Annex 2 - Site Condition Report

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Consulting Engineers Limited

GENT FAIRHEAD & CO LTD
RIVENHALL IWMF
SITE CONDITION REPORT

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1 INTRODUCTION

Gent Fairhead & Co Limited (GFC) is developing an Integrated Waste Management Facility (IWMF), the Rivenhall IWMF (the Installation). The Installation will comprise the following treatment processes:

- A Materials Recycling Facility (MRF);
- An anaerobic digestion (AD) facility;
- A Mechanical Biological Treatment (MBT) facility;
- A De-inked Paper Pulp Production Facility (Pulp plant);
- Combined Heat and Power (CHP) Plant; and
- Water treatment plant.

A detailed description of the Installation Activities is included within the Supporting Information document.

Gent Fairhead & Co Limited initially received planning permission (ESS/37/08/BTE) for the IWMF at Rivenhall Airfield on 2 March 2010 from the Secretary of State following a Public Inquiry (APP/Z1585/V/2104804).

The Environmental Impact Assessment which accompanied the planning application was prepared by Golder Associates (UK) Ltd, the adequacy and robustness of which was tested through public consultation (by statutory and non-statutory consultees) and throughout the planning application process and at Public Inquiry. This Site Condition Report draws upon some of the work that was carried out for that original EIA and subsequent updates for the same scheme.

Following a number of modifications, the extant planning permission is ESS/55/14/BTE granted by Essex County Council on 26th March 2015.

GFC has recently submitted a Section 73 Planning Application to Essex County Council (10 August 2015) for a number of further modifications to the design, involving some building layout changes and some detailed process design. However, the principles of the fully integrated waste management scheme have remained unchanged. The application included all other details related to planning conditions that must be discharged prior to commencement of development. The Environmental Permit application relates to this 'final detailed design' scheme, as would be constructed by GFC subject to gaining planning approval section 73 planning approval (anticipated October/November 2015).

1.1 Site

The Installation is located on the southeastern edge of a World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km), Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km).

Access to the site will be provided via a private access road from the existing A120.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permission, half of the old airfield will become a restored 'bowl' for continued agricultural use. The airfield was open and exposed and had been used predominantly for agricultural purposes, although extensive sand and gravel extraction and restoration has been undertaken at the site.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards and Park Gate Farm Cottages.

1.2 Report Objectives

The primary objective of this report is to provide details of the existing ground conditions for the land within the installation boundary.

This report uses various sources of background information which are provided as Appendices:

- 2008 Environmental Statement – Chapters 5 (Appendix A), Golder Associates;
- 2008 Environmental Statement – Chapters 6 (Appendix B), Golder Associates;
- 2009 Ground Investigation at Rivenhall Airfield, Essex, February 2010 (Appendix C), Golder Associates; and
- 2014 CC Ground Investigations Ltd (CCGI) - Factual Report – Rivenhall Airfield IWMF (Appendix D).

This report study considers:

(1) Geology;

(2) Hydrogeology;

(3) Hydrology and Flooding;

(4) Historical and present land use; and

(5) Existing ground conditions.

This report:

(1) considers the proposed activities to be carried out on the application site;

(2) identifies any land contamination risk the activities pose that may be linked to previous pollution events; and

(3) provides a baseline for the existing ground conditions.

Drawings can be found in Annex 1 of the supporting information for the Application, including:

(1) Site location plan;

(2) Installation boundary;

(3) Emission points drawing; and

(4) Process schematic.

2 DESK STUDY INFORMATION

2.1 Geology

2.1.1 Regional Geology

The published geological maps for the region, sheet 223 covering the Braintree area (IGS, 1982) and sheet 241 covering the Chelmsford area (IGS, 1976), show that the installation is underlain by Boulder Clay quaternary drift deposits overlying the London Clay.

The Boulder Clay (the Lowestoft Till) consists of a generally pale brown to buff sandy clay with chalk fragments. The basal beds have shown banding and crude laminations. Below the Boulder Clay a continuous or almost continuous sheet of Sands and Gravels is present. This is identified as the Kesgrave Sands and Gravels, which are a sequence of fluvial glacial gravels laid down in a braided river system and containing flint, vein quartz, quartzite, sandstone and occasional igneous and metamorphic rock gravel clasts. The deposit is worked extensively for aggregate and building sand. Across the majority of the IWMF's footprint the underlying sand and gravel has been worked and excavated as part of the wider quarrying operations across the site.

The tertiary London Clay underlies the drift deposits.

This is a stiff blue grey silty clay, with the upper surface often weathered exhibiting a colour change to brown grey. Up to 69 m of London Clay is indicated on the geological map in the area and it is exposed in the river valleys to the north and the south where the drift deposits have been eroded. Below the London Clay, the formations of the Thanet Sand and Lambeth Group can be recognised in borehole logs above the Upper Chalk. The surface of the Upper Chalk lies at approximately -40 m OD (approximately 90 m depth) beneath the current Site elevation, dipping to the south.

2.1.2 Local Geology

As reported in the planning application for the Riverhall IWMF, the local drift geology in the area has been investigated by RMC Group (now CEMEX) to provide information regarding the reserves of Sands and Gravels, and by Golder to provide information critical to establishing the hydrogeological environment of the area. The findings of the site investigations carried out in 1990 and 1991 are summarised below.

The investigations covered the whole of Rivenhall Airfield area, with only a limited number of boreholes being located within the installation boundary.

The quaternary Boulder Clay deposit is described in the site investigation borehole logs as consisting of layers of firm to stiff orange or brown grey chalky mainly silty or gravelly clay with occasional sandy clay. The reported thickness of the Boulder Clay deposit varies between 1.6 m and 17 m. However, the CCGI Factual Report, reports a thickness of up to 7m across the Site.

Below the Boulder Clay unit, Sands and Gravels deposits are reported in most boreholes. The deposits are described as consisting of loose to medium dense yellow or orange brown or grey brown Sands and Gravels or sandy Gravels with some chalk or flint in upper layers and some small cobbles or occasional clay nodules in lower layers. The Sands and Gravels layers are sometimes reported as being interspersed with thin sandy clay layers. The reported thickness of the Sands and Gravels deposit varies between 0 m and 11.2 m. However, the CGI Factual Report reports a thickness of approximately 6 to 7m across the Site.

The London Clay is reported below the Sands and Gravels in all boreholes.

This is described as consisting of stiff to very stiff brown or grey clay. The upper surface of the London Clay is often weathered; the upper layers of the clay are often described as silty clay and often contain some gravel. The upper surface of the London Clay is reported on Site between 33 m AOD and 36 m AOD.

2.2 Hydrogeology

The groundwater vulnerability maps for this area (Environment Agency, 1994 and Environment Agency, 1995) classify the Boulder Clay deposits that the Site is located on as a non-aquifer. A non-aquifer is a formation that is generally regarded as yielding insignificant quantities of groundwater. The Kesgrave Sands and Gravels beneath the Boulder Clay are classified as a Minor aquifer that can be used locally as a source of water and is important in supplying base flow to rivers (Figure 6-3B).

From all available information (and experience from quarrying operations in and around the IWMF site), the Kesgrave Formation sand and gravel deposits beneath the Site contain minor amounts of water, with the pattern of groundwater flow in and around the Site being influenced to some degree by the River Blackwater, and also by the topography of the surface of the underlying London Clay. Hollows in the underlying London Clay surface typically contain groundwater. The cohesive and relative impermeable nature of the Lowestoft Formation overburden typically restricts the recharge to the Kesgrave Formation.

The London Clay is classified as a non-aquifer, with the Upper Chalk below, classified as a Major Aquifer that is developed for industrial, public and general agricultural use. The hydrogeological map of the area (BGS, 1981) indicates that in 1976 the piezometric surface of the Chalk Aquifer was at around +10 m AOD, approximately 50 m below the current ground level. The Site is therefore separated from the Major Chalk Aquifer by approximately 40 m of the low permeability London Clay.

According to data maps located on the Environment Agency website, the Site is not located within any source protection zones (SPZ). The closest SPZ is located approximately 9 km to the north of the Site.

Information supplied by the Environment Agency has revealed that there are 6 licensed groundwater abstractions within a 5 km radius of the site (Appendix 6-1). These are detailed in Table 6-1 and shown on Figure 6-2. The Environmental Services Department of Braintree District Council have confirmed that they have no records of private water abstractions within 5 km of the Site.

2.3 Hydrology and Surface Waters

The Environment Agency (which includes the former National River Authority) has produced a series of maps, covering England and Wales, which identify the vulnerability of groundwater to contamination. It uses geological information to define Major Aquifers, Minor Aquifers and non-aquifers, and information on soils to determine the protection afforded to the underlying geology and therefore its overall vulnerability.

2.4 Pollution History

2.4.1 Historical Land Use within the Installation Boundary

Prior to World War II, historic on-Site activities were dominated by agricultural land use.

During the War, Rivenhall was developed into a base for the United States Air Force (USAF) and the Royal Air Force (RAF). Construction of the airfield started in the early months of 1943, and was operational until shortly after the end of the War in 1946. Presented in the table below is a summary of the historical development of the site, which has been informed by information from the landowner, as presented in the Environmental Statement, and the published information for the land within the installation boundary:

Table 2-1: Site History

Date	Description
Pre – 1943	The site was undeveloped and was used for agriculture.
Late 1943	Rivenhall Airfield was constructed.
1943 – 1946	Rivenhall was an operational base for both USAF and RAF.
1956 – 2002	Rivenhall Airfield runways and buildings let to Marconi and used for testing radar systems.
1946 – present	Land around runways at Rivenhall Airfield returned to agricultural use.
1999 – present	Quarrying operations across Bradwell Quarry dominate the area surrounding the site.

2.4.2 Historical Incidents

The contaminated land regime set out in Part IIA of the Environmental Protection Act 1990 provides a risk based approach to the identification and remediation of land. Part IIA is aimed at addressing land which has been historically contaminated and which poses unacceptable risks to human health or the environment.

Braintree District Council is currently in the process of compiling a database of contaminated land within the District boundary. Braintree District Council confirmed that there are no known contaminated land sites at or in the vicinity of Rivenhall Airfield. There are no sites on the database apart from a few small unknown in-fills which may have been highlighted when transferring information from old Ordnance Survey maps and may merely relate to a change in the topography of the land rather than any proven concerns.

It is unlikely that any of the current or historic land uses at the Site will have significantly contaminated the land beneath the proposed IWMF. Potential areas of concern such as the Bomb Dump and Shooting-in Butts associated with the airfield operations have been removed from the Site. Some localised areas of contamination as a result of the historic Generator Site or current scrap vehicle breaking, printing, and disposal and workshops are possible but these are located beyond the Site.

2.4.3 Permits & Consents

2.4.3.1 Groundwater Abstractions

As stated within the information presented in Appendix A, there are six licensed groundwater abstractions within a 5km radius of the installation, as presented below:

(1) A&B Hayes Farms (NGR – TL798236) – groundwater well;

(2) Blackwater Aggregates (NGR – TL81792172) – groundwater catchpit;

(3) JR Pearce (NGR – TL81792172) – groundwater well points;

(4) PT Tyrie (NGR – TL828187) – groundwater borehole;

(5) Total Butler (NGR – TL860185) – groundwater borehole; and

(6) Stacey Farms (NGR – TL809179) – groundwater well.

As can be seen from the information presented above, none of the abstractions are within the installation boundary.

2.4.3.2 Surface Water Abstractions and Discharges

There are sixteen licensed surface water abstractions and discharges within a 5km radius of the installation, as presented below:

(1) S&K Butler (NGR – TL786229, TL798232) – surface water abstraction;

(2) G&S Coode-Adams (NGR – TL853215, TL865211) – River Blackwater abstraction;

(3) R&D Bunting (NGR – TL850169, TL854211) – River Blackwater abstraction;

(4) A&B Hayes (NGR – TL850169, TL854211) – River Blackwater and Pond abstraction;

(5) R Goodwin & Sons (NGR – TL855173) – River Blackwater;

(6) Braintree Golf Club – (NGR – TL797243) – River Blackwater;

(7) RA Brice & Partners – (NGR – TL797243) – River Blackwater;

(8) G&S Coode-Adams – (NGR – TL864209, TL863195) – River Blackwater;

(9) G&S Coode-Adams – (NGR – TL864196, TL861214) – River Blackwater;

(10) G&S Coode-Adams – (NGR – TL864196, TL861214) – River Blackwater;

(11) G&S Coode-Adams – (NGR – TL864196, TL861214) – River Blackwater;

(12) Gent Fairhead & Co Limited (NGR – TL834222) – River Blackwater;

(13) G&S Coode-Adams – (NGR – TL860215, TL863195) – River Blackwater;

(14) Ferringbury Holdings – (NGR – TL801215) – River Blackwater;

(15) Strutt & Parker (Farms) Ltd – (NGR – TL801173, TL807163 & TL784188) – River Brain; and

(16) Strutt & Parker (Farms) Ltd – (NGR – TL794179, TL811161) – River Brain.

None of these abstraction and discharge licences are within the installation boundary.

2.4.3.3 Waste Management Licences

A review of the information presented on the Environment Agency 'What is in Your Backyard' (http://maps.environment-agency.gov.uk/wiyby/) it is indicated that there are three waste management licences for facilities within a 2km radius of the installation.

- Coggeshall Quarry - Waste land recovery;
- Braintree Quarry - Mining Waste; and
- Land / Premises at Woodhouse Lane - Waste treatment.

3 PREVIOUS CONTAMINATION AND SITE INVESTIGATIONS

As required by Environment Agency guidance note H5: Site Condition Report – Guidance and Templates, 'where a facility involves the use, production or release of RHS' a baseline report must be submitted as part of the application SCR.

At the time of submitting this application, there are only two reports available which provide detail on the extent of the existing ground conditions within the installation boundary. The reports are titled as follows:

(1) 2009 Ground Investigation at Rivenhall Airfield, Essex (Appendix B); and

(2) CC Ground Investigations Ltd (CCGI) - Factual Report – Rivenhall Airfield IWMF (Appendix C).

The analysis presented within these reports is intended to report on the baseline conditions for the installation, providing a quantitative assessment of the quality of the land prior to permit issue.

3.1 Site Investigations

3.1.1 2009 Ground Investigation at Rivenhall Airfield, Essex

The site investigation was commissioned by Golder Associates (UK) Ltd and undertaken between 8 and 16 June 2009.

The site investigation was commissioned to provide an initial characterisation of the geotechnical and geological ground conditions for the initial design of foundations and retaining walls. The results of the soil and groundwater analysis are presented within this report.

3.1.2 2014 CC Ground Investigations Ltd (CCGI) - Factual Report – Rivenhall Airfield IWMF

The purpose of the ground investigation was to provide information to assist in the design of IWMF.

Twenty exploratory holes were carried out between 21st July and 22nd August 2014. The boreholes used percussive sampling techniques to produce continuous disturbed samples ranging between 112mm and 98mm diameter. Gas/water monitoring standpipes were installed in four of the boreholes. Vibrating Wire Piezometers were installed in two of the boreholes.

The results of the soil and groundwater analysis are presented within this report.

3.1.3 Soil Contamination Monitoring & Results

All available results from soil testing data are presented within Table 3-1. Where pollutants were below the limit of detection, these have not been presented within this report.

Table 3-1: Soil Contaminants

Pollutant	Min Value (mg/kg) unless stated	Max Value (mg/kg) unless stated
Magnesium aqueous extract	< 10	68
pH	7.3	8.8

Table 3-1: Soil Contaminants		
Pollutant	**Min Value (mg/kg) unless stated**	**Max Value (mg/kg) unless stated**
Chloride aqueous extract	4.8	58
Nitrate aqueous extract (as NO3)	< 1.0	1.9
Sulphate aqueous extract (as SO4)	1.0	2100
Total Sulphur as S	< 0.01 %	1.5 %
Total Sulphate as SO4	0.02 %	0.31 %
Water soluble nitrate	-	< 1.0
Water soluble chloride	-	<50
Water soluble sulphate	0.01	50
Total (Acid-soluble) as SO4	< 0.010	0.12

3.1.4 Groundwater and Ground Gas Monitoring & Results

Groundwater monitoring was undertaken across the site in August 2013 by Golder Associates Ltd. Two of the boreholes (BH11 and H19) which were used for groundwater monitoring are located within the installation boundary. The results of contaminants presented within the groundwater are presented in Table 3-2. Where pollutants were below the limit of detection, these have been presented within this report.

Table 3-2: Groundwater Contaminants		
Pollutant	**Min Value (ug/l) unless stated**	**Max Value (ug/l) unless stated**
Dichlorodifluoromethane	-	<2
Methyl Tertiary Butyl Ether	-	<0.1
Chloromethane	-	<3
Vinyl Chloride	-	<0.1
Bromomethane	-	<1
Chloroethane	-	<3
Trichlorofluoromethane	-	<3
1,1-Dichloroethene (1,1 DCE)	-	<3
Dichloromethane (DCM)	-	<3
trans-1-2-Dichloroethene	-	<3
1,1-Dichloroethane	-	<3
cis-1-2-Dichloroethene	-	<3

Table 3-2: Groundwater Contaminants		
Pollutant	**Min Value (ug/l) unless stated**	**Max Value (ug/l) unless stated**
2,2-Dichloropropane	-	<1
Bromochloromethane	-	<2
Chloroform	-	<2
1,1,1-Trichloroethane	-	<2
1,1-Dichloropropene	-	<3
Carbon tetrachloride	-	<2
1,2-Dichloroethane	-	<2
Benzene	-	<0.5
Trichloroethene (TCE)	-	<3
1,2-Dichloropropane	-	<2
Dibromomethane	-	<3
Bromodichloromethane	-	<2
cis-1-3-Dichloropropene	-	<2
Toluene	-	<0.5
trans-1-3-Dichloropropene	-	<2
1,1,2-Trichloroethane	-	<2
Tetrachloroethene (PCE)	-	<3
1,3-Dichloropropane	-	<2
Dibromochloromethane	-	<2
1,2-Dibromoethane	-	<2
Chlorobenzene	-	<2
1,1,1,2-Tetrachloroethane	-	<2
Ethylbenzene	-	<0.5
p/m-Xylene	-	<1
o-Xylene	-	<0.5
Styrene	-	<2
Bromoform	-	<2
Isopropylbenzene	-	<3
1,1,2,2-Tetrachloroethane	-	<4
Bromobenzene	-	<2
1,2,3-Trichloropropane	-	<3
Propylbenzene	-	<3
2-Chlorotoluene	-	<3
1,3,5-Trimethylbenzene	-	<3

Table 3-2: Groundwater Contaminants		
Pollutant	**Min Value (ug/l) unless stated**	**Max Value (ug/l) unless stated**
4-Chlorotoluene	-	<3
tert-Butylbenzene	-	<3
1,2,4-Trimethylbenzene	-	<3
sec-Butylbenzene	-	<3
4-Isopropyltoluene	-	<3
1,3-Dichlorobenzene	-	<3
1,4-Dichlorobenzene	-	<3
n-Butylbenzene	-	<3
1,2-Dichlorobenzene	-	<3
1,2-Dibromo-3-chloropropane	-	<2
1,2,4-Trichlorobenzene	-	<3
Hexachlorobutadiene	-	<3
Naphthalene	-	<2
1,2,3-Trichlorobenzene	-	<3
Surrogate Recovery Toluene D8	-	102
Surrogate Recovery 4-Bromofluorobenzene	-	114
Dissolved Arsenic	-	<2.5
Dissolved Boron	-	<12
Dissolved Cadmium	-	<0.5
Dissolved Calcium	140.6	155.7
Total Dissolved Chromium	-	<1.5
Dissolved Copper	-	<7
Total Dissolved Iron	-	<20
Dissolved Lead	-	<5
Dissolved Magnesium	3	8.8
Dissolved Manganese	-	<2
Dissolved Mercury	-	<1
Dissolved Nickel	-	<2
Dissolved Potassium	0.4	9.7
Dissolved Selenium	-	<3
Dissolved Sodium	12.4	107.5
Dissolved Zinc	5	10

Table 3-2: Groundwater Contaminants		
Pollutant	**Min Value (ug/l) unless stated**	**Max Value (ug/l) unless stated**
EPH (C8-C40)	-	<10
GRO (>C4-C8)	-	<10
GRO (>C8-C12)	-	<10
GRO (>C4-C12)	-	<10
Sulphate	77.87	261.99
Chloride	17.8	43.9
Nitrate as NO3	63	73.8
Nitrite as NO2	-	<0.02
Ammoniacal Nitrogen as N	0.03	0.04
Total Alkalinity as CaC03	304	354
Carbonate Alkalinity as CaC03	-	<1
Bicarbonate Alkalinity as CaC03	304	354
BOD (Settled)	-	<1
COD (Settled)	7	9
pH	7.61	7.8
Total Organic Carbon	-	<2

At the time of submitting the EP application there are no records available for ground gas monitoring for the site.

3.2 Baseline Reference Data

The limited data available on any existing ground contamination is presented in section 3.1. Section 3.1 presents the range of concentrations recorded in the site investigation for a limited number of determinants.

As stated within Article 22 (2) of the IED:

Where the activity involves the use, production or release of relevant hazardous substances and having regard to the possibility of soil and groundwater contamination at the site of the installation, the operator shall prepare and submit to the competent authority a baseline report before starting operation of an installation or before a permit for an installation is updated for the first time after 7 January 2013.

There are two conditions within the planning permission (condition 24 and condition 25), which require a scheme for ground water monitoring and contaminated soil (including remediation and mitigation measures should contamination be identified) to be submitted to and approved by the Local Planning Authority prior to the commencement of construction. Records of any contamination and groundwater sampling collected for the discharge of these conditions will be used to further update the baseline ground conditions for the installation prior to the commencement of operations. As required by condition 24 of the planning permission, a scheme of works to undertake ground water monitoring at the site has been submitted to the Local Planning Authority for approval. When the scheme has been agreed with the Local Planning Authority this scheme will be fully implemented and the results of the monitoring will be made available to the Environment Agency. It is proposed by GFC that the implemented scheme is used to report on the baseline ground conditions at the installation.

In addition, as required by condition 25, whilst there is no existing evidence of ground contamination arising as a consequence of historical activities, the removal of remnants of the former airfield could lead to the disturbance of previously unidentified contamination. To address this issue a 'watching brief' will be maintained during site clearance works to determine the presence of previously unidentified zones of soils or groundwater contamination.

The 'watching brief' will implement a series of actions as follows:

- General removal of topsoil and subsoils should be undertaken in a manner that limits exposure of soil to surface water runoff and allows visual and olfactory observation of all materials by a competent, designated clerk of works or equivalent;
- In the event that visual or olfactory evidence indicates a potential area of concern, then all excavation works will cease to ensure that potentially unknown sources of contamination from the ground or groundwater are not mobilised further;
- The clerk of works will contact Gent Fairhead & Co Limited, to determine what steps can be taken to isolate the material pending further investigation. This may include, but not be limited to, excavation and storage of small volumes of soils in a designated quarantine area. The Environment Agency and Local Planning Authority will be informed and an appropriate course of action will be agreed;
- The potential area of concern will be appropriately assessed, primarily through sampling and laboratory analysis, and any requirement for remedial works will be identified. The scope of any proposed remedial works will be agreed with the Environment Agency and Local Planning Authority prior to works commencing. This may include the need for additional investigation and/or risk assessment to support the works; and
- Records shall be maintained of all areas investigated and actions taken to remediate these, including appropriate verification / validation reports. These will need to be submitted to the Environment Agency and Local Planning Authority for approval.

During construction of the installation concrete surfacing, site drainage, raw material and residue storage facilities will be constructed to provide protection of the underlying ground and groundwater.

4 PERMITTED ACTIVITIES

4.1 Permitted Activities

The permitted activity will consist of a combination of Schedule 1 installation activities (as defined in the Environmental Permitting Regulations) and directly associated activities:

Table 4-1: Environmental Permit Activities

Type of Activity	Schedule 1 Activity		Description of Activity
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 1)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 5.1 Part A1, b)	CHP Facility (Line 2)	Incineration of non-hazardous waste with a capacity of greater than 3 tonnes per hour
Installation	Section 6.1 Part A1, a)	Pulp plant	Processing of waste paper to produce a recycled paper pulp and a sludge which is suitable to be applied to land as a soil conditioner.
Waste operation		AD facility	The anaerobic digestion of organic waste to produce a biogas which is subsequently combusted in a biogas engine, and a digestate which is suitable to be applied to land as a soil conditioner.
Directly Associated Activities			
Directly Associated Activities		MRF	Processing of residual waste to recover recyclates and produce a fuel which is suitable for combustion within the CHP Plant; and the processing of treated materials from the MBT to recover recyclates and refine the fuel which is suitable for combustion within the CHP Plant
Directly Associated Activities		MBT	The biodrying of incoming waste to reduce the moisture content of the waste to produce a fuel which is suitable for combustion within the CHP Plant. Material which has been treated within the MBT will enter the MRF for the recovery of recyclates and final refinement prior to transfer to the CHP.
Directly Associated Activities		Wastewater Treatment	The treatment and storage of process effluents from the installation prior to re-use within the installation (effluent from the Pulp plant).

4.2 On-site Fuel and Chemical Storage Facilities

As identified in the supporting information document, the activities undertaken on site will utilise a number of fuels and chemicals. The primary, secondary and tertiary containment systems associated with the storage of these materials are presented in Table 4-2.

Table 4-2: Chemical and Fuel Containment Facilities

Process Area	Substance	Number of Storage Facilities	Primary Containment	Secondary Containment	Tertiary Containment
CHP	Gasoil	1	Tank	Bund	Hardstanding
CHP	Ammonia	1	Carbon Steel Tank	Impervious bund/ Hardstanding	Hardstanding
CHP	Sodium Bicarbonate	2	Carbon Steel Silo	Hardstanding	
CHP	PAC	1	Carbon Steel Silo	Hardstanding	
Pulp	Hydrogen Peroxide (50%)	1	Stainless steel or FRP tank	Impervious bund/ Hardstanding	Hardstanding
Pulp	Sodium silicate (50%)	1	Stainless steel or FRP tank	Impervious bund/ Hardstanding	Hardstanding
Pulp	Soap	1	IBC (x25)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Tenside	1	IBC (x3)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Calcium chloride	1	IBC (x5)	Impervious bund/ Hardstanding	Hardstanding
Pulp	FAS Hydrosulphite	1	1m³ metal containers	Hardstanding	
Pulp	PAC	1	IBC (x5)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Flocculant 1	1	Big Bag (Synthetic Fabric) (x5)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Flocculant 2	1	Big Bag (Synthetic Fabric) (x5)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Sulphuric acid	1	IBC (x5)	Impervious bund/ Hardstanding	Hardstanding

Table 4-2: Chemical and Fuel Containment Facilities

Process Area	Substance	Number of Storage Facilities	Primary Containment	Secondary Containment	Tertiary Containment
Pulp	NaClO	1	IBC (x10)	Impervious bund/ Hardstanding	Hardstanding
Pulp	Boiler treatment chemicals			Impervious bund/ Hardstanding	Hardstanding
Wastewater Treatment Plant	Ferric chloride solution 41%	1	Polypropylene tank	Impervious bund/ Hardstanding	Hardstanding
Wastewater Treatment Plant	Lime (Calcium hydroxide powder)	1	Silo	Hardstanding	
Wastewater Treatment Plant	Soda ash	1	Silo	Hardstanding	
Wastewater Treatment Plant	Hydrochloric acid	1	Polypropylene tank	Impervious bund/ Hardstanding	Hardstanding
Wastewater Treatment Plant	Magnesium chloride	1	FIBC	Hardstanding	
Wastewater Treatment Plant	Cationic polyelectrolyte	1	PVC drums	Impervious bund	
Wastewater Treatment Plant	Anionic polyelectrolyte powder	1	Polypropylene bags	Hardstanding	
Wastewater Treatment Plant	Chotosan powder	1	Polypropylene bags	Hardstanding	
Wastewater Treatment Plant	Anionic polyelectrolyte	1	Polypropylene bags	Hardstanding	
Wastewater Treatment Plant	Magnettite	1	FIBC	Hardstanding	
Wastewater Treatment Plant	Flocon(TM)	1	PVC drums	Impervious bund	Hardstanding
Wastewater Treatment Plant	Sodium hypochlorite	1	IBC	Impervious bund/ Hardstanding	Hardstanding
Wastewater Treatment Plant	Laboratory reagent chemicals			Chemical storage cupboards	Hardstanding

Table 4-2: Chemical and Fuel Containment Facilities					
Process Area	**Substance**	**Number of Storage Facilities**	**Primary Containment**	**Secondary Containment**	**Tertiary Containment**
Wastewater Treatment Plant	Citric Acid	1	PVC drums	Impervious bund	Hardstanding
Wastewater Treatment Plant	STPP (sodium tripolyphosphate) Na-dodecylbenzene sulphonate	1	PVC drums	Impervious bund	Hardstanding
Wastewater Treatment Plant	STPP (sodium tripolyphosphate)	1	PVC drums	Impervious bund	Hardstanding
Wastewater Treatment Plant	DBNPA 2,2-dibromo-3-nitrilopropionamide	1	PVC drums	Impervious bund	Hardstanding
Wastewater Treatment Plant	Hydrochlroric acid solution	1	Polypropylene Tank	Impervious bund	Hardstanding
Wastewater Treatment Plant	Sodium Hydroxide	1	IBC	Impervious bund	Hardstanding
Wastewater Treatment Plant	SDS (sodium dodecylsulphate)	1	PVC drums	Impervious bund	Hardstanding

4.3 Environmental Risk Assessment

An Environmental Risk Assessment has been carried out following the Environment Agency Horizontal Guidance Note H1. This is included within Annex 4 of the Environmental Permit Application. The assessment considers all potential sources of ground and surface water pollution that could occur due to fugitive emissions from the IWMF or from accidents occurring at the IWMF. The risk assessment also details any mitigation measures that will be employed to reduce the frequency or impact of these events.

The land use and pollution history of the site has been considered in this desk study.

The Environmental Risk Assessment identifies that the development will require the storage of various chemicals, which could pose a risk to the ground and groundwater during normal operation. All process areas, loading/unloading areas, materials handling areas and roadways will be covered in concrete and/or tarmac hardstanding. It is therefore not regarded that there will be any risk of ground/groundwater contamination during normal operation of the installation.

The Environmental Risk Assessment concluded that for land, groundwater and surface water, the residual impacts of the IWMF would be insignificant provided the recommended mitigation measures are employed.

It is therefore concluded that the installation will pose little risk of pollution. However, periodic soil and groundwater samples will be undertaken to fulfil the requirements of Articles 14(1)(b), 14(1)(e) and 16(2) of the IED.

4.4 Conclusion

For the reasons stated within this report, it anticipated that there will be little risk of pollution associated with the installation and its directly associated activities.

During the Operational phase of the installation, as required by the permit, any records which demonstrate how the land and groundwater have been protected will be maintained. This information will include inspection records of site infrastructure, pollution/incident reports, records of any ground investigations undertaken, and any monitoring records of soil, gas and/or water during the life of the permit. Where it is identified that pollution has occurred records will be maintained to demonstrate any pollution incidents that may have affected the land or groundwater. These records will be retained to be used at Permit Surrender.

Appendix A - Environmental Statement – Chapter 5

Appendix B - Environmental Statement – Chapter 6

Appendix C - 2009 Ground Investigation at Rivenhall Airfield, Essex, February 2010

Appendix D - CC Ground Investigations Ltd (CCGI) - Factual Report – Rivenhall Airfield IWMF

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5.0 LAND USE AND CONTAMINATED LAND

Gent Fairhead & Co Ltd has commissioned Golder Associates (UK) Ltd to develop an evolution of the planned Recycling and Composting Facility (the eRCF) at Rivenhall Airfield (the Site). The eRCF presents a further development of the design of the original Recycling & Composting Facility (RCF), which was resolved to be granted planning permission by Essex County Council's Planning Committee on 30 March 2007 for the Site at Rivenhall Airfield.

Gent Fairhead & Co Limited (GFC) is the landowner of Rivenhall Airfield including the site known as Site WM1 in the Schedule of Preferred Locations for Waste Management in the Essex and Southend Waste Local Plan (2001) (the Waste Plan) adopted on 21 September 2001 by ECC and Southend-on-Sea Borough Council.

The following presents a summary of the historic and current land use at the Site and surroundings in order to determine the land pollution history. Details of activities taking place in the vicinity of the Site have been obtained by reference to registers of licences held by the Environment Agency (EA), District Authorities and web-based research. In addition the agricultural land quality and soils both across and surrounding the Site have also been assessed.

5.1 Land Use at the Site and Surroundings

5.1.1 Existing RCF Resolution

On 30 March 2007, ECC resolved to grant planning permission for the Recycling & Composting Facility (RCF) on the area identified as Site WM1 - Schedule of Preferred Locations for Waste Management in the Essex and Southend Waste Local Plan (the Waste Plan) adopted 21 September 2001 by ECC and Southend-on-Sea Borough Council covering the period 1997-2010. A copy of the Minutes of the Development and Regulation Committee Meeting of 30 March 2007 and the Committee Report are presented in Appendix 5A.

5.1.2 Current On-Site Activities

The majority of the land at the Site is farmed agricultural land, with some woodland and low diversity grassland. The Site includes one of two original World War II aircraft hangars, the other being situated to the west of the airfield near to Sheepcotes Farm. Both hangars are in regular industrial/commercial use in accordance with current planning permissions. Hangar No 2 on the Site is in use for general storage and distribution ('B8' use). The adjacent land of Woodhouse Farm required for the Education Centre, is currently abandoned with disused and derelict buildings.

The processing of the sand and gravel being extracted from Rivenhall Airfield is carried out in the Bradwell Quarry immediately to the north of the airfield. This area is known as Bradwell Quarry or 'Site R' in the Essex Minerals Local Plan Adopted First Review (1996). There is a private access road connecting the existing sand and gravel operation to the A120.

5.1.3 Historic On-Site Activities

Prior to World War II, historic on-Site activities were dominated by agricultural land use. During the War, Rivenhall was developed into a base for the United States Air Force (USAF) and the Royal Air Force (RAF). Construction of the airfield started in the early months of 1943, and was operational until shortly after the end of the War in 1946. Presented in Table 5-1 is a summary of the known historic activities at the Site which has been developed from information that has been provided by the land owner and local residents or otherwise obtained through desk based research. Additional reference should be made to Chapter 9.

Table 5-1: Historic On-Site Activities

Date	Description
Before 1943	The Site is undeveloped and is in agricultural use.
Late 1943	Rivenhall Airfield constructed.
1943 - 1946	Rivenhall Airfield was an operational base for both the USAF and RAF.
1946	USAF and RAF cease operations at Rivenhall Airfield.
1956 -2002	Rivenhall Airfield runways and buildings let to Marconi and used for testing radar systems.
1946 - present day	Land around runways at Rivenhall Airfield returned to agricultural use.
1999 - present day	Quarrying operations across Bradwell Quarry dominate the area surrounding the Site.

5.1.4 Historic Airfield Buildings and Designated Areas

Presented as Table 5-2 is a summary of the buildings and structures that have been constructed within 1 km of the Site and details of their known occupational use.

Table 5-2: Historic Airfield Buildings and Designated Areas

Building/Storage Area	Current use
Shooting- in Butts	Removed during sand and gravel extraction
Bomb Dump	Removed during sand and gravel extraction
Woodhouse Farm	Derelict and not in use
Administration site (Wayfarers Site)	Derelict and not in use
Hangar 1	Industrial and Commercial use
Hangar 2	B8 Warehouse/Distribution
Radar Mast	Mobile Communications Networks
Base Hospital and medical quarters	Allshots Enterprises

Communal Buildings (Including cinema, barbers, shops and gymnasium)	Allshots Enterprises
Generator site (electrical generators)	Automotive storage and repairs

5.1.5 Historic Off-Site Activities (within 1 km)

Historic maps and plans typically indicate that off-Site activities within 1 km of the Site have been largely dominated by agricultural land use and farming. A summary of the known historic off-Site activities within 1 km of the Site are presented in Table 5-3.

Table 5-3: Historic Off-Site Activities (within 1 km)

Map Dates	Description
1634	The land surrounding the Site is being used for *(suspected)* agricultural purposes with land divisions of the fields present. Beyond the agricultural land lies the woodland of Herres and Wild Wood.
1777	The land surrounding the Site is being used for *(suspected)* agricultural use with land divisions of the fields present. The properties of Sheep Cote, Wood House, Rolf Farm and Capons Farm are indicated.
1838	The land surrounding the Site is being used for *(suspected)* agricultural purposes with land divisions of the fields present. Beyond the agricultural land lies the extended woodlands of Upney Wood.
1845	The land surrounding the Site is being used for *(suspected)* agricultural purposes with land divisions of the fields present. The buildings and orchards of Woodhouse Farm are shown.
1924 - 1:10,560	The land surrounding the Site, Upney Wood, Cutley's Wood, Maxey Spring, Round Spring and Storeys Wood all appear as wooded areas and heath land. Allshots Farm, Porters Farm, Herrings Farm and Hayward's are all indicated.
1944	The land surrounding the Site is being used for *(suspected)* agricultural purposes or woodland. The buildings of Woodhouse Farm with a wooded area to the east.
1944 - 1:2,500	The World War II airfield has been constructed across the Site and its surrounding area.
1980's	Industrial and commercial uses are evident at all airfield buildings by Marconi, Allshot's Enterprises and the Elephant House

Notes: Source: Historic Ordnance Survey Maps. Note that dates of publication can be some years later than the survey dates.

5.1.6 Current Off-Site Activities (within 1 km)

Current off-Site activities comprise a mix of agricultural, industrial and commercial uses. Gent Fairhead Aggregates Limited (GFA), a subsidiary of GFC, was granted planning permission for the extraction of 7 million tonnes of sand and gravel from the 65.7 hectares of Bradwell Quarry, and the low-level restoration utilising replaced overburden by ECC (Number ESS/07/98/BTE) on 24 May 1999 and subsequent approved modifications. The sand and gravel workings commenced on the airfield in 2002 by Blackwater Aggregates. Across other sections of the former airfield, land is being used for agricultural purposes.

An original World War II aircraft hangar is situated to the west of the airfield near to Sheepcotes Farm. The hangar (Hangar No 1) is in regular industrial/commercial use in accordance with current planning permissions. Other old World War II buildings in the

vicinity are also used for such purposes and there are approximately 40 existing established uses on and around the airfield for a range of activities as follows:

- Scrap vehicle breaking and disposal;
- Workshop and Vehicle Depot currently used for street cleansing services;
- General Manufacturing ('B2');
- Light/High Tech Manufacturing ('B1');
- Warehouse/Distribution ('B8'); and
- Mineral Extraction and Processing including ready-mix Concrete production and minerals bagging.

The area known as the Allshots Enterprises, the former Polish Site, facilitates approximately 19 industrial units used for a range of light engineering, manufacturing and distribution purposes. Allshots Farm is a vehicle spares company with a waste management licence for <25,000 tpa (WML No. 71090). The general location and business activities carried out within 1 km of the Site are presented in Table 5-4:

Table 5-4: Current off-Site Activities (within 1 km)

Unit/Building	Location	Business Activity
Elephant House	Rivenhall Airfield, 50m South of Site.	Gully emptying business
1	Allshots Enterprises, ~500m southeast of Site	Carpet and upholstery cleaners
2 & 8	Allshots Enterprises, ~500m southeast of Site	Carpenters, joinery and cabinets
3	Allshots Enterprises, ~500m southeast of Site	Vehicle Body repairs
4	Allshots Enterprises, ~500m southeast of Site	Rehearsal room
5, 6, 7	Allshots Enterprises, ~500m southeast of Site	Packaging manufacturers
9 &17	Allshots Enterprises, ~500m southeast of Site	Printing and publishing
10	Allshots Enterprises, ~500m southeast of Site	Screen printers
14	Allshots Enterprises, ~500m southeast of Site	Taxi firm
15	Allshots Enterprises, ~500m southeast of Site	Double glazing repairs
16	Allshots Enterprises, ~500m southeast of Site	Printers
18	Allshots Enterprises, ~500m southeast of Site	Computer repairs
19	Allshots Enterprises, ~500m southeast of Site	Automotive repairs and spares
-	Allshots Enterprises, ~500m southeast of Site	Conservatories
-	Allshots Farm, ~4000m northeast of Site	Breakers and Dismantlers
The Lodge	The Lodge, ~350m east of Site.	Gift shop and toy manufacturers
Bradwell Quarry	Rivenhall Airfield	Sand and Gravel Quarry

Groundwater flow beneath the Site, within the Sands and Gravels, is towards the northeast, suggesting that groundwater could discharge to the River Blackwater; additional reference should be made to Chapter 6. Contaminative land use at the Elephant House is therefore the only off-Site source that could potential influence the Site. Contamination arising from all other facilities is down gradient of the Site.

A search on the Environment Agency's website *(What's in your backyard webpage)* for the Rivenhall area indicates that there are no industrial sites where the Environment Agency ensures pollution is monitored correctly; there are no industrial sites where the Environment

Agency has details of waste transferred off-site for disposal or recovery; and there are no industrial sites where the Environment Agency rates the pollution hazards using IPC OPRA or EP OPRA.

A report on the Braintree District Council website identifies a pollution incident occurred at the Woodland International Transport site in Coggeshall on the 13 July 2002. The incident resulted in a pesticide preservative containing the chemical tributyltin being flushed into the local drainage system which lead to a section of the River Blackwater between Coggeshall and Kelvedon.

Table 5-5 presents the location of known waste management facilities in the towns surrounding Rivenhall that are monitored by the Environment Agency:

Table 5-5: Waste Facilities Monitored by Environment Agency

Operator Name	Address	License no.	Waste facility type
Mr W J Hedger	Long Green, Cressing Braintree, Essex, CM7 8DL	70412	Household, commercial and industrial waste transfer stations
Stephen John Bell	Woodhouse Lane, Kelvedon Nr Colchester, Essex, CO5 9DF	71090	Vehicle dismantlers
Essex County Council	Perry Road, Witham, Essex, CM8 3UD	71256	Household, commercial and industrial waste transfer stations
Braintree District Council	Unit 9 Lakes Road Industrial Estate, Braintree, Essex, CM7 3RU	71305	Material recycling facilities
RD Trading Ltd	29 Eastways, Witham, Essex, CM8 3YQ	71408	Household, commercial and industrial waste transfer stations

5.2 Contaminated Land Records

The contaminated land regime set out in Part IIA of the Environmental Protection Act 1990 provides a risk based approach to the identification and remediation of land. Part IIA is aimed at addressing land which has been historically contaminated and which poses unacceptable risks to human health or the environment.

Braintree District Council is currently in the process of compiling a database of contaminated land within the District boundary. Braintree District Council confirmed that there are no known contaminated land sites at or in the vicinity of Rivenhall Airfield. There are no sites on the database apart from a few small unknown in-fills which may have been highlighted when transferring information from old Ordnance Survey maps and may merely relate to a change in the topography of the land rather than any proven concerns.

It is unlikely that any of the current or historic land uses at the Site will have significantly contaminated the land beneath the proposed development. Potential areas of concern such as the Bomb Dump and Shooting-in Butts associated with the airfield operations have been

removed from the Site. Some localised areas of contamination as a result of the historic Generator Site or current scrap vehicle breaking, printing, and disposal and workshops are possible but these are located beyond the Site.

5.3 Abnormal Releases

Abnormal releases *(e.g. spills of fuel, lubricants etc.)* during construction or operation of the eRCF could give rise to predicted minor or intermediate negative effects in terms of pollution of land and/or groundwater if the release migrates beyond areas of hardstanding *(depending upon the extent of any spill).* However, appropriate mitigation measures will be put in place to prevent spills from occurring and to clean up spills should they occur. This should reduce the significance of effects, in the event of any spill to *neutral* or at worst *minor and negative.*

During normal and abnormal operating conditions, no impacts would be expected to occur to land and/or groundwater and therefore the significance of impacts would be *neutral.* However, in the event of a major incident such as a fire, should polluting liquids runoff onto areas which are not hardstanding, impacts may be of a *minor negative* nature for land, resulting in localised contamination of shallow soils and/or groundwater. If polluting substances were able to reach deeper groundwater, which is classed as a 'major aquifer', more serious pollution may occur. However, the significance of impacts would very much depend on the nature and extent of any incident, the presence of permeable horizons which would allow polluting substances to be transmitted and the response of the Site to such an incident.

There is a significant thickness of London Clay beneath the Site which overlies the 'major aquifer'; therefore in the unlikely event of a major incident it is highly unlikely that the underlying groundwater would be affected. Furthermore, the bunded capacity of the AD tank area is significantly greater than that required by current regulations and would be used to control and contain any major spillage or leakage from the eRCF. Impacts from major incidents cannot be predicted with confidence. However, fire response systems will be integrated with other appropriate emergency plans into the eRCF to ensure that the risks of runoff are minimised as far as is practicable and the environmental consequences of such events are minimised. Additional reference should be made to Chapter 3.

The design and layout of the eRCF will ensure that the risks associated with major incidents will where practicable be managed, minimised, controlled and contained.

5.4 Agricultural Land Quality and Soils

The area proposed for the eRCF is on the southeastern corner of the existing airfield, and includes one large aircraft hangar, and two smaller buildings. The adjacent land of Woodhouse Farm required for the Education Centre, is currently abandoned with disused and derelict buildings.

Between the existing concrete runways and tracks are blocks of plantation woodland and scrub. Areas surrounding buildings and either side of a major runway consist of low diversity grassland. The remaining land belongs to the client but is farmed by tenant farmers based at Allshots Farm.

The agricultural land quality of the existing farmland on Rivenhall Airfield, and various additional areas beyond the perimeter of the airfield, have been subject to extensive investigation by the former Ministry of Agriculture, Fisheries and food (MAFF) and by the consultants, Countryside Planning and Management ('CPM'), acting for the applicants in 1988, 1990 and 1995.

A full description of the soils on the whole airfield site was presented in the Planning Application made in 1993, based upon the results of a number of detailed soil surveys made by CPM. The report noted that there is no detailed soils information published for the area, but the 'National Soil Map' (Refer to Appendix 5B), at a scale of 1:250,000 shows Hanslope and Oak II associations covering the Site.

A more detailed analysis of the soil types shows that there are two main soil series that occur within Site WM1; namely the Hanslope and Faulkbourne soil series. Both soil types are derived from chalky boulder clay and are described as follows:

- Hanslope soils are slowly permeable calcareous clayey soils; and
- Faulkbourne soils have non calcareous topsoils and upper subsoils.

The distribution of soil types across the whole of Rivenhall Airfield including the application area is illustrated in Figure 5-2. This is a reproduction of CPM's summary diagram with the Bradwell Quarry and eRCF Site boundaries superimposed.

5.4.1 Agricultural Land to be Taken

Four fields will be affected by the development of the eRCF, namely: Bradwell South Field, New Field (non arable), Hangar Field, and Woodhouse Field.

The fields are presently affected by the excavation of mineral reserves from Bradwell Quarry; however, following restoration they will be used for a mixture of arable and non-arable agricultural purposes.

Prior to the 1995 planning application Inquiry for mineral extraction at Bradwell Quarry (Ref ESS/9/9/BTE), MAFF agreed that, by careful application of conventional good practice techniques of soil handling, movement, storage, replacement and after-care, there is no practical reason why the site could not be restored to a similar and acceptable agricultural land quality. Therefore, prior to any bulk excavation works across the Site, topsoil and subsoil from across Bradwell South Field, New Field (non arable), Hangar Field, and Woodhouse

Field will be removed and placed in stockpile. Topsoil will be used to form landscaping features such as screening bunds, and will therefore be available for future use on the Site. Soils will also be used to enhance or supplement the surrounding arable fields or woodland. It is intended that the upper sub-soils of the Faulkbourne and Hanslope series will be used as the soil cover in proposed tree planting areas.

New Field is the lowest point of the restoration scheme within Bradwell Quarry (Site R in the Essex Minerals Local Plan). The proposed restoration of New Field will include a mixture of shallow sloping agricultural fields, steeper woodland side slopes and a large surface water collection lagoon (New Field Lagoon).

The issue of best and most versatile agricultural land arises in relation to the Site because, approximately 12 hectares of the Site is made up of grade 3a agricultural land, refer to Figure 5-1 for and overview of the Agricultural Land Classification (ALC). Under the Agricultural Land Use classification best and most versatile agricultural land comprises Grade 1, 2 and 3a agricultural land.

Guidance on the development of the best and most versatile agricultural land is set out in PPS7 on Sustainable Development in Rural Areas. Paragraph 28 of PPS7 provides guidance in respect of the development of best of most versatile agricultural land. It states:

"Best and most versatile agricultural land

28. The presence of best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification), should be taken into account alongside other sustainability considerations (e.g. biodiversity; the quality and character of the landscape; its amenity value or heritage interest; accessibility to infrastructure, workforce and markets; maintaining viable communities; and the protection of natural resources, including soil quality) when determining planning applications. Where significant development of agricultural land is unavoidable, local planning authorities should seek to use areas of poorer quality land (grades 3b, 4 and 5) in preference to that of a higher quality, except where this would be inconsistent with other sustainability considerations. Little weight in agricultural terms should be given to the loss of agricultural land in grades 3b, 4 and 5, except in areas (such as uplands) where particular agricultural practices may themselves contribute in some special way to the quality and character of the environment or the local economy. If any undeveloped agricultural land needs to be developed, any adverse effects on the environment should be minimised".

Paragraph 29 advises that:

"…It is for local planning authorities to decide whether best and most versatile agricultural land can be developed, having carefully weighed the options in the light of competent advice".

What PPS7 therefore sets out is a policy framework within which the issues of best and most versatile agricultural land should be assessed. Local planning authorities must have regard to PPS7 and should take the quality of agricultural land into consideration when determining planning applications, but they must also take into account other sustainability considerations.

There are a number of development plan policies relating to the protection for the best and most versatile agricultural land. These include the Essex and Southend-on-Sea Joint Structure Plan 1996-2011 Policies CS2, NR8 and WM3, the Essex and Southend Waste Local Plan Policy W10E; and the Braintree District Local Plan Review Policy RLP88. These policies seek to ensure that the loss of best and most versatile agricultural land is taken into account and retained and/or is not developed unless there is an overriding need for the development and suitable alternative site of lower agricultural quality, and other sustainability considerations are taken into account.

The total anticipated loss of Grade 3a agricultural land associated with the development of the eRCF is presented in Table 5-6.

Table 5-6: Area and Extent of Agricultural Land Loss

Agricultural Land Classification (ALC)	Field Reference	Location from eRCF	Total Land Loss (ha)	Holding
3a	Bradwell South Field	north	0.5	Bradwell Hall Estate
3a	Hangar Field	west	4.3	Woodhouse Farm
3a	Woodhouse Field	north	6.7	Woodhouse Farm
3a	New Field (non arable)	north	0.5	Woodhouse Farm
		Total:	**12**	

5.4.2 Effects on Individual Farm Holdings

With the exception of Bradwell South Field (which is owned by the Bradwell Hall Estate) the holding most affected by the construction of the access road and eRCF, Woodhouse Farm, is owned by GFC and farmed under the terms of a farm business tenancy by neighbouring farmers.

5.4.2.1 Bradwell Hall Estate

The Bradwell Hall Estate and Bradwell Spring covers a 170 ha area, which includes all of the areas covered by the existing access road corridor and Bradwell Quarry. It is farmed by a single arable unit by a tenant farmer based at Bradwell Hall.

The proposals will result in the loss of 0.3% of the existing agricultural operations on the holding, comprising the construction of the new access road from Bradwell Quarry across

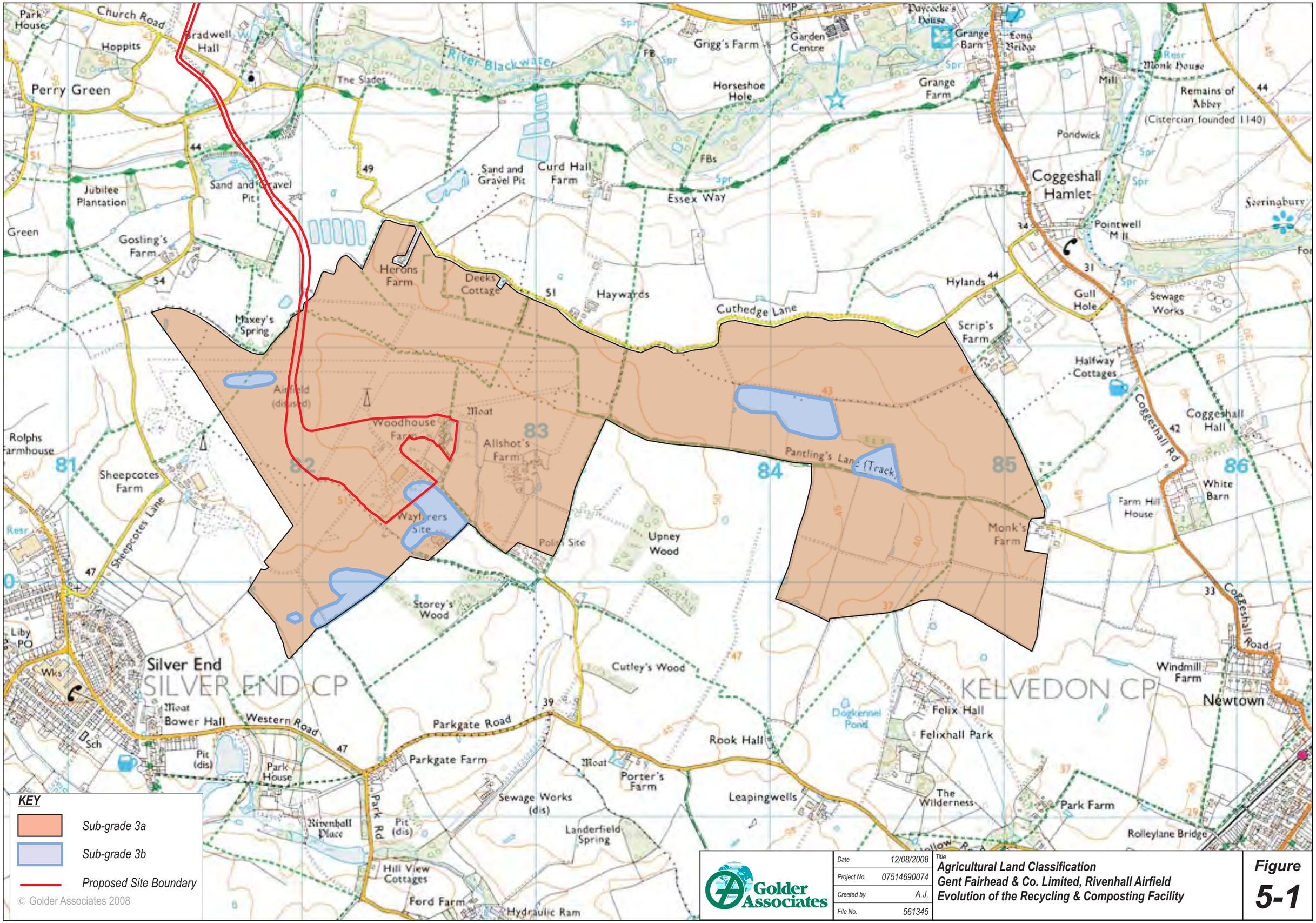
Bradwell Field South. While the new access road will divide the field, the resulting units can continue to be cropped, albeit with an increased headland length.

5.4.2.2 Woodhouse Farm

Woodhouse Farm is a block of arable land extending to 97 ha of which 92 ha is the subject of a farm business tenancy to an adjoining farm. Approximately 67 ha lies within Bradwell Quarry. Following the restoration of Bradwell Quarry, 11.5 ha of agricultural land within New Field (non arable), Hangar Field, and Woodhouse Field will be lost by the construction of the access road and eRCF. Woodhouse Farm currently lies derelict and unoccupied. There are a number of Farm buildings serving the land and the holding is worked by contractors rather than employed staff. The unit could not form a 'commercial unit of agriculture' under the present arable cropping regime.

There are currently no staff dependent entirely upon the land for their income. Therefore the disruption of the holding associated with the eRCF development is not significant and will not prejudice the continued management of the unit during the construction and operation of the eRCF.

FIGURES

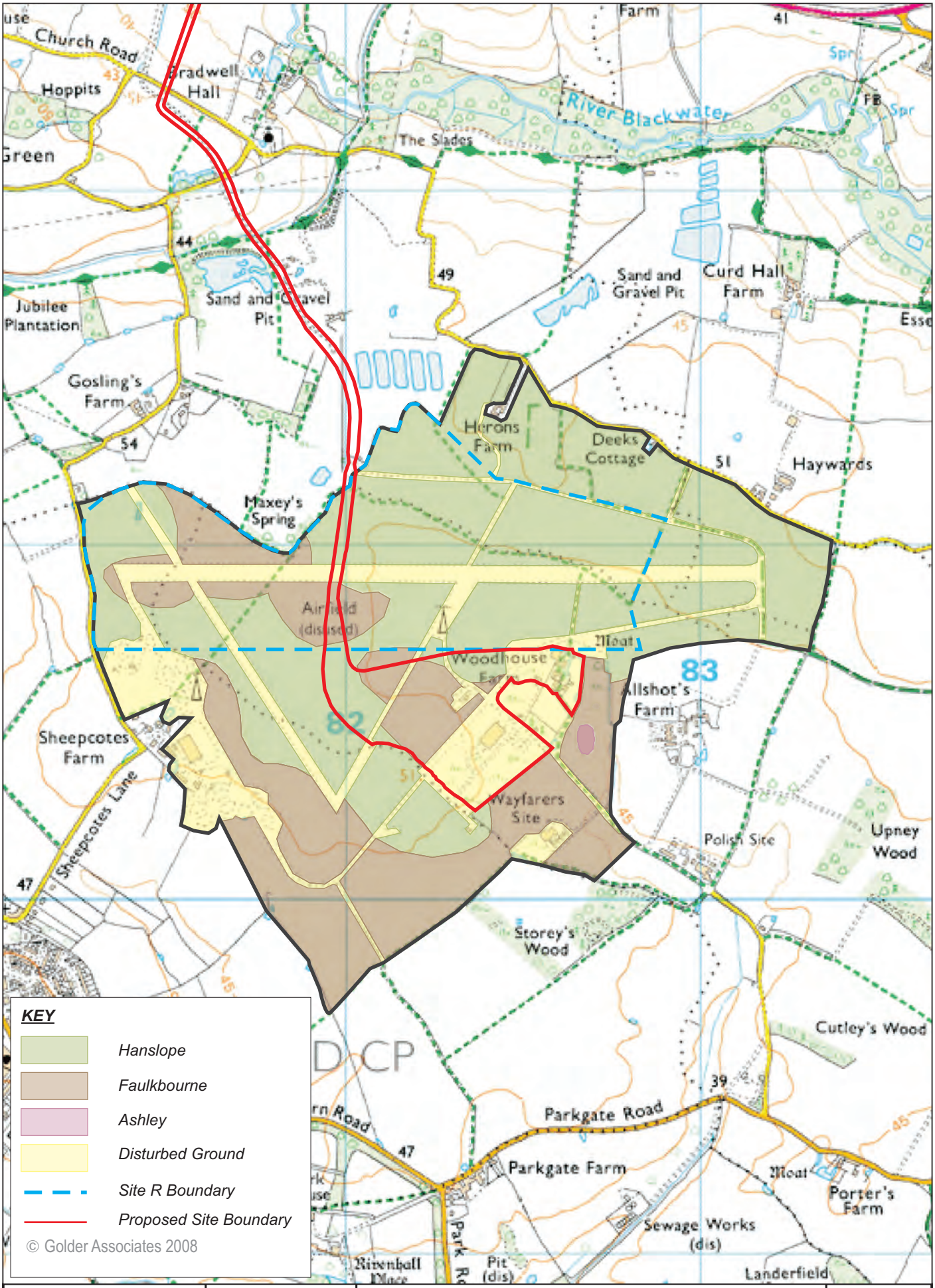


Golder Associates

Date	12/08/2008
Project No.	07514690074
Created by	A.J.
File No.	561345

Title
Agricultural Land Classification
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 5-1



Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	561344

Title

Soil Types
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 5-2

APPENDICES

APPENDIX 5-1

MINUTES OF THE DEVELOPMENT AND REGULATION COMMITTEE MEETING OF 30 MARCH 2007 & DEVELOPMENT AND REGULATION COMMITTEE REPORT

MINUTES OF A MEETING OF THE DEVELOPMENT AND REGULATION COMMITTEE HELD AT COUNTY HALL, CHELMSFORD ON 30 MARCH 2007

Membership

*****	N D C Edey (Chairman)	*	Mrs M Miller
*****	W Archibald	*	D W Morris (substitute for R Boyce)
*	K Bobbin		
*	A H Clover	*	R Pearson
*	W J C Dick	*	Mrs J Reeves
*	M J Mackrory	*	J Spencer

*present

27. Introduction.

The Chairman, Councillor N D C Edey welcomed those watching the Webcast of the meeting and especially to the public speakers who had registered their intention to speak in accordance with Essex County Council procedures.

The Chairman drew to the attention of all those in attendance that the meeting was being Webcast from commencement until the end of item 5 (a). All persons in attendance were advised that they were, in effect, giving consent for their image to be recorded and to appear in the Webcast.

All participants were reminded to use the microphones provided and to keep other noise or speaking to a minimum.

The procedure regarding fire alarms and the necessity of switching off mobile 'phones were noted.

The Chairman, with the approval of the Members of the committee, anticipated that there would be an adjournment for lunch after item 5(c) re-convening at 2.00pm with item 5(d). However, should circumstances require it he reserved the right to vary the order of business.

Because it was anticipated that the proceedings were likely to be lengthy the Chairman reminded all Members of the Committee that voting on an item would only be permitted if they were present throughout the whole of the debate of that item.

28. Variation in the Order of Business.

The Chairman's proposal concerning a possible variation in the order of business was agreed.

29. Apologies and Substitution Notices

The Committee Administrator reported that apologies had been received from Councillors R Boyce and R Gooding and substitution as shown in the membership above. Additionally, Councillor K Bobbin advised the Chairman that, regretfully, he had a prior engagement for the afternoon.

30. Minutes

The Minutes of the Committee held on 23 February 2007 were approved as a correct record and signed by the Chairman.

31. Declarations of Interest.

Councillor N D C Edey declared a prejudicial interest in respect of item 5(a). Councillor A H Clover declared a private but non-prejudicial interest in respect of item 5(d) and Councillor D W Morris declared a prejudicial interest in respect of item 5(e).

32. Identification of Items Involving Public Speaking.

At the request of the Chairman, the Committee Administrator advised those present that anyone wishing to speak at a meeting of the Development and Regulation Committee must give four working days notice to the Committee Administrator. There would normally be four 'categories' of persons registered being:

- A representative of a District or Borough, who would speak on behalf of the relevant Parish Council unless that Parish Council's view is different, in which case the Parish may also speak,
- An objector, usually a local resident,
- The applicant or their agent, and
- A supporter, usually a local resident.

For this meeting, those persons who, in accordance with the procedure, were registered to speak were:
In respect of item 5(a):

- Mr T Dunn and
- Mr R Keeble

And in respect of item 5(d):

- Mr C Clamp and
- Mr D Harker.

33. Information.

The Members of the Committee noted a number of amendments or corrections to the reports, to be found in the Addendum attached to these minutes.

MINERALS AND WASTE

34. Rivenhall Airfield, Coggeshall Road (A120) BRAINTREE CO5 9DF. ESS/38/06/BTE

The Chairman, Councillor N D C Edey declared a prejudicial interest and withdrew from the meeting for the duration of this item. With the approval of Members the Chair was assumed by Councillor W J C Dick.

Proposed enclosed recycling and enclosed composting facility for the treatment of residual waste comprising both municipal and commercial & industrial wastes; associated engineering works; extension to existing access road and provision of offices; biogas generators, storage tank, vehicle parking; and visitor/education centre.

The Committee considered report DR/015/07 by the Head of Development Control. It was noted that should Members be minded to approve the application, the matter would be a departure and will have to be referred to the Secretary of State.

Members noted the contents of the addendum as attached to these minutes and an amendment to the conditions.

The Committee was advised that the proposal was to provide a Recycling & Composting Facility serving North Essex, using Mechanical Biological Treatment comprising pre-sorting and separation of recyclables followed by Anaerobic Digestion and Composting technologies. The plant would process residual Municipal Solid Waste (MSW) following the public's separation and removal of recyclable materials. It would also receive and process a proportion of Commercial & Industrial wastes.

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report. Members were reminded of their site visit of the 18 January 2007. Additional representations received were provided to the Members of the Committee.

The Committee noted the Environmental Impact Assessment attached as appendix 1 to the report.

The Committee noted the key issues, which were:

- Government and Regional Waste Policy;
- Adopted Essex and Southend Waste Local Plan and justification for departure from the local plan;
- Draft Joint Municipal Waste Management Strategy for Essex;
- amenity;
- highways;
- sustainability and
- pollution.

In accordance with the protocol on public speaking the Committee was addressed by Mr. Dunn Parish Clerk designate to Bradwell Parish

Council. Mr Dunn expressed opposition and concern relating to the proposed development, and made the following specific points:

- That since 1994 BPC had consistently opposed the possibility of a Waste site at Rivenhall because of the scale of the facility.
- The 1999-2000 Public Inquiry and the resultant Local Waste Plan placed limitations on the area of the site. The Inspectors conclusion was that the site was suitable for limited development and this was not dependent on the type of waste process or the size of the site required to accommodate it. He maintained that these limitations appeared to have been ignored.
- The Road infrastructure from the A120, and interchange was 'inadequate' and already overloaded. At the 1999 Waste Local Plan public enquiry Essex County Council accepted that the actual road traffic situation would be taken into account at the time of any future application at this site. Mr Dunn maintained that this section of the A120 did not meet the standards of a trunk road, had a poor safety record – particularly recently, and at times the traffic was stationery. This proposal increased HGV's on to this road, at the rate of 1 every 100 seconds.
- If the Committee was minded to approve the scheme then BPC would wish this facility only to be operational when other facilities were at maximum capacity until such time as the new A120 was completed.
- Maximum HGV movements should become a condition of the planning condition.
- BPC supports the applicants request to have direct access to the new A120 and requests that Essex County Council should actively support the local improvements to the A120 and to ensure an appropriate works access to the site.
- The proposed road into the site crosses Church Road and Ash Lane and signage should give priority to the users of these roads and to the users of the public footpaths. Two-way crossings of Church Road and Ash lane should not be contemplated.
- Construction work should only be carried out between 07:00 and 18:30 Monday to Friday, and not at all at weekends.

In accordance with the protocol for public speaking the Committee was then addressed by Mr. Keeble, Director of Golder Associates UK Ltd. and agent for the applicant.
Mr Keeble reiterated the reasons behind the application – for the treatment or residual, municipal and commercial wastes generated in North Essex over the next 25 to 30 years.

- The site is one of the preferred locations for waste management in the current adopted waste plan. The chosen technology conforms to the current Waste Management Strategy which was agreed with the District Councils after extensive public consultation. The facility will enable the local District Councils to meet their recycling targets and sort and recover waste. The organic waste will become compost. Biogas will be used to create electricity.

- All treated residuals would be transported off-site in accordance with requirements for the pre-treatment of waste before landfill
- The design is flexible enough to allow for future growth and/or changes in recycling practices.
- This facility would provide approximately one-fifth of the needs of Essex for the treatment of waste.
- An extensive Environmental Impact Assessment was carried out. All movement of waste on the site will take place within buildings and controlled environments.
- There has been 11 years of extensive local consultation with the public, local communities, Parish and District Councils and the County Council and arising from this the design is compatible with its surroundings and makes strenuous efforts to minimize adverse impacts on the environment or local amenities. Mr Keeble then went on to specify some of the mitigation and landscaping features of the development.
- All treatment will take place within the 6 hectares designated in the Waste Plan.

Mr Keeble maintained that the proposal met the declared needs of Essex County Council and he requested that the proposal be approved.

The Committee was then addressed by Essex County Council Member, Councillor M Lager, Witham Northern Division, and (also) Member of Braintree District Council.
Councillor Lager stated that he had followed this application with interest, had visited the site, and was familiar with what was being proposed. He agreed that there had been widespread local consultation and the report reflects the various views expressed in those consultations.
The Braintree Local plan suggests that this proposal is ‘too much’ for this site and set out in page 9 of the report and he regretted that the Braintree District Planning Chairman had been unable to address the Committee. Although the views of Braintree District Council are set out in the report very well, he felt sure that she would have expressed concern that this proposal was not in conformity with the Braintree Local Plan. Councillor Lager felt that this was because the Braintree Local Plan centres around the duties of BDC as the collection authority whereas ECC is the disposal authority. However, Councillor Lager asked Members to consider a holistic approach when considering this application.
Councillor Lager expressed concerns about local impact – particularly relating to access and the related traffic movements. He also had concerns about the impact on the local environment, screening measures, noise and light pollution. On this latter point, and matters relating to emissions, he wondered if the conditions were sufficiently robust.
He noted the wishes, expressed in the report on page 30, to link the development to the proposed new A120 – but there was no date for when this new road may be approved and he urged the Committee to take note of the concerns of Mr Dunn from Bradwell Parish Council

who had asked to Committee, and Essex County Council to be more robust in its pursuit of the building of this road.
In conclusion, he agreed that the judgement being made, to approve or reject the proposal, was a 'balancing' of the needs and effects of the development. To that end he urged the Committee to ensure that the conditions, and the 106 Agreements were correct - if they were minded to approve.

Members of the Committee took the opportunity to debate the proposal and raised the following points, questions and observations:

- The report was extremely comprehensive.
- The site was remote.
- Although the footprint was larger than it would have been for an incinerator, this was acceptable – ECC does not support incineration.
- The development met a long-term need.
- Concerns about traffic movements in the locality were legitimate and ECC should make representations to secure direct access to the 'new' A120.
- Concerns remain about the crossover points for Church Road and Ash Lane.
- The location of the site would not appear to be 'perfect' but the advantages outweighed the disadvantages.

In response to questions raised, the Committee was advised that:

- The footprint of current technology was larger than the previously envisaged incineration; however 6 hectares was the 'typical' area for this technology.
- Members should concentrate on the current proposal in front of them, other factors that relate to other possible future proposals should not influence their decision.
- Mitigation of environmental impacts, noise and lighting are covered by comprehensive conditions.
- There is an established need – see pages 24 and 32 of the report.
- The Highways Agency has not opposed the application.
- The regulatory authorities will monitor the management of the site, and will not permit use of the site until they are satisfied that emissions from the processes can be sufficiently mitigated.

Additionally, in considering need for such facilities, the Committee was advised that the Regional Spatial Strategy had states that the East of England requires up to 20million tonnes of recovery capacity by yr2021 and that the Waste Planning Authority's own studies had identified that by yr2010 Essex would have a capacity gap of 985,000 tonnes for MSW and C+I waste recycling/composting and recovery/treatment.
It was also noted the Friends of the Earth incineration document 'Dirty Truths' considers anaerobic MBT technology to be one of the least climate damaging. The proposal in front of Members was one of the more favoured waste management processes.
For the avoidance of doubt, it was reiterated that waste materials would

not be incinerated at the facility.

The Members were then addressed by Mr Cook, Highways and Transportation Services, Essex County Council. He addressed concerns by Members in relation to the following points:

- There had been further agreement with the applicant for further improvement of the crossover points on Ash Lane and Church Road.
- Records show no HGV related accidents in the locality of the existing crossover points. There is a clause for monitoring of this at year 1 and year 5.
- The existing access to the A120 – the Highways Agency have responsibility for that area so he could not comment on their behalf.
- Essex County Council is in dialogue with the Highways Agency with a view to A120 improvements.

Councillor Mackrory expressed regret that it had been decided that this matter would be at County Hall in Chelmsford in a room not large enough for more persons to be accommodated. The Vice-Chairman, Councillor Dick responded by pointing out that there were other matters on the agenda, such as Ardleigh Reservoir and Pitsea and it was not practical to move the Committee to various locations. The use of the Internet allows a greater degree of accessibility to those persons unable to attend County Hall in person, or to be accommodated in the committee room.

Councillor Archibald stated that he would vote against the recommendation because he considered that in response to questions and summation the presenting officer had introduced additional information that should have been in the opening address. For example, a reference to a document produced by the Friends of the Earth – who should not be considered to be a neutral organisation. He also felt that the presenting officer had failed to stress that a considerable amount of the waste would be originating in Southend.

Councillor Pearson moved the recommendation, subject to the conditions stated in the report. This move was seconded by Councillor Clover.

A vote being taken, by a majority of 9 to 1 it was

Resolved:

That subject to:

- the Secretary of State not calling in the application for her own determination and

- the completion within 12 months of legal agreements relating to planning obligations/contributions for the provision and implementation of:

a. Ensuring that no excavation works take place on the site under this permission until the applicant has demonstrated their intention, to the satisfaction of the Waste Planning Authority, to substantially commence the construction of the Recycling Composting Facility.

b. Setting up of an index linked fund of £(to be agreed) to provide for the implementation of traffic management measures for the existing A 120 when no longer a Trunk Road.

c. Provision and implementation of:

- improvements to crossover points for Church Road and Ash Lane as indicated on Drawings IT569/SK/06 and IT569/SK/06 (or as amended);

  a Provision and implementation of:

  - a traffic routeing management system should HGV drivers be found to be using non County/Urban distributor roads between the A12 and A120 Trunk Roads;

  - monitoring and mitigation programme at 1 and 5 years from first beneficial occupation of the RCF, traffic capacity of the Church Road-Ash lane access road link to determine whether there is evidence of conflict with vehicles using the public highway at the crossover points and if found then install additional passing places or widen the access road to facilitate two way traffic.

  including funding for the;

  - installation of permanent information signs to direct HGV drivers to suitable County/Urban distributor roads to access the RCF via the A 120.

  b Setting up and meeting the reasonable expenses and administration of a Liaison Committee to hold regular meetings.

  c Reinstatement and refurbishment of the Woodhouse Farm complex a funded and managed heritage facility.

  d Educational areas of the Woodhouse Farm complex being available outside of normal working hours to local parish councils or other identified local community groups to be agreed with the Liaison Committee.

e Provision of fully funded management plan to secure the regular maintenance/replacement as required of all proposed planting for the site for a period of not less than 20 years from the first beneficial occupation of the RCF.

Planning permission be granted subject to conditions relating to the following matters:

Commencement

1. The development of the Recycling & Composting Facility (RCF) hereby permitted shall be begun before the expiration of 6 years from the date of this permission and not less than 30 days prior notification of commencement shall be given to the Waste Planning Authority.

Approved Plans and Details

2. The development hereby permitted shall only be carried out in accordance with the details submitted by way of the application dated 3 August 2006, and letters dated 6 September 2006, 20 September 2006, 10 November 2006 and 30 November 2006, together with drawing numbers:

Figure 1-1	Site Location Plan, Application & Landownership
Figure 1-2	Proposed Planning Application Area
Figure 1-4	Proposed Access Road Details
Figure 1-5	Typical Arrangement and Architectural Detail
Figure 1-6	Preliminary Arrangement
Figure 1-7	Proposed Excavation Profiles
Figure 1-8	Potential Layout of Woodhouse Farm
Figure 1-9	RCF Preliminary Layout and General Arrangement

Drawings Presented within Environmental Statement:

Chapter 2 – Approach to Environmental Statement

Figure EA/1 Proposed Planning Application Site Boundary

Chapter 3 – Construction and Operations

Figure 3-3	Proposed Site Layout
Figure 3-13	Schematic Arrangement of Woodhouse Farm
Figure 3-14	Upper Lagoon Drainage Details
Figure 3-16	RCF Preliminary Layout and Typical Section

Chapter 7 – Ecology and Nature Conservation

Figure 7-1	Drawing EA/1-2 Ecology A, Annex EcI, Baseline Ecology Report
Figure 7-2	Drawing EA/2-1 Ecology B, Annex EcI, Baseline

Ecology Report
Figure 7-3 Drawing EA/1-2 Ecology C, Annex EcI, Baseline Ecology Report

Chapter 8 – Landscape and Visual Effects

Figure 8-4 Footpaths and Visual Receptors 1:10,000
Figure 8-5 Tree Preservation Order 1:5,000
Figure 8-6 Mitigation Measures 1:5,000

Chapter 9 – Cultural Heritage

Drawing 2 Archaeological Sites & Finds within Study Area

Chapter 10 – Travel and Transport

IT569/SK/01 Observed 2004 12 Hour and 24 Hour Traffic Flows and Observed RCF Operational Distribution
IT569/SK/02 RCF Operational, Staff & Construction Traffic Flows 2010 & 2032
IT569/SK/03 'Observed Traffic Flows'
IT528/TA/04 Assumed RCF Operational Traffic Distribution and 2010 Base Traffic Flows
IT528/TA/05 2010 RCF Operational Traffic Distribution and 2032 Base Traffic Flows
IT528/TA/06 2032 RCF Operational Traffic Flows

Chapter 12 – Noise and Vibration

Figure 1 Monitoring Positions and Sensitive Receptors
Figure 2 Daytime External Predicted Noise Level Compared with Criteria in BS 8233 and WHO Guidelines
Figure 3 Night-time External Predicted Noise Level Compared with Criteria in BS 8233 and WHO Guidelines

Chapter 14 – Nuisances

Figure NIA1 Environmental Setting and Receptors Surrounding Site

except as varied by the following conditions:

Access

3. No development shall take place until full details of the extended access road have been submitted to and approved in writing by the Waste Planning Authority. The works shall then only be implemented in accordance with the approved details.

4. No construction works for the RCF shall take place until the access road extension and widening and all footpath crossover points have been provided.

5. All vehicles shall only enter and leave the site using the Coggeshall Road (A120) junction.

6. No vehicles shall park within passing bays on the access road between Church Road and Ash Lane.

Archaeology

7. No development shall take place until a programme for coordinating investigation by means of an archaeological 'Monitoring and Recording' brief has been submitted to and approved in writing by the Waste Planning Authority. The programme shall be implemented in conjunction with site clearance, phased soil stripping initial stages of construction.

Design and Layout

8. No development shall take place until design details, of materials colours and finishes of the external cladding of the RCF and associated plant have been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details.

9. No development shall take place until details of the RCF process layout and configuration have been submitted to and approved in writing by the Waste Planning Authority. At no time shall any equipment be installed that would enable the incineration of waste or other related materials.

10. No beneficial occupation the RCF shall take place until the areas indicated on Figures 1-4 and 1-5 have been clearly marked for the parking of cars, HGVs and any other vehicles that may use the RCF. These areas shall be retained and maintained permanently for manoeuvring and parking.

Drainage

11. No development shall take place until a detailed scheme for foul water and trade effluent management system, including details of the design and operation has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the operation of the RCF.

12. No development shall take place until a detailed scheme of the surface water drainage and the ground water management system, including details of the design and operation of the Upper lagoon to segregate 'grey' roof water from road surface run off and use of New Field as a balancing area for surface water, has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the operation of the RCF.

13. No excavation shall take place until a scheme identifying locations for the installation of boreholes to monitor groundwater has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the commencement of excavations.

Waste Management

14. No waste shall be brought onto the site other than that arising from within the administrative area of Essex and Southend-on-Sea. Records indicating origin of all waste consignments and tonnages shall be kept available for inspection by the Waste Planning Authority for at least 18 months.

15. No wastes other than dry non-hazardous Municipal Solid and Commercial & Industrial wastes shall be brought onto the site for processing or treatment in the RCF plant.

16. No more than 510,000 tonnes of waste, per annum, shall be brought onto the site. Records indicating origin of all waste consignments and tonnages shall be kept available for inspection by the Waste Planning Authority for at least 18 months.

17. No waste brought onto the site shall be discharged, deposited, handled, stored, composted or otherwise processed outside the Recycling and Composting Facility (RCF) buildings.

18. No waste materials other than those arriving in enclosed containers, and enclosed or sheeted vehicles shall be accepted for processing.

19. No vehicles shall leave the RCF site without first having been cleansed of all loose residual mineral or waste materials from the vehicle's body and chassis.

Hours of Working

20. No removal of soils or excavation of overburden, boulder clay, sand and gravel shall be carried out other than between 07:00-18:30 hours Monday to Friday, and 07:00 -13:00 hours Saturdays and not on Sundays, Bank and Public Holidays except for occasional maintenance of machinery, unless otherwise approved in writing by the Waste Planning Authority.

21. The construction works (including deliveries of building materials) for the RCF, hereby permitted shall only be carried out between 07:00-19:00 hours Monday to Sunday and not on Bank and Public Holidays except for occasional maintenance of machinery, unless otherwise approved in writing by the Waste Planning Authority.

22. No waste or processed materials shall be delivered to or removed

from any part of the RCF plant other than between 07:00 and 18:30 hours Monday to Friday and 07:00 and 13:00 hours on Saturdays, and not on Sundays, Public or Bank Holidays except for clearances from Household Waste Recycling Centres on Sundays and Bank and Public Holidays as required and then only between 10:00 and 16:00 hours.

Footpaths

23. No development shall take place until the layout of the cross over points as indicated on Figures 1-4 (or as amended) where the haul road, both existing and proposed, crosses the public footpaths, as shown on the Definitive Map and Statement of Public Rights of Way, are agreed with the Waste Planning Authority. The approved scheme shall be implemented before the access road is used by any Heavy Goods Vehicles associated with the construction of the RCF.

24. No development shall take place until visible, legible and durable British Standard signs have been erected on both sides of the haul/access road at the point where footpaths No. 31/35 and 56 cross, to warn pedestrians and vehicles of the intersection. The signs shall read: 'CAUTION: PEDESTRIANS CROSSING' and 'CAUTION: VEHICLES CROSSING'.

Noise

25. Except for temporary operations, as defined in Condition 29, between the hours of 07:00 and 19:00 the free field Equivalent Continuous Noise Level ($L_{Aeg\ 1\ hour}$) at noise sensitive properties adjoining the site, due to operations in the site, shall not exceed the $L_{Aeq\ 1hour}$ levels set out in the following table.

Noise Sensitive Properties:

Location	Criterion dB $L_{Aeq\ 1\ hour}$
• Herring's Farm	45
• Deeks Cottage	45
• Haywards	45
• Allshot's Farm	47
• The Lodge	49
• Sheepcotes Farm	45
• Greenpastures Bungalow	45
• Goslings Cottage	47
• Goslings Farm	47
• Goslings Barn	47
• Bumby Hall	45
• Parkgate Farm Cottages	45

Measurements shall be made no closer than 3.5m to the façade of

properties or any other reflective surface and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

26. The free field Equivalent Continuous Noise Level ($L_{Aeq\ 1\ hour}$) shall not exceed 47 dB(A) $L_{Aeq\ 1hour}$ between the hours of 19:00 and 23:00, as measured or predicted at noise sensitive properties adjoining the site. Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

27. The free field Equivalent Continuous Noise Level ($L_{Aeq\ 1\ hour}$) shall not exceed 40 dB(A) $L_{Aeq\ 5min}$ between the hours of 23:00 and 07:00, as measured and/or predicted at 1 metre from the façade of the bedroom at noise sensitive properties adjoining the site.

28. Noise levels shall be monitored at three monthly intervals at up to five locations as agreed with the Mineral/Waste Planning Authority. The results of the monitoring shall include the L_{A90} and L_{Aeq} noise levels, the prevailing weather conditions, details of the measurement equipment used and its calibration and comments on the sources of noise which control the noise climate. The survey shall be for two separate 15 minute periods during the working day and the results shall be kept by the operating company during the life of the permitted operations and a copy shall be supplied to the Mineral/Waste Planning Authority. After the first year of operation, the frequency of the monitoring may be modified by agreement with the Mineral/Waste Planning Authority.

29. For temporary operations, the free field noise level at sensitive properties shall not exceed 70dB $L_{Aeq\ 1\ hour}$, at noise sensitive properties adjoining the site, due to operations on the site. Temporary operations shall not exceed a total of eight weeks in any continuous 12 month period for work affecting any noise sensitive property. Not less than 5 days written notice shall be given to the Mineral/Waste Planning Authority in advance of the commencement of any temporary operation. Temporary operations shall include site preparation, bund formation and removal, site stripping and restoration, and other temporary activity as may be agreed, in advance of works taking place, with the Mineral/Waste Planning Authority.

Lighting

30. No external lighting shall be installed on site except in accordance with details to be submitted to and approved in writing by the Waste Planning Authority. The lighting shall not exceed 5 lux maintained average luminance. The scheme shall be implemented in accordance with the approved details and timings before the RCF becomes operational.

Operations

31. No processing other than dry screening of excavated sand and gravel shall take place within the application site.

32. Any fuel, lubricant or chemical storage above ground and refuelling facilities shall be sited on an impermeable base and surrounded and bunded to at least 110% of the tank/drums capacity with a sealed sump within the bunded area and no direct discharge to any watercourse, land or underground strata. All fill, draw and overflow pipes shall be within the bunded area.

33. No permanent RCF site perimeter fencing shall be erected other than in accordance with details that have been submitted to and approved in writing by the Waste Planning Authority. The fencing shall be erected in accordance with the approved details and maintained for the life of the operations on the site.
34. No development shall take place until details of external equipment required to control any fugitive dust from the handling/storage/processing of waste have been submitted to and approved in writing by the Waste Planning Authority. The approved scheme shall be implemented prior to the commencement of operations on site and maintained at all times whilst the RCF is operational.

35. No intake of waste shall take place until details of external equipment required to prevent fugitive odour nuisance have been submitted to and approved in writing by the Waste Planning Authority. The approved details shall be implemented and maintained whilst the RCF is operational.

36. No redundant plant or machinery, containers, skips, trailers or vehicles shall be parked other than within designated areas as indicated on Figures 1-4 and 1-5.

Ecological Mitigation

37. No on site works shall be undertaken until a scheme of appropriate working practice has been submitted to and approved in writing by the Mineral/Waste Planning Authority to secure a method to safeguard ecologically sensitive areas or disturbance at sensitive times as identified in the Environmental Statement with regard to, but not restricted to, the following:

    - Habitats;
    - Water bodies;
    - Fauna;

    ◦ Great Crested Newts;
    ◦ Bats; and
    ◦ Badgers.

38. The following ecological mitigation schemes shall be implemented as specified and as appropriate, individually or in combination, before, during or for one year after completion of construction works and monitored:

- Prior to the commencement of works, a detailed plan shall be submitted identifying trees, scrub or grassland that shall be removed and deadwood to remain on site. The felling of trees, scrub or grassland shall be undertaken outside the bird nesting and hare breeding season. Alternatively measures shall be taken in advance of the works to reduce the attractiveness to fauna of these areas early in spring;

- Measures to prevent run-off during construction into water bodies, in particular Pond 24 at Woodhouse Farm, shall be submitted to the Waste Planning Authority for approval prior to construction and thereafter implemented throughout the duration of the construction works;

- Prior to the commencement of works a faunal survey shall be undertaken prior to producing a planned scheme of mitigation and relocation for Great Crested Newts shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented;

- Prior to the removal of the existing aircraft hangar, associated out buildings and renovation of Woodhouse Farm, a bat survey shall be carried out. If bats are present, a planned scheme of mitigation and relocation measures shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented; and

- Prior to the commencement of works a Badger Survey shall be undertaken. If badgers are present within the Site a planned scheme of mitigation and relocation measures shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented.

Flare Operation and Control

39. The flare stack flame shall not exceed 15 metres above original ground level and at all times be controlled so that it is contained within the flare unit and not be visible from beyond the site boundaries.

Screening and Landscaping

40. All landscaping and planting shall be undertaken during the first planting season after completion of the RCF in accordance with the approved details in Figure 8-6.

