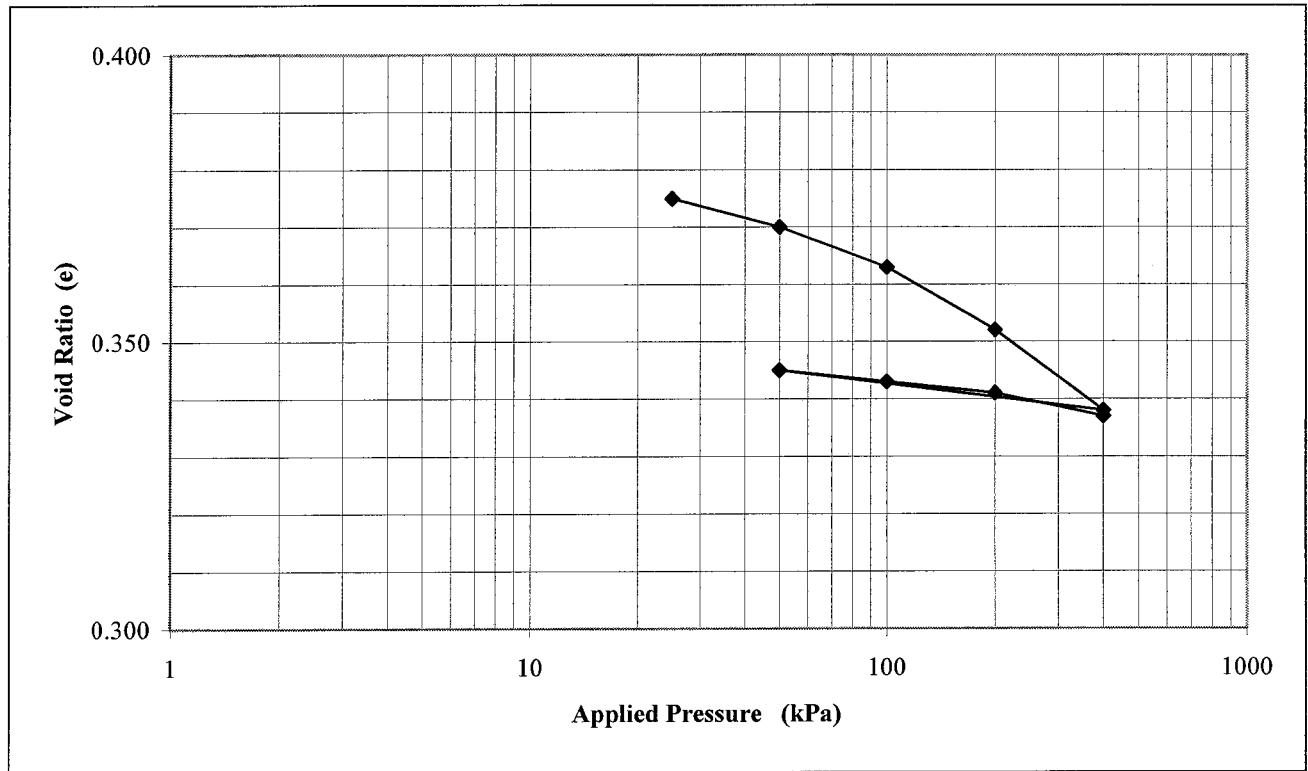
Appendix 2
Figure 2
Page 1 of 1

Contract Name **Pilsworth Road, Bury**Number **B8456**Sample Details **BH 2**Type **U100**Start Depth (m) **3.00**Sample Number **BS454**Test Specimen **Specimen taken 50 mm below the top of the U100 tube by vertical extrusion with horizontal orientation.**

Sample and Test Details					Laboratory Coefficients Sq. Root Time Method	
			Pressure (kPa)	Void Ratio	M_v (m^2/MN)	C_v ($m^2/year$)
Laboratory Temperature	(°C)	20 ± 2				
Initial Height	(mm)	19.25				
Area	(mm ²)	4383	2		0.411	1.00
Particle Density (Assumed)	2.68		25	0.484	0.219	1.14
			50	0.476	0.141	1.56
			100	0.466	0.105	3.30
			200	0.450	0.073	2.65
			400	0.429	0.032	7.21
	Initial Values	Final Values			0.054	2.15
Moisture Content (%)	19	16	50	0.445	0.044	3.91
Bulk Density (Mg/m ³)	2.13	2.21	100	0.441	0.032	4.24
Dry Density (Mg/m ³)	1.79	1.90	200	0.435		
Void Ratio (e)	0.498	0.426	400	0.426		
Saturation (%)	102.2	106.2				

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to BS 1377 : 1990 : Part 5 : Clause 3TERRA
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Figure 3
Page 1 of 1

Contract Name **Pilsworth Road, Bury**Number **B8456**Sample Details **BH 2**Type **U100**Start Depth (m) **5.00**Sample Number **BS455**Test Specimen **Specimen taken 50 mm below the top of the U100 tube by vertical extrusion with horizontal orientation.**

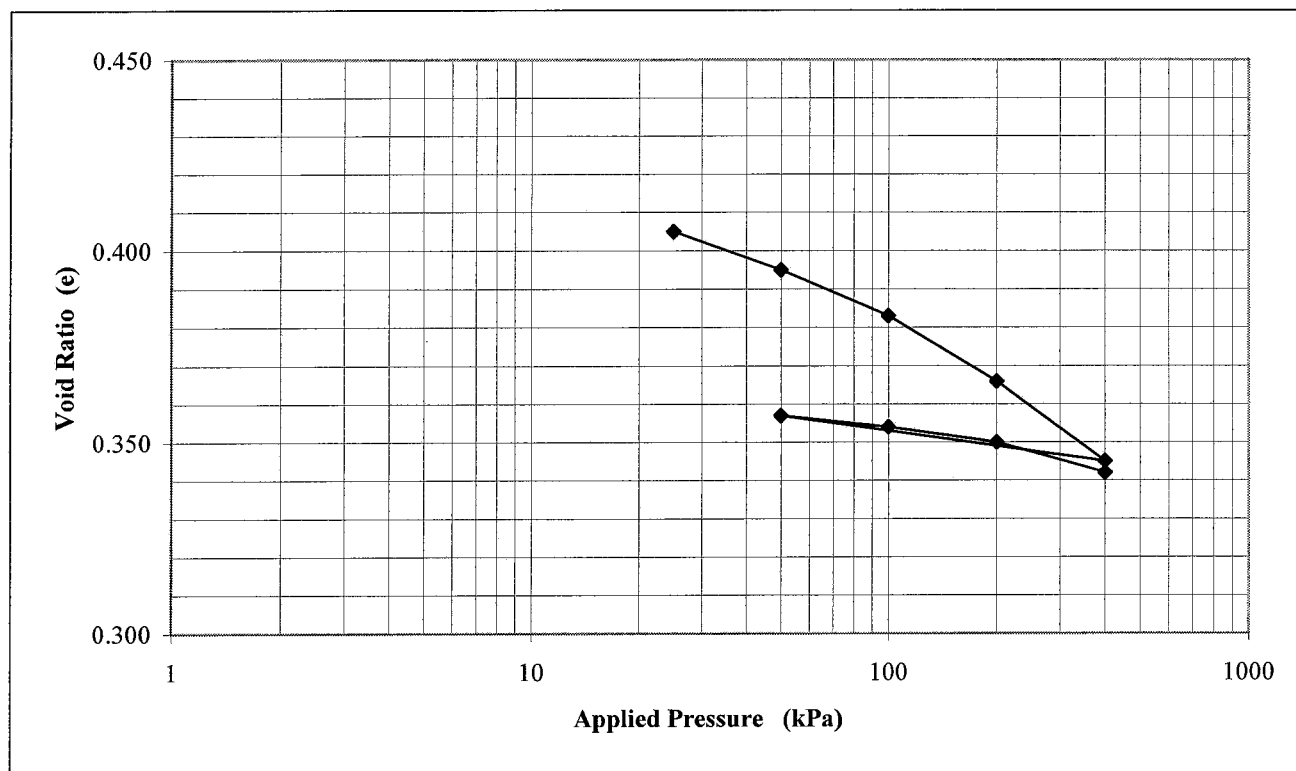
Sample and Test Details					Laboratory Coefficients Sq. Root Time Method	
Laboratory Temperature	(°C)	20 ± 2	Pressure	Void Ratio	M _v (m ² /MN)	C _v (m ² /year)
Initial Height	(mm)	19.30	(kPa)			
Area	(mm ²)	4383	2		0.373	1.51
Particle Density (Assumed)	2.68		25	0.375	0.154	1.31
			50	0.370	0.108	2.46
			100	0.363	0.080	6.01
			200	0.352	0.049	6.00
			400	0.338	0.015	31.97
Moisture Content	(%)	14	50	0.345	0.027	15.60
Bulk Density	(Mg/m ³)	2.20	100	0.343	0.020	9.68
Dry Density	(Mg/m ³)	1.93	200	0.341	0.016	22.46
Void Ratio	(e)	0.387	400	0.337		
Saturation	(%)	96.9				