41. Any tree or shrub forming part of a planting scheme approved in

connection with this development that dies, is damaged, diseased or removed within the period of the operations or 5 years after completion of the operations shall be replaced by the applicants during the next planting season with a tree or shrub of a species and size to be agreed with the Waste Planning Authority.

42. A scheme shall be submitted to the Mineral/Waste Planning Authority for written approval to retain the existing temporary earth mounding (under Planning Permission ESS/07/98/BTE) adjacent to 'Green Pastures' and extending eastwards to Maxey's Spring.

43. No development shall take place until details of tree retention and protection measures have been submitted to and approved in writing by the Waste Planning Authority. The details shall include indications of all existing trees, shrubs and hedgerows on the site and on the immediate adjoining land together with measures for their protection and the approved scheme shall be implemented.

Woodhouse Farm/Visitors/Education Centre

44. No redevelopment of the Woodhouse Farm complex shall take place until a scheme outlining the mechanisms and timetable for securing the appropriate Listed Building consents and detailed planning permission for conversions, access and car parking from Braintree District Council has been submitted to and approved in writing by the Waste Planning Authority. No beneficial use shall take place of the visitor and education centre until the works prescribed in the scheme have been implemented.

45. No parking within the Woodhouse Farm complex shall take place until suitable height barriers have been installed to prevent access by HGV's except for specific deliveries to the complex.

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The Vice-Chairman, Councillor Dick, noted that the webcast would then terminate.
The Chairman, Councillor Edey returned to the meeting and Councillor Dick vacated the Chair.

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35. Crumps Farm, Little Canfield, Nr Great Dunmow. ESS/50/06/UTT

Retention of sand and gravel processing plant, stockpiles of minerals and restoration materials lagoons weighbridges, ancillary buildings, portaloos and car parking facilities until 31 October 2033. Also continued use of haul road and access onto the B1256 (Stortford Road). The sand and gravel processing facilities, haul road and access for use only in conjunction with the winning and working of minerals as approved under IDO 2054 (as varied by UTT/509/86).

The Committee considered report DR/016/07 by the Head of Development Control.

Members noted the contents of the addendum as attached to these minutes and an amendment to the minutes. They also noted there was an amendment to the plans shown attached to the officers' report.

The Committee was advised that this matter had arisen since their consideration of the application at their last meeting. Members had resolved to approve the application as recommended subject to conditions. The previous report was attached as an appendix. In preparing the decision notice it was identified that an end date condition was not proposed for the application. The application description defined the end date as 31 October 2033, but this was not set out within a condition. It was considered that for clarity, the end date should be expressed as a specific condition.

Resolved:

That the previous resolution in respect of ESS/50/06/UTT be amended to include an additional condition as follows:

This permission shall be limited to the 31 October 2033 by which time all mineral processing and use of the haul road shall have ceased and restoration completed in accordance with the restoration details as submitted within the application as may be amended by details approved in accordance with condition 34 and shall be the subject of aftercare for a period of 5 years in accordance with details approved under condition 33. In the event of cessation of mineral extraction within the adjacent permitted mineral working [permitted by planning permission ESS/01/07/UTT(R)] the site shall be restored within 2 years of cessation of working in accordance with Restoration Scheme as submitted within the application as may be amended by details approved in accordance with Condition 34 and shall be subject of aftercare for a period of 5 years as required by condition 33.

Reason: To provide for the completion and progressive restoration of the site within the approved timescale in the interest of visual amenity an in accordance with MLP8 and MLP13.

36. Crumps Farm Little Canfield ESS/07/01/UTT(R)

Review of Old Mineral Permission UTT/509/86,

The Committee considered report DR/017/07 by the Head of Development Control.

Members noted the contents of the addendum as attached to these minutes and an amendment to the conditions. They also noted that there was an amendment to the plans shown.

The Committee was advised that the proposal was for the review of "old" mineral planning permissions (ROMP).

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report. An additional consultation response had been received – details of which may be found in the addendum attached to these minutes.

The Committee noted the Environmental Impact Assessment attached as appendix B to the report and an amendment to this EIA as shown in the addendum attached to these minutes.

The Committee noted the key issues, which were:

- the proposed method of working and restoration and whether the proposed schedule of conditions adhere to the principles of the original conditions,
- timescale and
- restoration,

The Committee was advised that the applicant was concerned that the conditions proposed restrict his ability to work the site and imposed timescales, but noted that they could not extend permissions beyond the previously agreed application.

Resolved:

Each of the proposed conditions is set out in italics below followed by a comment on each and then in bold the final wording if a change is recommended. The recommended conditions have also been renumbered. The new number is in brackets as **[0]**.

General

1. *The development hereby permitted shall be carried out in accordance with the details submitted by way of the Environment Act 1995 Review Application, accompanying Environmental Statement and drawings dated December 2006.*

   The condition is too general, for the avoidance of doubt the drawings are listed. In addition as previously discussed the plans are not considered to adequately demonstrate that the original constraints on the planning permission could be achieved and therefore the details of the phasing and restoration are therefore subject to further conditions.

[1] The development hereby permitted shall be carried out in accordance with the details submitted by way of the Environment Act 1995 Review Application dated 14 December 2006, supporting statement dated December 2006

accompanying Environmental Statement and drawings as follows:

M04106(b).32	**Location Plan**
M04106(b).33	**Current Situation**
M04106(b).34	**Sand and Gravel Extraction Areas**
M04106(b).35	**Clay Extraction Areas**
M04106(b).37	**Landscape enhancement Works North Eastern Boundary**

(The following plans are indicative only and do not form part of the permission, conditions 15 and 27 below require phasing and restoration plans to be submitted

M04106(b).36	**Phase 1**
M04106(b).38	**Phase 2**
M04106(b).39	**Phase 3**
M04106(b).40	**Phase 4**
M04106(b).41	**Concept Restoration)**

except as varied by the following conditions.

Termination

2. *This permission shall be limited to a period to twenty seven years from the date of this permission by which time extraction operations shall have ceased and the site have been restored in accordance with the scheme approved under Condition 23 and shall be the subject of aftercare for a period of 5 years unless otherwise agreed in writing with the Mineral Planning Authority.*

The applicant has offered a shorter date than that proposed by the 1995 Environment Act, which sets an end date of 22 February 2042. As explained previously the later date should be imposed. The reference to restoration and aftercare has been clarified in light of subsequent conditions to be imposed.

[2] T his permission shall expire on 22 February 2042 by which date all winning and working of mineral shall have ceased and the site shall have been restored to a beneficial afteruse in accordance with the restoration scheme approved under Condition 27 and shall be subject of aftercare for a period of 5 years as required by condition 28. In the event of earlier cessation the site shall be restored within 2 years of the substantial completion of the last phase of winning and working of minerals as approved under Condition 15 in accordance with Restoration Scheme approved under Condition 27 and shall be subject of aftercare for a period of 5 years as required by condition 28.

Amenity

3. **[3]** *Operations authorised or required by this permission shall only be carried out between the following times:*

0700 hours and 1800 hours Monday to Friday
0700 and 1300 hours Saturdays

and at no other time or on Sundays, Bank and Public Holidays unless otherwise approved in writing by the Mineral Planning Authority.

The proposed condition is acceptable.

Noise

4. **[4]** *All plant and machinery shall operate only during the permitted hours, as specified in Condition 3, except in emergency, and shall be silenced at all times in accordance with the manufacturers recommendations.*

The proposed condition is acceptable.

5. *Except for temporary operations, the free field Equivalent Continuous Noise Level (LAeq,1hr) at the noise sensitive premises around the site, due to operations within the site shall not exceed the following levels:*

Cherry Hill	*43dB*
Leander Way (Church Lane)	*48dB*
Crumps Farm	*55dB*
Little Bullocks Farm	*42dB*
The Warren Cottages	*54dB*

Measurements shall be made no closer than 3.5 metres to the façade of the properties or any other reflective surface and shall have regard to the extraneous noise and shall be corrected for any such effects.

The proposed condition proposes noise levels which are either lower or higher than required by government guidance and therefore have been amended to comply with government guidance.

[5] Except for temporary operations, the free field Equivalent Continuous Noise Level (LAeq,1hr) at the noise sensitive premises around the site, due to operations within the site when combined with the permitted operations within the area of ESS/50/06/UTT, shall not exceed the following levels:

Cherry Hill	**45dB**

Leander Way (Church Lane)	**48dB**
Crumps Farm	**55dB**
Little Bullocks Farm	**45dB**
The Warren Cottages	**53dB**

Measurements shall be made no closer than 3.5 metres to the façade of the properties or any other reflective surface and shall have regard to the extraneous noise and shall be corrected for any such effects.

6. **[6]** *For temporary operations, the free field noise level at noise sensitive properties shall not exceed 70 (LAeq, 1hr) expressed in the same manner as for condition 5. Temporary operations shall not exceed a total of eight weeks in any continuous 12 month period for work affecting any noise sensitive property. 5 days written notice shall be given to the Mineral Planning Authority in advance of the commencement of any temporary operation. Temporary operations shall include site preparation, bund formation and removal, site stripping and restoration, and other temporary activity as may be agreed, in advance of works taking place with the Mineral Planning Authority.*

The proposed condition is acceptable. However, no condition has been proposed requiring monitoring to show compliance to the maximum noise levels or to ensure that white noise alarms are used on the site and therefore the following 2 additional conditions should be imposed.

[7] **Noise levels shall be monitored by the operating company at six monthly intervals at the locations specified in condition 5. The monitoring survey shall be for a minimum of two separate 15 minute periods at each location during all permitted operations and should avoid meal breaks and periods of plant breakdown. The frequency and duration of such monitoring may be modified at the discretion of the Mineral Planning Authority. The monitoring may be required more frequently where it becomes necessary to demonstrate continuing compliance with the limiting noise levels specified above, or less frequently where the need does not arise.**

Monitoring should only be undertaken in calm weather conditions or at receptors with a component of wind blowing from the site. Monitoring should generally be avoided in conditions of wind speeds greater than 5m/sec average; rain; low temperatures (<3 degrees C). All noise measurements taken shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

The monitoring shall include the $L_{Aeq,1\ hour}$ dB noise levels both with and without the permitted operations, the prevailing weather conditions, details of the measurement equipment used and its calibration and comments on the sources of noise which control the noise climate. The results shall be submitted to the Mineral Planning Authority within 21 days of the monitoring taking place.

[8] Within 12 months of the date of this permission no silencers on plant and machinery used exclusively at the site shall be fitted with silencers that are of a standard less than white noise alarms.

Landscape

7. Within five years from the date of this permission, a detailed scheme showing full details of all proposed tree and shrub planting, and the proposed times of planting, shall be provided to the Mineral Planning Authority. The scheme shall detail the areas to be planted together with the species, spacing, protection, programme for implementation and maintenance of the planted areas. The scheme shall include indications of all existing trees and hedgerows on the site, with details of those to be retained, together with measures for their protection during the period of the operations. The scheme shall be implemented in accordance with the approved details.

The submitted plans show no specific areas of tree or shrub planting other than those associated with the restoration of the site. Some perimeter planting and enhancement of areas not to be worked would be beneficial to improve screening of the site. The condition is therefore suggested as follows.

[9] Within one year from the date of this permission, a detailed scheme of peripheral landscaping for the site showing full details of all proposed tree and shrub planting, creation of ponds in the north east of the site, and the proposed times of planting and pond formation, shall be provided to the Mineral Planning Authority. The tree and shrub planting scheme shall detail the areas to be planted together with the species, spacing, protection, programme for implementation and maintenance of the planted areas. The scheme shall include indications of all existing trees and hedgerows on the site, with details of those to be retained, together with measures for their protection during the period of the operations. The scheme shall be implemented in accordance with the approved details.

An additional condition would be required to ensure any failed plants are replaced.

[10] Any tree or shrub forming part of a landscaping scheme approved in connection with the development that dies, is damaged, diseased or removed within the period of 5 years during and after the completion of the operations shall be replaced by the applicants in the next available planting season (October to March inclusive) with a tree or shrub to be agreed with the Mineral Planning Authority.

Pollution

8. **[11]** *Any fuel, lubricant or chemical storage above ground and refuelling facilities shall be sited on an impermeable base and surrounded and bunded to at least 110% of the tank/drums capacity with a sealed sump within the bunded area and no direct discharge to any watercourse, land or underground strata. All fill, draw and overflow pipes shall be within the bunded area.*

The proposed condition is acceptable.

9. **[12]** *Any temporary fuel or chemical storage vessel shall be within an impermeable container with a sealed sump and capable of holding at least 110% of the vessel's capacity. All fill, draw and overflow pipes shall be properly housed to avoid spillage.*

The proposed condition is acceptable.

Dust

10. **[13]** *The access/haul road used in connection with the operations hereby permitted shall be sprayed with water during dry weather conditions to prevent dust nuisance.*

The proposed condition is acceptable.

Archaeology

11. An archaeologist shall be afforded access to monitor the stripping of soils and allowed sufficient time to excavate and record archaeological features in advance of their destruction. Within twelve months from the date of this permission, a scheme for this work will be submitted to the Mineral Planning Authority.

The condition does not provide for the full archaeological evaluation of the site and would allow further areas to be opened in the next 12 months without a scheme of investigation in place. The following condition is therefore required.

[14] From the date of this permission no further part of the site shall be disturbed or stripped of top soils until the

applicant has secured the implementation of a programme of archaeological work and recording in accordance with a written scheme of investigation which has been submitted in writing to and approved by the Mineral Planning Authority. The scheme shall be implemented in accordance with the approved details.

Phasing

The original conditions of the ID 2054 imposed certain restrictions with respect to the area subject to excavation and unrestored at one time as discussed earlier and therefore the following conditions should be imposed to reflect the original restrictions and demonstrate that the operations are able to adhere to these constraints.

[15] Not more than 2.428ha (6 acres) of the site shall be open for extraction and/or be unrestored at any one time. Prior to any further stripping of soils at the site a detailed phasing scheme for extraction and restoration of the whole site, including both plans and cross-sections, shall be submitted in writing to and approved by the Mineral Planning Authority. The phasing scheme shall not have more than 2.428ha (6 acres) of the site open for stripping, extraction of mineral and/or unrestored at any one time. The phasing shall be carried out in accordance with approved details.

Soil Handling and Storage

12. Before topsoil and subsoil are stripped on each phase, or part phase, a Scheme of Soil Movement shall be submitted to the Mineral Planning Authority for its written approval. Such schemes shall:

a. Be submitted at least 3 months prior to the expected commencement of soil stripping.

b. Where subsoil is not to be retained, identify those soils and soil substitutes intended to be used in their place.

c. Identify clearly the origin, intermediate and final locations of soils for use in the agricultural restoration, as defined by soil units, together with details balancing the quantities, depths, and areas involved.

While it is considered beneficial that there should be a soil movement scheme, it is considered the wording of this condition is not appropriate as all soils are to be retained on site and utilised in a combination of agriculture and woodland restoration and no importation of soils is permitted. The following wording is therefore proposed.

[16] Before topsoil and subsoil are stripped on each phase, or part phase, a Scheme of Soil Movement shall be submitted

to the Mineral Planning Authority for its written approval. Such schemes shall:

a. Be submitted at least 3 months prior to the expected commencement of soil stripping.

b. Identify clearly the origin, intermediate and final locations of soils for use in the agricultural and woodland restoration, as defined by soil units, together with details balancing the quantities, depths, and areas involved.

The Scheme of Soil Movement shall be implemented in accordance with the approved details.

13. *Before development commences a Scheme of Machine Movements for the stripping and replacement of soils shall be agreed in writing with the Mineral Planning Authority. The Scheme shall define the type of machinery to be used. All machine movements shall be restricted to those agreed.*

The condition is acceptable, however development has already commenced and this should be reflected in the condition, further more best practice requires that the details should be "approved" in writing by the Mineral Planning Authority, as opposed to "agreed" and this amendment should be made.

[17] From the date of this permission no stripping or replacement of soils shall take place until a detailed scheme of Machine Movements for the stripping and replacement of soils has been submitted and approved in writing by the Mineral Planning Authority. The Scheme shall define the type of machinery to be used. All machine movements shall be in accordance with the approved details.

14. *Topsoil, subsoil, and soil making material shall only be handled when they are in a dry and friable condition:*

a. The criteria for determining dry and friable shall be based on a field assessment on the soil's wetness in relation to its lower plastic limit. An assessment shall be made by attempting to roll a ball of soil into a thread on the surface of a clean plain glazed tile (or plate glass square) using light pressure from the flat of the hand. If a thread of approximately 15cm in length and less than 3mm diameter can be formed, the soil is wetter than the lower plastic limit and soil moving should not take place until the soils have dried out. If the soil crumbles before a thread of approximately 15cm in length and 3mm diameter can be formed, then the soil is dry enough to move. This assessment shall be carried out on representative samples of each major soil type.

b. No movement of soils shall occur:

i) when there are pools of water on the land surface (covering more than 5% of the land surface of the area from where the soils are to be removed).

The condition is acceptable, except that it does not prevent soil movement between November and March when soils are unlikely to be dry and friable. The following amended wording is suggested.

[18] Topsoil, subsoil, and soil making material shall only be handled when they are in a dry and friable condition:

a. The criteria for determining dry and friable shall be based on a field assessment on the soil's wetness in relation to its lower plastic limit. An assessment shall be made by attempting to roll a ball of soil into a thread on the surface of a clean plain glazed tile (or plate glass square) using light pressure from the flat of the hand. If a thread of approximately 15cm in length and less than 3mm diameter can be formed, the soil is wetter than the lower plastic limit and soil moving should not take place until the soils have dried out. If the soil crumbles before a thread of approximately 15cm in length and 3mm diameter can be formed, then the soil is dry enough to move. This assessment shall be carried out on representative samples of each major soil type.

b. No movement of soils shall occur:

i) when there are pools of water on the land surface (covering more than 5% of the land surface of the area from where the soils are to be removed) or

ii) Between the months of November and March (inclusive) unless otherwise approved in advance in writing by the Minerals Planning Authority.

15. Plant or vehicle movement shall be confined to clearly defined haul routes agreed in writing by the Mineral Planning Authority in consultation with the Natural England, or to the overburden/infill surface and shall not cross areas of topsoil and subsoil except for the express purpose of soil stripping or replacement operations. No soils shall be removed prior to the receipt of the agreement in writing.

The condition is acceptable, except for some minor drafting changes and in view of the fact that the site involves no infilling the reference to such be removed.

[19] Plant and vehicle movement shall be confined to clearly defined haul routes approved in writing by the Mineral Planning Authority in consultation with the Natural England, or movements shall be on the overburden surface and shall not cross areas of topsoil and subsoil except for the express purpose of soil stripping or replacement operations. No soils shall be stripped prior to the receipt of the written approval of the Mineral Planning Authority and shall be implemented in accordance with the approved details.

16. Topsoil and subsoil stripping:

a. The topsoil shall be stripped to the full depth (generally 30 cm) and shall, wherever possible, be immediately respread over an area of reinstated subsoil. If this immediate respreading is not practicable, the topsoil shall be stored separately for subsequent replacement.

b. When the subsoil is to be retained for use in the restoration process it shall be stripped to a depth of not less than 70 cm and shall, wherever possible, be immediately respread over the replaced overburden. If this immediate respreading is not practicable the subsoil shall be stored separately for subsequent replacement. Subsoil not being retained for use in the restoration process shall be regarded as overburden.

The condition is acceptable, except that as all subsoils are to be retained on site for restoration purposes the reference to “overburden” should be therefore be removed to avoid confusion, and minor drafting changes to cross reference the conditions.

[20] Topsoil and subsoil stripping:

a. The topsoil shall be stripped to the full depth (generally 30 cm) and shall, wherever possible, be immediately respread over an area of reinstated subsoil. If this immediate respreading is not practicable, the topsoil shall be stored separately for subsequent replacement, in accordance with condition 16.

b. Subsoil shall be stripped to a depth of not less than 70 cm and shall, wherever possible, be immediately respread over the replaced overburden. If this immediate respreading is not practicable the subsoil shall be stored separately for subsequent replacement, in accordance with condition 16.

17. **[21]***Soils identified for use as a subsoil substitute shall be stripped separately and, wherever possible, be immediately respread over the replaced overburden. If this respreading is not*

practicable, the subsoil substitute shall be stored separately for subsequent replacement.

The condition is acceptable.

18. *Written notification shall be made giving the Mineral Planning Authority five clear working days notice of the intention to start stripping soils.*

The aim of the condition ensures the Mineral Planning Authority has ample opportunity to make a site inspection, however as worded notification could be given months in advance and not when soils are about to be stripped. The following wording is therefore suggested.

[22] Written notification shall be provided to the Mineral Planning Authority not less than five clear working days in advance of the intention to start soil stripping operations and not more than 21 days in advance of the intention to start soil stripping.

19. **[23]***Bunds for the storage of agricultural soils shall conform to the following criteria:*

a. Topsoil, subsoil, and subsoil substitutes shall be stored separately.

b. Materials shall be stored like upon like, so that topsoil shall be stripped from beneath subsoil bunds and subsoil from beneath overburden bunds.

c. Where continuous bunds are used dissimilar soils shall be separated by a third material, previously agreed in writing with the Mineral Planning Authority.

d. Topsoil bunds shall not exceed 3m in height and subsoil (or subsoil substitute) bunds shall not exceed 5m in height.

The condition is acceptable except for the replacement of "*agreed in writing with*" with "approved in writing by" under point c."

20. *All storage bunds intended to remain in situ for more than 6 months shall be grassed over and weed control and other necessary maintenance carried out to the satisfaction of the Mineral Planning Authority. The seed mixture and the application rates shall be agreed in writing with the Mineral Planning Authority no less than one month before it is expected to complete the formation of the storage bunds.*

The condition is largely acceptable except "*to the satisfaction of the MPA" is* subjective and unenforceable; therefore the following wording is suggested.

[24] All storage bunds intended to remain in situ for more than 6 months shall be grass seeded and managed to maintain a complete grass sward, free from weeds using either mechanical or chemical means. The seed mixture and the application rates shall be approved in writing by the Mineral Planning Authority prior to any further soil stripping.

*21***.[25]***All topsoil , subsoil and soil making material shall be retained on the site.*

The condition is acceptable.

22. The subsoil is to be tipped in windrows and spread to the required level, in usually 5m wide strips in such a manner as to avoid compacting placed soils. Topsoil is then to be tipped, lifted and evenly spread onto the levelled subsoil, also in such a manner as to avoid compacting the placed soils.

This condition is likely to be in conflict with new condition **[17]** above and therefore should be deleted.

Restoration

23. The site shall be restored in a progressive manner and the sequence of restoration shall, unless otherwise agreed in writing with the Mineral Planning Authority, accord with that shown on Drawing Numbers M04106 (b).36 to 41.

The principle of progressive restoration is encompassed within the original IDO permission and is supported. However, subject to the outcome of new condition **15,** the phasing plans submitted can only be considered as indicative. The following amended wording is therefore proposed.

[26] The site shall be restored in a progressive manner and the sequence of restoration shall be in accordance with the approved phasing details as approved under condition 15.

24. Within five years of the date of this permission, a detailed scheme of restoration shall be submitted to the Mineral Planning Authority.

The timescale for submission would prevent any restoration works commencing within the next 5 years and so hinder progressive restoration. The condition does not specify what details would be required to be included within the restoration scheme, the following wording is therefore proposed.

[27] Within 12 months of the date of this permission a Restoration Master Plan for the site shall be submitted for approval in writing by the Mineral Planning Authority. The Restoration Master Plan shall identify areas to be restored to agriculture, woodland,

grassland and water and include detailed interim restoration details for any areas requiring early restoration in accordance with the phasing and restoration scheme approved under condition 15. Within 18 months of the date of this permission a detailed progressive restoration scheme and bio-diversity strategy, conforming to the phasing approved under condition 15 and the Restoration Master Plan shall be submitted in writing for approval by the Mineral Planning Authority, to restore the site to a combination of agriculture, woodland, grassland, and water. The scheme shall detail the restoration works associated with each sequence of operations and shall provide and make provision for the following

- **restoration contours, no restored batter shall be less than 1:3.**
- **soil restoration profiles for all parts of the restoration sequence appropriate to the end use vegetation**
- **cultivation works**
- **earth works**
- **drainage works including SUDS, compliance with Advice Note 6 "Potential Bird Hazards from Sustainable urban Drainage Schemes (SUDS), details of water bodies and any pumping arrangements ditches, culverts and outfalls**
- **restoration profile and contours shall demonstrate that no more than an 6 acres (2.428ha) of the restored site shall be covered by water in an ordinary winter; and the remainder of the site shall be restored to an even surface at least 3 feet (0.9m) above the winter water level, with adequate drainage to bring the land to the required standard for the proposed restoration uses including agriculture and woodland planting.**
- **for water bodies, water depth, bank profiles, margins, shallow shelving edges and wetland plant species**
- **tree and shrub planting mixes and spacing for all planted areas**
- **seed mixes for all planted areas**
- **fencing**
- **compliance with Advice Note 3, "Potential Bird Hazards from Amenity Landscaping & Building Design".**
- **The restoration Master Plan, interim restoration and detailed restoration schemes shall be implemented in accordance with approved details."**

Aftercare

25. *An Aftercare Scheme requiring that such steps as may be necessary to bring the land to the required standard for the use of agriculture and woodlands shall be submitted for the written approval of the Mineral Planning Authority not later than 3 months prior to the date on which it is first expected that the replacement of topsoil shall take place. Aftercare shall be implemented in accordance with the approved scheme.*

The submitted Scheme shall:

a. Provide an outline strategy in accordance with Annex A of MPG7 for the five year aftercare period. This shall specify steps to be taken and the period during which they are to be taken. The scheme shall include provision of a field drainage system where required and provide for an annual meeting between the applicants, the Mineral Planning Authority and Natural England.

b. Provide for a detailed annual programme, in accordance with Annexes A and B of MPG7 to be submitted to the Mineral Planning Authority not later than two months prior to the annual Aftercare meeting.

c. Unless the Mineral Planning Authority, after consultation with the Natural England, agree in writing with the person or persons responsible for undertaking the Aftercare steps that there shall be lesser steps or a different timing between steps, the Aftercare shall be carried out in accordance with the submitted Schemes.

The aftercare condition really only addresses the information necessary for agricultural areas and not those of woodland and other nature conservation areas.

[28]. Aftercare Schemes requiring that such steps as may be necessary to bring the land to the required standard for the use of agriculture and to create areas of woodland, grassland and water bodies shall be submitted for the written approval of the Mineral Planning Authority not later than 3 months prior to the date on which it is first expected that the replacement of topsoil shall take place. The aftercare schemes shall be implemented in accordance with the approved schemes.

a) The submitted agricultural aftercare scheme shall:

- **Provide an outline strategy in accordance with Annex A of MPG7 for the five year aftercare period. This shall specify steps to be taken and the period during which they are to be taken. The scheme shall include provision of a field drainage system where required and provide for an annual meeting between the applicants, the Mineral Planning Authority and Natural England.**

- **Provide for a detailed annual programme, in accordance with Annexes A and B of MPG7 to be submitted to the Mineral Planning Authority not later than two months prior to the annual Aftercare meeting.**

- **Unless the Mineral Planning Authority, after consultation with Natural England, agree in writing with the person or persons**

responsible for undertaking the Aftercare steps that there shall be lesser steps or a different timing between steps, the Aftercare shall be carried out in accordance with the submitted Schemes.

b) The submitted aftercare scheme for woodland areas shall provide an outline strategy for the five year aftercare period and this shall specify steps to be taken, including bi-annual inspections to ensure the tree bases i.e. within 0.5m is maintained in a weed free condition, firming of stakes, adjustment of ties, guards and shelters where necessary and replacement of any losses during the aftercare period.

c) The submitted aftercare scheme for grassland and water bodies, shall make provision for reseeding and/or planting to replace losses, managing weed control and preparation of annual ecological appraisal with management recommendations.

Ecology

26. Prior to entering each new phase of the development, a survey shall be undertaken of the proposed area to identify whether any mitigation for protected species including breeding birds and badgers and any other species as may be relevant is required. If necessary a detailed scheme for the protection and mitigation of such species shall be submitted to the Mineral Planning Authority and this shall be implemented as prepared.

The condition does not require the proposed mitigation measures to be approved prior to entering a new phase, therefore the following wording is proposed.

[29] Prior to entering each new phase of the development, as approved under condition 15 a survey shall be undertaken of the proposed area to identify whether any mitigation for protected species including breeding birds and badgers and any other species as may be relevant is required. If necessary prior to entering each new phase of the development a detailed scheme for the protection and mitigation of such species shall be submitted to the Mineral Planning Authority for approval. The mitigation scheme shall be implemented in accordance with the approved details.

Bird-strike

27. Within one year from the date of this permission a bird hazard management plan shall be submitted to Mineral Planning Authority in consultation with British Airports Authority (operators of London Stansted). This shall include a scheme identifying preventative or deterrent measures to ensure that there is no increased risk of bird-strike likely to occur. The approved measures shall be implemented within three months

from the date of the Mineral Planning Authority grant approval and shall be maintained and operated to the agreed standard at all times.

On advice from British Aviation Authority above more detailed conditions have been requested to manage both bird strike during the working phase and upon restoration. The timescale has also been reduced for submission of the details to ensure measures are implemented within a reasonable timescale in view of the potential risk to aircraft.

[30] Within 6 months from the date of this permission a Bird Hazard Management Plan shall have been submitted to and approved in writing by the Mineral Planning Authority. The submitted plan shall include details of:

- ***The monitoring, of bird activity on any standing and open water within the site temporary or permanent***
- ***Bird species***
- ***Target numbers***
- ***Record keeping***
- ***Failure criteria***
- ***Dispersal methods***
- ***No notice access to BAA Airfield Operations staff***

The Bird Hazard Management Plan shall be implemented as approved. No subsequent alterations to the plan are to take place unless first submitted to and approved in writing by the Mineral Planning Authority.

[31] Prior to the restoration of any part of the site in accordance with the restoration scheme permitted under condition 27, a Bird Hazard Management Plan shall be submitted to and approved in writing by the Mineral Planning Authority. The submitted plan shall include details of :

- **Monitoring of all open water within the site temporary or permanent**
- **Monitoring of wet/dry woodland**
- **Bird species**
- **Target numbers**
- **Record keeping**
- **Failure criteria**
- **Dispersal methods**
- **No notice access to BAA Airfield Operations staff**
- **Method statement of how site will be accessed and monitored on a regular basis**

The Bird Hazard Management Plan shall be implemented in accordance with the approved details on completion of the minerals extraction and apply for the duration of the

aftercare period. No subsequent alterations to the plan are to take place unless first submitted to and approved in writing by the Mineral Planning Authority

In addition to the proposed conditions set out above a number of additional are also recommended. These are as follows:

[32] Notwithstanding the provisions of the Town and Country Planning (General Permitted Development) Order 1995 (or any order revoking and re-enacting that Order with or without modification) no building, structure, fixed plant or machinery shall be installed, extended or erected on the site without the benefit of planning permission.

Reason: to enable the Mineral Planning Authority to adequately control, monitor and minimise the impacts on the amenities of the local area and to comply with Policy MLP10, MLP11 and MLP13.

[33] In the event of a cessation of winning and working of mineral prior to the completion of the approved restoration scheme referred to in condition 27, which in the opinion of the Mineral Planning Authority constitutes a permanent cessation within the terms of paragraph 3 of Schedule 9 of the Town and Country Planning Act 1990, a revised scheme of restoration and aftercare shall be submitted to and approved by the Mineral Planning Authority within 3 months of the cessation. The approved revised scheme shall be fully implemented within 2 years of the written approval.

Reason: To secure proper restoration of the site within a reasonable and acceptable timescale and to comply with policies MLP8, MLP9 and MLP12 and MLP13.

[34] Within 6 months of the date of this permission a scheme of details and programme of implementation with respect to monitoring of water levels and pumping and discharge rates at the site shall be submitted to and approved in writing by the Mineral Planning Authority. The water monitoring shall be undertaken in accordance with approve details. Within 2 months of a derogation of either ground or surface water being identified a detailed scheme of mitigation measures and implementation programme shall be submitted and approved in writing by the Mineral Planning Authority.

Reason: to minimise the risk of derogation of and pollution to the water courses and aquifers and to comply with policy MLP13.

[35] The screening bund located in the north east of the site shall be regraded in accordance with the details shown on drawing M04106(b) 37 “Landscape Enhancement Works North Eastern

Boundary". The regarding shall be carried out within 2 years of the date of this permission.

Reason: To minimise the visual impact of the development and to protect the amenities of local residents and to comply with policy MLP13.

36] Working of the site shall be carried at a batter that shall not give rise to structural instability within adjacent land. No restored slope of the site shall be left so as to leave a batter of slope steeper than 1:3.

Reason: To ensure compliance with terms of the original old planning permission in accordance with the Environment Act 1995, to prevent structural instability in surrounding land and to ensure the batter on restored slopes does not hinder the beneficial afteruse of the site and to ensure compliance with policies MLP8 and MLP13

THE APPLICANT'S RESPONSE

These revised conditions had been forwarded to the applicants for any views they wished to give. The views received were reported to the Committee.

RECOMMENDED

The schedule of conditions as set out above be agreed as the replacement conditions for UTT/509/86.

…….

37. INFORMATION.

It was agreed that in accordance with the previously approved variation in the order of business, the Committee would take items 5(d) and 5(e) after the lunchtime adjournment. Until then, the remainder of the agenda would be taken in the published order.

…….

38. Harlow Mill Goods Yard, Station Approach, Harlow Mill, CM20 2EL. ESS/03/07/HLW

Continuation of development for the production of coated roadstone without compliance with Condition 5 (hours of operation) as attached to planning permission ESS/31/01/HLW, to allow extended night time and introduce Sunday Working for a period not exceeding 40 days per annum.

The Committee considered report DR/020/07 by the Head of Development Control.

Members noted the contents of the addendum as attached to these minutes.

The Committee was advised that the proposal was for a temporary period and sought permission to produce coated roadstone outside the permitted hours for no more than 40 days in a 12 month trial period. The concrete batching plant would continue to operate in accordance with the conditions imposed on the original permission.

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report and noted that there had been 208 letters of direct neighbour notification and 28 responses.

The Committee noted the key issues, which were:

- Need,
- Emissions and
- Impact.

The resolution was moved, seconded and

Resolved:

That planning permission be granted for the proposed variation of condition subject to the following conditions:

Conditions 2,3,4,6,7,8,9,10,11,12,13,14,15 and 16 of planning permission ESS/31/01/HLW remain unchanged.

2. Commencement within 12 months. Prior notification to the Minerals Planning Authority advising when the development would commence.

5. No coated roadstone or concrete products shall be manufactured other than between the hours of:

   05:30-00:00 hours Monday to Friday
   06:00-22:00 hours Saturdays
   09:00-18:00 hours Sundays

and at no other time on Bank Holidays, and for no more than 40 days per annum, the dates of which shall be monitored by the company and notified to the County Planning Authority.

17. The out of hours working hereby permitted shall cease 12 months after the date of commencement.

18. No working during extended hours when neighbouring coating plant is in operation.

19. Records shall be kept by the operating company, which shall be

made available upon request, showing the dates on which the working occurs. No more than 40 occasions within the life of this application.

DEVELOPMENT BY THE COUNTY COUNCIL

39. Noak Bridge County Primary School, Coppice Lane Basildon, Essex, SS15 4JS. CC/BAS/16/07

Provision of security fencing and gates to selected locations along the perimeter of the schools grounds.

The Committee noted that this item had been withdrawn from the agenda.

40. Burrsville Community Infant School, Craigfield Avenue, Clacton-on-Sea, Essex. CC/TEN/12/07

The continued use of two relocatable classroom units until 31st January 2009 without complying with condition 1 (time limit) attached to planning permission CC/TEN/25/04.

The Committee considered report DR/022/07 by the Head of Development Control.

The Committee was advised that the proposal was for the continued use of two single relocatable classroom units until 31 January 2009.

The Members of the Committee noted that there was a typographical error in the addendum attached to these minutes and a change to the expiration date.

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report. It was noted that Tendring District Council have objected to the proposal.

The Committee noted the key issues, which were:

- Need and
- Visual Amenity.

Resolved:

That pursuant to Regulation 3 of the Town and County Planning General Regulations 1992, planning permission be granted subject to the following conditions:

1. The development hereby permitted shall be carried out in

accordance with the details submitted by way of the application dated 2 February 2007, together with the application plan numbered 2061 except as varied by the following condition:-

2. The use hereby permitted shall expire on the 31 January 2009 and the buildings shall be removed from site within two weeks of that date and the site reinstated to its former condition within a further 28 days.

INFORMATION ITEMS

41. Paynes Lane, Nazeing.

Lawful development certificate appeal (ZB.22./421/14/29) – The Council's refusal to grant a certificate of lawfulness (ESS/37/05/EPF) for the use of land for the importation of soil, compost and composting material and screening of same prior to exportation for use for landscaping and similar purposes.

The Committee considered report DR/023/07 by the Head of Development Control.

Resolved:

Members noted the decision by the Inspector to allow the appeal and that remedial action was underway to remedy any remaining breach of planning control.

42. Applications, Enforcement and Appeals Statistics

The Committee considered report DR/024/07 by the Head of Development Control.

Resolved:

The report was noted.

…….

INFORMATION.

The Members of the Committee agreed to adjourn for lunch. The meeting was to be reconvened at 2.00pm.

…….

The Development and Regulation Committee reconvened at 2.00pm. Councillor D Morris and Councillor K Bobbin (apologies) were unable to attend

the remainder of the meeting.

…….

MINERALS AND WASTE

43. Wick Farm Ardleigh. Ardleigh Reservoir. ESS/57/04/TEN

Winning and working of minerals, removal surplus soils and the erection of a low profile processing plant, concrete batching plant and ancillary buildings (including workshop) interim restoration to lakes and subsequent construction of potable water storage reservoir as an extension to the Ardleigh Reservoir with landscaping and an area of public open space.

The Committee considered report DR/018/07 by the Head of Development Control.

Members noted the contents of the addendum as attached to these minutes and an additional condition.

The Committee was advised that the proposal sought to construct a new 2 million cubic metre reservoir to double the storage capacity of the existing Ardleigh Reservoir. In order to facilitate the reservoir, it was proposed to extract 4 million tonnes of sand and gravel from 50 hectares of the site at a rate of 250,000 tonnes per annum over 16 years. This would create a void to accommodate the additional potable water storage capacity.

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report. As shown in the addendum, an additional consultation response had been received from Ardleigh Parish Council objecting to the proposal and three further letters of representation had been received.

The Committee noted the Environmental Impact Assessment shown in the addendum attached to these minutes.

The Committee noted the key issues, which were:

- Need,
- Pre-maturity,
- Landscape,
- Traffic
- Nature Conservation,
- Archaeology,
- Water Resources,
- Agricultural Land,
- Rights of Way,
- Amenity Issues and
- Other Material Considerations.

In accordance with the protocol for public speaking the Committee was addressed by Mr Clamp, a local resident who objected to the proposal.

Mr Clamp was concerned that:

- Should the proposal be approved it would lead to a lowering of the water table, and there may be difficulties in filling the void with water.
- The resultant excavation would be used for purposes other than that for which permission was granted. Perhaps landfill?
- That the evidence contained within the report was unfounded or in dispute.
- The need was unproven.
- That the application was not to increase the reservoir but solely a commercial venture to obtain gravel.
- He remained unconvinced that there was sufficient mitigation of the adverse affects of lorry movements on local roads.
- The operation would take longer than 16 years.

In accordance with the protocol for public speaking the Committee was addressed by Mr Harker, from Anglian Water, who spoke on behalf of the applicant.

Mr Harker:

- Acknowledged that the application and permissions sought to permit the extraction of gravel from the site, but asked the Committee to note that the proposal arose from an established and anticipated need for water resources in Essex.
- The existing ground water storage was fully developed and an extension to the existing reservoir would meet this need.
- The applicant was making every effort to mitigate the effect of the development on the local community.

The Committee was then addressed by Essex County Councillor S. Candy, Local Member for Tendring Rural West.
Councillor Candy stated that spoke on behalf of the local residents who felt that they had not been adequately consulted. This is in fact contrary to Mr Chris Binney's report that implies that local residents had been consulted.
She was also concerned that the proposal would allow working on the site for a period of 16 years. This was such a long timescale that she felt it was difficult for anyone to be certain of the water needs for Essex and whether an extension to Ardleigh Reservoir was appropriate. The local residents, she maintained, believe that the report does not establish the need. They also are of the opinion that the principal objective of the applicant is, not to secure water resources, but to extract gravel.

In response to matters raised by the public speakers and the Local Member for Tendring Rural West the Committee was advised that:

- The site would not be used for landfill.

- It would be possible to reduce the period of development from 16 years to 10 years, but if the development was to be achieved, then the numbers of lorry movements would have to be increased.
- The references made to Mr Binney's report suggest that the development of Ardleigh Reservoir would not guarantee water supply. This is true, and the reason why the recommendation seeks an agreement to establish need before development can take place.
- It had been alleged that there had been inadequate consultation with local residents. The Committee was assured that – as far as the planning application was concerned – proper neighbourhood consultation had taken place. The Head of Development Control could not comment on the consultation that may have been undertaken by Anglian Water or other parties.

Members of the Committee considered and debated various issues relating to the application including a concern that the long-term water needs for water, or for this development had not been adequately determined. There were, for example, other ways that the need – if any – could be met, for example, the Ely/Ouse Transfer Scheme. There was also a concern that, notwithstanding the primary proposal is not for the extraction of gravel, ECC is breaking the provisions of the Minerals Local Plan. Local roads, HGV movements and potential traffic generated by the Cuckoo Farm development and Park and Ride Schemes in the area also were causes for concern. Members considered that the principal question was: does this development meet a need for water resources, or is it only for gravel extraction? All Members agreed that is was a difficult judgement which was difficult to determine on the evidence before them. However, because there are adequate safeguards in the imposed conditions Members felt inclined to approve.

The recommendation, as amended, was moved by Councillor Dick, seconded by Councillor Mackrory and put to a vote.

By a majority of 6 votes to 1, with 2 abstentions it was:

Resolved:

That subject to the Secretary of State confirming that the application will not be 'called in' for determination and subject to the applicants and all the relevant landowners entering into agreements to cover the following:

- Monitoring of groundwater including the moat around Wick Farm, and ponds to the south of the site.

- Provision for deepening boreholes or alternative water supply facilities for individual residential properties in the vicinity of the site including those fronting Wick Lane and Crown Lane North in the

event that ground water monitoring shows a detrimental impact on the potential yield of these boreholes as a result of mineral extraction and/or reservoir construction and other mitigating measures have failed to restore groundwater levels.

- Retention of the area restored for public open space to remain open and available for public use for a period of at least 50 years post completion of the reservoir.

- Provision of a 50 year management programme for the site post completion of the reservoir, including the areas of public open space and new habitat areas.

- Provision for post restoration visitor facilities, including car and cycle parking, disabled access, access to waters edge, toilet facilities and interpretation boards.

- Revocation of any planning permissions to work and process the remaining minerals at Tiptree Quarry and its early closure.

- To provide details of the end use of soils and demonstrate that they are to be used in a sustainable manner.

- Dedication of new public rights of way around the reservoir including a commuted sum for future maintenance of the new public bridleways.

- Following a monitoring period, if the current arrangements lead to access difficulties for Large Goods Vehicles, the provision additional waiting restrictions in Old Ipswich Road. Details to be submitted to and approved in writing by the Minerals Planning Authority.

Planning permission be granted subject to the following conditions:

1. C1 Commencement within 5 years

2. G1 Details in accordance with submitted plans

3. A2 Hours of operation 07:00 – 18:30 Monday to Friday, 07:00 – 13:00 Saturdays

4. G5 Records of outputs

5. H6 Wheel cleaning

6. H1 Point of access

7. The provision of the access onto Ipswich Road as shown in principle on drawing numbered IT430/SK/01 dated January 2007 to include the following:

   a. A 4.5 metre by 160 metre visibility splay to the north and 4.5 metre by 215 metre visibility splay to the south as measured from the nearside edge of Ipswich Road

   b. Radius kerbs of 15 metres (minimum) returned to an access road width of 7.3 metres which shall be a straight and metalled for at least the first 30 metres from its junction with the public highway.

8. The permanent closure of the existing access into the application site from Ipswich Road. Full details to be submitted to and approved in writing by the Minerals Planning Authority.

9. The provision of a road signage scheme to include advanced warning signs to inform road users of the presence of Large Goods Vehicles, full details to submitted to and approved in writing by the Minerals Planning Authority.

10. The safeguarding/diversion of Public Footpath 19 Ardleigh during construction stages 1 to 4 and completion of the reservoir, full details to be submitted to and approved in writing by the Minerals Planning Authority.

11. Any gates or barriers provided at the site access shall only open inwards and shall be set back a minimum of 15 metres from the nearside edge of the carriageway.

12. The submission of full details relating to the proposed car park and access arrangements for the recreational use following completion of the reservoir.

13. D4 Lorries to be sheeted

14. N2 Noise Limits

15. N3 Noise monitoring

16. N5 No audible warning devices without prior approval

17. N1 Silencing of Plant and Machinery

18. A6 No lighting except in accordance with approved details

19. Stockpile Heights shall not exceed 46 metres AoD

20. L1 Submission of a detailed landscaping scheme to be broadly in accordance with the details submitted with the planning application

21. L2 Replacement Planting

22. L3 Tree Protection Measures

23. S1 Soil Movement scheme

24. S7 Stripping of top and sub soil

25. S11 Maintenance of Bunds

26. S4 Soil handling in a dry and friable condition

27. S13 Spreading soils

28. S14 Depth of sub and topsoil

29. S15 stone picking following soil placement

30. S9 Notification of commencement of soil stripping (add that the maximum period for notification is 21 days)

31. Ar1 Archaeological investigation

32. P3 Fuel and Oil Storage

33. Ra2 Aftercare scheme to be approved

34. T3 Expiration of planning permission modified to relate to mineral extraction and construction of the reservoir

35. T7 Removal of plant and equipment removal when no longer required

36. Prior to the commencement of each new phase of a working an ecological survey and mitigation shall be carried out in accordance with an approved scheme

37. T5 Details of restoration if works stop

38. G3 No importation for processing other than cement for the concrete batching plant

39. G2 Removal of permitted development rights (minerals only)

40. D1 Dust management scheme

41. No existing vegetation shall be removed between September and February

42. Through the duration of the mineral extraction provision shall be made for fodder crops in accordance with an approved scheme

43. Prior to the commencement of the development hereby approved the developer shall provide written confirmation to the Mineral Planning Authority that a Habitats Directive compliant source of water will be available to supply the reservoir

44. Mineral extraction and reservoir construction operations within 100 metres of Chilver's Cottages, Whinstones and Gate House Farm shall be limited to no more than 8 weeks in any one calendar year

45. Detailed restoration scheme to be submitted and approved in writing

46. Details of the link between the existing and proposed reservoir to be submitted and approved in writing

47. The maximum number of vehicle movements associated with the development hereby permitted shall not exceed the following limits:

    - 170 HGV (all vehicles in excess of 7.5 t gvw) movements (85 in and 85 out) per day (Monday to Friday)
    - 84 HGV (all vehicles in excess of 7.5 t gvw) movements (42 in and 42 out) per day (Saturdays)

    No vehicle movements shall take place outside the hours of operation authorised in condition 3 of this permission.

44. Pitsea Waste Management Facility, Pitsea Hall Lane, Pitsea SS16 4UW. ESS/35/06/BAS

Proposed installation of waste pre-treatment facilities and re-contouring of landfill to facilitate restoration.

The Committee considered report DR/019/07 by the Head of Development Control.

The Committee noted amendments to the report and recommendation as shown in the addendum attached to these minutes.

The Committee was advised that the proposal was for modifications to the operational management of this landfill site.

Policies relevant to the application were detailed in the report,

Details of Consultation and Representations received were set out in the report. The Committee noted that there had been no responses to the direct neighbour consultation. A letter had been received from Basildon District Council which had raised 9 points of concern detailed in the report.

The Committee noted the Environmental Impact Assessment attached

as appendix 1 to the report.

The Committee noted the key issues, which were:

- Planning Policies,
- Green Belt,
- Restoration Need,
- Transportation,
- Impact on the Landscape,
- Nature Conservation and Biodiversity, and
- Impact on Amenity.

Councillor Archibald suggested that the reference in the report to 'occasional' hold-ups understates the true situation. Local residents know that the traffic problems are frequent. He also suggested that he could see no reason for the 'road improvements' other than those that would benefit the owners of the site. He emphasised to other Members that what was really being proposed was an extension of the life of this site, that at some future time we would be considering a further extension, and that this site and the extensions to its operating life were not of benefit to the people of Basildon.

In response to further questions and comments made by Members the Committee was advised that:

- There are no current proposals to bring in water-borne waste, although there is a provision for an extension to the wharf which would bring in soils and overburden for use as restoration material which the applicants are investigating.
- Although it would be possible to vary the conditions to ensure that the site handled Essex waste only, this would inevitably reduce the amount of waste being imported, and have a consequent impact on the life of the site.
- Recent gas management processes have helped to reduce odour problems in the vicinity.

The recommendation, subject to the amendment to the conditions was moved by Councillor Dick, seconded by Councillor Pearson and put to a vote.

By a majority of 6 votes to 2 votes, with 1 abstention it was

Resolved:

That, subject to the Secretary of State not calling in the application for her own determination, and to the completion of a Section 106 Agreement with the applicant and landowner relating to the following:-

1. Provision for the release of the site for informal recreation and nature conservation uses.

2. Provision of a management plan and programme of implementation within 12 months of date of permission.

3. Provision of a foot/cycle bridge, including a commuted sum for the maintenance of such, adjacent to the existing railway bridge on Pitsea Hall Lane. The contribution currently held by ECC in relation to the previous planning application BAS/51/96 to be put towards the construction of this bridge.

4. Provision for the release, management and afteruses on the "blue land" surrounding the application site, within 12 months of date of permission.

5. To provide for an Education Interpretation and Field Study Center (EIFSC) at the site.

6. Provide for a liaison scheme for the life of the site.

7. That this agreement supersedes the existing Section 52 Agreement (106 Agreement).

Planning permission be granted incorporating conditions outlined as follows:-

General

1. C1 – commencement within 1 year.

2. G1 – compliance with submitted details.

3. Waste Imports from source as submitted by supplementary statement, waste imports to be recorded and monitored by WPA.

Termination

4. T2 – Cessation of landfilling by 31 December 2015, restoration and agreed afteruse by 31 December 2017.

5. T7 – removal of plant, hardstandings etc except as agreed.

Amenity

6. A2 – hours, 07:00-18:00 Monday to Friday 07:00-13:00 Saturday (no waste to be received before 07:30) to include Saturday afternoon working (for public holiday catch-ups, 13:00-16:30) Saturday, Sunday, Bank and Public Holidays for Civic Amenity Wastes, 13:00-17:00 Saturdays, 09:00-16:30 Sundays and Public Holidays.

7. A5 – bund height.

Noise

8. N1 – plant and machinery operating only during the permitted

hours, and silenced.

9. N2 – Noise Level ($L_{Aeq.1h}$) at the noise sensitive premises not to exceed 55 dB.

10. N3 – for temporary operations the free-field noise level not to exceed 70 dB.

11. N4 – noise levels shall be monitored by the operating company.

12. N5 – No audible warning device.

Landscape-Planting

13. L1 – planting scheme and implementation.

14. L2 – maintenance of landscaping for 5 years post-restoration.

15. All stockpiles in situ for more than 6 months to be grass-seeded and kept weed free.

Dust

16. Provision and implementation of dust control measures.

Highway Safety and Amenity

17. H1 – All vehiclular access from via existing main Pitsea Hall Lane entrance.

Soils Handling and Storage

18. S1 – soil movement scheme.

19. S2 – scheme of machine movements.

20. Soil movement only when dry and friable.

21. S10 – restoration soils storage.

22. S12 – retention of soils.

Reinstatement

23. Details of soil depths across site prior to soil replacement.

24. R9 – pre-settlement contours to be no higher than as shown on approved post settlement plan to ensure final subject to triennial review to reflect changes in waste composition that may affect allowance for settlement.

Restoration

25. Scheme for amenity and nature conservation afteruse with habitat creation.

26. AF1 and AF2 – differential settlement.

27. AF3 – aftercare.

28. AF5 – under field drainage where required and outfall discharge control.

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There being no further business the meeting closed at 15.30pm

Chairman.

AGENDA ITEM (5a)

DR/015/07

committee DEVELOPMENT & REGULATION

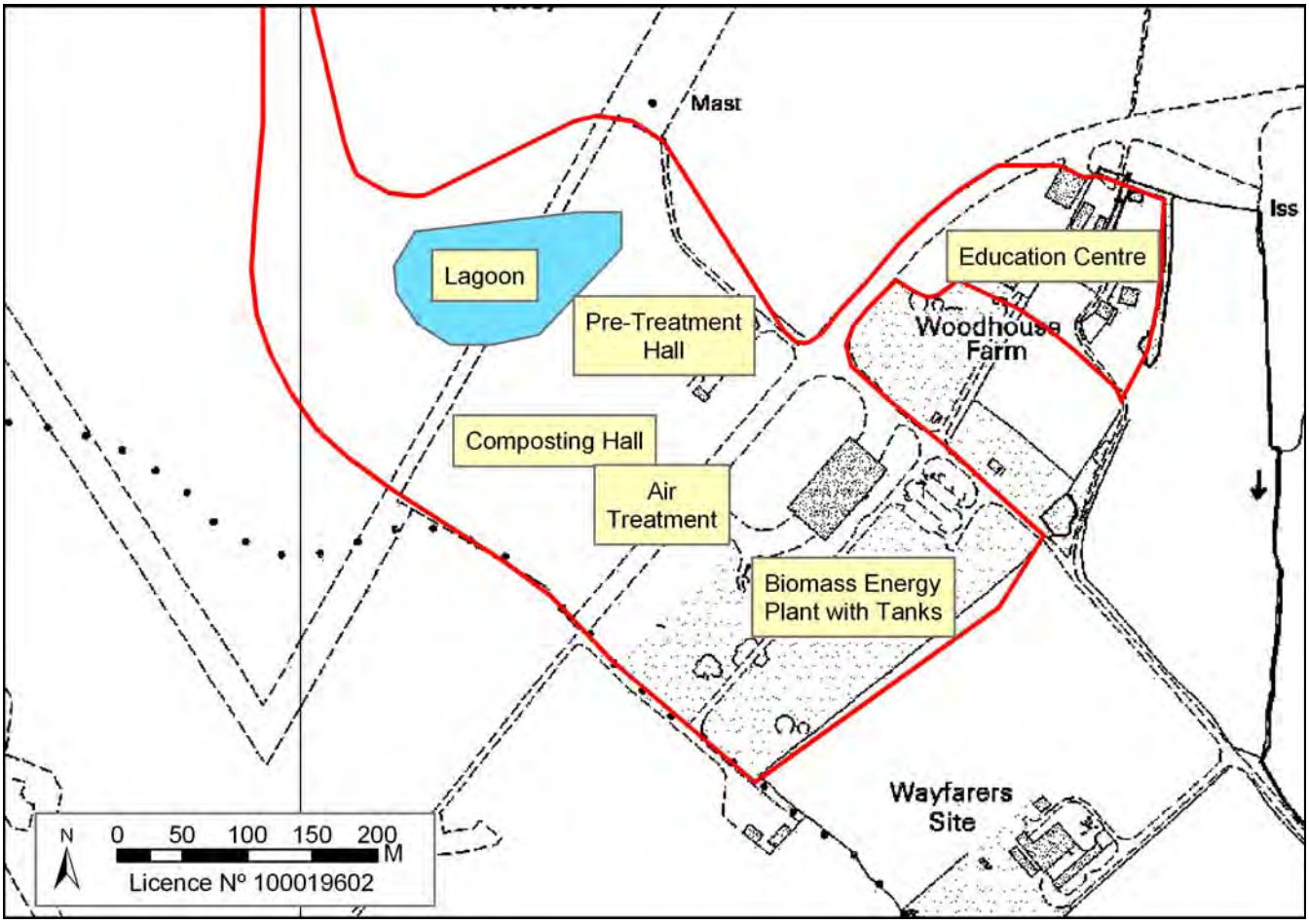
date 30 March 2007

MINERALS AND WASTE

Proposed enclosed recycling and enclosed composting facility for the treatment of residual waste comprising both municipal and commercial & industrial wastes; associated engineering works; extension to existing access road and provision of offices; biogas generators, storage tank, vehicle parking; and visitor/education centre. Rivenhall Airfield, Coggeshall Road (A120) BRAINTREE CO5 9DF. Gent Fairhead & Co Limited. ESS/38/06/BTE

Report by Head of Development Control

Enquiries to Peter Unthank – Tel: 01245 437525



1. BACKGROUND

Waste management in the UK is currently unsustainable with some 73% nationally of household waste being landfilled of which a high proportion is biodegradable with potential to generate 'green house' gases.

The Government's key objective set out in Planning Policy Statement 10 (PPS 10) 2006 is to move the management of all waste up the "waste hierarchy", viewing waste as a resource and only disposing of waste (i.e. landfill) as a last resort. Delivering sustainable waste management practice means a shift in waste management practice away from the current reliance on landfill essential to meet EU obligations under the Landfill Directive, to reduce the amount of biodegradable waste sent to landfill to 75% of 1995 levels by 2010 throughout the U.K. National targets grow steadily tighter from 2010 to 2020 and failure will result in fines, potentially both at national and Waste Disposal Authority level.

The Landfill Directive sets ambitious targets to reduce the amount of biodegradable municipal waste being sent to landfill. Similar targets are anticipated for Commercial & Industrial wastes. Since 1995, the baseline date, there is little evidence to suggest that waste arisings are diminishing and it is more likely that they are rising making the targets even harder to achieve.

A substantial step change is, therefore, required in the way that waste is managed to achieve statutory government targets for recovering waste and reducing the quantity of biodegradable waste that is landfilled as eventually only treated waste will be accepted as landfill.

To help address this within Essex, the Essex and Southend Waste Local Plan (WLP) 2001 identifies six 'Preferred Locations' for Waste Management Facilities. Rivenhall Airfield site [WM1] is one of the six 'Preferred Locations'.

An Environmental Statement (ES) detailing the Environmental Impact Assessment for the proposal considered the following:

- Construction and operations
- Policies and plans
- Land use and contaminated land
- Water resources
- Ecology and nature conservation
- Landscape and visual effects
- Cultural heritage
- Travel and transport
- Air quality
- Noise and vibration
- Social and community issues
- Nuisances

An appraisal of the Environmental Statement is set out in Appendix 1

2. SITE

The 25.3 hectare application site including the Woodhouse Farm complex and the extended access road from Coggeshall Road (A120 -Trunk) is situated within the southern part of the former airfield located approximately 1.7km south of Coggeshall Road, east of Bradwell village and approximately 1km to the north east of Silver End (Conservation Model Garden) village. It also adjoins Bradwell Quarry where sand and gravel extraction with low level restoration to agriculture is anticipated to be completed by 2021.

The site lies within an 'area of countryside' as defined by the adopted Braintree Local Plan. Part of the access route, crossing the River Blackwater, is within a Special Landscape Area. There are County Wildlife Sites within 3 km. of the site at Maxeys Spring, Storeys wood and Blackwater Plantation. The access route, serving Bradwell Quarry is part 2-lane and part single-lane with passing bays, and crosses Church Road and Ash Lane (a Protected Lane).

The site comprises a former aircraft hanger; concrete hardstandings and runway; the Listed Woodhouse Farm buildings, agricultural land and woodland to the south of the hanger containing 6 groups of protected (TPO) trees and 11 individually preserved trees. Three footpaths (FP's 19, 57 & 58), including the Essex Way, are crossed by the existing quarry access road and there is a public footpath No. 8 routed through the eastern part of Woodhouse Farm.

3. PROPOSAL

The proposed facility would provide a Recycling & Composting Facility serving North Essex, using Mechanical Biological Treatment comprising pre-sorting and separation of recyclables followed by Anaerobic Digestion and Composting technologies. The plant would process residual Municipal Solid Waste (MSW) following the public's separation and removal of recyclable materials. It would also receive and process a proportion of Commercial & Industrial waste that is collected either with the household waste or as a separate activity.

The facility would comprise 56,530 m^2 of partially sunken buildings and treatment plant situated on the south-eastern edge of Rivenhall Airfield providing employment for around 50 people. It would have a shared access southwards from Coggeshall Road (A120 Trunk) via an extension of the existing private roadway serving Bradwell Quarry. From the quarry there would be a single 8 m. wide metalled carriageway to the proposed Recycling and Composting Facility (RCF) crossing Public Footpaths 31/35 and 56.

The proposed Mechanical Biological Treatment (MBT) building would measure 120m x 253m x 20m and would contain the waste reception and pre-treatment facility. The adjoining composting hall would measure 98m x 180m x 20m. Both buildings would have "green" sedum-covered roofs. To the south of the site would be 6 Anaerobic Digestion (AD) tanks approx 25m in height and approximately 10 to15 m in diameter, biogas generators with flare stack and gas storage tank and smaller buildings accommodating the biofilter and water treatment and air treatment plant.

The facility has been designed to process up to 510,000 tonnes waste annually comprising residual waste arisings generated in the northern 'half' of the County and "a proportion of Commercial and Industrial waste".

Residual waste includes black bag waste, (the waste that remains after households have taken out material for recycling), together with the non recyclable waste taken from the County Council's Civic Amenity sites in the north of the County and the relatively small element of trade waste that Waste Collection Authorities pick up in their normal collection rounds.

The facility has the potential to generate a maximum of 404 daily Heavy Goods Vehicle (HGV) movements comprising 202 into and 202 out of the site with an average of 346 daily HGV movements (173 in and 173 out). All traffic would only use the A120 to access the site.

Waste would be delivered in enclosed vehicles or containers and all waste and composting operations would take place indoors under negative air pressure and within controlled air movement regimes, minimising nuisances such as odours, dust and litter which could otherwise attract insects, vermin and birds. Regular monitoring for signs of litter, dust, vermin or other nuisances would be carried out by the operator to meet the requirements of their Pollution Prevention Control permit issued by the Waste Regulator.

Proposed hours of operation for the receipt of incoming waste and departure of outgoing recycled, composted materials and treated waste would be 07:00 to 18:30 Monday to Friday and 07:00 to 13:00 Saturday with no deliveries on Sundays, Bank and Public Holidays. It is intended that the plant would, if required by the contract with the Waste Disposal Authority, accept and receive clearances from local Household Waste Recycling Centres on Sundays, Bank and Public Holidays. Due to the continuous operational nature of the waste treatment processes, the plant would operate on a 24 hour basis but not involve external activity for large scale plant or vehicle movements outside the normal operating hours for the receipt of waste. The evening operatives shift would finish at 22:00 hours.

Provision would be made to hold approximately $2^1/_2$ days of imported waste within an internal bunker to ensure that waste processing and treatment operations run continuously and that there is spare capacity in the event of temporary shutdown of the facility.

None of the processes involve waste incineration. Bio-gas from the Anaerobic Digestion (AD) process would be used to fuel generators producing electricity with unused bio-gas occasionally being flared off in a controlled manner.

Following an archaeological investigation the excavation of overburden soils would ensure that the bulk of the structures would be constructed below surrounding ground level, thereby reducing night-time illumination and providing screening to mitigate their overall visual impact from the wider and long-distant views. The complex of building set within a hollow would require the removal of around 760,000 m^2 of boulder clay and around 250,000 m^2 of sand and gravel. These materials would be removed over a period of 12 months as part of the

preparatory excavation works with the possibility of the sand and gravel being processed at Bradwell Quarry and reused in the construction, rather than being disposed of off site. This proposed importation to Bradwell quarry for processing would require a separate planning permission.

Approximately 1.6 hectares of woodland in the south eastern part of the site would be removed involving the loss of 4 trees (T1,G1,G4 & T8) covered by Tree Preservation Orders (TPO) and 2 TPOd groups of trees (W2 & W3) leaving a strip of woodland at the edge of the hollow to reduce visual impact. The 'American Oaks' on site which would be felled have been authenticated as native English Oaks.

The structures would be no higher above surrounding ground level than the existing hangar currently on the Site (12.5 m maximum height) for the AD tanks and less for the buildings. The 6 hectare footprint of the new buildings, however, would be considerably larger than the existing hangar and would project north of the existing woodland towards the adjacent quarry.

The construction of the facility would take between 2 and 3 years overall including excavation works. Cladding materials would be dark in colour to ensure that they generally blend into the existing landscape, woodland backdrop, distant horizon and immediate surroundings. New planting at existing ground levels is proposed alongside side the two main buildings.

The proposal is situated within a light sensitive area and therefore low level lighting with timers and solar sensitive detectors would be fitted to the exterior of the plant and installed at a low level to prevent light pollution. Internal lighting levels would be reduced to approximately 5 lux. for security purposes at the end of the working day or 23:00 hours whichever occurs first.

Woodhouse Farm, a Grade II Listed Building and associated 'Bakehouse', would be refurbished as part of the proposed development for use as an Education Centre for the public with an area set aside as a local heritage and airfield museum. The listed farmhouse and listed bake-house together with the L-shaped outbuilding group would be refurbished as a visitor/education centre. An area within the farm complex would be set aside as a local heritage and airfield museum together with visitor and employee parking only.

Detailed ecological surveys have been undertaken on and in the vicinity of the Site in order to evaluate the importance of any habitats or species present. In addition, records of protected species and birds in the local area have been gathered in order to determine whether species may be present off-site which may be affected by the development. Mitigation measures are included within the proposal.

4. POLICIES

The following policies of the emerging East of England Plan (Draft Regional Spatial Strategy) 2004-6 (DRSS), Adopted Minerals Local Plan 1996 (MLP), Adopted Essex and Southend Waste Local Plan 2001 (WLP) and Adopted Braintree Local Plan Review 2005 (ABLPR) are considered relevant to the consideration of the proposals:

a. DRSS

SS1: Achieving Sustainable Development
- living within environmental limits
- using sound science responsibly

T6: Strategic and Regional Road Networks
- local role importance of strategic roads

ENV2: Landscape Conservation
- securing appropriate mitigation measures for damage to local landscape character

ENV3: Biodiversity and Earth Heritage
- minimise damage to biodiversity, retain existing assets and new habitat creation
- promote conservation, enhancement, restoration, re-establishment and good management of habitats

ENV4: Agriculture, Land and Soils
- encourage sustainable re-use of degraded soils to beneficial after-uses including woodland and habitat creation

ENV5: Woodlands
- protect existing and increase woodland cover with new planting on derelict land

ENV6: The Historic Environment
- protect, conserve and enhance historic environment, listed buildings and their settings

ENV7: Quality in the Built Environment
- buildings of an appropriate scale, founded on clear site analysis and design principles
- promote resource efficiency and sustainable construction

ENG1: Carbon Dioxide Emissions/Energy Performance
- supply energy from on site renewable/low carbon energy sources/energy saving initiatives

ENG2: Renewable Energy Targets
- support for renewable power generation

WAT1: Water Efficiency
- improvements in efficiency matched by reductions in consumption

WAT4: Flood Risk Management
- sustainable drainage systems to be employed in all appropriate developments

WM1: Waste Management Objectives

- ensure timely and adequate provision of the facilities required for the recovery and disposal of the region's waste and reduction of wastes imported into the region

- minimise the environmental impact of waste management, including impacts arising from the movement of waste, and help secure the recovery and disposal of waste without endangering human health

- seek community support in responding positively to the need to manage waste and to recognise the particular locational needs of some types of waste management facility in determining planning applications and defining green belt boundaries, and that these locational needs, together with the wider environmental and economic benefits of sustainable waste management, should be given significant weight in determining whether proposals should be given planning permission

WM2: Waste Management Targets

- achievable targets adopted by all authorities and commercial waste producers to minimise waste and secure at least the following minimum levels of recovery:

  i. municipal waste – recovery of 50% at 2010 and 70% at 2015
  ii. commercial and industrial waste – recovery of 72% at 2010 and 75% at 2015 and
  iii. to eliminate the landfilling of untreated municipal and commercial waste in the region by 2021

WM3: Imported Waste

- East of England should plan for a progressive reduction in imported waste
- allowance should only be made for new non-landfill waste facilities dealing primarily with waste from outside where there is a clear benefit to the region, such as the provision of specialist processing or treatment facilities which would not be viable without a wider catchment and which would enable recovery of more locally arising wastes.

WM4: Regional Waste Apportionment

- waste planning authorities should take responsibility for waste arising within their own administrative areas and should plan for the following average annual tonnages of MSW and C&I waste to be managed each year for periods: 2005/6-2010/11; 2010/11- 2015/16; 2015/16-20 20/21:-
  For Essex & Southend: 2,150; 2,310; 2,540 (thousand tonnes) including imported untreated waste and post-treatment residues until 2015 in accordance with Policy WM3

- for waste arising in the region no allowance has been made for waste residues from treatment processes

WM5: Planning for Waste Management

- additional capacity required to manage the collection, sorting and storage of waste, and its treatment, recycling and disposal requires an appropriate number and range of sites for waste facilities for composting and waste minimisation processes, such as mechanical-biological treatment (MBT) and thermal energy recovery, should be encouraged

b. MLP

MLP4 Sand and gravel working where there is over-riding justification or benefit for the release of the site and the proposal is environmentally acceptable

c. WLP

W3A Achieve sustainable development, avoid conflict with other waste hierarchy options and adhere to Proximity Principle

W3C Receipt of Essex wastes only

W4C Suitable access to regional route

W7A Composting within buildings

W7B Open air composting

W7C Support for anaerobic digestion and composting

W8A Preferred locations for waste management

W8B Provision for large-scale waste management facilities at non-identified locations

W10A Conditions/agreements to control operations

W10B Siting, design, external appearance of buildings, landscaping and mitigation of adverse effects

W10E Development control criteria

W10G Safeguarding/improvements to Rights of Way

d. ABLPR

RLP 78 Protection of countryside from development
RLP 79 Special Landscape Areas
RLP 75 Waste reprocessing facilities
RLP 86 River corridors
RLP 35 Industrial and environmental standards

RLP 54	Transport assessments
RLP 62	Development likely to give rise to or risk of pollution
RLP 63	Air quality
RLP 65	External lighting
RLP 70	Water efficiency
RLP 77	Energy efficiency
RLP 80	Landscape features and habitats
RLP 83	Local Nature Reserves, Wildlife sites on Regionally Important Geological/Geomorphological Sites
RLP 90	Layout and design of development
RLP 100	Alterations, extensions and changes of use to Listed Buildings and their settings
RLP 105	Archaeological evaluation
RLP 163	Infrastructure and community facilities

5. CONSULTATIONS

EAST OF ENGLAND REGIONAL ASSEMBLY (EERA) - No comment as the application is considered to be consistent with the draft East of England Plan.

BRAINTREE DISTRICT COUNCIL objects:-

- Proposed facility is significantly larger than Adopted Essex and Southend Waste Local Plan allocation for 'preferred site for waste management' and applicant has not made sufficient case to justify departing from plan policy to resist larger waste management facilities outside of 'preferred sites.

- The proposal for treating Municipal Solid Waste is predicated on an emerging rather than agreed contract strategy and assumptions that any shortfall of residual waste for treatment would be replaced by a demand for capacity to bulk up recycled materials.

- The proposal has been promoted on the basis of 2 large waste management sites serving the whole county. The application site is evidently too small and given potential of other preferred sites in the north of the County there is not at this stage considered to be sufficient need to override the clear intention of the Adopted Essex and Southend Waste Local Plan to secure the provision of the necessary capacity on the preferred sites. Moreover there is a lack of any justification for the proposed treatment of Commercial and Industrial (C&I) waste or basis for assuming that C&I producers would use the facility.

- Serious reservations about impact of development due to size, scale and intensity on the character and appearance of the countryside including loss of 4 preserved and 2 groups of preserved trees.

- Capacity of A120 to cope with related vehicle activity.

Without prejudice to these objections should planning permission be granted then Braintree District Council has requested that a Section 106 Obligation be sought for the following:-

a. Reinstatement and refurbishment of the Woodhouse Farm complex to provide a funded and managed heritage facility.

b. Woodhouse Farm complex being available outside of normal working hours and free to local parish councils or other identified local community groups.

c. Regular maintenance/replacement as required of all vegetation planting proposed for the site.

HIGHWAYS AGENCY - No objection as proposal would not adversely affect the A120.

HIGHWAYS AND TRANSPORTATION:-

Development Control - No objection

- Subject to mechanism to ensure traffic management modifications for Church Road and Ash Lane crossover points and connecting access road.

Public Rights Of Way - No objection

- Although not proposed suggests that consideration be given to a permanent diversion to Footpath 8, possibly to the eastern side of the Education/Visitors Centre along the western side of the moat with a spur off to the education centre. Dedicated crossing points required wherever access road crosses footpaths.

ENVIRONMENT AGENCY - welcomes proposal as it would:

- Divert a significant amount of waste away from landfill due to the high levels of waste recovery/recycling from the residual MSW stream.

- Provide a ‘state of the art’ facility maximising waste recovery and using Best Available Techniques necessary for Pollution Prevention & Control (PPC) Permit/Waste Management Licence (WML).

- Undertake all waste handling and treatment processes within environmentally controlled buildings ensuring a very low risk that pollution from emissions, including those from the biogas, would cause nuisance due to odour, noise, litter, dust and vermin.

- Promote biodiversity benefits, in recognition of ecological impacts set out comprehensively in the Environmental Statement, by incorporating ‘sedum’ roofing, restoration of existing and creation of wetland habitats, soft landscaping and mitigation measures for flora, fauna and Protected Species.

PRIMARY CARE TRUST - no objection:

- Due to safeguards to human health and environment as detailed in the application/Environmental Statement.

- Welcomes innovative means of dealing with waste recovery and recycling providing a viable alternative to landfill.

- Environmentally controlled building together with rigorous monitoring will mitigate potential harmful emissions to air from dust, odour and noise.

- No flooding risk on raised plateau and comprehensive ecological impact assessment will ensure minimal disruption to habitat and landscape.

EAST OF ENGLAND DEVELOPMENT AGENCY (EEDA) - No objection. Proposed development would contribute to the implementation of opportunities for recycling/recovery as an alternative to landfill.

ENGLISH NATURE - No objection provided outlined mitigation incorporated into agreement or planning condition due to adequacy of mitigation and compensation measures for lost and disturbed habitat. Defra licences required. Pre-construction badger survey required together with mitigation management plan, scope for otter ledge under road-bridge and compensation relating to great crested newts warrants a management plan.

THE RAMBLER'S ASSOCIATION - Objects to the proposal, raising concerns about general disruption, noise, dust and extra traffic and requests a condition that all paths are reinstated to the alignments shown on the Definitive Map.

COMMISSION FOR ARCHITECTURE AND THE BUILT ENVIRONMENT (CABE), ESSEX WILDLIFE TRUST and CAMPAIGN TO PROTECT RURAL ESSEX - No objection.

THE COUNTRYSIDE AGENCY (Landscape, Access and Recreation Division), ENGLISH HERITAGE and BRITISH TELECOM - No comment.

STATE VETENARY SERVICE - No response

COUNTY NOISE/LIGHTING ADVISOR (MouchelParkman):-

- Noise – No reason for proposal to be refused on noise grounds.

- Lighting - Requests a design for external lighting to be submitted.

ENVIRONMENT & COMMERCE: -

Historic Environment - Archaeology - no objection subject to monitoring and recording brief.

Historic Buildings and Conservation - visual impact on Listed Buildings minimised by reducing 'height' of buildings to below that of trees separating development - no waste traffic to use Woodhouse Farm car parks.

Built Environment - Wishes to see 'green' roofing as advised by Urban Place Supplement.

Landscape and Ecology – No objections subject to mitigating conditions.

Waste and Recycling -

- Proposal consistent with Draft Joint Municipal Waste Management Strategy for Essex (DJMWMS) endorsed in December 2004 by all the constituent District and Borough Councils in Essex and should help to achieve the aspirational recycling rate target of 60%

- Use of anaerobic digestion technology and enclosed composting for treating municipal waste is consistent with the County Council's policy for the long term management of residual waste and electricity generation from biogas and by diverting biodegradable waste from landfill will help to comply with the Landfill Allowance and Trading Scheme (England) Regulations 2004

- The scale of the proposed plant is consistent with the growth profile forecasts of municipal waste arisings as set out in the DJMWMS and the facility would be capable of managing a combination of waste receipt scenarios including where waste growth patterns fall below those forecast in the Strategy

- Whilst the Best Practicable Environmental Option (BPEO) for Essex was a single plant in the north supplied by a series of satellite transfer station in November 2005 the three Area waste Management Joint Committees (AWMJC) resolved to establish a two-area disposal solution as a separate contract(s) consistent with the BPEO a plant in the north would also accord with the agreed procurement procedure

- This proposal would help to deliver the draft Joint Municipal Waste Management Strategy for Essex.

SILVER END PARISH COUNCIL - Objects as proposed site would be four times greater than adopted Waste Plan, 1.2 km. from village and visually intrusive. It should be smaller, deeper and further away.

Facility should only accept kerbside collections from Braintree area. It fails Proximity Principle, instead greater number of smaller sites. Fear that waste outputs incinerated on site, breaching short stack E.U. limits, or exported. Unknown long term health implications for villagers as emissions cannot be predicted. Noise and light at night would be intrusive; fugitive odour emissions would be carried by easterly winds towards village. Wildlife lost as well as woodland planted by American airmen. Replacement deciduous planting will take long time to establish and provide little cover during winter months.

BRADWELL PARISH COUNCIL - Objects due to scale of plant misleadingly called 'brownfield' and failure to respect limitations imposed by Inspector at the 1999/2000 Public Inquiry for Essex and Southend Waste Local Plan (September 2001). Reservations whether proposal meets Proximity Principle. No clarity whether corridor reserved for the new A120/access routes during construction. Concerns about increased traffic overloading the A120 until new A120 operational and problems due to existing queuing quarry HGVs. Extension of existing site road must not nullify the existing bollard arrangements. Suggest traffic signals to

manage crossovers of Ash Lane and Church Road to cope with potential increase from 200 to 600 maximum daily HGV movements. Predicted noise level of 60dB unacceptable over 7 day working week. Recommend initially to trial a similar small facility. More explicit information on monitoring procedures should be provided, records kept, and an Emergency Plan produced.

RIVENHALL PARISH COUNCIL - Objects to large site, exceeding size as allocated in Waste Plan, and breach of Proximity Principle. Reservations that by lowering of the site surrounding trees will still not offer sufficient screening. Removal of WW2 Ordnance not considered adequately. Concerns about, litter from and vehicle movements along the A120, A12, local roads and access to and exit from the site also litter on security fencing. Requests an independent ecological survey to address concerns about damage to wildlife habitats and the Essex Way. Risk of increases in vermin, groundwater, noise, light and unacceptability of air pollution due to combustion. Woodhouse Farm redevelopment not in accordance with local Policy Documents.

COGGESHALL PARISH COUNCIL - Objects due to size of proposed plant, levels of industrial waste to be taken in and increased traffic movements, particularly affecting the A120 due to dangerous junction similar to that with Earls Colne Road.

KELVEDON PARISH COUNCIL - Objects due to the proposed capacity of the plant; vehicle movements; impact on the countryside; odours, particulates etc; impact on trees. Requests a condition regarding the waymarking of footpaths and Section 106 Agreements to benefit the local community.

Local Members - (BRAINTREE EASTERN and WITHAM NORTHERN) - controversial item to be determined at Committee.

6. REPRESENTATIONS

The applicant has prepared a Public Consultation Statement detailing the Public Involvement Programme leading up to and after the submission of the planning application.

The proposed development was introduced by way of letter drop and public exhibition on site where attendees were able to make their views and opinions known via feedback forms and a questionnaire.

200 persons attended the exhibition and 53 feedback forms were received indicating 55% neutral comments, 23% negative and 22% positive.

The post application exhibition was visited by approximately 217 persons and 74 feedback forms were received indicating 40% neutral comments, 26% negative and 34% positive.

The concerns arising from all public consultation and the exhibition are reflected in the observations below.

The application has been advertised on site and in the local press.

Neighbourhood Notification has also been undertaken by the Waste Planning Authority direct to 3 properties within 250 metres of the application site boundary.

Thirty nine representations have been received raising the following issues:-

Observations	Comment
PUBLICITY	
Insufficient consultation.	See comments above on Public Involvement Programme.
There has not been a proper consultation on the recent draft Waste Strategy, only via the Essex 'War on Waste' consultation.	This is a matter for the Waste Disposal Authority to address.
WASTE PLANNING	
Proposal is contrary to a number of Plan policies. Waste will arrive from a number of districts in Essex, and the developer can enter into contracts to bring waste in from elsewhere especially C & I wastes from London.	This is unspecific as no particular policies identified. The RCF would form an integral part of a network of existing and new waste management facilities across North Essex as part of the new county-wide Integrated Waste Management Contract (IWMC).C & I wastes were stated in the application description and supporting text then further amplified in the applicant's supplementary statement. It is not proposed that wastes would be imported from outside Essex which could be ensured by condition.
What types of waste would be accepted at the site?	The proposed RCF would treat only type B & C wastes i.e. Municipal Solid Waste (MSW) & Commercial and Industrial (C&I) wastes.
Destroying valuable recyclables will cost taxpayers. High recycling with separated kerbside collections, local baling and composting is only 2/3 the cost of long-term contracts for centralised sorting and disposal facilities.	The RCF conforms entirely to the Draft Joint Municipal Waste Management Strategy for Essex (2005 to 2030) and is in line with the East of England Regional Waste Management Strategy (EERWMS) which identifies MBT as the preferred option for treating residual waste having been subject to Best Practicable Environmental Option (BPEO) assessment which takes account of proximity.

A single plant for North Essex is disputed as the Best Practicable Environmental Option and is contrary to the proximity principle as it is largely a commercial venture.	See above
The Essex & Southend Waste Plan is seriously out of date and therefore unsound.	The Essex & Southend Waste Local Plan was adopted in September 2001 to plan for a period of 10 years, and so is not out of date. The objectives of PPS 10 take primacy where there is any conflict with existing plans. The proposal does not conflict with PPS 10 and is in accordance with policies in the emerging DRSS.
The proposed tonnage for treatment is a massive overprovision and will not allow for higher recycling targets. It will also counteract the principles of waste minimisation.	The RCF could receive waste in a number of forms depending upon the exact final nature of the awarded collection and treatment contracts.
The applicants confuse WM1 site size with the footprint of the proposed building as the area occupied by this facility is 17 hectares whereas the original designation area is 6 hectares.	WM1 area is used for comparison; however, the RCF's footprint is comparable for pro rata tonnages with other examples of MBT plants in Europe. Compared to incinerators the RCF process requires longer residence times and correspondingly larger sites.
MBT is an expensive, dirty option, resulting in RDF or incineration. The proposed MBT plants would contravene the commitment to Zero Waste by 2020 as well as the 'Working Together' policy. It fails to reflect the preferred option of the WoW consultation for 60% recycling by 2010.	The RCF conforms to the objectives of the Draft Joint Municipal Waste Management Strategy for Essex (2005 to 2030).
The proposed MBT plant does not have public support.	See above.
No attempt has been made to compare costs with those of recycling policy demanded in the WoW.	Such a comparison is for any review of the DJMWMS and, therefore, outside the scope of this planning application.
ECC misrepresented the WoW.	See above.

Recycling & Compositing facility does not accord with Policy RLP 78.	The proposal would be a departure from the Adopted Essex and Southend Waste Local Plan and the Adopted Braintree Local Plan Review (see appraisal). Should the Development and Regulation Committee resolve to grant planning permission then the proposal would need to be forwarded to Government Office for endorsement. Also see appraisal.
The proposal assumes waste growth continuing relentlessly until 2030 and the current plans for massive waste disposal plants at Basildon, Stanway and Rivenhall Airfield will cost the council taxpayers huge sums, while not achieving the recycling aims the county and district councils were committed to follow.	The RCF is designed to be highly flexible and capable of treating a range of wastes. If it receives less than the estimated residual waste this is because it would then be receiving larger quantities of separately collected mixed dry recyclables. The RCF would be able to treat all residual waste from North Essex in addition to at least half of the requirement to process mixed dry recyclables. Alternatively, depending upon the nature of any long-term contract, the RCF could treat all of the residuals, 40% of the mixed dry recyclables and 30% of the mixed organic wastes for composting.
The proposal conflicts with the latest waste strategy.	See above.
Application seems predicated on a 30% recycling rate. A higher recycling rate will result in a higher cost per tonne disposed of via the MBT.	The proposal is based on 30% recycling actually being achieved (since targets and achievement may not always correspond).
Development would avoid landfill and wholesale incineration of domestic waste. There should be no requirement for landfill.	The primary purpose of treating Municipal Solid Waste is to remove its biodegradable content before landfilling any residue. Landfilling is not proposed within the application site.
Proposal would involve incineration. Transporting the refuse derived fuel out of the county is not acceptable.	RDF/SRF could be exported for use in high energy demand processes equipped for the burning of this type of fuel in substitution for fossil fuel. As a waste derived fuel, it would still be subject to the requirements of the Waste Incineration Directive and require full exhaust gas scrubbing, thus ensuring no increase in air pollution wherever it is utilised.

MARKETS FOR OUTPUTS	
The market for Refuse Derived Fuel (RDF)/Solid Recovered Fuel (SRF) is highly uncertain.	This is a matter for consideration by the Waste Disposal Authority when negotiating the JMWMS contracts.
Is there a ready market for the main output from the plant?	As above but the RCF is designed to reduce the biodegradability of municipal waste residues and extract outputs of high calorific value, recyclable materials and biogas to produce electricity. Composted residues would be to an assured standard to maximise its marketability rather than disposal.
HIGHWAYS AND ACCESS	
Traffic levels would increase in the area. Access would be far better from Parkgate Road, with traffic going through Rivenhall to the A12. HGV traffic would take short cuts through Rivenhall village anyway.	Parkgate Road would be an unsuitable direct route to the A12, as the link from Rivenhall End to Silver End is not a County /Urban distributor as it is subject to 3.9 metre height and 7.5 tonne restrictions.
Lorries used for the site would place an unsustainable burden on communities.	All traffic would only enter and leave the site via the A120 access. The Highways Agency has confirmed: '…the application would not adversely affect the A120 trunk road at this location.'
Highways Agency have stated that it be 'not acceptable' for access to the new A120.	The Highways Agency is considering ‘the Proposed Southern Route’ which could run through the middle of the airfield. The applicant has indicated a desire to secure a safe and suitable direct access onto the ‘new A120’ independently of this application.
The access road is too near to residential properties.	Properties around Bradwell Hall are approximately 150 and 300m from the existing access road and Goslings Cottage, Herrings Farm and Sheepcotes Farm are all in excess of 400m.
An accident black spot will be created where the haul road crosses Church Road and where it joins the A120.	The safety implications of the site access road and its crossing with Church Road is unlikely to jeopardise highway safety. The Highways Agency has confirmed that: '…the application would not adversely affect the A120 trunk road.'

HGV traffic should be constrained to the A120 and measures put in place to prevent HGV's from using other local roads. Is the A120 the only route into the site?	Access would only be from the A120 and not surrounding roads. Appropriate road barriers would be installed at strategic locations around the perimeter of the airfield which would only permit authorised or emergency vehicles to enter the site. See also earlier comment on the use of Parkgate Road.
INDUSTRIALISATION	
The proposed facility is too large.	The RCF has been designed to be as flexible as possible in its ability to accept a range of likely wastes, aimed at the treatment of Municipal Solid Waste (MSW), Mixed Organic Wastes (MOW) and Mixed Dry Recyclables (MDR) from household kerbside collections. Its capacity would be consistent with the requirements of the Joint Municipal waste Management Strategy (JMWMS).
The rural setting would become industrialised	Part of the site is an Adopted Waste Local Plan preferred location for waste management. The area contains a mixture of agriculture, residential and small pockets of industry but there are no signs of it rapidly becoming industrialised.
Twenty eight metre high structures would deface the already scarred countryside	The only substantial structures of this height would be the AD tanks which would be constructed within a deep excavation. Ground levels would be lowered by 16m, leaving only the upper 12m of the tanks exposed above ground level. With existing and proposed adjoining tree and shrub planting providing screening together with the 'Sedum' roofs of the proposed buildings, the visual impact would be limited.
Operating hours should be curtailed to suit the rural location	Reception of waste at the RCF would be limited to between the hours of 07:00-18:30 Monday to Friday, and 07:00-13:00 Saturday, excluding Sunday, Bank and Public Holidays. The internal processes of the RCF would, however, operate on a 24-hour basis. Moreover the site is remote from highly populated residential areas.
There are plenty of other suitable locations, far enough away from existing residential areas.	The principle of the site allocation is established in the Adopted Waste Local Plan. Some 22 sites were submitted and the Inspector removed 2 of the 8 sites put

	forward in the Deposit Draft and recommended that 6 be retained as "preferred locations for waste management facilities. No other alternative sites were put forward in the area local to Rivenhall Airfield.
This is an isolated area that has not seen building works for about sixty years.	Within the vicinity of the proposed RCF there is: - a scrap vehicle breakers; a street cleansing services vehicle depot; General Manufacturing ('B2'); Light/High Tech. Manufacturing ('B1'); Warehouse/Distribution ('B8'); and Mineral Extraction and Processing including ready-mix concrete production and minerals bagging.
POLLUTION	
Dust would be a disturbance.	All waste handling activities would be undertaken within purpose built buildings operating under negative air pressure in a controlled regime, treating all collected air prior to release to atmosphere to minimise fugitive air emissions.
Pollution would be generated from the plant and from traffic movements	Negative impacts on air quality would be minimised by all waste and composting operations being within enclosed buildings, using controlled air movement regimes, treating all collected air prior to release to atmosphere, utilising or flaring all the generated biogas and site management procedures to minimise fugitive air emissions and odour. The increase in Annual Average Daily Traffic (AADT) flows on the local road network would be less than 10% and not considered to be significant in terms of deterioration of change in air quality, as there will be only one access route from the A120.
Odour would be generated from the plant and would affect nearby footpaths	The above measures would minimise the occurrence of fugitive emissions and odours with monitoring and regulating through a Pollution Prevention Control Permit issued by the Environment Agency.
Unknown effectiveness of spent filtered fumes.	Air from the main building would be extracted, scrubbed and then passed through a bio-filter. Air within the compost building which would be on a semi-closed circuit would be re-circulated and treated using thermal oxidation before being passed into

	the bio-filter and discharged. Assessment of potential emissions also demonstrates that there would be no undue health problems or unpleasant side effects for residents.
Emissions from the plant could be toxic.	The EIA identifies and evaluates potential emissions so that they can be avoided or mitigation measures put in place. No significant environmental impacts were identified. Potential emissions would be managed and monitored through the Integrated Pollution prevention Control (IPPC) regulations.
Gas burning emissions would exceed safety limits.	Gas burning emissions would be regulated by the Environment Agency via the PPC Permit to ensure that adopted emissions would be within safe limits. Maximum height of flare stack would be 15 metres above original ground level.
The burning of RDF and mass-burn incineration is a highly polluting process.	Neither form of combustion is being proposed at Rivenhall Airfield.
There would be a number of health problems through the burning of solid waste at the site.	As above
Wasted energy from the shredding and destroying of the materials involved.	The Anaerobic Digestion processes produces biogas that would be converted into electricity for on-site use with any surplus being diverted to the National Grid.
HEALTH AND SAFETY	
Proposal should include the storage of any excess methane gas.	Gas would be stored in a conventional gas meter.
Gas burning emissions would exceed safety limits.	Gas burning emissions would be regulated by the Environment Agency via the PPC Permit to ensure that adopted emissions would be within safe limits.
Public Safety would be jeopardised by the storage of explosive gas.	Gas storage would be limited to the contents of the gasometer which would be on a closed circuit and protected with safety valves. Consequently the amount would not be notifiable under Control of Hazardous Substances Legislation. The final details of storage and control would be agreed under

	the PPC Permit to ensure that any risks are minimised.
RIGHTS OF WAY	
Proposal would cause disturbance/removal of footpath routes.	Footpath 8 would be diverted, though this would be largely dependent upon the scale of the works required to the derelict Grade II listed buildings.
Footpaths and their routes are incorrectly drawn on the submitted plans.	No relevant discrepancies with the plotting of Footpaths 8,19,35,56,57 and 58 have been identified by Rights of Way.
Any diverted footpaths should be way marked and clearly marked on maps. All paths should be reinstated to the alignments on the Definitive Map.	This is proposed and footpath reinstatement would follow restoration of mineral workings.
Paths, where they cross the haul road, should allow for safe pedestrian crossing by use of pelican or zebra crossing controls.	Wooden barriers consistent with the rural nature of the surrounding countryside would be erected at the crossing points and designed in accordance with recognised standards such as The British Horse Society, Advisory Statement No 5. Signage and road markings would be installed along the road and footpath.
The proposed would conflict with Policy WIOG of the Essex and Southend Waste Local Plan 2001 relating to Public Rights of Way.	The proposal makes provision for the retention of footpaths; with cross over points appropriately protected where they intersect the haul road.
NOISE	
Noise would be a disturbance	There would be no discernable increase in noise levels associated with the RCF development. It is considered that the surrounding villages of Bradwell, Silver End, Cressing, Rivenhall and Coggeshall would be unaffected by the operation of the RCF. This view is supported by the County Noise Advisor.
VISUAL INTRUSION	
The development would be inadequately screened throughout the year. Gas flares would be visually intrusive.	The RCF would largely be constructed below existing ground level significantly reducing its overall visual impact. The proposed mitigation measures would result in an

	improvement in landscape quality and obscure the occasionally used gas management flarestack.
The development would be visually intrusive on local footpaths	The view of the plant from all footpaths would be limited due to the RCF being constructed below ground level with screening from existing trees and new planting.
NATURAL ENVIRONMENT	
Protected wildlife could be affected	The Baseline Ecological Report concludes the site has no internationally or nationally significant habitats. The only species with statutory wildlife protection recorded in these surveys are Great Crested Newts in pond number 24 at Woodhouse Farm and low numbers of Brown Long-Eared and Pipistrelle bats around Woodhouse Farm....but no bats were found to be resident within the site or Woodhouse Farm areas".
The proposal will involve the removal of 1.6 hectares of established woodland, which is protected by Tree Preservation Orders.	Compensatory planting comprising ‘2.2 ha. of scrub/woodland and over 350 linear metres of hedgerow’ is proposed, together with grass and wild flower sowing.
Woodland protected by Tree Preservation Orders would be felled	Developing the 6 ha. Waste Local Plan site (WM1) site & would have resulted in the loss of 5 oaks, 2 groups of trees and two areas of woodland totaling approximately 3 ha. The proposed development, however, would result in the loss of 4 trees (T1, G1, G4 & T8) covered by Tree Preservation Orders (TPO) and 2 TPO'd groups of trees (W2 & W3) leaving a strip of woodland at the edge of the hollow to reduce visual impact. The 'American Oaks' which would be felled have been authenticated as native English Oaks. The proposal would also preserve a large block of existing woodland, 4 oaks, and include 2.2 ha of additional planting with improved screening of the development. Compensatory planting would result in greater areas of woodland established across the site.
12 hectares of the best and most versatile agricultural land would be lost.	The disruption of the holding associated with the RCF development is not significant and would not prejudice the continued management of the unit during the

	construction and operation of the RCF.
The existing haul road would be extended to reach the waste site, crossing Church Road and Ash Lane and the Blackwater Special Landscape Area.	The actual development site lies outside the SLA, though the existing access road passes through this area. There are no proposals to change this road and so there would be no additional impact on the SLA.
HISTORICAL CONTEXT	
The historic significance of Rivenhall Airfield would be destroyed.	The wall murals from the Elephant House could be reproduced and displayed on the front of the RCF as Public Art. Woodhouse Farm would be refurbished and redeveloped as part of the proposed Education Centre linked to the RCF. An area within the complex would be set aside as a local heritage and airfield museum.
Proposal would affect a Listed Building, and a number of footpaths and lanes.	Woodhouse Farm is the only Listed Building that would be affected as it would be restored and brought into regular use. Footpaths crossed by the access road to the RCF development would be provided with cross over points and the Footpath 8 through Woodhouse Farm may require a temporary diversion. Traffic management measures for Church Road and Ash Lane are being evaluated by the Highway Authority.

7. APPRAISAL

The key issues are Government and Regional Waste Policy;
Adopted Essex and Southend Waste Local Plan and justification for departure from the local plan; and Draft Joint Municipal Waste Management Strategy for Essex; amenity; highways; sustainability and pollution.

a. GOVERNMENT AND REGIONAL SPATIAL STRATEGY

Government's key planning objectives set out in Planning Policy Statement PPS 10 are to help deliver sustainable development through driving waste management up the waste hierarchy and by addressing waste as a resource looking only to disposal as the last option but one that must be adequately catered for.

The principles of 'self sufficiency' and 'proximity' of waste disposal (as set out in the EU Waste Framework Directive) have been re-formulated and are now set out as objectives to be delivered through the framework delivered by development plans and strategies. The objectives are that communities should take more responsibility for their own waste (self-sufficiency), and that waste should be disposed of in one of the nearest appropriate installations (proximity).

In this respect communities have to take greater responsibility for reducing their own waste and waste management facilities need to be provided to meet the needs of communities. This would be consistent with the national waste strategy and set targets required under European legislation and the Waste Management Licensing Regulations 1994.

There are some contradictions that may need to be reconciled when considering these issues, including economies of scale and transport issues. In some situations it may be appropriate for centralised facilities to be developed which take in wastes from outside the immediate area, for example, the use of rail as a means of waste transfer is generally not economic over short distances. Similarly achieving economies of scale can be critical to the financial viability of some thermal and mechanical processing operations.

PPS 10 advises that 'waste, therefore, should be recovered or disposed of in one of the nearest appropriate installations without endangering human health and harming the environment taking account of the concerns and community interests, the needs of waste collection and disposal authorities and business whilst encouraging competitiveness.'

The guidance in PPS 10 takes primacy over the WLP where there is any conflict until it is replaced by a Waste Development Framework. Similarly there should be compatibility between Waste Planning Policy and the Waste Management Strategy.

The Draft Regional Spatial Strategy (DRSS) is replacing the Essex and Southend-on-Sea Structure Plan and sets out a range of policies for the development of the region reinforcing the broad objectives of national policy for waste. These embrace sustainability and the recognition of the need to manage waste in a responsible manner emphasising that Waste Planning Authorities have to take responsibility for managing waste arising within their administrative area.

The DRSS projects the following provisional median waste arisings for Essex and Southend as at January 2007:

Years	MSW (tonnes)	Other Incl. C+I & C+D (tonnes)
05/06	882,000	1,550,000
10/11	1,052,000	1,550,000
20/21	1,116,000	1,550,000

It acknowledges that locational needs must be recognised for certain types of waste management facilities when both defining revisions to green belt boundaries and determining planning applications for waste proposals. Locational needs have to be balanced against the other policies in the strategy and together with the wider environmental and economic benefits of sustainable waste management are material considerations and should accordingly be given significant weight in determining proposals for waste management facilities. In turn these should be of a design and layout that supports sustainable waste

management. The proposal therefore accords with RSS Policies SS1, WM1, WM2, WM3, WM4 and WM5.

b. ADOPTED ESSEX AND SOUTHEND WASTE LOCAL PLAN AND JUSTIFICATION FOR DEPARTURE

The Plan was adopted in 2001 and uses a site specific approach setting out policies to guide waste management development for waste generated by all producers in the county until 2011. Six sites for larger and integrated waste management facilities (i.e. 100,000 tonnes per annum capacity or more) are specifically identified in the plan under Waste Plan Policy W8A as 'preferred locations for waste management facilities to assist the move up the hierarchy away from landfill'. 'Preferred Locations' were identified to deal essentially with non-inert wastes, formerly Categories B and C amounting respectively to approximately 728,000 and 750,000 tonnes per annum in 1996.

Policy W8A requires proposals to meet following criteria:

- need for facility to manage waste arisings in Essex and Southend
- complies with other relevant policies in the Plan, adequate road access W4C
- buildings and structures are of a high standard of design, with landscaping and screening provided as necessary; and
- integrated schemes for recycling, composting, materials recovery and energy recovery from waste supported where benefits in the management of waste which would not otherwise be obtained.

The Waste Local Plan, however, does not specify the waste processes which might take place at each site. This was to enable flexibility in meeting the requirements for different types of process and to allow for innovation in waste management.

Policy W8B makes provision for large-scale waste management facilities at non-identified locations where it can be shown that preferred locations are less suitable or not available for a particular waste stream whilst criteria based policies make provision for smaller scale facilities.

The deposit Draft Waste Local Plan was the subject of a Local Plan Inquiry between November 1999 and January 2000. Considerable emphasis was placed on mass burn incineration in the Essex and Southend Waste Local Plan Deposit Draft 1998 (ESWLPDD) and was recurring theme throughout the Waste Local Plan (WLP) inquiry. The Inspector's report made a number of references to incineration to the extent of using SELCHP incinerator in Lewisham as a benchmark for a restricted urban site. He recognised that incinerators can be very large buildings with a 100 metre high chimney and would, therefore, be visible over a very wide area, adding that in most locations there would be limited opportunity to lower the ground levels to absorb buildings.

In his report considering objections to the Rivenhall site WM1 the Local Plan Inspector identified the main issues to Rivenhall airfield as: visual impact; traffic and access, environmental impact; effect on the historic airfield and the setting of the listed buildings; effect on neighbouring communities; relationship to existing Development Plan policies; relationship to ongoing mineral working, alternative locations and light pollution. His report also recorded that although local objectors suggested that other local sites could be more suitable none were put forward for consideration.

The Inspector concluded that the 16.3 ha site originally proposed should be reduced to 6 ha to include the hanger, the smaller buildings to the north-west of the hanger and immediate surroundings with the proviso that their use or their replacement by broadly equivalent new development could be acceptable in visual terms and not risk harming the setting of Woodhouse Farm. The prospect of an incineration plant placed at ground level on the partially exposed plateau of Rivenhall Airfield anywhere within a 16.3 hectares site appears to have been envisaged by the Inspector when considering the visual impact of such an installation. Being of an industrial nature a large building or a complex of buildings and a tall flue stack would have certainly been very prominent in the landscape and impossible to completely screen by landscaping.

The Inspector, however, recognised that a large structure such as a conventional incinerator would be difficult to accommodate due to its visual impact in the open countryside and that access should only be from the A 120. The Inspector's assessment of site WM1 was based on the concept of surface development for possibly an incinerator with tall flue stacks; the 2.5 hectare benchmark for such thermal treatment plants was well documented at the time of the Waste Plan Inquiry.

Conversely the knowledge and understanding about biological processes was less well appreciated particularly their need for far greater floor-space to accommodate composting residence times in terms of weeks rather than days for thermal treatment. The Essex and Southend Waste Plan adopted in September 2001 incorporated the Inspector's findings and added the comment that replacement buildings and structures should be sensitively designed with regard to their surroundings and comparable to the scale of the current buildings. The more open areas of the site would be more likely to be appropriate for outdoor composting whilst screening and landscaping should have regard to public viewpoints and those from Silver End.

The Inspector recommended that waste policy W7K addressing incineration should remain in the Waste Plan but this policy was subsequently deleted by the Waste Planning Authority.

The County Council's decision not to follow the thermal treatment route was, however, after the Waste Plan Inquiry and adoption of the Waste Plan and, therefore, offered no opportunity to review the preferred site boundaries given that the potential impact of an incinerator at Rivenhall had resulted in the site boundaries being drawn more tightly than for any of the other preferred sites.

In response to substantial opposition to incineration ECC's Waste Management Strategy has focussed on non incineration methods of waste management with particular emphasis on innovative MBT/AD and Composting. The consequence of this is that they require a far larger area for waste handling than the corresponding incineration solution contemplated by the Inspector at the time of the inquiry as the most effective solution to Municipal Solid Waste management.

In consideration of the waste plan sites whilst the Inspector could not have predicted the outcome of the County's Waste Management Strategy he did not rule out that any one of the preferred sites may have needed to accommodate an incinerator capable of dealing with Municipal Solid Waste arisings although with sites at Old Heath and North Weald he was very aware of the proximity of many residential properties. By comparison the larger sites resembling a Resource Recovery Park would be able to provide additional scope for processing a range of waste materials including open air composting and recycling of Commercial and Industrial and Construction and Demolition wastes which require extensive areas for open storage and processing. In dismissing the larger site at Rivenhall the Inspector acknowledged scope for smaller scale outdoor composting consistent with waste policy W7B.

Any sizeable plant capable still requires vehicle manoeuvring areas, ancillary plant, offices, weighbridges and staff facilities whether processing 200,000 or 500,000 tonnes per annum. The Inspector acknowledged that reducing a plant's capacity and throughput does not lead to a proportionate reduction in the size of the building and its overall footprint. However, the Inspector contemplated that the reduced Rivenhall site of 6.0 hectares could nonetheless accommodate an incinerator similar to that at Lewisham. It would appear that the Inspector's main justification for recommending a reduction in the site area was to mitigate visual impact on landscape and adverse effect on the setting of the listed buildings within Woodhouse Farm.

The fundamental difference now is that instead of incineration MBT/AD technology requires far more extensive floor space in an enclosed environment for the processing and longer residence times to improve the stabilisation of waste which equates to a requirement for larger buildings. It uses proven technology developed from that already being used by the German, Italian and Spanish waste management industry and is considered to be comparable to light industrial or B2 industrial use. Likewise the anaerobic digestion technology has been used for many years in waste water treatment installations for treating sewage and on farms for slurry.

The net area of the tanks and buildings is, however, no greater than the 6.0 hectare approved site, so the additional area could be justified on the basis that it reflects changes in waste management technology and best practice that were not considered by or available to the Inspector.

Government guidance through Planning Policy Statement PPS 7 considers development in the countryside beyond areas designated in development plans but recognises that subsequent emerging guidance has to be taken into account. In these circumstances Planning Policy Statement (PPS 10) and the DRSS outweigh WLP policy W8B and Braintree Local Plan Review policy RLP 78.

Flexibility in the WLP is the key to facilitating waste management by enabling sites to be developed even though they may have larger footprints than originally envisaged. This is in order to ensure that waste development, including that required to deliver the Draft Joint Municipal Waste Management Strategy (DJMWMS) is implemented by using publicly acceptable technologies that may be relatively new to the United Kingdom but have been tried, tested and are now in everyday use in Europe and elsewhere.

There is, therefore, a compellingly strong case for considering a larger site than the 6.0 hectares for Rivenhall but only within the context of the 16.3 hectare site considered in the deposit draft. Whilst the site is nearly three times larger, a substantial amount of the land take is due to unusable batters of the excavation to accommodate the plant below ground, and the surface water lagoon that is necessary for grey water management as well as Woodhouse Farm. The greater footprint of the buildings, however, is required for the AD tanks, storage of feedstock and enclosed composting capacity allowing prolonged residence time required for maturation to ensure sufficient bio-stabilisation of the inputted wastes.

The need for such a facility and endorsement by the DJMWMS are considered to be overriding factors when assessing the implications both environmentally and financially (although not a planning concern) for not complying with European Legislation and Government's aspirations to fundamentally change the way waste has traditionally been managed. These factors supported by Planning Policy Statement 10 and emerging DRSS are sufficient to justify a departure from the WLP and Policy RLP 78 of the Adopted Braintree Local Plan Review 2005 (ABLPR). However, the proposal would still be consistent with DRSS Policies: SS1, T6, ENV2, ENV3, ENV4, ENV5, ENV6, ENV7, ENG1, ENG2, WAT1, WAT4, WM1, WM2, WM3, WM4 and WM5; WLP policies W3A,W3C,W7A,W7C,W8A and W8B and ABLPR policies RLP35 and RLP54.

To summarise, the site is well located for large buildings and a waste management facility as set out in the WLP. The proposal, however, would take up a larger site area than within the WLP due to change in technologies now being promoted. As the WLP remains a statutory plan, then this proposal being a departure from that plan in terms of the size of the site proposed only, has to be referred to the Secretary of State if Members resolve to grant planning permission.

However, site related issues, discussed later, still need to be considered to ensure that no unacceptable harm to the environment would arise.

c. WASTE MANAGEMENT STRATEGY

Despite waste minimisation and recycling initiatives, growth in the amount of waste being generated broadly correlates with population growth. Achieving meaningful reductions in household waste, however, relies heavily on the commitment and capability of individuals and in practice, circumstances dictate that not everyone will be able or willing to participate. It is on this basis, therefore, that the Draft Joint Municipal Waste Management Strategy (DJMWMS) identifies the requirement to establish waste management facilities to deal with projected household waste arisings that the population cannot or will not deal with. Landfill is still the last resort but where there is no alternative, the bio-degradable element

still has to be substantially reduced. This helps to remove potential pollutants and much of the bulk, preserving landfill space and significantly reducing the potentially harmful and problematic side effects of groundwater contamination, landfill gas and settlement.

The DJMWMS in 2005 carried out an extensive consultation exercise facilitated by MORI concluded that with a 95% confidence level some 84% of respondents supported the bio treatment to deal with residual rubbish remaining after recylates had been removed.

The current DJMWMS states that Essex will reach a recycling rate of 45% by 2010/11 and that by the end of the Strategy period the Waste Disposal and Collection Authorities aspiration will be to achieve 60% recycling/composting of all household waste. Provided that this facility would be available to treat and process waste predominately arising from within Essex then for MSW this proposal if secured though the DJMWMS contract would undoubtedly help to deliver the Joint Municipal Waste Management Strategy consistent with Waste Plan Policies W3A, W3C and W8A.

d. AMENITY

Noise

Potentially intrusive noise emissions from the operations should be limited to those associated with external HGV traffic and not any external storage as all of the vehicle manoeuvring and waste handling and processing would take place within buildings. Air purification circulation and extraction units together with pumps and alarms would be acoustically attenuated to minimise potential for night time disturbance. Overall, however, the location of the plant predominantly below ground and distance from the nearest occupied properties would serve to provide the most effective noise containment possible.

Traffic noise particularly empty HGV's similarly should not give rise to an unacceptable impact due to the sunken alignment and metalled surface of the access road extension from the existing quarry. Controls imposed by conditions should ensure that development would be consistent with WLP: W10A, W10E and ABLPR: RLP 35 & RLP62.

Light

As with noise containment the location of the plant predominantly below ground and distance from the nearest occupied properties would provide effective direct screening. However, in addition the use of PIR controlled, low level and low energy lighting would significantly reduce the vertical illumination skywards from the plant. The proposal is consistent with DRSS: ENG2; WLP: W10B, W10E and ABLPR: RLP 65 & 77.

Landscape and Ecology

Waste Management Facilities are essentially very large buildings containing waste processing machinery although recycled products may be stored externally. Their

construction by contrast is relatively short lived and their final form fixed rather than ever changing and visually disruptive. So through good design whilst recognising the airfield's World War II heritage, appropriate choice of cladding materials, technological innovation such as grey water management, sympathetic earth-mounding and prolific planting to provide short and long term screening, the development can be completed and then allowed to mature within its surroundings.

A development of this size may cause some degree of additional harm to that envisaged by the Local Plan Inspector in respect of the smaller site. However, despite its size the proposal would counteract concerns about its visual impact by its being sunken into an engineered void coupled with an innovative design to reduce its silhouette and bulk.

Environment and Commerce (Landscape and Ecology) recognise that due to the particular character of the airfield disguising such a large complex of buildings at ground level would be impossible but that by sinking these buildings into the ground has helped to substantially minimise their impact to an acceptable degree and would be sympathetic to the surrounding landscape when coupled with existing and proposed extensive landscaping and tree/shrub planting. The proposal is correspondingly consistent with DRSS: ENV2, ENV3, ENV4, ENV5, ENV 7, WAT 1 and WAT 4; MLP: MLP4; WLP: W10B, W10E and ABLPR: RLP80, RLP83, RLP86 & RLP90.

e. HIGHWAYS

Heavy Goods Vehicle generation, however, is a fundamental element of a waste management facility. It is, therefore, essential that from the road hierarchy designed for HGVs, any access road serving the permanent waste management facility is capable of carrying the proposed additional traffic without an undue adverse impact on the locality.

Bradwell Quarry has the potential to generate 225 daily HGV movements (112 in +112 out) at peak sand and gravel production. The proposed waste management facility would at full capacity produce an additional 404 daily HGV movements (202 in + 202 out) which would almost treble the daily movements using the existing access route and crossover points for Church Road, Ash Lane and Public Footpaths 19, 35, 56, 57 and 58.

Coggeshall Road the A120 trunk is responsibility of Highways Agency but Church Road and Ash Lane crossed over by the access road are the responsibility of the Highway Authority. Sole access to the site would be from the A 120 but concerns have been expressed regarding traffic volume and HGVs overhanging central reservation when turning in and out of site similar to the situation on the Coggeshall by-pass.

Additional HGV traffic generation using the existing A 120 Trunk road, whilst of local concern, has not been subject to a ‘Direction’ by the Highways Agency and with a new A 120 route were such traffic to remain would then only become a relatively minor flow compared to current usage. At the same time the applicant, has indicated an unequivocal willingness to secure a direct access to the new A

120 subject to negotiations with the Highways Agency. This, however, cannot be regarded a material consideration in the determination of this application, which must be considered on the current road system and capacity.

The design of the cross-over into the site entrance, however, meets current standards and is acceptable to the Highways Agency and the applicant has undertaken to modify the Church Road/Ash Lane crossovers. The proposal is, therefore, consistent with DRSS: T6, WM1; WLP: W4C, W10A, W10E, W10G and ABLPR: RLP 54.

f. SUSTAINABILITY AND POLLUTION

This proposal would contribute towards sustainable waste management because it would employ separation and treatment techniques on a large municipal scale to complement the domestic waste management that householders are being encouraged to undertake through waste separation for kerbside collections, home composting and delivery to household waste and recycling centres. The proposal is, therefore, considered to be consistent with DRSS: SS1, WLP: W10E and ABLPR: RLP 62 & 75.

Waste within the proposed waste management facility would be stored and processed on impermeable base and odours and other gaseous emissions would all be subject to filtering/scrubbing equipment to meet the requirements of an integrated pollution prevention control regime.

Waste management facilities within buildings operated under negative air pressure and in line with current pollution control techniques and standards should eliminate the risk of bio-aerosol emissions normally associated with open windrow composting and should, consequently, pose little risk to human health. Detailed consideration of a waste management process and the implications for human health, if any, is the responsibility of the pollution control regulators. Where health concerns are raised waste planning authorities should through drawing on Government advice and research, and consultation with the relevant health authorities and agencies to obtain considered advice of epidemiological and other health studies and the location implications of such advice.

The considered view of the Environment Agency and the Primary Care Trust is that the proposed processes would not cause harm to human health.

The proposal is of such a nature that due to all processes being within an enclosed and controlled environment the risk of any sustained adverse emissions is highly unlikely and, therefore, the development would satisfy the following policies: DRSS: SS1, WM5, ENG1 and WM1; WLP: W7A, W10A, W10B and W10E and ABLPR: RLP 35, RLP62, RLP63, RLP70, RLP75 & RLP77.

Measures to preserve and re-use the Listed Building at Woodhouse Farm are to be supported and are consistent with the objectives of DRSS: SS1 & ENV6; WLP: W10A & W10E and ABLPR: RLP100 & RLP163.

The use of bio-gas to power the on site generators which would provide electricity for the RCF and supply surplus power to the National Grid contributing towards

the objectives of DRSS: SS1 & ENG2 and ABLPR: RLP 77.

8. CONCLUSION

Through modelling and risk management despite the less ambitious but probably more realistic, Waste Disposal Authority's MSW recycling/composting targets ranging from a 32% (2005/6) baseline up to 45% there will, however, still be residual wastes combined with collected recyclables that need managing. The 'Enviros' 2005 LATS study undertaken by the Waste Disposal Authority demonstrated that even with best practice kerbside recycling performance it would not be possible to achieve compliance with the Landfill Directive beyond 2010 without residual waste treatment. Consequently there is a pressing need to introduce waste management plants such as this into the county before the LATS penalties are imposed. Equally the consequence of the Landfill Tax escalator driving up landfill costs for C&I waste will be to increase demand for the type of treatment facilities being proposed. The provision of waste management facilities is, therefore, critical to meeting this commitment and addressing the need to manage commercial and industrial wastes in a responsible manner.

Currently, however, there are still numerous unknowns until District Councils' commit to guaranteed recycling rates and the Integrated Waste Management Contracts can be let. The successful waste management contractor would, nonetheless, be required to commit contractually to managing all residuals regardless of the composition of the final arisings.

The facility, therefore, needs to be sufficiently versatile to respond to a variable mix of waste types depending on the nature and complexity of the contracts awarded by the Essex and Southend WDA's and WCA's and sufficiently flexible to address the success or otherwise of the waste recycling/composting collection schemes. Mechanisms to control the timing and function of the facility, however, need to be in place by way of legal agreement together with mitigation measures as set out in the Environmental Statement or required by condition.

Overall though there is a compelling argument for enabling such a facility to be developed within the northern part of the county which is driven by the DJMWMS, European Legislation and Government's aspirations to fundamentally change the way waste has traditionally been managed. These factors are supported by the emerging DRSS and since it is considered that the harms associated with the proposal can be satisfactorily mitigated, there is sufficient justification to warrant departing from the Adopted Essex and Southend Waste Local Plan 2001 (WLP) and the Adopted Braintree Local Plan Review 2005 (ABLPR).

9. RECOMMENDED

That subject to:-

- the Secretary of State not calling in the application for her own determination and

- the completion within 12 months of legal agreements relating to planning obligations/contributions for the provision and implementation of:

a. Ensuring that no excavation works take place on the site under this permission until the applicant has demonstrated their intention, to the satisfaction of the Waste Planning Authority, to substantially commence the construction of the Recycling Composting Facility.

b. Setting up of an index linked fund of £(to be confirmed) to provide for the implementation of traffic management measures for the existing A 120 when no longer a Trunk Road.

c. Provision and implementation of:

- improvements to crossover points for Church Road and Ash Lane as indicated on Drawings IT569/SK/06 and IT569/SK/06 (or as amended);

  a Provision and implementation of:

  - a traffic routeing management system should HGV drivers be found to be using non County/Urban distributor roads between the A12 and A120 Trunk Roads;

  - monitoring and mitigation programme at 1 and 5 years from first beneficial occupation of the RCF, traffic capacity of the Church Road-Ash lane access road link to determine whether there is evidence of conflict with vehicles using the public highway at the crossover points and if found then install additional passing places or widen the access road to facilitate two way traffic.

  including funding for the;

  - installation of permanent information signs to direct HGV drivers to suitable County/Urban distributor roads to access the RCF via the A 120.

  b Setting up and meeting the reasonable expenses and administration of a Liaison Committee to hold regular meetings.

  c Reinstatement and refurbishment of the Woodhouse Farm complex a funded and managed heritage facility.

  d Educational areas of the Woodhouse Farm complex being available outside of normal working hours to local parish councils or other identified local community groups to be agreed with the Liaison Committee.

  e Provision of fully funded management plan to secure the regular maintenance/replacement as required of all proposed planting for the site for a period of not less than 20 years from the first beneficial occupation of the RCF.

Planning permission be granted subject to conditions relating to the following matters:

Commencement

1. The development of the Recycling & Composting Facility (RCF) hereby permitted shall be begun before the expiration of 6 years from the date of this permission and not less than 30 days prior notification of commencement shall be given to the Waste Planning Authority.

Approved Plans and Details

2. The development hereby permitted shall only be carried out in accordance with the details submitted by way of the application dated 3 August 2006, and letters dated 6 September 2006, 20 September 2006, 10 November 2006 and 30 November 2006, together with drawing numbers:

Figure 1-1	Site Location Plan, Application & Landownership
Figure 1-2	Proposed Planning Application Area
Figure 1-4	Proposed Access Road Details
Figure 1-5	Typical Arrangement and Architectural Detail
Figure 1-6	Preliminary Arrangement
Figure 1-7	Proposed Excavation Profiles
Figure 1-8	Potential Layout of Woodhouse Farm
Figure 1-9	RCF Preliminary Layout and General Arrangement

Drawings Presented within Environmental Statement:

Chapter 2 – Approach to Environmental Statement

Figure EA/1 Proposed Planning Application Site Boundary

Chapter 3 – Construction and Operations

Figure 3-3	Proposed Site Layout
Figure 3-13	Schematic Arrangement of Woodhouse Farm
Figure 3-14	Upper Lagoon Drainage Details
Figure 3-16	RCF Preliminary Layout and Typical Section

Chapter 7 – Ecology and Nature Conservation

Figure 7-1	Drawing EA/1-2 Ecology A, Annex EcI, Baseline Ecology Report
Figure 7-2	Drawing EA/2-1 Ecology B, Annex EcI, Baseline Ecology Report
Figure 7-3	Drawing EA/1-2 Ecology C, Annex EcI, Baseline Ecology Report

Chapter 8 – Landscape and Visual Effects

Figure 8-4 Footpaths and Visual Receptors 1:10,000
Figure 8-5 Tree Preservation Order 1:5,000
Figure 8-6 Mitigation Measures 1:5,000

Chapter 9 – Cultural Heritage

Drawing 2 Archaeological Sites & Finds within Study Area

Chapter 10 – Travel and Transport

IT569/SK/01 Observed 2004 12 Hour and 24 Hour Traffic Flows and Observed RCF Operational Distribution
IT569/SK/02 RCF Operational, Staff & Construction Traffic Flows 2010 & 2032
IT569/SK/03 'Observed Traffic Flows'
IT528/TA/04 Assumed RCF Operational Traffic Distribution and 2010 Base Traffic Flows
IT528/TA/05 2010 RCF Operational Traffic Distribution and 2032 Base Traffic Flows
IT528/TA/06 2032 RCF Operational Traffic Flows

Chapter 12 – Noise and Vibration

Figure 1 Monitoring Positions and Sensitive Receptors
Figure 2 Daytime External Predicted Noise Level Compared with Criteria in BS 8233 and WHO Guidelines
Figure 3 Night-time External Predicted Noise Level Compared with Criteria in BS 8233 and WHO Guidelines

Chapter 14 – Nuisances

Figure NIA1 Environmental Setting and Receptors Surrounding Site

except as varied by the following conditions:

Access

3. No development shall take place until full details of the extended access road have been submitted to and approved in writing by the Waste Planning Authority. The works shall then only be implemented in accordance with the approved details.

4. No construction works for the RCF shall take place until the access road extension and widening and all footpath crossover points have been provided.

5. All vehicles shall only enter and leave the site using the Coggeshall Road (A120) junction.

6. No vehicles shall park within passing bays on the access road between Church Road and Ash Lane.

Archaeology

7. No development shall take place until a programme for coordinating investigation by means of an archaeological 'Monitoring and Recording' brief has been submitted to and approved in writing by the Waste Planning Authority. The programme shall be implemented in conjunction with site clearance, phased soil stripping initial stages of construction.

Design and Layout

8. No development shall take place until design details, of materials colours and finishes of the external cladding of the RCF and associated plant have been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details.

9. No development shall take place until details of the RCF process layout and configuration have been submitted to and approved in writing by the Waste Planning Authority. At no time shall any equipment be installed that would enable the incineration of waste or other related materials.

10. No beneficial occupation the RCF shall take place until the areas indicated on Figures 1-4 and 1-5 have been clearly marked for the parking of cars, HGVs and any other vehicles that may use the RCF. These areas shall be retained and maintained permanently for manoeuvring and parking.

Drainage

11. No development shall take place until a detailed scheme for foul water and trade effluent management system, including details of the design and operation has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the operation of the RCF.

12. No development shall take place until a detailed scheme of the surface water drainage and the ground water management system, including details of the design and operation of the Upper lagoon to segregate 'grey' roof water from road surface run off and use of New Field as a balancing area for surface water, has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the operation of the RCF.

13. No excavation shall take place until a scheme identifying locations for the installation of boreholes to monitor groundwater has been submitted to and approved in writing by the Waste Planning Authority. The scheme shall be implemented in accordance with the approved details prior to the commencement of excavations.

Waste Management

14. No waste shall be brought onto the site other than that arising from within the administrative area of Essex and Southend-on-Sea. Records indicating origin

of all waste consignments and tonnages shall be kept available for inspection by the Waste Planning Authority for at least 18 months.

15. No wastes other than dry non-hazardous Municipal Solid and Commercial & Industrial wastes shall be brought onto the site for processing or treatment in the RCF plant.

16. No more than 510,000 tonnes of waste, per annum, shall be brought onto the site. Records indicating origin of all waste consignments and tonnages shall be kept available for inspection by the Waste Planning Authority for at least 18 months.

17. No waste brought onto the site shall be discharged, deposited, handled, stored, composted or otherwise processed outside the Recycling and Composting Facility (RCF) buildings.

18. No waste materials other than those arriving in enclosed containers, and enclosed or sheeted vehicles shall be accepted for processing.

19. No vehicles shall leave the RCF site without first having been cleansed of all loose residual mineral or waste materials from the vehicle's body and chassis.

Hours of Working

20. No removal of soils or excavation of overburden, boulder clay, sand and gravel shall be carried out other than between 07:00-18:30 hours Monday to Friday, and 07:00 -13:00 hours Saturdays and not on Sundays, Bank and Public Holidays except for occasional maintenance of machinery, unless otherwise approved in writing by the Waste Planning Authority.

21. The construction works (including deliveries of building materials) for the RCF, hereby permitted shall only be carried out between 07:00-19:00 hours Monday to Sunday and not on Bank and Public Holidays except for occasional maintenance of machinery, unless otherwise approved in writing by the Waste Planning Authority.

22. No waste or processed materials shall be delivered to or removed from any part of the RCF plant other than between 07:00 and 18:30 hours Monday to Friday and 07:00 and 13:00 hours on Saturdays, and not on Sundays, Public or Bank Holidays except for clearances from Household Waste Recycling Centres on Sundays and Bank and Public Holidays as required and then only between 10:00 and 16:00 hours.

Footpaths

23. No development shall take place until the layout of the cross over points as indicated on Figures 1-4 (or as amended) where the haul road, both existing and proposed, crosses the public footpaths, as shown on the Definitive Map and Statement of Public Rights of Way, are agreed with the Waste Planning Authority. The approved scheme shall be implemented before the access

road is used by any Heavy Goods Vehicles associated with the construction of the RCF.

24. No development shall take place until visible, legible and durable British Standard signs have been erected on both sides of the haul/access road at the point where footpaths No. 31/35 and 56 cross, to warn pedestrians and vehicles of the intersection. The signs shall read: 'CAUTION: PEDESTRIANS CROSSING' and 'CAUTION: VEHICLES CROSSING'.

Noise

25. Except for temporary operations, as defined in Condition 29, between the hours of 07:00 and 19:00 the free field Equivalent Continuous Noise Level ($L_{Aeg\ 1\ hour}$) at noise sensitive properties adjoining the site, due to operations in the site, shall not exceed the $L_{Aeq\ 1hour}$ levels set out in the following table.

Noise Sensitive Properties:

Location	Criterion dB $L_{Aeq\ 1\ hour}$
• Herring's Farm	45
• Deeks Cottage	45
• Haywards	45
• Allshot's Farm	47
• The Lodge	49
• Sheepcotes Farm	45
• Greenpastures Bungalow	45
• Goslings Cottage	47
• Goslings Farm	47
• Goslings Barn	47
• Bumby Hall	45
• Parkgate Farm Cottages	45

Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

26. The free field Equivalent Continuous Noise Level ($L_{Aeq\ 1\ hour}$) shall not exceed 47 dB(A) $L_{Aeq\ 1hour}$ between the hours of 19:00 and 23:00, as measured or predicted at noise sensitive properties adjoining the site. Measurements shall be made no closer than 3.5m to the façade of properties or any other reflective surface and shall have regard to the effects of extraneous noise and shall be corrected for any such effects.

27. The free field Equivalent Continuous Noise Level ($L_{Aeq\ 1\ hour}$) shall not exceed 40 dB(A) $L_{Aeq\ 5min}$ between the hours of 23:00 and 07:00, as measured and/or predicted at 1 metre from the façade of the bedroom at noise sensitive properties adjoining the site.

28. Noise levels shall be monitored at three monthly intervals at up to five locations as agreed with the Mineral/Waste Planning Authority. The results of

the monitoring shall include the L_{A90} and L_{Aeq} noise levels, the prevailing weather conditions, details of the measurement equipment used and its calibration and comments on the sources of noise which control the noise climate. The survey shall be for two separate 15 minute periods during the working day and the results shall be kept by the operating company during the life of the permitted operations and a copy shall be supplied to the Mineral/Waste Planning Authority. After the first year of operation, the frequency of the monitoring may be modified by agreement with the Mineral/Waste Planning Authority.

29. For temporary operations, the free field noise level at sensitive properties shall not exceed 70dB $L_{Aeq\ 1\ hour}$, at noise sensitive properties adjoining the site, due to operations on the site. Temporary operations shall not exceed a total of eight weeks in any continuous 12 month period for work affecting any noise sensitive property. Not less than 5 days written notice shall be given to the Mineral/Waste Planning Authority in advance of the commencement of any temporary operation. Temporary operations shall include site preparation, bund formation and removal, site stripping and restoration, and other temporary activity as may be agreed, in advance of works taking place, with the Mineral/Waste Planning Authority.

Lighting

30. No external lighting shall be installed on site except in accordance with details to be submitted to and approved in writing by the Waste Planning Authority. The lighting shall not exceed 5 lux maintained average luminance. The scheme shall be implemented in accordance with the approved details and timings before the RCF becomes operational.

Operations

31. No processing other than dry screening of excavated sand and gravel shall take place within the application site.

32. Any fuel, lubricant or chemical storage above ground and refuelling facilities shall be sited on an impermeable base and surrounded and bunded to at least 110% of the tank/drums capacity with a sealed sump within the bunded area and no direct discharge to any watercourse, land or underground strata. All fill, draw and overflow pipes shall be within the bunded area.

33. No permanent RCF site perimeter fencing shall be erected other than in accordance with details that have been submitted to and approved in writing by the Waste Planning Authority. The fencing shall be erected in accordance with the approved details and maintained for the life of the operations on the site.
34. No development shall take place until details of external equipment required to control any fugitive dust from the handling/storage/processing of waste have been submitted to and approved in writing by the Waste Planning Authority. The approved scheme shall be implemented prior to the commencement of operations on site and maintained at all times whilst the RCF is operational.

35. No intake of waste shall take place until details of external equipment required to prevent fugitive odour nuisance have been submitted to and approved in writing by the Waste Planning Authority. The approved details shall be implemented and maintained whilst the RCF is operational.

36. No redundant plant or machinery, containers, skips, trailers or vehicles shall be parked other than within designated areas as indicated on Figures 1-4 and 1-5.

Ecological Mitigation

37. No on site works shall be undertaken until a scheme of appropriate working practice has been submitted to and approved in writing by the Mineral/Waste Planning Authority to secure a method to safeguard ecologically sensitive areas or disturbance at sensitive times as identified in the Environmental Statement with regard to, but not restricted to, the following:

- Habitats;
- Water bodies;
- Fauna;

  - Great Crested Newts;
  - Bats; and
  - Badgers.

38. The following ecological mitigation schemes shall be implemented as specified and as appropriate, individually or in combination, before, during or for one year after completion of construction works and monitored:

- Prior to the commencement of works, a detailed plan shall be submitted identifying trees, scrub or grassland that shall be removed and deadwood to remain on site. The felling of trees, scrub or grassland shall be undertaken outside the bird nesting and hare breeding season. Alternatively measures shall be taken in advance of the works to reduce the attractiveness to fauna of these areas early in spring;

- Measures to prevent run-off during construction into water bodies, in particular Pond 24 at Woodhouse Farm, shall be submitted to the Waste Planning Authority for approval prior to construction and thereafter implemented throughout the duration of the construction works;
- Prior to the commencement of works a faunal survey shall be undertaken prior to producing a planned scheme of mitigation and relocation for Great Crested Newts shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented;

- Prior to the removal of the existing aircraft hangar, associated out buildings and renovation of Woodhouse Farm, a bat survey shall be carried out. If bats are present, a planned scheme of mitigation and relocation measures shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented; and

- Prior to the commencement of works a Badger Survey shall be undertaken. If badgers are present within the Site a planned scheme of mitigation and relocation measures shall be developed and submitted to the Waste Planning Authority for written approval and thereafter implemented.

Flare Operation and Control

39. The flare stack flame shall not exceed 15 metres above original ground level and at all times be controlled so that it is contained within the flare unit and not be visible from beyond the site boundaries.

Screening and Landscaping

40. All landscaping and planting shall be undertaken during the first planting season after completion of the RCF in accordance with the approved details in Figure 8-6.

41. Any tree or shrub forming part of a planting scheme approved in connection with this development that dies, is damaged, diseased or removed within the period of the operations or 5 years after completion of the operations shall be replaced by the applicants during the next planting season with a tree or shrub of a species and size to be agreed with the Waste Planning Authority.

42. A scheme shall be submitted to the Mineral/Waste Planning Authority for written approval to retain the existing temporary earth mounding (under Planning Permission ESS/07/98/BTE) adjacent to 'Green Pastures' and extending eastwards to Maxey's Spring.

43. No development shall take place until details of tree retention and protection measures have been submitted to and approved in writing by the Waste Planning Authority. The details shall include indications of all existing trees, shrubs and hedgerows on the site and on the immediate adjoining land together with measures for their protection and the approved scheme shall be implemented.

Woodhouse Farm/Visitors/Education Centre

44. No redevelopment of the Woodhouse Farm complex shall take place until a scheme outlining the mechanisms and timetable for securing the appropriate Listed Building consents and detailed planning permission for conversions, access and car parking from Braintree District Council has been submitted to and approved in writing by the Waste Planning Authority. No beneficial use shall take place of the visitor and education centre until the works prescribed in the scheme have been implemented.

45. No parking within the Woodhouse Farm complex shall take place until suitable height barriers have been installed to prevent access by HGV's except for specific deliveries to the complex.

BACKGROUND PAPERS

Consultation Replies
Letters of Representation

Ref: P/DC/Peter Unthank/ESS/38/06/BTE

LOCAL MEMBER NOTIFICATION

BRAINTREE - Braintree Eastern and Witham Northern

APPENDIX 1

MINERALS AND WASTE – APPRAISAL OF ENVIRONMENTAL STATEMENT

Proposed enclosed recycling and enclosed composting facility (RCF) for the treatment of residual waste comprising both municipal and commercial & industrial wastes; associated engineering works; extension to existing access road and provision of offices; biogas generators, storage tank, vehicle parking; and visitor / education centre. Rivenhall Airfield, Coggeshall Road (A120) BRAINTREE CO5 9DF. Gent Fairhead & Co Limited. ESS/38/06/BTE.

Environmental Impact Assessment (EIA)

An Environmental Statement (ES) has been submitted with the application and examines the existing situation and the main impacts to be associated with the proposed development. The EIA looks at each of the impacts in turn to assess the potential impact on the natural and built environment and considers, where necessary, the ameliorative measures to reduce and minimise the potential impact. The impacts identified are:-

- Construction and operations
- Land use and contaminated land
- Water resources
- Ecology and nature conservation
- Landscape and visual effects
- Cultural heritage
- Travel and transport
- Air quality and colour
- Noise and vibration
- Social and community issues
- Nuisances

An assessment of potential environmental effects has been carried out of the elements that could potentially result in environmental impacts.

EIA SUMMARY AND RECOMMENDATIONS

The following provides a summary of the significant effects that could potentially arise as a result of the proposed development of the RCF at Rivenhall Airfield, to receive, recycle, process and compost up to 510,000 tonnes per annum of wastes arising from 'North Essex'.

Construction and Operations

Precautionary measures would be taken to reduce potential impacts from construction works through the effective management of noise, dust, visual impact and traffic such as damping down haul roads and excavations, minimising speed of vehicles on-site and phasing of operations.

Noisy construction operations would be screened and contained either by acoustic bunds, or carried out below existing ground level or contained within buildings.

Where practicable, materials construct the RCF would be sourced locally and temporary screening, plants would maximise the reuse of site-won minerals.

Throughout construction prefabricated cranes and plant would be sited within the footprint of the excavation to screen them from view and construction plant and equipment likely to be visible would be of dark and neutral shades and painted colours such as black, mid grey (BS18B25) and a very dark neutral olive green.

Impacts associated with construction operations are anticipated to be negligible.

Land Use/Contaminated Land

During World War II, Rivenhall was developed into a strategic base for the United States Air Force (USAF) and the Royal Air Force (RAF).

There is no known contaminated land at or within the vicinity of Rivenhall Airfield and it is considered unlikely that any of the historic or current land uses at the site would have significantly contaminated the land beneath the proposed development.

Spills of fuel, lubricants etc. beyond areas of hardstanding could give rise to negative effects in terms of pollution of land and/or groundwater. Mitigation measures, however, would be put in place to prevent spills and clean up spills should they occur. For a major incident such as a fire, should polluting liquids runoff onto unsurfaced areas impacts may result in minor contamination of shallow soils and / or ground water.

Water Resources

Dewatering would result in a reduction in the water table, 'the cone of depression', but limited to within 200 m of the site and would cause only a *minor negative impact* to groundwater hydrology.

Spillages of fuel etc. could give rise to *minor* or *intermediate negative* effects in terms of pollution to groundwater. Appropriate mitigation measures, however, would be put in place to minimise the chance of spills occurring and clean up should they occur.

Some 50 metres of underlying London Clay would significantly reduce the likelihood of a *negative impact* on groundwater quality of the Upper Chalk.

Development would cause a local *minor* increase in surface water due to impermeable concrete and tarmac surfaces.

Surface runoff stored in the new 'Upper Lagoon' together with treated process water would be main source of water for use within the waste treatment process. During prolonged rainfall water could be pumped to New Field, which would naturally overflow by a new pipe system to the Bradwell Pond. A small pumping station would be constructed so as to pump back to Upper Lagoon. The lagoon system would attenuate and minimise any flood risk caused by any increase in surface water runoff.

Discharge of excess surface water runoff would not cause a residual *negative impact* on surface water quality after implementation of mitigation measures, including the regulation and monitoring of the discharge.

Design of the buildings and 'Upper Lagoon' would ensure that sufficient storage capacity is available to contain runoff during storm events so that impacts on surrounding areas are *minimised*.

Ecology and Nature Conservation

Ecological Surveys undertaken included an extended Phase 1 habitat survey and habitat assessment along the entire length of the access road, the RCF Site, Woodhouse Farm; a hedgerow survey throughout; and protected species surveys in areas identified from the habitat assessment as being suitable for bats, Water Voles, Otters, amphibians (newts), reptiles, Badgers and breeding birds.

Direct impacts included loss of habitats; amenity grassland: some scrub/woodland and plantation woodland. An area of arable land and amenity grassland would also be lost. Indirect impacts included noise dust and light impacts to birds and other fauna at the site both during construction and operation.

Mitigation measures including creation of habitats around the lagoon, transplanting individual oak trees to the site periphery or to Woodhouse Farm and controlled management of the moat system ditches, ponds and adjacent grassland. Such measures would be a significant long term, *positive impact* for Great Crested Newts. Renovation of Woodhouse Farm would include wildlife friendly features such as bat and bird boxes.

Great Crested Newt impacts would be mitigated by special fencing as discussed in the Ecology report. For British bat species with the evidence of low use and no roosts, impacts are considered to be *low and not significant.* Therefore overall impact considered to be significant only at a localised scale.

Majority of impacts would be generally of *minor impact*. Mitigation and compensation in the form of habitat restoration and creation would be undertaken. It is anticipated that there would be *no impacts* on County Wildlife sites.

Landscape and Visual Assessment

Site does not lie in a designated or nationally protected landscape area but access road passes through a Special Landscape Area.

Construction of the RCF would be sympathetic to surrounding landscape and excavation of soils would ensure that the RCF is largely constructed below surrounding ground level, providing screening and reducing the overall visual impact of the RCF from the wider and long-distant views. New buildings would be no higher above existing and surrounding ground level than the existing hangar (12½ m maximum height) but footprint would be considerably larger than existing hangar and would project north of existing woodland but affecting relatively few sensitive visual receptors. Four isolated properties and users of footpaths north of the site assessed as experiencing *slight adverse* impacts during construction and early operating years of the RCF. Views from Silver End would be over 1 km distant, relatively well screened and impact on properties on the eastern periphery of the

village assessed as *slight adverse*.

The use of 'sedum' roofs would, however, disguise the mass of the RCF buildings, providing immediate visual mitigation.

Proposed landscape mitigation measures would take time to screen the proposed building, but within 15 years, the facility should be completely screened from nearby visual receptors augmenting the landscape resource of the area.

Most significant impact would be loss of mature woodland from centre of the site, though most of woodland along southeast and southwest boundaries would be retained as a visual screen. Losses would be adequately compensated for with proposed woodland planting to the southwest boundary and triangle of land to the northeast of the site.

Cultural Heritage

Proposed RCF is located within area of high archaeological potential, although no direct evidence found within site itself. The archaeological assessment considers that the overall impact of the scheme upon the potential archaeological resource if considered to be *severe*. However this risk would be mitigated by a 'watching brief' managed through a programme of fieldwork and archaeological evaluation, undertaken prior to and during construction works.

Access road currently used by traffic associated with sand and gravel extraction and processing operations to the north and therefore the proposed RCF development would have *no impact* upon potential archaeological to the north of main WWII runway.

Construction of coach and car parking at Woodhouse Farm may impact upon buried remains of a medieval homestead or an infilled moat arm and the potential impact upon the archaeological resource is considered to be *major.* This risk would be mitigated by 'watching brief' of fieldwork and archaeological evaluation, undertaken prior to and during construction works.

The RCF encompasses the WWII administration site associated with the former military airfield. None of these structures remain within the wooded area at the southern end of the site. Two ancillary structures are located within the central part of the RCF site but are not considered to be of significant historic importance.

Hangar No. 2 is neither listed nor scheduled. English Heritage recently published a list of newly listed World War II airfields and Rivenhall was not identified as one where there is a case for preservation.

Woodhouse Farmhouse and 'Bakehouse', Grade II listed structures and both derelict are to be renovated as part of the proposed development. This would have a *positive* impact upon the heritage resource.

The RCF development considered to have a *negligible* visual impact upon buildings and surrounding moat at Woodhouse Farm and would be screened from the moat by comparatively dense woodland with no coherent view towards the moated enclosure. The development is considered to have *no physical or visual impact* upon the buildings within

Woodhouse Farm.

Travel and Transport

Potential transport assessments undertaken have found there are unlikely to be adverse highway and transportation impacts.

Study concluded that, for traffic flows during the construction and operation of the RCF, the A120 is likely to experience a worst case increase in two way traffic flow in the a.m. and p.m. peak hours of 1.4% which is significantly lower than the Institution of Highways and Transportation (IHT) 5% threshold and represent *no impact* to the operation of the local highway network.

Existing junctions with Church Road and Ash Lane require modification with the introduction of a number of safety measures and with some additional measures are proposed such as cutting back vegetation and traffic management within site. With such measures the development, is therefore, unlikely to jeopardise the highway safety.

Access to the RCF would only be permitted via the existing A120. Barriers could be installed at strategic locations around the perimeter of the airfield only permitting authorised or emergency vehicles to enter the site from the surrounding road network.

During refurbishment, improvement and redevelopment to Woodhouse Farm, the existing rights of way would remain open and available for as long as possible. If necessary footpath 8 would be temporarily diverted around the eastern edged of Woodhouse Farm and the existing moat.

The access road crosses footpaths No. 56 and 31/35. The existing access road from the A120 into Bradwell Pit is already well established and provides suitable crossing points for the public footpath and bridleway network. Improvements would be made to these crossing points by installing further signage and road markings. The development of the RCF on the surrounding public footpath and bridleway network is therefore considered to be *low*.

Air Quality and Odour

An assessment of the impact of the proposed development on air quality has been carried out and considered receptors in the vicinity of the proposed development, including all identified residential properties within 1 km, footpaths and County Wildlife Sites.

Predicted Environmental Concentrations (PECs) of CO and NO_2 from combustion of biogas and the odours from the Biofilter have been assessed. Short term and long term PECs of CO and NO_2 from the combustion of biogas within the biogas engines and flares would not exceed the relevant environmental standards, with the exception of the short term PEC of NO_2 from the biogas engines. Short term PEC of odour from the Biofilter would not exceed the relevant odour threshold, with exception of potential for exceedances at four footpath locations and at the Wayfarers site.

Increasing the biogas engine stack height to 15 m, above surrounding ground level as well as incorporating modifications such as decreasing the exhaust diameters or increasing the exhaust velocities would prevent the predicted exceedances.

Increasing the biofilter release height from 0 m up to 7 m, as well as modifying the biofilter media and increasing the residence time in order would prevent the predicted exceedances.

With specific measures in place to meet the requirement of Best Available Techniques (BAT), the significance of potential residual effects would be predicted to be *neutral to minor* for those receptors located within o.5 km and neutral to minor for those receptors within 1 km.

A good neighbour/complaints policy, ensuring any complaints are investigated and responded to would secure public confidence that BAT are being adopted to minimise odour as well as other potential nuisances.

Emissions to air from the combustion of the biogas, fugitive emissions and odours, odour emissions from the Biofilter and road traffic emissions have been considered based on a peak waste throughput and for both normal operational and non-typical operational scenarios.

All operations would take place within buildings and maintained under negative air pressure and air movement regimes to ensure that fugitive emissions are minimised; collected air would be treated and released through a Biofilter. Impacts of fugitive emissions and odours were predicted to be *minor and adverse to neutral* for those receptors within 1 km.

With specific mitigation measures in place, potential residual effects predicted to have a *minor and adverse* impact (for receptors within 0.5 km) and *minor and adverse to neutral* impact for receptors within 1 km. Monitoring of emissions would probably be required by the Environment Agency.

Impacts on County Wildlife Sites at Maxeys Spring, Storeys Wood and Blackwater Plantation located within a 3.0 km radius and Silver End residential area and Coggeshall residential area have been assessed for protection of vegetation and ecosystems. *None,* however, are predicted to be *adversely affected*.

Impact of increased traffic on air quality also considered. The increase in Annual Average Daily Traffic (AADT) flows would be less than 10%, and *not* considered *significant* in terms of change in air quality.

Combustion of the biogas in the electricity-generating engines with up to 99% destruction efficiency would reduce the global impact of the biogas. Overall carbon balance of the RCF would be undertaken on the detailed design of the facility.

Noise and Vibration

Worst case noise predictions were made to twelve potentially noise sensitive receptors around the site and found that longer term noise levels would be significantly lower than those predicted.

During the construction worst case predicted noise levels would not exceed noise criterion of 60 $dBL_{Aeq,1h}$ at any of the sensitive receptors. Operational noise levels indicate *minor and adverse to neutral* impact at the closest noise sensitive properties.

During night-time operations predicted noise levels at all locations are below the design

criterion, rated as 'good' in BS 8233 when an attenuation of 10 dB is assumed for partially open windows. Predicted daytime noise levels at all but one location are below design criterion rated as 'good'. As the smallest detectable increase in noise level is 3 dB(A), the 1 dB(A) exceedance of the 'good' criterion at one location is considered to be insignificant. Impact is predicted to be of neutral significance.

It is considered that the surrounding villages of Bradwell, Silver End, Cressing, Rivenhall and Coggeshall would be unaffected by the operation of the RCF.

Associated HGV movements along A120 would result in a maximum increase to L_{A10} noise level of 0.5 dB. This would be imperceptible and therefore of *neutral significance*.

The operation of the facility would follow IPPC guidance with regard to noise and would utilise appropriate noise control measures to ensure that the noise from the installation does not give rise to cause for annoyance.

The RCF would noise control measures to ensure noise from installation does not give rise to annoyance. Vibration would represent *no impact*.

Social and Community Issues

A Social Impact Assessment undertaken of how activities could affect social and economic condition of adjacent local communities.

The RCF would contribute to regional targets and strategies for economic development and waste management by fulfilling an important role in the East of England region's overall Waste Management Strategy, particularly in the long term and possibly in the wider context. The refurbished Woodhouse Farm as an Education and training centre, and mini-museum would have a positive impact on the regional rural policy and action plan.

The RCF would have some positive impacts on local socio-economic development, district rural and/or local community plans and contribute positively to some elements of these local development strategies. It would employ up to 50 members of staff to operate the process with potential employment for supporting equipment and service suppliers.

The applicant is committed to supporting regional learning and local development through a pro-active community engagement programme, to ensure *positive impact* on the local socio-economic environment.

Nuisances

Assessment of potential nuisances was prepared in accordance with source-pathway-receptor methodology. Potential sources of dust and particulate matter, bioaerosols, litter, insects, vermin and birds and light pollution from the site were assessed.

For each aspect potential sources at the site were identified. Operational practices and principles to prevent, minimise and control these sources have been assessed. Potentially sensitive receptors, together with potential pathways, were identified. Prevailing wind direction is towards the north-east and the closest receptor is Woodhouse Farm. The location of proposed Education Centre considered, however, to have *low sensitivity* to nuisances from the RCF. Receptors to the north-east are Deeks Cottage and Haywards, at

a distance of over 800 m from the proposed RCF.

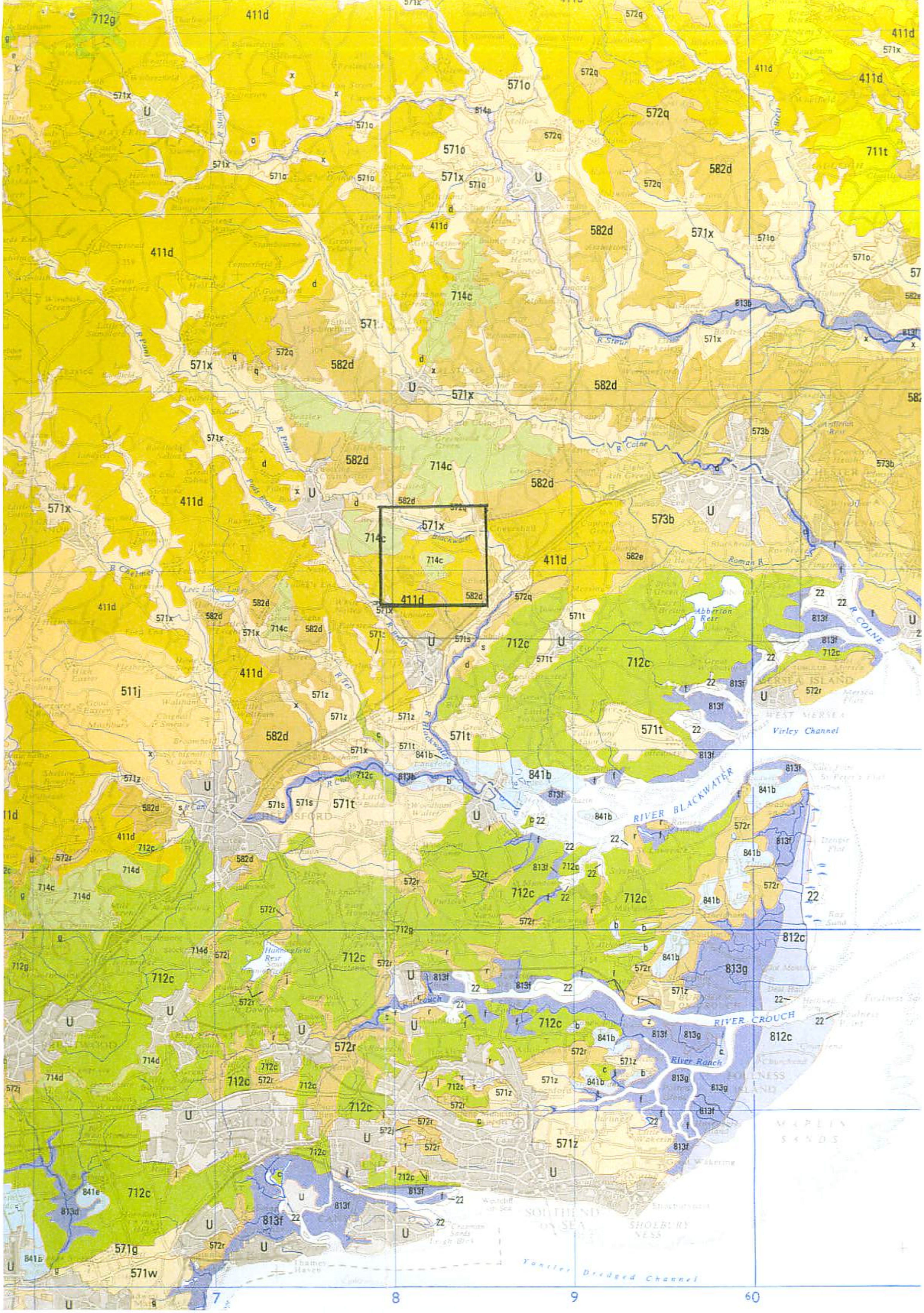
Assessment of each potential source concluded that operational measures to be employed are extensive enough to minimise and control the sources. Waste would be delivered in enclosed vehicles or containers and all waste and composting operations would take place indoors under negative air pressure and within controlled air movement regimes, minimising nuisances such as odours, dust and litter which could otherwise attract insects, vermin and birds. Regular monitoring for litter, dust, vermin or other nuisances would be carried out. Risk assessment concluded that at identified nearby properties there would be a *minor and adverse to neutral* impact as a result of nuisances from the site.

Summary

The development of the RCF is unlikely to have a significant environmental impact. Through detailed design and the implementation of targeted control and mitigation measures, the overall impact of the RCF is considered to be *low to negligible* on the surrounding environment.

APPENDIX 5-2

NATIONAL SOILS MAP



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WEST MERSEA
Virley Channel
RIVER BLACKWATER
RIVER CROUCH
River Roach
SOUTHEND ON SEA
SHOEBURY NESS
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Yantlet Dredged Channel
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Map symbol and subgroup	Soil Association †	Ancillary subgroups and soil series	Geology	Soil and site characteristics	Cropping and Land Use #	Area km² (%) ¶
22	UNRIPENED GLEY SOILS		Marine alluvium	Soils of variable texture flooded by high tides. Many are soft and unripened, others, often on higher sites or of sandy texture, are firm and ripened. Frequently calcareous	Saltmarsh habitats, some summer grazing, recreation	319 (·21)
311 a	REVIDGE	1013 Crowdy 1011 Winter Hill	Palaeozoic gritstone and sandstone	Very shallow very acid peaty upland soils over rock. Some thick peat. Steep craggy ground with extensive bare rock and scree.	Stock rearing on wet moorland habitats of poor grazing value in the uplands, recreation	103 (·06)
311 b	SKIDDAW	651 Hiraethog 1011 Winter Hill	Palaeozoic slaty mudstone and siltstone	Very shallow very acid peaty upland soils over rock often on steep slopes. Some deeper peaty-topped soils with ironpan. Thick peat on gentler slopes. Bare rock locally.	Stock rearing on wet moorland habitats of moderate grazing value in the uplands and mountains, recreation	138 (·09)
311 c	WETTON 1	341 Marian 313 Crwbin 541 Malham	Carboniferous limestone	Very shallow loamy upland soils over limestone, mostly humose and sometimes calcareous. Some deeper silty soils. Frequent steep slopes. Extensive bare rock, crag and scree.	Stock rearing on herb-rich grassland habitats of good grazing value, recreation	136 (·09)
311 d	WETTON 2	541 Malham	Carboniferous limestone	Very shallow humose loamy upland soils over limestone. Some well drained deeper silty soils. Extensive limestone pavements and crags.	Stock rearing on moorland and herb-rich grassland habitats of good grazing value, recreation	162 (·10)
311 e	BANGOR	1013 Crowdy 1011 Winter Hill	Acid igneous rock	Very shallow very acid peaty-topped upland soils. Often on steep slopes. Thick peat in hollows and on gentler slopes. Much rock and scree locally.	Stock rearing on moorland habitats of poor grazing value in uplands and mountains, recreation.	533 (·35)
313 a	DUNWELL	611 Davidstow 311 Presely	Basic and intermediate igneous rock	Shallow loamy upland soils on steep slopes, some with peaty topsoils. Some well drained deeper soils. Scree and bare rock locally.	Stock rearing on moderate value rough grazing in uplands, coniferous woodland.	48 (·03)
313 b	POWYS	541 Denbigh	Palaeozoic slaty mudstone and siltstone	Shallow well drained loamy soils over rock. Many steep slopes with some gently sloping interfluves. Bare rock locally.	Permanent and short term grassland; stock rearing in uplands, dairying in moist lowlands, some cereals in Devon and Cornwall.	253 (·16)
313 c	CRWBIN	541 Malham and Wattham	Carboniferous limestone	Very shallow and shallow well drained loamy soils over limestone, often on steep slopes. Limestone pavement, and other rock exposures common.	Stock rearing on herb-rich grassland habitats of good grazing value, recreation, some arable in lowlands.	406 (·26)
341	ICKNIELD	343 Andover 514 Millington 511 Coombe 342 Upton	Chalk	Shallow, mostly humose, well drained calcareous soils over chalk on steep slopes and hill tops. Deeper flinty calcareous silty soils in small coombes and valleys.	Permanent grassland, downland habitats and deciduous woodland on steep scarps; recreation, cereals and short term grassland on plateaux; military use	390 (·25)
342 a	UPTON 1	343 Andover 341 Ickneld 511 Panholes and Coombe	Chalk	Shallow well drained calcareous silty soils over chalk. Mainly on moderately steep, sometimes very steep land. Deeper fine silty calcareous soils in coombes and dry valleys.	Permanent grassland, rough grazing and woodland on scarps; cereals and short term grassland on gentle slopes; recreation	764 (·50)
342 b	UPTON 2	342 Wantage 511 Blewbury	Chalk	Shallow well drained calcareous silty soils over argillaceous chalk. Some deeper well drained calcareous clayey soils	Winter cereals, cereal and grassland rotations, some dairying	67 (·04)
342 c	WANTAGE 1	344 Gore 342 Upton	Chalk	Well drained calcareous silty soils, in places shallow over argillaceous chalk	Winter cereals; cereal and grassland rotations with dairying	94 (·06)
342 d	WANTAGE 2	345 Burwell 511 Swatham Prior	Chalk	Shallow well drained calcareous silty soils over argillaceous chalk associated with similar soils affected by groundwater. Deeper well drained coarse loamy soils in places. Complex soil patterns locally.	Cereals, especially barley, with sugar beet and other arable crops	138 (·09)
343 a	ELMTON 1	511 Aburford and Moreton 571 Shippon	Jurassic limestone	Shallow well drained brashy calcareous fine loamy soils over limestone. Some similar deeper soils and some non-calcareous and calcareous clayey soils.	Cereals, sugar beet and potatoes; winter cereals and dairying in the South West	1351 (·89)
343 b	ELMTON 2	541 Waltham 571 Tetbury	Jurassic limestone and sandy limestone	Shallow, well drained brashy calcareous fine loamy soils over limestone. Some deeper fine loamy or fine loamy over clayey soils	Cereals, and short term grassland with stock rearing and dairying	319 (·21)
343 c	Elmton 3	411 Evesham and Haselor 712 Denchworth 511 Moreton	Jurassic limestone and clay	Shallow well drained brashy calcareous fine loamy soils over limestone. Some deeper slowly permeable seasonally waterlogged, mainly calcareous, clayey soils.	Cereals, sugar beet and potatoes; winter cereals, stock rearing and dairying in the South West.	214 (·14)
343 d	SHERBORNE	511 Moreton 411 Evesham and Haselor	Jurassic limestone and clay	Shallow well drained brashy calcareous clayey soils over limestone, associated with slowly permeable calcareous clayey soils.	Cereals, short term and permanent grassland with dairying and stock rearing	1122 (·74)

e	MARCHAM	511 Cranwell and Aberford 343 Elmton	Jurassic limestone	Shallow well drained calcareous coarse and fine loamy soils over limestone associated with similar deeper soils.	Cereals, sugar beet and potatoes	75 (·04)
f	NEWMARKET 1	343 Elveden 521 Methwold	Chalk and chalky drift	Shallow well drained calcareous sandy and coarse loamy soils over chalk or chalk rubble. Some similar deeper sandy soils, often in an intricate striped pattern. Risk of wind erosion.	Barley, sugar beet and some carrots; coniferous woodland; some lowland heath habitats; recreation	251 (·16)
343 g	Newmarket 2	511 Swaffham Prior and Soham 571 Moulton 561 Newport 343 Rudham	Chalk and chalky drift	Shallow well drained calcareous coarse loamy and sandy soils over chalk rubble associated with well drained deeper coarse loamy and sandy soils often in an intricate pattern. Slight risk of water erosion.	Cereals, peas, beans and sugar beet; some short term grassland	443 (·29)
h	ANDOVER 1	511 Panholes and Coombe 342 Upton 671 Charity	Chalk	Shallow well drained calcareous silty soils over chalk, on slopes and crests. Deep calcareous and non-calcareous fine silty soils in valley bottoms. Striped soil patterns locally.	Winter cereals and short term grassland with dairying and stock rearing; cereals, sugar beet and potatoes in Lincolnshire and Yorkshire; some woodland	2845 (1·87)
i	ANDOVER 2	571 Garston 581 Carstens 571 Charity	Chalk and Clay-with-flints	Shallow well drained calcareous silty soils over chalk. Associated with deeper non-calcareous variably flinty well drained fine silty and fine silty over clayey soils.	Winter cereals; cereal and grassland rotations with dairying and stock rearing; woodland	413 (·27)
346	Reach	872 Blackdyke 346 Burwell	Chalk and chalky drift	Shallow humose fine loamy calcareous soils over chalk or chalk rubble with groundwater controlled by ditches and pumps.	Cereals and sugar beet	47 (·03)
361	Sandwich	11 Baw sand 321 Beckfoot 821 Formby	Dune sand and marine shingle	Mainly deep well drained calcareous and non-calcareous sandy soils. Some sparsely vegetated unstable soils. Waterlogged soils in hollows locally. Shingle bars and spits locally extensive. Risk of wind erosion.	Sand dune and some wetland habitats; recreation; very limited agriculture and coniferous woodland; some gravel extraction in the South East Region	343 (·22)
372	Willingham	372 Padney and Coltbror 373 Brimpton 1024 Adventurers	Lake marl, tufa and peat	Extremely calcareous silty and clayey soils, in places humose, and often over peat. Some patches of deep peat. Flat land. Groundwater usually controlled by ditches and pumps. Risk of wind erosion.	Cereals, potatoes, sugar beet and other arable crops; vegetables locally	43 (·02)
a	Evesham 1	411 Haselor 343 Sherborne 511 Moreton	Jurassic clay and limestone	Slowly permeable calcareous clayey soils associated with shallow well drained brashy calcareous soils over limestone. Landslips and associated irregular terrain locally.	Permanent and short term grassland with much winter cereals; stock rearing and dairying in moist lowlands	923 (·60)
b	EVESHAM 2	712 Denchworth 711 Wickham	Jurassic and Cretaceous clay	Slowly permeable calcareous clayey soils. Some slowly permeable seasonally waterlogged non-calcareous clayey and fine loamy or fine silty over clayey soils. Landslips and associated irregular terrain locally.	Winter cereals and short term grassland with stock rearing in drier lowlands; much dairying on permanent grassland in moist lowlands.	1119 (·73)
411 c	EVESHAM 3	513 St Lawrence 712 Denchworth	Jurassic and Cretaceous clay	Slowly permeable calcareous clayey, and fine loamy over clayey soils. Some slowly permeable seasonally waterlogged non-calcareous clayey soils.	Winter cereals in dry lowlands; grassland with some cereals in moist lowlands	809 (·53)
d	HANSLOPE	431 Faulkbourne	Chalky till	Slowly permeable calcareous clayey soils. Some slowly permeable non-calcareous clayey soils. Slight risk of water erosion.	Winter cereals with some other arable crops; some grassland	3634 (2·40)
a	STOW	541 Atrim 542 Heapey 712 Dale	Jurassic mudstone and siltstone	Slowly permeable clayey soils, mainly on steep slopes. Some fine silty and fine loamy soils over siltstone, the latter with slowly permeable subsoils and slight seasonal waterlogging. Slowly permeable seasonally waterlogged clayey soils on less sloping ground.	Permanent and short term grassland with dairying and stock rearing; some cereals; coniferous woodland	107 (·07)
421 b	HALSTOW	712 Hallsworth and Tedburn 541 Denbigh	Carboniferous shale	Slowly permeable clayey soils often over shale. Some well drained fine loamy soils.	Permanent and short term grassland with dairying and stock rearing; some winter cereals	278 (·18)
431	WORCESTER	572 Whimple 411 Clayworth	Permo-Triassic reddish mudstone	Slowly permeable non-calcareous and calcareous reddish clayey soils over mudstone, shallow on steeper slopes. Associated with similar non-calcareous fine loamy over clayey soils. Slight risk of water erosion.	Permanent and short term grassland with dairying and stock rearing; some winter cereals in drier districts	925 (·61)
a	ABERFORD	343 Elmton 514 Dullingham	Permian, Jurassic and Eocene limestone	Shallow, locally brashy, well drained calcareous fine loamy soils over limestone. Some deeper calcareous soils in colluvium.	Cereals with some sugar beet and potatoes; limited permanent grassland	1018 (·67)
b	Moreton	411 Evesham and Haselor 343 Sherborne and Elmton 511 Aberford	Jurassic clay and limestone	Well drained calcareous clayey and fine loamy soils over limestone, in places shallow and brashy. Some deeper slowly permeable calcareous clayey soils.	Winter cereals; some short term grassland and potatoes	235 (·15)
511 c	PANHOLES	343 Andover 671 Charity	Chalk	Well drained calcareous fine silty soils over chalk. Associated similar shallow soils and deeper non-calcareous fine silty soils.	Cereals; some short term grassland, potatoes and field vegetables.	256 (·16)
d	Blewbury	513 Winterbourne 511 Yatesbury 342 Wantage	Chalk	Well drained calcareous clayey and fine silty over clayey soils over argillaceous chalk. Some fine silty over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.	Cereals and short term grassland with dairying and stock rearing	218 (·14)

713	d	CEGIN	713 Greyland and Brickfield 542 Samhan 541 Denbigh	Drift from Palaeozoic slaty mudstone and siltstone	Slowly permeable seasonally waterlogged fine silty and clayey soils. Some fine silty and fine loamy soils with slowly permeable subsoils and slight seasonal waterlogging on slopes. Well drained fine loamy soils over rock in places.	Stock rearing on permanent grassland, dairying on lower ground	1622 (1·07)
	e	BRICKFIELD 1	713 Cegin and Greyland 721 Wilcocks	Drift from Palaeozoic slaty mudstone and siltstone	Slowly permeable seasonally waterlogged fine loamy and fine silty soils, some with wet peaty surface horizons.	Stock rearing on permanent grassland and wet moorland of moderate and good grazing value	468 (·30)
	f	BRICKFIELD 2	542 Nercwys 541 East Keswick	Drift from Palaeozoic and Mesozoic sandstone and shale	Slowly permeable seasonally waterlogged fine loamy soils. Associated with fine loamy soils with only slight waterlogging and some deep well drained fine loamy soils.	Dairying and stock rearing on permanent or short term grassland, some cereals in drier areas	1470 (·97)
	g	BRICKFIELD 3	711 Dunkeswick 712 Haliswurth	Drift from Palaeozoic sandstone and shale	Slowly permeable seasonally waterlogged fine loamy, fine loamy over clayey and clayey soils.	Stock rearing and some dairying on permanent grassland, grassland and winter cereals in drier lowlands	3677 (2·42)
714	a	DUNKESWELL	723 Blackdown 582 Batcombe	Plateau drift	Slowly permeable seasonally waterlogged fine silty over clayey soils some with a humose surface horizon. Some deep fine silty over clayey soils with slowly permeable subsoils and slight seasonal waterlogging.	Dairying on short term and permanent grassland, cereals; some coniferous woodland and wet heath.	60 (·03)
	b	OAK 1	711 Salop	Reddish till	Slowly permeable seasonally waterlogged fine loamy over clayey soils.	Winter cereals and some short term grassland; stock rearing and dairying.	110 (·07)
	c	OAK 2	582 Hornbeam and Batcombe 712 Hagdale 714 Dunkeswell	Chalky till	Slowly permeable seasonally waterlogged fine loamy over clayey and fine silty over clayey soils. Some similar soils with slowly permeable subsoils and slight seasonal waterlogging. Some clayey soils with chalky subsoil.	Winter wheat and other arable crops	92 (·06)
	d	ESSENDON	714 Oak 711 Wickham 582 Berkhamsted and Hornbeam	Plateau and river terrace drift	Slowly permeable seasonally waterlogged coarse loamy over clayey soils. Associated with similar fine loamy over clayey and fine silty over clayey soils	Dairying, winter cereals in Hertfordshire and Essex; lowland heath and woodland habitats; coniferous woodland; recreation	165 (·10)
721	a	PRINCETOWN		Granite and other acid igneous rock	Slowly permeable very acid gritty loamy upland soils with a wet peaty or humose surface horizon.	Wet moorland habitats of moderate and poor grazing value in uplands, some improved grassland, coniferous woodland, military use and recreation	135 (·08)
	b	ONECOTE	721 Wilcocks and Ipstones	Carboniferous and Jurassic mudstone	Slowly permeable seasonally waterlogged clayey and loamy upland soils with a peaty surface horizon often over soft rock. Soils very acid where not limed.	Wet moorland habitats of poor and moderate grazing value, some dairying on improved ground; coniferous woodland	414 (·27)
	c	WILCOCKS 1	721 Kielder 871 Fordham	Drift from Palaeozoic sandstone, mudstone and shale	Slowly permeable seasonally waterlogged fine loamy and fine loamy over clayey upland soils with a peaty surface horizon. Coarse loamy soils affected by groundwater in places. Very acid where not limed.	Wet moorland habitats of moderate and poor grazing value, some improved grassland, coniferous woodland, military use	3822 (2·52)
	d	WILCOCKS 2	1013 Crowdy 1011 Winter Hill 654 Hafren	Drift from Palaeozoic sandstone, mudstone and shale	Slowly permeable seasonally waterlogged loamy upland soils with a peaty surface horizon. Some very acid peat soils.	Stock rearing on wet moorland of moderate grazing value and some permanent grassland; coniferous woodland; recreation	655 (·43)
	e	WENALLT	1013 Crowdy 651 Clay	Drift from reddish sandstone and siltstone	Slowly permeable seasonally waterlogged reddish loamy upland soils with a peaty surface horizon. Some patches of peat soils and some soils with thin ironpan. Very acid where not limed.	Wet moorland of poor grazing value; coniferous woodland; military use.	237 (·15)
811	a	ENBORNE	582 Trent 813 Fladbury	River alluvium	Deep stoneless fine loamy and clayey soils variably affected by groundwater. Flat land. Risk of flooding.	Permanent grassland with stock rearing and dairying; some arable cropping where flood risk low.	299 (·19)
	b	CONWAY	582 Clwyd 813 Fladbury	River alluvium	Deep stoneless fine silty and clayey soils variably affected by groundwater. Flat land. Risk of flooding.	Dairying and stock rearing on permanent grassland.	634 (·41)
	c	HOLLINGTON	813 Compton 562 Mathon	Reddish river alluvium	Deep stoneless reddish fine silty and clayey soils variably affected by groundwater. Flat land. Risk of flooding.	Stock rearing on permanent grassland.	97 (·06)
	d	ROCKCLIFFE	811 Tanvats 662 Snargate	Marine alluvium	Deep stoneless silty and fine sandy soils variably affected by groundwater depending on artificial drainage. Flat land.	Cereals and permanent and short term grassland in Cumbria, arable and horticultural crops in the Fens.	207 (·13)
	e	TANVATS	811 Pepperthorpe and Rockcliffe 813 Wallasea	Marine alluvium	Deep stoneless fine and coarse silty and clayey soils with groundwater levels controlled by ditches and pumps. Flat land.	Cereals, sugar beet, potatoes and field vegetables in the Fens; stock rearing and dairying on permanent grassland in Wales.	177 (·11)
812	a	FROME	372 Wylye 811 Racton 1024 Adventurers 862 Gade	Chalky and gravelly river alluvium	Shallow calcareous and non-calcareous loamy soils over flint gravel affected by groundwater. Small areas of peat. Risk of flooding.	Permanent grassland with dairying and stock rearing, some cereals and short term grassland; wetland habitats; recreation.	236 (·15)

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6.0 GROUNDWATER AND SURFACE WATER ASSESSMENT

6.1 Introduction

Gent Fairhead & Co Ltd has commissioned Golder Associates (UK) Ltd to develop an evolution of the planned Recycling and Composting Facility (the eRCF) at Rivenhall Airfield (the Site). The eRCF presents a further development of the design of the original Recycling & Composting Facility (RCF), which was resolved to be granted planning permission by Essex County Council's Planning Committee on 30 March 2007 for the Site at Rivenhall Airfield.

This Ground and Surface Water Assessment considers the impact of the proposed eRCF on the hydrogeology, surface water and flood risk of the area. The potential impacts will be assessed in consideration of mitigation provided by the proposed Site engineering.

The aim of this Groundwater and Surface Water Assessment is to identify, describe and assess the potential direct and indirect impacts to the ground and surface water in line with the guidance published by the Environment Agency (Environment Agency, 2002) relating to the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations, 1999. The flood risk considerations within this report have been assessed in accordance with the guidance provided in Planning Policy Statement 25: Development and Flood Risk, Communities and Local Government (CLG, 2006) (PPS25) and the associated Practice Guide.

This impact assessment identifies and assesses the potential risks posed to the ground and surface water by the extraction of overburden and other materials and the construction and operation of the proposed eRCF at Rivenhall Airfield.

The objectives of the groundwater and surface water assessment are to:

- Identify and describe the potential impacts of the proposed eRCF to groundwater;
- Identify and describe the potential impacts of the proposed eRCF to surface water;
- Assess the significance of these potential impacts;
- Propose mitigation measures to deal with these impacts;
- Review the residual risk of the impacts following mitigation measures;
- To assess the flood risk issues on site in accordance with the guidance given in PPS25; and
- Recommend mitigation measures to deal with any increased risk of flooding.

6.2 Site Setting

The Site is located on the south-eastern edge of a World War II airfield known as Rivenhall Airfield between the villages of Bradwell (northwest 2.6 km), Silver End (southwest 1.1 km),

Rivenhall (south 2.3 km), Coggeshall (northeast 2.8 km) and Kelvedon (southeast 3.4 km). The Site location and boundaries are illustrated on Figure 6-1.

In terms of landscape, the former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated and, therefore, under the current planning permission, half of the old airfield will become a restored 'bowl' for continued agricultural use. The airfield was open and exposed and had been used predominantly for agricultural purposes, although currently it is under extensive sand and gravel extraction and restoration.

One of the reasons that this location was originally approved by the Inspector in the Waste Plan was due to its remote location compared with many alternatives. This is demonstrated by the distances to and from the proposed Plant to the edges of the surrounding village envelopes as follows:

- Bradwell 2.2 km;
- Silver End 1.1 km;
- Cressing 2.7 km;
- Kelvedon 3.6 km;
- Rivenhall 2.6 km; and
- Coggeshall 2.9 km.