Results
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to BS 1377 : 1990 : Part 5 : Clause 3

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Appendix 2
Figure 4
Page 1 of 1

Contract Name **Pilsworth Road, Bury**Number **B8456**Sample Details **BH 3**Type **U100**Start Depth (m) **3.00**Sample Number **BS458**Test Specimen **Specimen taken 50 mm below the top of the U100 tube by vertical extrusion with horizontal orientation.**

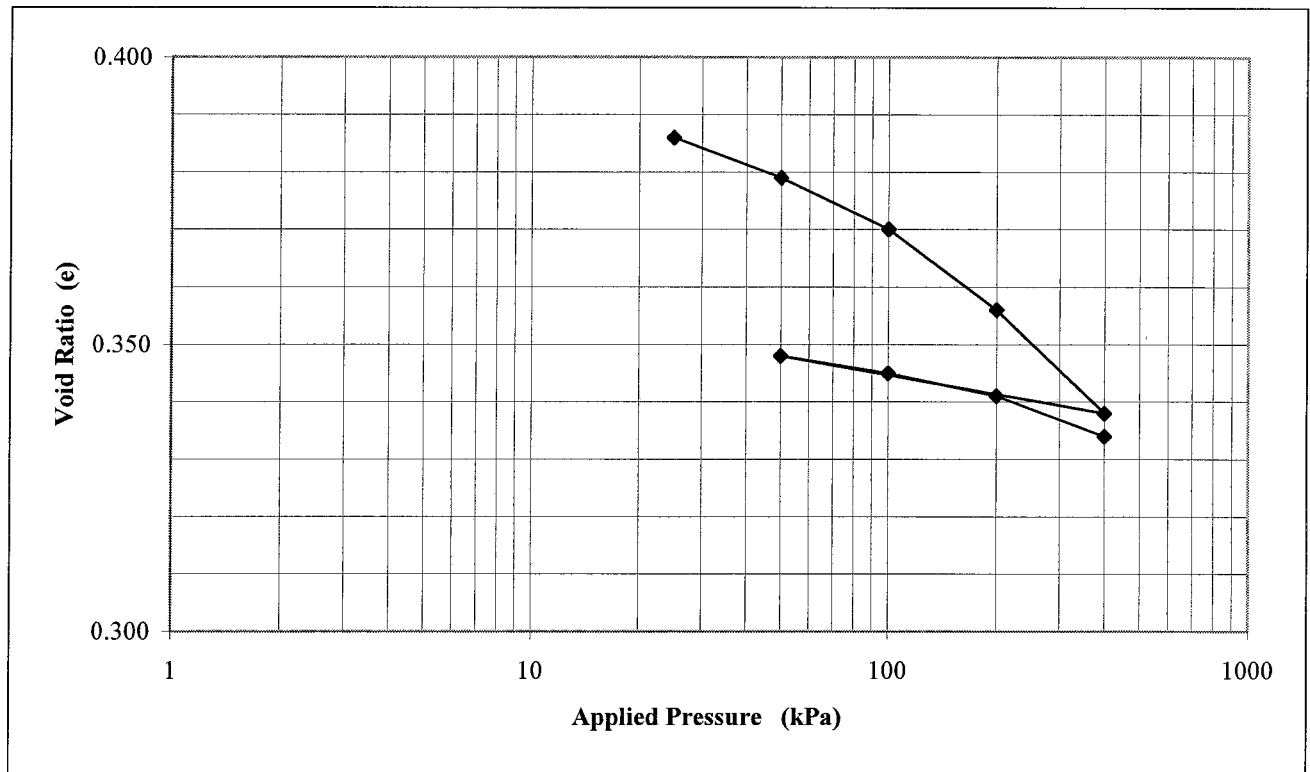
Sample and Test Details					Laboratory Coefficients Sq. Root Time Method	
Laboratory Temperature	(°C)	20 ± 2	Pressure	Void Ratio	M _v (m ² /MN)	C _v (m ² /year)
Initial Height	(mm)	19.60	(kPa)			
Area	(mm ²)	4414	2		0.524	1.23
Particle Density	(Assumed)	2.68	25	0.405	0.286	1.16
			50	0.395	0.175	2.10
			100	0.383	0.124	2.77
			200	0.366	0.077	5.86
			400	0.345	0.027	5.48
Moisture Content	(%)	15	50	0.357	0.042	3.21
Bulk Density	(Mg/m ³)	2.17	100	0.354	0.034	10.69
Dry Density	(Mg/m ³)	1.88	200	0.350	0.030	3.51
Void Ratio	(e)	0.422	400	0.342		
Saturation	(%)	95.2				