The nearest residential properties within 1 km of the Site are: The Lodge, Allshotts Farm, Bumby Hall, Sheepcotes Farm, Green Pastures Bungalow, Goslings Cottage, Goslings Barn, Goslings Farm, Deeks Cottage, Heron's Farm, Deeks Cottage, Haywards, and Park Gate Farm Cottages.

The Site has an approximate planning application area of 25.3 ha and includes the following:

- An area of approximately 6 ha for the eRCF processing plant itself, equivalent in size to the total of 6 ha designated as Site WM1 within the Waste Plan for this process;
- An area of approximately 2.6 ha allocated for the redevelopment of Woodhouse Farm;
- An area of approximately 11.9 ha to include the freshwater lagoon and the protected landscaping and embankments which will screen the plant from long-distant views;
- An area of approximately 3.8 ha allocated for the construction of the access road extension; and
- An area of approximately 1.0 ha that is already constructed access road in use for the sand and gravel extraction and processing operations.

Site WM1 is within an area of trees and scrub on the edge of the old airfield. The airfield base was operational between February 1944 and January 1946. Some of the runways and tarmac areas remain generally intact and one of two former aircraft hangers and remnants of partly derelict air station buildings remain on the Site.

Two buildings within the proposed application site are listed as being of Special Architectural Interest. Woodhouse Farm is a Grade II Listed Building, which will be redeveloped *(as part*

of a proposed Education Centre linked to the eRCF operations). The adjacent outbuilding, known as *'The Bakehouse'*, is also a Grade II Listed Building in an extremely dilapidated condition. A simple iron 'rocking' hand water pump, located on the southern side of this outbuilding, is also Grade II listed. This has not been located at the Site, and it is likely that the headworks have been removed and the borehole has become covered.

To the south of Site, the land is open arable agricultural land at present with the occupied buildings of Wayfarers Site.

6.3 Topography

The majority of the Site is relatively flat, lying at around 50 m AOD. Generally ground levels fall towards the River Blackwater which is at an elevation of approximately 30 m AOD to the north and east of the Site, and 20 m AOD to the south.

The former airfield and its immediate surroundings are on a plateau above the River Blackwater. This plateau is currently being excavated by Blackwater Aggregates and, therefore, under the current planning permission (ESS/07/98/BTE), half of the old airfield will become a restored 'bowl' for continued agricultural use. The sand and gravel workings commenced on the airfield in 2002. Subsequent modifications to the planning permission have amended the original restoration scheme to include a mixture of shallow sloping agricultural fields, steeper woodland side slopes and a large surface water collection lagoon (New Field Lagoon).

6.4 Meteorology

The Flood Estimation Handbook (FEH, 1999) reports annual rainfall of 566 mm per year in the area of the Site. Total long-term rainfall and potential evapotranspiration are also reported in the Ministry of Agriculture, Fisheries and Food Technical Bulletin 35 for the period 1941 to 1970 (MAFF, 1976). The Site lies within Area 33E (Chelmsford), for which rainfall is reported as being 577 mm per year and potential evapotranspiration is reported as being 540 mm per year. A first order estimate of the effective rainfall to grassland in the region can then be calculated from the monthly precipitation and potential evapotranspiration values reported in the Technical Bulletin. The sum of the excess monthly rainfall, when the potential evapotranspiration is lower than the precipitation, gives an effective rainfall value of 213 mm per year.

Rainfall data supplied by the Meteorological Office from the Faulkbourne Hall weather station (located approximately 4 km southwest of the Site) in 1992 gave the annual average rainfall for the area as 566 mm per year, while the 1970 to 2000 annual average reported by the Wattisham weather station (located approximately 40 km northeast of the Site) is 574 mm per year. Therefore, the estimated rainfall of 566 mm per year (FEH, 1999) is considered to be reasonably accurate for the purpose of calculation of effective rainfall.

A better estimate of the average annual effective rainfall to bare soil has been calculated using the ERAIN software. ERAIN uses the soil water budgeting method developed by Grindley to estimate infiltration. The calculation for effective rainfall to grassland incorporated an initial soil moisture deficit of zero, and a root constant of 75 mm. The calculation for bare soil incorporated an initial soil moisture deficit of zero, and a root constant of 0 mm. The root constant is a specified amount of soil moisture that may be extracted by vegetation from soil. The calculation predicts that the average annual effective rainfall to grassland will be approximately 99.2 mm per year. Effective rainfall to bare soil, indicative of working quarries or unrestored areas, is estimated to be approximately 168 mm per year, although it should be noted that calculations using monthly values could be in error by as much as 20%.

6.5 Regional Hydrological Network

The principal surface water features in the vicinity of the Site are the River Blackwater and the River Brain (Figure 6-2). The Site lies on the elevated ground that constitutes the watershed between the two rivers.

The River Blackwater lies approximately 1.5 km north of the Site at its closest point and flows eastward towards Coggeshall. It then alters course and flows southwards to within 4 km southeast of the Site. An unnamed tributary of the River Blackwater flows south-eastwards approximately 1 km southwest of the Site at its closest point, to discharge to the River Blackwater approximately 4.5 km southeast of the Site. The River Blackwater forms a confluence with the River Brain to the immediate south-east of Witham. This drains to the sea, 17 km south of the Site, near Maldon.

Bradwell Pond is located approximately 1 km north if the main Site area, next to the existing private access road (Figure 6-2). This surface feature was created during sand and gravel excavation and is located close to a tributary of the River Blackwater. The pond is an independent surface water feature with no outfall and does not receive water from any watercourse or groundwater source.

A surface water moat is located on the Site in the Woodhouse Farm area. This moat occurs within the Boulder Clay deposits, receiving surface water runoff and direct precipitation. It is not considered to be a direct expression of groundwater and often dries out in the summer months.

Additional surface water features located close to the Site are a surface water pond located adjacent to the eastern corner of the Site and a land drainage ditch flowing towards the River Blackwater from North to South located approximately 75 m to the east of the Site. These surface water features also occur within the Boulder Clay deposits, receiving surface water runoff and direct precipitation. The features are not considered to be direct expressions of groundwater and often dry out in the summer months.

Information supplied by the Environment Agency has revealed that there are 19 licensed surface water abstractions within a 5 km radius of the Site (Appendix 6-1). The closest abstraction is 1.7 km from the Site and is taken from the River Blackwater.

The Site is located in an area identified by the Environment Agency as being outside the extent of extreme flooding. Generally this means that the chance of flooding each year from rivers or the sea is 0.1% (1 in 1000) or less.

6.6 Summary of the Development

The eRCF will receive various components of MSW collected by the WCA's and/or C&I waste and SRF produced off-site by other treatment facilities. Therefore the eRCF has been designed to receive a range of waste materials including:

- Mixed Dry Co-mingled Recyclables (MDR);
- Mixed Organic Wastes comprising kerbside collected kitchen and green waste (MOW);
- Residual MSW including a proportion of Commercial and Industrial waste that is collected by the WCAs at the same time as residual MSW from schools, offices etc; and
- Other commercial and industrial waste.

The eRCF scheme will comprise the following elements:

- A MRF for 100,000 tonnes per annum (tpa) of mixed dry recyclables for the recovery of recyclable materials such as paper, card, plastic, metals and fine sand and gravels from local householders and Civic Amenity[1] sites;
- AD for 85,000 tpa Mixed Organic Waste (MOW) from kitchen and green waste collections from local householders and Civic Amenity sites;
- MBT for 226,000 tpa residual MSW wastes *(i.e. black bag wastes)* and/or C&I waste;
- A Pulp Facility for up to 360,000 tpa of reclaimed paper (i.e. 331,000 tpa of imported waste paper, magazines and card and 29,000 tpa residual paper and card derived from the MRF & MBT);
- CHP for 197,000 tpa Solid Recovered Fuel (SRF), plus paper pulp residues;
- The redevelopment of Woodhouse Farm, which will be used as an Education Centre and associated car and coach parking for the public; and
- To provide maximum visual impact mitigation and to safeguard the protection of national mineral reserves, the prior removal of overburden and other material at the Site to lower the plant at least 11 m below existing ground level.

In addition the Site will receive reclaimed paper from Local Authority and merchant sources which alongside papers reclaimed from the eRCF's own MBT and MRF, will be converted to clean paper pulp feedstock for new paper.

The eRCF will be founded significantly below ground level, providing mitigation of visual impact; therefore it is proposed to construct the eRCF foundations at the following elevations:

[1] Household Waste Recycling Centre (HWRC)

- Materials Recycling Facility and Materials Recycling Facility Reception Area, 40m AOD;
- Waste Reception Hall, Biodrying Hall and Pulp Production Facility, 35m AOD;
- Waste Reception *(MOW and Paper & Card)* and SRF Bunkers, 9m AOD;
- Water Treatment and CHP facility, 30m AOD; and
- AD tanks, 33m AOD.

There are a wide variety of possible soil support systems that can be used to construct the eRCF, such as sheet piles, contiguous piles, soldier piles, secant piles and diaphragm walling. The choice of system will ultimately be dependant on whether the wall needs to impermeable, the applied loading from the structure and the height limitations of that system.

Once the retaining walls have been installed, excavation works will commence to lower ground levels and establish the various basement levels. To construct deeper foundations inside the footprint of the eRCF (particularly for the bunkers), the retaining walls could be constructed using a combination piles or by using either standard diaphragm wall or deep caisson construction techniques. Additional reference should be made to Chapter 3 – Construction & Operations.

The excavation is likely to extend below groundwater level, and will require temporary dewatering during construction (dewatering abstractions will require a Transfer Licence from the Environment Agency).

As part of the dewatering activities, a French drain and collector pits will be constructed around the AD tanks and CHP. The French drain will remain in place following construction, to keep the structures dry and allow possible future use as an abstraction for groundwater supply to the eRCF. The use of abstracted groundwater for supply to the eRCF will require an abstraction licence from the Environment Agency.

Where practicable, any groundwater pumped from the Site either during the construction phase of the works, or during the operation and management of the eRCF, will be stored and contained for future use. Typically, groundwater will be pumped into the proposed Upper Lagoon for storage and use within the processes of the eRCF.

Upper Lagoon will be a large freshwater storage lagoon located in front of the eRCF. The lagoon will be constructed below ground level to collect and store water from a combination of sources, namely: rainfall and surface water collected from the roofs of the eRCF and areas of hardstanding around the Site; groundwater pumped from the beneath the Site either during the construction phase of the works, or during the operation and management of the eRCF; water which has been cleaned and treated from the eRCF processes *i.e. liquids arising from the MBT's bio-drying operation*; water transferred from Bradwell Quarry into Upper Lagoon; and water which will be pumped from licensed surface water abstraction points held by GFC from the River Blackwater, or possibly from the local utility water supply network.

Maximum use will be made of the large-scale potential to collect, store and utilise all rain water from building roofs and other surface water runoff, local groundwater management and control systems and the treated eRCF process water.

New Field is the lowest point of the restoration scheme within Bradwell Quarry (Site R in the Essex Minerals Local Plan). The proposed restoration of New Field will include a mixture of shallow sloping agricultural fields, steeper woodland side slopes and a large surface water collection lagoon (New Field Lagoon) area.

New Field Lagoon will act as an additional surface water resource by the provision *(under this application)* of a sump and pump house next to the new access road to return surface water to Upper Lagoon when necessary. This will provide a much larger catchment area to obtain water for the eRCF's waste processing operation. The ability to transfer water between Upper Lagoon and New Field Lagoon will also ensure that water levels within Upper Lagoon can be managed and controlled as well as ensuring that discharge from New Field to the environment will be maintained below *'Greenfield runoff rates'*. At all times, it is intended that Upper Lagoon will have sufficient compensatory storage for rainfall run off from the eRCF in the event of 1 in 100 year storm event plus a 10 % increase in rainfall to allow for climate change.

Following recent discussions with the Environment Agency, it has been confirmed that the transfer of water between Upper Lagoon and New Field Lagoon would not be subject to a Transfer Licence.

6.7 Responses to Consultation relating to Ground and Surface Water

On the 22 May 2008 a Scoping Opinion Request was issued to Essex County Council for the proposed Evolution of the planned Recycling and Composting Facility (the eRCF) at Rivenhall Airfield (the Site). The eRCF scoping opinion request presents the third development of the design of the original RCF, which was approved by the Planning Committee on 30 March 2007 for the Site at Rivenhall Airfield.

The first formal EIA scoping opinion request for the Site (Golder, 2005) identified several issues relating to the assessment of the impact on ground and Surface water. It stated that the following would need to be evaluated:

- The potential effects associated with any loss of agricultural land;
- The potential effects associated with both the proposed sand and gravel working phase and the operational Recycling & Composting Facility (RCF) phase of the works;
- The potential impacts upon groundwater to be assessed in consideration of mitigation provided by the proposed Site engineering;
- Potential indirect effects to groundwater associated with off-Site disposal of residues from the waste process to be examined in a qualitative manner;

- Potential environmental impacts associated with any necessary waste water treatment and disposal to be evaluated and reported, this would need to include waste water from all on site sources;
- The potential impacts upon surface water to be assessed in consideration of mitigation provided by the proposed Site engineering;
- The potential for higher runoff of surface water due to the creation of new impervious areas *(the development of hardstanding areas on-Site being a pre-requisite for pollution prevention purposes),* and the impact to the River Blackwater and the River Brain from the receipt of future surface water runoff; and
- A Flood Risk Assessment will be necessary as flood risk is a material consideration for planning purposes.

The second formal EIA scoping opinion request for the Site (Golder, 2006) reiterated these issues, however the proposed sand and gravel working phase was then limited to excavation of overburden and other materials that were required for construction of the RCF at a lower ground elevation.

The third formal EIA scoping request for the Site (Golder, 2008) stated that the proposed changes in operation to an eRCF were unlikely to result in a change in the overall impact on the hydrogeology of the Site. The impact of the eRCF was to be reviewed and any identified impacts included in this revised assessment.

The responses received from the Environment Agency and Essex County Council in relation to the first formal EIA scoping opinion request are provided in Appendix 6-2. Additional issues identified by the Environment Agency and Essex County Council Planning relating to ground and surface water are:

- The need for an assessment of the increased risk to controlled waters, in particular the Sands and Gravels Minor aquifer, from the removal of organic soils, clays and unsaturated natural deposits that usually help attenuate surface spillages and contaminant leaks;
- The need for assessment of the risk to controlled waters of the activities to be undertaken at the RCF;
- The issues surrounding the need for dewatering will need to be considered;
- The importance of identifying all potential sources, pathways and degrees of risk of pollution that the development may produce, and identification of measures to eliminate or attenuate these;
- The need to identify any riparian rights and to assess whether these will be affected by the development;
- The need to ensure the availability of capacity in the foul water sewer for waste water discharge; and
- The need to ensure adequate water supply to the Site and the potential to collect, store and utilise rain water from roofs and surface water runoff.

The responses received from the Environment Agency and Essex County Council in relation to the second formal EIA scoping opinion request (Golder, 2006) are provided in Appendix 6-3. No additional issues related to groundwater were identified. Additional issues identified by Essex County Council relating to surface water were:

- The need to assess the hydrological impact of dewatering; and
- The need to assess surface water drainage flows from the watershed into the Rivers Blackwater and Brain.

The responses received from the Environment Agency and Essex County Council in relation to the third formal EIA scoping opinion request (Golder, 2008) are provided in Appendix 6-4. The response from the Historic Buildings and Conservation group of Essex County Council stated that the Groundwater conditions affecting the Listed Pump, moat and buildings associated with Woodhouse Farm should be included in the EIA. No additional issues relating to groundwater were identified by the Environment Agency.

In addition to the scoping opinion request and the resulting correspondence, the following Environment Agency scoping guideline notes (Environment Agency, 2002) are referenced for this Environmental Impact Assessment:

- D2 Scoping the environmental impacts of opencast mining and quarrying operations;
- L4 Scoping the environmental impacts of solid waste management facilities; and
- G11 Scoping the environmental impacts of pulp, paper and board production.

6.8 Geology

6.8.1 Regional Geology

The published geological maps for the region, sheet 223 covering the Braintree area (IGS, 1982) and sheet 241 covering the Chelmsford area (IGS, 1976) show that the Site is underlain by Boulder Clay quaternary drift deposits overlying the London Clay (Figure 6-3A).

The Boulder Clay (the Lowestoft Till) consists of a generally pale brown to buff sandy clay with chalk fragments. The basal beds have shown banding and crude laminations. Below the Boulder Clay a continuous or almost continuous sheet of Sands and Gravels is present. This is identified as the Kesgrave Sands and Gravels, which are a sequence of fluvial glacial gravels laid down in a braided river system and containing flint, vein quartz, quartzite, sandstone and occasional igneous and metamorphic rock gravel clasts. The deposit is worked extensively for aggregate and building sand and it is stated in the Environmental Statement for the Sand and Gravel extraction occurring to the north in Site 'R' (Ralph Keeble Associates Ltd 1997) that Site 'R' is identified in the Minerals Assessment Reports for the areas Coggeshall and Witham.

The tertiary London Clay underlies the drift deposits. It is a stiff blue grey silty clay, with the upper surface often weathered exhibiting a colour change to brown grey. Up to 69 m of London Clay is indicated on the geological map in the area and it is exposed in the river valleys to the north and the south where the drift deposits have been eroded. Below the London Clay, the formations of the Thanet Sand and Lambeth Group can be recognised in borehole logs above the Upper Chalk. The surface of the Upper Chalk lies at approximately

-40 m OD (approximately 90 m depth) beneath the current Site elevation, dipping to the south.

6.8.2 Local Geology

The local drift geology in the area has been investigated by RMC Group (now CEMEX) to provide information regarding the reserves of Sands and Gravels, and by Golder to provide information critical to establishing the hydrogeological environment of the area. The results of the site investigations carried out in 1990 and 1991 are summarised below. The investigations covered the whole of Rivenhall Airfield area, with only a limited number of boreholes being located within the Site area. Geological cross-sections across the Site are presented in Figure 6-4.

The quaternary Boulder Clay deposit is described in the site investigation borehole logs as consisting of layers of firm to stiff orange or brown grey chalky mainly silty or gravelly clay with occasional sandy clay. The reported thickness of the Boulder Clay deposit varies between 1.6 m and 17 m, while on the Site it is reported to vary between 3.2 and 10.8 m.

Below the Boulder Clay unit, Sands and Gravels deposits are reported in most boreholes. The deposits are described as consisting of loose to medium dense yellow or orange brown or grey brown Sands and Gravels or sandy Gravels with some chalk or flint in upper layers and some small cobbles or occasional clay nodules in lower layers. The Sands and Gravels layers are sometimes reported interspersed with thin sandy clay layers. The reported thickness of the Sands and Gravels deposit varies between 0 m and 11.2 m, while on the Site it is reported to vary between 3.26 and 9.8 m.

The London Clay is reported below the Sands and Gravels in all boreholes. This is described as consisting of stiff to very stiff brown or grey clay. The upper surface of the London Clay is often weathered; the upper layers of the clay are often described as silty clay and often contain some gravel. The upper surface of the London Clay is reported on Site between 33 m AOD and 36 m AOD. A contour plot of the surface is presented on Figure 6-5.

6.9 Hydrogeology

6.9.1 Aquifer Status and Vulnerability

The Environment Agency (which includes the former National River Authority) has produced a series of maps, covering England and Wales, which identify the vulnerability of groundwater to contamination. It uses geological information to define Major Aquifers, Minor Aquifers and non-aquifers, and information on soils to determine the protection afforded to the underlying geology and therefore its overall vulnerability.

The groundwater vulnerability maps for this area (Environment Agency, 1994 and Environment Agency, 1995) classify the Boulder Clay deposits that the Site is located on as a non-aquifer. A non-aquifer is a formation that is generally regarded as yielding insignificant quantities of groundwater. The Kesgrave Sands and Gravels beneath the Boulder Clay are classified as a Minor aquifer that can be used locally as a source of water and is important in supplying base flow to rivers (Figure 6-3B).

The London Clay is classified as a non-aquifer, with the Upper Chalk below, classified as a Major Aquifer that is developed for industrial, public and general agricultural use. The hydrogeological map of the area (BGS, 1981) indicates that in 1976 the piezometric surface of the Chalk Aquifer was at around +10 m AOD, approximately 50 m below the current ground level. The Site is therefore separated from the Major Chalk Aquifer by approximately 40 m of the low permeability London Clay.

According to data maps located on the Environment Agency website the Site is not located within any source protection zones (SPZ). The closest SPZ is located approximately 9 km to the north of the Site.

Information supplied by the Environment Agency has revealed that there are 6 licensed groundwater abstractions within a 5 km radius of the site (Appendix 6-1). These are detailed in Table 6-1 and shown on Figure 6-2. The Environmental Services Department of Braintree District Council have confirmed that they have no records of private water abstractions within 5 km of the Site.

Table 6-1: Licensed Groundwater Abstractions within 5 km of NGR: TL 823 205

Licence Holder	NGR	Purpose	Source/Annual Quantity	Distance from Site (km)
A & B Hayes Farms	TL 798 236	Agriculture – general agriculture, general farming & domestic.	Groundwater well (5,454 m^3)	4.0
Blackwater Aggregates	TL 8179 2172	Industrial, Commercial and Public Services – Mineral Products Make-Up or Top Up water, Mineral products and Mineral washing.	Groundwater catchpit (47,000 m^3)	1.3
J R Pearce	TL 828 187	Agriculture – general agriculture. spray irrigation – direct.	Groundwater well points (14,000 m^3)	1.9
P T Tyrie	TL 800 222	Amenity – Industrial/commercial/energy/public services.	Groundwater borehole (5,000 m^3)	2.9
Total Butler	TL 860 185	Environmental – Other environmental improvements. Pollution Remediation.	Groundwater borehole (36,500 m^3)	4.2
Stacey Farms	TL 809 179	Agriculture – general agriculture, general farming & domestic.	Groundwater well (460 m^3)	3.0

Sand and Gravel extraction is currently occurring to the north of the Site, in an area known as Bradwell Quarry or 'Site R' (Figure 6-2). Dewatering is carried out in this quarry when groundwater is encountered. This abstraction is currently unlicensed.

6.9.2 Groundwater Flow

Groundwater levels within the Sands and Gravels measured across the area in 2005 range between approximately 33 m AOD and 39 m AOD. The groundwater levels within the Sands and Gravels at the Site range between approximately 35 m AOD and 39 m AOD (Figure 6-6), and as such are unconfined. Contours derived from the groundwater elevations measured in the winter (January) and summer (August) show the direction of groundwater flow within the Sands and Gravels is towards the northeast, suggesting that groundwater could discharge to the River Blackwater. The contours suggest some recharge to the Sands and Gravels occurs slightly to the west of the Site on the plateau. However, the groundwater data collected show virtually no evidence of seasonal fluctuation, suggesting either a lack of local recharge or that the Sands and Gravels have a high hydraulic diffusivity.

The variation in the saturated aquifer thickness is not related to the surface topography, instead hollows in the London Clay surface typically contain the largest saturated aquifer thickness (Figure 6-5). The saturated thickness at the Site varies between 1 m and 3.5 m. The thick Boulder Clay overburden is restricting recharge to the Sands and Gravels. Whilst the London Clay surface appears to be more important than the surface topography in controlling saturated thickness, surface topography is important in determining the groundwater flow direction.

In-situ permeability tests have been undertaken (Golder, 1992) in the saturated Sands and Gravels. Seventeen individual tests yielded permeability results ranging from 1×10^{-3} m/s to 5×10^{-5} m/s, with an average of 2×10^{-4} m/s.

It is possible to estimate the volume of water moving beneath the Site using Darcy's Law. Taking the average permeability value, a typical saturated thickness of 2 m, the width of the aquifer (perpendicular to the flow direction) of 750 m and the observed range of hydraulic gradients (0.00476 to 0.00951), the range of calculated flow rates are between 123 m^3/d and 246 m^3/d.

6.9.3 Groundwater Quality

The quality of the groundwater contained in the Sands and Gravels in the area has been monitored on one occasion from thirteen boreholes (Golder, 1992). The groundwater quality measured was consistent with past land uses and the land use at the time. It is considered that the current groundwater quality may not be significantly different.

The groundwater quality has been benchmarked against UK Drinking Water Standards (UK DWS) taken from the Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184).

Concentrations of total oxidised nitrogen (TON) were present ranging from <0.5 mg/l to 17 mg/l and this is considered to reflect the use of agricultural fertilisers. Nitrite concentrations were observed from <0.005 to 1.34 mg/l, exceeding the UK DWS of 0.1 mg/l in five boreholes.

The groundwater was analysed for a selection of halogenated solvents to determine whether any historical contamination due to the presence of the airfield and associated buildings was present. Measurable quantities of 1,1,1 trichloroethane were detected in ten of the thirteen samples with a maximum concentration of 25 µg/l. Tetrachloromethane was detected in two samples (maximum 1.98 µg/l), tribromomethane (bromoform) in one sample (0.1 µg/l) and tetrachloroethene in one sample (0.04 µg/l).

The analysis of the groundwater indicated a wide variation in metal concentrations over the area. Iron was measured from <10 µg/l to 2,500 µg/l, with two samples above the UK DWS of 200 µg/l. Nickel concentrations ranged from <5 µg/l to 36 µg/l, with two samples above the UK DWS of 20 µg/l. Manganese concentrations ranged from <10 µg/l to 1,080 µg/l, with five samples above the UK DWS of 50 µg/l. Chromium was detected in three samples to a maximum of 3.4 µg/l, below the UK DWS of 50 µg/l. Zinc was detected in three samples to a maximum of 40 µg/l, below the UK DWS of 5,000 µg/l.

The groundwater present in the Sands and Gravels is therefore of relatively poor quality and would be unlikely to be used as a future source of potable water.

6.10 Identification of Potential Groundwater Impacts

The proposed eRCF could impact on groundwater hydrology, such as flow amount and direction, or on groundwater quality. The potential impacts arising from activities carried out during the three phases of the Site: excavation of overburden and other materials; the eRCF construction; and once the eRCF is operational are identified in Table 6-2.

Table 6-2: Groundwater Impact Identification

Receptor of Impact	Phase of Site	Activity	Potential Impacts
Groundwater hydrology	Excavation	Earthworks and site drainage	Decrease in local water table.
			Changes to groundwater distribution and flow.
			Changes to hydrostatic pressure at distant locations connected hydraulically.
	Construction	Earthworks and site drainage	Decrease in local water table.
			Changes to groundwater distribution and

Receptor of Impact	Phase of Site	Activity	Potential Impacts
			flow.
	Operational	Physical presence of waste management facility	Changes to groundwater distribution and flow.
Groundwater quality	Excavation	Earthworks	Mobilisation of contaminated materials and subsequent groundwater pollution.
			Removal of attenuating organic soils, clays and unsaturated natural deposits and subsequent groundwater pollution.
		Materials management	Pollution from spills or leaks of fuel, oil and building materials.
			Pollution from the spillage of contaminated materials during processing or relocation.
	Construction	Earthworks	Disturbance of contaminated soil and subsequent groundwater pollution.
		Materials management	Pollution from spills or leaks of fuel, oil, or construction materials.
	Operational	Leachate management	Contamination from sudden releases (e.g. from containment or drain failure) or slow seepage of leachate to groundwater.
		Surface water management	Contamination from leaks of the surface water stored in the lagoon.
		Materials management	Contamination from spills or leaks of fuel, oil or contaminated water.

6.11 Groundwater Assessment Criteria

6.11.1 Groundwater Hydrology

The assessment criteria applied to the impact on groundwater levels has been established by reference to the nearest groundwater abstraction licence to the Site. This is owned by Blackwater Aggregates to abstract water from a catchpit. The abstraction licence allows for the abstraction of 47,000 m^3 per year and is the largest licensed abstraction within 5 km of the Site. Blackwater Aggregates abstract from a holding lagoon located adjacent to the main site infrastructure and processing area, 1 km north of the proposed eRCF. The water levels in the lagoon vary on a seasonal basis with a water elevation of 36.21 m AOD measured in November 2004.

The Grade II listed pump has likely been lost and as the moat at Woodhouse Farm is not considered an expression of groundwater due to its location on the Boulder Clay, these are not considered as criteria for the assessment of groundwater hydrology.

6.11.2 Groundwater Quality

The assessment criteria applied to the groundwater quality in the Chalk Major aquifer is the UK Drinking Water Standard (UK DWS), since the water contained within the aquifer is a major potable source of water.

Two assessment criteria could be applied to the groundwater quality in the quaternary Sands and Gravels deposits Minor aquifer. Since the groundwater within the quaternary Sands and Gravels is not used for potable supplies within a 5 km radius of the Site but could be important in supplying base flow to the rivers Blackwater and Brain, the Environmental Quality Standards (EQS) could be applied. However, the groundwater is abstracted for agricultural uses within 5 km of the Site and applied as spray irrigation on crops. It could therefore be argued that the UK DWS should be applied, since the crops are for human consumption.

It is considered that since the River Blackwater and the tributary that feeds it are closer to the Site than the down gradient abstraction boreholes that the surface water is more at risk and therefore the EQS will be used in the assessment.

6.12 Significance of Groundwater Impacts

6.12.1 Groundwater Hydrology

The excavation to be carried out during the construction of the eRCF will be accompanied by a certain degree of dewatering.

Initial mineral extraction will be undertaken with no dewatering as only the lower horizons (1 to 3.5 m) of the Sands and Gravels are saturated. Dewatering will be necessary when hollows in the London Clay are encountered, since this is where accumulations of water occur.

To assess the cone of depression in the water table that will result from the dewatering at the Site, the radius of influence, R_o, is estimated. The radius of influence is defined as the distance from a well, or in this case an excavation, to the point at which drawdown is just equal to zero. This therefore, indicates the area that will be affected by the dewatering at the Site.

The radius of influence can be estimated in three ways: from a water balance of recharge and known discharge to the existing quarry; with an empirical formula for steady state conditions; and with a mathematical expression for transient conditions. Each of these estimates is discussed in turn. The last estimate allows the calculation of drawdown at a 1 km distance from the Site through a re-arrangement of the Thiem Dupuit equation for abstraction well discharge in an unconfined aquifer. All the approaches provide first order estimates and are provided to estimate the approximate extent of the impact. In each approach, values are applied to ensure a conservative radius of influence is estimated including the uncertainty in each equation.

The current quarrying operations pump around 34,100 m^3 of groundwater per year to settling lagoons and this is used as an estimate of the amount of groundwater that would need to be dewatered from the excavation. Given that the effective rainfall in the area is around 100 mm

per year to grassland, the area supplying the discharge to the excavation can be calculated if it is assumed that all the effective rainfall infiltrates to the Sands and Gravels. This area can then be used to calculate a circular radius of influence for the excavation, using the following equations:

$$A = Q / I \quad (1)$$

$$R_o = \left(\sqrt{A/\pi}\right) - R_q \quad (2)$$

Where: A = Catchment area (m^2)
Q = Discharge from the excavation (m^3/yr)
I = Effective rainfall over catchment area (m/yr)
R_o = Radius of Influence (m)
R_q = Excavation radius (m)

The radius of influence estimated for the Site from the equations making up this water balance is made by applying the current quarrying pumping rate (34,100 m^3/yr) as the discharge from the excavation, an effective rainfall of 0.1 m/yr and the radius of the excavation as 175 m (half the excavation width). This gives a radius of influence of around 154 m from the Site. This estimate is conservative since it assumes the only recharge to the Sands and Gravels is from infiltration. In reality there will be recharge from regional flow, and as such there will be less drawdown than that predicted.

Estimates of the radius of influence at steady state conditions can be made using the empirical formula of Sichardt (Preene et al, 2000):

$$R_o = C(H - h_w)\sqrt{K} \quad (3)$$

Where: R_o = Radius of Influence (m)
C = Empirical calibration factor
H = Initial head of water in the aquifer (m)
h_w = Target head inside the excavation (m)
K = Permeability (m/s)

The radius of influence estimated for the Site from this equation is made by applying the conservative highest measured permeability of 1 x 10^{-3} m/s, a conservative drawdown of 3.5 m required to dewater the Site ($H - h_w$), and a calibration factor of 3000, which is appropriate for applications calculating the distance of influence from a fully penetrating slot as opposed to a well (Preene et al, 2000). This gives a radius of influence of around 332 m from the Site.

The distance of influence is not a constant; it is theoretically zero at the instant pumping commences and gradually increases with time while pumping continues (Preene et al, 2000). Therefore, the following equation is used to estimate the radius of influence, which includes an aquifer storage value and introduces a time factor:

$$R_0 = \sqrt{\frac{2.25KHt}{S_y}} \quad (4)$$

Where: R_o = Radius of Influence (m)
K = Permeability (m/yr)
H = Initial head of water in the aquifer (m)
t = time since commencement of pumping (yr)
S_y = specific yield of the aquifer (unitless)

The values applied in this equation are selected to calculate a maximum radius of influence. As such the highest measured permeability of 1 x 10^{-3} m/s, an initial head of water in the aquifer of 3.5 m, and a specific yield of 0.23 for a coarse gravel material (Kruseman and de Ridder, 2000) are applied.

The radius of influence calculated by this estimate is unrealistic since no recharge from infiltration is included in the calculation and therefore the radius continues to increase with time. At 1 year it is around 1 km, while at 10 years it is around 3.3 km. Therefore it is important to calculate the extent of the drawdown 1 km from the Site at the location of the Blackwater Aggregates groundwater abstraction. This is achieved by solving a re-arrangement of Thiem Dupuit equation for abstraction well discharge for unconfined aquifers. The equation assumes that the aquifer has a seemingly infinite areal extent, that the aquifer is homogeneous, isotropic and of uniform thickness over the area influenced by pumping, and that the water table is horizontal prior to pumping (Huxley et al, 2004). Whilst most of these assumptions are not strictly appropriate, the equation provides a first order estimate of the predicted drawdown that will require monitoring. The re-arrangement of the Thiem Dupuit equation gives the groundwater head at a distance from the Site as the following:

$$h = \sqrt{\left(H^2 - \frac{Q\ln(R_o / r)}{\pi K}\right)} \quad (5)$$

Where: h = Groundwater head at distance r (m)
R_o = Radius of Influence (m) at time t from equation 4
K = Permeability (m/yr)
H = Initial head of water in the aquifer (m)
r = Distance from the excavation (m)
Q = Discharge from the excavation (m^3/yr)

Since the drawdown is defined as the amount the water table has been lowered, the drawdown amount can be calculated from the groundwater head at a distance from the excavation as the following:

$$s = H - h \quad (6)$$

Where: s = Drawdown at a distance r (m)
H = Initial head of water in the aquifer (m)
h = groundwater head calculated from equation 5 (m)

Applying these equations with the current quarrying pumping rate (34,100 m^3/yr) as the discharge from the excavation, and 1 km (1000 m) as the distance from the excavation, drawdown only starts to occur from around 1.0 years after pumping commences and only reaches a depth of around 0.2 m after 1000 years. Applying 200 m as the distance from the quarry the drawdown increases approximately 0.1 m. This indicates that drawdown is limited to within 200 m of the Site.

The three estimates of the radius of influence of the mineral dewatering associated with the construction of the facility indicate that the cone of depression resulting from the mineral dewatering will be limited to within approximately 300 m of the Site. As such, no substantial impact on the abstraction by Blackwater Aggregates is likely. The estimates are also considered to be worst case, since it is likely that quarrying and associated dewatering to the north of the Site will still be in operation while the Site is being constructed, having a greater influence on the groundwater regime. Buildings at Woodhouse Farm will have already been subject to the dewatering from the quarrying activities 160 m to the north of the buildings and therefore the dewatering to be carried out at the Site (located in the main 160 m to the southwest of the buildings) is unlikely to have any effects not already observed.

6.12.2 Groundwater Quality

Due to the presence of the substantial thickness (at least 50 m) of very low permeability (average of 1.16 x 10^{-8} m/s BGS, 2000) London Clay below the Site, the impact to the groundwater quality of the Chalk from leaks or spills of contaminated water or leachate from the proposed development is considered to be low.

The potential for impact to the groundwater quality of the Minor aquifer Sands and Gravels varies during the different stages of the proposed development.

During the extraction and construction phases of the development there will be a risk of pollution from spills or leaks of fuel or oil from the Site plant once the attenuating Boulder Clay has been removed. Once excavation into the saturated Sands and Gravels has begun, the risk of pollution will decrease since the groundwater hydraulic gradient will be into the excavation from where groundwater will be pumped out and treated appropriately before disposal or storage in the Upper Lagoon. There will be a potential impact of spills or leaks of fuel or oil from the Site plant to the groundwater away from the excavation following infiltration through the attenuating Boulder Clay.

During the operational phase of the development the impact to the groundwater in the Sands and Gravels from spills or leaks of fuel, oils and building materials on-Site is considered to be

low, since impermeable concrete and tarmac surfaces will be present, from where runoff water will be collected and removed in a managed fashion. The impact to the groundwater in the Sands and Gravels from leaks of the freshwater Upper Lagoon on-Site is considered to be low, since the lagoon will be lined and the stored water is unlikely to become contaminated.

6.13 Groundwater Mitigation Proposals

The proposed developments are intended to comply with the Environment Agency's Pollution Prevention Guidelines (EA PPG) that aim to provide advice on statutory responsibilities and good environmental practice. Adherence to the EA PPGs detailed in Table 6-3 is considered essential to ensure the development is designed with sensitivity to the receiving groundwater environment.

Table 6-3: EA PPGs Relevant to the Scheme

EA PPG	Title
1	General Guide To The Prevention Of Pollution
2	Above Ground Oil Storage Tanks
3	The Use And Design Of Oil Separators in Surface water drainage systems
4	Treatment and disposal of sewage where no foul sewer is available
6	Working At Construction And Demolition Sites
8	Safe Storage And Disposal Of Used Oils
13	Vehicle Washing and Cleaning
18	Managing firewater and major spillages
21	Pollution Incident Response Planning
22	Dealing With Spillages On Highways
26	Storage and Handling of Drums and Intermediate Bulk Containers
27	Installation, decommissioning and Removal of Underground Storage Tanks

In addition to complying with the EA PPGs detailed in Table 6-3 and referring to the Environment Agency 10-point checklist, *"Is your site right?"* (Environment Agency, 2008), groundwater monitoring is proposed.

The groundwater levels in the Sands and Gravels will continue to be monitored monthly throughout the extraction and construction phases of the Site, to check that dewatering impacts from the Site are as expected. The monitoring frequency may be reduced once the eRCF is operational if the French drain is not required to be pumped. The long term monitoring of the water levels will also allow any increasing water level trends to be identified early and any additional flood mitigation measures for the Site will be able to be put into place. The recommended boreholes for monitoring are presented in Table 6-4. Control levels for groundwater levels are suggested for boreholes Pz16A and Pz18 *(these are the nearest boreholes to the Site where groundwater elevation has been obtained)*, and these are set at 0.5 m below the lowest recorded groundwater elevation in 2005. The control levels will allow early identification of any unexpected drawdown and enable appropriate investigations or corrective measures to be carried out prior to any substantial drawdown effects.

Table 6-4: Groundwater Monitoring Boreholes

Borehole Identifier (as shown on Figure 6-5)	Eastings	Northings	Currently Monitored	Groundwater Level Control (m AOD)
Pz1	582600	221380	Y	
Pz2	582960	221200	Y	
Pz3*	581600	220950	N	
Pz4	582410	220940	Y	
Pz7	583360	220680	Y	
Pz9	583980	220540	Y	
Pz11	584750	221100	Y	
Pz15	584260	219840	N	
Pz16A*	583140	220310	Y	34.6 m AOD
Pz18*	581910	219800	Y	36.9 m AOD
Pz19*	581980	220320	Y	
Pz20*	582200	220700	Y	

* Boreholes to be monitored for groundwater level and quality.

The current quality of the groundwater will need to be characterised to assess if the development of a treatment procedure for the groundwater abstracted prior to its discharge to the Upper Lagoon, surface water, or sewer, is required. This will involve monitoring the groundwater Boreholes Pz3, Pz16A, Pz18, Pz19 and Pz20 on an initial six monthly basis for the determinands detailed in Table 6-5. It is expected that the treatment of the groundwater will be carried out to meet Environment Agency or sewage undertaker criteria to be agreed following characterisation.

Following the implementation of a treatment procedure, the groundwater collected and the treated groundwater discharged will be monitored in line with that agreed on the discharge consent.

Table 6-5: Groundwater Quality Monitoring Schedule

Determinand	Units
pH	pH units
Temperature	ºC
Electrical Conductivity	µS/cm
Dissolved Oxygen	mg/l
Biological Oxygen Demand (BOD)	mg/l
Chemical Oxygen Demand (COD)	mg/l
Total Organic Carbon	mg/l
Major Ions - Ca, Mg, Na, K, SO_4, Cl, HCO_3	mg/l
Ammoniacal Nitrogen	mg/l
Total Oxidised Nitrogen	mg/l
Nitrate	mg/l
Phosphate	mg/l
Minor Ions – As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Se, B, Fe, Mn	µg/l
Volatile Organic Carbon Compounds	µg/l
Semi Volatile Organic Carbon Compounds	µg/l

6.14 Residual Groundwater Impacts

Following the implementation of the mitigation proposals in Section 6.13 the following residual impacts result from the proposed Site development:

6.14.1 Groundwater Hydrology

The proposed Site development will not cause a substantial residual impact to the groundwater hydrology. Any depression in the water table of the Sands and Gravels Minor aquifer due to pumping of the excavation will be of limited extent. Calculations in Section 6.12 have shown that the depression in the water table from long-term continuous pumping will be mainly within 300 m of the Site, and is unlikely to impact the surrounding uses of the groundwater. Water level measurements will enable the development and recovery of the cone of depression to be monitored. It should be noted that the draw down assessment presents a reasonable worst case of the impacts to groundwater.

The pumping of the French drains to supply top-up water to the Upper lagoon will require an abstraction licence.

6.14.2 Groundwater Quality

There is unlikely to be a residual impact on groundwater quality following the implementation of the mitigation proposals during all phases of the Site.

6.15 Groundwater Summary

This groundwater assessment has identified the likely impacts on groundwater hydrology and groundwater quality resulting from the proposed development of the eRCF at Rivenhall Airfield. These are detailed in Table 6-2, with a significance matrix of the impacts before and after mitigation presented in Appendix 6-5.

The issues that have arisen from the groundwater impact assessment are as follows:

- The Minor aquifer of the Sands and Gravels will be dewatered during mineral extraction causing the development of a cone of depression in the water table around the Site; and
- The quality is at risk of pollution from spills or leaks of fuel or oil from Site plant during the excavation and construction phases of the Site.

It is calculated in Section 6-12 that the cone of depression formed around the Site is likely to be limited in extent, with drawdown only occurring within 300 m of the Site. Groundwater levels will be monitored monthly throughout the excavation and construction phases of the Site, to ensure that dewatering impacts from the Site are as expected. The monitoring frequency may be reduced once the facility is operational if it is found that groundwater is not

required to be pumped from the French drain to keep the structures dry or to top-up the Upper Lagoon. The long term monitoring of the water levels will also allow any increasing water level trends to be identified early and any mitigation measures needed for the Site will be identified and put into practice.

The reduction in groundwater levels and the associated changes in groundwater distribution and flow are expected to have a minor adverse negative residual impact following the implementation of the mitigation proposals, if the French Drain is pumped during the operational period.

The Site intend to follow the Environment Agency's Pollution Prevention Guidelines (EA PPG) stated in Table 6-3. These will provide mitigation of the risks to groundwater quality from pollution. The removal of the attenuating soils and unsaturated deposits could lead to a minor adverse negative impact on the groundwater quality of the Sands and Gravels following the implementation of the mitigation proposals.

6.16 Surface Water Classifications

The River Blackwater and the River Brain are classified by the Environment Agency as *'Main'* rivers. These rivers are strategically important waterways that drain a large catchment area.

The tributary feeding the River Blackwater located 1 km southeast of the Site is classified as an *'ordinary'* water course.

6.16.1 Surface Water Flow

The Environment Agency monitors the flow of the River Blackwater and the River Brain. The locations of the monitoring stations are shown on Figure 6-7. The River Blackwater is monitored at Appleford Bridge monitoring station *(Number 37010);* this reports a maximum flow measured of 20.2 m^3/s from a catchment area covering 247 km^2. The River Brain is monitored at Guithavon Valley monitoring station *(Number 37009);* this reports a maximum flow of 11.52 m^3/s from a catchment area covering 60.2 km^2.

The eRCF will have a negligible effect on the catchment areas for the Rivers Blackwater and Brain, and would not have any significant adverse impact on surface water flows into nearby watercourses during periods of low flow. However, the construction of Upper Lagoon (and the use and transfer of water to and from New Field Lagoon) will improve the existing flood management of the Site during periods of high flow, or flood flow. In addition, it should be noted that the Site will also be in a position to receive water which could be pumped from the River Blackwater during periods of high flow or flood.

6.16.2 Sources of Flooding

The Site is located in an area identified by the Environment Agency indicative flood maps as being outside the extent of extreme fluvial or tidal flooding. Extreme flooding is defined by the Agency as flooding, which has more than a 0.1% chance of occurring every year (1 in 1,000 year return period). Therefore, in accordance with definitions provided in PPS25, the Site is located in Flood Zone 1. The Agency flood zones in the region are presented on Figure 6-8. There is no current flood management at the Site, and no historical information to indicate that the Site has been subject to fluvial or tidal flooding.

Neither the River Blackwater nor the River Brain have flood alleviation schemes.

Groundwater flooding and Pluvial flooding caused by rainfall runoff on the site is assessed in Section 6.20.3 of this report.

6.16.3 Surface Water Quality

The Environment Agency monitors the surface water quality of the River Blackwater and the River Brain on a monthly basis. Three reaches of the River Blackwater are monitored, with four monitored on the River Brain. Figure 6-7 shows the location of the monitoring points.

The 2004 to 2006 data collected from the River Blackwater led to the quality being classified as Grade A (very good) for ammonia, with the exception of the reach between Coggeshall sewage treatment works and Domsey Brook that was classified as Grade B (good). The quality was classified as Grade C (fairly good) for dissolved oxygen until the Coggeshall sewage treatment works, located approximately 3 km east of the Site, from where the quality improves to Grade A (very good) until Domsey Brook and Grade B (good) in the final reach to the River Brain. All reaches on the River were classified as Grade B (good) for biological oxygen demand (BOD), Grade 5 (very high) for phosphate and Grade 6 (very high) for nitrates. A summary of the data collected is presented in Table 6-6.

The 2004 to 2006 data collected from the River Brain led to the quality being classified as Grade B (good) for BOD until it reaches Bulford Mill, the quality then degrades to Grade C (fairly good). All reaches on the River were classified Grade C (fairly good) for ammonia and dissolved oxygen, as Grade 5 (very high) for phosphate and Grade 6 (very high) for nitrates. A summary of the data collected is presented in Table 6-7.

There are no water quality data for the pond and moat surface water features.

Table 6-6: River Blackwater Water Quality Data Collected by the Environment Agency 2004 - 2006

NGR of Sampling Point	Reach of River	Biological Oxygen Demand (mg/l)			Ammonia (mgN/l)			Dissolved Oxygen (% saturation)			Nitrate (mg/l)	Phosphate (mg/l)	
		Average	Std Dev	90th Percentile	Average	Std Dev	90th Percentile	Average	Std Dev	10th Percentile	Mean	Mean	Std Dev
584966 222559	Shelbourne Bridge Brook -Robins Brook	1.41	1.13	2.71	0.055	0.047	0.108	90.28	15.86	69.95	43.66	0.37	0.90
585972 221422	Robins Brook - Coggeshall STW	1.41	1.13	2.71	0.055	0.047	0.108	90.28	15.86	69.95	43.66	0.37	0.90
589607 218776	Coggeshall STW - Domsey Brook	1.98	1.26	3.53	0.283	0.228	0.546	102.01	16.3	81.12	45.02	0.42	0.87
583186 213675	Domsey Brook - River Brain	1.52	1.04	2.78	0.077	0.058	0.145	100.3	17.42	77.96	43.65	0.34	0.92

Table 6-7: River Brain Water Quality Data Collected by the Environment Agency 2004 - 2006

NGR of Sampling Point	Reach of River	Biological Oxygen Demand (mg/l)			Ammonia (mgN/l)			Dissolved Oxygen (% saturation)			Nitrate (mg/l)	Phosphate (mg/l)	
		Average	Std Dev	90th Percentile	Average	Std Dev	90th Percentile	Average	Std Dev	10th Percentile	Mean	Mean	Std Dev
577294 220496	Braintree STW – Bulford Mill	2.93	2.11	5.45	0.516	1.145	1.172	84.77	11.92	69.49	46.11	0.50	0.83
578934 218194	Bulford Mill - White Notley STW	1.81	1.3	3.36	0.395	1.019	0.89	88.12	16.3	67.22	46.53	0.47	0.81
581686 215495	White Notley STW – Chipping Hill	2.05	1.24	3.59	0.384	1.094	0.855	91.18	17.5	68.75	49.14	0.71	0.61

6.17 Surface Water Abstractions and Discharges

Information supplied by the Environment Agency has revealed that there are 19 licensed surface water abstractions within a 5 km radius of the Site (Appendix 6-6). These are detailed in Table 6-8. The closest abstraction is 1.5 km from the Site and is taken from the River Blackwater.

Table 6-8: Licensed Abstractions within 5 km of NGR: TL 823 205

Licence Holder	NGR	Purpose	Source/Annual Quantity	Distance from Site (km)
S & K Butler	TL 786 229 TL 798 232	Agriculture – general agriculture, spray irrigation – direct.	Surface Water (3,000 m^3)	3.7
G & S Coode-Adams	TL 853 215 TL 865 211	Agriculture – general agriculture, spray irrigation – direct.	River Blackwater (22,730 m^3)	2.5
R & D Bunting	TL 850 169 TL 854 172	Agriculture – general agriculture, spray irrigation – direct.	River Blackwater (2,270 m^3)	4.5
A & B Hayes Farms	TL 794 241 & TL 796 242 TL 806 231	Agriculture – general agriculture, spray irrigation – direct.	Pond (7,000 m^3) River Blackwater (7,000 m^3)	4.6
R Goodwin & Son	TL 855 173	Agriculture – general agriculture, spray irrigation – storage	River Blackwater (13,600 m^3)	4.5
Gent Fairhead & Co Limited	TL 829 221	Industrial, Commercial and Public Services – mineral products, mineral washing	River Blackwater (90,900 m^3)	1.5
Braintree Golf Club	TL 797 243	Industrial, Commercial and Public Services – Golf Courses, spray irrigation – direct	River Blackwater (1,400 m^3)	4.6
R A Brice & Partners	TL 849 166	Agriculture – general agriculture, spray irrigation – direct.	River Blackwater (51,000 m^3)	4.7
G & S Coode-Adams	TL 864 209 TL 863 195	Agriculture – general agriculture, spray irrigation – direct.	River Blackwater (2,270 m^3)	4.1
G & S Coode-Adams	TL 864 196 TL 861 214	Agriculture – general agriculture, spray irrigation – storage and anti frost storage	River Blackwater (45,460 m^3)	3.5
G & S Coode-Adams	TL 864 196 TL 861 214	Agriculture – general agriculture, spray irrigation – direct, storage and anti frost storage	River Blackwater (22,730 m^3)	4.2
G & S Coode-Adams	TL 864 196 TL 861 214	Agriculture – general agriculture, spray irrigation – direct	River Blackwater (12,520 m^3)	4.2
Gent Fairhead & Co Limited	TL 834 222	Industrial, Commercial and Public Services – extractive mineral washing	River Blackwater (15,000 m^3)	2.1
G & S Coode-	TL 860 215	Agriculture – general	River Blackwater	3.2

Licence Holder	NGR	Purpose	Source/Annual Quantity	Distance from Site (km)
Adams		agriculture, spray irrigation – anti frost	(82,500 m^3)	
Feeringbury Holdings	TL 864 215	Agriculture – general agriculture, spray irrigation – storage	River Blackwater (180,000 m^3)	4.2
Strutt & Parker (Farms) Ltd	TL 801 173, TL 807 163 & TL 784 188	Agriculture – general agriculture, spray irrigation – storage	River Brain (91,000 m^3)	3.9
Strutt & Parker (Farms) Ltd	TL 794 179 TL 811 161	Agriculture – general agriculture, spray irrigation – direct	River Brain (40,000 m^3)	3.9

The abstraction licences (8/37/31/*S/0127 and 8/37/31/*S/0215) owned by Gent Fairhead & Co Limited is subject to a *'Change of Use'* application and negotiation associated with permitted abstraction quantities. Licence 8/37/31/*S/0215 is permitted for the filling a reservoir and subsequent re-abstraction for the purpose of sand and gravel washing, and licence 8/37/31/*S/0127 is permitted for filling a reservoir for the purpose of sand and gravel washing.

Subject to negotiations with the Environment Agency it is anticipated that a minimum of 17,727 m^3 per year (approximately 49 m^3 per day) will be secured through a *'Change of Use'*.

Seventy eight licensed discharge consents are currently held within a 5 km radius of the Site, according to the Environment Agency. A list of these discharge consents is included in Appendix 6-6. The majority of discharges (63) involve the discharge of sewage to surface water, either by Anglian Water or private owners. In addition, four involve the discharge of agricultural arable farming discharges to land, one is for a retail filling station, one is for a reservoir and the remaining nine are unspecified.

It should be noted that the transfer of water between Upper Lagoon and New Field Lagoon will not be subject to a Transfer Licence.

6.18 Assessment of Potential Surface Water Impacts

6.18.1 Proposed Surface Water Management

Upper Lagoon will be a large freshwater storage lagoon located in front of the eRCF. The lagoon will be constructed below ground level to collect and store water from a combination of sources, namely: rainfall and surface water collected from the roofs of the eRCF and areas of hardstanding around the Site; groundwater pumped from the beneath the Site either during the construction phase of the works, or during the operation and management of the eRCF;

water which has been cleaned and treated in the eRCF's Waste Water Treatment Plant (WWTP) *i.e. liquids arising from the MBT's bio-drying operation*; water transferred from Bradwell Quarry into Upper Lagoon; and water which will be pumped from licensed surface water abstraction points held by GFC from the River Blackwater, or possibly from the local utility water supply network.

The use of water within the eRCF will be controlled whereby losses from the waste treatment and recycling operations are significantly minimised through the use of waste water collection and *closed loop* treatment processes. It should be noted that the principle source of process water will be supplied from the eRCF's WWTP.

The WWTP will treat a daily average of 7,352.5 m^3 per day and approximately 6,984.8 m^3 per day will be returned to Upper Lagoon as clean and treated water. The Upper Lagoon will receive an additional average daily volume of 238.5 m^3 collected rainwater to give a total input of 7,223.3 m^3 per day of water. Since the whole process demands 7,343.9 m^3 per day of process water, a net water shortfall of 120.6 m^3 per day is apparent.

The volume of water returned to Upper Lagoon from the WWTP ensures that less than 5% of the total water demand of the eRCF is required from the proposed combination of sources *i.e. rainwater collected in Upper Lagoon will provide approximately 3.2% of the eRCF's process water supply, and 'make up water' to compensate for the overall water losses in the eRCF system of approximately 1.6 %, gives a total combined demand of 4.8% (~5%).* Additional reference should be made to Chapter 3 – Construction and Operations.

For operational purposes the Upper Lagoon will be maintained with a water level, which will allow for a continuous water supply to the eRCF.

Areas of hardstanding across the Site will be constructed with gradients and crossfalls to ensure that rainwater and surface water runoff collects in drainage channels. The surface water drains will drain under gravity to a single location before being discharged into Upper Lagoon. Oil interceptors are to be installed in the drainage system to protect the receiving waters from pollution.

During periods of prolonged rainfall, the Upper Lagoon will have the facility for overflow into New Field Lagoon.

An approximate monthly water balance for the Upper Lagoon is presented in Appendix 6-7. This indicates that there is a negative monthly water balance and therefore, additional water will be required for each month.

For the construction phase it is estimated that on-Site contractor numbers will be in the order of 30 people. Once operational, the eRCF will employ approximately 50 full-time staff. The approximate water requirements of the development in each stage are detailed in Table 6-9.

The service plans for the Site and its surrounding area indicate that the water utilities network is connected to the Site. Once the water and sewage requirements of the eRCF can be confirmed, Anglian Water will be contacted to ensure that the existing network has the capacity to supply potable drinking water to the eRCF. It should be noted that all foul water generated by the operation of the eRCF will be collected and treated within the eRCF's waste water treatment plant, for treatment and reuse. This will mitigate any unnecessary water losses from the Site.

There are no watercourses crossing the Site that would be interrupted or diverted. Therefore, riparian rights will not be impaired.

6.18.2 Identification of Surface Water Impacts

The proposed eRCF will have an impact on the Site's surface water hydrology. Impacts may include changes to flow and surface water quality in receiving watercourses or waterbodies. The potential surface water impacts arising from the excavation of overburden and other materials from the Site; eRCF construction; and eRCF operations, are presented in Table 6-10.

Table 6-9: Estimates of Water Requirements of the Development (Volume m^3 per year)

				Phase of Site		
				Extraction	**Construction**	**Operational**
Estimated Maximum number of people to be employed				30	30	50
	Rate		**Calculation**			
Water Needs						
Water for domestic use[1]	0.05	m^3/person/ day	Total m^3/yr = rate * number of people employed during phase * number of working days	380	380	633
Water for construction needs[2]	0.06	m^3/person/ day	Total m^3/yr = rate * number of people employed during phase * number of working days[5]		455	
Process Water consumption for plant[3]	7344	m^3/d	Total m^3/yr = rate * number of working days[5]			1,858,032
Total per year			m^3/yr	380	835	1,858,665
			l/yr	379,500	834,900	1,858,665,000
Waste Water needs						
Sewage waste – staff[4]	0.09	m^3/person/ day	Total m^3/yr = rate * number of people employed during phase * number of working days	683	683	1139
Sewage waste - office with canteen[4]	0.1	m^3/person/ activity/day	Total m^3/yr = rate * number of people employed during phase * number of working days			1265
Sewage waste - construction/quarrying[4]	0.06	m^3/person/ activity/day	Total m^3/yr = rate * number of people employed during phase * number of working days	455	455	
Total per year			m^3/yr	1,139	1,139	2,404
			l/yr	1,138,500	1,138,500	2,403,500

1 From Defra, 2000 Environmental Reporting Guidelines for Company Reporting on Water
2 Estimated to be similar to the waste water needs
3 Estimate made in the water balance section
4 Details taken from British Water, 2005 Code of Practice Flows and Loads – 2.
5 Number of working days estimated at 253

Table 6-10: Surface Water Impact Identification

Receptor of Impact	Phase of Site	Activity	Potential Impacts
Surface Water Hydrology and Channel Morphology	Excavation	Use of vehicles and machinery	Increase in surface runoff from soil compaction.
		Works next to or near watercourses	No direct impact, Site is some distance from watercourses
		Earthworks	Increased sedimentation of receiving water body.
		Site drainage from collection of groundwater and surface water runoff	Additional drainage requirements.
			Changes in deposition regime, caused by changes in flow and possible increase in sediment input.
	Construction	Use of vehicles and machinery	Increase in surface runoff from soil compaction, hardstanding and site building roofs.
		Works next to or near watercourses	No direct impact, Site is some distance from watercourses
		Earthworks	Increased sedimentation of receiving water body.
		Site drainage from collection of groundwater and surface water runoff	Additional drainage requirements with possible use of 'New Field Lagoon'
			Changes in deposition regime, caused by changes in flow and possible increase in sediment input.
	Operational	Use of vehicles and machinery	Increase in surface runoff from soil compaction and hardstanding.
		Site drainage from collection of runoff from roofs and car parks, and sewage	Rapid transfer of rainwater to temporary storage via drainage.
			Additional drainage requirements with possible use of 'New Field Lagoon'
			Changes in depositional regime, caused by changes in flow and possible increase in sediment input from soil erosion.
Surface Water Quality	Excavation	Earthworks	Pollution from suspended material.
			Pollution of receiving water body by contaminated sediments.
		Materials management	Pollution from spills or leaks of fuel, oil, or other materials.
		Use of machinery	Sediment-loading of receiving water body.
		Site drainage from collection of groundwater and surface water runoff	Pollution from spills or leaks of contaminated groundwater or surface runoff water.
	Construction	Earthworks	Pollution from suspended material.
			Disturbance of contaminated soil and subsequent pollution of receiving water body.
		Materials management	Pollution from spills or leaks of fuel, oil, or construction materials.
		Site drainage from collection of groundwater and surface water runoff	Pollution from spills or leaks of contaminated groundwater or surface runoff water.
	Operational	Leachate management	Decrease in water quality from sudden releases (e.g. from containment or drain failure) or gradual seepage of leachate into receiving water body that may contribute to

Receptor of Impact	Phase of Site	Activity	Potential Impacts
			eutrophication.
		Materials management	Pollution from spills or leaks of fuel and oil.
		Use of machinery	Sediment loading of receiving water body.
		Site drainage from collection of runoff from roofs and car parks, and sewage	Pollution from spills or leaks of oil interceptor waste.
			Pollution from spills or leaks of contaminated surface runoff water or sewage.

6.18.3 Sources of Flooding

The following five potential sources of flood waters have been considered: fluvial flooding; tidal flooding; coastal flooding; groundwater flooding and pluvial flooding. Table 6-11 identifies the potential sources of flooding arising from activities carried out during the three phases of the Site, namely: the excavation of overburden and other materials, eRCF construction and eRCF is operations.

Table 6-11: Sources of Flood Risk

Source of Flooding	Phase of Site	Potential Of Impacts from Proposed Development
River	All Site Phases	No potential for flooding due to Site location.
Tidal	All Site Phases	No potential for flooding due to Site location.
Coastal	All Site Phases	No potential for flooding due to Site location.
Groundwater	Excavation	Potential for on-Site flooding of excavation if groundwater pumping fails. No potential for off-Site flooding due to dewatering in excavation.
	Construction	Potential for on-Site flooding if pumping fails. No potential for off-Site flooding due to dewatering in excavation.
	Operational	Potential for on-Site flooding if structure of subsurface AD tanks and related below ground construction fails. No potential for off-Site flooding.
Surface Water	Excavation	Potential for on-Site flooding of excavation if groundwater pumping fails. Potential for on-Site and off-Site flooding from increased Site runoff generated by a high return period rainfall event. No additional potential for off-Site flooding from the development due to dewatering in excavation.
	Construction	Potential for on-Site flooding if pumping fails. Potential for on-Site and off-Site flooding from increased Site runoff generated by a high return period rainfall event.
	Operational	Potential for on-Site flooding if pumping from drainage fails, or if the Upper Lagoon overtops. Potential for on-Site and off-Site flooding from increased Site runoff generated by a high return period rainfall event.

6.19 Surface Water Assessment Criteria

6.19.1 Surface Water Hydrology

The impact on the surface water hydrology has been assessed in relation to changes in the regional drainage pattern and the changes of surface runoff volumes likely to be caused by the proposed eRCF.

6.19.2 Surface Water Quality

The impact on the surface water quality in the Rivers Blackwater and Brain has been assessed against the Environmental Quality Standards (EQS). For substances with EQS that are hardness related *(chromium, copper, lead, nickel, vanadium and zinc)* the highest standards are applied, since the hydrogeological map of the region (BGS, 1981) describes the water contained in both the Boulder Clay and Sands and Gravels to be of a hard to very hard composition. It is therefore expected that surface water quality at the Site will also be hard.

It is anticipated that the discharge of suspended solids will be regulated by a consent from the Environment Agency. This is likely to allow a discharge of up to 100 mg/l of suspended solids from the Site; this is therefore considered to be the assessment criteria for suspended solids.

6.19.3 Flood Risk Assessment Criteria

To assess the flood risk at the Site the surface water runoff generated during a high return period rainfall event is calculated, and the surface water management options across the Site are explored.

Surface water management can be provided by temporary flood storage, which will be fed by gravity from a number of different surface water collection points. Runoff generated from rain falling on contaminated areas of the Site would need to be managed and/or treated to an adequate quality. Contaminated or dirty water would be diverted to the eRCF's waste water treatment plant.

Rainfall on areas of hardstanding such as access roads, or on the roofs of the eRCF (which would not be considered contaminated) will be collected and attenuated using the Upper Lagoon before being used by the eRCF. During sustained periods of rainfall, excess water collected and diverted to Upper Lagoon will be allowed to flow via a controlled discharge to the *'New Field Lagoon'* area.

The required temporary flood storage volume to manage flood risk on Site is calculated in the following Sections.

6.20 Significance of Surface Water Impacts

6.20.1 Surface Water Hydrology

The proposed development of the eRCF will not alter the regional drainage pattern of the area. There will be a decrease in regional surface runoff due to the proposed collection, reuse, treatment, recirculation and discharge of Site surface runoff by the eRCF. However, this decrease will not significantly impact the flow regimes and channel morphologies of the

surface water courses. It should also be noted that the Site is of a relatively small area in comparison the overall catchment area of the Rivers Blackwater and Brain and is located on a high elevated plateau.

The amount of surface runoff generated on-Site will increase from the current volume in all phases of the eRCF development. The area of bare soil will increase during the excavation phase and the development of the eRCF buildings, access roads and areas of hardstanding will increase the total area of impermeable surfaces during the eRCF construction and eRCF operation. Assessments of the pluvial flood risk to the Site are made in Section 6.20.3.

Increased sedimentation of local surface water courses could result from the uncontrolled discharge or runoff of suspended material from the Site. Therefore, it is recommended that surface water runoff is channelled and diverted into Upper Lagoon which will offer attenuation and allow it to settle before discharge to *'New Field Lagoon'* .

6.20.2 Surface Water Quality

There is a high potential for the eRCF to impact on the quality of surface water in all the phases of the Site's development and operation.

During the excavation and construction phases of the eRCF there is a significant risk to the quality of the surface water collecting on Site from increased quantities of suspended solids caused by the removal or compaction of soil. There is also a risk from spills and leaks of fuel or oil from plant or machinery operating at the Site. The uncontrolled discharge of contaminated surface water drainage to surface water courses would impact the quality.

During the operational phase of the Site, there is significant risk to the quality of the surface water collecting on Site from quantities of suspended solids arising from operational traffic and from dust and particulates from the Site activities. There is also a potential risk from spills and leaks of fuel or oil from plant machinery and operational traffic, or leaks of contaminated water from the eRCF. However, the proposed collection, reuse, treatment, and recirculation of water within the proposed waste recycling and treatment processes, will significantly reduce any risk of uncontrolled discharge from the eRCF. Therefore, leachate and contaminated water are unlikely discharges from the Site. All waste treatment and processing activities will take place within environmentally controlled buildings and will not be connected to the surface water management system.

6.20.3 Flood Risk Assessment

6.20.3.1 On-Site Flooding

Surface Water Runoff Assessment

In accordance with the guidance provided in PPS25, a surface water runoff assessment is required for all sites with an area greater than 1 ha, to understand the likely off-site impacts from pluvial flooding. Surface water runoff as a direct result of development at the Site is assessed using the Rational Method. This method considers the runoff generated across the Site in the current situation and following the construction of the proposed development. This leads to the calculation of the maximum storage volume required on-Site during a storm event, and an assessment of the additional volume of runoff likely to be created following the development of the Site.

In the interest of conservatism, only the pre-development *(baseline)* and post-development *(operational)* scenarios have been considered. The volumes calculated for the post-development scenario can be considered as conservative estimates for the extraction and construction phases, as impermeable ground surfaces can be considered at a maximum during the post development scenario.

The Rational Method calculates peak volumes from the Site surface runoff for such an event using the following equation:

$$V = I * C * A$$

Where: V = Surface Water runoff volume (m^3)
I = Peak rainfall for a 24 hour event with a 1% probability of occurrence every year (m)
C = Runoff coefficient (ground surface specific, dimensionless)
A = Area of the Site (m^2)

The peak rainfall depth for a 24 hour storm with a 1% chance of occurring each year at the Site has been taken from the Flood Estimation Handbook (FEH, 1999). This has been increased by 10% to account for climate change for the period between 2025 to 2055 as stated in Table B.2 of PPS25.

The peak rainfall for the 1 in 100 year return period storm event has been calculated as 86.6 mm, this is increased to 95.26 mm to incorporate 10% climate change to provide the recommended design criteria for flood storage.

The Rational Method has assessed only rainfall falling within the curtilage of the Site. The current pre-development surface water runoff volumes have been calculated using the following ground surface areas: 15,800 m^2 of impervious concrete or tarmac and 199,200 m^2 of grassland. The post development surface water runoff volumes have been calculated using a conservative total surface area of 215,000 m^2 of concrete, tarmac or eRCF building roofs.

The Rational Method requires a runoff coefficient relative to the type of ground surface. The runoff coefficient for each different ground surface type incorporates a number of parameters *e.g. infiltration, evaporation and depression storage*. Coefficients have been estimated with guidance taken from the CIRIA document "*Drainage of Development Sites. A guide*" (CIRIA, 2005).

It has been conservatively assumed that there would be 100% runoff from the concrete and tarmac areas *(Runoff coefficient = 1)*. A greenfield discharge rate of 5 l/s/hectare is generally accepted by the Environment Agency. During a 24 hour storm producing a rainfall depth of 95.26 mm, the greenfield discharge of 5 l/s/ha *(43 mm/day)* is equivalent to 45 % runoff (*i.e. 43/95.26 x 100%)*, giving a greenfield runoff coefficient of 0.45.

A weighted average has been applied to provide an overall runoff coefficient for each scenario, which incorporates the proportion of impervious and grassland or landscaped surfaces. Therefore the baseline scenario will have a weighted average runoff coefficient of 0.49 and the post development scenario will have a weighted average runoff coefficient of 1.

Since the Site is to be constructed below existing ground level it is considered that all runoff generated on Site during a high return period rainfall event will require temporary storage before controlled discharge to the environment. If the Site was maintained at the current ground level, the temporary storage requirement for surface water runoff generated on Site during a high return period rainfall event would be restricted to the maximum incremental change between uncontaminated runoff generated pre development and uncontaminated runoff generated post development. The additional volume of runoff likely to be created following the development of the Site could then be calculated by subtracting the pre-development volume from the post development volume.

The amount of surface water runoff currently generated on Site is calculated to be 10,111 m^3 from a rainfall event with a 1% chance of occurring each year. The amount of surface runoff calculated to occur from a rainfall event with a 1% chance of occurring each year when the Site is operational is 20,481 m^3.

If the Site is lowered, there will be no reliance on drainage under gravity, therefore different surface water management would be required. Therefore, if the Site is to be lowered below current ground level 20,481 m^3 of temporary storage will be required for surface water runoff generated on Site during a rainfall event with a 1% chance of occurring each year.

If the Site were to remain at its current ground level 10,370 m^3 of additional temporary storage would be required for surface water runoff generated on Site during a rainfall event with a 1% chance of occurring each year.

Groundwater Flooding

There is potential for groundwater inflow to the Site to cause flooding during the excavation construction and operational phases if the pumping system fails. The groundwater flow to the Site is estimated to be between approximately 123 m^3/d and 246 m^3/d, similar to that occurring in the existing quarry located to the north of the Site.

It is considered that the volume of water generated from groundwater flooding would be significantly less than that generated through pluvial flooding. Therefore groundwater flooding would be managed by the surface water management systems proposed on Site.

6.20.3.2 Off-Site Flooding

Upper Lagoon will be designed to contain provision to store the worst case volume of water generated during a storm event (20,481 m^3), *i.e. with the Site lowered into the ground during a 1 in 100 year return period event plus an allowance for climate change.*

However, during periods of continued excessive rainfall; controlled overflow from Upper Lagoon can be discharged to the *'New Field Lagoon'*.

New Field Lagoon provides Blackwater Aggregates with a large surface water collection lagoon capable of storing up to 250,000 m^3 of water which will be used to supply the mineral washing and processing plant (in the short to mid term) and to create an interesting and diverse ecological habitat within the restoration plan (in the long term). The lagoon will have a piped overflow or outfall that will allow controlled discharge to the Bradwell Pond at a rate below the greenfield runoff rate.

6.20.3.3 Floodplain Storage

The Site is located outside of the floodplain of any significant watercourse which poses a risk of fluvial flooding, therefore no compensatory floodplain storage will be required for the proposed eRCF.

6.21 Surface Water Mitigation Proposals

The proposed developments are required to comply with the Environment Agency's Pollution Prevention Guidelines (EA PPG) which aim to provide advice on statutory responsibilities and good environmental practice. The EA PPGs detailed in Table 6-12 are considered to be essential in ensuring the development is designed with sensitivity to the receiving environment.

In addition to complying with the EA PPGs detailed in Table 6-12 and referring to the 10-point checklist, *"Is your site right?"*, the following surface water monitoring mitigation proposals are made:

- A monitoring procedure will be put in place from the excavation phase onwards to ensure that all tanks and pipelines are maintained to ensure the risk of leaks and spills is reduced;
- Surface water runoff and treated process water will be stored on Site in the Upper Lagoon;
- The surface water drainage system and Upper Lagoon will be designed with a temporary storage in accordance with the calculations in Section 6.20.3;
- Upper Lagoon will be used for the temporary storage of surface water and runoff, and will provide a constant supply of water to the eRCF. During periods of prolonged rainfall, Upper Lagoon will have the facility for overflow to 'New Field Lagoon'. 'New Field Lagoon' will in turn overflow to the Bradwell Pond in line with the existing permitted scheme of restoration for Bradwell Quarry. The discharge will be in line with the existing arrangements deemed to be acceptable by the Environment Agency;
- Upper Lagoon will provide a suitable location for surface water quality monitoring. It will also allow for attenuation of flows and settlement of sediment before discharge to New Field Lagoon and Bradwell Pond at a rate deemed to be acceptable by the Environment Agency;
- Upper Lagoon will be used to collect runoff from the roofs of eRCF buildings and used within the eRCF process; and
- Permeable paving will be provided where possible.

Table 6-12: EA PPGs Relevant to the Scheme

EA PPG	Title
1	General Guide To The Prevention Of Pollution
2	Above Ground Oil Storage Tanks
3	The Use And Design Of Oil Separators in Surface water drainage systems
4	Treatment and disposal of sewage where no foul sewer is available
6	Working At Construction And Demolition Sites
8	Safe Storage And Disposal Of Used Oils
13	Vehicle Washing and Cleaning
18	Managing firewater and major spillages
21	Pollution Incident Response Planning
22	Dealing With Spillages On Highways
26	Storage and Handling of Drums and Intermediate Bulk Containers
27	Installation, decommissioning and Removal of Underground Storage Tanks

6.22 Residual Surface Water Impacts

Following the implementation of the mitigation proposals the following residual impacts to surface water result from the proposed eRCF:

6.22.1 Surface Water Hydrology and Flood Risk

The eRCF will have no significant residual impact to the surface water hydrology. Discharge of water from Upper Lagoon to 'New Field Lagoon' and ultimately Bradwell Pond will require a new discharge consent. The regulation and monitoring of the discharge will ensure that the impact of the discharge quantity is acceptable.

6.22.2 Surface Water Quality

The proposed eRCF will have no significant residual impact to the surface water quality. Discharge of water from Upper Lagoon to 'New Field Lagoon' and ultimately Bradwell Pond will require a new discharge consent. The regulation and monitoring of the discharge will ensure that the impact of the discharge quality is acceptable.

6.23 Surface Water Summary

The surface water assessment has identified the likely impacts on surface water hydrology and surface water quality resulting from the proposed eRCF at Rivenhall Airfield. The significant issues that have arisen from the surface water impact assessment are as follows:

- The surface water quality is at risk of pollution from spills or leaks of fuel or oil from Site plant and from increased quantities of suspended solids during the Sand and Gravel extraction and construction phases of the Site;
- During the operation of the eRCF, surface water quality is at risk of pollution from spills or leaks of fuel or oil from Site plant and from quantities of suspended solids arising from Site activities; and
- There is potential for on-Site flooding from surface water runoff generated on Site during a high return period rainfall event. The discharge must be controlled to ensure the final overflow to New Field Lagoon and Bradwell Pond will not cause on-Site or third party flooding.

The Site intends to follow the Environment Agency's Pollution Prevention Guidelines (EA PPG) stated in Table 6-12. These will provide some mitigation of the risks to surface water quality from pollution. In addition, a monitoring procedure will be put in place to ensure all tanks and pipelines are maintained.

Upper Lagoon will be designed with a temporary storage to accommodate up to 20,481 m^3 of water from the predicted 24 hour storm with a 1% chance of occurring each year, and incorporating a 10% climate change increase. Any overflow from Upper Lagoon will be discharged under control to New Field Lagoon, which will be able to ultimately discharge under control to Bradwell Pond at a rate deemed to be acceptable by the Environment Agency.

Upper Lagoon will be constructed early in the construction phase to provide flood storage and attenuation, as well as providing a useful supply of water throughout the construction of the eRCF.

6.24 References

6.24.1 Groundwater References

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British Geological Survey, 2000. The physical properties of minor aquifers in England and Wales. Hydrogeology Group Technical Report WD/00/04 Environment Agency R&D Publication 68.

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Huxley, C.L, Gill, T.S, Carroll, L.S and Thompson, A, 2004. Optimising the Efficiency of Recharge Features as a Mechanism for Mitigating the Impacts of Quarry Dewatering – Research Report. Report to the Minerals Industry Research Organisation and The Department of the Environment, Food and Rural Affairs. Symonds Group Ltd, East Grinstead.

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6.24.2 Surface Water References

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Golder Associates, 2006. Gent Fairhead & Co Limited Rivenhall Airfield Waste Management Facility Second Formal EIA Scoping Opinion Request. Report 04569328/250 Version B.0.

Golder Associates, 2008. Gent Fairhead & Co Limited Rivenhall Airfield Waste Management Facility Third Formal EIA Scoping Opinion Request. Report 07514690074 Version B.0.

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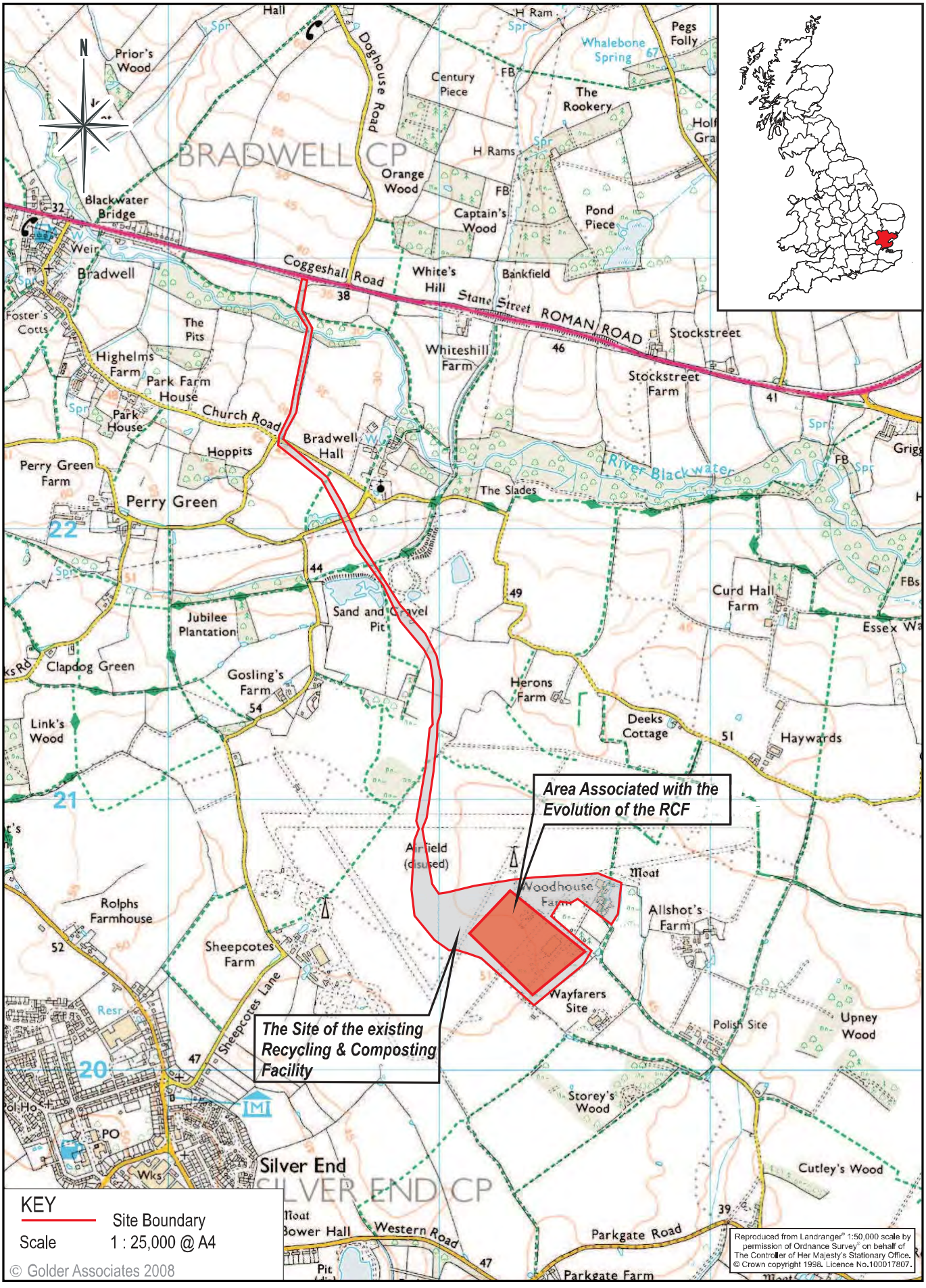
FIGURES



Date	12/08/2008
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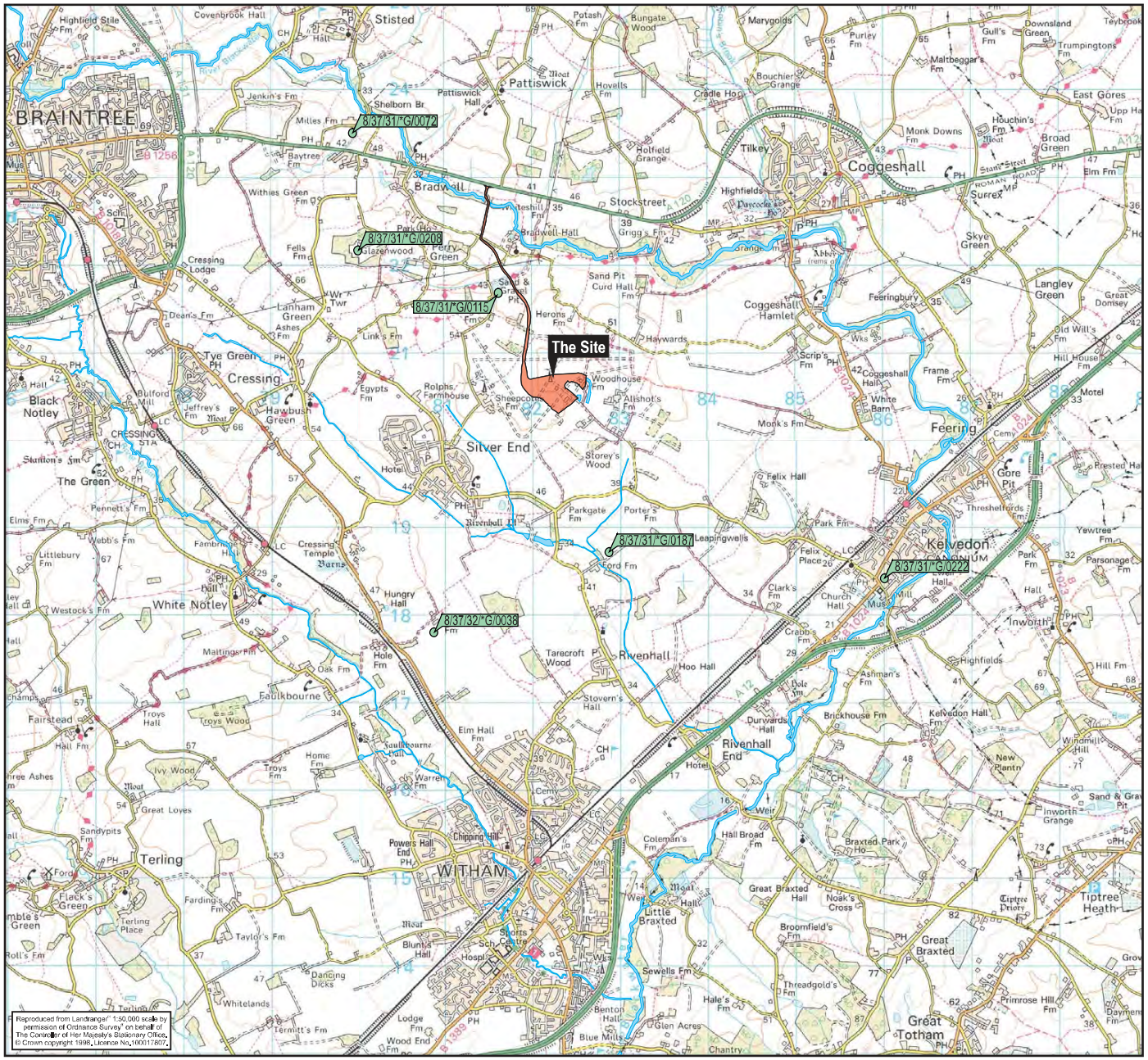
File No.	560067

Title

Site Location Plan
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 6-1



LEGEND

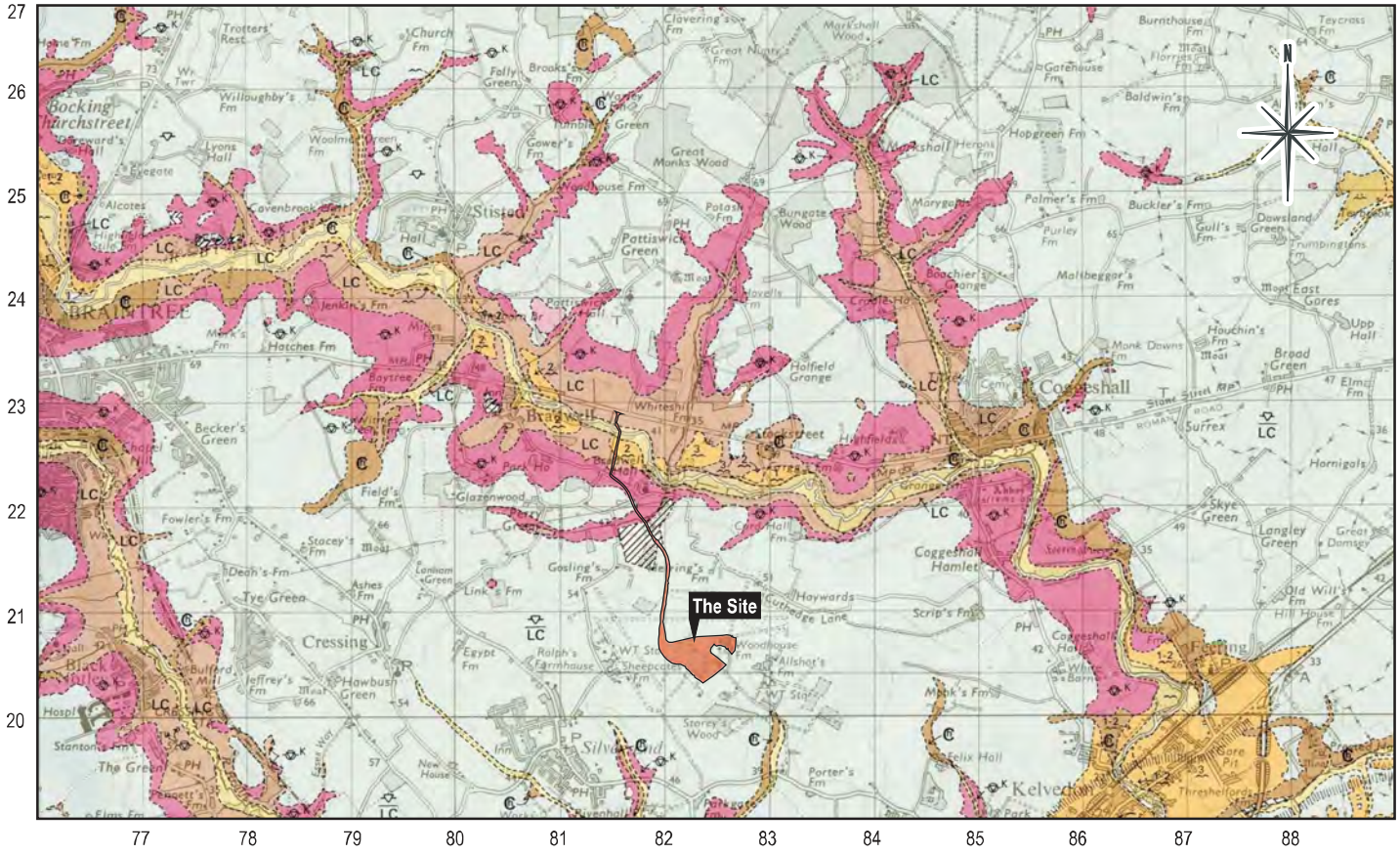
- 8/37/31"G/0187 — Groundwater abstraction licences
- Location of moat
- Location of pond
- Site boundary

Golder Associates

Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	5224973r5

Title
Local Hydology and Groundwater Abstractions
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 6-2



REFERENCE

Original data taken from:
Braintree Sheet 223 and Chelmsford Sheet 241,
Institute of Geological Sciences
(Natural Environmental Research Council).

LEGEND

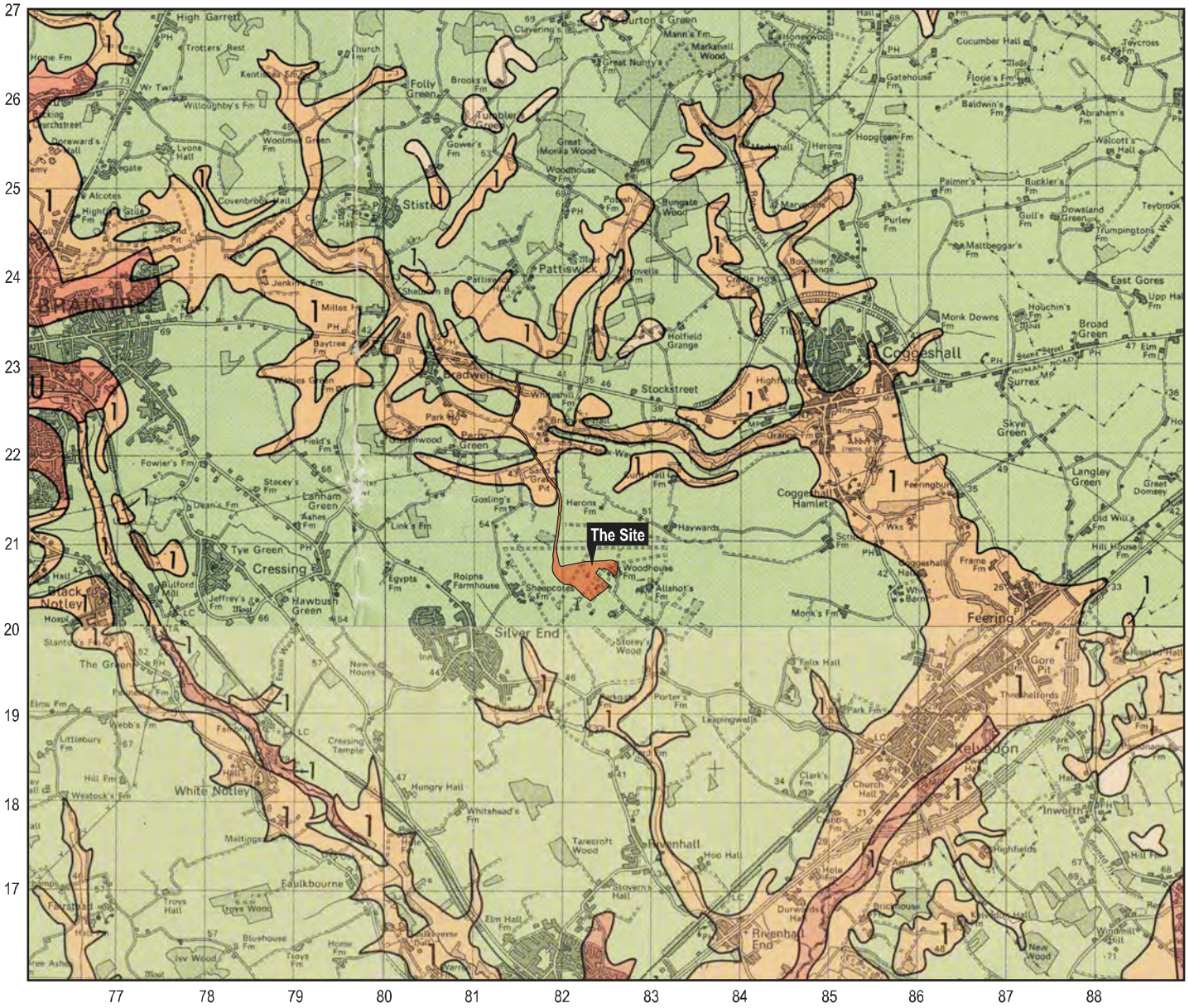
- Calcareous Tufa
- Peat
- Tidal Flat Deposits
- Storm Gravel Beach Deposits
- Estuarine Alluvium
- Older Estuarine Alluvium
- Alluvium
- Lacustrine Deposits
- 1st Terrace (Loam)
- 1st Terrace (Gravel)
- 2nd Terrace (Loam)
- 2nd Terrace (Gravel)
- 3rd Terrace (Gravel)
- 4th Terrace (Gravel)
- 5th Terrace (Gravel)
- Terrace (undifferentiated)
- Brickearth
- Lake Deposits
- Boulder Clay
- Glacial Sand and Gravel
- Landslip
- Head
- Head Brickearth
- River Terrace Deposits, Tq to Sth as numbered
- River Terrace Deposits, undifferentiated
- Head Gravel
- Glacial Silt
- Kesgrave Sands and Gravels
- Crag
- London Clay
- Lower London Tertiaries
- Upper Chalk
- Buried (drift-filled) Channel, where proved in detail
- Geological Boundary, Drift
- Geological Boundary, Solid
- Fault at Surface, crosshatch indicates Downthrow side
- Selected Water Well or Borehole
- Worked Area of Gravel or Brick clay
- Made ground

Scale : 1 : 50,000 @ A3

Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	5300249

Title
Geological Map of the Rivenhall Area
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure
6-3A



REFERENCE

Original data taken from Groundwater Vulnerability of the Thames Estuary, Sheet 40 and Groundwater Vulnerability of North Essex, sheet 32, National Rivers Authority, dated 1994

LEGEND

Geological Classes	Soil Classes
Major Aquifer (Highly Permeable)	High (H) 1,2,3,U
	Intermediate (I) 1,2
	Low
Minor Aquifer (Variably Permeable)	High (H) 1,2,3,U
	Low
Non-Aquifer (Negligibly Permeable)	

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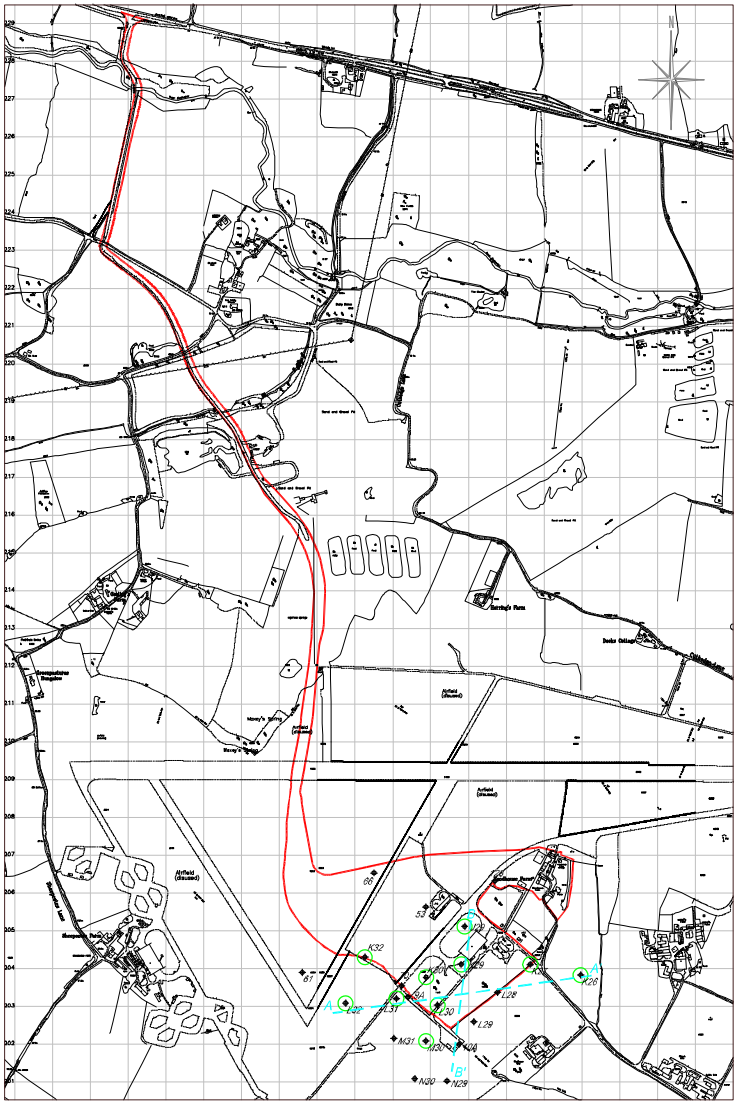
File No.	5224974r5

Title

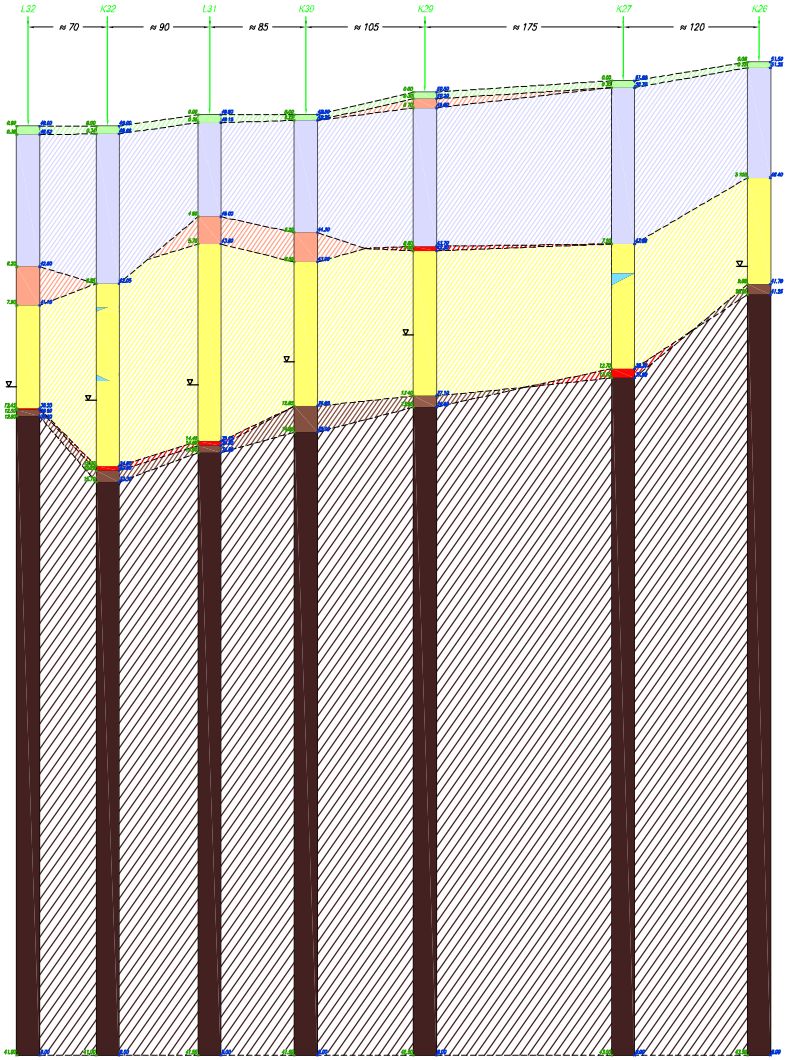
Groundwater Vulnerability Map of the Rivenhall Area
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 6-3B

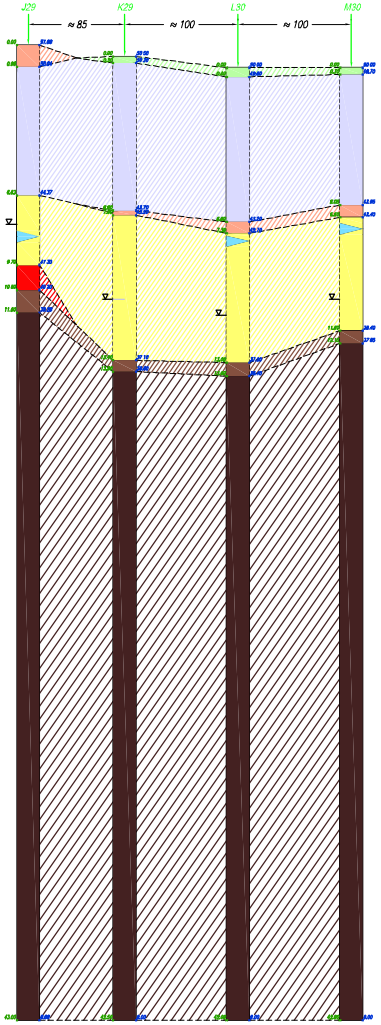


PLAN OF SECTIONS INDICATING BOREHOLES DRILLED IN & AROUND THE SITE SCALE 1:10,000

A-A' (EAST-WEST) GEOLOGICAL CROSS SECTION



B-B' (NORTH-SOUTH) GEOLOGICAL CROSS SECTION



LEGEND

KEY

- SITE BOUNDARY
- LINES OF SECTION
- BOREHOLES USED IN CROSS-SECTION

BOREHOLE KEY

- A26 - F40: RMC SHELL & AUGER BOREHOLES 1991
- 6 - 70, 1/86 - 22/86, 4A - 10A: RRC BOREHOLES
- 1/90 - 22/90: DK SYMES SHELL & AUGER BOREHOLES
- 82SW21: WAU BOREHOLES
- 1S- 30S: REDLAND BOREHOLES
- L1P1 - L19P19: CARDIFF UNIVERSITY RESEARCH AREA BOREHOLES
- NOTE: BOREHOLE KEY TAKEN FROM RMC DRAWING TL 82 DATED DEC. 1991

0 100 200 300 400 500m

MAP SCALE

LEGEND

KEY

- TOP SOIL / MADE GROUND
- BOULDER CLAY
- GRAVELLY CLAY
- KESGRAVE SAND & GRAVEL
- INTERBURDEN
- CLAY BOUNDED GRAVEL
- WEATHERED LONDON CLAY
- LONDON CLAY
- 50.20 LEVELS - mAOD
- 0.30 LEVELS - m BELOW GROUND LEVEL
- GROUNDWATER STRIKE
- J29 BOREHOLE LOCATIONS

VERTICAL SCALE

HORIZONTAL SCALE

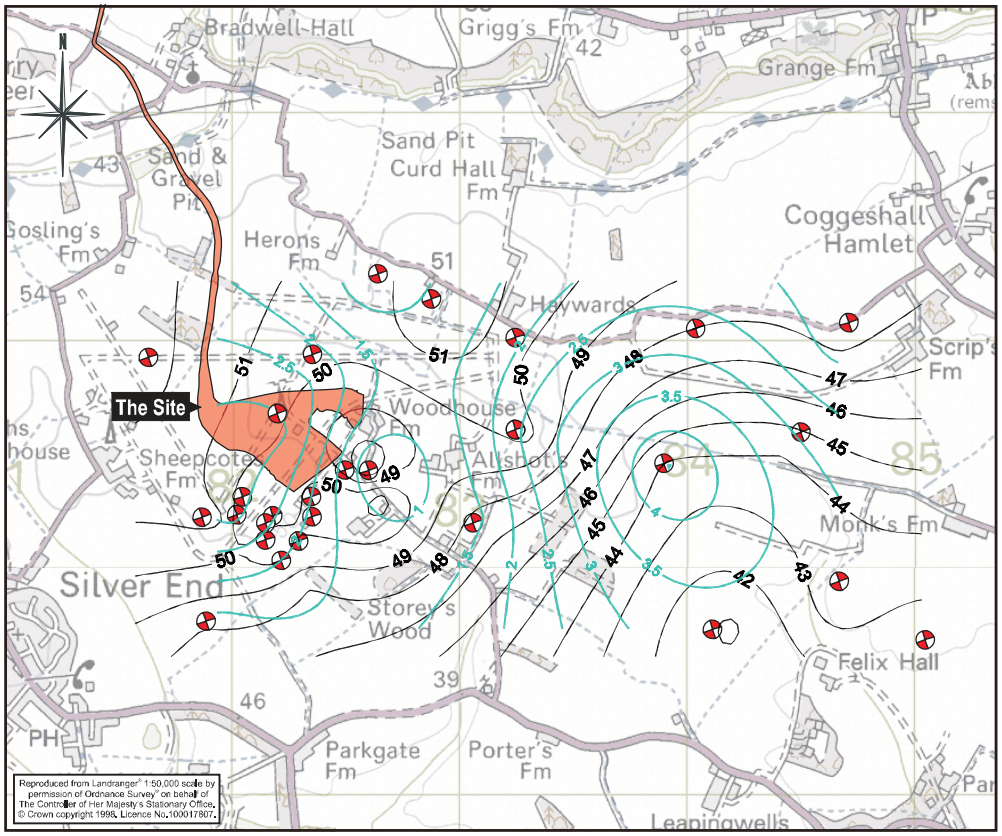
Golder Associates

Date	12/08/2008
Project No.	07514690074
Checked by	A J
File No.	5300254

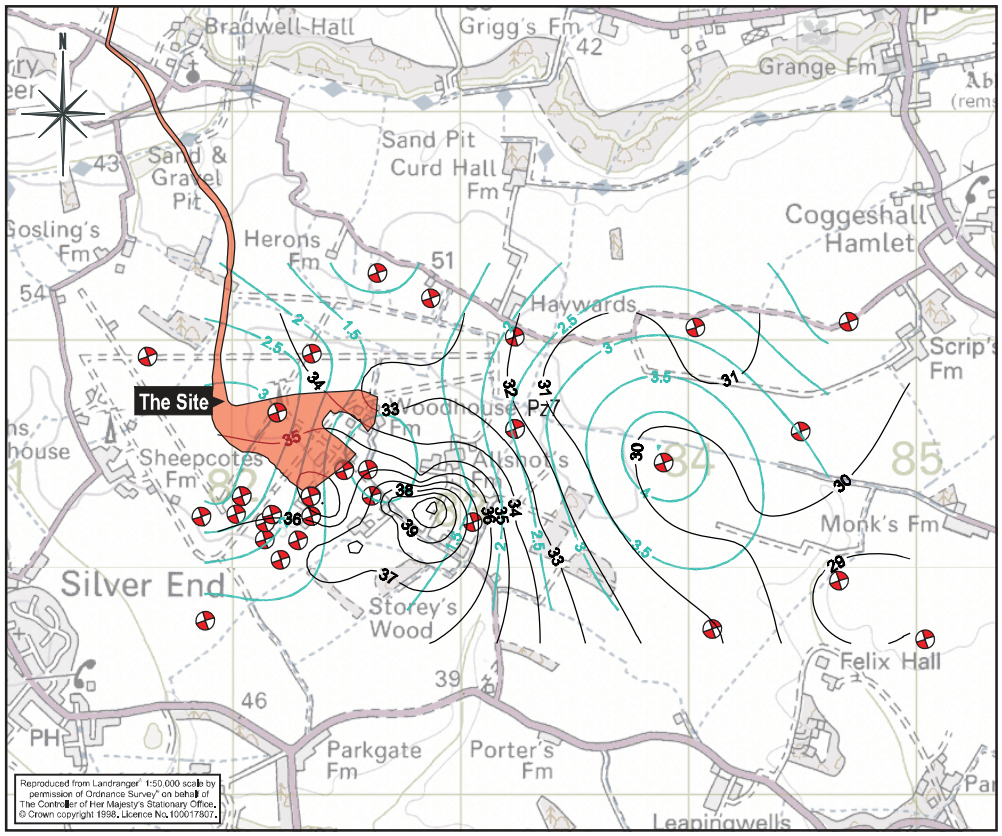
Title
Geological Cross Sections
Gent Fairhead & Co. Limited, rivenhall Airfield
Evolution of the Recycling & Composting Facility
Scale : As shown @ A2

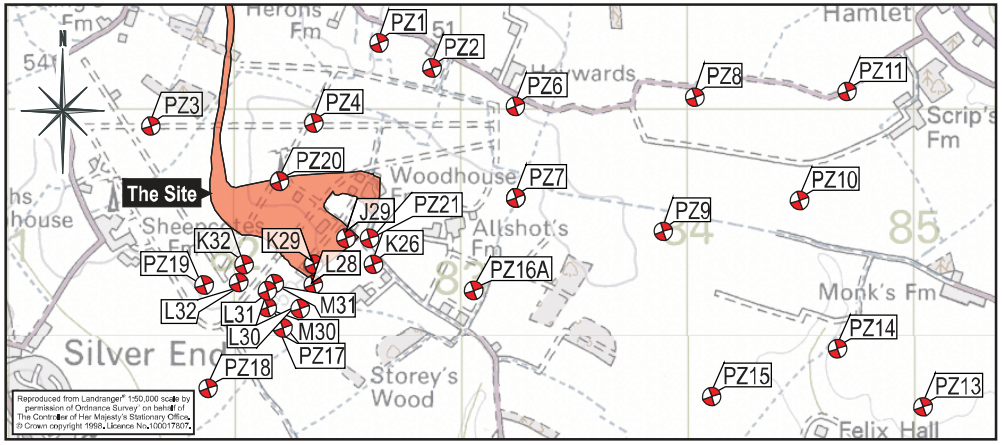
Figure
6-4

A. GROUND ELEVATION CONTOURS



B. LONDON CLAY SURFACE CONTOURS





LEGEND

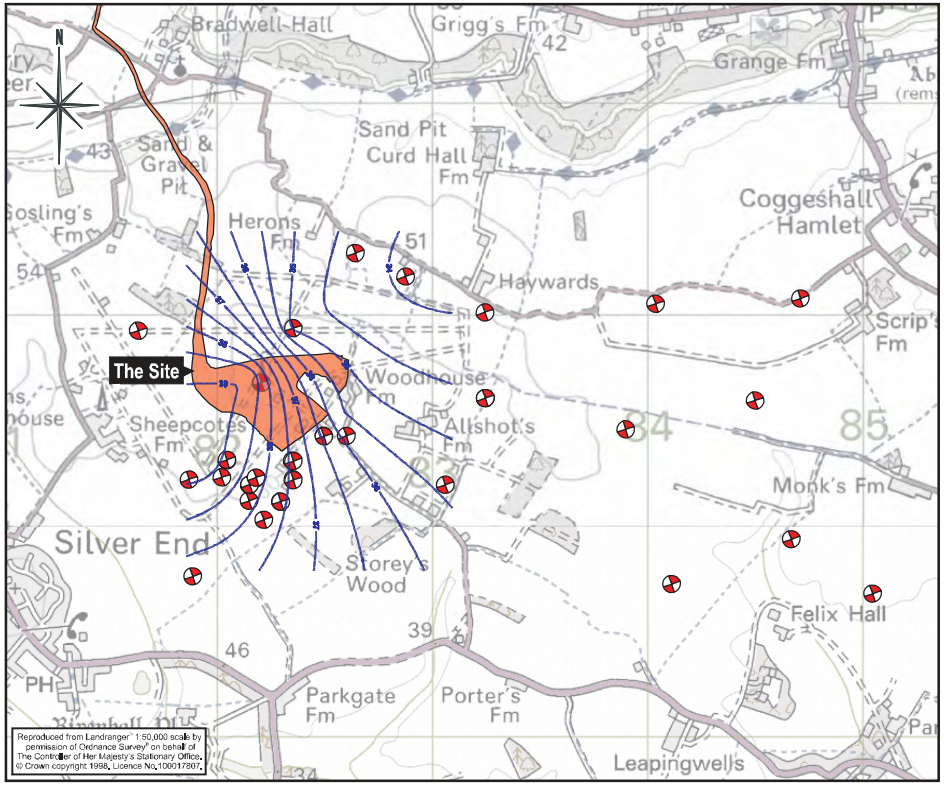
31	*Groundwater contours (m depth above London Clay)*
44	*Surface contours (mAOD)* *A - Ground elevation* *B - London Clay*
PZ14	*Location of boreholes used in construction of contour plots*

Date	12/08/2008
Project No.	07514690074
Created by	A.J.
File No.	5224975r5

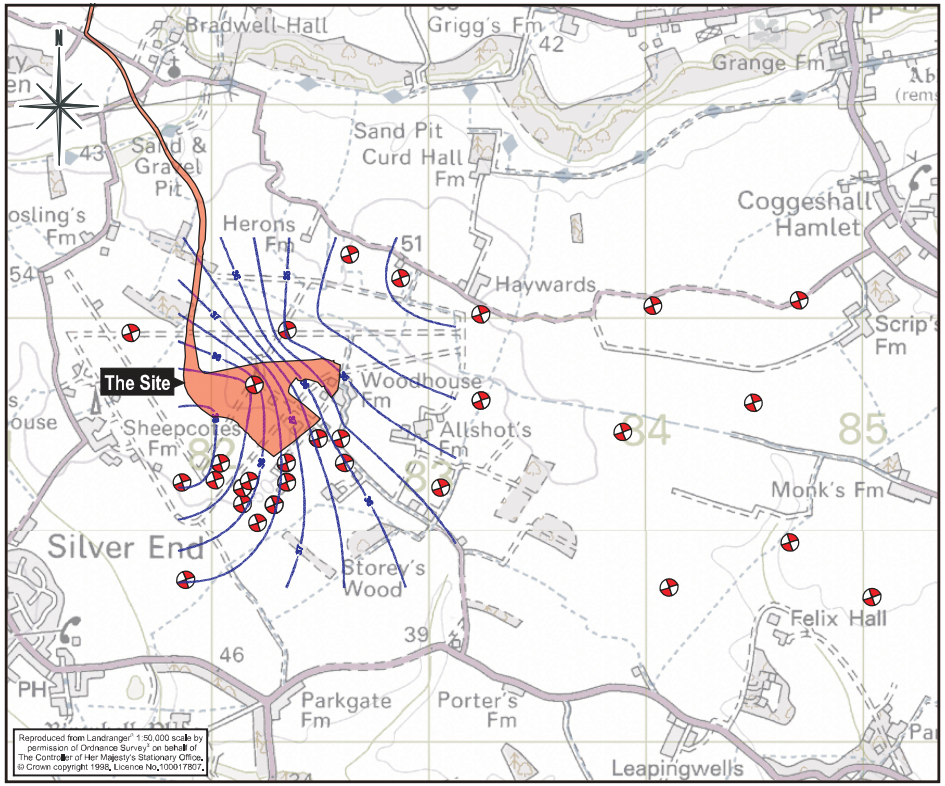
Title
Ground Elevation, London Clay Surface Elevation and Contours of Groundwater Depth
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

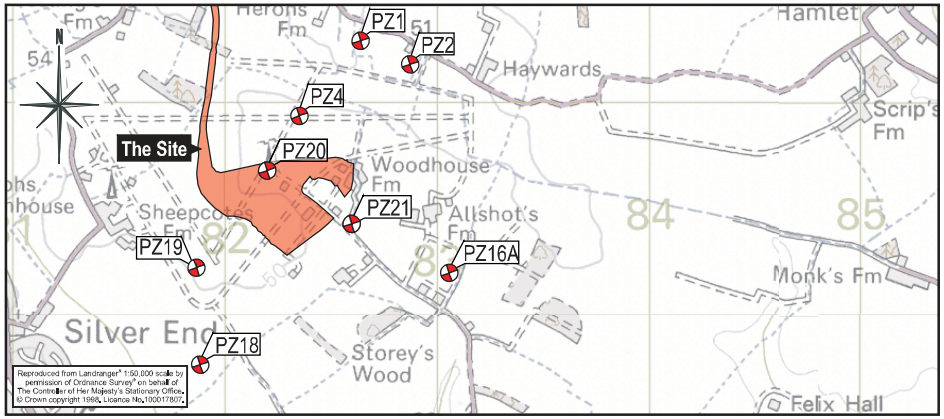
Figure 6-5

A. GROUNDWATER ELEVATIONS, JANUARY 2005



B. GROUNDWATER ELEVATIONS, AUGUST 2005





LEGEND

- Groundwater contours (mAOD)
- PZ14 — Location of boreholes used in construction of contour plots

Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	5224976r3

Title
Groundwater Elevation Contours
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure
6-6

LEGEND

- 8/37/32/*S/0032 — Surface Water Abstraction Licences
- SWF(37010) — Surface Water Flow Monitoring Points (Environment Agency)
- SWQ — Surface Water Quality Monitoring Points (Environment Agency)
- Location of Moat
- Location of Pond
- Site Boundary

Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	5224971r4

Title: *Local Hydrology and Surface Water Abstractions (1:45,000) Gent Fairhead & Co. Limited, Rivenhall Airfield Evolution of the Recycling & Composting Facility*

Figure 6-7

LEGEND
Flooding from rivers or sea without defences
Extent of extreme flood

NOTES

Original map taken from the Environment Agency website.

Date	12/08/2008
Project No.	07514690074
Created by	A.J
File No.	5224995r2

Title

Environment Agency Flood Zones
Gent Fairhead & Co. Limited, Rivenhall Airfield
Evolution of the Recycling & Composting Facility

Figure 6-8

APPENDICES

APPENDIX 6-1

LICENSED SURFACE WATER AND GROUNDWATER ABSTRACTION AND DISCHARGE CONSENTS

Report Title ABSTRACTION LICENCE SUMMARY BY MANAGEMENT UNIT / REPORTING UNIT

Short Name AR251R

PARAMETERS	VALUES	PARAMETERS	VALUES
USER	AHOWARD		
REPORT TYPE	SUMMARY	SORT BY	LIC_NO
DESTINATION TYPE	Preview	DESTINATION NAME	
REQUIRED DATE FROM	31/10/2005	REQUIRED DATE TO	
MANAGEMENT UNIT		REPORTING UNIT	EASTERN AREA
LICENCE NO	ALL	WATER ACT 2003 LICENCE TYPE	ALL
LICENCE HOLDER NAME	ALL		
CONDITIONS ON LICENCES	ALL	AGREEMENTS	ALL
SOURCE OF SUPPLY	ALL	SOS TYPE	ALL
CRITICALITY CLASS	ALL	POINT CATEGORY	ALL
PURPOSE	ALL	POINT TYPE	ALL
	ALL		
	ALL		
RANGE SEARCH BY ANNUAL QTY	NONE DEFINED		
RANGE SEARCH BY DAILY QTY	NONE DEFINED		
RADIAL SEARCH	NGR TL 823 205	DISTANCE 5.0 km	
SQUARE SEARCH	NONE DEFINED		

Warning: The figures shown on this report do not take account of any authorised quantity restrictions that may exist between linked licences or within a licence (See the conditions section of the report for this information)

Licence No: 8/37/31/*G/0072 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	31/05/1999		N	N

Licence Holder
38442 A & B HAYES FARMS
66314 KILLIGREWS
MARGARETTING
ESSEX
CM4 0EZ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : SM: All licences <20m3/day
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
General Farming & Domestic
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	5454	m3	Usability:	Legal	Conditions Exist: No
Daily Qty:	18	m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:		m3	Usability:		
Inst Qty:		l/s	Usability:		

Local Name	Primary Type	Secondary Type	Category
3 WELLS AT MILLES FARM,STISTED	Groundwater	Well	Single Point

NGR1:TL 798 236 4.0km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0115 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
103	0	CURR	01/01/2001		Y	Y

Licence Holder
41024 BLACKWATER AGGREGATES
69194 BRADWELL QUARRY
CHURCH ROAD
BRADWELL
ESSEX
CM77 8EP

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Mineral Products
Make-Up or Top Up Water
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	47000 m3	Usability:	Legal
Daily Qty:	245 m3	Usability:	Legal
Hourly Qty:	68.2 m3	Usability:	Legal
Inst Qty:	19 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name
SAND AND GRAVELS AT BRADWELL,ESSEX
NGR1:TL 8179 2172 1.3km NGR2: NGR3: NGR4:

Primary Type: Groundwater
Secondary Type: Catchpit
Category: Single Point

Purpose: Industrial, Commercial and Public Services - Mineral Products
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	47000 m3	Usability:	Legal
Daily Qty:	245 m3	Usability:	Legal
Hourly Qty:	68.2 m3	Usability:	Legal
Inst Qty:	19 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name
SAND AND GRAVELS AT BRADWELL,ESSEX
NGR1:TL 8179 2172 1.3km NGR2: NGR3: NGR4:

Primary Type: Groundwater
Secondary Type: Catchpit
Category: Single Point

Licence No: 8/37/31/*G/0187 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1993		Y	Y

Licence Holder
32509 J R PEARCE
57941 BROCKHILL FARM
WICKFORD
ESSEX

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	14000 m3	Usability:	Legal	Conditions Exist:	No
Daily Qty:	330 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	13.68 m3	Usability:	Derived		
Inst Qty:	3.8 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
SIX WELLPOINTS - RIVENHALL	Groundwater	Wellpoints	Single Point

NGR1:TL 828 187 1.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0208 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/02/1998		Y	Y

Licence Holder
32515 P T TYRIE
57955 GLAZENWOOD HOUSE
BRADWELL
BRAINTREE
ESSEX
CM7 8ET

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Amenity - Industrial/Commercial/Energy/Public Services
Make-Up or Top Up Water
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	5000 m3	Usability:	Legal
Daily Qty:	20 m3	Usability:	Legal
Hourly Qty:	2 m3	Usability:	Legal
Inst Qty:	.5 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name	Primary Type	Secondary Type	Category
BOREHOLE AT BRADWELL	Groundwater	Borehole	Single Point

NGR1:TL 800 222 2.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0222 Orig Application: EN1913 Expiry Date: 31/07/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	01/08/2004		Y	Y

Licence Holder
43882 TOTAL BUTLER
72274 COUNTY HOUSE
BAYSHILL ROAD
CHELTENHAM
GLOUCESTERSHIRE
GL50 5LY

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Environmental - Other Environmental Improvements
Pollution Remediation
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	36500 m3	Usability:	Legal	Conditions Exist:	No
Daily Qty:	100 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	5 m3	Usability:	Legal		
Inst Qty:	1.2 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
8 BOREHOLES AT KELVEDON OIL DEPOT	Groundwater	Borehole	Single Point

NGR1:TL 860 185 4.2km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0013 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
102	0	CURR	01/04/2003		Y	Y

Licence Holder
45642 S & K BUTLER
74394 BAYTREE FARM
COGGESHALL ROAD
STISTED
BRAINTREE
ESSEX
CM77 8AE

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	3000 m3	Usability:	Legal
Daily Qty:	100 m3	Usability:	Legal
Hourly Qty:	13.6 m3	Usability:	Legal
Inst Qty:	3.6 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name	Primary Type	Secondary Type	Category
BAYTREE FARM, STISTED.	Surfacewater	River / Stream	Reach

NGR1:TL 786 229 4.4km NGR2:TL 798 232 3.7km NGR3: NGR4:

Licence No: 8/37/31/*S/0033 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
102	0	CURR	20/03/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/3 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	327.3 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	13.6 m3	Usability:	Legal		
Inst Qty:	3.8 l/s	Usability:	Derived		

Local Name	Primary Type	Secondary Type	Category
FEERING BURY, KELVEDON	Surfacewater	River / Stream	Reach

NGR1:TL 853 215 3.2km NGR2:TL 865 211 4.2km NGR3: NGR4:

Licence No: 8/37/31/*S/0052 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	23/02/2001		Y	Y

Licence Holder
39343 R & D BUNTING
67299 HIGHFIELDS FARM
KELVEDON
ESSEX
CO5 9BJ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	2270 m3	Usability:	Legal
Daily Qty:	382 m3	Usability:	Legal
Hourly Qty:	54.72 m3	Usability:	Derived
Inst Qty:	15.2 l/s	Usability:	Legal

Conditions Exist: Yes
Agreements Exist: Yes

Local Name	Primary Type	Secondary Type	Category
HOLE FARM, RIVENHALL	Surfacewater	River / Stream	Reach

NGR1:TL 850 169 4.5km NGR2:TL 854 172 4.5km NGR3: NGR4:

Licence No: 8/37/31/*S/0071 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	1	CURR	31/07/2000		Y	Y

Licence Holder
38442 A & B HAYES FARMS
66314 KILLIGREWS
MARGARETTING
ESSEX
CM4 0EZ

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty: 7000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 68 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 2.8 m3 Usability: Derived
Inst Qty: l/s Usability:

Local Name	Primary Type	Secondary Type	Category
MILLES FARM 1, STISTED - POND	Surfacewater	River / Stream	Reach

NGR1:TL 794 241 4.6km NGR2:TL 798 241 4.4km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty: 7000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 68 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: m3 Usability:
Inst Qty: l/s Usability:

Local Name	Primary Type	Secondary Type	Category
MILLES FARM 2, STISTED-R.BLACK	Surfacewater	River / Stream	Reach

NGR1:TL 796 242 4.6km NGR2:TL 806 231 3.1km NGR3: NGR4:

Licence No: 8/37/31/*S/0088 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1995		Y	Y

Licence Holder
32807 R GOODWIN & SON
59007 ASHMANS FARM
KELVEDON
COLCHESTER
ESSEX
CO5 9BT

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	13600 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	382 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	16 m3	Usability:	Legal	
Inst Qty:	4.42 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT KELVEDON	Surfacewater	River / Stream	Single Point

NGR1:TL 855 173 4.5km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0127 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	01/01/1999		Y	Y

Licence Holder
32855 R M C AGGREGATES (EASTERN COUNTIES) LTD
60099 5 GUARDIAN ROAD
NORWICH
NORFOLK
NR5 8PB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Mineral Products
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	90900 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	9820 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	410.4 m3	Usability:	Derived	
Inst Qty:	114 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R BLACKWATER, COGGESHALL.	Surfacewater	River / Stream	Single Point

NGR1:TL 829 221 1.7km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0128 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/10/1997		Y	Y

Licence Holder
32463 BRAINTREE GOLF CLUB LTD
58019 KINGS LANE
STISTED
BRAINTREE
ESSEX
CM7 8DA

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Golf courses
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	1400 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	110 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	14.4 m3	Usability:	Derived	
Inst Qty:	4 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R BLACKWATER AT STISTED	Surfacewater	River / Stream	Single Point

NGR1:TL 797 243 4.6km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0169 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	1	CURR	02/02/1999		Y	Y

Licence Holder
32805 R A BRICE & PARTNERS
58983 ROSE COTTAGE
RIVENHALL END
WITHAM
ESSEX
CM8 3EZ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	51000 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	6912 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	95.76 m3	Usability:	Derived	
Inst Qty:	26.6 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R. BLACKWATER, ROSE COTTAGE	Surfacewater	River / Stream	Single Point

NGR1:TL 849 166 4.7km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0172 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	2	CURR	02/10/1987		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	2270 m3	Usability:	Legal
Daily Qty:	382 m3	Usability:	Legal
Hourly Qty:	54.72 m3	Usability:	Derived
Inst Qty:	15.2 l/s	Usability:	Legal

Conditions Exist: Yes
Agreements Exist: Yes

Local Name	Primary Type	Secondary Type	Category
R. BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 864 209 4.1km NGR2:TL 863 195 4.1km NGR3: NGR4:

Licence No: 8/37/31/*S/0178 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/06/1989		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	45460 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3600 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	149.76 m3	Usability:	Derived		
Inst Qty:	41.6 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Single Point

NGR1:TL 861 214 3.9km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	45460 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3600 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	149.76 m3	Usability:	Derived		
Inst Qty:	41.6 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Single Point

NGR1:TL 861 214 3.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0212 Orig Application: Expiry Date: 31/10/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
2	1	CURR	25/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	3456 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	144 m3	Usability: Legal	
Inst Qty:	40 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	3456 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	144 m3	Usability: Legal	
Inst Qty:	40 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Licence No: 8/37/31/*S/0212 Orig Application: Expiry Date: 31/10/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
2	1	CURR	25/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3456 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	144 m3	Usability:	Legal		
Inst Qty:	40 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3456 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	144 m3	Usability:	Legal		
Inst Qty:	40 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Licence No: 8/37/31/*S/0213 Orig Application: Expiry Date: 30/09/2008
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	24/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? :

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	12520 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	382 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	54.7 m3	Usability:	Legal	
Inst Qty:	15.2 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Licence No: 8/37/31/*S/0215 Orig Application: Expiry Date: 31/03/2010
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	21/08/2000		Y	Y

Licence Holder
36922 RMC AGGREGATES (EASTERN COUNTIES) LTD
60099 5 GUARDIAN ROAD
NORWICH
NORFOLK
NR5 8PB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Extractive
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	15000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	280 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	m3	Usability:			
Inst Qty:	8 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT COGGESHALL, ESSEX	Surfacewater	River / Stream	Single Point

NGR1:TL 8343 2223 2.1km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0217 Orig Application: Expiry Date: 08/06/2013
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	13/05/2002		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58059 FEERINGBURY
COGGESHALL
COLCHESTER
ESSEX

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost
Abs Period Start:1/10 Abs Period End: 8/6 Time Ltd Start: Time Ltd End:

Annual Qty:	82500 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	10303 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	792 m3	Usability: Legal	
Inst Qty:	220 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER IN FEERINGBURY, KELVEDON	Surfacewater	River / Stream	Single Point

NGR1:TL 8604 2148 3.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0221 Orig Application: Expiry Date: 31/03/2025
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	1	CURR	22/07/2003		Y	Y

Licence Holder
32883 FEERINGBURY HOLDINGS
59179 BURY LODGE
FEERINGBURY FARM
COGGESHALL ROAD
FEERING
COLCHESTER
ESSEX
CO5 9RB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	180000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	2428 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	102 m3	Usability:	Legal		
Inst Qty:	28.1 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERINGBURY FARM	Surfacewater	River / Stream	Single Point

NGR1:TL 8635 2146 4.2km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*G/0038 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1997		Y	N

Licence Holder
32799 STACEY FARMS
58141 WHITEHEADS FARM
CRESSING ROAD
WITHAM
ESSEX
CM8 1RL

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
General Farming & Domestic
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	460 m3	Usability:	Legal	Conditions Exist: No
Daily Qty:	20 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	m3	Usability:		
Inst Qty:	l/s	Usability:		

Local Name	Primary Type	Secondary Type	Category
WELL AT WHITEHEADS FARM	Groundwater	Well	Single Point

NGR1:TL 809 179 3.0km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*S/0032 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/04/1996		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty: 91000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 1123 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 46.8 m3 Usability: Derived
Inst Qty: 13 l/s Usability: Legal

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT FAULKBOURNE.	Surfacewater	River / Stream	Single Point

NGR1:TL 801 173 3.9km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty: 91000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 1123 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 46.8 m3 Usability: Derived
Inst Qty: 13 l/s Usability: Legal

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT WITHAM.	Surfacewater	River / Stream	Single Point

NGR1:TL 807 163 4.5km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Licence No: 8/37/32/*S/0032 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/04/1996		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	91000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	1123 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	46.8 m3	Usability:	Derived		
Inst Qty:	13 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT WHITE NOTLEY.	Surfacewater	River / Stream	Single Point

NGR1:TL 784 188 4.3km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*S/0042 Orig Application: EN2001 Expiry Date: 31/03/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	10/06/2005		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	40000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	990 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	66 m3	Usability:	Legal		
Inst Qty:	18.33 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT FAULKBOURNE	Surfacewater	River / Stream	Reach

NGR1:TL 7943 1787 3.9km NGR2:TL 8107 1610 4.6km NGR3: NGR4:

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* END OF REPORT *
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Report Title **ABSTRACTION LICENCE SUMMARY BY MANAGEMENT UNIT / REPORTING UNIT**

Short Name **AR251R**

REPORT SUMMARY

Report Summary for report Date : 31/10/2005

Total Number of Licences	Sum of Hourly Quantities	Sum of Daily Quantities	Sum of Annual Quantities
23	2863.700 m3	58305.300 m3	1141444.000 m3

Discharge Consents

Consent Number	Version	Issue Date	Effective Dat	Review Date	Long Name	DS_ADD1	DS_ADD2	DS_ADD3	DS_ADD4	DS_PCODE	DS_NGR	EASTING	NORTHING	DS_TYPE	REGION
ASENF16261	1	29-MAR-04	29-MAR-04	29-MAR-08	COGGESHALL TPS	COGGESHALL			BRAINTREE		TL854702251	585470	222510	Sewerage Network - Pumping Station - water comp	AN
AW2NF151	3	17-DEC-04	01-JAN-06	01-JAN-10	COGGESHALL STW	COGGESHALL			ESSEX		TL858032127	585803	221271	Sewage Disposal Works - water company	AN
AW2NF811	3	29-JUN-05	01-JAN-06	29-JUN-09	WHITE NOTLEY STW		WHITE NOTLEY	WITHAM	ESSEX		TL789311833	578931	218333	Sewage Disposal Works - water company	AN
AW2NFC174	1	29-MAY-63	29-MAY-63		EAST ST COGGESHALL	ESSEX					TL854502263	585450	222630	Sewage Disposal Works - water company	AN
AW2NFC175	1	29-MAY-63	29-MAY-63		EAST ST COGGESHALL	ESSEX					TL854502263	585450	222630	Sewage Disposal Works - water company	AN
AW2NFC183	1	29-MAY-63	29-MAY-63		STATION RD KELVEDON	ESSEX					TL863301936	586330	219360	Sewage Disposal Works - water company	AN
AW2NFC185	1	29-MAY-63	29-MAY-63		STATION RD KELVEDON	ESSEX					TL863301936	586330	219360	Sewage Disposal Works - water company	AN
AW2NFE02454	5	26-MAR-04	01-JAN-06	26-MAR-08	RIVENHALL END STW						TL842891641	584289	216417	Sewage Disposal Works - water company	AN
AW2NFE02579	1	28-SEP-79	28-SEP-79		ESSEX C.C. DEPOT	COGGESHALL	ESSEX				TL851202250	585120	222500	Sewage Disposal Works - water company	AN
AW2NFE05179	1	18-MAR-80	18-MAR-80		OUTLET AT GREY'S MILL	MALDON ROAD	KELVEDON	ESSEX.		CO5 9BD	TL860701817	586070	218170	Sewage Disposal Works - water company	AN
AW2NFE09072	5	31-MAR-03	31-DEC-05	27-OCT-93	STISTED STW	WATER LANE	SISTED	BRAINTREE		NR11 8	TL802702439	580270	224390	Sewage Disposal Works - water company	AN
AW2NFE11784	1	11-MAY-87	11-MAY-87		CRESSING VILLAGE PS	CRESSING	NR BRAINTREE	ESSEX.			TL794002050	579400	220500	Sewage Disposal Works - water company	AN
AW2NFE11884	1	13-MAY-87	13-MAY-87		WHITE NOTLEY SPS	WHITE NOTLEY	WITHAM	ESSEX.			TL787001840	578700	218400	Sewage Disposal Works - water company	AN
GWELF50095	1	22-MAY-00	01-APR-99	01-APR-03	PATTISWICK HALL FARM	PATTISWICK HALL	BRAINTREE	ESSEX	.	CM7 8BH	TL814502417	581450	224170	Arable Farming	AN
GWELF50108	1	23-MAY-00	01-APR-99	01-APR-03	CURD HALL	COGGESHALL	COLCHESTER	ESSEX	.	CO6 1PA	TL849002110	584900	221100	Arable Farming	AN
GWELF50361	1	19-MAY-00	01-APR-99	01-APR-03	ROSE COTTAGE	RIVENHALL END	WITHAM	ESSEX	.	CM8 3EZ	TL842001630	584200	216300	Arable Farming	AN
GWELF50518	1	22-JAN-01	31-MAR-99	31-MAR-03	OAK FARM	FAULKBOURNE	WITHAM	ESSEX	.	CM8 1SE	TL792001760	579200	217600	Arable Farming	AN
PR2LFS03784	1	25-JUL-84	25-JUL-84		BRAMBLES	EAST END ROAD	BRADWELL-ON-SEA				TL800002300	580000	223000		AN
PR2LFS12078	1	29-DEC-78	29-DEC-78		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PR2LFS12676	1	28-SEP-76	28-SEP-76		BRAMBLES	EAST END ROAD	BRADWELL-ON-SEA				TL800002300	580000	223000		AN
PR2LFS13371	1	15-JUL-71	15-JUL-71		47 COLNE ROAD	COGGESHALL	ESSEX			CO6 1TD	TL850002200	585000	222000		AN
PR2LFS15870	1	09-SEP-70	09-SEP-70		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PR2NF238	1	23-JUN-86	23-JUN-86		IVY COTTAGE	LONG GREEN	CRESSING	ESSEX		CM7 8DL	TL780802187	578080	221870	Sewage disposal works - other	AN
PR2NF604	2	11-DEC-92	11-DEC-92		47 COLNE ROAD	COGGESHALL	ESSEX			CO6 1TD	TL854302383	585430	223830	Sewage disposal works - other	AN
PR2NF799	1	17-MAR-88	17-MAR-88		COLNE RD IND PARK	COGGESHALL	ESSEX				TL854002350	585400	223500	Undefined or Other	AN
PR2NF849	2	12-APR-04	12-APR-04	12-APR-08	BRADWELL AUTOPOINT	COGGESHALL ROAD	BRADWELL	BRAINTREE	ESSEX	CM7 8EB	TL810032302	581003	223021	Retail Filling Stations	AN
PR2NF850	1	13-MAY-88	13-MAY-88		BRADWELL AUTOPOINT	COGGESHALL RD	BRADWELL	BRAINTREE		CM7 8EB	TL810802300	581080	223000		AN
PR2NFE01676	1	22-APR-76	22-APR-76		HIGH STREET KELVEDON	ESSEX					TL860701850	586070	218500		AN
PR2NFE01678	1	06-APR-78	06-APR-78		CAR PARK KELVEDON STAT	KELVEDON	ESSEX				TL863201931	586320	219310		AN
PR2NFE05165	1	26-JUL-65	26-JUL-65		RAILWAY GARAGE	KELVEDON	COLCHESTER	ESSEX		CO5 9NR	TL864001930	586400	219300		AN
PR2NFE05671	2	02-MAR-92	02-MAR-92		FARM HILL HOUSE	KELVEDON	ESSEX			CO5 9PH	TL858002020	585800	220200	Sewage disposal works - other	AN
PR2NFE07270	1	09-JUL-70	09-JUL-70		APPLETREE FARM	CRESSING	BRAINTREE	ESSEX		CM7 8NY	TL788502040	578850	220400	Sewage disposal works - other	AN
PR2NFE08169	1	05-JUN-69	05-JUN-69		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PREAF02100	1	12-JAN-90	12-JAN-90		GLAZENWOOD	BRADWELL	BRAINTREE	ESSEX.			TL800002222	580000	222220	Sewage disposal works - other	AN
PRELF03007	1	22-AUG-90	22-AUG-90		ALLSHOTS FARM	KELVEDON	COLCHESTER	ESSEX		CO5 9DF	TL829702039	582970	220390	Sewage disposal works - other	AN
PRENF00356	2	15-JAN-92	15-JAN-92		RYE MILL HOUSE	RYE MILL LANE	FEERING	KELVEDON	ESSEX	CO5 9SB	TL867701996	586770	219960	Sewage disposal works - other	AN
PRENF00562	1	18-APR-89	18-APR-89		PREMISES AT THATCHED COTTAGE	SNIVELLERS LANE	KELVEDON				TL845601813	584560	218130	Sewage disposal works - other	AN
PRENF00719	2	14-JAN-92	14-JAN-92		MONKS FARM COTTAGES	PANTLINGS LANE	COGGESHALL RD	KELVEDON	ESSEX	CO5 9PG	TL852602028	585260	220280	Sewage disposal works - other	AN
PRENF03000	2	13-JAN-92	13-JAN-92		ASH BROOKS	BULFORD MILL LANE	BLACK NOTLEY	BRAINTREE	ESSEX	CM7 8NS	TL774502041	577450	220410	Sewage disposal works - other	AN
PRENF04059	2	09-DEC-92	09-DEC-92		SKYE GREEN COTTAGE		FEERING	COLCHESTER		CO5	TL871702202	587170	222020	Sewage disposal works - other	AN

PRENF04063	2	13-JAN-92	13-JAN-92		BARNS ADJACENT TO WARREN FARM	FAULKBOURNE	WITHAM	ESSEX			TL806601612	580660	216120	Sewage disposal works - other	AN
PRENF04417	2	17-JAN-92	17-JAN-92		WARREN FARM HOUSE	THE STREET	FAULKBOURNE				TL806601613	580660	216130	Sewage disposal works - other	AN
PRENF08114	1	08-JUL-92	08-JUL-92		NEW HOUSE BARN	CHURCH ROAD	CRESSING	ESSEX		CM7 8PF	TL799901959	579990	219590	Sewage disposal works - other	AN
PRENF08146	2	07-JUL-94	07-JUL-94		KENMIL 133/134	COGGESHALL ROAD	STISTED	BRAINTREE	ESSEX	CM7 8AB	TL784402346	578440	223460	Sewage disposal works - other	AN
PRENF08255	1	08-JUN-93	08-JUN-93		THE COMPASSES INN	COMPASSES ROAD	PATTISWICK	NR BRAINTREE		CM7 8BG	TL820302464	582030	224640	Sewage disposal works - other	AN
PRENF08558	1	21-SEP-93	21-SEP-93		MILL COTTAGE ABBEY MILL	COGGESHALL	COLCHESTER	ESSEX			TL856002215	585600	222150	Sewage disposal works - other	AN
PRENF08757	1	27-JAN-95	27-JAN-95		BRIDGEFOOT HOUSE	KELVEDON	COLCHESTER	ESSEX		CO5 9BE	TL860701800	586070	218000	Sewage disposal works - other	AN
PRENF10081	1	28-APR-95	28-APR-95		THE OLD RECTORY	MARKSHALL	COGGLESHALL	ESSEX		SS4 1NT	TL843902404	584390	224040	Sewage disposal works - other	AN
PRENF10592	1	10-SEP-96	10-SEP-96		BULFORD COTTAGE	BULFORD MILL LANE	CRESSING	BRAINTREE	ESSEX	CM7 8NS	TL774502038	577450	220380	Sewage disposal works - other	AN
PRENF10748	1	14-FEB-97	14-FEB-97		ALFA KENNELS	WATER LANE	STISTED	ESSEX		CM7 8AP	TL799802421	579980	224210	Sewage disposal works - other	AN
PRENF10774	1	28-FEB-97	28-FEB-97		RIVENHALL P STN & CAFE	RIVENHALL WAY	WITHAM	ESSEX			TL841801670	584180	216700	Sewage disposal works - other	AN
PRENF11225	1	30-JAN-98	30-JAN-98		SANDY HILL NURSERIES	COGGLESHALL ROAD	NR BRADWELL	BRAINTREE	ESSEX		TL798402326	579840	223260	Sewage disposal works - other	AN
PRENF11448	1	21-AUG-98	21-AUG-98		1 GLEBE COTTAGES	THE GREEN	WHITE NOTLEY	WITHAM	ESSEX	CM8 1RG	TL775701938	577570	219380	Sewage disposal works - other	AN
PRENF11672	1	12-AUG-99	21-MAY-99	21-MAY-03	RIVENHALL P STN & CAFE	RIVENHALL WAY	WITHAM	ESSEX			TL841801670	584180	216700	Sewage disposal works - other	AN
PRENF11780	1	18-AUG-99	13-JUL-99	13-JUL-03	GOSLINGS BARN	SHEEPCOTES LANE	BRADWELL		ESSEX	CM7 8ER	TL814002145	581400	221450	Sewage disposal works - other	AN
PRENF11918	1	18-APR-00	17-DEC-99	17-DEC-03	KELVEDON PARK (FORMER DURWARDS HA	LONDON ROAD	RIVENHALL		ESSEX	CM8 3HB	TL846401710	584640	217109	Sewage disposal works - other	AN
PRENF13275	1	21-AUG-00	24-AUG-00	24-AUG-04	BAILIFFS COTTAGE	FELIX HALL	KELVEDON		ESSEX	CO5 9DQ	TL851601902	585160	219020	Sewage disposal works - other	AN
PRENF13415	2	08-MAY-02	08-MAY-02	08-MAY-05	KELVEDON OIL DEPOT	14 HIGH STREET		KELVEDON	ESSEX	CO5 9AG	TL860371847	586037	218472	Undefined or Other	AN
PRENF13528	1	20-APR-01	16-MAR-01	16-MAR-05	FAULKBOURNE ESTATE	HILL FARMHOUSE	WITHAM		ESSEX		TL796201724	579620	217240	Sewage disposal works - other	AN
PRENF13570	1	08-JUN-01	08-JUN-01	08-JUN-05	LANHAMS FARM COTTAGE	CRESSING	BRAINTREE		ESSEX	CM7 8DQ	TL791902187	579190	221870	Sewage disposal works - other	AN
PRENF13692	1	13-SEP-01	19-JUL-01	19-JUL-05	BRIDGE FARM	NEW ROAD	KELVEDON		ESSEX		TL858601898	585860	218980	Sewage disposal works - other	AN
PRENF13822	1	03-JAN-02	13-DEC-01	13-DEC-05	ETIVE COTTAGE	FELIX HALL	KELVEDON		ESSEX	CO5 9DQ	TL850601902	585060	219020	Sewage disposal works - other	AN
PRENF13823	1	25-APR-02	01-OCT-01	01-OCT-05	ABBEY MILL HOUSE	ABBEY MILL LANE	COGGESHALL		ESSEX	CO6 1RD	TL855202215	585520	222150	Sewage disposal works - other	AN
PRENF13976	1	06-FEB-02	07-FEB-02	07-FEB-06	THE OLD RECTORY	PATTISWICK	BRAINTREE		ESSEX	CM7 4TW	TL819802434	581980	224340	Sewage disposal works - other	AN
PRENF13978	1	12-FEB-02	07-FEB-02	07-FEB-06	CRESSING LODGE	LONG GREEN	CRESSING	BRAINTREE	ESSEX	CM7 8DL	TL780202199	578020	221990	Sewage disposal works - other	AN
PRENF13988	1	25-FEB-02	19-FEB-02	19-FEB-06	PARKGATE FARMHOUSE	PARK ROAD	RIVENHALL	BRAINTREE	ESSEX	CM8 3PS	TL824801920	582480	219200	Sewage disposal works - other	AN
PRENF14039	1	20-MAR-02	11-MAR-02	11-MAR-06	THE OLD RECTORY	FAULKBOURNE	WITHAM		ESSEX	CM8 1SP	TL803901604	580390	216040	Sewage disposal works - other	AN
PRENF15441	1	03-FEB-03	03-FEB-03	03-FEB-07	THE BARN	RECTORY LANE	RIVENHALL	BRAINTREE	ESSEX	CM8 3HJ	TL823001679	582300	216790	Sewage disposal works - other	AN
PRENF15442	1	03-FEB-03	03-FEB-03	03-FEB-07	RICKSTONES FARM	RICKSTONES ROAD	RIVENHALL	BRAINTREE	ESSEX	CM8 3HQ	TL822701681	582270	216810	Sewage disposal works - other	AN
PRENF15715	1	13-MAY-03	16-APR-03	16-APR-07	BULFORD FARM	BULFORD MILL FARM	CRESSING	BRAINTREE	ESSEX	CM7 8NS	TL774182041	577418	220419	Sewage disposal works - other	AN
PRENF15963	1	29-AUG-03	29-AUG-03	29-AUG-07	THE CLOCK HOUSE	THE CLOCK HOUSE	KELVEDONN	KELVEDON	ESSEX	CO5 9DG	TL846291955	584629	219550	Sewage disposal works - other	AN
PRENF16008	1	10-SEP-03	10-SEP-03	10-SEP-07	119 WATER LANE	STISTED	STISTED	ESSEX	ESSEX	CM7 8AP	TL800672417	580067	224170	Sewage disposal works - other	AN
PRENF16122	1	10-NOV-03	10-NOV-03	10-NOV-07	POINTWELL MILL	POINTWELL LANE	COGGESHALL		ESSEX	CO6 1RH	TL853222152	585322	221522	Sewage disposal works - other	AN
PRENF16588	1	27-JUL-04	27-JUL-04	27-JUL-08	76 STOCK STREET	COGGESHALL			ESSEX	CO6 1NX	TL830752258	583075	222585	Sewage disposal works - other	AN
PRENF16861	1	16-FEB-05	16-FEB-05	16-FEB-09	AGRICULTURAL RESERVOIR SITE	FAULKEBOURNE FARI	WITHAM		ESSEX		TL813001720	581300	217200	Reservoir/Borehole Site	AN
PRENF16973	1	09-NOV-04	09-NOV-04	09-NOV-08	WHYLIE CLARKS COTTAGE	CRANES LANE	KELVEDON	KELVEDON	ESSEX		TL845251812	584525	218125	Sewage disposal works - other	AN
PRENF16998	1	19-NOV-04	19-NOV-04	19-NOV-08	HATWARDS FARM COTTAGE	CUT HEDGE LANE	COGGESHALL	COLCHESTER	ESSEX		TL831992113	583199	221131	Sewage disposal works - other	AN
PRENF19551	1	18-AUG-05	18-AUG-05	18-AUG-09	HATCHCROFT HOUSE	THE GREEN	WHITE NOTLEY	ESSEX	ESSEX	CM8 1RG	TL775741944	577574	219442	Sewage disposal works - other	AN

APPENDIX 6-2

RESPONSES TO REQUEST FOR SCOPING OPINION

ENVIRONMENT AGENCY

Our Ref : AE/2005/015880-1/1
Your Ref : DC/CMT/ESS/31/05/BTE/SPO

Date : 15 September 2005

CMT/ESS/31/05/BTE/SPO
58839

Claire Tomalin
Essex County Council
Planning Services Group
Town Hall. Chelmsford,
Essex
CM1 1QH

Dear Madam

REQUEST FOR SCOPING OPINION ON WASTE MANAGEMENT FACILITY. RIVENHALL AIRFIELD, BRAINTREE.

Thank you for consulting us on the request for a Scoping Opinion under the Town and Country Planning (Environmental Impact Assessment) Regulations 1999 in relation to the above development proposal. We apologize for the delay in responding. We have the following advisory comments on scoping matters, as well as informatives, which should be considered. if applicable. by the developer.

Scoping Issues

We agree. in principle, that the Environmental Statement should encompass the issues mentioned in the Scoping Report. However. there are a number of issues which we consider should also be addressed and these are discussed below. We have also enclosed a copy of the Environment Agency Guidance Note 'Scoping the environmental impacts of opencast mining and quarrying operations', which has been produced as guidance to developers for determining the content of an Environmental Impact Assessment. This should help both as an aide-memoire and checklist. The issues of concern for the Environment Agency are listed in Table D2. We have passed a copy of the Guidance Note to Golder Associates (UK) Limited.

Groundwater/hydrology

We understand that prior to the development of the proposed Waste Management Facility there will be a phased extraction of approximately 900.000 tonnes of sand and gravel and that this would lower the ground by around 7 metres. It seems that the facility will be constructed within this quarried area. It is important that the Environment Impact Assessment (EIA) specifically includes an assessment of the increased risk posed to the Minor Aquifer (and controlled waters in general) from the removal of this material. The reason for this is that organic soils, clays and unsaturated natural deposits usually help to attenuate surface spillages and leaks of contaminants that can impact upon water resources.

There should also be a more general assessment of the risk to controlled waters with regards to all of the activities that will be undertaken at the waste management facility, oil storage etc.

Environment Agency
Cobham Road. Ipswich. Suffolk. IP3 9JE. Tel no:01473 706749. Fax no:01473 706723

Any dewatering of the Minor Aquifer during the gravel extraction phase will require the formal approval of the Environment Agency. The applicant or his consultant should contact Stuart Oxley (direct dial 01473 706066) of our Groundwater & Contaminated Land Team in the first instance. Any discharge of dewatered groundwater may similarly require formal approval.

We note that the applicant intends undertaking a Flood Risk Assessment (FRA) and would mention that Roger Webster, Development Control Engineer in this office, should be contacted (direct dial 01473 706771) if any assistance is required in scoping the contents of the FRA.

Pollution Prevention

Needless to say, it is important that the EIA considers all of the potential sources of pollution that the proposed development will produce, their pathways and degree of risk they pose to their respective receiving environments and identify the measures - to eliminate those sources or to attenuate them - that could be taken.

Issues include: oil storage, noise, dust, odours and microbiological emissions from the AD and composting activities and newly delivered waste, contaminated water collection, treatment and disposal, separating clean water from contaminating sources, potential for fly tipping.

The application describes the composting process as one of tunnel composting. We would urge that a closed vessel method be considered as an alternative, probably allowing far greater control over the composting process and final product quality.

Biodiversity issues

Detailed ecological survey s describing the habitats and species present on the site of the proposed waste management facility will need to be undertaken and appropriate mitigation measures based on the results of these surveys included in the Environmental Statement as part of the EIA process. Information on any legally protected or Essex Biodiversity Action Plan species or habitat present should be highlighted. Species survey work will also need to consider the potential use of the redundant airfield buildings by protected species, particularly bats, and will need to propose detailed mitigation measures if bats are found to be present and will also need to address the potential Defra protected species licensing requirements.

Detailed proposals regarding the removal of areas of existing semi-natural habitat will also need to be included, including detailed statements concerning the timing and method of vegetation removal paying particular regard to the results of the species surveys.

The risk to the ecology of surrounding watercourses from potential contamination from leachate/sediment arising from the waste facility will need to be addressed and detailed mitigation measures proposed.

Detailed landscaping proposals will also need to be included in the Environmental Statement including information on how native species of local provenance will be included in the

proposals.

The use of best practice in the design and construction of the associated buildings should be addressed in the Environmental Statement, particularly regarding the use of green roofs which can be used to help make the link between waste management/recycling/minimisation and the associated biodiversity benefits.

Waste

The specialist in our Waste Regulatory Team covering Essex is currently away from the office and therefore the Team Leader has taken on the role of reviewing the Scoping Report. Unfortunately the Team Leader has been required to attend a court case this week and he will not be in a position to provide comments before the extended deadline. Any comments on waste issues will be the subject of a separate letter, which will passed direct to Golder Associates (UK) Limited, with a copy to the Council.

Environmental Statement

The Environmental Statement should include a section on monitoring proposals, with particular reference to particulate discharges and water quality impacts.

We would recommend that copies of responses on scoping issues provided by consultation bodies, statutory and non-statutory, should be incorporated in the body of the Environmental Statement. The purpose of such incorporation is to ensure that the key environmental impact issues identified are addressed by the Environmental Statement and that it is clear why any issues previously identified by consultation bodies, which are relevant, are not addressed.

Informatives

The proposal is identified as falling under the Pollution Prevention & Control Regulations and an application will be forthcoming.

We note the reference to a river crossing of the River Blackwater and would advise that under the terms of the Water Resources Act 1991 and the Land Drainage Byelaws, the prior written consent of the Environment Agency is required for any proposed works or structures in, under, over or within 9 metres of the top of the bank of the main river (Blackwater).

Under Section 30 of the Water Resources Act 1991 the developer is required to inform the Environment Agency of any intention to dewater any quarry or excavation (see above). The Agency may issue a 'Conservation Notice' setting out measures that the person responsible for the dewatering work must take to conserve water.

The applicant should be aware of his responsibilities to ensure that the operations do not interfere with riparian owners common law rights to receive water undiminished in quantity or quality. If any watercourses crossing the site are interrupted or diverted then, notwithstanding the need for any statutory consents or licences, it is the applicant's responsibility to take appropriate steps to protect the rights of the riparian owners, for which he has a liability.

Environment Agency
Cobham Road, Ipswich, Suffolk, IP3 9JE. Tel no:01473 706749. Fax no:01473 706723

Other matters

The sewerage undertaker should be consulted regarding the availability of capacity in the foul water sewer. If there is not capacity in the sewer then the Environment Agency must be reconsulted with alternative methods of disposal.

We trust that our comments help.

Yours faithfully

ANDREW HUNTER
Development Planning Officer
Planning Liaison Team

CC: Golder Associates (UK) Ltd

Environment Agency
Cobham Road, Ipswich, Suffolk, IP3 9JE. Tel no:01473 706749. Fax no:01473 706723

Appendix

SCOPING OPINION

The Planning Application

Description of development
A detailed description of all the elements of the proposals is required.

In context of the County Council's Waste Strategy, the application should describe the area the facility proposes to serve and the throughput that the plant is designed to manage.

Would any commercial or industrial waste be handled at the site?

Details of all buildings and plant, including plans and elevations are required. Buildings should be of high design quality in sympathy with the landscape and rural/agricultural setting, the idea of a green roof would be very appropriate in this rural location.

Details of each element of the development should be described in full, it must be born in mind that it should be understandable by a lay person, this is particularly important for the Non-Technical Summary. Flow diagrams often provide effective ways of explaining how each element of waste brought to the site would go through the different processes.

What are the proposed hours of operation for the different elements of the proposal?

Waste treatment process

Reception - there appears to be no breaking up into smaller pieces of the waste, except within the trommel screeners, which as I understand are more for separation as opposed to breaking up. Why is the coarse fraction anything greater than 100mm? This would seem to result in a particularly large proportion of the waste (50%) being handled going to landfill, even if some waste has previously taken from the waste stream for recycling. Why cannot a higher level be achieved, perhaps through breaking down the waste into smaller pieces within the reception process. How can this be justified against the principles of the waste hierarchy?

Trommel screen and separators - what materials would be removed/recovered by the trommel screens and how would they be dealt with afterwards.

Pulper & drum screen - Describe in detail the purpose and operation of the pulper and drum screen

Specify what is meant by heavy inerts and sands recovered through pulping and the drum screen. As they have been mixed with biodegradable waste e.g. kitchen and food waste are they considered to be inert? Coggeshall is due for

completion in 2006 or sooner and therefore is unlikely to be available for disposal of inerts, where would these be disposed of?

Anaerobic Digestion (AD) – As the municipal waste would include kitchen and food waste would the combination of AD and tunnel composting meet the animal by-product regulations. The State Veterinary Agency has also raised concern on this point.

Tunnel Composting - What processing of green waste and kitchen/food waste e.g. shredding would be required prior to mixing with the digestate. What plant would be used and where would the building to house the plant be located. Would the tunnel composting along with green waste and kitchen/food waste meet the animal by-product regulations.

Environmental services facilities - What is meant by an environmental services depot and offices, fleet workshops and lorry park? Where are these currently located, why is there a need to relocate them, what is the justification for locating them with the waste management facility?

Expand details on the Local Waste Sorting and Transfer Centre. What would this include, any plant machinery, where is this currently carried out and why does it need to be located at the site?

Access road

The application area will need to include the full length of the access road to the A120 including any additional areas required for widening of the haul road. How would minor road and Rights of Way crossing points be dealt with?

Mineral extraction

The extraction of mineral beneath the waste site should be clearly justified and considered against the policies of the Minerals Local Plan (MLP) and Structure Plan policies and emerging policies of the Minerals Development Document. The site is not a preferred site within the current MLP and therefore it needs to be demonstrated that "there is some other over-riding justification or benefit for the release of the site and the site would be environmentally acceptable" policies MLP4 and MIN3

The application will need to set out how the additional mineral would be worked, phased and screened. How it would impact upon the phasing and life of the existing quarry. I would envisage that the application will need to include the application area of the quarry as it will not only affect phasing and timescales, but the whole quarries restoration scheme, particularly as potentially the haul road would remain beyond the life of the quarry.

The document at section 5.2 refers to the current quarry potentially continuing "into the long distant future as the adjacent contiguous seam is permitted and worked". Any extensions to the Bradwell Quarry would be subject to consideration against policies of the Minerals Local Plan and the emerging Mineral Development Document, there can be no assumption that future extension would be permitted at this stage.

Electricity Generation
Details of the generation plant need to be included. The application will need to include details of the connection to the National Grid and the alignment of the cable connection, which should preferably be underground.

Residues and End products
What would be the various end products and residues from the whole site and what tonnages?

Soil conditioner – how much soil conditioner would be required to be used for restoration of the quarry and the justification for such as top and subsoils already exist on site for most of the site. Where would the soil conditioner be used once the quarry finishes in 2020.

Coarse fraction – proposed to be landfilled, approximately what tonnage and which landfills

Policy Context
The proposals should be considered and justified against International, National and Local Policy and in particular:-

The Essex and Southend Replacement Structure Plan adopted April 2001
The Essex & Southend-On-Sea Waste Local Plan
The Essex Minerals Local Plan adopted November 1996
The Braintree District Local Plan
Regional Spatial Strategy 9
Emerging Regional Spatial Strategy 14
Planning Policy Statement 10

Environmental Impact Assessment

Topics & Issues to be addressed are listed below in each case the potential negative and positive impacts should be identified and any mitigation measures and monitoring proposed:-

Site description and surrounding uses.
Need to describe the site in wider context, what are the surrounding landuses.

Details of residential properties near to the site, including distances.

Alternatives
I cannot agree that the EIA should not consider alternatives.

The development of the site is an alternative to that considered likely by the WLP i.e. below ground, involving mineral extraction, over a much larger site and not utilising the existing building and as such is contrary to both policies of the WLP and the MLP. Why have these choices been made and how are they justified.

In addition in choosing to use the technologies described you must have considered alternatives and have chosen those proposed as opposed to others for particular reasons. E.g. why tunnel composting as opposed to open windrow or in-vessel. The alternatives considered and the choices made should be justified and set out within the document.

Size and Location of the Site

The proposed site is larger than that allocated within the WLP, 14 ha as opposed to 6 ha and the site allocation was reduced by the Inspector following inquiry due to potential environmental/landscape/amenity impact of the proposals. It was also suggested that the existing building might be utilised. The justification for the larger site will need to be fully justified as it is contrary to the Waste Local Plan.

Landscape, Cultural and Historical issues

A survey of all existing surrounding vegetation should be undertaken, both of vegetation within the boundaries of the site and any surrounding the site that is likely to be relied upon for screening. What potential is there to protect and or enhance this vegetation? Reference is made to the fact the woodland blocks are remnants of much larger woodlands, what potential is there to recreate larger woodland blocks and enhance screening of the site. Where vegetation outside the site is to be relied upon for screening it needs to be demonstrated that the developer has control over these areas. Photomontages would be beneficial to show views with and without the proposals (winter and summer views may be very different)

Particular consideration should be given to the impact of overhead powerlines on the landscape of the Blackwater Valley.

Any assessment of Landscape Impact should make reference to the Essex Landscape Character Assessment (LCA)

The LCA is available on CD ROM at a cost of £45 from

Sue Thompson
EIS
Essex County Council
County Hall
Chelmsford CM1 1LX
Tel: 01245 434200

The proposed scheme would result in the loss of areas of woodland to the south of the existing hanger. There are also several TPO within the site and adjacent to the site. Details obtained from Braintree District Council attached.

I understand that certain individual oaks are subject of TPO's and have cultural and historical value as these were planted by the American airman and are significant trees, which would be lost under the current scheme. No consideration has been made of this loss.

Boundary treatment
How would the site be enclosed and what methods of litter control would be implemented on site.

Ecology
The EIA should include an ecological survey, including surveys for protected species as emphasised by EN, EWT and EA.

The document makes no reference to The County Wildlife Site W139 Storeys Wood; details attached and should be considered as part of the EIA.
The ES should address whether or not biodiversity action targets can be met, for example, through landscaping or creation of habitats. The Essex Biodiversity Action Plan (BAP) is available at www.essexbiodiversoty.org.uk – click on "Action Plan". This point is also emphasised by the EA.

Contact Emma Simmonds – Essex County Council Ecology Officer

Archaeology
You will see from comments of the County's Archaeology team that the suggested archaeological investigation within the Scoping Opinion does not meet the either the County's or other guidance. Therefore investigation as set out within the response from the County Archaeological team dated 17 August should be adhered to.

Pollution Prevention
As indicated in the letter from EA all sources of potential pollution should be assessed and addressed.

Air – emissions
Emissions from the facilities are likely to be a significant issue, particularly its impact upon surrounding residents. While the control of such would be part of the IPP permit process, this issue should be addressed within the EIA as it will be an issue that has to be addressed in the determination of any application. Setting out clearly what would be the nature of emissions and how the proposed plant would "clean" any gaseous emissions.

Assessment of emissions should also be considered with respect to vehicle movements both during construction and once operational.

Air - odour
What parts of the process and areas of the facility are likely to give rise to odour? How would these be addressed: e.g. loading and unloading of odorous materials, odours from composting and AD, as emphasised by EA letter dated 30 September 2005

Light pollution
An assessment of the impact of any proposed lighting should be included. The planning application should detail where and what lighting is proposed

and hours of operation and the mechanisms to ensure it is only operational when necessary e.g. timers and solar sensitive.

Animal By-Product Regulations (ABPR)
As raised earlier on the basis that the municipal waste would contain kitchen and food waste, the process should surely be designed to meet ABPR requirements to ensure maximum utilisation of the soil conditioner to be generated.

Groundwater /Hydrology
The EA (see the attached letter dated 15 September 2005) have drawn attention to need for a risk assessment of the potential impact upon the minor aquifer from the mineral extraction and the low-level location of the waste management facilities with its potential emissions.

The assessment should consider the impact during construction and operation of the proposals with respect to ground and surface water.

What would be the water requirements of the facility? Are there adequate main supplies in the vicinity? Is any water abstraction proposed? What potential is there to collect, store and utilise rain water from building roofs and surface water runoff.

Noise
A survey and assessment of the background noise levels both day and night and the likely impact of the proposals both during construction and once operational should be carried out. This should utilise up to date survey and related to historical data as the noise climate has changed since the opening of the new A120 between the M11 and Braintree and would change again if and when the A120 new route is constructed. I would refer you to the County Council's noise consultant's comments on the details of the assessment.

Highways & Traffic
A traffic Impact Assessment would be required. An assessment of traffic must be on the basis of the proposed use of the existing A120 for the full life of the development, as at this stage the is no certainty that the site could be linked to the new A120, particularly as there is no decision as to route, the acceptability of a junction onto the new A120 (see HA letter) or firm programme for implementation of the road scheme.

Since the submission of the Scoping Opinion Intermodal Transportation have written to both the Highways Agency and the Highways Authority with details of the Traffic Assessment, copy attached. The Highways Authority has commented on the need to assess traffic controls on the crossing points with Church Road and Ash Lane. The Highways Agency have informally stated that they are also satisfied with the proposed scope of the TA, subject to clarification of accident data or other anomalies, see the attached correspondence.

From an environmental perspective I would expect that the haul road should be two-way for its entire length, to minimise the need for stop and start of vehicles which would be likely at cross overs and at passing bay, as this activity leads to noise and additional air pollution.

Details of the routeing of vehicles to and from the site associated with the proposals should also be considered.

Details of construction traffic should also be assessed including vehicle numbers, access and routeing.

Risk Assessment & Management
A risk assessment of the various processes should be included and details of operational monitoring and management to reduce any risk. A bio-aerosols risk assessment would be required.

Decommissioning & Demolition
Details should be provided of what would happen if in the future the development became redundant, with a commitment to restore the site to a beneficial afteruse

Consultations
I would advise approaching consultees direct

The following bodies were consulted on the Scoping Opinion

Braintree District Council – Planning & EHO
Environment Agency
English Nature
Essex Wildlife Trust
Highways Agency
Highways Authority
Countryside Agency
County's Landscape & Ecology
County's noise consultants – Mouchel
County's Historic Environment & Archaeology
DEFRA
State Veterinary Agency
HSE
Kelvedon Parish Council
Bradwell Parish Council
Silver End Parish Council
Rivenhall Parish Council

Other bodies that would be consulted on any application & EIA would be:-

CPRE
Eastern electricity
Powergen

Transco
Anglian Water
Fire Authority
Local Member x 2

Non-Technical Summary

A Non-Technical Summary is required to accompany an EIA and should summarise the proposal, EIA (setting out the positive and negative impacts and the mitigation measures, monitoring and management of the development) and plans showing the location and layout of the development. Preferably this should be available free of charge.

APPENDIX 6-3

RESPONSES TO SECOND REQUEST FOR SCOPING OPINION

RECEIVED
15 MAY 2006

ENVIRONMENT AGENCY

Our Ref : AE/2006/017355-1/1
Your Ref : ESS/15/06/BTE/SPO

Date : 10 May 2006

Golder Associates (UK) Ltd
Kensal House
77 Springfield Road
Chelmsford,
Essex,
CM2 6JG.

Dear Sir

PROPOSED WASTE MANAGEMENT FACILITY RIVENHALL AIRFIELD, BRAINTREE

Please find below a copy of the Agency's response to the above.

If you have any queries about the enclosed letter please do not hesitate to contact this office.

Thank you for consulting the Environment Agency on the above request for a Scoping Opinion under the Town and Country Planning (Environmental Impact Assessment) Regulations 1999. We apologize for the delay in responding and trust that our comments will still be taken into account.

We have considered the contents of the second scoping opinion report and we are satisfied that the comments previously made on the first scoping request have been adequately addressed. In addition, the design/operational changes for the site identified in the second report do not appear to raise any additional issues (in terms of matters to be addressed in the Environmental Impact Assessment). Overall, the proposals now provide for a more contained facility (e.g. outdoor windrow composting removed) and hence the Environmental Impact Assessment should be more straightforward in terms of emissions/impacts from the waste storage and processing activities.

Yours faithfully

ANDREW HUNTER
Development Planning Officer
Planning Liaison Team

Environment Agency
Iceni House, Cobham Road, Ipswich, Suffolk, IP3 9JD, Tel no:01473 706749, Fax no:01473 706723

TOWN AND COUNTRY PLANNING ACT 1990 (as amended)
TOWN AND COUNTRY PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 1999

Second Scoping Opinion: Waste Management Facility
Location: Rivenhall Airfield - BRAINTREE
Application No: ESS/15/06/BTE/SPO

Background:

The Second Screening Opinion Request document dated April 2006 (Application ESS/15/06/BTE/SPO) incorporates the revisions required by the First Scoping Opinion adopted by Essex County Council on 5 October 2005 (Application ESS/31/05/BTE/SPO.

The purpose of the Second Screening Opinion Report is to reflect the revisions to the County Council's Integrated Waste Management Strategy Contract, consequent changes to the footprint and layout of the proposed Waste Management Facility (WMF) and provide for additional community engagement.

A number of the Statutory Consultees have indicated that they are satisfied that their comments previously made on the First Scoping Opinion Request have been adequately addressed in the Second Scoping Opinion Request report and, therefore, have no further observations.

Additional: issues to be addressed

The following issues, however, have been raised through the consultation process and should be addressed additionally in the Environmental Impact Assessment.

Description of:

- Site history to include NFFO award.

- Predicted waste throughputs given anticipated increased recycling rates / waste growth and Commercial / Industrial inputs of treated and disposal of untreated wastes residues.

- Anticipated proportions of wastes originating from within Essex, Eastern Region and beyond.

- Markets for recycled / treated and destinations for disposal of untreated wastes.

Policy Context embracing Regional and Local Plan Policy:-

- Transition from Regional Planning Guidance 9 to Emerging Regional Spatial Strategy 14
- Emerging Regional Spatial Strategy 14 subsuming saved policies of Essex & Southend-on-Sea Replacement Structure Plan Adopted April 2001
- Braintree District Local Plan Review adopted July 2005

Relationship of waste management processes selected to emerging National Waste Strategy Review 2006 and relationship to 'proximity principle' examined in Planning Policy Statement 10

'Whole life' impacts

To include site preparation, operation, decommissioning and reinstatement evaluating probability, effect and timescale) of direct, secondary and cumulative positive and negative impacts of the project together with measures for mitigation / management / monitoring and remedial mitigation measures for all of the following:-

Health Impact Assessment

- Subject to NHS Primary Care Trust guidance.

Contact Dr. Mark Shackell NHS Chelmsford Primary Care Trust

Tel: 01245 398770

- Consideration of potentially harmful bio-aerosol, gas emissions and odours carried by easterly and westerly winds towards, respectively, Silver End and Coggeshall and their build up during prolonged dry periods when temperature inversions occur.

- Emergency plan measures to minimise / mitigate accidental emissions due to plant / power supply failure.

Impact on Residential Amenity

Noise Impact Assessment from all proposed construction and 24/7 operations, including glass and metal management, reversing alarms, Health and Safety klaxons / audible devices, vehicle movements on site and from / to A120, air extraction / conditioning systems, gas-engined generators and pumps cumulatively with all existing quarry activity, compared to baseline background noise levels obtained when no other operations are taking place within any part of Bradwell Quarry.

Comparison of change in noise impacts on representative 'noise sensitive' Bradwell Village properties fronting the A 120 between all current traffic flows and future additional Large Goods Vehicle (LGV) [HGV] movements generated by WMF.

Prediction of LGV (HGV) noise generated from elevated section of potential grade separated junction of A120.

Note:

- Night-time operations cover period 18:30 to 07:00

- Baseline data for potentially 'noise sensitive' properties surrounding WMF site, except Bumby Hall, identified in Mouchel-Parkman's letter of 2 May 2006

Contact: ray.butler@mouchelparkman.com

Tel: 01245 247075

- Light pollution from operational / security sources

- Visible flame from gas flare stack

Archaeology

- Desk top study covering cartographic and documentary sources for the area in detail and Woodhouse Farm complex.

- Walk-over survey to provide understanding of landscape and define methodologies for environmental sampling.

- Assessment of Woodhouse Farm Listed and unlisted buildings including all farm and industrial buildings with internal assessment of structures with photographic record and short description based on list description to provide a detailed understanding of each building

- Trial trenching to assess any undisturbed areas affected by proposed development

- Potential for Palaeo-environmental sampling of potential for survival within the moated site.

- Hydrological impact of dewatering on the moat.

Guidance on Historic Environment content within EIA's set out in Planarch II Intereg Project: www.planarch.org

Guidance on archaeological brief can be obtained from ECC's Historic Environment Management Team.

Contact: vanessa.clarke@essexcc.gov.uk

Direct Line: 01245 437638

Water Management

- Hydrological impact of dewatering.

- Surface water drainage flows from watershed into Rivers Blackwater and Brain.

Landscape Character Assessment (LCA)

- Consider against 'Guidelines for Landscape and Visual Impact Assessment' published by Landscape Institute with Institute of Environmental Management and Assessment (SPON Press 2002)

- Impact on Blackwater 'Special Landscape Area'

- Identify TPO's, detailed tree survey to identify losses and retention with measures to protect during construction phase as set out in BS 5837 'Trees in Relation to Construction'.

- Permanent loss of agricultural land due to roadway / roadway widening.