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Figure 5
Page 1 of 1

Contract Name **Pilsworth Road, Bury**Number **B8456**Sample Details **BH 3**Type **U100**Start Depth (m) **4.50**Sample Number **BS457**

Test Specimen **Specimen taken 50 mm below the top of the U100 tube by vertical extrusion with horizontal orientation.**



Sample and Test Details					Laboratory Coefficients Sq. Root Time Method	
Laboratory Temperature	(°C)	20 ± 2	Pressure	Void Ratio	M _v (m ² /MN)	C _v (m ² /year)
Initial Height	(mm)	19.50	(kPa)			
Area	(mm ²)	4411	2		0.284	1.34
Particle Density	(Assumed)	2.68	25	0.386	0.195	1.08
			50	0.379	0.134	1.31
			100	0.370	0.100	2.63
			200	0.356	0.066	3.97
			400	0.338	0.022	11.01
Moisture Content	(%)	14	50	0.348	0.008	2.16
Bulk Density	(Mg/m ³)	2.19	100	0.345	0.027	23.86
Dry Density	(Mg/m ³)	1.92	200	0.341	0.030	4.70
Void Ratio	(e)	0.395	400	0.334		
Saturation	(%)	95.0				
		103.2				

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Appendix 2
Figure 6
Page 1 of 1