Contact: brian.stacey@essexcc.gov.uk

Tel: 01245 437690

Design and layout of buildings to contribute positively to character of the area

Contact: peter.dawson@essexcc.gov.uk

Tel: 01245 437668

- Materials / colours of aviation themed buildings to be assessed within landscape / topographical context.

Contact: brian.stacey@essexcc.gov.uk

Tel: 01245 437690

- Assessment of nature and extent of works required to enable re-use of Woodhouse Farm buildings.

Contact: pippa.colchester@essexcc.gov.uk

Tel: 01245 437337

Ecology and Biodiversity

- Consideration of effects of proposed amendments to Habitats Regulations 1994 arising from Habitats directive Consultation 2006.

- The ecological assessment should consider the impact of the development on all local designations and inclusively through to international designations.

- A minimum of a Phase 2 Habitat Survey and Habitat Assessment should be carried out on all areas of habitat that may be affected by the proposal in addition to protected species surveys.

Contact: emma.simmonds@essexcc.gov.uk

Tel: 01245 437655

- Potential impacts both during construction of WMF and once operational should be considered together with management, monitoring and mitigation measures.

Contact: ann.law@essexwt.org.uk of Essex Wildlife Trust for baseline ecological data held by EECOS, Essex Ecology Services

Tel: 01621 862986

See latest version of Essex Biodiversity Action Plan (BAP) available at www.essexbiodiversity.org.uk – 'Action Plan' as latest revisions place more emphasis on 'brownfield' sites and habitats.

- Ecological survey work should recognise BAP priority species and habitats as well as species with statutory protection.

- Mitigation to reduce negative impacts of the development on local biodiversity needs to also consider compensation for those negative effects which cannot be avoided despite mitigation.

Contact: charlie.williams@english-nature.org.uk

Tel: 01206 796666

Highways and Traffic Generation

A Transport Assessment (TA) should be produced covering the following issues:

- For the A 120 whether the existing access arrangement by single lane dualling would still be appropriate or if an alternative junction arrangement, for example a roundabout, may be required.

- The scope of the TA should be agreed with the Highways Agency and the Highway Authority as the 'old' A120 will revert to a county road upon completion of a new A120 scheme between Braintree and the A12 trunk road.

- The level of HGV traffic that may continue to use A120 through the villages of Bradwell and Marks Tey following completion of a new A120 from Braintree to the A12.

- Church Road and Ash Lane, which has Protected Lane status, should be assessed, including accident investigation, of these junctions with the private access road to Bradwell Quarry in order to determine if the current junction arrangements are adequate or if additional traffic control measures should be introduced.

- An assessment of the need for the existing private access road to become two-way should be undertaken together with a specification for the proposed private access road connecting the Waste Management Facility to the existing private access road to Bradwell Quarry.

- Data for current quarry LGV movements using existing A 120.

- Consideration of alternative accesses to new A 120 *inter alia* extended exit / entry slip roads, left in, left out configuration and private haul road to proposed nodal interchange.

- Measures to prevent LGV's from using Woodhouse Lane and associated local roads in vicinity of Silver End / Rivenhall.

Contact: matthew.bradley@essexcc.gov.uk

Tel: 01245 437299

Contact: paul.marshall2@highways.gsi.gov.uk

Tel: 01234 796025

Highways Agency
Woodlands
Manton Lane
Manton Industrial Estate
BEDFORD
MK41 7LW

Rights of Way

- Safety Audit should be undertaken for predicted LGV traffic using access road when assessing crossing points for Public Footpaths 19,35,56,57,58 and temporary diversion of footpaths 31 / 35 Kelvedon and 68 Bradwell.

- Consideration should also be given to those Footpaths that are to be upgraded to Bridleways as part of the restoration of the quarry and the potential impact on horses and riders.

- Footpath 8 through Woodhouse Farm may need diversion to avoid conflict with visiting traffic.

Contact: ann.tompkins@essexcc.gov.uk

Tel: 01245 437112

Energy balance sheet

- Carbon emissions for additional HGV traffic using access road and mitigation should be addressed.

- Use of low energy lighting and on site heating and power generation from solar, wind, photovoltaic cells and renewable energy sources to be considered.

- Methodology for gas storage and use within process.

Environmental Statement

The Environmental Statement should set out positive and negative impacts together with mitigation, management, monitoring and remedial mitigation measures through Environmental Management Systems for the development which should be incorporated into the planning application.

Non-Technical Summary

A Non-Technical Summary of the EIA should accompany the Environmental Statement and a summary of the proposal accompanying the planning application would benefit public engagement.

The EIA documentation needs to be made readily available for inspection and purchase at a reasonable cost to the public at convenient locations. The provision of the documentation on CD ROM would also be beneficial for consultation purposes and for public information.

General Observations:

Regional Economic Strategy is based on (A Shared Vision: The Regional Economic Strategy for the East of England)

Contact: natalieblaken@eeda.org.uk

Direct Line: 01223 200844

Consistency of terminology: Large Goods Vehicles paras. 34 and 165 or HGV's paras. 139 *et al*

For clarification and any additional information regarding this Scoping Opinion

Contact: peter.unthank@essexcc.gov.uk

Tel: 01245 437525

Scoping Opinion Prepared by:	Scoping Opinion Audited by:
Peter Unthank Principal Planner	Roy Leavitt Head of D. C.
Date: May 2006	Date: May 2006

Project Management:

The following actions should be considered to expedite any subsequent planning application

Pollution Prevention Control application to run in parallel with planning application

Unilateral Planning Obligation(s) to provide for;-

- only receiving and treating wastes arising from with Essex.
- funding / provision of highway works and traffic management measures
- providing Management Plan and/or commuted sum for the long term management of habitats
- ecological monitoring and remediation.
- organising and administering Liaison Group with interested parties.

Consultation responses still awaited:

Highways and Transportation

NHS Primary Care Trust

East of England Regional Assembly

Silver End Parish Council

Kelvedon Parish Council

Essex Bridleways

Braintree Ramblers Association

CABE

EDF Energy Networks
Transco (BG plc)

Essex and Suffolk Water plc

Essex County Fire and Rescue

These will be forwarded as received.

APPENDIX 6-4

RESPONSES TO THIRD REQUEST FOR SCOPING OPINION

Essex County Council
Historic Buildings & Conservation
County Hall
Chelmsford
ESSEX CM1 1QH

For the attention of Claire Tomalin
Development Control Manager (Planning)
Planning Service Group
Essex County Council
County Hall
Chelmsford
ESSEX CM1 1QH

Your ref: ESS/BTE/19/08
Our ref:
Date: 23 June 2008

HISTORIC BUILDINGS AND CONSERVATION ADVICE

Dear Claire

RE: RECYCLING & COMPOSTING FACILITY AT RIVENHALL AIRFIELD, COGGESHALL ROAD, BRAINTREE.

Thank you for your consultation on this scoping opinion prior to an Environmental Impact Assessment which has been passed on to me. There are 9 Listed buildings in the immediate vicinity of the proposed works as follows:

Bradwell Holy Trinity Church. Grade 1.
Ancillary Building at Bradwell Hall. Grade II.
Gosling's Farmhouse. Grade II.
Cartlodge & Granary 25 Metres SW of Gosling's Farmhouse. Grade II.
Woodhouse Farmhouse. Grade II.
Ancillary Building 10 metres E of Woodhouse Farmhouse. Grade II.
Pump 13 metres E of Woodhouse Farmhouse. Grade II.
Allshot's Farmhouse. Grade II.
Barn 45 metres NNW of Allshot's Farmhouse. Grade II.

Of these, Woodhouse Farmhouse and its ancillary Listed and curtilage Listed buildings and its moat, are most directly affected.

Any submission should include Built Heritage:

1. An impact assessment for Woodhouse Farm and the other affected Listed buildings.
2. Sections through the site showing the relationship of the new works (including height and bulk of the new buildings and chimney) to the Listed buildings and moat at Woodhouse Farm.
3. Details of the car-parking, vehicle barriers and any alterations to surfacing and the boundary proposed adjacent Woodhouse Farm.
4. All refurbishment works proposed to the listed buildings. It is noted that it is intended to convert these for use as an Education Centre and Visitor/Education centre as part of the works and there is separate application, however the implications, feasibility and general principles of repair and sympathetic reuse need to be established in any application for the site.
5. Ground water conditions affecting the Listed pump, moat and buildings.

Continued.....

On the basis of the submission so far, this impact is likely to be damaging. Specific concerns include:

1. The loss of the remaining historic setting including boundaries and woodland and risk of alteration to the historic moat. In previous discussion, the area taken up by proposed buildings was smaller and there was more woodland between the new facility and the Listed buildings at Woodhouse Farm. The revision is therefore more problematic. There is further concern because the submitted sections and site plan do not correspond regarding the space between the buildings and remaining trees. If the proposed buildings are as shown on the section, there is insufficient space for the tree screen.
2. The bulk and height of the proposed facility and the non-agricultural appearance in this sensitive setting. This would be more obvious because of the reduction of screening and the design changes including addition of a chimney, increased size of buildings and loss of grass roofs.
3. The likely increase in traffic, noise, smell and nuisance.
4. The proximity of car-parking to the listed buildings and resulting loss of rural setting.
5. The increase of lighting in the rural area and amongst the Listed rural buildings.
6. Identification of a proposed new use for the Listed buildings prior to investigation of alternatives or the impact involved.

Specific guidance is covered under Planning Policy Guidance 15: Planning and Historic Environment (PPG 15). For advice on specific proposals or the impact assessment for the Listed buildings please contact me.

Yours sincerely

Corrie Newell
Senior Historic Buildings Adviser

Please reply to Miss Corrie Newell
Telephone: 01245 437644.
Email: corrie.newell@essexcc.gov.uk.
Fax: 01245 437213

creating a better place

Environment Agency

Ms Claire Tomalin
Essex County Council
County Hall
Chelmsford
Essex
CM1 1QH

Our ref: AE/2008/105818/01-L01
Your ref: ESS/19/08/BTE/SPO

Date: 20 June 2008

1 2496

1 2496

ESS/19/08/BTE/SPO
CMT

Dear Ms Tomalin

RECYCLING AND COMPOSTING FACILITY WITH FULLY INTEGRATED COMPOSTING, ANEROBIC DIGESTION, DRY RECYCLABLE RECOVERY, PAPER RECYCLING AND COMBINED HEAT AND POWER PLANT; FOR THE TREATMENT OF RESIDUAL WASTE COMPRISING BOTH MUNICIPAL AND COMMERCIAL AND INDUSTRIAL WASTES; USING MECHANICAL BIOLOGICAL TREATMENT, MATERIAL RECOVERY FACILITY, A MIXED ORGANIC WASTE DIGESTION PLANT TO GENERATE GREEN POWER FROM BIOGAS, A MARKET DE-INKED PAPER PULP FACILITY AND A COMBINED HEAT AND POWER FACILITY TO GENERATE ELECTRICITY, HEAT AND STEAM; AND ASSOCIATED ENGINEERING WORKS; EXTENSION TO EXISTING ACCESS ROAD AND PROVISION OF OFFICES, BIOGAS GENERATORS, STORAGE TANKS, VEHICLE PARKING; AND VISITOR/EDUCATION CENTRE RIVENHALL AIRFIELD COGGESHALL ROAD BRAINTREE

Thank you for referring the above application which was received on 30th May 2008.

We have inspected the application as submitted, and wish to make the following advisory comments.

Environmental Permit

The proposed process falls under the Environmental Permitting Regulations (England and Wales) 2007.

The processes described have potential to produce significant quantities of odours, microbial aerosols and contaminated waters and as fugitive emissions. Control and mitigating processes must be explored, identified and tailored using the source pathway receptor principals.

Environment Agency
Cobham Road, Ipswich, Suffolk, IP3 9JD.
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk
Cont/d..

The risks of taking in unacceptable wastes that could impact upon the treatment processes should be assessed further. Public awareness and education may be a way forwards.

Drainage

The Scoping Report (May 2008) has made a number of comments regarding the need for management of surface water arising from the proposed development, including:

- The EIA will review the baseline conditions for surface water, established alongside a previous planning application for recycling facilities on this site (ESS/38/6/BTE, granted in 2007).
- The evolved proposal will still incorporate a large clear water lagoon for the purposes of surface water attenuation.
- The evolved proposal will continue to maintain a flood alleviation area (known as "New Field" lagoon under a proposed variation to permission ESS/07/98/BTE).
- The provision of surface water management for the evolved recycling facility will be revised and update in the EIA.

We look forward to receiving more information on these comments when the full EIA is submitted; in particular the Hydrology and Flood Risk Assessment (FRA) section of the EIA.

We do have the following comments to make at this early stage, which we hope will aid in the production of a satisfactory FRA.

Figure 5, submitted in the Scoping Request, appears to indicate that the built area will be expanded, and therefore provide a greater impermeable area on site than the previous scheme (granted planning permission in 2007). Any increase in impermeable area should be taken into consideration in the review of the surface water management scheme and in particular the design of the lagoon.

In order for us to fully assess the surface water management scheme proposed, the following information should be conveyed with the EIA, and supported by full evidence of calculations undertaken:

1. Pre-development Runoff Rate - The FRA should state the pre-development runoff rate and provide calculations to show how this rate has been derived. The method for such calculations are outlined in the Institute of Hydrology report 124 (IOH124), we recommend this is the method used to calculate runoff rates.
2. Attenuation Rate - The FRA should include detailed discussion of how the pre-development runoff rate will be attenuated to. All surface water generated must be attenuated for the 1in 1 year to 1 in 100 year rainfall event gearing the flows to the existing runoff rate (plus allowances for climate change).
3. Attenuation Devices - In this particular case it has already been indicated that a large attenuation lagoon will be utilised to attenuate runoff from this development. The FRA should state the minimum storage volume for the lagoon to achieve the required attenuation rate, and include detailed calculations to support this statement. This should also include discussion of additional devices, such as the lagoon outlet, needed to achieve this. We recommend that a detailed drainage design is included to demonstrate how

Cont/d..

flows will be routed to and from the lagoon, so we can assess if continuity of storage is achieved on site.

4. Response to Climate Change Requirements - The FRA should discuss the provision of allowances for climate change within the design of the lagoon.
5. Drainage Scheme Management - Details of how the proposed drainage scheme is to be managed should be included within the FRA, in terms of who will be responsible for the maintenance of the development in perpetuity. In order to secure a management scheme a section 106 agreement is often agreed to.

INFORMATIVE

Methods for calculating climate change have been updated since the previous submission for planning permission, please refer to Planning Policy Statement 25: Development and Flood RIsk (PPS25) for further guidance, Table B2 of Annex B. Climate change should be calculated for 60 years for commercial development. Evidence of how this value has been calculated should be provided within any FRA submitted.

Please be aware that our comments above are based on our current guidance. If there are any policy changes or changes in national guidance before we are formally consulted on this development proposal as part of the planning process, our comments may change. Also allowance should be given for issues overlooked at the early consultation phase.

Ecology

The reports appear to cover most of the ecological issues. Reptile surveys have been performed in September and October 2007, but it may be prudent to repeat these in order to confirm absence of these species.

It is recommended that opportunities for habitat creation and enhancement are taken as well as planned mitigation for habitat loss and impact on species.

Yours sincerely

Miss Lindsay Hinchsliffe
Planning Liaison Officer

Direct dial 01473 706820
Direct fax 01473 271320
Direct e-mail lindsay.hinchsliffe@environment-agency.gov.uk

End

Natural England
Harbour House, Hythe Quay, Colchester, Essex CO2 8JF
Tel 01206 796666 Fax 01206 794466
Email essex.herts@naturalengland.org.uk
www.naturalengland.org.uk

ENGLAND

Essex County Council
Planning Development Control
Environment & Commerce
County Hall
Chelmsford
Essex CM1 1QH

For the attention of Claire Tomalin

Our reference: APR/3736/Braintree/ECC
Your reference: DC/CMT/ESS/19/08/BTE/SPO

6 June 2008

Dear Madam

Environmental Impact Assessment – Scoping Opinion
Recycling and Composting Facility etc.
Location: Rivenhall Airfield, Coggeshall Road (A120) Braintree
Application No: ESS/19/08/BTE/SPO

Thank you for consulting Natural England on the above proposal. Your letter was received by this office on 30 May 2008. Natural England is broadly satisfied with the scope of the EIA, which should be consistent with the approach set out within the Institute of Ecology and Environmental Management's *Guidelines for Ecological Impact Assessment*, referenced within the scoping report. Please find additional comments set out below.

Statutory Designated Sites

Natural England advises that the Environmental Statement (ES) should include an assessment of the likely impacts of the proposals upon the range of statutory designated sites including Sites of Special Scientific Interest (SSSI), European Special Areas for Conservation (SAC) and Special Protection Areas (SPA), and the international Ramsar wetland areas.

Sites of Special Scientific Interest are protected under the Wildlife & Countryside Act 1981 (as amended). European Special Areas for Conservation and Special Protection Areas are protected under The Conservation (Natural Habitats, &c.) Regulations 1994. Under PPS9, listed Ramsar sites should receive the same protection as designated SPAs and SACs as a matter of policy. Please consult the legislation for exact wording.

Non-Statutory Designated Sites

It is further advised that the ES contains an assessment of the likely impacts upon local sites. These might include County Wildlife Sites, Sites of Nature Conservation Importance (SNCI), Site of Interest for Nature Conservation (SINC), Local Nature Reserves (LNR) and/or Regionally Important Geological Sites (RIGS). We also advise you to contact the Essex Wildlife Trust as they may wish to comment on the nature conservation implications of the proposals, particularly with regard to the relative proximity of CWS site Bra 178 (Storey's Wood).

Protected Species

The proposals may also have implications for protected species. If protected species are suspected or present on a proposed development site then the following information should be requested from the applicant, usually in the form of an ecological survey by an appropriately qualified consultant, prior to the planning application being determined.

a. What is the species concerned?
b. What is the population level at the site, or affected by the proposal?
c. What impact is the proposal likely to have upon the species present?
d. What can be done to mitigate against this impact?
e. Is the impact necessary or acceptable?
f. Is a licence required from Natural England?

This information should be submitted to and considered by the planning authority prior to determining the planning application. If the submitted information leads you to conclude that you need further advice then please do not hesitate to contact us.

Natural England is aware that previous survey work has been undertaken on this site in 2006. The majority of this work can still be considered valid for the current ES, but if consideration of the site were to extend into 2009, it might then become necessary to resurvey for certain protected species – notably amphibians and badgers.

Further information on protected species surveys can be found on pages 48-50 of the *Guide to Good Practice* accompanying *PPS9*. Guidelines on mitigation can also be downloaded from the publications section of Natural England's website at www.naturalengland.org.uk.

Biodiversity enhancement

We also welcome the consideration of opportunities to address targets in the UK and Essex Biodiversity Action Plans (BAPs) through re-creation and enhancement of habitats. Both the UK and Essex BAPs are regularly updated and it is important that the latest versions are referred to for the EIA. Revisions of both BAPs are likely to include more emphasis on the biodiversity value of some 'brownfield' sites and habitats, which is likely to be relevant to this development.

Nearby Rivers

We welcome the stress on consideration of impacts on nearby surface water bodies, in particular the rivers Blackwater and Brain. These rivers are relatively close to the site, are of high value for biodiversity, and potentially sensitive to impacts during both construction and operation of the WMF.

If you have any questions about this advice, or need clarification on particular points, please feel free to contact me at the email address below, or by telephone on 01206 796666

Please forward a copy of the decision notice to us at the above address.

Yours sincerely,

Andrew Robinson
Planning and Biodiversity Adviser
Four Counties Government Team (Beds.Cambs.Herts & Essex)

andrew.robinson@naturalengland.org.uk

APPENDIX 6-5

GROUNDWATER IMPACTS & MITIGATION

Groundwater Impact Significance Matrix

				Pre-Mitigation				Post-Mitigation			
Receptor of Impact	**Phase of Site**	**Activity**	**Potential Impacts**	**Scale of Impact**	**Scale of Impact upon Receptor**	**Impact Significance Category**	**Impact Prediction Confidence**	**Scale of Impact**	**Scale of Impact upon Receptor**	**Impact Significance Category**	**Impact Prediction Confidence**
Groundwater hydrology	Excavation	Earthworks and site drainage	Decrease in local water table.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
			Changes to groundwater distribution and flow.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
			Changes to hydrostatic pressure at distant locations connected hydraulically.	Slight	Minor	-1	Low	Negligible	Neutral	0	High
	Construction	Earthworks and site drainage	Decrease in local water table.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
			Changes to groundwater distribution and flow.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
	Operational	Physical presence of waste management facility	Changes to groundwater distribution and flow.	Slight	Minor	-2	High	Slight	Minor	-1	High
Groundwater quality	Excavation	Earthworks	Mobilisation of contaminated materials and subsequent groundwater pollution.	Moderate	Intermediate to Minor	-2	Low	Negligible	Neutral	0	High
			Removal of attenuating organic soils, clays and unsaturated natural deposits and subsequent groundwater pollution.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
		Materials management	Pollution from spills or leaks of fuel, oil and building material.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
			Pollution from the spillage of contaminated materials during processing or relocation.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
	Construction	Earthworks	Disturbance of contaminated soil and subsequent groundwater pollution.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
			Removal of attenuating organic soils, clays and unsaturated natural deposits and subsequent groundwater pollution.	Moderate	Intermediate to Minor	-2	High	Moderate	Intermediate to Minor	-1	High
		Materials management	Pollution from spills or leaks of fuel, oil, or construction materials.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
	Operational	Leachate management	Contamination from sudden releases (e.g. from containment or drain failure) or slow seepage of leachate to groundwater.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
		Surface water management	Contamination from leaks of the surface water stored in the lagoon.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High
		Materials management	Contamination from spills or leaks of fuel, oil or contaminated water.	Moderate	Intermediate to Minor	-2	High	Negligible	Neutral	0	High

APPENDIX 6-6

SURFACE WATER ABSTRACTIONS WITHIN 5 KM RADIUS OF THE SITE

Report Title ABSTRACTION LICENCE SUMMARY BY MANAGEMENT UNIT / REPORTING UNIT

Short Name AR251R

PARAMETERS	VALUES	PARAMETERS	VALUES
USER	AHOWARD		
REPORT TYPE	SUMMARY	SORT BY	LIC_NO
DESTINATION TYPE	Preview	DESTINATION NAME	
REQUIRED DATE FROM	31/10/2005	REQUIRED DATE TO	
MANAGEMENT UNIT		REPORTING UNIT	EASTERN AREA
LICENCE NO	ALL	WATER ACT 2003 LICENCE TYPE	ALL
LICENCE HOLDER NAME	ALL		
CONDITIONS ON LICENCES	ALL	AGREEMENTS	ALL
SOURCE OF SUPPLY	ALL	SOS TYPE	ALL
CRITICALITY CLASS	ALL	POINT CATEGORY	ALL
PURPOSE	ALL	POINT TYPE	ALL
	ALL		
	ALL		
RANGE SEARCH BY ANNUAL QTY	NONE DEFINED		
RANGE SEARCH BY DAILY QTY	NONE DEFINED		
RADIAL SEARCH	NGR TL 823 205	DISTANCE 5.0 km	
SQUARE SEARCH	NONE DEFINED		

Warning: The figures shown on this report do not take account of any authorised quantity restrictions that may exist between linked licences or within a licence (See the conditions section of the report for this information)

Licence No: 8/37/31/*G/0072 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	31/05/1999		N	N

Licence Holder
38442 A & B HAYES FARMS
66314 KILLIGREWS
MARGARETTING
ESSEX
CM4 0EZ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : SM: All licences <20m3/day
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
General Farming & Domestic
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	5454	m3	Usability:	Legal	Conditions Exist: No
Daily Qty:	18	m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:		m3	Usability:		
Inst Qty:		l/s	Usability:		

Local Name	Primary Type	Secondary Type	Category
3 WELLS AT MILLES FARM,STISTED	Groundwater	Well	Single Point

NGR1:TL 798 236 4.0km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0115 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
103	0	CURR	01/01/2001		Y	Y

Licence Holder
41024 BLACKWATER AGGREGATES
69194 BRADWELL QUARRY
CHURCH ROAD
BRADWELL
ESSEX
CM77 8EP

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Mineral Products
Make-Up or Top Up Water
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	47000 m3	Usability:	Legal
Daily Qty:	245 m3	Usability:	Legal
Hourly Qty:	68.2 m3	Usability:	Legal
Inst Qty:	19 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name
SAND AND GRAVELS AT BRADWELL,ESSEX
NGR1:TL 8179 2172 1.3km NGR2: NGR3: NGR4:

Primary Type: Groundwater
Secondary Type: Catchpit
Category: Single Point

Purpose: Industrial, Commercial and Public Services - Mineral Products
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	47000 m3	Usability:	Legal
Daily Qty:	245 m3	Usability:	Legal
Hourly Qty:	68.2 m3	Usability:	Legal
Inst Qty:	19 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name
SAND AND GRAVELS AT BRADWELL,ESSEX
NGR1:TL 8179 2172 1.3km NGR2: NGR3: NGR4:

Primary Type: Groundwater
Secondary Type: Catchpit
Category: Single Point

Licence No: 8/37/31/*G/0187 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1993		Y	Y

Licence Holder
32509 J R PEARCE
57941 BROCKHILL FARM
WICKFORD
ESSEX

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	14000 m3	Usability:	Legal	Conditions Exist:	No
Daily Qty:	330 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	13.68 m3	Usability:	Derived		
Inst Qty:	3.8 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
SIX WELLPOINTS - RIVENHALL	Groundwater	Wellpoints	Single Point

NGR1:TL 828 187 1.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0208 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/02/1998		Y	Y

Licence Holder
32515 P T TYRIE
57955 GLAZENWOOD HOUSE
BRADWELL
BRAINTREE
ESSEX
CM7 8ET

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Amenity - Industrial/Commercial/Energy/Public Services
Make-Up or Top Up Water
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	5000 m3	Usability:	Legal
Daily Qty:	20 m3	Usability:	Legal
Hourly Qty:	2 m3	Usability:	Legal
Inst Qty:	.5 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name	Primary Type	Secondary Type	Category
BOREHOLE AT BRADWELL	Groundwater	Borehole	Single Point

NGR1:TL 800 222 2.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*G/0222 Orig Application: EN1913 Expiry Date: 31/07/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	01/08/2004		Y	Y

Licence Holder
43882 TOTAL BUTLER
72274 COUNTY HOUSE
BAYSHILL ROAD
CHELTENHAM
GLOUCESTERSHIRE
GL50 5LY

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Environmental - Other Environmental Improvements
Pollution Remediation
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	36500 m3	Usability:	Legal	Conditions Exist:	No
Daily Qty:	100 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	5 m3	Usability:	Legal		
Inst Qty:	1.2 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
8 BOREHOLES AT KELVEDON OIL DEPOT	Groundwater	Borehole	Single Point

NGR1:TL 860 185 4.2km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0013 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
102	0	CURR	01/04/2003		Y	Y

Licence Holder
45642 S & K BUTLER
74394 BAYTREE FARM
COGGESHALL ROAD
STISTED
BRAINTREE
ESSEX
CM77 8AE

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	3000 m3	Usability:	Legal
Daily Qty:	100 m3	Usability:	Legal
Hourly Qty:	13.6 m3	Usability:	Legal
Inst Qty:	3.6 l/s	Usability:	Derived

Conditions Exist: No
Agreements Exist: No

Local Name	Primary Type	Secondary Type	Category
BAYTREE FARM, STISTED.	Surfacewater	River / Stream	Reach

NGR1:TL 786 229 4.4km NGR2:TL 798 232 3.7km NGR3: NGR4:

Licence No: 8/37/31/*S/0033 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
102	0	CURR	20/03/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/3 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	327.3 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	13.6 m3	Usability:	Legal		
Inst Qty:	3.8 l/s	Usability:	Derived		

Local Name	Primary Type	Secondary Type	Category
FEERING BURY, KELVEDON	Surfacewater	River / Stream	Reach

NGR1:TL 853 215 3.2km NGR2:TL 865 211 4.2km NGR3: NGR4:

Licence No: 8/37/31/*S/0052 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	23/02/2001		Y	Y

Licence Holder
39343 R & D BUNTING
67299 HIGHFIELDS FARM
KELVEDON
ESSEX
CO5 9BJ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	2270 m3	Usability:	Legal
Daily Qty:	382 m3	Usability:	Legal
Hourly Qty:	54.72 m3	Usability:	Derived
Inst Qty:	15.2 l/s	Usability:	Legal

Conditions Exist: Yes
Agreements Exist: Yes

Local Name	Primary Type	Secondary Type	Category
HOLE FARM, RIVENHALL	Surfacewater	River / Stream	Reach

NGR1:TL 850 169 4.5km NGR2:TL 854 172 4.5km NGR3: NGR4:

Licence No: 8/37/31/*S/0071 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	1	CURR	31/07/2000		Y	Y

Licence Holder
38442 A & B HAYES FARMS
66314 KILLIGREWS
MARGARETTING
ESSEX
CM4 0EZ

Licence Type : Licence of Right
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty: 7000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 68 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 2.8 m3 Usability: Derived
Inst Qty: l/s Usability:

Local Name	Primary Type	Secondary Type	Category
MILLES FARM 1, STISTED - POND	Surfacewater	River / Stream	Reach

NGR1:TL 794 241 4.6km NGR2:TL 798 241 4.4km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty: 7000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 68 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: m3 Usability:
Inst Qty: l/s Usability:

Local Name	Primary Type	Secondary Type	Category
MILLES FARM 2, STISTED-R.BLACK	Surfacewater	River / Stream	Reach

NGR1:TL 796 242 4.6km NGR2:TL 806 231 3.1km NGR3: NGR4:

Licence No: 8/37/31/*S/0088 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1995		Y	Y

Licence Holder
32807 R GOODWIN & SON
59007 ASHMANS FARM
KELVEDON
COLCHESTER
ESSEX
CO5 9BT

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	13600 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	382 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	16 m3	Usability:	Legal	
Inst Qty:	4.42 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT KELVEDON	Surfacewater	River / Stream	Single Point

NGR1:TL 855 173 4.5km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0127 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
101	0	CURR	01/01/1999		Y	Y

Licence Holder
32855 R M C AGGREGATES (EASTERN COUNTIES) LTD
60099 5 GUARDIAN ROAD
NORWICH
NORFOLK
NR5 8PB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Mineral Products
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	90900 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	9820 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	410.4 m3	Usability:	Derived	
Inst Qty:	114 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R BLACKWATER, COGGESHALL.	Surfacewater	River / Stream	Single Point

NGR1:TL 829 221 1.7km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0128 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/10/1997		Y	Y

Licence Holder
32463 BRAINTREE GOLF CLUB LTD
58019 KINGS LANE
STISTED
BRAINTREE
ESSEX
CM7 8DA

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Golf courses
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	1400 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	110 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	14.4 m3	Usability:	Derived	
Inst Qty:	4 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R BLACKWATER AT STISTED	Surfacewater	River / Stream	Single Point

NGR1:TL 797 243 4.6km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0169 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	1	CURR	02/02/1999		Y	Y

Licence Holder
32805 R A BRICE & PARTNERS
58983 ROSE COTTAGE
RIVENHALL END
WITHAM
ESSEX
CM8 3EZ

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	51000 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	6912 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	95.76 m3	Usability:	Derived	
Inst Qty:	26.6 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
R. BLACKWATER, ROSE COTTAGE	Surfacewater	River / Stream	Single Point

NGR1:TL 849 166 4.7km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0172 Orig Application:

Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	2	CURR	02/10/1987		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	2270 m3	Usability:	Legal
Daily Qty:	382 m3	Usability:	Legal
Hourly Qty:	54.72 m3	Usability:	Derived
Inst Qty:	15.2 l/s	Usability:	Legal

Conditions Exist: Yes
Agreements Exist: Yes

Local Name	Primary Type	Secondary Type	Category
R. BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 864 209 4.1km NGR2:TL 863 195 4.1km NGR3: NGR4:

Licence No: 8/37/31/*S/0178 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/06/1989		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	45460 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3600 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	149.76 m3	Usability:	Derived		
Inst Qty:	41.6 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Single Point

NGR1:TL 861 214 3.9km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	45460 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3600 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	149.76 m3	Usability:	Derived		
Inst Qty:	41.6 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Single Point

NGR1:TL 861 214 3.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0212 Orig Application: Expiry Date: 31/10/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
2	1	CURR	25/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	3456 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	144 m3	Usability: Legal	
Inst Qty:	40 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	3456 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	144 m3	Usability: Legal	
Inst Qty:	40 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Licence No: 8/37/31/*S/0212 Orig Application: Expiry Date: 31/10/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
2	1	CURR	25/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3456 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	144 m3	Usability:	Legal		
Inst Qty:	40 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	22730 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	3456 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	144 m3	Usability:	Legal		
Inst Qty:	40 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Licence No: 8/37/31/*S/0213 Orig Application: Expiry Date: 30/09/2008
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	24/06/1999		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58057 FEERINGBURY MANOR
FEERING
COLCHESTER
ESSEX
CO5 9RD

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? :

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/5 Abs Period End: 30/9 Time Ltd Start: Time Ltd End:

Annual Qty:	12520 m3	Usability:	Legal	Conditions Exist: Yes
Daily Qty:	382 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	54.7 m3	Usability:	Legal	
Inst Qty:	15.2 l/s	Usability:	Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERING	Surfacewater	River / Stream	Reach

NGR1:TL 8640 1959 4.2km NGR2:TL 8610 2142 3.9km NGR3: NGR4:

Licence No: 8/37/31/*S/0215 Orig Application: Expiry Date: 31/03/2010
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	21/08/2000		Y	Y

Licence Holder
36922 RMC AGGREGATES (EASTERN COUNTIES) LTD
60099 5 GUARDIAN ROAD
NORWICH
NORFOLK
NR5 8PB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Industrial, Commercial and Public Services - Extractive
Mineral Washing
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	15000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	280 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	m3	Usability:			
Inst Qty:	8 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT COGGESHALL, ESSEX	Surfacewater	River / Stream	Single Point

NGR1:TL 8343 2223 2.1km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0217 Orig Application: Expiry Date: 08/06/2013
Revoked Date:
Lapsed Date:

Issue No	**Incr No**	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	13/05/2002		Y	Y

Licence Holder
32949 G & S COODE-ADAMS
58059 FEERINGBURY
COGGESHALL
COLCHESTER
ESSEX

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Anti Frost
Abs Period Start:1/10 Abs Period End: 8/6 Time Ltd Start: Time Ltd End:

Annual Qty:	82500 m3	Usability: Legal	Conditions Exist: Yes
Daily Qty:	10303 m3	Usability: Legal	Agreements Exist: Yes
Hourly Qty:	792 m3	Usability: Legal	
Inst Qty:	220 l/s	Usability: Legal	

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER IN FEERINGBURY, KELVEDON	Surfacewater	River / Stream	Single Point

NGR1:TL 8604 2148 3.9km NGR2: NGR3: NGR4:

Licence No: 8/37/31/*S/0221 Orig Application: Expiry Date: 31/03/2025
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	1	CURR	22/07/2003		Y	Y

Licence Holder
32883 FEERINGBURY HOLDINGS
59179 BURY LODGE
FEERINGBURY FARM
COGGESHALL ROAD
FEERING
COLCHESTER
ESSEX
CO5 9RB

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	180000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	2428 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	102 m3	Usability:	Legal		
Inst Qty:	28.1 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BLACKWATER AT FEERINGBURY FARM	Surfacewater	River / Stream	Single Point

NGR1:TL 8635 2146 4.2km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*G/0038 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/01/1997		Y	N

Licence Holder
32799 STACEY FARMS
58141 WHITEHEADS FARM
CRESSING ROAD
WITHAM
ESSEX
CM8 1RL

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Less Critical
Source : GROUND WATER SOURCE OF SUPPLY
Multiple Lh? : Y

Purpose: Agriculture - General Agriculture
General Farming & Domestic
Abs Period Start:1/1 Abs Period End: 31/12 Time Ltd Start: Time Ltd End:

Annual Qty:	460 m3	Usability:	Legal	Conditions Exist: No
Daily Qty:	20 m3	Usability:	Legal	Agreements Exist: No
Hourly Qty:	m3	Usability:		
Inst Qty:	l/s	Usability:		

Local Name	Primary Type	Secondary Type	Category
WELL AT WHITEHEADS FARM	Groundwater	Well	Single Point

NGR1:TL 809 179 3.0km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*S/0032 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/04/1996		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty: 91000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 1123 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 46.8 m3 Usability: Derived
Inst Qty: 13 l/s Usability: Legal

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT FAULKBOURNE.	Surfacewater	River / Stream	Single Point

NGR1:TL 801 173 3.9km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty: 91000 m3 Usability: Legal Conditions Exist: Yes
Daily Qty: 1123 m3 Usability: Legal Agreements Exist: Yes
Hourly Qty: 46.8 m3 Usability: Derived
Inst Qty: 13 l/s Usability: Legal

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT WITHAM.	Surfacewater	River / Stream	Single Point

NGR1:TL 807 163 4.5km NGR2: NGR3: NGR4:

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Licence No: 8/37/32/*S/0032 Orig Application: Expiry Date:
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
100	0	CURR	01/04/1996		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Storage
Abs Period Start:1/11 Abs Period End: 31/3 Time Ltd Start: Time Ltd End:

Annual Qty:	91000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	1123 m3	Usability:	Legal	Agreements Exist:	Yes
Hourly Qty:	46.8 m3	Usability:	Derived		
Inst Qty:	13 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT WHITE NOTLEY.	Surfacewater	River / Stream	Single Point

NGR1:TL 784 188 4.3km NGR2: NGR3: NGR4:

Licence No: 8/37/32/*S/0042 Orig Application: EN2001 Expiry Date: 31/03/2008
Revoked Date:
Lapsed Date:

Issue No	Incr No	Status	Effective Start	Effective End	Returns Req?	Chargeable?
1	0	CURR	10/06/2005		Y	Y

Licence Holder
28295 STRUTT & PARKER (FARMS) LTD
52563 PEVEREL HOUSE
MALDON ROAD
HATFIELD PEVEREL
CHELMSFORD
ESSEX
CM3 2JF

Licence Type : Ordinary Licence
Water Act '03 Not Yet Available
Lic Type :
Criticality : Critical
Source : SURFACE WATER SOURCE OF SUPPLY
Multiple Lh? : N

Purpose: Agriculture - General Agriculture
Spray Irrigation - Direct
Abs Period Start:1/4 Abs Period End: 31/10 Time Ltd Start: Time Ltd End:

Annual Qty:	40000 m3	Usability:	Legal	Conditions Exist:	Yes
Daily Qty:	990 m3	Usability:	Legal	Agreements Exist:	No
Hourly Qty:	66 m3	Usability:	Legal		
Inst Qty:	18.33 l/s	Usability:	Legal		

Local Name	Primary Type	Secondary Type	Category
RIVER BRAIN AT FAULKBOURNE	Surfacewater	River / Stream	Reach

NGR1:TL 7943 1787 3.9km NGR2:TL 8107 1610 4.6km NGR3: NGR4:

****
* END OF REPORT *
****

Report Title **ABSTRACTION LICENCE SUMMARY BY MANAGEMENT UNIT / REPORTING UNIT**

Short Name **AR251R**

REPORT SUMMARY

Report Summary for report Date : 31/10/2005

Total Number of Licences	Sum of Hourly Quantities	Sum of Daily Quantities	Sum of Annual Quantities
23	2863.700 m3	58305.300 m3	1141444.000 m3

Discharge Consents

Consent Number	Version	Issue Date	Effective Dat	Review Date	Long Name	DS_ADD1	DS_ADD2	DS_ADD3	DS_ADD4	DS_PCODE	DS_NGR	EASTING	NORTHING	DS_TYPE	REGION
ASENF16261	1	29-MAR-04	29-MAR-04	29-MAR-08	COGGESHALL TPS	COGGESHALL			BRAINTREE		TL854702251	585470	222510	Sewerage Network - Pumping Station - water comp	AN
AW2NF151	3	17-DEC-04	01-JAN-06	01-JAN-10	COGGESHALL STW	COGGESHALL			ESSEX		TL858032127	585803	221271	Sewage Disposal Works - water company	AN
AW2NF811	3	29-JUN-05	01-JAN-06	29-JUN-09	WHITE NOTLEY STW		WHITE NOTLEY	WITHAM	ESSEX		TL789311833	578931	218333	Sewage Disposal Works - water company	AN
AW2NFC174	1	29-MAY-63	29-MAY-63		EAST ST COGGESHALL	ESSEX					TL854502263	585450	222630	Sewage Disposal Works - water company	AN
AW2NFC175	1	29-MAY-63	29-MAY-63		EAST ST COGGESHALL	ESSEX					TL854502263	585450	222630	Sewage Disposal Works - water company	AN
AW2NFC183	1	29-MAY-63	29-MAY-63		STATION RD KELVEDON	ESSEX					TL863301936	586330	219360	Sewage Disposal Works - water company	AN
AW2NFC185	1	29-MAY-63	29-MAY-63		STATION RD KELVEDON	ESSEX					TL863301936	586330	219360	Sewage Disposal Works - water company	AN
AW2NFE02454	5	26-MAR-04	01-JAN-06	26-MAR-08	RIVENHALL END STW						TL842891641	584289	216417	Sewage Disposal Works - water company	AN
AW2NFE02579	1	28-SEP-79	28-SEP-79		ESSEX C.C. DEPOT	COGGESHALL	ESSEX				TL851202250	585120	222500	Sewage Disposal Works - water company	AN
AW2NFE05179	1	18-MAR-80	18-MAR-80		OUTLET AT GREY'S MILL	MALDON ROAD	KELVEDON	ESSEX.		CO5 9BD	TL860701817	586070	218170	Sewage Disposal Works - water company	AN
AW2NFE09072	5	31-MAR-03	31-DEC-05	27-OCT-93	STISTED STW	WATER LANE	SISTED	BRAINTREE		NR11 8	TL802702439	580270	224390	Sewage Disposal Works - water company	AN
AW2NFE11784	1	11-MAY-87	11-MAY-87		CRESSING VILLAGE PS	CRESSING	NR BRAINTREE	ESSEX.			TL794002050	579400	220500	Sewage Disposal Works - water company	AN
AW2NFE11884	1	13-MAY-87	13-MAY-87		WHITE NOTLEY SPS	WHITE NOTLEY	WITHAM	ESSEX.			TL787001840	578700	218400	Sewage Disposal Works - water company	AN
GWELF50095	1	22-MAY-00	01-APR-99	01-APR-03	PATTISWICK HALL FARM	PATTISWICK HALL	BRAINTREE	ESSEX	.	CM7 8BH	TL814502417	581450	224170	Arable Farming	AN
GWELF50108	1	23-MAY-00	01-APR-99	01-APR-03	CURD HALL	COGGESHALL	COLCHESTER	ESSEX	.	CO6 1PA	TL849002110	584900	221100	Arable Farming	AN
GWELF50361	1	19-MAY-00	01-APR-99	01-APR-03	ROSE COTTAGE	RIVENHALL END	WITHAM	ESSEX	.	CM8 3EZ	TL842001630	584200	216300	Arable Farming	AN
GWELF50518	1	22-JAN-01	31-MAR-99	31-MAR-03	OAK FARM	FAULKBOURNE	WITHAM	ESSEX	.	CM8 1SE	TL792001760	579200	217600	Arable Farming	AN
PR2LFS03784	1	25-JUL-84	25-JUL-84		BRAMBLES	EAST END ROAD	BRADWELL-ON-SEA				TL800002300	580000	223000		AN
PR2LFS12078	1	29-DEC-78	29-DEC-78		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PR2LFS12676	1	28-SEP-76	28-SEP-76		BRAMBLES	EAST END ROAD	BRADWELL-ON-SEA				TL800002300	580000	223000		AN
PR2LFS13371	1	15-JUL-71	15-JUL-71		47 COLNE ROAD	COGGESHALL	ESSEX			CO6 1TD	TL850002200	585000	222000		AN
PR2LFS15870	1	09-SEP-70	09-SEP-70		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PR2NF238	1	23-JUN-86	23-JUN-86		IVY COTTAGE	LONG GREEN	CRESSING	ESSEX		CM7 8DL	TL780802187	578080	221870	Sewage disposal works - other	AN
PR2NF604	2	11-DEC-92	11-DEC-92		47 COLNE ROAD	COGGESHALL	ESSEX			CO6 1TD	TL854302383	585430	223830	Sewage disposal works - other	AN
PR2NF799	1	17-MAR-88	17-MAR-88		COLNE RD IND PARK	COGGESHALL	ESSEX				TL854002350	585400	223500	Undefined or Other	AN
PR2NF849	2	12-APR-04	12-APR-04	12-APR-08	BRADWELL AUTOPOINT	COGGESHALL ROAD	BRADWELL	BRAINTREE	ESSEX	CM7 8EB	TL810032302	581003	223021	Retail Filling Stations	AN
PR2NF850	1	13-MAY-88	13-MAY-88		BRADWELL AUTOPOINT	COGGESHALL RD	BRADWELL	BRAINTREE		CM7 8EB	TL810802300	581080	223000		AN
PR2NFE01676	1	22-APR-76	22-APR-76		HIGH STREET KELVEDON	ESSEX					TL860701850	586070	218500		AN
PR2NFE01678	1	06-APR-78	06-APR-78		CAR PARK KELVEDON STAT	KELVEDON	ESSEX				TL863201931	586320	219310		AN
PR2NFE05165	1	26-JUL-65	26-JUL-65		RAILWAY GARAGE	KELVEDON	COLCHESTER	ESSEX		CO5 9NR	TL864001930	586400	219300		AN
PR2NFE05671	2	02-MAR-92	02-MAR-92		FARM HILL HOUSE	KELVEDON	ESSEX			CO5 9PH	TL858002020	585800	220200	Sewage disposal works - other	AN
PR2NFE07270	1	09-JUL-70	09-JUL-70		APPLETREE FARM	CRESSING	BRAINTREE	ESSEX		CM7 8NY	TL788502040	578850	220400	Sewage disposal works - other	AN
PR2NFE08169	1	05-JUN-69	05-JUN-69		DWELLING AT POLECAT LA	CRESSING	BRAINTREE	ESSEX			TL780002000	578000	220000	Sewage disposal works - other	AN
PREAF02100	1	12-JAN-90	12-JAN-90		GLAZENWOOD	BRADWELL	BRAINTREE	ESSEX.			TL800002222	580000	222220	Sewage disposal works - other	AN
PRELF03007	1	22-AUG-90	22-AUG-90		ALLSHOTS FARM	KELVEDON	COLCHESTER	ESSEX		CO5 9DF	TL829702039	582970	220390	Sewage disposal works - other	AN
PRENF00356	2	15-JAN-92	15-JAN-92		RYE MILL HOUSE	RYE MILL LANE	FEERING	KELVEDON	ESSEX	CO5 9SB	TL867701996	586770	219960	Sewage disposal works - other	AN
PRENF00562	1	18-APR-89	18-APR-89		PREMISES AT THATCHED COTTAGE	SNIVELLERS LANE	KELVEDON				TL845601813	584560	218130	Sewage disposal works - other	AN
PRENF00719	2	14-JAN-92	14-JAN-92		MONKS FARM COTTAGES	PANTLINGS LANE	COGGESHALL RD	KELVEDON	ESSEX	CO5 9PG	TL852602028	585260	220280	Sewage disposal works - other	AN
PRENF03000	2	13-JAN-92	13-JAN-92		ASH BROOKS	BULFORD MILL LANE	BLACK NOTLEY	BRAINTREE	ESSEX	CM7 8NS	TL774502041	577450	220410	Sewage disposal works - other	AN
PRENF04059	2	09-DEC-92	09-DEC-92		SKYE GREEN COTTAGE		FEERING	COLCHESTER		CO5	TL871702202	587170	222020	Sewage disposal works - other	AN

PRENF04063	2	13-JAN-92	13-JAN-92		BARNS ADJACENT TO WARREN FARM	FAULKBOURNE	WITHAM	ESSEX			TL806601612	580660	216120	Sewage disposal works - other	AN
PRENF04417	2	17-JAN-92	17-JAN-92		WARREN FARM HOUSE	THE STREET	FAULKBOURNE				TL806601613	580660	216130	Sewage disposal works - other	AN
PRENF08114	1	08-JUL-92	08-JUL-92		NEW HOUSE BARN	CHURCH ROAD	CRESSING	ESSEX		CM7 8PF	TL799901959	579990	219590	Sewage disposal works - other	AN
PRENF08146	2	07-JUL-94	07-JUL-94		KENMIL 133/134	COGGESHALL ROAD	STISTED	BRAINTREE	ESSEX	CM7 8AB	TL784402346	578440	223460	Sewage disposal works - other	AN
PRENF08255	1	08-JUN-93	08-JUN-93		THE COMPASSES INN	COMPASSES ROAD	PATTISWICK	NR BRAINTREE		CM7 8BG	TL820302464	582030	224640	Sewage disposal works - other	AN
PRENF08558	1	21-SEP-93	21-SEP-93		MILL COTTAGE ABBEY MILL	COGGESHALL	COLCHESTER	ESSEX			TL856002215	585600	222150	Sewage disposal works - other	AN
PRENF08757	1	27-JAN-95	27-JAN-95		BRIDGEFOOT HOUSE	KELVEDON	COLCHESTER	ESSEX		CO5 9BE	TL860701800	586070	218000	Sewage disposal works - other	AN
PRENF10081	1	28-APR-95	28-APR-95		THE OLD RECTORY	MARKSHALL	COGGLESHALL	ESSEX		SS4 1NT	TL843902404	584390	224040	Sewage disposal works - other	AN
PRENF10592	1	10-SEP-96	10-SEP-96		BULFORD COTTAGE	BULFORD MILL LANE	CRESSING	BRAINTREE	ESSEX	CM7 8NS	TL774502038	577450	220380	Sewage disposal works - other	AN
PRENF10748	1	14-FEB-97	14-FEB-97		ALFA KENNELS	WATER LANE	STISTED	ESSEX		CM7 8AP	TL799802421	579980	224210	Sewage disposal works - other	AN
PRENF10774	1	28-FEB-97	28-FEB-97		RIVENHALL P STN & CAFE	RIVENHALL WAY	WITHAM	ESSEX			TL841801670	584180	216700	Sewage disposal works - other	AN
PRENF11225	1	30-JAN-98	30-JAN-98		SANDY HILL NURSERIES	COGGLESHALL ROAD	NR BRADWELL	BRAINTREE	ESSEX		TL798402326	579840	223260	Sewage disposal works - other	AN
PRENF11448	1	21-AUG-98	21-AUG-98		1 GLEBE COTTAGES	THE GREEN	WHITE NOTLEY	WITHAM	ESSEX	CM8 1RG	TL775701938	577570	219380	Sewage disposal works - other	AN
PRENF11672	1	12-AUG-99	21-MAY-99	21-MAY-03	RIVENHALL P STN & CAFE	RIVENHALL WAY	WITHAM	ESSEX			TL841801670	584180	216700	Sewage disposal works - other	AN
PRENF11780	1	18-AUG-99	13-JUL-99	13-JUL-03	GOSLINGS BARN	SHEEPCOTES LANE	BRADWELL		ESSEX	CM7 8ER	TL814002145	581400	221450	Sewage disposal works - other	AN
PRENF11918	1	18-APR-00	17-DEC-99	17-DEC-03	KELVEDON PARK (FORMER DURWARDS HA	LONDON ROAD	RIVENHALL		ESSEX	CM8 3HB	TL846401710	584640	217109	Sewage disposal works - other	AN
PRENF13275	1	21-AUG-00	24-AUG-00	24-AUG-04	BAILIFFS COTTAGE	FELIX HALL	KELVEDON		ESSEX	CO5 9DQ	TL851601902	585160	219020	Sewage disposal works - other	AN
PRENF13415	2	08-MAY-02	08-MAY-02	08-MAY-05	KELVEDON OIL DEPOT	14 HIGH STREET		KELVEDON	ESSEX	CO5 9AG	TL860371847	586037	218472	Undefined or Other	AN
PRENF13528	1	20-APR-01	16-MAR-01	16-MAR-05	FAULKBOURNE ESTATE	HILL FARMHOUSE	WITHAM		ESSEX		TL796201724	579620	217240	Sewage disposal works - other	AN
PRENF13570	1	08-JUN-01	08-JUN-01	08-JUN-05	LANHAMS FARM COTTAGE	CRESSING	BRAINTREE		ESSEX	CM7 8DQ	TL791902187	579190	221870	Sewage disposal works - other	AN
PRENF13692	1	13-SEP-01	19-JUL-01	19-JUL-05	BRIDGE FARM	NEW ROAD	KELVEDON		ESSEX		TL858601898	585860	218980	Sewage disposal works - other	AN
PRENF13822	1	03-JAN-02	13-DEC-01	13-DEC-05	ETIVE COTTAGE	FELIX HALL	KELVEDON		ESSEX	CO5 9DQ	TL850601902	585060	219020	Sewage disposal works - other	AN
PRENF13823	1	25-APR-02	01-OCT-01	01-OCT-05	ABBEY MILL HOUSE	ABBEY MILL LANE	COGGESHALL		ESSEX	CO6 1RD	TL855202215	585520	222150	Sewage disposal works - other	AN
PRENF13976	1	06-FEB-02	07-FEB-02	07-FEB-06	THE OLD RECTORY	PATTISWICK	BRAINTREE		ESSEX	CM7 4TW	TL819802434	581980	224340	Sewage disposal works - other	AN
PRENF13978	1	12-FEB-02	07-FEB-02	07-FEB-06	CRESSING LODGE	LONG GREEN	CRESSING	BRAINTREE	ESSEX	CM7 8DL	TL780202199	578020	221990	Sewage disposal works - other	AN
PRENF13988	1	25-FEB-02	19-FEB-02	19-FEB-06	PARKGATE FARMHOUSE	PARK ROAD	RIVENHALL	BRAINTREE	ESSEX	CM8 3PS	TL824801920	582480	219200	Sewage disposal works - other	AN
PRENF14039	1	20-MAR-02	11-MAR-02	11-MAR-06	THE OLD RECTORY	FAULKBOURNE	WITHAM		ESSEX	CM8 1SP	TL803901604	580390	216040	Sewage disposal works - other	AN
PRENF15441	1	03-FEB-03	03-FEB-03	03-FEB-07	THE BARN	RECTORY LANE	RIVENHALL	BRAINTREE	ESSEX	CM8 3HJ	TL823001679	582300	216790	Sewage disposal works - other	AN
PRENF15442	1	03-FEB-03	03-FEB-03	03-FEB-07	RICKSTONES FARM	RICKSTONES ROAD	RIVENHALL	BRAINTREE	ESSEX	CM8 3HQ	TL822701681	582270	216810	Sewage disposal works - other	AN
PRENF15715	1	13-MAY-03	16-APR-03	16-APR-07	BULFORD FARM	BULFORD MILL FARM	CRESSING	BRAINTREE	ESSEX	CM7 8NS	TL774182041	577418	220419	Sewage disposal works - other	AN
PRENF15963	1	29-AUG-03	29-AUG-03	29-AUG-07	THE CLOCK HOUSE	THE CLOCK HOUSE	KELVEDONN	KELVEDON	ESSEX	CO5 9DG	TL846291955	584629	219550	Sewage disposal works - other	AN
PRENF16008	1	10-SEP-03	10-SEP-03	10-SEP-07	119 WATER LANE	STISTED	STISTED	ESSEX	ESSEX	CM7 8AP	TL800672417	580067	224170	Sewage disposal works - other	AN
PRENF16122	1	10-NOV-03	10-NOV-03	10-NOV-07	POINTWELL MILL	POINTWELL LANE	COGGESHALL		ESSEX	CO6 1RH	TL853222152	585322	221522	Sewage disposal works - other	AN
PRENF16588	1	27-JUL-04	27-JUL-04	27-JUL-08	76 STOCK STREET	COGGESHALL			ESSEX	CO6 1NX	TL830752258	583075	222585	Sewage disposal works - other	AN
PRENF16861	1	16-FEB-05	16-FEB-05	16-FEB-09	AGRICULTURAL RESERVOIR SITE	FAULKEBOURNE FARI	WITHAM		ESSEX		TL813001720	581300	217200	Reservoir/Borehole Site	AN
PRENF16973	1	09-NOV-04	09-NOV-04	09-NOV-08	WHYLIE CLARKS COTTAGE	CRANES LANE	KELVEDON	KELVEDON	ESSEX		TL845251812	584525	218125	Sewage disposal works - other	AN
PRENF16998	1	19-NOV-04	19-NOV-04	19-NOV-08	HATWARDS FARM COTTAGE	CUT HEDGE LANE	COGGESHALL	COLCHESTER	ESSEX		TL831992113	583199	221131	Sewage disposal works - other	AN
PRENF19551	1	18-AUG-05	18-AUG-05	18-AUG-09	HATCHCROFT HOUSE	THE GREEN	WHITE NOTLEY	ESSEX	ESSEX	CM8 1RG	TL775741944	577574	219442	Sewage disposal works - other	AN

APPENDIX 6-7

MONTHLY WATER BALANCE UPPER LAGOON

Approximate Water Balance

Month	Rainfall (mm)	Evaporation (mm)	Effective Rainfall (mm)	Runoff (m^3)	Direct Rainfall to Upper Lagoon (m^3)	Evaporation from Upper Lagoon (m^3)	Estimated water usage in process^(m^3)	Storage required (m^3)*	Top-up water required (m^3/d)
Calculation			(Rainfall-Evaporation) where positive	(Effective Rainfall (m)* Development Area)	(Rainfall (m) * Upper Lagoon Area)	(Evaporation (m) * Upper Lagoon Area)		(Runoff + Direct rainfall to lagoon - evaporation from lagoon-estimated water usage)	(-storage required*12/365)
January	48	3	45	9,675	786	49	170,901	-160,490	5276
February	37	10	27	5,805	606	164	154,363	-148,116	4870
March	37	32	5	1,075	606	524	170,901	*-169,745*	5581
April	36	57	0	0	589	933	165,389	*-165,732*	5449
May	43	84	0	0	704	1,375	170,901	*-171,573*	5641
June	46	98	0	0	753	1,605	165,389	*-166,240*	5465
July	54	98	0	0	884	1,605	170,901	*-171,622*	5642
August	59	80	0	0	966	1,310	170,901	*-171,245*	5630
September	48	51	0	0	786	835	165,389	*-165,438*	5439
October	49	21	28	6,020	802	344	170,901	-164,423	5406
November	58	5	53	11,395	950	82	165,389	-153,126	5034
December	51	1	50	10,750	835	16	170,901	-159,333	5238

Rainfall based on FEH (1999) value spread across the monhtly proportions provided in MAFF (1976)

Evaporation data taken from MAFF (1999)

^ Based on process water usage of 6125.5 m^3/d for 90% of month

*Positive Storage Required indicates when overflow will occur from the upper lagoon, Negative storage required indicates where additional water will be required to maintain upper lagoon level.

Areas

Development	215,000	m^2
Upper Lagoon	16,373	m^2
Depth of Upper Lagoon	7	m
Volume of Upper Lagoon	114,611	m^3

February 2010

GENT FAIRHEAD & CO. LTD

2009 Ground Investigation at Rivenhall Airfield, Essex

Submitted to:
Mr. Tom Fairhead,
Gent Fairhead & Co. Ltd,
9 Royal Crescent,
London,
W11 4SL

REPORT

A world of capabilities delivered locally

Report Number: 07514690074.510/B.0

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Golder Associates

Record of Issue

Company	Client Contact	Version	Date Issued	Method of Delivery
Gent Fairhead & Co Ltd	Tom Fairhead	07514690074.510/B.0	8 February 2010	Post and e-mail
Blackwater Aggregates	Patrick Wigg	07514690074.510/B.0	8 February 2010	Post and e-mail

Executive Summary

Golder Associates (UK) Ltd carried out a ground investigation at Rivenhall Airfield in June 2009 on behalf of Gent Fairhead & Co Ltd (GFC). GFC commissioned Golder to develop an evolution of the planned Recycling and Composting Facility (the eRCF) at Rivenhall Airfield (the Site). The eRCF is a development of the original Recycling and Composting Facility (RCF) design, for which Essex County Council resolved to grant planning permission on 30 March 2007 for the Site at Rivenhall Airfield.

Golder commissioned Boart Longyear Environmental & Infrastructure Drilling Service (Boart Longyear) to undertake rota-sonic drilling of four drill holes. Locations were selected by Golder to provide an initial characterisation of the geotechnical and geological ground conditions for the initial design of foundations and retaining walls.

Golder supervised drilling works and logged the cores. Borehole logs (provided as Appendix A to this report) indicate that clay is present below an initial Made Ground layer. A band of sand and/or gravel intersperses the clay for a few metres, with further clay present below this.

Standard Penetration Tests (SPTs) were carried out during drilling, the results of which are detailed within the borehole logs. Sub samples of the cores were taken and subsequently dispatched to the GEOLABS Ltd laboratory for geotechnical analysis. Analysis results are provided as Appendix D to this report. Three standpipe piezometers and two vibrating wire piezometers were installed in the boreholes detailed in the borehole logs contained in Appendix A.

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Drawing

1.0 INTRODUCTION

Golder Associates (UK) Ltd (Golder) was commissioned by Gent Fairhead & Co Limited (GFC) in June 2009 to undertake a site investigation at Rivenhall Airfield, Essex (the Site). GFC propose to develop an evolution to a planned Recycling and Composting Facility (the eRCF) at the Site. The eRCF is a development of the original Recycling and Composting Facility (RCF) design, for which Essex County Council resolved to grant planning permission on 30 March 2007 for the Site at Rivenhall Airfield.

Ground investigation works took place between the 8 and 16 June 2009 with Boart Longyear Environmental & Infrastructure Drilling Service (Boart Longyear) commissioned by Golder to undertake drilling works. Boart Longyear mobilised two Rota-Sonic drilling rigs to develop four boreholes in locations specified by Golder. This factual report represents the results of site investigation and associated laboratory analysis, with borehole logs provided in Appendix A.

1.1 Purpose

The programme of work was undertaken to investigate in further detail the ground conditions at Rivenhall Airfield. The infrastructure required to develop the Site for the construction and operation of the eRCF will include foundations, retaining walls, roads and services. The ground investigation work was undertaken to enable an initial characterisation of the ground conditions to inform preliminary design.

Rota-Sonic drill holes were to be undertaken to depths in excess of the proposed foundation levels to provide soil conditions, *in situ* testing, ground water conditions and samples for laboratory testing.

2.0 DESK STUDY

2.1 Site Description

The majority of land at the Site comprises farmed agricultural land, with some patches of woodland and grassland also present. A number of concrete runways remain and an original WWII aircraft hangar is also present related to the original airfield, now used for storage and distribution activities which take place in line with a planning permission for commercial/industrial use.

The proposed location of the planned eRCF is in the south eastern corner of the airfield. To the immediate north of the airfield is a sand and gravel extraction facility, Bradwell Quarry.

2.2 Site Geology

The published geological map for the region, Sheet 223 covering the Braintree area (BGS, 1982), shows the Site is underlain by Boulder Clay quaternary drift deposits overlying the London Clay.

According to Sheet 223, the Boulder Clay (the Lowestoft Till) consists of a generally pale brown to buff sandy clay with chalk fragments. The basal beds have shown banding and crude laminations. Below the Boulder Clay a continuous, or almost continuous, sheet of sand and gravel is present. This is identified as the Kesgrave Sands and Gravels, which are a sequence of fluvial glacial gravels laid down in a braided river system containing flint, vein quartz, quartzite, sandstone and occasional igneous and metamorphic rock gravel clasts. The deposit is worked extensively for aggregate and building sand and is identified in the Minerals Assessment Reports for the areas of Coggeshall and Witham.

The Tertiary London Clay underlies the drift deposits, it is a stiff blue grey silty clay, with the upper surface often weathered exhibiting a colour change to brown grey. Up to 69 m of London Clay is indicated on the geological map in the area and it is exposed in the river valleys to the north and the south where the drift deposits have been eroded. Below the London Clay the formations of the Thanet Sand and Lambeth Group can be recognised in borehole logs above the Upper Chalk. The surface of the Upper Chalk lies at approximately 90 m beneath the Site (-40 m AOD), dipping to the south.

2.3 Site Hydrogeology

The Groundwater Vulnerability Maps for this area (Environment Agency 1994 and Environment Agency 1995) classify the Boulder Clay deposits and London Clay at the Site as non-aquifer. The Kesgrave Sands and Gravels beneath the Boulder Clay are classified as a minor aquifer. The Upper Chalk is classified as a major aquifer.

The Hydrogeological Map of the area (British Geological Survey, 1981) indicates that in 1976, the piezometric surface of the Chalk Aquifer was at in the order of +10 m AOD, approximately 50 m below the existing ground level. The chalk aquifer is confined beneath the London Clay and groundwater flow is essentially towards the south.

2.4 Previous Ground Investigation

A detailed summary of the previous ground investigations is provided in Chapter's 5 and 6 of the eRCF Environmental Statement (Golder Associates (UK) Ltd, 2008). A selection of historical borehole logs is contained in Appendix B.

The local drift geology in the area was investigated by RMC Group (now CEMEX) to provide information regarding the reserves of sand and gravel, and by Golder to provide information critical to establishing the geological and hydrogeological setting of the area. The results of the site investigations carried out in 1990

and 1991 are summarised below. The investigations covered the whole of Rivenhall Airfield area, with only a limited number of boreholes being located within the Site area.

The quaternary Boulder Clay deposit (Lowestoft Till) is described in the site investigation borehole logs as consisting of layers of firm to stiff orange or brown grey chalky mainly silty or gravely Clay with occasional sandy clay. The reported thickness of the Boulder Clay across the Site varies between 4 m and 6 m.

A continuous sheet of sand and gravel (Kesgrave Sand and Gravel) underlies the Boulder Clay. The deposits are described as consisting of loose to medium dense yellow or orange brown or grey brown Sands and Gravels or sandy Gravels with some chalk or flint in upper layers and some small cobbles or occasional clay nodules in lower layers. The sand and gravel layers are sometimes reported interspersed with thin sandy clay layers. The reported thickness of the Sands and Gravels across the Site is reported to vary between 6 m to 7 m.

London Clay is reported below the Sands and Gravels. This is described to consist of stiff to very stiff brown or grey clay. The upper surface of the London Clay is often weathered; the upper layers of the clay are often described as silty Clay and often contain some gravel. The upper surface of the London Clay is typically at or around 36 m AOD.

Groundwater levels within the Sands and Gravels measured across the area in 2005 range between approximately 33 m AOD and 39 m AOD and are unconfined. It is understood that the groundwater flow is generally to the north east towards the River Blackwater.

3.0 FIELDWORK

3.1 Drilling Works

Boart Longyear mobilised two sonic drilling rigs and associated support equipment to the site on 8 June 2009 to commence the drilling works. These rigs comprised a DB320 rubber track mounted Rota-Sonic drill outfit and a BL300 T truck mounted outfit. Associated equipment comprised coring tools, drilling casing, installation casing and an off-road vehicle with a trailer to transport equipment.

Works took place over the course of two weeks, with four drill holes completed in this time. Borehole RBH 01 was drilled to 13.5 m below ground level (bgl) on the first day of the investigation to provide an initial understanding of the ground conditions. RBH 02, RBH 03, and RBH 04 were subsequently constructed to depths of 30 m, 50 m and 50 m bgl respectively. Borehole locations are shown on Drawing No. RGI-01 contained in Appendix E.

Drilled holes RBH02, RBH02 and RBH04 were installed with standpipe piezometers and vibrating wire piezometers in a granular surround and backfilled bentonite as detailed in the borehole logs and Table 1.

3.2 Drilling Supervision Works

Golder supervised drilling and installation by Boart Longyear, logged arisings and collected samples for laboratory analysis. Monitoring installations were specified to provide details of the groundwater conditions within the soils.

Golder Site activity and logging of arisings was conducted in accordance with the guidance in BS EN 1997 Part 2: Eurocode 7 - Ground Investigation and Testing (2007).

Borehole logs detailing the geology observed are provided in Appendix A. In general, the geology encountered at each location comprised a thin layer of Made Ground followed by clay down to depths of approximately 7 to 8 metres below ground level (m bgl). Sands and gravels were present below this down to depths ranging from 10 m to 12.7 m bgl, with further clay present below the sand and gravel to the base of the hole in each location

3.3 In Situ Testing

During development of the drill holes Golder supervised in-situ testing of holes and the sampling of arisings. Standard Penetration Tests (SPTs) were carried out during the drilling of each of the holes.

Details of SPTs conducted are provided in the Borehole logs in Appendix A. A plot of SPT versus depth is also presented in Appendix A.

3.4 Installations

Drill holes were installed with casing and backfilled with bentonite pellets and gravels. In addition, Table 1 shows the following additional installations were constructed in the drill holes to allow monitoring of groundwater activity within the soils;

Table 1: Borehole Installation Details

Borehole	Standpipe Piezometer (SP) Perforated Section	Vibrating Wire Piezometer (VWP)
RBH 02	6.9 – 10.6 m bgl	-
RBH 03	7.5 – 13.5 m bgl	50 m bgl
RBH 04	7.2 – 13.2 m bgl	50 m bgl

3.4.1 Standpipe Piezometers

Three 63 mm outside diameter (OD) standpipe piezometers were installed in the boreholes at the depths identified in Table 1 and were targeted at the base of the Sand and Gravel layer. The standpipe piezometers comprised a solid section and slotted section and terminated with an end cap. The slotted section in RBH03 was placed in a geotextile surround. Backfill comprised bentonite pellets and granular surround to the slotted section of pipe. Table 2 shows the results of the dip readings taken in the standpipe piezometers.

Table 2: Standpipe Piezometer Readings

Date	RBH 02		RBH 03		RBH 04	
	Depth to Water	Depth to Base	Depth to Water	Depth to Base	Depth to Water	Depth to Base
	(m)	Repo(m)	(m)	(m)	(m)	(m)
19/08/2009	8.03	8.04				
28/08/2009	8.09	8.10	9.56	9.66	9.29	9.30
24/09/2009	8.00	8.10	9.70	9.20	9.20	9.50

The standpipe piezometer readings indicate that some soil infiltration has taken place such that the readings are not representative.

3.4.2 Vibrating Wire Piezometer

Two vibrating wire piezometers were installed in Boreholes RBH03 and RBH04 to a depth of 50 m bgl. These are to enable the future monitoring of the potential piezometric conditions within the London Clay due to the underlying Chalk aquifer and are for use in the design stage.

Details of the vibrating wire piezometers and calibration certificates are contained in Appendix C.

4.0 LABORATORY TESTING

Soil samples were scheduled for laboratory testing to provide soil properties, with scheduling based on the ground conditions encountered whilst logging.

Collected samples were dispatched to the UKAS accredited geotechnical analysis laboratory, GEOLABS Ltd for analysis. Samples were scheduled for analysis of various geotechnical properties, within the following categories: classification, chemical, compaction, compressibility and shear strength to the relevant British Standard. Testing comprised:

- Moisture Content;
- Liquid limit, plastic limit and plasticity index;
- Particle Size Distribution (PSD) by wet sieving;
- Sedimentation by pipette;
- Dry density/moisture content relationship;
- One Dimensional consolidation properties;
- Undrained shear strength;
- Consolidated undrained triaxial compression test with measurement of pore pressure;
- Determination of one dimensional consolidation properties of soils; and
- BRE SD1 suite.

The results of laboratory analysis are described in Section 5.0.

5.0 RESULTS

5.1 Geotechnical Test Results

This section provides a summary of the geotechnical test results.

The results received from GEOLABS are contained in Appendix D and are summarised in Table 3 to Table 5. Each table presents the results from individual strata. Minimum, maximum and mean values are quoted for each test.

Table 3: Boulder Clay Geotechnical Test Results Summary

Test	Results			
	No. of Samples	Max	Min	Mean
Moisture Content (%)	14	20	11	17
Liquid Limit (%)	7	47	34	38
Plastic Limit (%)	7	20	14	16
Plasticity Index (%)	7	27	19	22
Particle Size Distribution (% passing 425 µm)	7	100	75	93
Bulk Density (Mg/m^3)	1	2.16	2.16	2.16
Dry Density (Mg/m^3)	1	1.83	1.83	1.83
Mean Shear Stress (kPa)	2	175	120	148
Apparent Cohesion (kPa)	1	167	167	167
Angle of Shearing Resistance (°)	1	1.5	1.5	1.5
Optimum Moisture Content (%)	1	1.97	1.97	1.97
Maximum Dry Density (Mg/m^3)	1	11	11	11

Table 4: Sand & Gravel Geotechnical Test Results Summary

Test	Results			
	No. of Samples	Max	Min	Mean
Moisture Content (%)	1	10	10	10
Liquid Limit (%)	1	32	32	32
Plastic Limit (%)	1	14	14	14
Plasticity Index (%)	1	18	18	18
Bulk Density (Mg/m^3)	1	2.22	2.22	2.22
Dry Density (Mg/m^3)	1	2.03	2.03	2.03
Mean Shear Stress (kPa)	1	109	109	109

Test	Results			
Apparent Cohesion (kPa)	1	34	34	34
Angle of Shearing Resistance (°)	1	15	15	15

Table 5: London Clay Geotechnical Test Results Summary

Test	Results			
	No. of Samples	Max	Min	Mean
Moisture Content (%)	28	55	24	29
Liquid Limit (%)	14	95	73	84
Plastic Limit (%)	14	31	24	27
Plasticity Index (%)	14	66	47	57
Particle Size Distribution (% passing 425 µm)	14	100	100	100
Bulk Density (Mg/m^3)	5	2.73	1.95	2.14
Dry Density (Mg/m^3)	5	2.09	1.51	1.66
Total Stress Parameters				
Mean Shear Stress (kPa)	5	338	92	248
Apparent Cohesion (kPa)	5	338	83	234
Angle of Shearing Resistance (°)	5	2	1	0.8
Effective Stress Parameters				
Cohesion (kPa)	5	53	19	48
Angle of Shearing Resistance (°)	5	20	18	19
Cohesion (kPa)	5	53	19	48
Angle of Shearing Resistance (°)	5	20	18	19
Earthworks Testing				
Optimum Moisture Content (%)	1	1.71	1.71	1.71
Maximum Dry Density (Mg/m^3)	1	20	20	20

The results of the one dimensional consolidation tests conducted on the London Clay are contained within Appendix D.

5.2 Chemical Test Results

Chemical testing was undertaken in accordance with the recommendations outlined in BRE Special Digest 1:2005 (Third Edition). The results received from GEOLABS are contained in Appendix D and are summarised in Table 6 to Table 8.

Table 6: Boulder Clay Chemical Testing Summary

Test	Results			
	No. of Samples	Max	Min	Mean
pH	2	8.0	7.5	7.75
Acid Soluble SO_4 (%)	2	0.02	<0.01	0.015
Water Soluble SO_4 (g/l)	2	0.05	0.02	0.035
Total Sulphur (%)	2	<0.01	<0.01	<0.01
Water Soluble Chloride (mg/l)	2	<50	<50	<50
Water Soluble Nitrate (mg/l)	2	<1.0	<1.0	<1.0
Magnesium (mg/l)	0	-	-	-

Table 7: Sand & Gravel Chemical Testing Summary

Test	Results			
	No. of Samples	Max	Min	Mean
pH	4	8.3	7.3	8.03
Acid Soluble SO_4 (%)	4	<0.01	<0.01	<0.01
Water Soluble SO_4 (g/l)	4	0.03	0.01	0.02
Total Sulphur (%)	4	<0.01	<0.01	<0.01
Water Soluble Chloride (mg/l)	4	<50	<50	<50
Water Soluble Nitrate (mg/l)	4	<1.0	<1.0	<1.0
Magnesium (mg/l)	0	-	-	-

Table 8: London Clay Chemical Testing Summary

Test	Results			
	No. of Samples	Max	Min	Mean
pH	4	8.2	7.7	7.97
Acid Soluble SO_4 (%)	4	0.12	0.04	0.07
Water Soluble SO_4 (g/l)	4	1	0.33	0.58

Test	Results			
Total Sulphur (%)	4	0.89	0.16	0.44
Water Soluble Chloride (mg/l)	4	<50	<50	<50
Water Soluble Nitrate (mg/l)	4	<1.0	<1.0	<1.0
Magnesium (mg/l)	0	-	-	-

6.0 REFERENCES

British Geological Survey, 1981: Sheet 5; Hydrogeological Map of Southern East Anglia.

British Geological Survey, 2000. The physical properties of minor aquifers in England and Wales. Hydrogeology Group Technical Report WD/00/04 Environment Agency R&D Publication 68;

Building Research Establishment, 2005: Concrete in Aggressive Ground. Special Digest 1;

BS EN 1997-2: 2007: Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing;

Environment Agency, 1994: Groundwater Vulnerability Map of North Essex. Sheet 32;

Environment Agency, 1995: Groundwater Vulnerability Map of the Thames Estuary. Sheet 40;

Golder Associates (UK) Ltd, 2008: Planning Application and Environmental Statement, Volume 2 Environmental Statement, Evolution of the Recycling & Composting Facility at Rivenhall Airfield;

Institute of Geological Sciences (Natural Environmental Research Council), 1976. Geological Map of Chelmsford, Sheet 241 Solid and Drift Edition 1:50,000 Scale;

Institute of Geological Sciences (Natural Environmental Research Council), 1982. Geological Map of Braintree, Sheet 223 Solid and Drift Edition 1:50,000 Scale.

Report Signature Page

Steven Smith
Project Manager

Darren King
Reviewer

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APPENDIX A

Golder Borehole Logs

Golder Associates

Client : Gent Fairhead & Co Ltd

Hole No. RBH01

Site : Rivenhall Airfield

Project : Rivenhall Airfield Ground Investigation

Project No : 07514690074

Equipment & Methods : Rota-Sonic

Contractor : Boart Longyear

Date Started : 08/06/2009 **Completed :** 08/06/2009

Logged by : AJ

Ground Level :

Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(0.65)	MADE GROUND: Recovered as loose, red/brown, very sandy clayey, becoming very clayey GRAVEL of assorted fill, including flint, brick and concrete, with rare rootlets and nail.
								0.65	Stiff, red/brown, gravelley CLAY. Gravel is angular.
								0.85	Firm, brown mottled grey, slightly sandy gravelley CLAY. Gravel is fine to medium, sub-rounded to rounded Flint.
								(5.15)	
								6.00	Very stiff, dark brown, gravelley CLAY. Gravel is fine to coarse of chalk and flint. Chalk is angular, flint is sub-angular to rounded.
								(1.20)	
								7.20	Firm to stiff, red/brown, gravelley CLAY. Gravel is medium to coarse, sub-rounded to rounded and of Flint with occaisonal Quartz.
								7.50	Loose, orange/brown, gravelley SAND.
								(2.50)	

Remarks :
Initial borehole to check ground conditions.
No samples taken.
No water strikes recorded.
No Instrumentation installed.

Checked By: DK

Scale 1:50

GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH01
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 08/06/2009 Completed : 08/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								10.00	
								(0.50)	Soft, brown sandy CLAY
								10.50	
								(0.60)	Soft to firm, brown, slightly sandy CLAY with frequent fine to medium, sub-rounded to rounded gravel of Flint.
								11.10	
								(0.60)	Loose, grey/light brown, sandy GRAVEL. Sand is fine to coarse, gravel is sub-angular to round, fine to coarse.
								11.70	
								(0.80)	Very stiff, dark brown CLAY (LONDON CLAY)
								12.50	
								(1.00)	Very stiff, dark grey CLAY (LONDON CLAY)
								13.50	End of Hole at 13.50m

Remarks :
Initial borehole to check ground conditions.
No samples taken.
No water strikes recorded.
No Instrumentation installed.

Checked By: DK

Scale 1:50

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Golder Associates

Client : Gent Fairhead & Co Ltd

Hole No. RBH02

Site : Rivenhall Airfield

Project : Rivenhall Airfield Ground Investigation

Project No : 07514690074

Equipment & Methods : Rota-Sonic

Contractor : Boart Longyear

Date Started : 10/06/2009 **Completed :** 11/06/2009

Logged by : AJ

Ground Level :

Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING: Top of Core Run	CORING: TCR (%)	CORING: SCR (%)	CORING: RQD (%)	STRATA RECORD: Level (mAOD)	Legend	Depth (Thickness) m	Description
								(0.40)	MADE GROUND: Soft, dark grey, very sandy and gravelley CLAY with occaisonal sub-rounded cobbles. Sand is fine to coarse, gravel is fine to coarse, angular to sub-rounded.
								0.40	Soft to firm, orange brown, slightly gravelly CLAY. Gravel is medium to coarse, angular to sub-angular.
								(0.95)	
								1.35	
								1.50	Firm, pale brown, slightly gravelly CLAY. Gravel is fine to coarse, sub-rounded of chalk.
								(3.00)	Soft to firm, pale brown mottled dark brown, slightly sandy slightly gravelly CLAY. Sand is medium to coarse chalk. Gravel is fine to coarse, sub-angular to sub-rounded chalk. Becoming gravelly CLAY with occasional cobble sized chalk with depth. Gravel is fine to coarse, sub-angular to sub-roundeded chalk.
								4.50	Firm to stiff, brown, sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to coarse, angular to round of chalk and flint. Becoming becoming less chalk and more flint with occasional cobbles of flint with depth.
								(1.50)	
								6.00	Firm to stiff, orange/brown, slightly gravelly CLAY. Gravel is fine of chalk.
								(0.60)	
								6.60	Soft, orange, fine to coarse sandy CLAY with frequent medium to coarse, angular to round gravel of flint. Becoming very sandy from 6.7m.
								6.90	Loose, orange/brown, gravelly medium to coarse SAND. Gravel is fine to coarse, angular to round flint.
								7.10	Recovered as loose, grey slightly clayey gravelly medium to coarse SAND. Gravel is fine to coarse, angular to round of flint. Becoming with depth pink/grey, slightly clayey fine SAND with occasional medium to coarse gravel.
								7.40	Recovered as loose, orange/brown, very gravelly medium to coarse SAND. Gravel is fine to coarse, angular to round of flint
								7.70	Loose to dense, light grey mottled dark grey, very clayey very gravelly fine to medium SAND. Gravel is fine to coarse, angular to round of flint.
								7.90	Loose, grey/brown, slightly clayey fine to coarse SAND. Becoming with depth orange/brown, clayey fine to medium SAND with occasional fine to medium, angular to sub-angular gravel.
								(1.10)	
								9.00	Dense, grey, clayey fine to medium SAND.
								(0.50)	
								9.50	Loose, grey/light brown, slightly clayey fine to medium SAND.
								9.70	Loose, light brown, gravelly fine to coarse SAND. Gravel is fine to coarse, angular to sub-rounded of flint.

Remarks :
Water added between 6 and 7.5m bgl.
Water level at 4.30 m at 19.00 on 10/06/09
Stand pipe piezometer installations: Solid 0 - 6.9 m bgl, slotted 6.9 - 10.6 m bgl.
Backfill: Bentonite pellets 0 - 6.7 m bgl, gravel 6.7 - 10.7 m bgl, bentonite 10.7 - 30.65 m bgl.

Checked By: DK

Scale 1:50

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Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH02
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 10/06/2009 Completed : 11/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(0.60)	Loose, light brown, gravelly fine to coarse SAND. Gravel is fine to coarse, angular to sub-rounded of flint.
								10.30	
								10.50	Loose, orange, very sandy fine to medium, sub-angular to rounded GRAVEL. Sand is fine to coarse.
									Stiff to very stiff, orange/brown, CLAY (LONDON CLAY)
								(0.90)	
								11.40	
									Stiff to very stiff, dark grey, CLAY (LONDON CLAY)

Remarks :
Water added between 6 and 7.5m bgl.
Water level at 4.30 m at 19.00 on 10/06/09
Stand pipe piezometer installations: Solid 0 - 6.9 m bgl, slotted 6.9 - 10.6 m bgl.
Backfill: Bentonite pellets 0 - 6.7 m bgl, gravel 6.7 - 10.7 m bgl, bentonite 10.7 - 30.65 m bgl.

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Golder Associates

	Client : Gent Fairhead & Co Ltd	**Hole No.** **RBH02**
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 10/06/2009 **Completed :** 11/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(19.25)	Stiff to very stiff, dark grey, CLAY (LONDON CLAY)

Remarks :
Water added between 6 and 7.5m bgl.
Water level at 4.30 m at 19.00 on 10/06/09
Stand pipe piezometer installations: Solid 0 - 6.9 m bgl, slotted 6.9 - 10.6 m bgl.
Backfill: Bentonite pellets 0 - 6.7 m bgl, gravel 6.7 - 10.7 m bgl, bentonite 10.7 - 30.65 m bgl.

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Golder Associates

	Client : Gent Fairhead & Co Ltd	**Hole No.** **RBH02**
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 10/06/2009 **Completed :** 11/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
									Stiff to very stiff, dark grey, CLAY (LONDON CLAY)
								30.65	End of Hole at 30.65m

Remarks :
Water added between 6 and 7.5m bgl.
Water level at 4.30 m at 19.00 on 10/06/09
Stand pipe piezometer installations: Solid 0 - 6.9 m bgl, slotted 6.9 - 10.6 m bgl.
Backfill: Bentonite pellets 0 - 6.7 m bgl, gravel 6.7 - 10.7 m bgl, bentonite 10.7 - 30.65 m bgl.

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH03
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 11/06/2009 Completed : 11/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								0.30	MADE GROUND: Recovered as loose, brown mottled grey, very silty very clayey SAND with fine to coarse, angular to sub-rounded gravel with rare cobble.
								(1.20)	Soft to firm, very thinly bedded, orange/brown, silty CLAY with rare fine to medium gravel.
								1.50	Firm to stiff, brown to pale brown, CLAY with angular, fine to coarse chalk, becoming white with depth.
								(2.00)	
								3.50	Firm to stiff, brown, slightly gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded of chalk and flint with rare cobble of chalk.
								(3.50)	
								7.00	
								7.20	Stiff to firm, orange mottled dark brown, slightly sandy CLAY. Sand is medium to coarse with abundant fine to medium gravel of flints.
								(1.80)	Recovered as loose, orange, gravelly fine to coarse SAND. Gravel is fine to coarse, sub-angular to rounded of flints with rare rounded, coarse quartz.
								9.00	
								9.30	Recovered as loose, grey to pale brown, slightly clayey sandy GRAVEL. Gravel is fine to coarse, angular to round of flint
								(0.70)	Recovered as loose, grey brown, sandy fine to coarse, angular to round GRAVEL of flint with rare sub-rounded cobble. sand is coarse. Becoming orange brown from 9.4m

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH03
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 11/06/2009 Completed : 11/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								10.00	Recovered as loose, brown, gravelly SAND. Sand is medium to coarse. Gravel is fine to coarse, sub-rounded to rounded of flint. Becoming orange/brown from 10.3m
								(0.65)	
								10.65	Stiff, orange/brown CLAY (LONDON CLAY)
								11.00	Stiff, dark grey CLAY with rare angular cobble of mudstone (LONDON CLAY)
								(3.00)	
								14.00	Stiff to very stiff, dark grey CLAY (LONDON CLAY)

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH03
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 11/06/2009 Completed : 11/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
									Stiff to very stiff, dark grey CLAY (LONDON CLAY)

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates

	Client : Gent Fairhead & Co Ltd	**Hole No.** RBH03
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 11/06/2009 **Completed :** 11/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(36.00)	Stiff to very stiff, dark grey CLAY (LONDON CLAY)

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates

Client : Gent Fairhead & Co Ltd

Hole No. RBH03

Site : Rivenhall Airfield

Project : Rivenhall Airfield Ground Investigation

Project No : 07514690074

Equipment & Methods : Rota-Sonic

Contractor : Boart Longyear

Date Started : 11/06/2009 **Completed :** 11/06/2009

Logged by : AJ

Ground Level :

Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
									Stiff to very stiff, dark grey CLAY (LONDON CLAY)
									End of Hole at 50.00m

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK

Scale 1:50

GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH03
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 11/06/2009 Completed : 11/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								50.00	

Remarks :
Suspected water table at 9.0 m bgl
Stand pipe piezometer installations: Solid 0 - 7.5 m bgl, slotted 7.5 - 13.5 m bgl.
Backfill: Bentonite pellets 0 - 7.5 m bgl, gravel 7.5 - 13.5 m bgl, bentonite 13.5 - 49 m bgl, sand 49 - 50 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl

Checked By: DK

Scale 1:50

GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. **RBH04**
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 12/06/2009 **Completed :** 16/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								0.10	MADE GROUND: Concrete
								(0.40)	MADE GROUND: Recovered as loose, pale grey/white, very gravelly fine to coarse SAND. Gravel is fragmented fine to coarse concrete. Becoming red/brown, slightly sandy, fine to coarse, angular to sub angular GRAVEL with occasional cobble of brick with depth.
								0.50	Soft to firm, red/brown, slightly sandy CLAY with occasional fine to coarse, angular to round gravel of flint. Sand is fine.
								(2.50)	
								3.00	Firm, orange/brown, slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to coarse, sub-rounded to rounded of chalk with rare cobble of flint.
								(1.50)	
								4.50	Stiff, brown, slightly sandy slightly gravelly CLAY. Sand is fine, gravel is fine to coarse, sub-rounded to round chalk with occasional cobbles. Becoming dense orange mottled red clayey fine to medium SAND with depth.
								(3.00)	
								7.50	Dense, orange/brown, slightly clayey, fine to medium SAND. Becoming loose orange/brown gravelly fine to medium SAND with rare cobbles of soft, grey clay.
								7.80	Loose, orange/brown, gravelly, fine to medium SAND. Gravel is fine to coarse, angular to sub-angular.
								(0.80)	
								8.60	Loose, dry, light brown, fine SAND.
								8.90	
								9.00	Loose, red/orange, medium to coarse SAND with occasional fine to medium gravel of flint.
								(1.40)	Recovered as loose, dry, light brown, medium to coarse SAND with occasional coarse, sub-rounded to rounded gravel of flint. Becoming slightly gravelly coarse SAND with depth. Gravel is coarse.