TERRA TEK
 Site Investigation & Laboratory Services

Project

Pilsworth Road, Bury

Lab Ref No **B8456**

Client

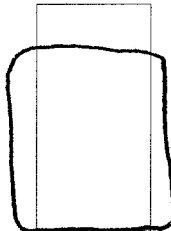
DTS Raeburn

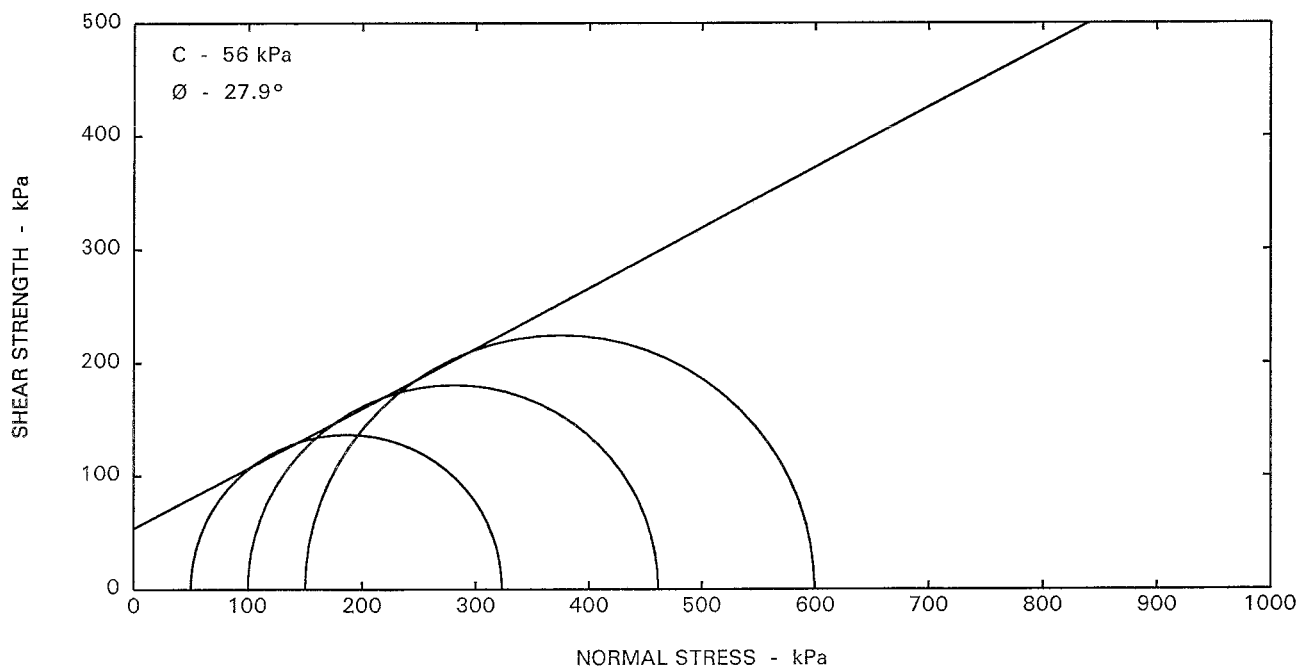
Borehole No 1

Sample

Depth 5.50 - 5.90m

Our Sample Ref 451

Description		Soft to firm dark brown sandy CLAY		
Sample Details				
Specimen Conditions		Undisturbed		
Height	mm	198.2		
Diameter	mm	103.4		
Moisture Content	%	12		
Bulk Density	Mg/m³	2.26		
Dry Density	Mg/m³	2.01		
Test Details	Stage No	1	2	3
Latex Membrane Thickness	mm	1 x 0.5	1 x 0.5	1 x 0.5
Membrane Correction	kPa	1.6	1.8	1.8
Rate of Axial Displacement	%/min	2.02	2.02	2.02
Cell Pressure	kPa	50	100	150
Strain at Failure	%	16.1	18.7	20.2
Maximum Deviator Stress	kPa	273	362	450
Shear Strength	kPa	137	181	225
Mode of Failure				

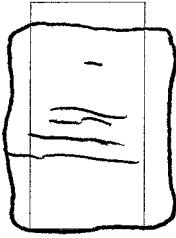
 Orientation and
position of sample
 

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Approved By
 

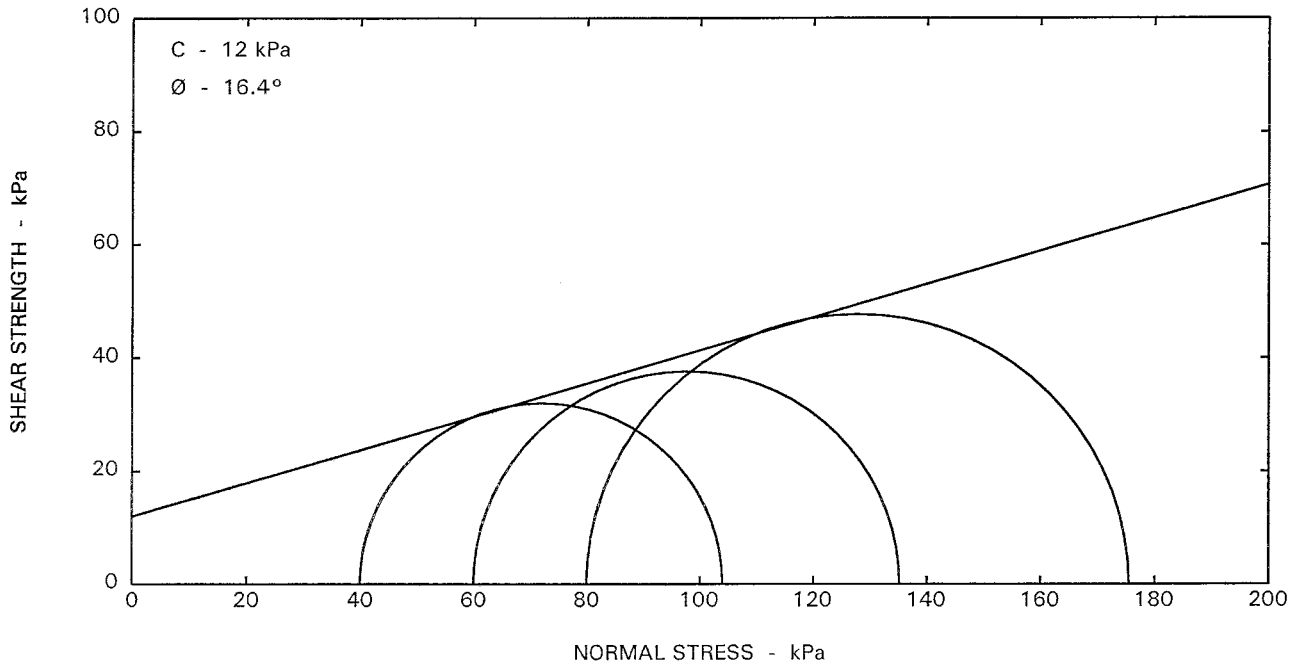
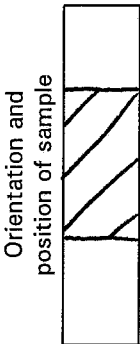
 UNCONSOLIDATED UNDRAINED MULTISTAGE
 TRIAXIAL COMPRESSION
 BS1377:Part 7:1990 Clause 9

 Appendix 2
 Figure 7

Sheet 1 of 1

Project	Pilsworth Road, Bury	Lab Ref No	B8456
Client	DTS Raeburn	Borehole No 2	Sample
		Depth 3.0 - 3.45	Our Sample Ref 454

Description		Soft to firm dark brown silty CLAY with occasional fine to medium rounded gravel			
Sample Details					
Specimen Conditions		Undisturbed			
Height	mm	197.7			
Diameter	mm	103.0			
Moisture Content	%	21			
Bulk Density	Mg/m³	2.06			
Dry Density	Mg/m³	1.70			
Test Details		Stage No	1	2	3
Latex Membrane Thickness	mm		1 x 0.5	1 x 0.5	1 x 0.5
Membrane Correction	kPa		0.8	1.0	1.9
Rate of Axial Displacement	%/min		2.02	2.02	2.02
Cell Pressure	kPa		40	60	80
Strain at Failure	%		6.6	9.1	20.2
Maximum Deviator Stress	kPa		64	75	95
Shear Strength	kPa		32	38	48
Mode of Failure					



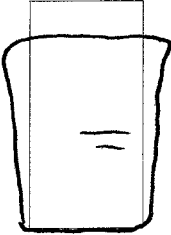
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Appendix 2
Figure 8

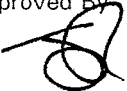
Sheet 1 of 1

TERRA TEK Site Investigation & Laboratory Services	Project	Pilsworth Road, Bury	Lab Ref No	B8456
	Client	DTS Raeburn	Borehole No 2 Sample Depth 5.0 - 5.45m Our Sample Ref 455	

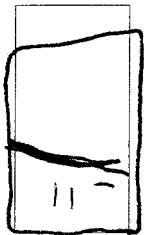
Description		Soft dark brown sandy CLAY	
Sample Details	Specimen No	Single	
Specimen Conditions		Undisturbed	
Height	mm	198.1	
Diameter	mm	103.3	
Moisture Content	%	15	
Bulk Density	Mg/m³	2.14	
Dry Density	Mg/m³	1.86	
Test Details			
Latex Membrane Thickness	mm	1 x 0.5	
Membrane Correction	kPa	1.8	
Rate of Axial Displacement	%/min	2.02	
Cell Pressure	kPa	50	
Strain at Failure	%	20.2	
Maximum Deviator Stress	kPa	135	
Shear Strength	kPa	67	
Mode of Failure			

Orientation and position of sample

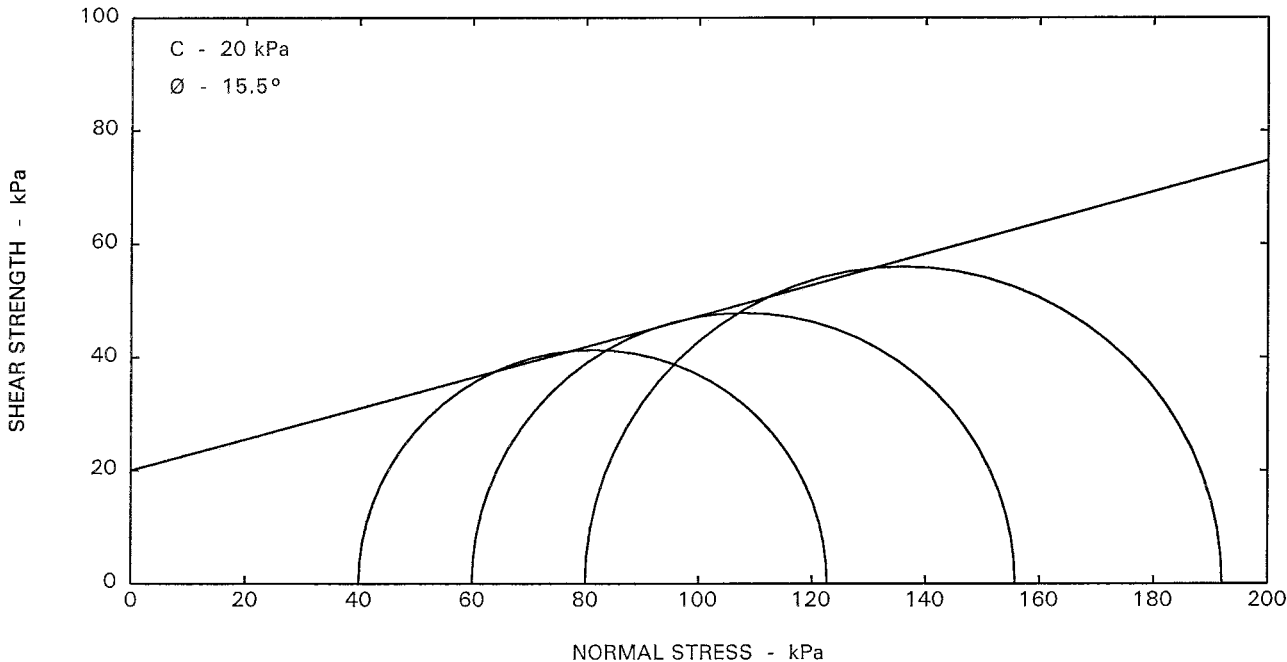


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Project	Pilsworth Road, Bury	Lab Ref No	B8456
Client	DTS Raeburn	Borehole No 3	Sample
		Depth 3.0 - 3.40m	Our Sample Ref 458

Description		Soft to firm dark brown silty CLAY with occasional fine to medium rounded gravel			
Sample Details					
Specimen Conditions		Undisturbed			
Height	mm	197.8			
Diameter	mm	103.1			
Moisture Content	%	15			
Bulk Density	Mg/m³	2.20			
Dry Density	Mg/m³	1.91			
Test Details		Stage No	1	2	3
Latex Membrane Thickness	mm		1 x 0.5	1 x 0.5	1 x 0.5
Membrane Correction	kPa		0.8	1.1	1.9
Rate of Axial Displacement	%/min		2.02	2.02	2.02
Cell Pressure	kPa		40	60	80
Strain at Failure	%		6.6	9.6	20.2
Maximum Deviator Stress	kPa		83	96	112
Shear Strength	kPa		41	48	56
Mode of Failure					
					

Orientation and
position of sample



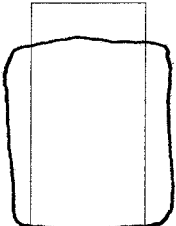
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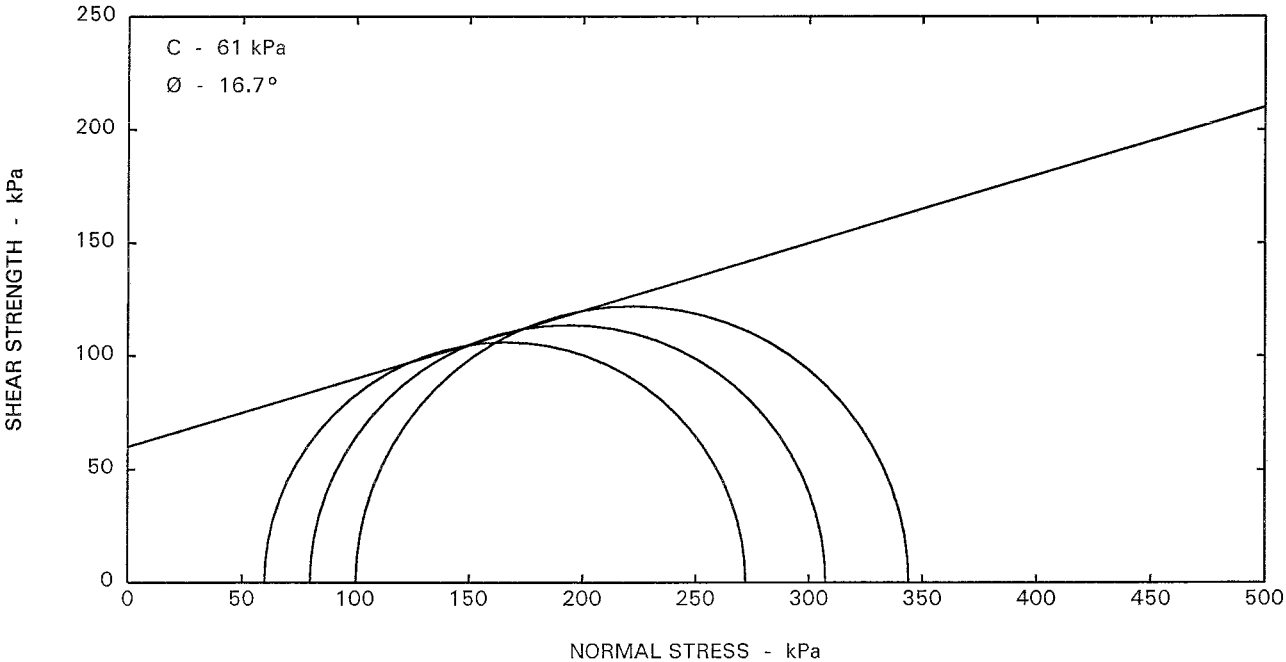
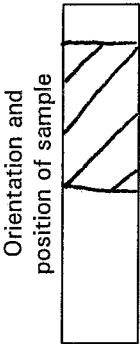
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Appendix 2
Figure 10

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Project	Pilsworth Road, Bury	Lab Ref No	B8456
		Borehole No 3 Sample Depth 4.50 - 4.90m Our Sample Ref 457	
Client	DTS Raeburn		

Description		Firm to stiff dark brown sandy CLAY			
Sample Details					
Specimen Conditions		Undisturbed			
Height	mm	197.9			
Diameter	mm	103.1			
Moisture Content	%	14			
Bulk Density	Mg/m³	2.20			
Dry Density	Mg/m³	1.93			
Test Details		Stage No	1	2	3
Latex Membrane Thickness	mm		1 x 0.5	1 x 0.5	1 x 0.5
Membrane Correction	kPa		1.3	1.5	1.9
Rate of Axial Displacement	%/min		2.02	2.02	2.02
Cell Pressure	kPa		60	80	100
Strain at Failure	%		13.1	15.7	20.2
Maximum Deviator Stress	kPa		212	227	244
Shear Strength	kPa		106	114	122
Mode of Failure					



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TRIAXIAL COMPRESSION

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APPENDIX 3

Contamination Laboratory Test Results (4 pages)

Project Name

Pilsworth Road, Bury

Project Number

B8456

Test Results

Sample Identification	TP3	TP3	TP4	No	No	No	No
Sample Start Depth	0.65	1.00	1.00	sample	sample	sample	sample
Laboratory Sample Number	360	361	345	~	~	~	~
Diesel Range Hydrocarbons (C ₁₀ - C ₄₀) mg/kg	1,369	281	464				
Mineral Oil mg/kg	1,245	198	135				
Interpretation Code	B	B	A				
Petrol Range Hydrocarbons (C ₄ - C ₁₃) µg/kg	681	22	27				
Benzene µg/kg	17	<10	<10				
Toluene µg/kg	18	22	27				
Ethylbenzene µg/kg	<10	<10	<10				
Xylene µg/kg	20	<10	<10				

Result Interpretation Codes

Code Letter	Interpretation
A	No Identification possible
B	Biodegraded diesel/humic acids

Issued

S Langman



Summary of Laboratory Test Results
for Total Petroleum Hydrocarbons
Contained in Soil Samples

Terra Tek
Limited

Appendix 3
Figure 2
Page 1 of 1

B8456

Project Name

Pilsworth Road, Bury

Project Number

B8456

Sample Identification	TP1 2.00	TP2 0.70	TP3 1.00	TP3 1.60	TP3 2.15	TP4 1.70	No sample
Laboratory Sample Number	330	358	361	338	337	341	~
Water Soluble Sulphate as SO ₄ g/l	<0.10	<0.10	<0.10	<0.10	0.16	<0.10	
pH	7.9	~	~	~	6.1	~	

Results
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Approved By

Summary of Laboratory Test Results

Terra
Tek
LimitedAppendix 3
Figure 4
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