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH04
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 12/06/2009 Completed : 16/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
									Recovered as loose, dry, light brown, medium to coarse SAND with occasional coarse, sub-rounded to rounded gravel of flint. Becoming slightly gravelly coarse SAND with depth. Gravel is coarse.
								10.40	
								(0.60)	Recovered as loose, orange/brown, slightly sandy, medium to coarse, sub-angular to round GRAVEL. Sand is coarse.
								11.00	
									Becoming very gravelly, medium to coarse SAND. Gravel is fine to coarse, sub-rounded to round of flint with occasional cobble of flint.
								(1.70)	
								12.70	
									Stiff, orange CLAY (LONDON CLAY)
								(2.30)	
								15.00	
									Stiff to very stiff, dark grey CLAY with rare cobble of mudstone/flint (LONDON CLAY)

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK

Scale 1:50

GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. **RBH04**
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 12/06/2009 **Completed :** 16/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(15.00)	Stiff to very stiff, dark grey CLAY with rare cobble of mudstone/flint (LONDON CLAY)

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH04
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 12/06/2009 Completed : 16/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								30.00	Stiff to very stiff, dark grey, silty CLAY (LONDON CLAY)

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK
Scale 1:50
GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. **RBH04**
Site : Rivenhall Airfield	**Project :** Rivenhall Airfield Ground Investigation	**Project No :** 07514690074
Equipment & Methods : Rota-Sonic	**Contractor :** Boart Longyear **Date Started :** 12/06/2009 **Completed :** 16/06/2009 **Logged by :** AJ	**Ground Level :** **Co-ordinates :** E N

WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								(21.15)	Stiff to very stiff, dark grey, silty CLAY (LONDON CLAY)

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK

Scale 1:50

GAUK - RC April 2008

Golder Associates	Client : Gent Fairhead & Co Ltd	Hole No. RBH04
Site : Rivenhall Airfield	Project : Rivenhall Airfield Ground Investigation	Project No : 07514690074
Equipment & Methods : Rota-Sonic	Contractor : Boart Longyear Date Started : 12/06/2009 Completed : 16/06/2009 Logged by : AJ	Ground Level : Co-ordinates : E N

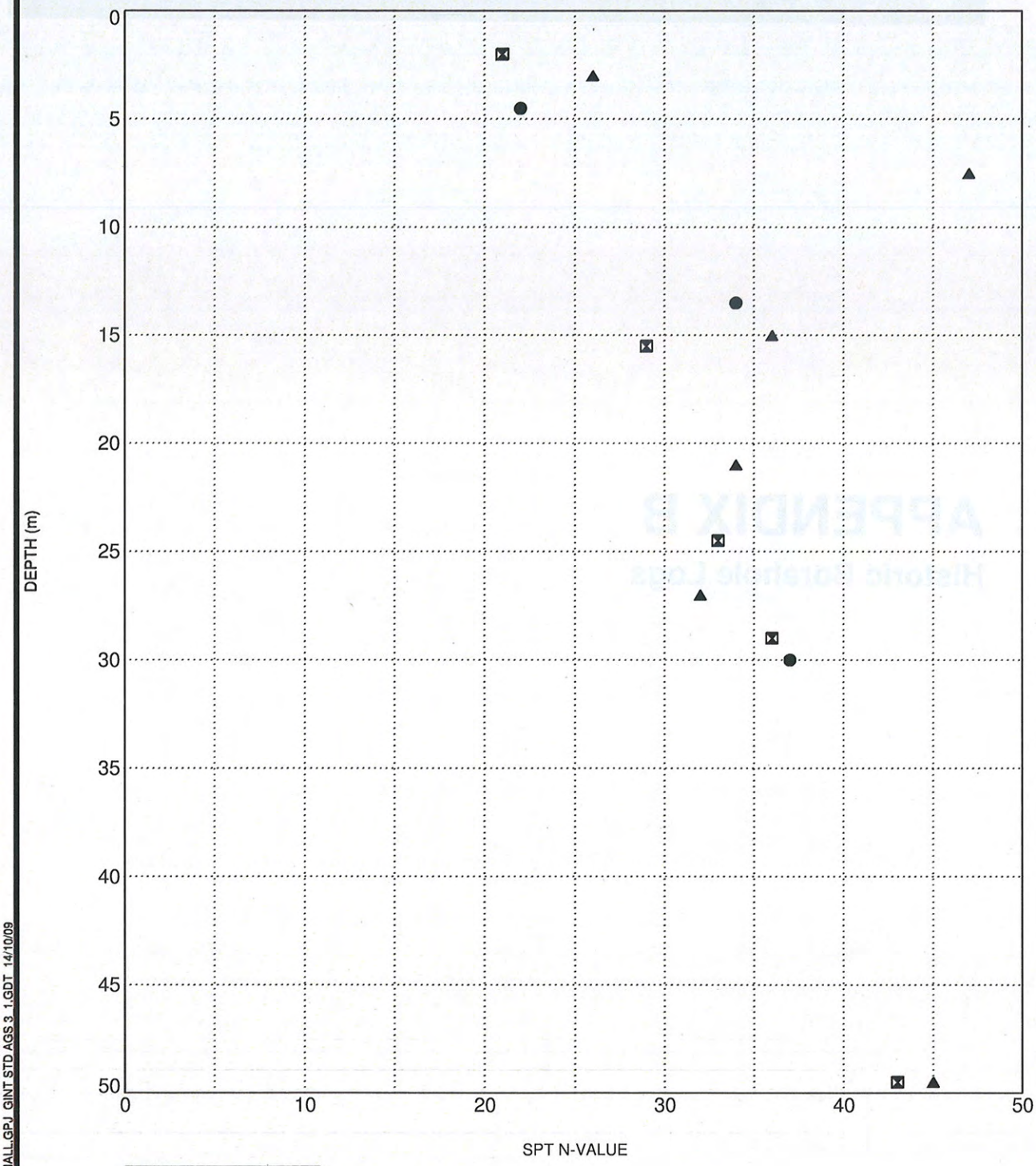
WATER/ PROGRESS	INSTALLATION /BACKFILL	CORING				STRATA RECORD			
		Top of Core Run	TCR (%)	SCR (%)	RQD (%)	Level (mAOD)	Legend	Depth (Thickness) m	Description
								51.15	Stiff to very stiff, dark grey, silty CLAY (LONDON CLAY)
									End of Hole at 50.00m

Remarks :
Stand pipe piezometer installations: Solid 0 - 7.2 m bgl, slotted 7.2 - 13.2 m bgl.
Backfill: Bentonite pellets 0 - 7.2 m bgl, gravel 7.2 - 13.3 m bgl, bentonite 13.3 - 49 m bgl.
Vibrating Wire piezometer at 50 m bgl, in sand from 49 - 50 m bgl.

Checked By: DK

Scale 1:50

GAUK - RC April 2008



LEGEND
● RBH02
⊠ RBH03
▲ RBH04

Golder Associates

SPT N-VALUE vs DEPTH

Client: Gent Fairhead & Co Ltd

Project: Rivenhall Airfield Ground Investigation

Number: 07514690074

APPENDIX B

Historic Borehole Logs

Project WOODHOUSE FARM		BOREHOLE No. PZ 19
Client Gent Fairhead	Contractor Drilling and Servicing	Sheet 1 of 1
Rig Type Cable percussion	Location See location map	Driller Engineer NH
Hole Diameter 200mm	Ground Surface Elevation mOD. Not known	Date Started 3.4.91
Completion Depth 15.50m	Casing Details 200mm to approx. 15.00m	Date Completed 4.4.91

Borehole Progress	Depth to Water	Samples/Tests: Depth/m From	Depth/m To	No.	Type	Symbolic Log	Elevation, m OD	Depth, m (thickness, m)	Geological Description
		0.45	0.80		B			0.45	Soft to slightly firm, brown, silty CLAY, with occasional sand and fine gravel
		0.80	2.30		B			0.80	Stiff, orange - pale grown, silty CLAY, with some to much fine - medium gravel sized chalk and sand
2		2.30	3.80		B				Stiff, orange mottled brown silty CLAY, with some fine gravel sized chalk, and sand
4		3.80	5.30		B				.. becoming stiff, pale brown, slightly silty CLAY with some fine and medium gravel sized chalk
		5.50	5.95		B				
		5.30	6.80		B				
6		6.80	7.20		B				
		7.20	7.35		B			7.20	
		7.35	8.30		B			7.35	Soft, orange, very sandy CLAY
8		8.30	9.30		B			8.30	Loose, orange, silty, fine and medium GRAVEL with much sand
		9.30	10.30		B			9.30	Loose, orange, silty, fine and medium SAND, with some fine and medium GRAVEL
10		10.30	11.35		B				.. becoming slightly more gravelly with occasional small cobbles
	▽	11.35	11.50		B			11.35	
	11.40	11.50	12.30		B			11.50	Soft, orange/brown, fine -medium silty CLAY with much sand
12		12.30	12.85		B			12.30	Loose, orange/beige, very gravelly, medium and coarse SAND
		12.85	13.40		B				Loose, bright orange, sandy, fine and medium GRAVEL with silt
14								15.10	
								15.50	Stiff grey-brown CLAY (LONDON CLAY)
16									Borehole complete at 15.50 metres
18									

Remarks

1. Water struck at 11.40, level fluctuated 11.70-11.76, (5/4/91-10/4/91)
2. For installation detail see Figure ?

Scale 1:100	Golder Associates	Cable Percussion Record	Project No. 9152015

582205, 220700 – 49.4

Project WOODHOUSE FARM		BOREHOLE No. PZ 20
Client Gent Fairhead	Contractor Drilling and Servicing	Sheet 1 of 1
Rig Type Cable Percussion Hole Diameter 200mm Completion Depth 15.40m	Location Site location map Ground Surface Elevation mOD. Not known Casing Details 200m to approx. 14.00m	Driller Engineer NH Date Started 29.3.91 Date Completed 29.3.91

Downhole Depth	Borehole Progress	Depth to Water	Samples/Tests: Depth/m From	Depth/m To	No.	Type	Symbolic Log	Elevation, m OD	Depth, m (thickness, m)	Geological Description
								49.0	0.40	TOPSOIL
			1.20	2.50		B			1.20	Stiff, dark brown, silty CLAY, with assorted fill material including bricks (Made Ground)
2			2.50	4.00		B				
4			4.00	4.50		B				Stiff, orange and grey mottled, pale beige, silty CLAY, with coarse sand, and gravel sized chalk
			4.50	4.95		U(22				
			5.00	5.50		B				
6			5.50	7.00		B		B/C		
			7.00	8.50		B				
8									8.20	
			8.50	10.00		B				Stiff, grey brown CLAY, with some fine and medium gravel sized chalk
10			10.00	10.30		B			10.30	
		29/3/91 ▽	10.30	10.70		B				Soft to firm, bright orange/brown, sandy CLAY with occasional medium gravel
		10.92	10.70	11.70		B		38.7	10.70	Loose, beige/brown, very sandy GRAVEL, with occasional small cobbles (Top 0.30m is sand with some gravel)
12			11.70	12.70		B				
			12.70	13.70		B		SG		
			13.70	14.20		B				
14								35.2	14.20	
									14.40	Firm, pale orange/brown, sandy CLAY with occasional fine and medium gravel
								34.2	15.40	Stiff, grey/brown London CLAY
16										Borehole complete at 15.40 metres
18										

Remarks

1. Water struck at 10.92, and fluctuated 10.82-10.91 (3/4/91-10/4/91)
2. For installation detail see Figure ?

Scale 1:100	Golder Associates	Cable Percussion Record	Project No. 9152015

582645, 220540 - 46.0

Project WOODHOUSE FARM		BOREHOLE No. PZ 21
Client Gent Fairhead	Contractor Drilling and Servicing	Sheet 1 of 1
Rig Type Cable percussion Hole Diameter 200mm Completion Depth 13.00	Location See Location Map Ground Surface Elevation mOD. Not known Casing Details 200mm to approx. 11.50m	Driller LC Engineer NH Date Started 4.4.91 Date Completed 4.4.91

Downhole Depth	Borehole Progress	Depth to Water	Samples/Tests Depth/m From	To	No.	Type	Symbolic Log	Elevation, m OD	Depth, m (thickness, m)	Geological Description
			0.50	2.00		B		45.85	0.15	TOPSOIL.
									2.00	Firm to stiff, grey mottled beige/brown silty CLAY with much sand and gravel sized chalk and occasional small cobble sized chalk and flint
2			2.00	3.50		B				... becoming less chalky, and stiffer with depth
			3.50	5.00		B		BC	4.00	
4										.. becoming stiff, beige - pale brown slightly silty CLAY, with some coarse sand, and fine to medium gravel sized flint and chalk
			5.00	6.50		B			5.40	
										Stiff, brown, sandy, silty CLAY with some fine medium, and occasionally coarse gravel
6									6.40	
									6.60	Stiff, orange/brown, medium sandy CLAY with the some fine and medium gravel
			6.60	7.00		B		39.4		
			7.00	8.00		B				Soft to loose, pink/beige, medium SAND, with occasional fine gravel and occasional clay nodules
8			8.00	9.00		B				
			9.00	10.00		B		68.6		
10			10.00	11.00		B				
		4/4/91 ▽ 10.90 (4)	11.00	11.70		B			11.70	
								34.3	11.90	Stiff, brown, silty CLAY with sand and gravel*
12			11.70	12.70		B		BLC		Stiff, brown silty CLAY (LONDON CLAY) (1)
									13.00	
										Borehole complete at 13.00 metres
14										
16										
18										

Remarks
1. Interpreted from driller's notes
2. Water struck at 10.90 and rose to 11.06 (9-10/4/91)
3. For installation detail see Figure ?
4. Interpreted from drillers logs

Scale 1:100	Golder Associates	Cable Percussion Record	Project No. 9152015

APPENDIX C

Vibrating Wire Installation Information

» readouts | datalogers | terminal stations

VW2106 Vibrating Wire Readout

VW2106 Vibrating Wire Readout shown with Vibrating Wire Piezometer

The portable VW2106 Vibrating Wire Readout reads, displays, and logs both vibrating wire sensors and thermistors. Vibrating wire load cells can be read without any additional accessories.

Unprecedented accuracy, flexible memory options and ease of use make the VW2106 invaluable for projects requiring vibrating wire sensor monitoring. Maximum download time is only 15 seconds.

Complementing its high level of accuracy, the VW2106 is also designed for maximum efficiency with the user in mind. In addition to the simple power requirements of only 3 "AA" batteries, the VW2106 comes well-equipped with standard features such as a large graphics display with backlight, a built-in multiplexer, "no-tools" vibrating wire transducer inputs (eliminating the need for alligator clips), and a convenient on-board speaker for sensor diagnostics.

specs

DESCRIPTION	SPECIFICATION
Vibrating Wire Readout Excitation Range	400 Hz to 6000 Hz, 5 V Square Wave
Vibrating Wire Readout Resolution	0.01 µs
Vibrating Wire Readout Timebase Accuracy	±50 ppm
Supported Temperature Readout Sensors	NTC3000 (standard), NTC2252, NTC10K, RTD
Temperature Readout Accuracy	±0.1°C
Temperature Readout Range	-50°C to 80°C
Display	Graphic 128 x 64 pixels large character display
Display Backlight	**High efficiency LCD with auto off**
Max Instrument Locations	254
Memory Capacity	11,400 custom labelled points
Location Identification String	Up to 20 characters
Download Speed	15 seconds (full memory)
Battery	3 "AA" alkaline
Battery Indicator	**On-screen, low battery indicator**
Operating Temperature	-20°C to 60°C
Dimensions	W 22 cm x D 19 cm x H 9.5 cm (8.75 x 7.5 x 3.75in.)
Weight	1.1 kg (2.4 lbs)

ordering info

PART #	DESCRIPTION
VW2106	Vibrating Wire Readout

applications

Reads, displays, and logs both vibrating wire sensors and thermistors.

features

Durable, compact design for excellent portability and field use.

Large graphics display with a convenient backlight.

Readings in raw or engineering units.

Built-in multiplexer for load cells up to 6 vibrating wire gauges.

"No-tools" vibrating wire transducer inputs eliminates the need for alligator clips.

Field-replaceable "AA" alkaline batteries eliminate the need for a large, bulky 12 V battery and a charger.

On-board speaker for sensor diagnostics.

Stores up to 254 instrument locations per route, each with a text label, calibration constants, previous data, and up to 11,400 time/date stamped data points.

Data transfer to a host computer via USB in a compatible file format for Microsoft Excel® and other spreadsheets. User friendly host software for Microsoft Windows® included.

rst INSTRUMENTS

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ISO 9001:2000
REGISTERED QUALITY SYSTEM

GEOTECHNICAL. MINING. STRUCTURAL

RBH03

GEOSENSE

MGS QUALITY PROCEDURE
Form No MGS /QF/123
ISS. 1
DATE : 18/09/08
SIG. SKH

VIBRATING WIRE TRANSDUCER CALIBRATION

Model	G51-Series	Cal date	5-Feb-09	DPI No.	52001702
Serial	314135	Baro	979.0	Readout No.	VR0299
Works ID	52 8 284	Temp °C	21	R/O Cal. date	23/05/2008

Applied pressure		Readings [digit]			Calculated Pressure		Error % fso	
psi	kPa	1 up	1 down	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.000	0.000	9475	9475	9475.0	-1.64	0.19	-0.24%	0.03%
20.015	138.000	8766	8766	8766.0	138.17	137.79	0.02%	-0.03%
40.029	276.000	8061	8061	8061.0	277.19	275.73	0.17%	-0.04%
60.044	414.000	7359	7359	7359.0	415.62	414.19	0.23%	0.03%
80.058	552.000	6664	6664	6664.0	552.66	552.34	0.10%	0.05%
100.073	690.000	5978	5978	5978.0	687.94	689.76	-0.30%	-0.03%

Calibration of master DPI valid from 08 Aug 2008. UKAS Certificate of Calibration 04252 issued by Chamois Metrology (UKAS Accredited Calibration Laboratory 0822)

CALIBRATION FACTORS

Linear factor (k)

kPa per digit	psi per digit	mH_2O per digit
-0.197192432	-0.028599	-0.020108

Polynomial factors

	kPa	psi	mH_2O
A	1.11438E-06	1.61621E-07	1.1363E-07
B	-0.214411803	-0.031097	-0.021864
C	1931.693501	280.1585933	196.977918

Note: Digits are $Hz^2 \times 10^{-3}$ units.

(please consult the User Manuals for conversion of alternative reading units)

Polynomial calculation [kPa] = A * (Reading)2 + B * (Reading) + C

Linear calculation [kPa] = k (kPa) * (Current Reading - Site Zero Reading)

THIS CERTIFICATE IS VALID ONLY WHEN CARRYING THE OFFICIAL ORIGINAL STAMP OF MGS-GEOSENSE BELOW

TR

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RBH04

GEOSENSE

MGS QUALITY PROCEDURE
Form No MGS /QF/123
ISS. 1
DATE : 18/09/08
SIG. SKH

VIBRATING WIRE TRANSDUCER CALIBRATION

Model	G51-Series	Cal date	5-Feb-09	DPI No.	52001702
Serial	314137	Baro	979.0	Readout No.	VR0299
Works ID	52 8 287	Temp °C	21	R/O Cal. date	23/05/2008

Applied pressure		Readings [digit]			Calculated Pressure		Error % fso	
psi	kPa	1 up	1 down	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.000	0.000	9294	9294	9294.0	-1.80	0.24	-0.26%	0.04%
20.015	138.000	8567	8567	8567.0	138.05	137.63	0.01%	-0.05%
40.029	276.000	7842	7842	7842.0	277.53	275.89	0.22%	-0.02%
60.044	414.000	7124	7124	7124.0	415.65	414.05	0.24%	0.01%
80.058	552.000	6411	6411	6411.0	552.82	552.46	0.12%	0.07%
100.073	690.000	5710	5710	5710.0	687.67	689.72	-0.34%	-0.04%

Calibration of master DPI valid from 08 Aug 2008. UKAS Certificate of Calibration 04252 issued by Chamois Metrology (UKAS Accredited Calibration Laboratory 0822)

CALIBRATION FACTORS

Linear factor (k)

kPa per digit	psi per digit	mH_2O per digit
-0.192375978	-0.027901	-0.019617

Polynomial factors

	kPa	psi	mH_2O
A	1.18825E-06	1.72335E-07	1.2117E-07
B	-0.210203288	-0.030486	-0.021435
C	1851.234758	268.48945	188.773410

Note: Digits are $Hz^2 \times 10^{-3}$ units.
(please consult the User Manuals for conversion of alternative reading units)
Polynomial calculation [kPa] = A * (Reading)2 + B * (Reading) + C

Linear calculation [kPa] = k (kPa) * (Current Reading - Site Zero Reading)

THIS CERTIFICATE IS VALID ONLY WHEN CARRYING THE OFFICIAL ORIGINAL STAMP OF MGS-GEOSENSE BELOW

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APPENDIX D

GEOLABS Analysis Results

February 2010
Report No. 07514690074.510/B.0

Golder Associates

PROJECT NAME	**RIVENHALL**
PROJECT NO:	**GEO / 14720**

Date	24/07/2009
Approved	J Sturges
Page	1 of 5

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression Tests					Chemical Tests			
Borehole No.	Depth (m)	No.	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Mean Shear Stress (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	Other tests and comments
RBH02	2.50	-	D	Light brown slightly gravelly CLAY, gravel is fine to medium chalk	17															
RBH02	3.00 - 4.50	-	U	Firm to stiff brown gravelly CLAY, gravel is fine to coarse flint and chalk	18	41	14	27	96	2.16	1.83	40 80 160	346 350 354	175	167	1.5				Chemical Testing
RBH02	4.50 - 5.15	-	D	Light brown slightly gravelly CLAY, gravel is fine to medium chalk	15															
RBH02	5.50	-	D	Dark brown slightly gravelly CLAY, gravel is fine to medium	11															
RBH02	7.00 - 7.50	-	B	Orange-brown slightly clayey silty SAND and GRAVEL																Particle Size Distribution Test Chemical Testing
RBH02	11.00	-	B	Dark brown CLAY	27	81	30	51	100											
RBH02	12.00 - 13.50	-	U	Stiff fissured dark grey CLAY	28	88	25	63	100											Oedometer Consolidation Test
RBH02	13.50 - 14.15	-	D	Dark grey CLAY	25															
RBH02	15.50	-	D	Dark grey CLAY	32															
RBH02	20.00	-	D	Dark grey CLAY	27	87	26	61	100											
RBH02	24.50	-	D	Dark grey CLAY	30															
RBH02	28.50 - 30.00	-	U	Very stiff closely fissured dark grey CLAY	28	80	28	52	100	2.01	1.57	400 800 1400	506 513 513	255	252	0				Oedometer Consolidation Test Effective Stress Triaxial Test

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

PROJECT NAME	RIVENHALL	Date	24/07/2009
PROJECT NO:	GEO / 14720	Approved	J Sturges
		Page	2 of 5

Sample details					Classification Tests					Density Tests		Undrained Triaxial Compression Tests					Chemical Tests			
Borehole No.	Depth (m)	No.	Type	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Mean Shear Stress (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	Other tests and comments
RBH02	30.00 - 30.65	-	D	Dark grey CLAY	28															
RBH03	0.50	-	D	Light brown slightly sandy CLAY	20	47	20	27	100											
RBH03	2.00 - 3.50	-	U	Light brown gravelly CLAY, gravel is fine to medium chalk	18	37	18	19	90											
RBH03	2.00 - 2.65	-	D	Light brown gravelly CLAY, gravel is fine to medium chalk	19															
RBH03	4.00	-	D	Light brown gravelly CLAY, gravel is fine to medium chalk	17															
RBH03	6.00	-	D	Light brown gravelly CLAY, gravel is fine to medium chalk	18	35	16	19	97											
RBH03	7.00 - 8.00	-	B	Orange-brown slightly silty slightly clayey SAND and GRAVEL																Particle Size Distribution Test Chemical Testing
RBH03	8.00 - 9.00	-	U	Stiff light brown gravelly clayey SAND	10	32	14	18	61	2.22	2.03	80 160 320	141 204 309	109	34	15				Chemical Testing
RBH03	9.00	-	D	Sample not received																Sample not received
RBH03	9.50 - 10.50	-	B	Orange-brown clayey very sandy GRAVEL																Particle Size Distribution Test
RBH03	14.00 - 15.50	-	U	Firm closely fissured dark grey CLAY with rare pyrite nodules	31	86	25	61	100	2.73	2.09	150 300 600	175 184 195	92	83	1				Chemical Testing
RBH03	15.50 - 16.15	-	D	Grey CLAY	29															

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

PROJECT NAME RIVENHALL
PROJECT NO: GEO / 14720

Date	24/07/2009
Approved	J Sturges
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Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests					Chemical Tests			Other tests and comments
Borehole No.	Depth (m)	No.	Type		MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Mean Shear Stress (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	
RBH03	23.00 - 24.50	-	U	Very stiff closely fissured dark grey CLAY	28	84	27	57	100	2.00	1.56	250 500 1000	535 582 598	286	254	2				Oedometer Consolidation Test Effective Stress Triaxial Test
RBH03	24.50	-	D	Grey CLAY	28															
RBH03	29.00 - 29.85	-	D	Grey CLAY	27															
RBH03	34.00 - 34.20	-	D	Grey CLAY	27	78	31	47	100											
RBH03	40.00 - 40.20	-	D	Grey CLAY	29	83	30	53	100											Effective Stress Triaxial Test Chemical Testing
RBH03	48.00 - 49.50	-	U	Very stiff fissured dark grey CLAY	30	95	29	66	100	1.95	1.51	500 900 1400	679 681 671	338	338	0				Oedometer Consolidation Test Effective Stress Triaxial Test
RBH03	49.50 - 50.15	-	D	Grey CLAY	30															
RBH04	1.00	-	D	Brown slightly sandy gravelly CLAY, gravel is fine to medium chalk		34	15	19	96											
RBH04	3.00 - 3.65	-	D	Brown slightly sandy gravelly CLAY, gravel is fine to medium chalk	18															
RBH04	4.00	-	D	Orange-brown slightly sandy slightly gravelly CLAY; gravel is fine to coarse chalk	19															Particle Density = 2.72 Mg/m³
RBH04	4.00 - 6.00	-	D	Orange-brown slightly sandy gravelly CLAY, gravel is fine to coarse chalk nodules		36	16	20	97											4.5kg Compaction Test
RBH04	6.00	-	D	Light brown slightly sandy gravelly CLAY, gravel is fine to medium chalk	15															

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

PROJECT NAME	**RIVENHALL**
PROJECT NO:	**GEO / 14720**

Date	24/07/2009
Approved	J Sturges
Page	4 of 5

Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests					Chemical Tests			Other tests and comments
Borehole No.	Depth (m)	No.	Type		MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Mean Shear Stress (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	
RBH04	6.00 - 7.50	-	U	Firm brown slightly sandy gravel CLAY	14	38	15	23	75	2.18	1.92	75	240	120						Chemical Testing Sample failed at 20% strain
RBH04	7.50 - 8.15	-	D	Light brown orange sandy CLAY	18															
RBH04	8.00 - 9.00	-	B	Light brown slightly gravelly clayey silty SAND																Particle Size Distribution Test Chemical Testing
RBH04	11.00 - 11.50	-	B	Orange-brown slightly clayey very sandy GRAVEL																Particle Size Distribution Test
RBH04	13.50	-	D	Brown CLAY	55															
RBH04	13.50 - 15.00	-	U	Dark grey fissured CLAY	25	83	24	59	100											Chemical Testing
RBH04	15.00 - 15.65	-	D	Dark grey fissured CLAY	27															
RBH04	18.00	-	D	Dark grey fissured CLAY	28															
RBH04	18.00 - 21.00	-	D	Dark grey CLAY with rare bands of mudstone		86	26	60	100											4.5kg Compaction Test Particle Density = 2.76 Mg/m³
RBH04	21.00 - 21.65	-	D	Dark grey fissured CLAY	28	83	25	58	100											
RBH04	27.00 - 27.65	-	D	Dark grey fissured CLAY	24															
RBH04	35.00	-	D	Dark grey fissured CLAY	28															

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

PROJECT NAME RIVENHALL
PROJECT NO: GEO / 14720

Date	24/07/2009
Approved	J Sturges
Page	5 of 5

Sample details				Description	Classification Tests					Density Tests		Undrained Triaxial Compression Tests					Chemical Tests			Other tests and comments
Borehole No.	Depth (m)	No.	Type		MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Mean Shear Stress (kPa)	Apparent Cohesion (kPa)	Angle of Shearing Resistance (°)	pH	2:1 W/S SO4 (g/l)	Ground Water SO4 (g/l)	
RBH04	39.00	-	D	Dark grey fissured CLAY	32	92	30	62	100											
RBH04	48.00	-	U	Dark grey fissured CLAY	31															Chemical Testing
RBH04	48.00 - 49.50	-	D	Stiff dark grey CLAY	28	73	24	49	100	1.99	1.56	500 900 1400	524 536 562	270	245	1				
RBH04	49.50 - 51.15	-	D	Dark grey fissured CLAY	28															

SUMMARY OF GEOTECHNICAL TESTING

GEOLABS

BS1377 : Part 2 : Clause 9 : 1990

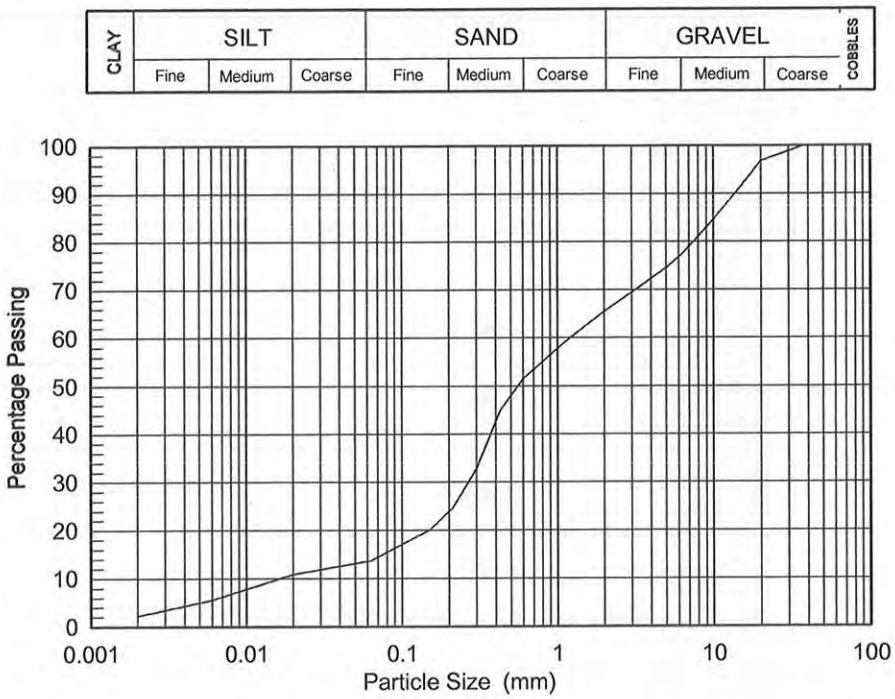
Determination of Particle Size Distribution

Borehole Number:	RBH02
Sample Number:	-
Depth (m):	7.00 - 7.50

Description:
Orange-brown slightly clayey silty SAND and GRAVEL

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
BS1377 : Part 2 : Clause 9.4 : 1990 Sedimentation by the Pipette Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	99
20 mm	97
14 mm	90
10 mm	85
6.3 mm	77
5 mm	75
3.35 mm	71
2 mm	65
1.18 mm	60
600 µm	52
425 µm	45
300 µm	33
212 µm	25
150 µm	20
63 µm	14



Particle Proportions		
Cobbles	0.0	%
Gravel	34.5	%
Sand	51.8	%
Silt	11.5	%
Clay	2.2	%

PIPETTE	
Particle size	% pass
20.0 µm	11
6.0 µm	6
2.0 µm	2

Preparation:
No Pre-treatment used

Temp (°C)	20

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

BS1377 : Part 2 : Clause 9 : 1990

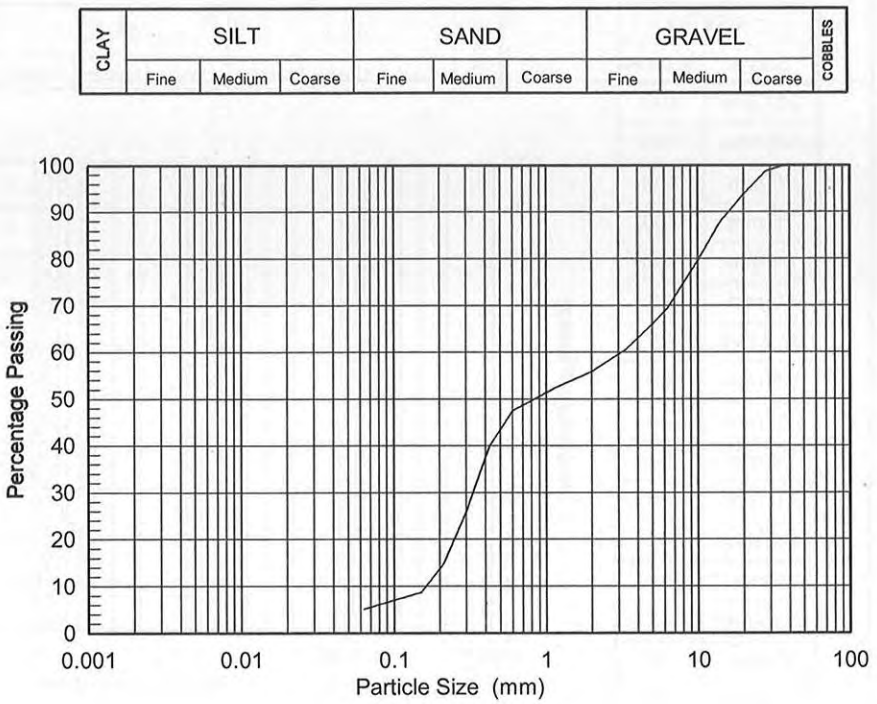
Determination of Particle Size Distribution

Borehole Number:	RBH03
Sample Number:	-
Depth (m):	7.00 - 8.00

Description:
Orange-brown slightly silty slightly clayey SAND and GRAVEL

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	99
20 mm	94
14 mm	88
10 mm	80
6.3 mm	69
5 mm	66
3.35 mm	61
2 mm	56
1.18 mm	53
600 µm	47
425 µm	40
300 µm	26
212 µm	15
150 µm	9
63 µm	5



Particle Proportions		
Cobbles	0.0	%
Gravel	44.2	%
Sand	50.7	%
Silt & Clay	5.1	%

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

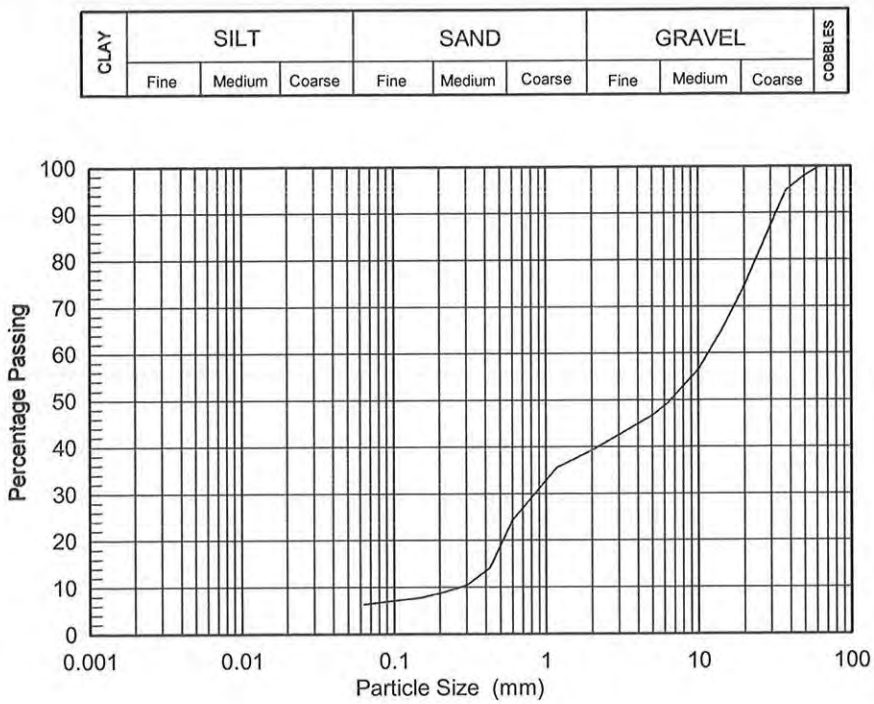
BS1377 : Part 2 : Clause 9 : 1990

Determination of Particle Size Distribution

Borehole Number: RBH03 Sample Number: - Depth (m): 9.50 - 10.50	Description: Orange-brown clayey very sandy GRAVEL

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	98
37.5 mm	95
28 mm	85
20 mm	74
14 mm	64
10 mm	56
6.3 mm	49
5 mm	47
3.35 mm	43
2 mm	39
1.18 mm	36
600 µm	24
425 µm	14
300 µm	10
212 µm	9
150 µm	8
63 µm	6



Particle Proportions		
Cobbles	0.0	%
Gravel	60.7	%
Sand	32.8	%
Silt & Clay	6.4	%

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

BS1377 : Part 2 : Clause 9 : 1990

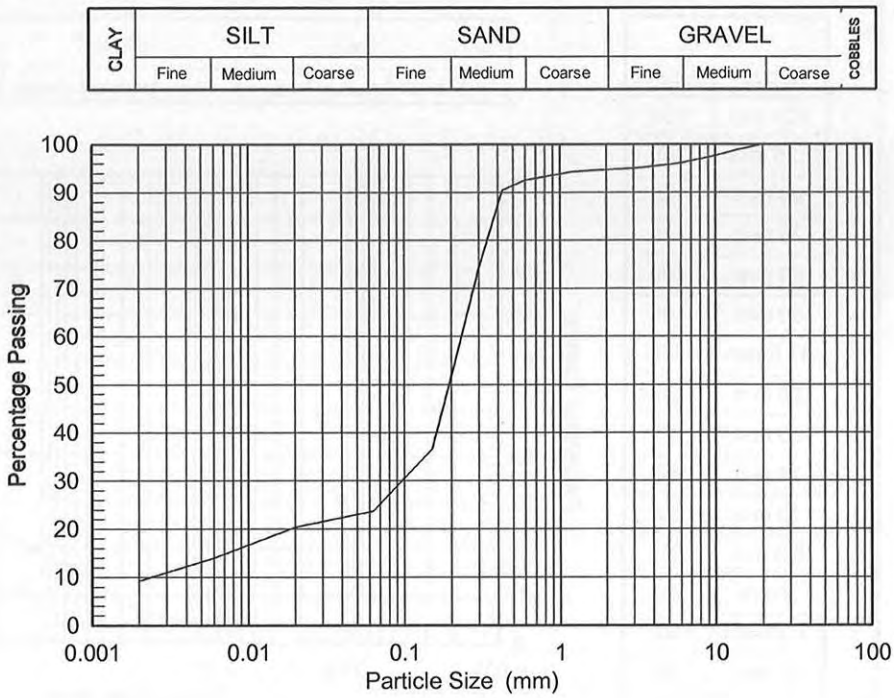
Determination of Particle Size Distribution

Borehole Number:	RBH04
Sample Number:	-
Depth (m):	8.00 - 9.00

Description:
Light brown slightly gravelly clayey silty SAND

BS1377 : Part 2 : Clause 9.2 : 1990 Wet Sieving Method
BS1377 : Part 2 : Clause 9.4 : 1990 Sedimentation by the Pipette Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	100
28 mm	100
20 mm	100
14 mm	99
10 mm	98
6.3 mm	96
5 mm	96
3.35 mm	95
2 mm	95
1.18 mm	94
600 µm	93
425 µm	90
300 µm	74
212 µm	55
150 µm	37
63 µm	24



Particle Proportions		
Cobbles	0.0	%
Gravel	5.3	%
Sand	71.0	%
Silt	14.4	%
Clay	9.3	%

PIPETTE	
Particle size	% pass
20.0 µm	20
6.0 µm	14
2.0 µm	9
Preparation: No Pre-treatment used	

Temp (°C)	20

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

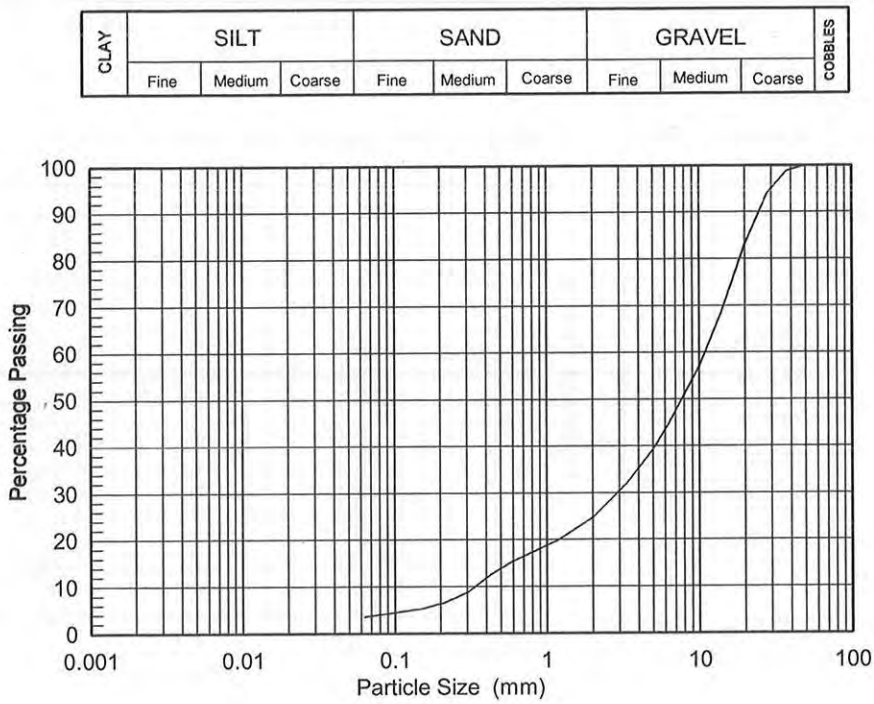
BS1377 ; Part 2 : Clause 9 : 1990

Determination of Particle Size Distribution

Borehole Number: RBH04	Description:
Sample Number: -	Orange-brown slightly clayey very sandy GRAVEL
Depth (m): 11.00 - 11.50	

BS1377 : Part 2 : Clause 9.3 : 1990 Dry Sieving Method

SIEVE	
Sieve	% pass
200 mm	100
125 mm	100
90 mm	100
75 mm	100
63 mm	100
50 mm	100
37.5 mm	99
28 mm	94
20 mm	83
14 mm	69
10 mm	57
6.3 mm	45
5 mm	39
3.35 mm	32
2 mm	25
1.18 mm	20
600 µm	15
425 µm	12
300 µm	9
212 µm	7
150 µm	5
63 µm	4



Particle Proportions		
Cobbles	0.0	%
Gravel	75.3	%
Sand	21.2	%
Silt & Clay	3.6	%

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

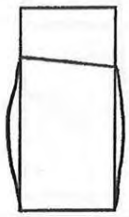
Borehole Number: RBH02	Description:
Sample Number: -	Firm to stiff brown gravelly CLAY, gravel is fine
Depth (m): 3.00 - 4.50	to coarse flint and chalk

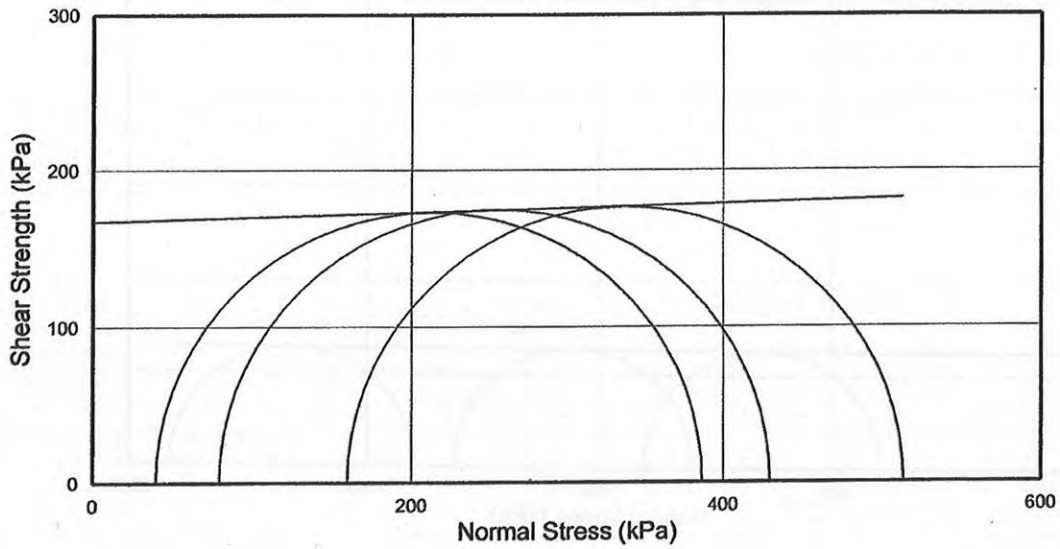
3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	173.1		
Diameter (mm):	87.2		
Moisture Content (%):	18		
Bulk Density (Mg/m³):	2.16		
Dry Density (Mg/m³):	1.83		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	1.0	1.1	1.3
Axial displacement rate (%/min):	2.2	2.2	2.2
Cell pressure (kPa):	40	80	160
Strain at failure (%):	14.4	15.6	20.2
Maximum Deviator Stress (kPa):	346	350	354
Shear Stress Cu (kPa):	173	175	177

Orientation and position of sample: n/a

Mode of failure:





c = 167 kPa Ø = 1.5 °

Checked and Approved	Project Number:	
Initials: JS	Project Name:	GEO / 14720 RIVENHALL
Date: 24/07/2009		GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

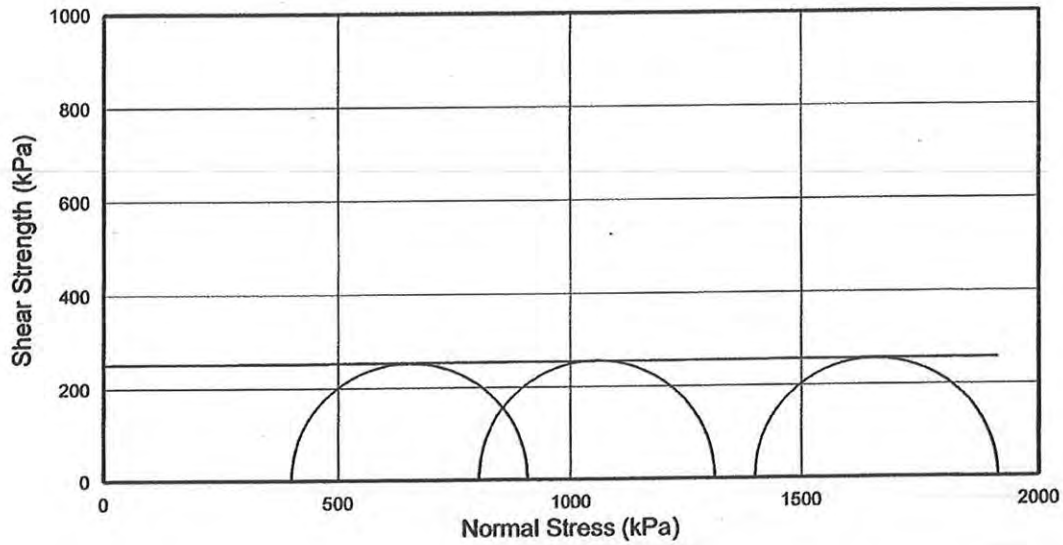
Borehole Number: RBH02	Description:
Sample Number: -	Very stiff closely fissured dark grey CLAY
Depth (m): 28.50 - 30.00	

3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	172.8		
Diameter (mm):	86.1		
Moisture Content (%):	28		
Bulk Density (Mg/m³):	2.01		
Dry Density (Mg/m³):	1.57		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.7	0.8	0.8
Axial displacement rate (%/min):	0.66	0.66	0.66
Cell pressure (kPa):	400	800	1400
Strain at failure (%):	9.3	10.4	11.0
Maximum Deviator Stress (kPa):	506	513	513
Shear Stress Cu (kPa):	253	257	256

Orientation and position of sample: n/a

Mode of failure:



c = 252 kPa Ø = 0 °

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

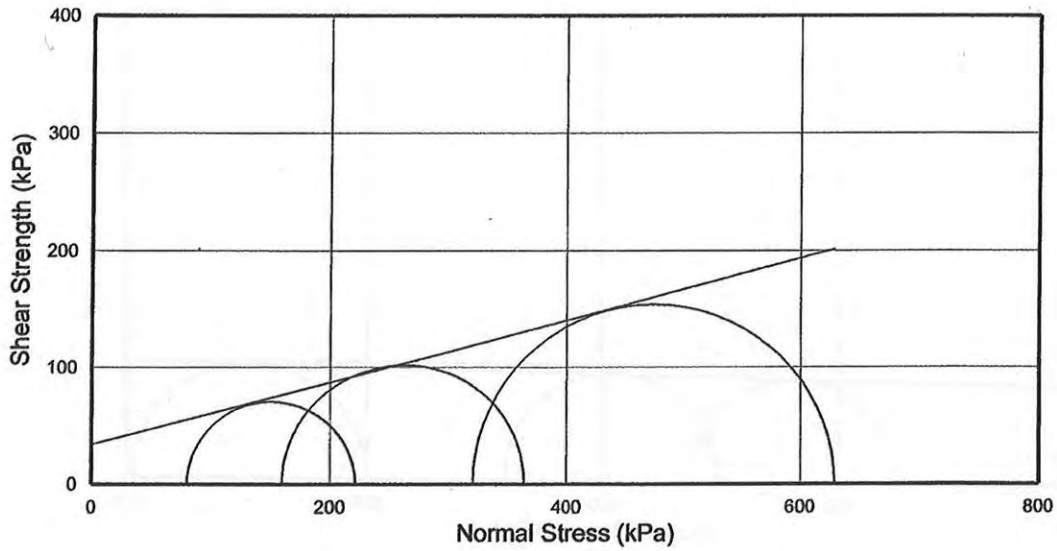
Borehole Number: RBH03 Sample Number: - Depth (m): 8.00 - 9.00	Description: Stiff light brown gravelly clayey SAND

3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	179.7		
Diameter (mm):	95.4		
Moisture Content (%):	9.6		
Bulk Density (Mg/m³):	2.22		
Dry Density (Mg/m³):	2.03		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.4	0.7	0.9
Axial displacement rate (%/min):	2.1	2.1	2.1
Cell pressure (kPa):	80	160	320
Strain at failure (%):	4.5	10.6	13.9
Maximum Deviator Stress (kPa):	141	204	309
Shear Stress Cu (kPa):	71	102	154

Orientation and position of sample: n/a

Mode of failure:



c = 34 kPa Ø = 15 °

Some patching required

Checked and Approved	Project Number:	
Initials: JS Date: 24/07/2009	Project Name:	GEO / 14720 RIVENHALL

GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

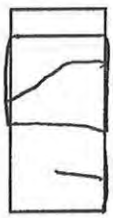
Borehole Number: RBH03 Sample Number: - Depth (m): 14.00 - 15.50	Description: Firm closely fissured dark grey CLAY with rare pyrite nodules

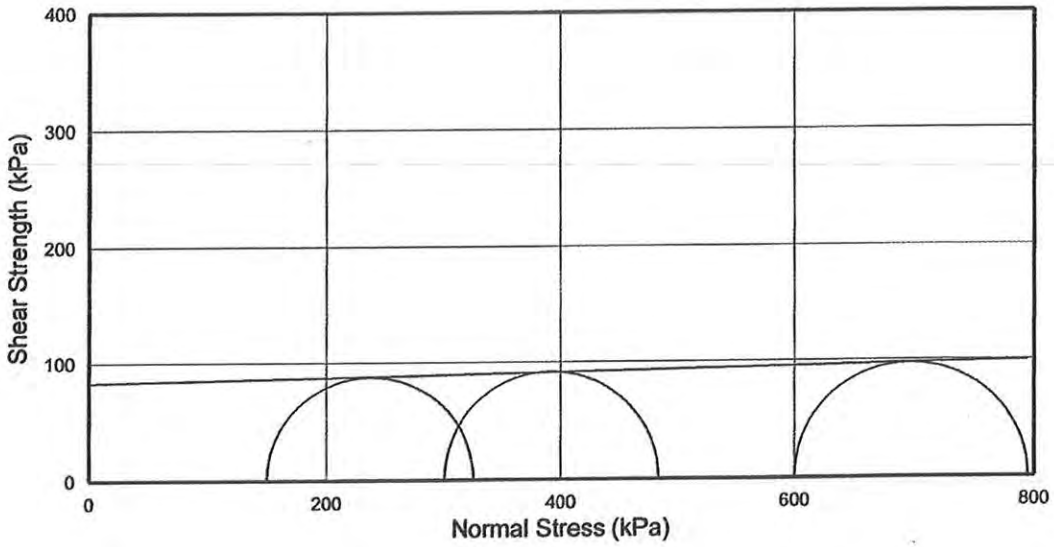
3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	186.9		
Diameter (mm):	93.6		
Moisture Content (%):	31		
Bulk Density (Mg/m³):	2.73		
Dry Density (Mg/m³):	2.09		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.5	0.6	0.8
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	150	300	600
Strain at failure (%):	6.4	8.0	10.7
Maximum Deviator Stress (kPa):	175	184	195
Shear Stress Cu (kPa):	88	92	97

Orientation and position of sample: n/a

Mode of failure:





c = 83 kPa Ø = 1 °

Checked and Approved	Project Number:	
Initials: JS Date: 24/07/2009	Project Name: GEO / 14720 RIVENHALL	GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

Borehole Number:	RBH03
Sample Number:	-
Depth (m):	23.00 - 24.50

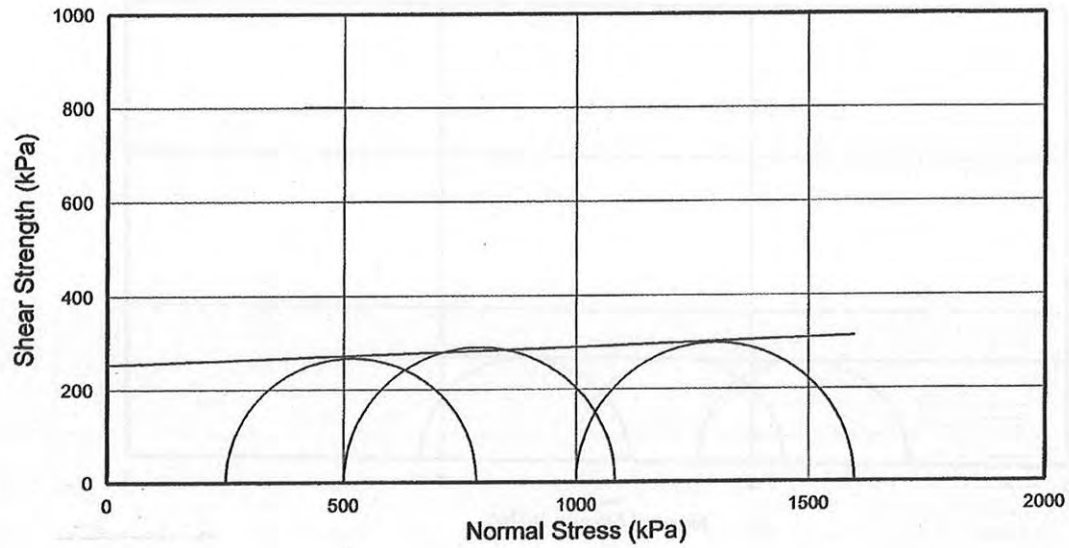
Description:
Very stiff closely fissured dark grey CLAY

3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	194.7		
Diameter (mm):	93.6		
Moisture Content (%):	28		
Bulk Density (Mg/m³):	2.00		
Dry Density (Mg/m³):	1.56		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.4	0.6	0.6
Axial displacement rate (%/min):	2.0	2.0	2.0
Cell pressure (kPa):	250	500	1000
Strain at failure (%):	4.6	7.7	8.2
Maximum Deviator Stress (kPa):	535	582	598
Shear Stress Cu (kPa):	268	291	299

Orientation and position of sample: n/a

Mode of failure:



c = 254 kPa Ø = 2 °

Checked and Approved	Project Number:	
Initials: JS	Project Name:	GEO / 14720 RIVENHALL
Date: 24/07/2009		GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

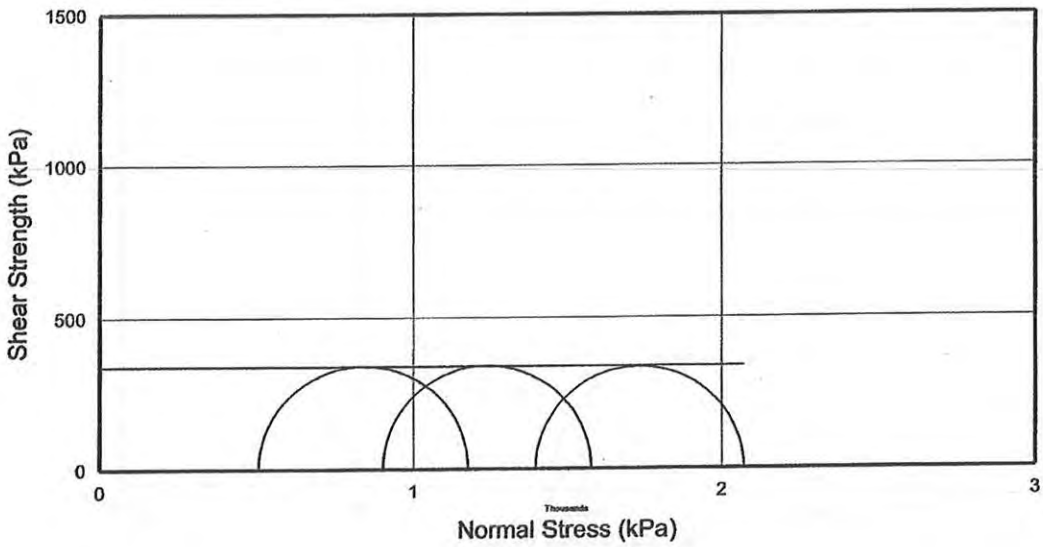
Borehole Number: RBH03 Sample Number: - Depth (m): 48.00 - 49.50	Description: Very stiff fissured dark grey CLAY

3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	192.8		
Diameter (mm):	94.1		
Moisture Content (%):	30		
Bulk Density (Mg/m³):	1.95		
Dry Density (Mg/m³):	1.51		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.7	0.8	0.8
Axial displacement rate (%/min):	0.59	0.59	0.59
Cell pressure (kPa):	500	900	1400
Strain at failure (%):	9.9	10.9	11.9
Maximum Deviator Stress (kPa):	679	681	671
Shear Stress Cu (kPa):	340	340	336

Orientation and position of sample: n/a

Mode of failure:



c = 338 kPa Ø = 0 °

Checked and Approved	Project Number:	
Initials: JS Date: 24/07/2009	Project Name: GEO / 14720 RIVENHALL	GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 7 : Clause 8 : 1990

Quick Undrained Triaxial Test

Borehole Number: RBH04 Sample Number: - Depth (m): 6.00 - 7.50	Description: Firm brown slightly sandy gravel CLAY

Single Stage Specimen

Specimen details	Single Specimen
Specimen condition:	Undisturbed
Length (mm):	170.8
Diameter (mm):	86.6
Moisture Content (%):	14
Bulk Density (Mg/m³):	2.18
Dry Density (Mg/m³):	1.92
Test details	
Latex membrane thickness (mm):	0.3
Membrane correction (kPa):	1.3
Axial displacement rate (%/min):	2.2
Cell pressure (kPa):	75
Strain at failure (%):	19.9
Maximum Deviator Stress (kPa):	240
Shear Stress Cu (kPa):	120

Orientation and position of sample: n/a

Mode of failure:

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

BS1377 : Part 7 : Clause 9 : 1990

Quick Undrained Triaxial Test

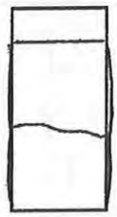
Borehole Number: RBH04 Sample Number: - Depth (m): 48.00 - 49.50	Description: Stiff dark grey CLAY

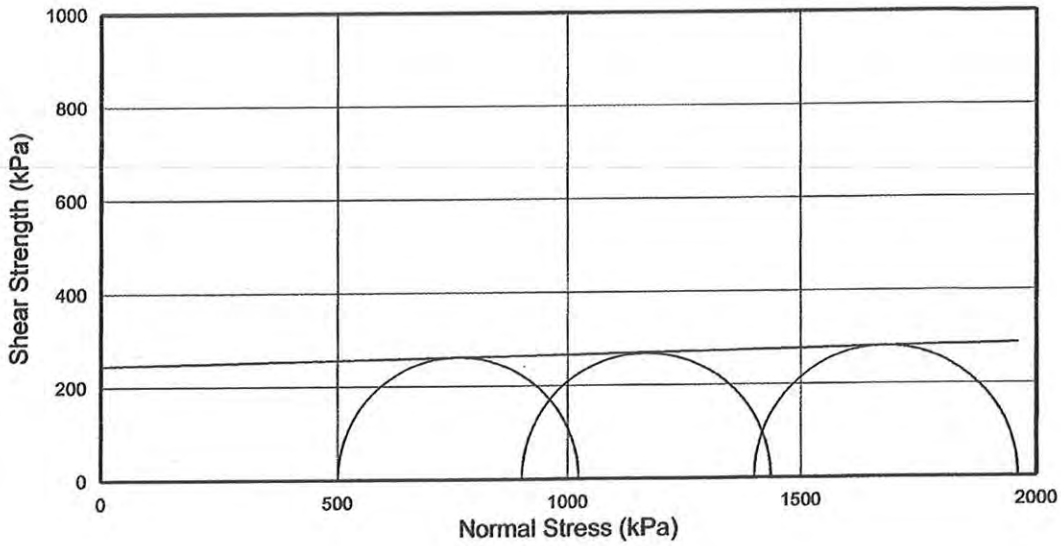
3 Stage Specimen

Specimen details	Single Specimen		
Specimen conditions:	Undisturbed		
Length (mm):	172.3		
Diameter (mm):	85.8		
Moisture Content (%):	28		
Bulk Density (Mg/m³):	1.99		
Dry Density (Mg/m³):	1.56		
Test details	**Stage 1**	**Stage 2**	**Stage 3**
Latex membrane thickness (mm):	0.3	0.3	0.3
Membrane correction (kPa):	0.9	0.9	1.0
Axial displacement rate (%/min):	0.66	0.66	0.66
Cell pressure (kPa):	500	900	1400
Strain at failure (%):	11.0	12.2	13.3
Maximum Deviator Stress (kPa):	524	536	562
Shear Stress Cu (kPa):	262	268	281

Orientation and position of sample: n/a

Mode of failure:





c = 245 kPa Ø = 1 °

Checked and Approved	Project Number:	
Initials: JS Date: 24/07/2009	Project Name:	GEO / 14720 RIVENHALL

GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH02 Depth (m): 28.5-30.0	Description: Very stiff dark brown CLAY

SPECIMEN DETAILS				
Depth within original sample		500mm from top		
Orientation within original sample		Vertical		
TEST DETAILS				
Specimen Preparation		Undisturbed		
Cell Preparation		Checks performed in accordance with Clause 3.5		
Specimen Number		**Multistage**		
Initial Diameter	*mm*	86.2		
Initial Length	*mm*	175.0		
Initial Moisture Content	*%*	29		
Initial Wet Density	*Mg/m³*	1.95		
Drainage Conditions		Stage 1: one end and radial boundary	Stages 2 & 3: Both ends and radial boundary	
SATURATION STAGE				
Final Cell Pressure	*kPa*	800		
Final Pore Pressure	*kPa*	679		
Final Pore Pressure Parameter B		0.98		
Duration	*day(s)*	5		
CONSOLIDATION STAGE		**Stage No 1**	**Stage No 2**	**Stage No 3**
Cell Pressure	*kPa*	800	1200	1700
Back Pressure	*kPa*	400 single	400 double	300 double
Effective Pressure	*kPa*	400 ended	800 ended	1400 ended
Final Pore Pressure	*kPa*	407	418	**Test Terminated**
Final Pore Pressure Dissipation	*%*	97	96	
Duration	*day(s)*	12	15	6
SHEARING STAGE				
Cell Pressure	*kPa*	800	1200	
Rate of Axial Displacement	*mm/min*	0.00080	0.00060	
Initial Pore Pressure	*kPa*	407	418	
Initial Effective Stress	*kPa*	393	782	
CONDITIONS AT FAILURE	*criteria*	Maximum Principal Stress Ratio		
Pore Pressure	*kPa*	534	675	
Minor Effective Principal Stress	*kPa*	266	525	
Deviator Stress	*kPa*	359	580	
Major Effective Principal Stress	*kPa*	625	1105	
Effective Principal Stress Ratio		2.35	2.10	
Pore Pressure Parameter A		0.35	0.44	
Axial Strain	*%*	5.7	5.0	
Correction applied to Deviator Stress	*kPa*	5	5	
Duration : charged / actual	*day(s)*	6 / 12	10	
Final Moisture Content	*%*	27		
Final Wet Density	*Mg/m³*	2.20		
EFFECTIVE STRESS PARAMETERS				
Cohesion	*kPa*	48		
Angle of Shear Resistance	*degrees*	17.5		

FAILURE SKETCH

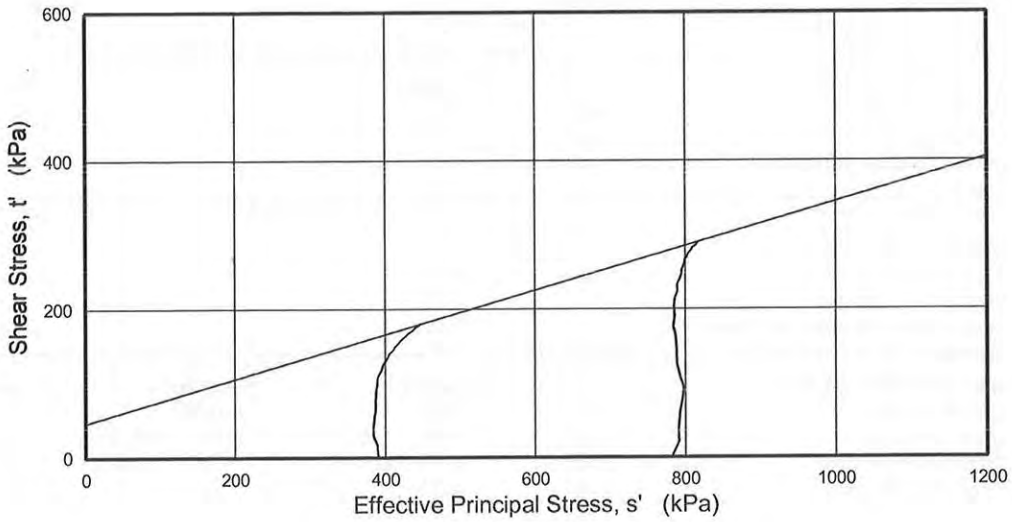
Checked and Approved Initials: CFW Date: 18/09/09	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

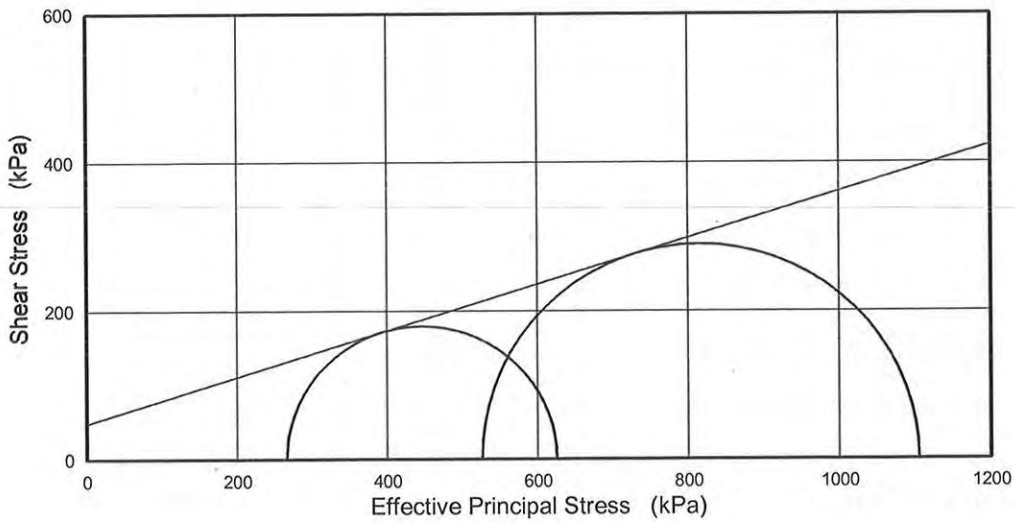
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehle Number: RBH02 Depth (m): 28.5-30.0	Description: Very stiff dark brown CLAY





Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	GEOLABS

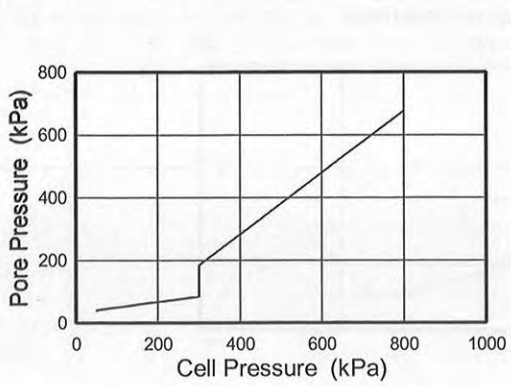
Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

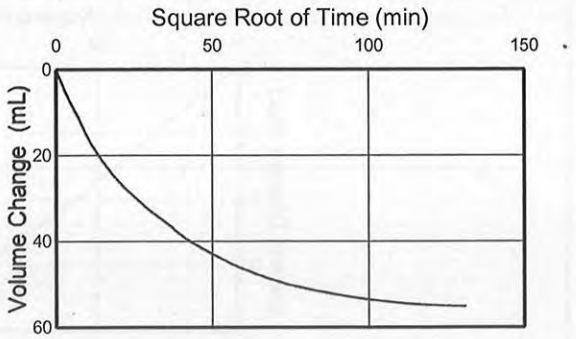
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

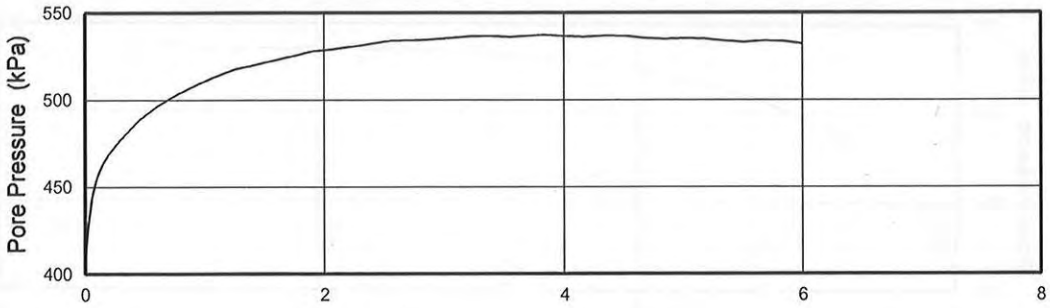
Consolidated Undrained Multistage Triaxial Compression Test

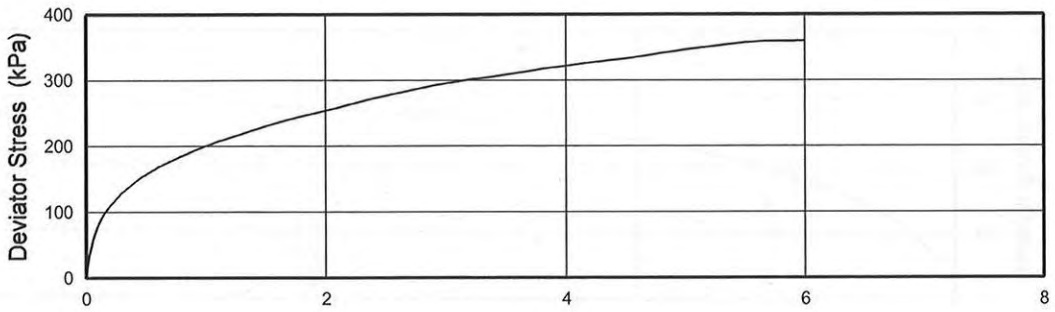
with Measurement of Pore Pressure

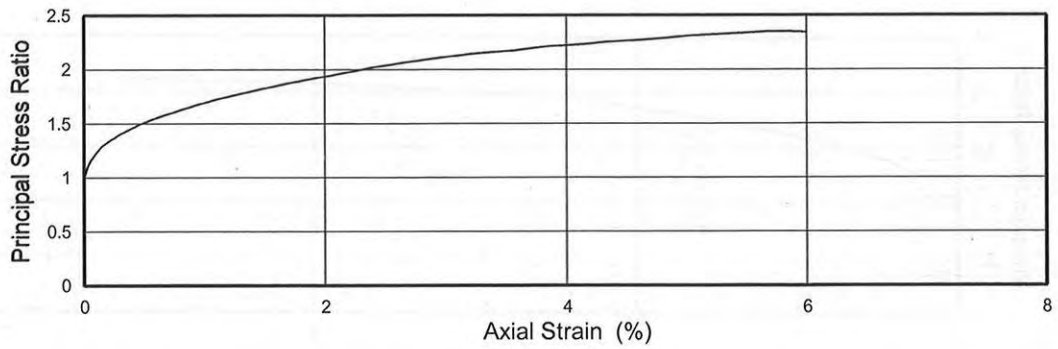
Borehole Number: RBH02 Depth (m): 28.5-30.0	**Stage No 1**











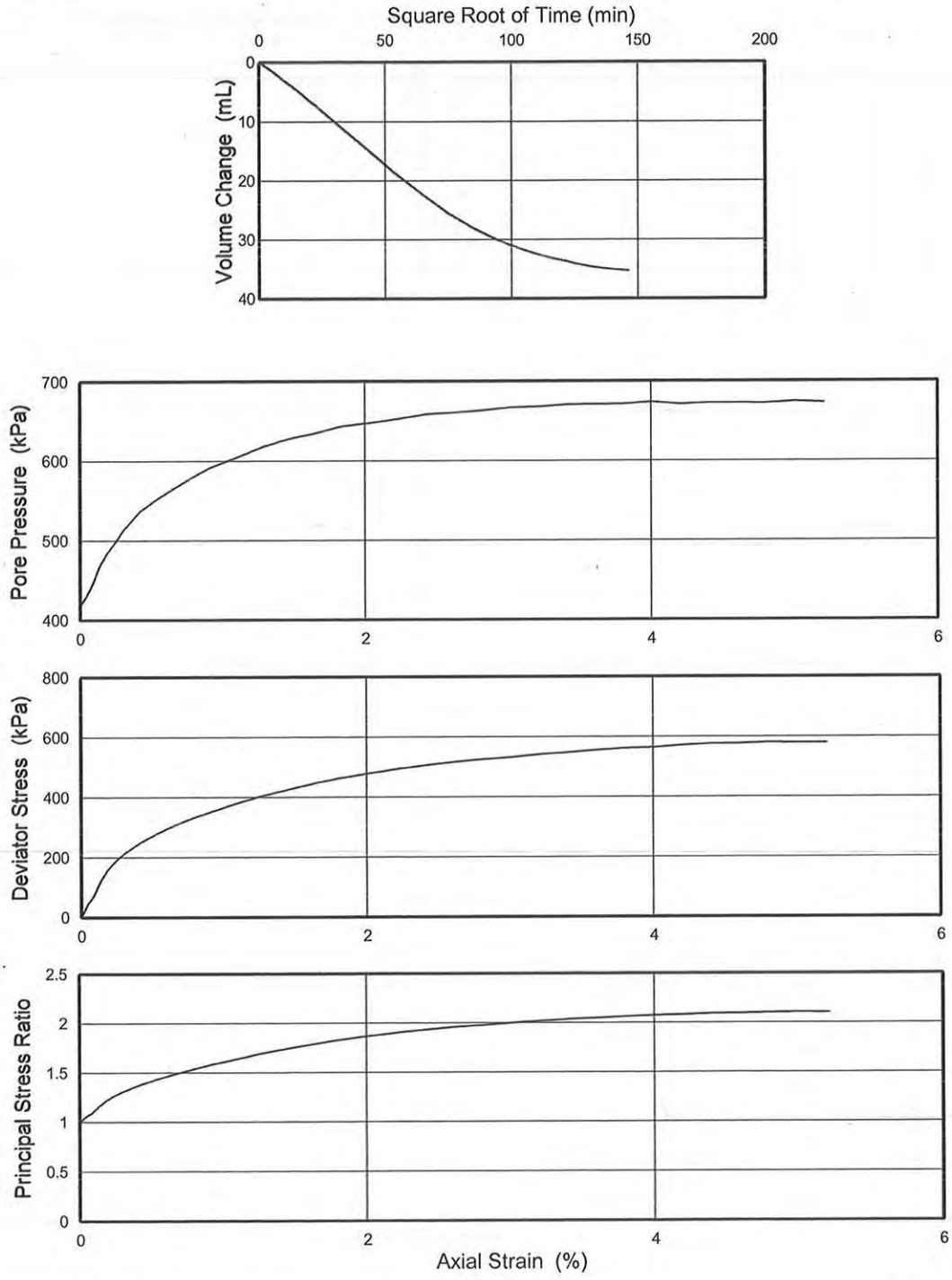
Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	GEOLABS

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehle Number: RBH02 Depth (m): 28.5-30.0	**Stage No 2**



Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number:	RBH03
Sample Number:	U
Depth (m):	23.0-24.5

Description:
Very stiff brown CLAY.

SPECIMEN DETAILS				
Depth within original sample		1000 mm from top		
Orientation within original sample		Vertical		
TEST DETAILS				
Specimen Preparation		Undisturbed		
Cell Preparation		Checks performed in accordance with Clause 3.5		
Specimen Number		**Multistage**		
Initial Diameter	*mm*	94.9		
Initial Length	*mm*	174.2		
Initial Moisture Content	*%*	30		
Initial Wet Density	*Mg/m³*	1.96		
Drainage Conditions		Stage 1 & 2: one end and radial boundary		Stage 3: Both ends and radial boundary
SATURATION STAGE				
Final Cell Pressure	*kPa*	750		
Final Pore Pressure	*kPa*	666		
Final Pore Pressure Parameter B		0.98		
Duration	*day(s)*	4		
CONSOLIDATION STAGE		**Stage No 1**	**Stage No 2**	**Stage No 3**
Cell Pressure	*kPa*	750	1000	1500
Back Pressure	*kPa*	500 single	500 single	500 double
Effective Pressure	*kPa*	250 ended	500 ended	1000 ended
Final Pore Pressure	*kPa*	506	513	508
Final Pore Pressure Dissipation	*%*	96	96	99
Duration	*day(s)*	7	7	8
SHEARING STAGE				
Cell Pressure	*kPa*	750	1000	1500
Rate of Axial Displacement	*mm/min*	0.0024	0.0011	0.00077
Initial Pore Pressure	*kPa*	506	512	508
Initial Effective Stress	*kPa*	244	488	992
CONDITIONS AT FAILURE	*criteria*	Maximum Principal Stress Ratio		
Pore Pressure	*kPa*	563	673	884
Minor Effective Principal Stress	*kPa*	187	327	616
Deviator Stress	*kPa*	244	360	656
Major Effective Principal Stress	*kPa*	431	687	1272
Effective Principal Stress Ratio		2.31	2.10	2.06
Pore Pressure Parameter A		0.24	0.45	0.57
Axial Strain	*%*	3.2	4.7	4.6
Correction applied to Deviator Stress	*kPa*	4	4	4
Duration	*day(s)*	3	6	8
Final Moisture Content	*%*	30		
Final Wet Density	*Mg/m³*	2.16		
EFFECTIVE STRESS PARAMETERS				
Cohesion	*kPa*	19		
Angle of Shear Resistance	*degrees*	19		

FAILURE SKETCH

Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

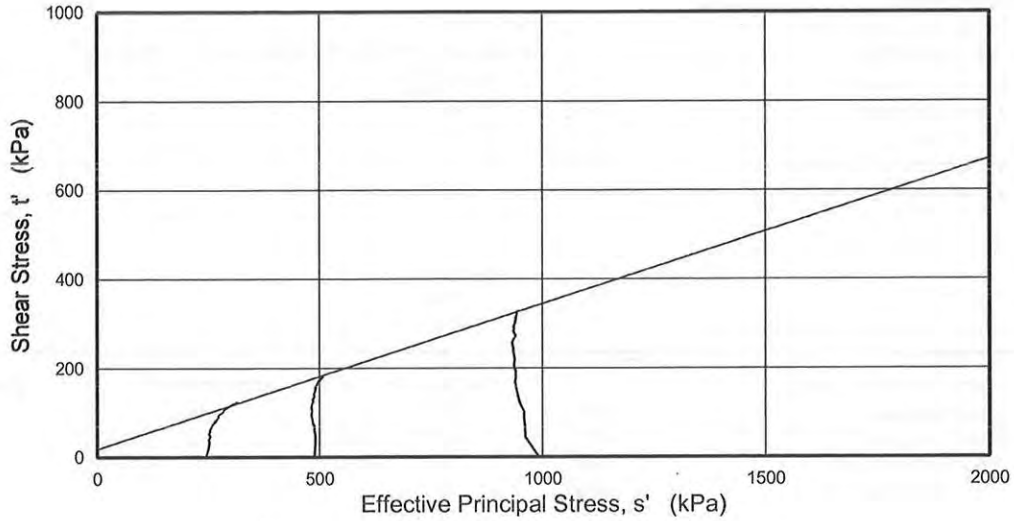
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

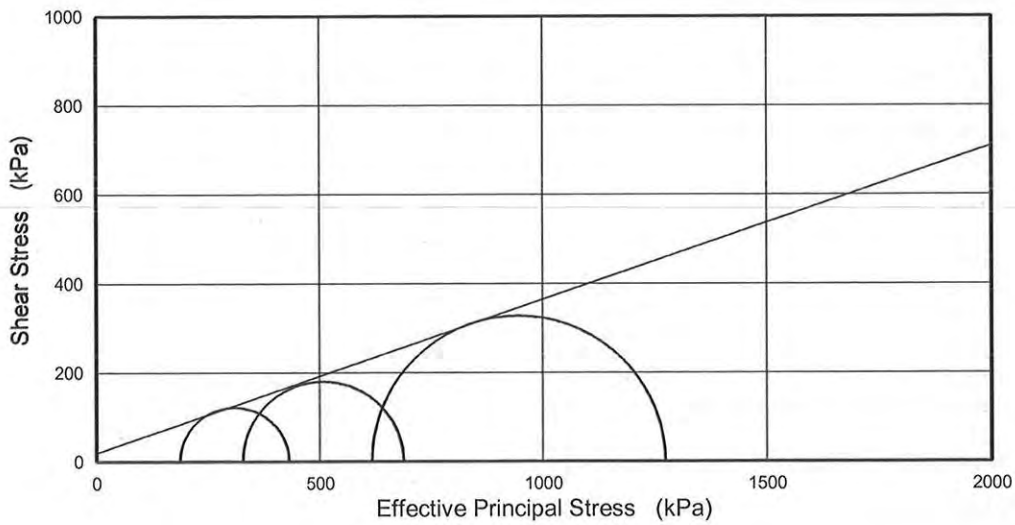
Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number:	RBH03
Sample Number:	U
Depth (m):	23.0-24.5

Description:
Very stiff brown CLAY.





Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

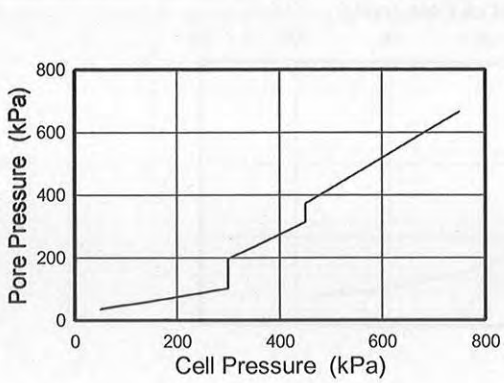
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

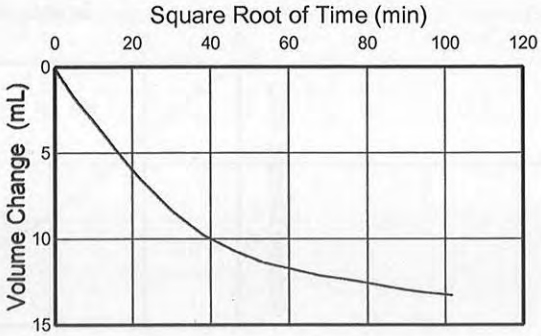
Consolidated Undrained Multistage Triaxial Compression Test

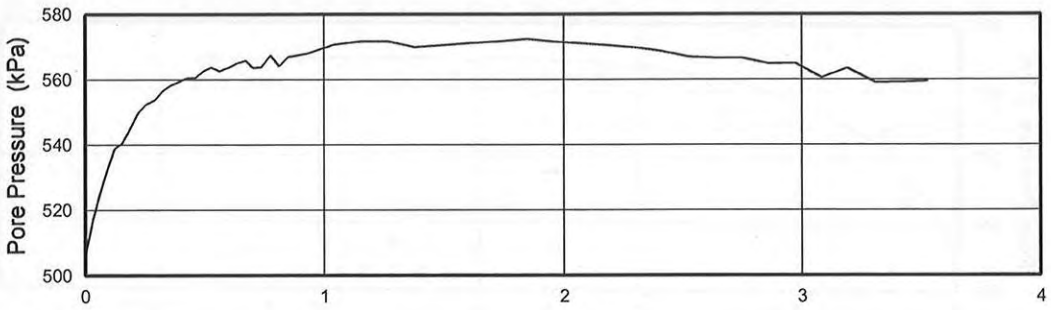
with Measurement of Pore Pressure

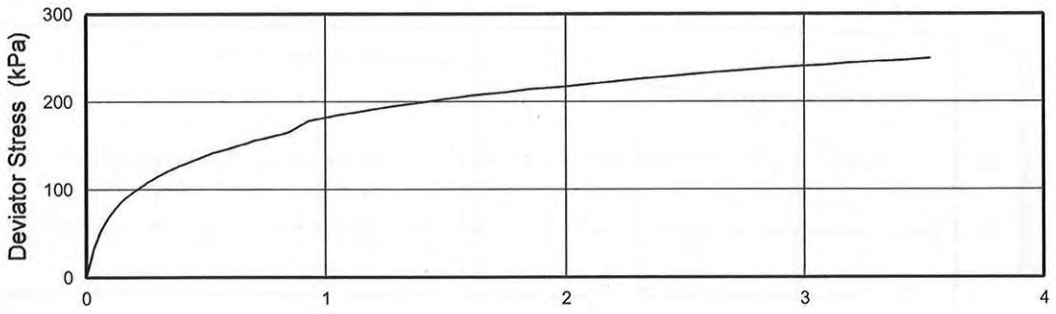
Borehole Number:	RBH03
Sample Number:	U
Depth (m):	23.0-24.5

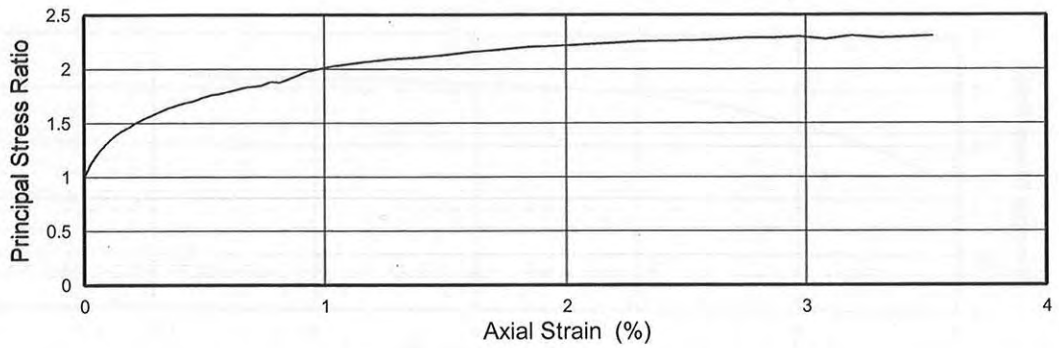
Stage No 1











Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

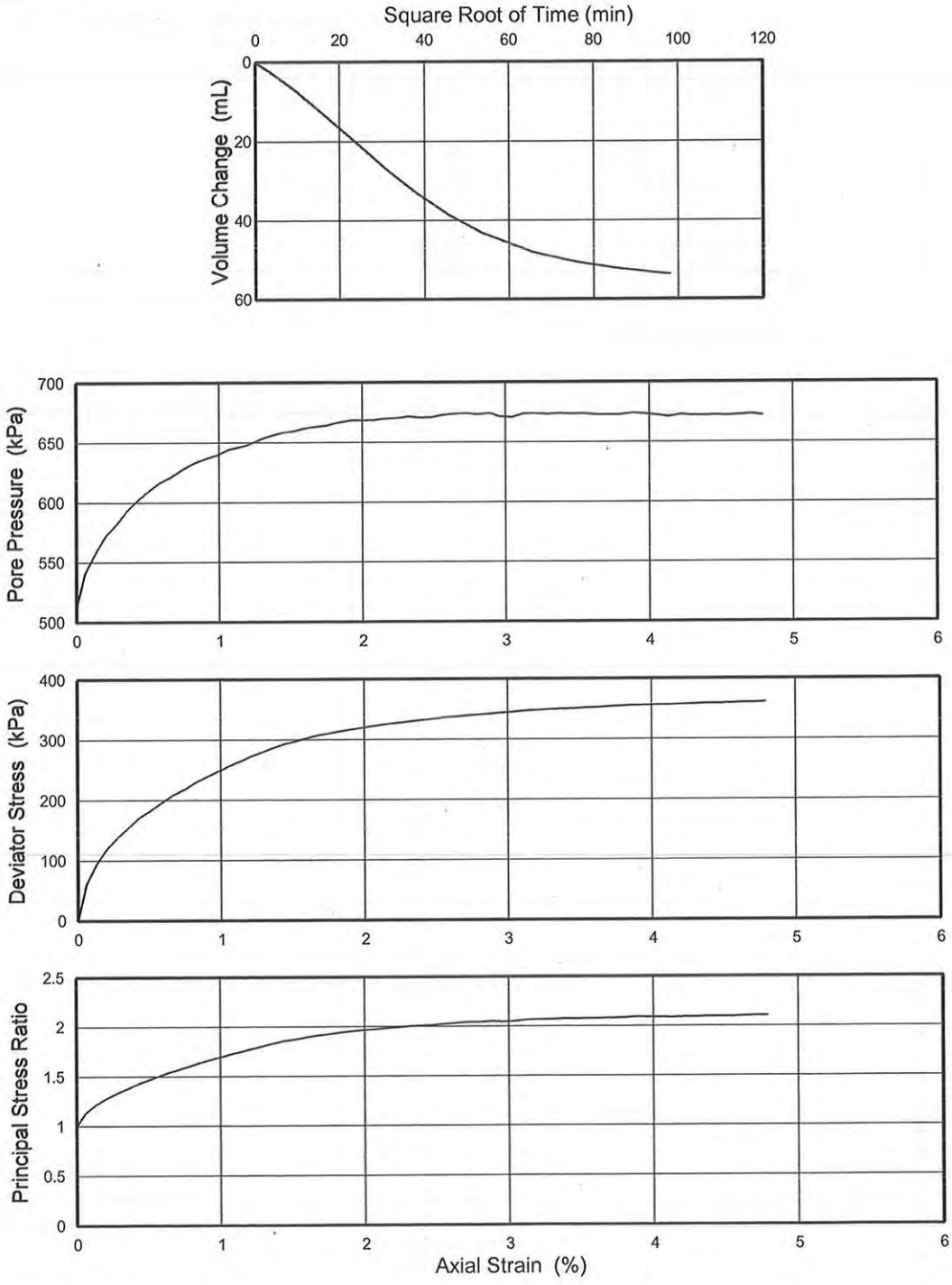
Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03	**Stage No 2**
Sample Number: U	
Depth (m): 23.0-24.5	



Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	GEOLABS

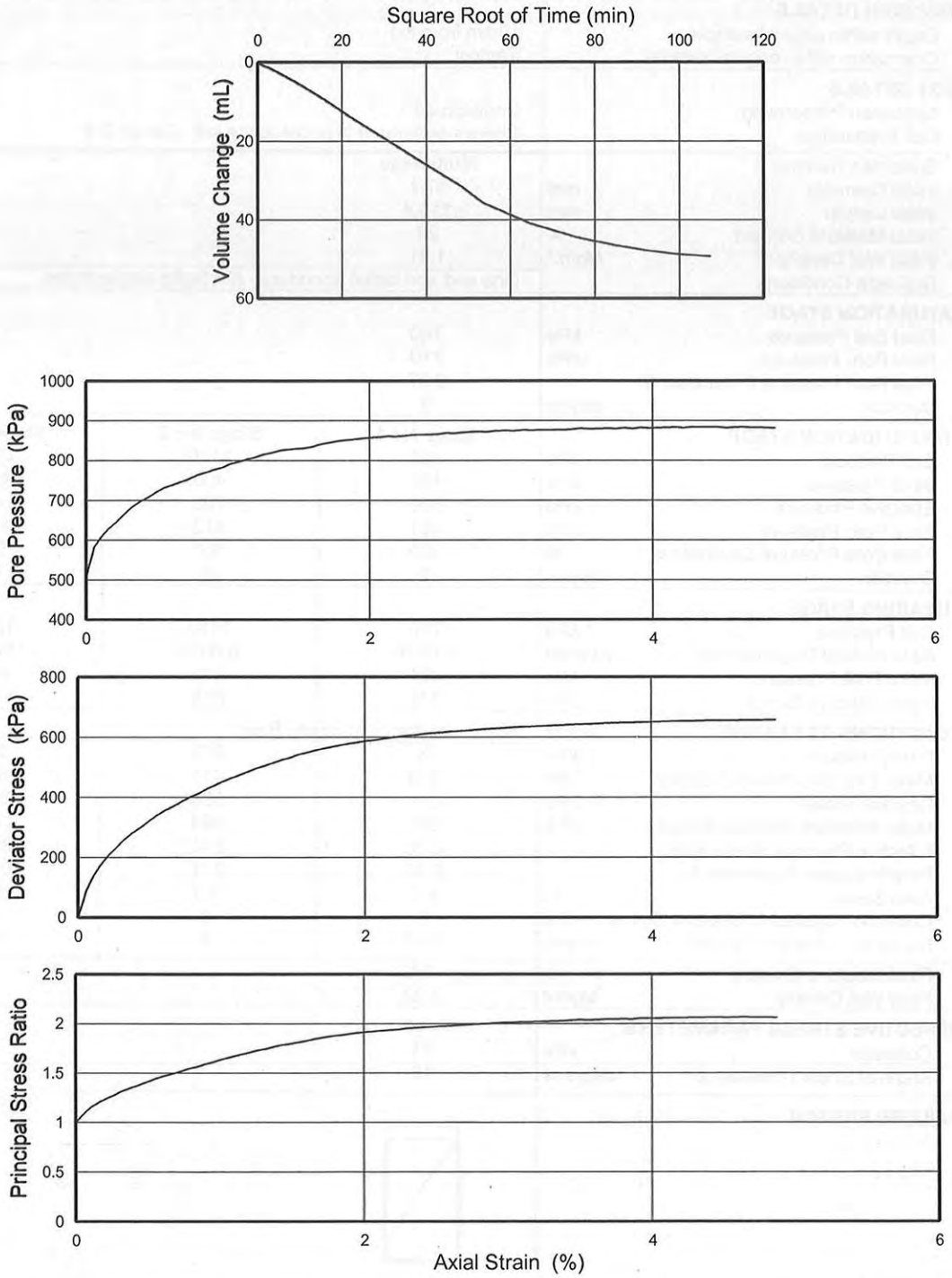
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number:	RBH03
Sample Number:	U
Depth (m):	23.0-24.5

Stage No 3



Checked and Approved Initials: CFW Date: 18/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

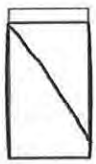
Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03 Depth (m): 40.0-40.2	Description: Stiff dark grey and brown CLAY.

SPECIMEN DETAILS				
Depth within original sample		10mm from top		
Orientation within original sample		Vertical		
TEST DETAILS				
Specimen Preparation		Undisturbed		
Cell Preparation		Checks performed in accordance with Clause 3.5		
Specimen Number		**Multistage**		
Initial Diameter	*mm*	67.7		
Initial Length	*mm*	115.4		
Initial Moisture Content	*%*	29		
Initial Wet Density	*Mg/m³*	1.91		
Drainage Conditions		One end and radial boundary - all stages single ended		
SATURATION STAGE				
Final Cell Pressure	*kPa*	750		
Final Pore Pressure	*kPa*	710		
Final Pore Pressure Parameter B		0.97		
Duration	*day(s)*	6		
CONSOLIDATION STAGE		**Stage No 1**	**Stage No 2**	**Stage No 3**
Cell Pressure	*kPa*	750	1100	1800
Back Pressure	*kPa*	400	400	400
Effective Pressure	*kPa*	350	700	1400
Final Pore Pressure	*kPa*	401	412	427
Final Pore Pressure Dissipation	*%*	100	97	97
Duration	*day(s)*	2	5	19
SHEARING STAGE				
Cell Pressure	*kPa*	750	1100	1800
Rate of Axial Displacement	*mm/min*	0.0010	0.0016	0.00032
Initial Pore Pressure	*kPa*	401	412	427
Initial Effective Stress	*kPa*	349	688	1373
CONDITIONS AT FAILURE	*criteria*	Maximum Principal Stress Ratio		
Pore Pressure	*kPa*	537	689	997
Minor Effective Principal Stress	*kPa*	213	411	803
Deviator Stress	*kPa*	374	583	909
Major Effective Principal Stress	*kPa*	587	994	1712
Effective Principal Stress Ratio		2.76	2.42	2.13
Pore Pressure Parameter A		0.36	0.48	0.63
Axial Strain	*%*	8.0	6.0	5.9
Correction applied to Deviator Stress	*kPa*	6	6	6
Duration: charged / actual	*day(s)*	3 / 8	3	15
Final Moisture Content	*%*	27		
Final Wet Density	*Mg/m³*	2.22		
EFFECTIVE STRESS PARAMETERS				
Cohesion	*kPa*	71		
Angle of Shear Resistance	*degrees*	18		

FAILURE SKETCH



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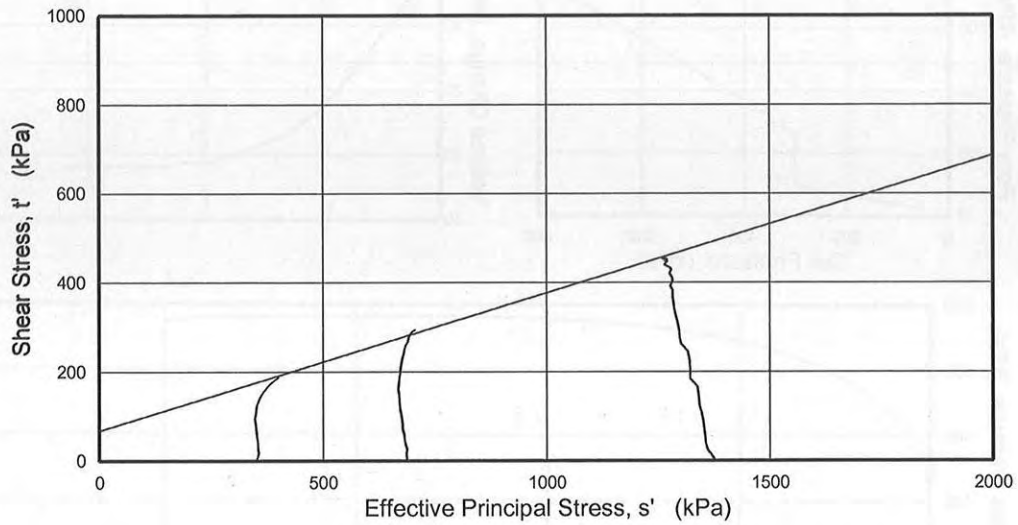
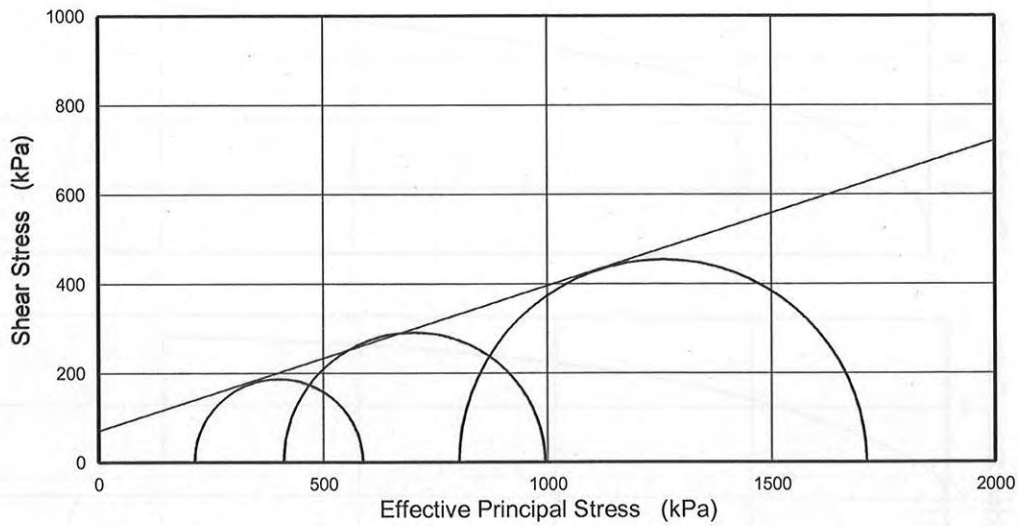
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03 Depth (m): 40.0-40.2	Description: Stiff dark grey and brown CLAY.





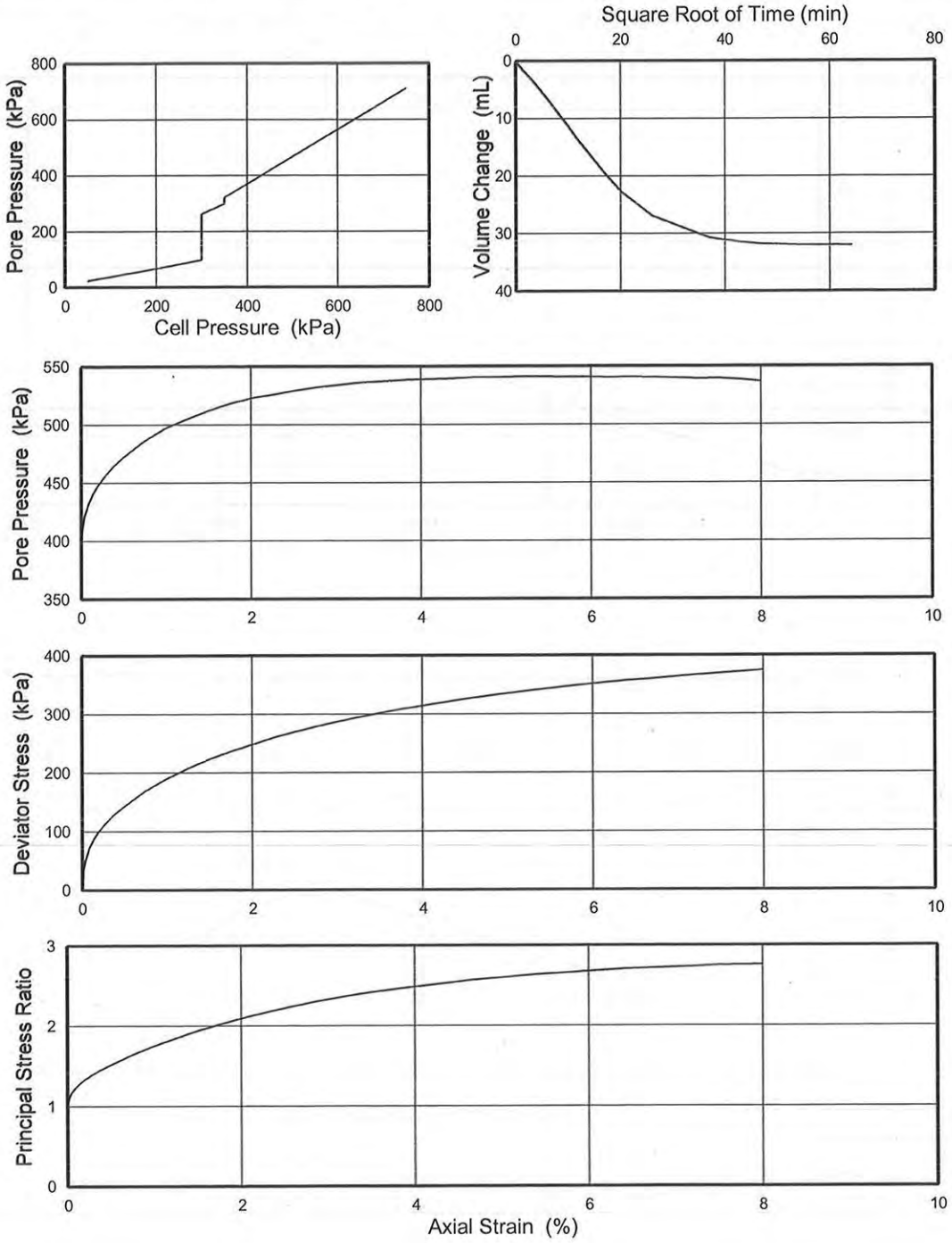
Checked and Approved Initials: RJP Date: 21/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehle Number: RBH03 Depth (m): 40.0-40.2	**Stage No 1**



Checked and Approved Initials: RJP Date: 21/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

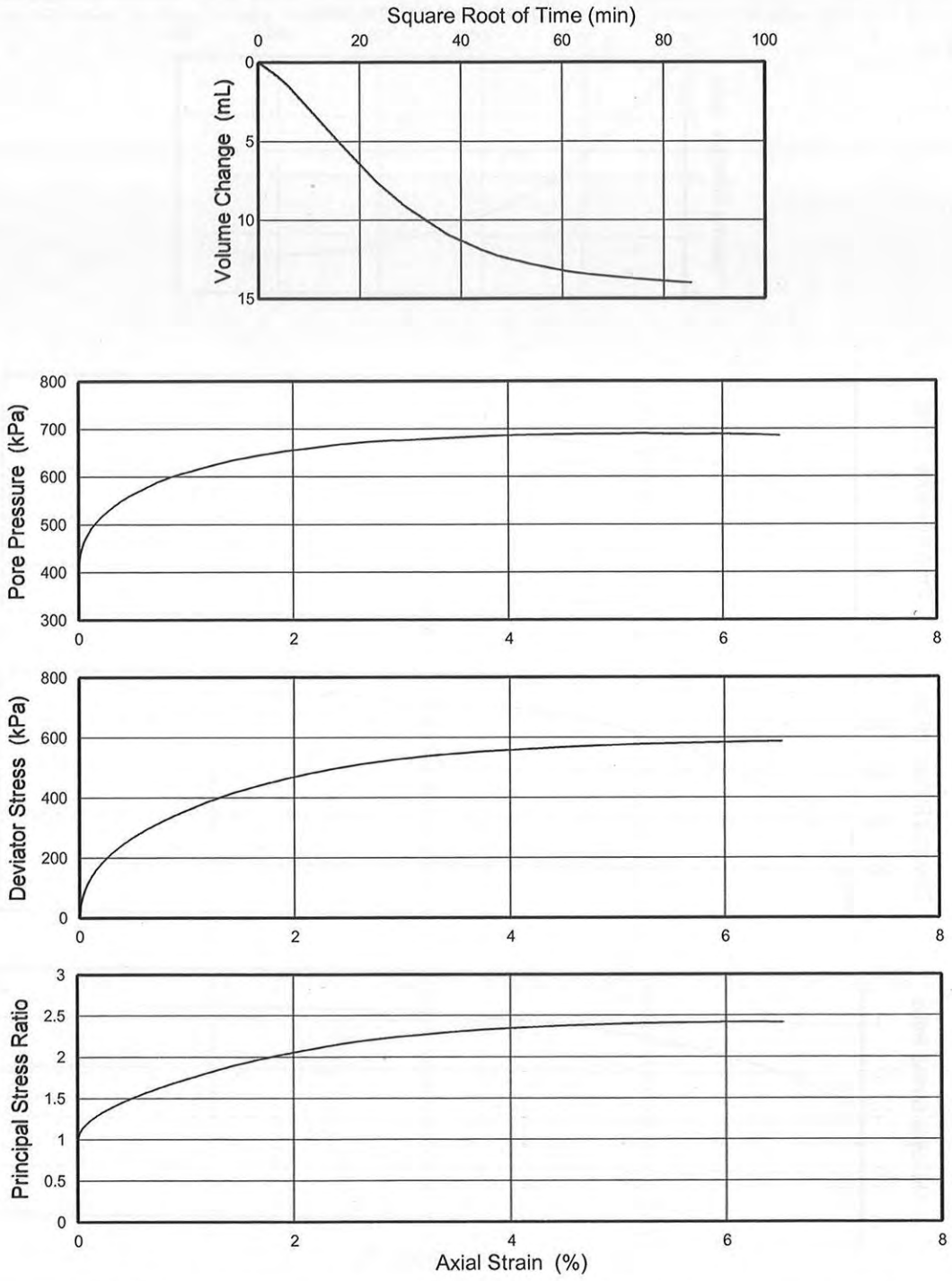
Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03 Depth (m): 40.0-40.2	**Stage No 2**



Checked and Approved Initials: RJP Date: 21/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

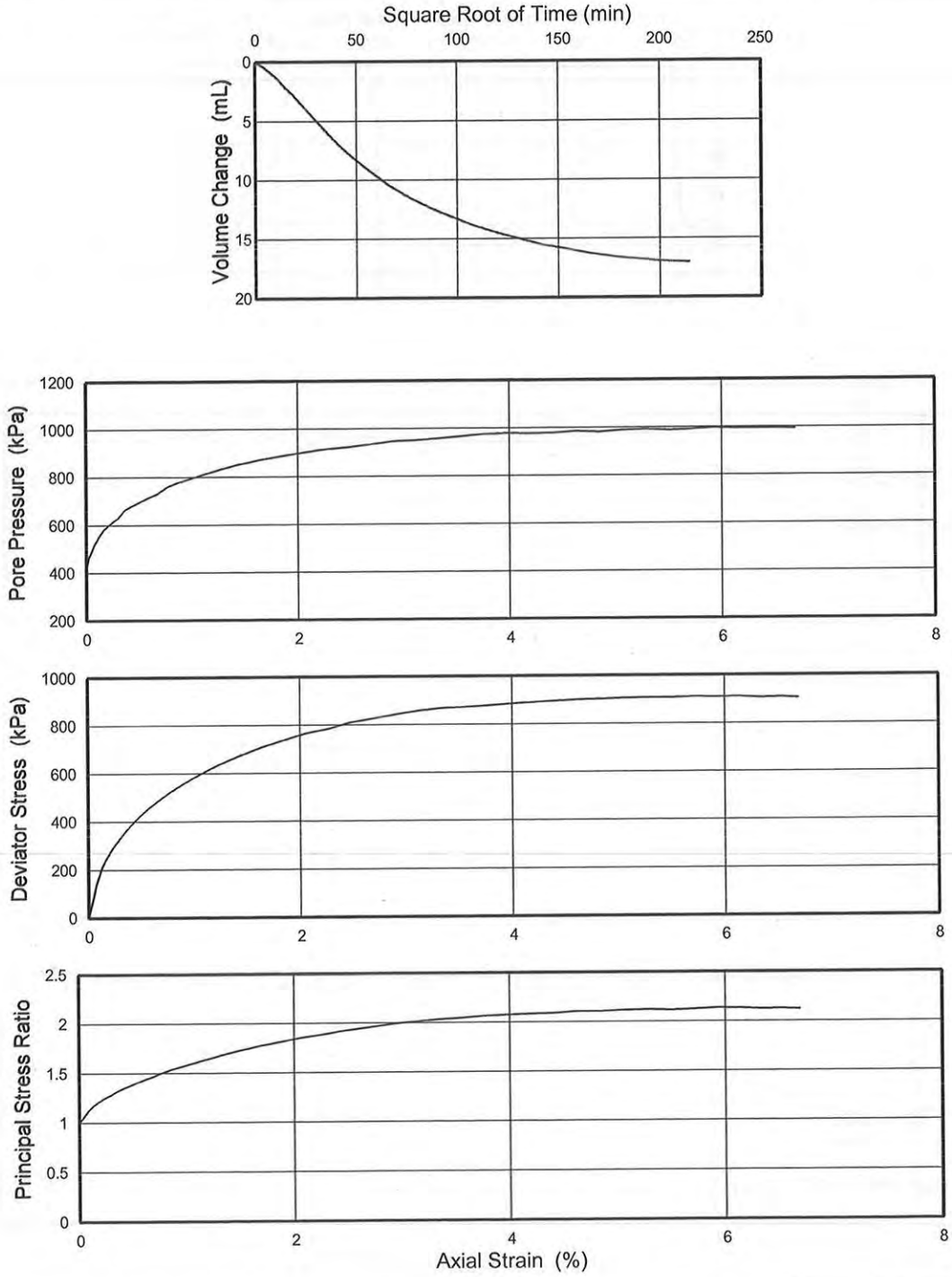
Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehle Number: RBH03 Depth (m): 40.0-40.2	**Stage No 3**



Checked and Approved Initials: RJP Date: 21/09/09	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

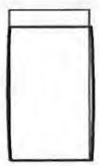
Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03	Description:
Sample Number: U	Very stiff brown CLAY.
Depth (m): 48.0-49.5	

SPECIMEN DETAILS				
Depth within original sample		1000 mm from top		
Orientation within original sample		Vertical		
TEST DETAILS				
Specimen Preparation		Undisturbed		
Cell Preparation		Checks performed in accordance with Clause 3.5		
Specimen Number		**Multistage**		
Initial Diameter	*mm*	94.2		
Initial Length	*mm*	175.2		
Initial Moisture Content	*%*	30		
Initial Wet Density	*Mg/m³*	1.93		
Drainage Conditions		Stage 1: one end and radial boundary	Stages 2 & 3: Both ends and radial boundary	
SATURATION STAGE				
Final Cell Pressure	*kPa*	750		
Final Pore Pressure	*kPa*	702		
Final Pore Pressure Parameter B		1.00		
Duration	*day(s)*	7		
CONSOLIDATION STAGE		**Stage No 1**	**Stage No 2**	**Stage No 3**
Cell Pressure	*kPa*	750	1100	1800
Back Pressure	*kPa*	400 single	400 double	400 double
Effective Pressure	*kPa*	350 ended	700 ended	1400 ended
Final Pore Pressure	*kPa*	413	406	**Test Terminated**
Final Pore Pressure Dissipation	*%*	96	99	
Duration	*day(s)*	9	8	5
SHEARING STAGE				
Cell Pressure	*kPa*	750	1100	
Rate of Axial Displacement	*mm/min*	0.0016	0.00071	
Initial Pore Pressure	*kPa*	408	406	
Initial Effective Stress	*kPa*	342	694	
CONDITIONS AT FAILURE	*criteria*	Maximum Principal Stress Ratio		
Pore Pressure	*kPa*	542	693	
Minor Effective Principal Stress	*kPa*	208	407	
Deviator Stress	*kPa*	373	584	
Major Effective Principal Stress	*kPa*	581	991	
Effective Principal Stress Ratio		2.79	2.43	
Pore Pressure Parameter A		0.36	0.49	
Axial Strain	*%*	5.7	4.2	
Correction applied to Deviator Stress	*kPa*	4	4	
Duration	*day(s)*	5	9	
Final Moisture Content	*%*	28		
Final Wet Density	*Mg/m³*	2.12		
EFFECTIVE STRESS PARAMETERS				
Cohesion	*kPa*	53		
Angle of Shear Resistance	*degrees*	20		

FAILURE SKETCH



Checked and Approved	Project Number:	
Initials: CFW	Project Name: **GEO / 14720** **RIVENHALL**	GEOLABS
Date: 18/09/09		

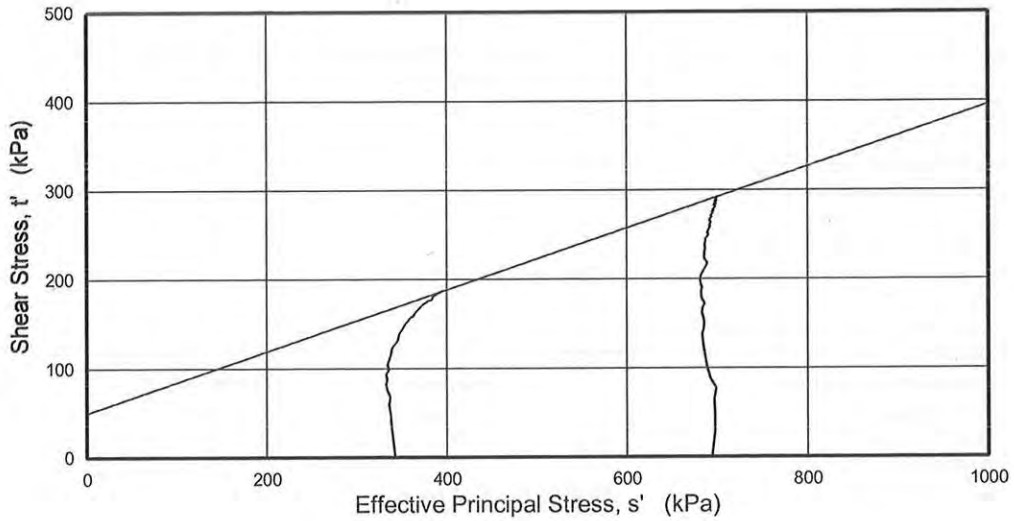
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

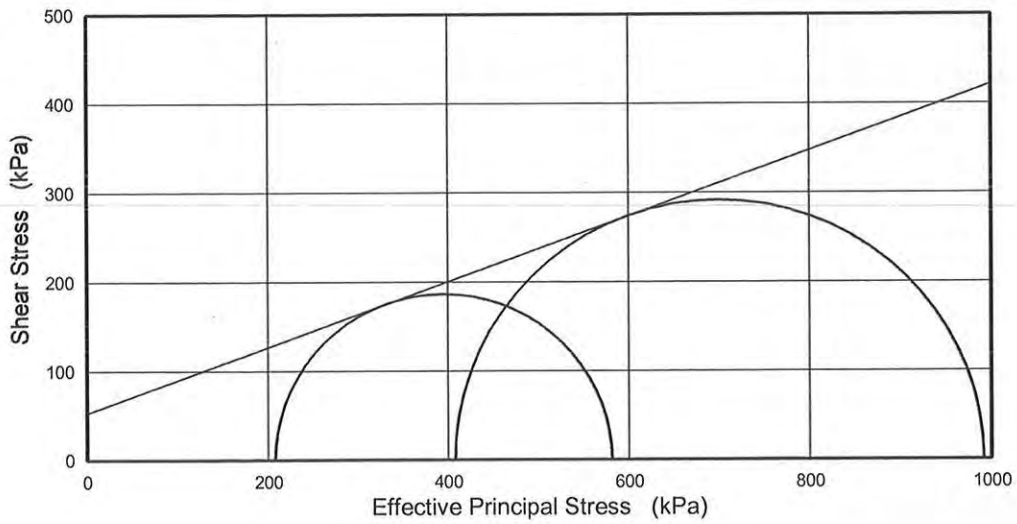
Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number:	RBH03
Sample Number:	U
Depth (m):	48.0-49.5

Description:
Very stiff brown CLAY.





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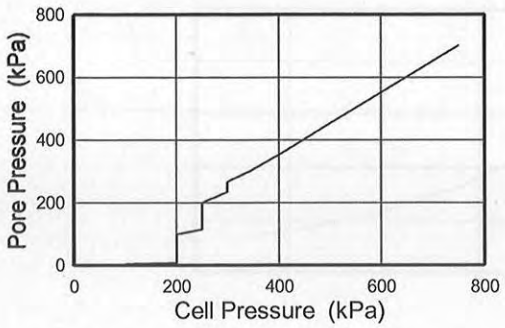
BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

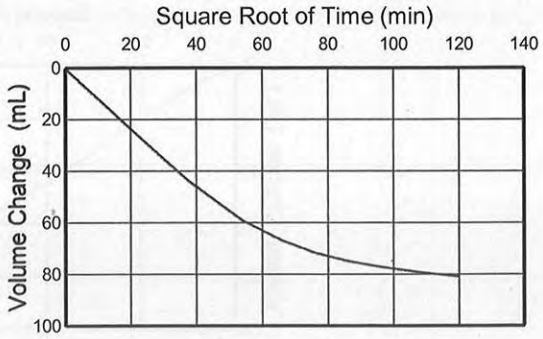
Consolidated Undrained Multistage Triaxial Compression Test

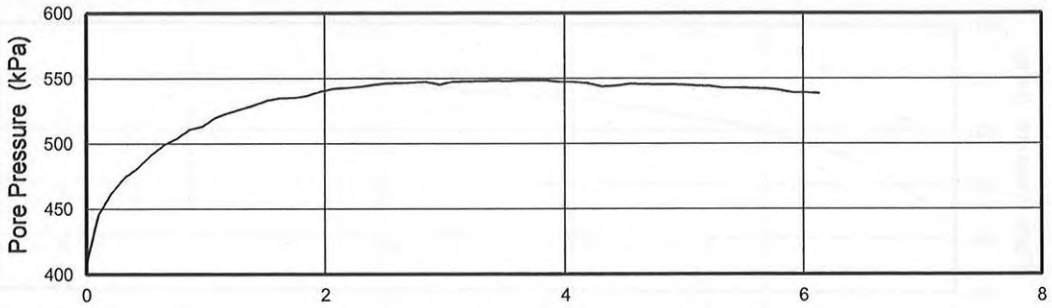
with Measurement of Pore Pressure

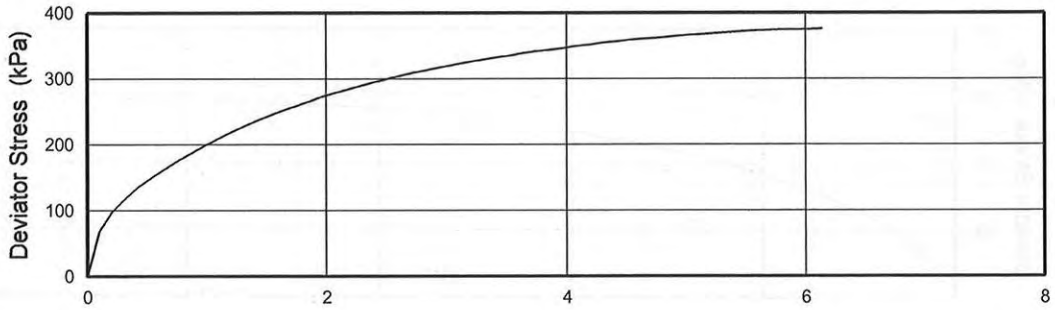
Borehole Number:	RBH03
Sample Number:	U
Depth (m):	48.0-49.5

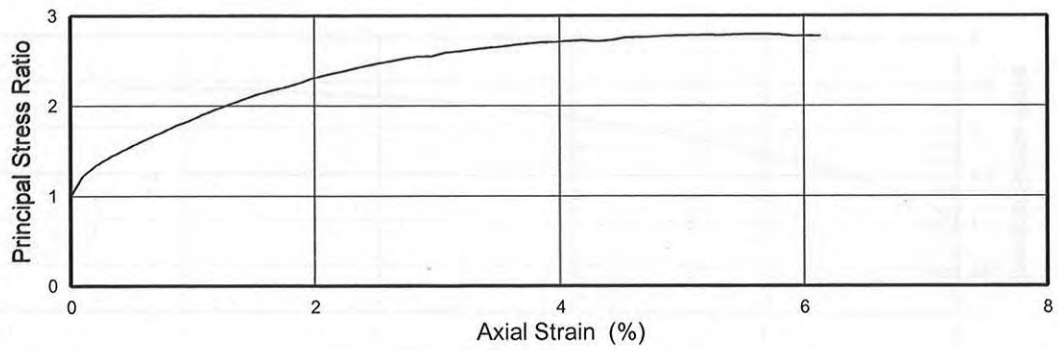
Stage No 1











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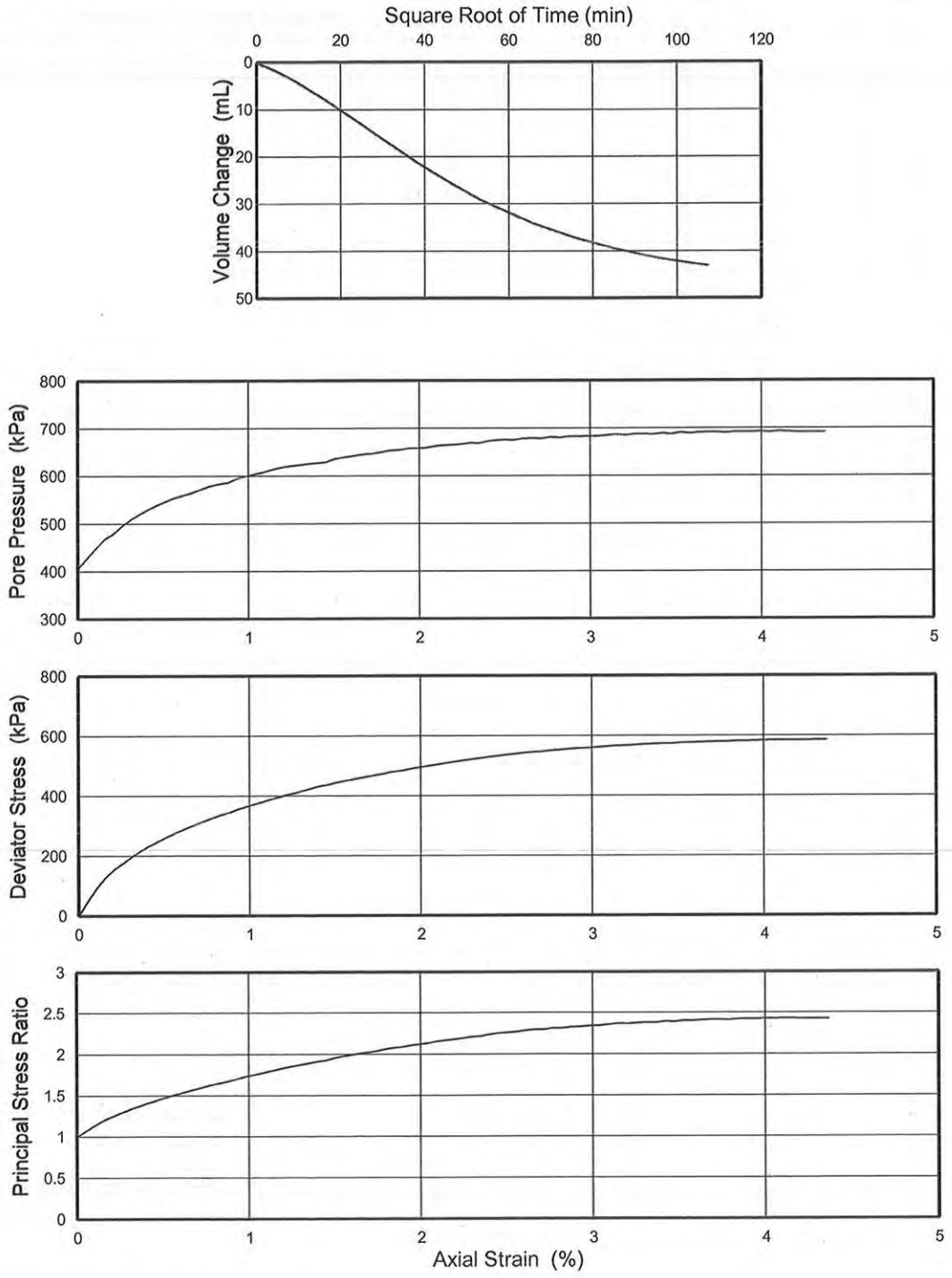
Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

BS1377 : Part 8 : Clause 7 : 1990 and Technical Procedure TP38

Consolidated Undrained Multistage Triaxial Compression Test

with Measurement of Pore Pressure

Borehole Number: RBH03	**Stage No 2**
Sample Number: U	
Depth (m): 48.0-49.5	



Checked and Approved Initials: CFW Date: 18/09/09	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

BS1377 : Part 4 : 1990

Moisture Content / Dry Density Relationship

Borehole No:	RBH04
Sample No:	-
Depth:	4.00 - 6.00

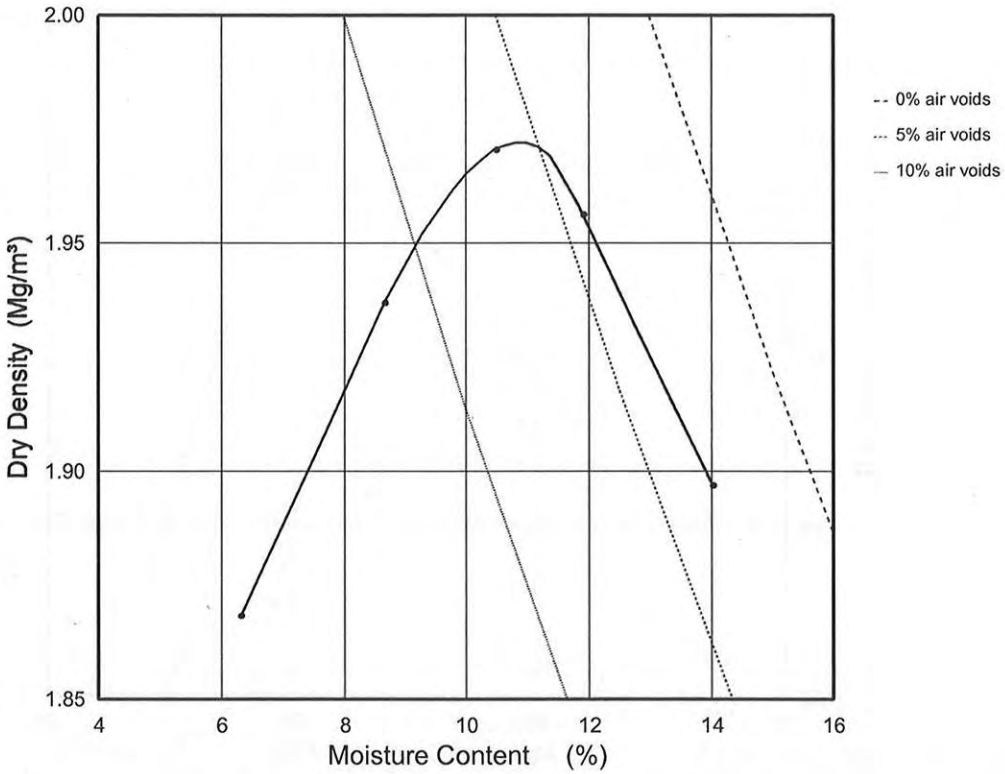
Description:
Orange-brown slightly sandy gravelly CLAY, gravel is fine to coarse chalk nodules

BS1377 : Part 4 : Clause 3.5.4.1 : 1990 4.5 kg Compaction Test

Sample Preparation: Material was air dried. Single sample
Particles greater than 20mm were removed

Particle Density: 2.70 (assumed)

Material Retained
on 20 mm test sieve: 3 %
on 37.5 mm test sieve: 0 %



Maximum Dry Density **1.97 Mg/m³**

Optimum Moisture Content **11 %**

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: **GEO / 14720** Project Name: **RIVENHALL**	**GEOLABS**

BS1377 : Part 4 : 1990

Moisture Content / Dry Density Relationship

Borehole No:	RBH04
Sample No:	-
Depth:	18.00 - 21.00

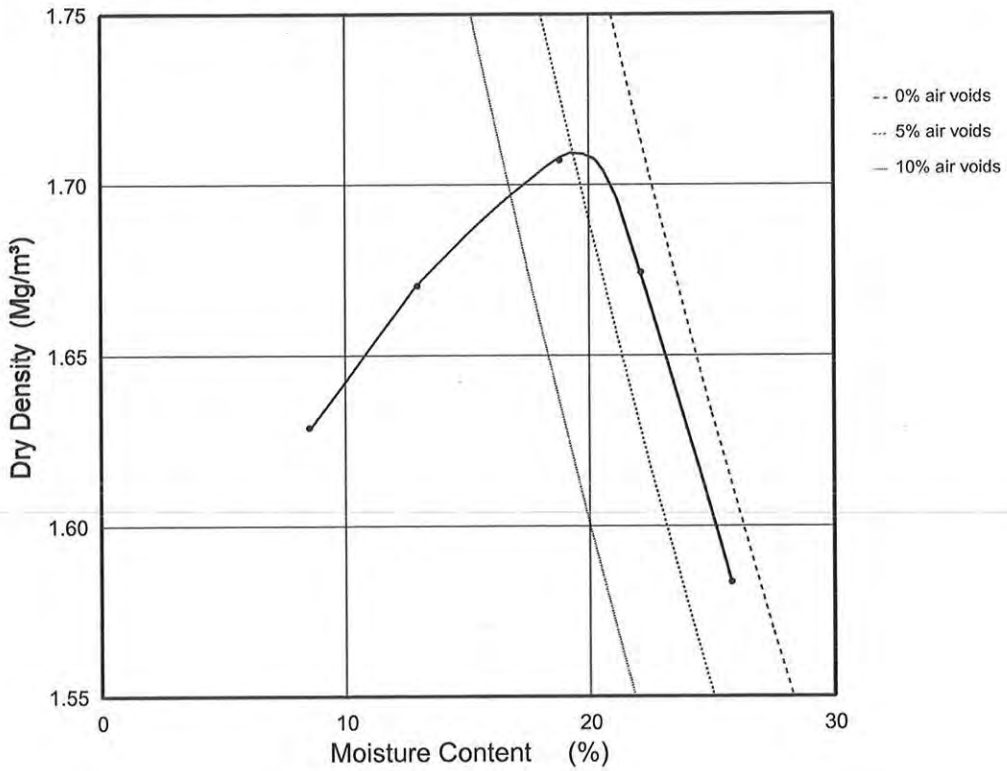
Description:
Dark grey CLAY with rare bands of mudstone

BS1377 : Part 4 : Clause 3.5.4.1 : 1990 4.5 kg Compaction Test

Sample Preparation: Material was air dried. Single sample
Particles greater than 20mm were removed

Particle Density: 2.76 (measured by small pyknometer method)

Material Retained
on 20 mm test sieve: 2 %
on 37.5 mm test sieve: 0 %



Maximum Dry Density **1.71 Mg/m³**

Optimum Moisture Content **20 %**

Checked and Approved Initials: JS Date: 24/07/2009	Project Number: GEO / 14720 Project Name: RIVENHALL	GEOLABS

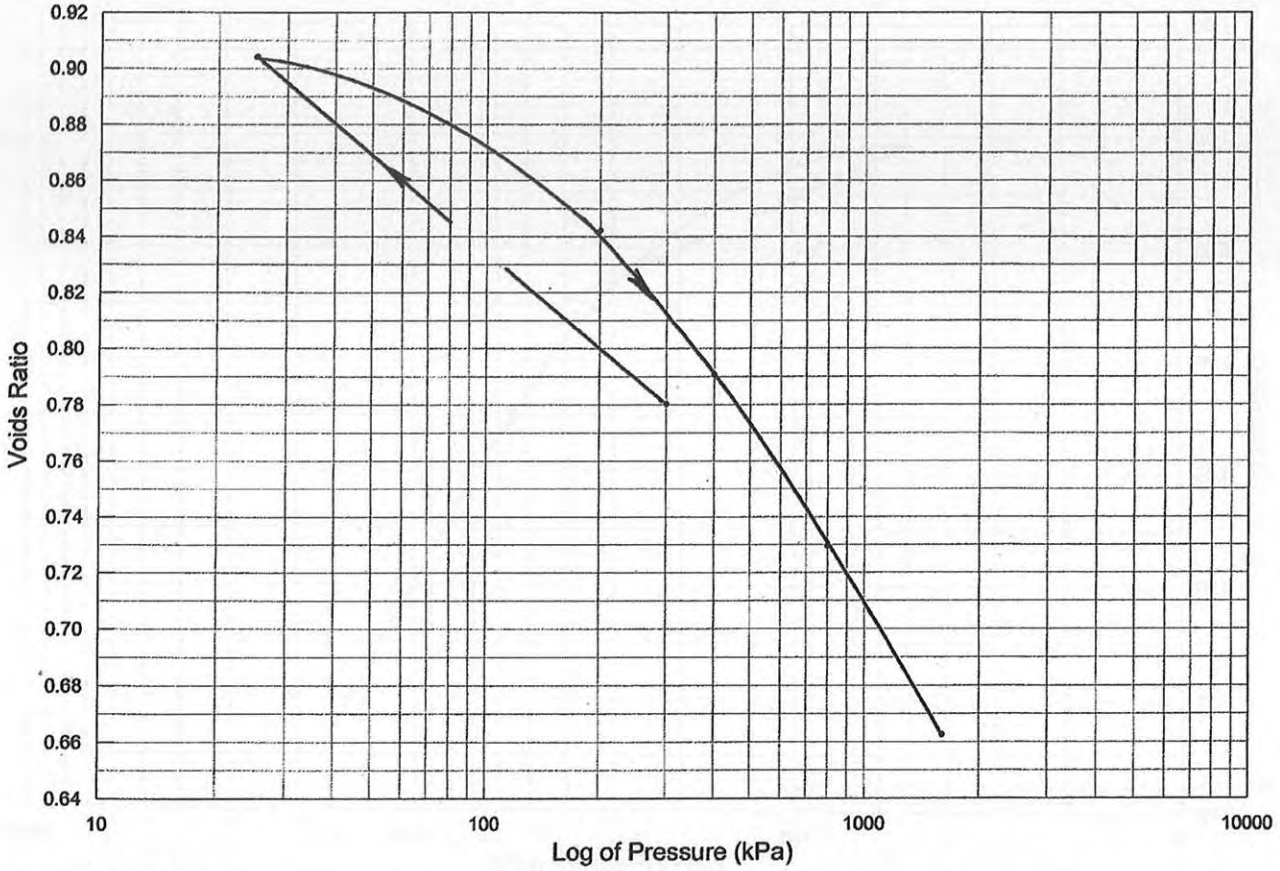
BS1377 : Part 5 : Clause 3 : 1990

Determination of One Dimensional Consolidation Properties of Soil

Borehole No:	RBH02
Sample No:	-
Depth (m):	12.00 - 13.50
Depth of test specimen (m):	-
Orientation:	Vertical
Specimen preparation:	Undisturbed

Description:

Stiff fissured dark grey CLAY



Initial Conditions:

Moisture Content (%)	27
Voids Ratio	0.785
Diameter (mm)	75.1
Height (mm)	16.8
Bulk Density (Mg/m³)	1.93
Dry Density (Mg/m³)	1.51

Final Conditions:

Moisture Content (%)	26
Voids Ratio	0.663
Particle Density (Mg/m³)	2.70 (Assumed)
Laboratory Temperature (°C)	20

Pressure Range (kPa)	Mv (m²/MN)	Cv (m²/yr)	Time Fitting Method	Voids Ratio
0 - 300 (SP)	-	-	-	0.780
300 - 25	- 0.253	0.0222 (Sv)	t50	0.904
25 - 200	0.186	0.146	t50	0.842
200 - 400	0.140	0.129	t50	0.791
400 - 800	0.0854	0.151	t50	0.730

* SP = Swelling Pressure

Checked and Approved

Initials: RJP

Date: 27/07/09

Project Number: GEO / 14720

Project Name: RIVENHALL

GEOLABS

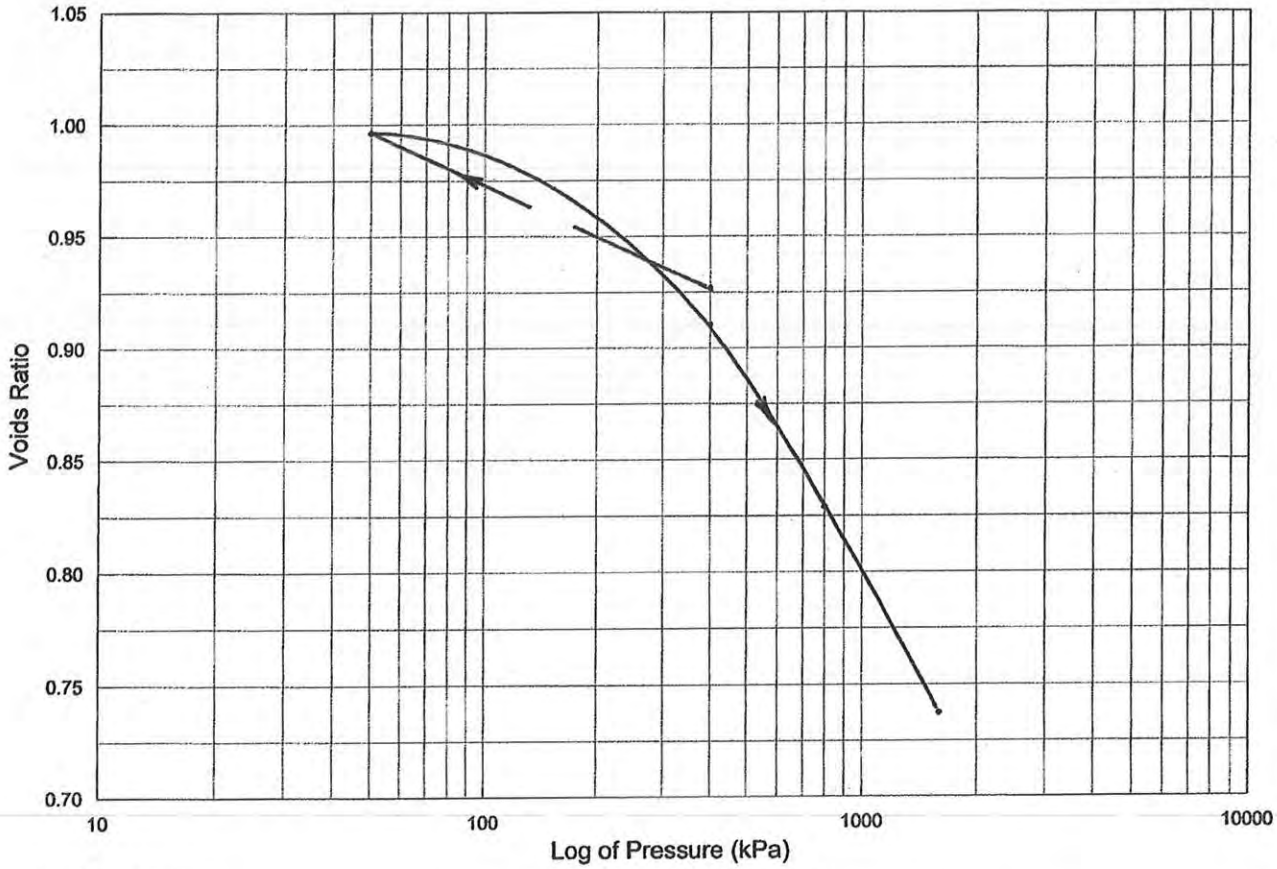
BS1377 : Part 5 : Clause 3 : 1990

Determination of One Dimensional Consolidation Properties of Soil

Borehole No:	RBH02
Sample No:	-
Depth (m):	28.00 - 30.00
Depth of test specimen (m):	-
Orientation:	Vertical
Specimen preparation:	Undisturbed

Description:

Stiff fissured dark grey CLAY



Initial Conditions:

Moisture Content (%)	44
Voids Ratio	1.117
Diameter (mm)	75.6
Height (mm)	19.1
Bulk Density (Mg/m³)	1.84
Dry Density (Mg/m³)	1.28

Final Conditions:

Moisture Content (%)	31
Voids Ratio	0.737
Particle Density (Mg/m³)	2.70 (Assumed)
Laboratory Temperature (°C)	20

Pressure Range (kPa)	Mv (m²/MN)	Cv (m²/yr)	Time Fitting Method	Voids Ratio
0 - 400	0.224	0.447	t50	0.927
400 - 50	- 0.103	0.177 (Sv)	t50	0.996
50 - 400	0.123	0.374	t50	0.910
400 - 800	0.107	0.231	t50	0.829
800 - 1600	0.0625	0.287	t50	0.737

Checked and Approved

Initials: RJP

Date: 27/07/09

Project Number: GEO /14720

Project Name: RIVENHALL

GEOLABS

Client: Golder Associates (UK) Limited, Kensel House, 77 Springfield Road, Chelmsford CM2 6JG

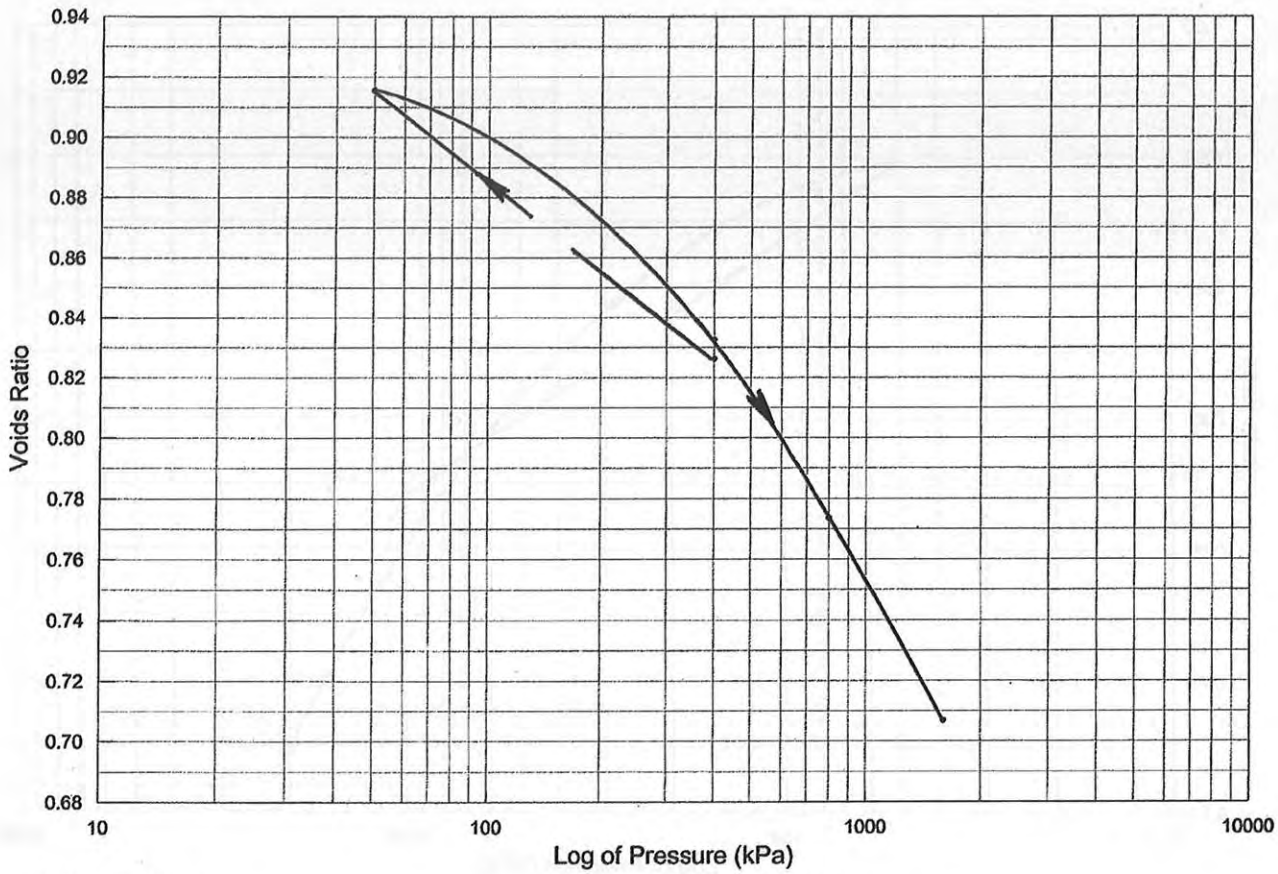
BS1377 : Part 5 : Clause 3 : 1990

Determination of One Dimensional Consolidation Properties of Soil

Borehole No:	RBH03
Sample No:	-
Depth (m):	23.00 - 24.50
Depth of test specimen (m):	-
Orientation:	Vertical
Specimen preparation:	Undisturbed

Description:

Very stiff closely fissured dark grey CLAY



Initial Conditions:

Moisture Content (%)	30
Voids Ratio	0.845
Diameter (mm)	75.0
Height (mm)	17.0
Bulk Density (Mg/m³)	1.91
Dry Density (Mg/m³)	1.46

Final Conditions:

Moisture Content (%)	28
Voids Ratio	0.707
Particle Density (Mg/m³)	2.70 (Assumed)
Laboratory Temperature (°C)	20

Pressure Range (kPa)	Mv (m²/MN)	Cv (m²/yr)	Time Fitting Method	Voids Ratio
0 - 400	0.0249	0.458	t50	0.826
400 - 50	- 0.140	0.103 (Sv)	t50	0.916
50 - 400	0.124	0.225	t50	0.833
400 - 800	0.0804	0.264	t50	0.774
800 - 1600	0.0470	0.289	t50	0.707

Checked and Approved

Initials: RJP

Date: 27/07/09

Project Number: GEO / 14720

Project Name: RIVENHALL

GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

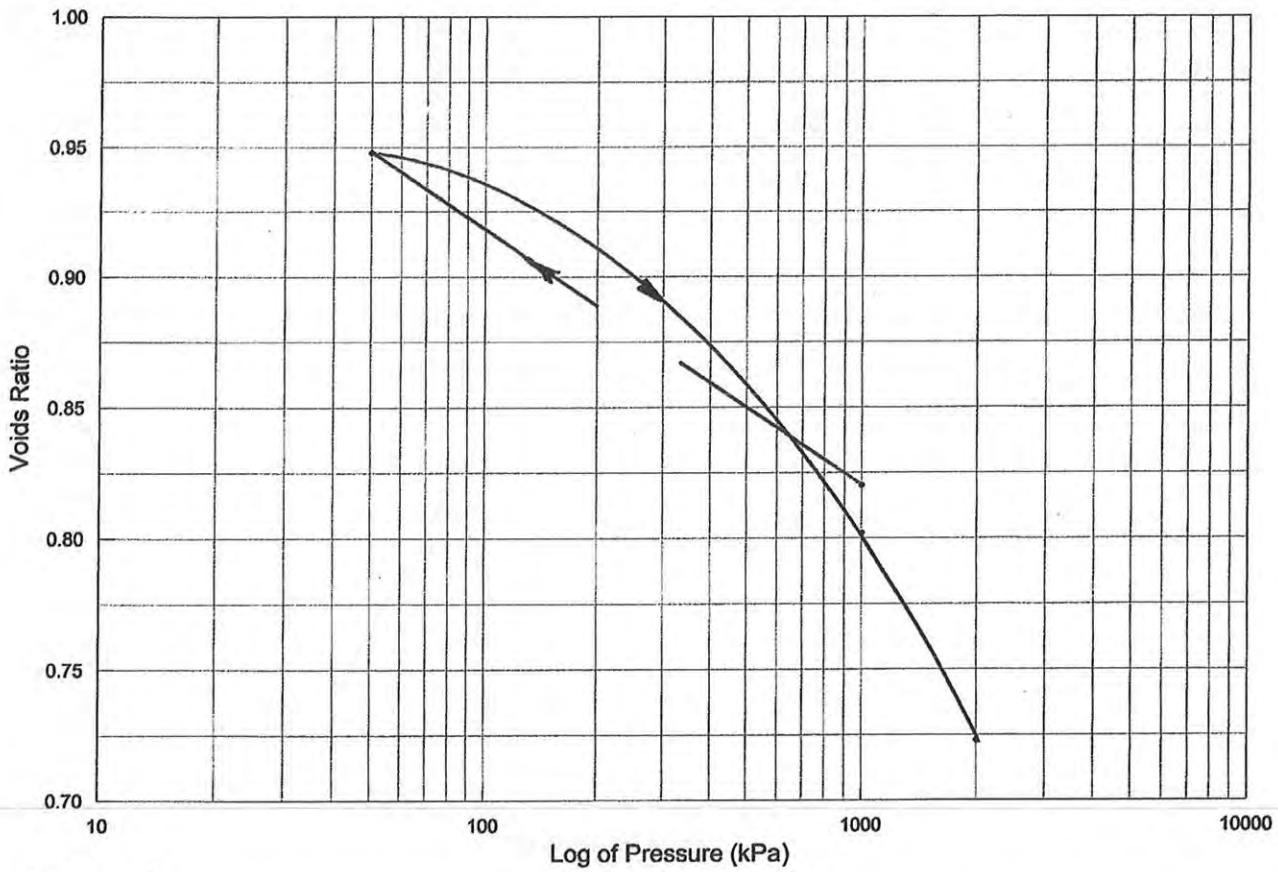
BS1377 : Part 5 : Clause 3 : 1990

Determination of One Dimensional Consolidation Properties of Soil

Borehole No:	RBH03
Sample No:	-
Depth (m):	48.00 - 49.50
Depth of test specimen (m):	-
Orientation:	Vertical
Specimen preparation:	Undisturbed

Description:

Very stiff fissured dark grey CLAY .



Initial Conditions:

Moisture Content (%)	33
Voids Ratio	0.893
Diameter (mm)	75.1
Height (mm)	19.1
Bulk Density (Mg/m³)	1.89
Dry Density (Mg/m³)	1.43

Final Conditions:

Moisture Content (%)	31
Voids Ratio	0.723
Particle Density (Mg/m³)	2.70 (Assumed)
Laboratory Temperature (°C)	20

Pressure Range (kPa)	Mv (m²/MN)	Cv (m²/yr)	Time Fitting Method	Voids Ratio
0 - 1000	0.0386	0.462	t50	0.820
1000 - 50	- 0.0737	0.108 (Sv)	t50	0.948
50 - 1000	0.0788	0.201	t50	0.802
1000 - 2000	0.0439	0.147	t50	0.723

Checked and Approved

Initials: RJP

Date: 27/07/09

Project Number: GEO /14720

Project Name: RIVENHALL

GEOLABS

Client: Golder Associates (UK) Limited, Kensal House, 77 Springfield Road, Chelmsford CM2 6JG

GEOLABS

PROJECT NAME :	RIVENHALL
PROJECT NO:	GEO / 14720

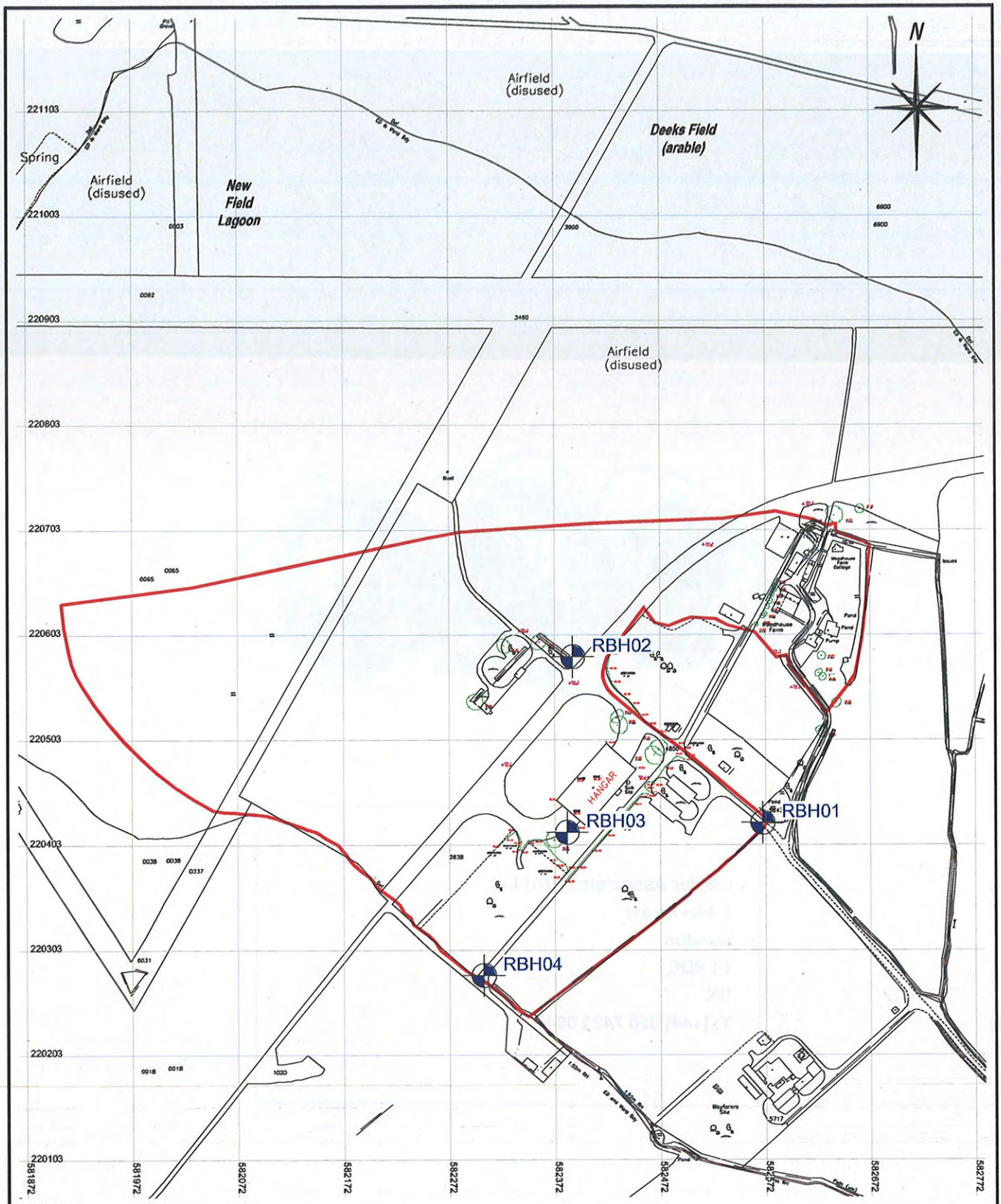
BH	Sample No.	Depth (m)	pH	Total (Acid-soluble) SO4 (%)	Water-soluble (2:1 extract) SO4 (g/l)	Total Sulphur (%)	Water Soluble Chloride (mg/l)	Water Soluble Nitrate (mg/l)	Magnesium (mg/l)	Organic Content (%)	Carbonate Content (%)
RBH02	-	3.00 - 4.50	8.0	0.02	0.02	<0.010	<50	<1.0	-	-	-
RBH02	-	7.00 - 7.50	8.2	<0.010	0.02	<0.010	<50	<1.0	-	-	-
RBH03	-	7.00 - 8.00	8.3	<0.010	0.02	<0.010	<50	<1.0	-	-	-
RBH03	-	8.00 - 9.00	8.3	<0.010	0.01	<0.010	<50	<1.0	-	-	-
RBH03	-	14.00 - 15.50	8.0	0.04	0.41	0.16	<50	<1.0	-	-	-
RBH03	-	40.00 - 40.20	8.2	0.12	1.00	0.89	<50	<1.0	-	-	-
RBH04	-	6.00 - 7.50	7.5	<0.010	0.05	<0.010	<50	<1.0	-	-	-
RBH04	-	8.00 - 9.00	7.3	<0.010	0.03	<0.010	<50	<1.0	-	-	-
RBH04	-	13.50 - 15.00	7.7	0.05	0.33	0.28	<50	<1.0	-	-	-

Checked and approved:
Initials: JS
Date: 24/07/2009

SUMMARY OF CHEMICAL TESTS ON SOIL

APPENDIX E

Drawing



KEY

SITE BOUNDARY

RBH## **BOREHOLE LOCATION**

Proposed eRCF Plant

Rev	Description	PM	Review	Date
B	Drawing Title Changed	DAK	DAK	03/11/09
A	Amended Boreholes	DAK	DAK	02/06/09

Golder Associates

Client	Gent Fairhead & Co.Limited
Project	Evolution of the Recycling & Composting Facility, Rivenhall Airfield
Title	Borehole Locations

Created by: AJ	Project Manager: DAK	Reviewer: DAK	Date: 30/04/2009
File No.: 560434		Project No.: 07514690074	
Size: A4	Scale: 1:5000	Status: For Information	
Drawing No.: **RGI-01**			Rev: **B**

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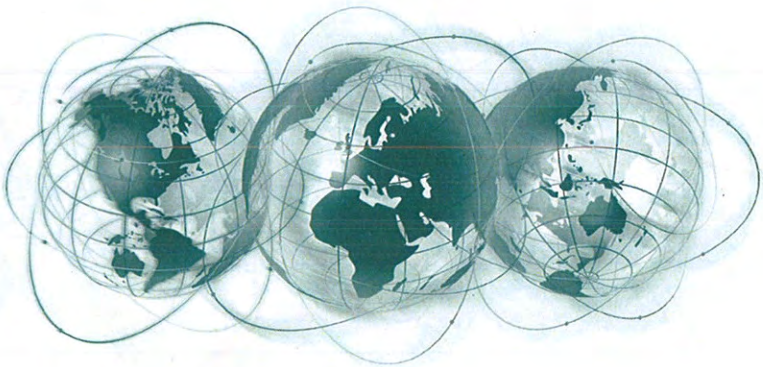

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Golder Associates

CC Ground Investigations Ltd

FACTUAL REPORT

SITE: Rivenhall Airfield IWMF

CLIENT: Gent Fairhead & Co. Ltd

ORDER No: Instruction Letter Dated 25.06.14

DATE: 05 December 2014

REPORT No: C4237

CONTENTS

1. INTRODUCTION

This investigation was carried out by CC Ground Investigations Ltd (CCGI) on the instruction and on behalf of Gent Fairhead & Co. Ltd (The Client) under the technical direction of Fichtner Consulting Engineers Ltd (the Engineer)

The purpose of the ground investigation was to provide information to assist in the design of a new energy from waste facility with associated industrial units, access roads, fuel tanks , weigh bridges and water treatments areas along with a 460m long 20-25m high retaining wall enclosing the entire site.

The scope of the ground investigation was defined in the Engineer's specification, reference: Job No. 213033 – Rivenhall Airfield IWMF – Site Investigation Tender

This report describes the work carried out by CC Ground Investigations Ltd and presents the findings.

All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, and on the results of laboratory and field tests performed during the investigation. There may however be conditions at or adjacent to the site which have not been taken into account, such as unpredictable soil strata and water conditions between or below exploratory holes. A careful watch should be maintained during any future groundworks and the comments of this report reviewed as necessary.

This report has been prepared for Gent Fairhead & Co Ltd. This report shall not be relied upon or transferred to other parties without the written consent of CC

Ground Investigations Ltd. Should any information contained within this report be used by any unauthorised third party it is done so at their own risk and shall not be the responsibility of CC Ground Investigations Ltd.

2. SITE DESCRIPTION AND GEOLOGY

2.1 Site Description

The area of investigation comprises an area of existing quarrying operations, areas of hardstanding and an area of woodland within the former RAF Rivenhall Site in Silver End, Essex. The site is centred on the approximate National Grid Reference TL 822 208.

2.2 Geology

Geological Records (British Geological Survey (BGS), England and Wales sheet 223, Braintree 1:50,000 scale) indicate the site is underlain by superficial deposits the Lowestoft Formation. Underlying solid geology comprising the London Clay Formation was recorded.

3. GROUND INVESTIGATION

3.1 Fieldwork

Twenty exploratory holes were carried out between 21st July and 22nd August 2014. All exploratory hole locations are shown on the site plan (Appendix A). The exploratory hole locations were set out by CCGI as directed by the Client on site.

The fieldwork was carried out in general accordance with BS5930, Amendment 2 (2010).

The boreholes, referenced BH02, BH07, BH10, BH11, BH12, BH13, BH16, BH18A and BH19 (Exploratory Hole Data – Appendix B) were formed using track mounted Comacchio MC300/305/GEO205 and Fraste ML/PL multi-purpose rigs. Following CAT scanning hand tools were used to excavate an inspection pit to a maximum depth of 1.20m to check for buried services. Bulk and small disturbed samples were taken and retained from the inspection pits. The boreholes were then advanced using percussive sampling techniques to produce continuous disturbed samples ranging between 112mm and 98mm diameter.

On refusal of percussive sampling the boreholes were continued by rotary core drilling techniques utilising a water or polymer flush. A double-tube swivel core barrel with a semi-rigid plastic liner was utilised to recover continuous cores of 91mm diameter. Where appropriate, dynamic sampling techniques were carried out to recover dropped core or where rotary core drilling was not suitable.

Soil samples were retained in semi-rigid plastic liners, which were capped on site to prevent moisture loss.

The boreholes, referenced BH01, BH03, BH04, BH05, BH06 and BH09 (Exploratory Hole Data – Appendix B) were formed using towable Dando 2000 / Pilcon 1500 cable percussion drilling rigs. Following CAT scanning hand tools were used to excavate an inspection pit to a maximum depth of 1.20m to check for buried services. The boreholes were then advanced using cable percussion techniques to produce small and bulk disturbed samples which were logged on site.

The boreholes referenced BH08, BH14, BH15, BH17 and BH20 (Exploratory Hole Data – Appendix B) were initially formed using a towable Dando 2000 or Pilcon 1500 cable percussion rig. Following CAT scanning hand tools were used to excavate an inspection pit to a maximum depth of 1.20m to check for buried services. The boreholes were then advanced using cable percussion techniques to produce small and bulk disturbed samples which were logged on site. Once the top of the London Clay Formation was reached the boreholes were advanced further using a track mounted Comacchio MC300/305 or Fraste ML multi-purpose rig. Rotary core drilling techniques utilising a water or polymer flush were used. A double-tube swivel core barrel with a semi-rigid plastic liner was utilised to recover continuous cores of 91mm diameter. Where appropriate, dynamic sampling techniques were carried out to recover dropped core or where rotary core drilling was not suitable.

Undisturbed samples of 100mm nominal diameter were taken in suitable cohesive material using an open drive sampler (U(T)100). The samples were wax sealed on site to prevent moisture loss.

Boreholes were monitored for groundwater ingress as they were advanced. Upon encountering water, sampling was temporarily stopped to allow the level to stabilise. Water levels were also recorded at the start and finish of each day's work /on completion of the borehole and are presented on the relevant log.

On completion gas/water monitoring standpipes were installed in BH05, BH10, BH11 and BH19. Each installation consisted of a 50mm ID HDPE slotted tube set in a filter response zone of limestone free gravel. The installation was sealed above and below with a bentonite pellet seal and accessed via a valve assembly. The installations were protected at the surface by a lockable, galvanised steel borehole helmet set in concrete. Installation details are given on the relevant borehole log.

On completion, BH01, BH03-BH04, BH06-BH09, BH12-BH17 and BH20 were backfilled with arisings/bentonite pellets and the surface reinstated.

On completion Vibrating Wire Piezometers (VWP's) were installed in BH02 and BH18 using the fully grouted method. The installations were protected at the surface by a lockable cover set in concrete. Installation details are given on the relevant borehole log along with the relevant calibration certificate.

A single inspection pit, referenced BH18, was excavated using hand tools to a depth of 1.20m. The inspection pit was backfilled on completion and re-located to BH18A.

In situ hand shear vane tests were carried out in accordance with BS1377: Part 9:1990:4.4. The results are presented in on the exploratory hole logs in Appendix B. Differing vane sizes were used depending on the consistency of the soil encountered and, if necessary, a correction factor applied to convert the values to shear strength.

Subsequent to fieldwork, all exploratory hole positions were surveyed and National Grid co-ordinates and levels are presented on the relevant log.

On completion of fieldwork all samples were brought to CCGI's office for storage. Samples will remain available for laboratory testing until 1 month from issue of the final factual report.

3.2 In Situ Testing

Standard penetration tests (SPT's) were carried out in general accordance with BS EN ISO 22476-3:2005. A split barrel or a solid cone was used depending upon the materials encountered and the split barrel samples retained as small disturbed samples. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. SPT results are summarised as uncorrected N values on the borehole logs.

On refusal of dynamic sampling techniques and commencement of water flush rotary coring, SPT's were carried out using a solid cone within BH01, BH07, BH14, BH15, BH17 and BH18A.

SPT hammer calibration data is presented in Appendix G.

In situ California Bearing Ratio (CBR) tests referenced CBR01 to CBR03 (Appendix E) were carried out in accordance with BS1377: Part 9:1990:4.3.

The test force was applied to the CBR plunger via a screw jack, the apparatus being mounted on a Land Rover which provided the reaction load. The test force was measured by a calibrated proving ring and the vertical penetration of the plunger by a calibrated dial gauge readable to 0.01mm. The jack applied the load so as to keep the plunger penetration rate at 1mm/min.

Once the test area was prepared, 250mm diameter annular surcharge discs (with a total weight of 8.5kg) were positioned on a thin bed of. The sand was not present in the central area beneath the plunger.

The force readings were recorded at intervals of 0.25mm penetration to a maximum total penetration of 7.5mm. On completion of the test, a sample of soil from beneath the central test area was taken for the determination of its moisture content.

Self boring pressure meter tests were carried out at a range of depth in BH12 and BH14. A full has been compiled by a specialist subcontractor which is included in Appendix D.

3.3 Logging

Soil samples from the exploratory holes were logged by an Engineering Geologist in general accordance with BS5930, Amendment 2 (2010). Bulk, small disturbed, core, environmental soil samples were taken retained at a range of depths. Samples were stored on site in temperature controlled conditions. Soil descriptions are presented in the borehole logs together with details of sampling, in situ testing and relevant comments on drilling techniques.

3.4 Laboratory Testing

The following laboratory tests were carried out by Professional Soil Laboratory (PSL) (UKAS No. 4043) in accordance with BS1377:1990, Parts 1 to 8, unless otherwise stated. The results are presented in Appendix C.

Test Type	No. of Tests	Remarks
Natural Moisture Content	80	The results are shown on the summary of soil classification tests.
Liquid and Plastic Limits	48	The results are shown on the plasticity chart and summary of soil classification tests.
Particle Size Distribution (wet sieving method)	23	
One Dimensional Consolidation	48	12no One Dimensional Consolidation tests are ongoing.
Quick Undrained Triaxial Test	52	4no of these tests were Multistage
Consolidated Drained Multi-stage Triaxial Test (Effective Stress)	4	
BRE SD1 chemical testing suite for soil and water	37	Testing carried out by Chemical Testing Laboratories in accordance with BRE Special Digest 1.

A range of chemical tests were carried out on soil and water samples by DETS (UKAS No. 2139). Testing was carried out in accordance with ISO 17025. The results are tabulated and presented in Appendix C.

3.5 Groundwater Monitoring

One return visit has been made by CCGI to monitor and sample groundwater at all installed boreholes and to take readings from all VWP's.

Groundwater and VWP monitoring data is presented in Appendix F along with VWP calibration certificates.

CC GROUND INVESTIGATIONS LIMITED

Christopher Scrivens BSc (Hons) FGS
Senior Engineering Geologist

Rob Clarke. BSc (Hons) MSc (Eng) FGS
Director

4. REFERENCES

British Geological Society, Solid and Drift Sheet 223, Braintree, 1:50,000 scale

BRE Special Digest 1:2003: Concrete in aggressive ground. Part 1.

BS 5930+A2:1999 (2010), Code of Practice for Site Investigations

BS 1377: Parts 1 to 9 (1990), Methods of Tests of Soils for Civil Engineering Purposes

BS EN ISO 14688: Part 1: (2002), Identification and description of soil.

BS EN ISO 14688: Part 2: (2004), Principles for a classification of soil.

BS EN ISO 14689: Part 1: (2003), Identification and description.

BS EN ISO 22475: Part 1: (2006), Technical principles for execution.

BS EN ISO 22476: Part 3: (2005), Standard penetration test.

APPENDIX A

Appendix A – Site Plan

Woodhouse Farm

Chainage 1135.0m

top of excavation

base of excavation

Site levels relate to latetst survey drawing.

Approx outline of area excavated to remove sand and gravels.

Backfilling is now ongoing.

BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH10 BH11 BH12 BH13 BH14 BH15 BH16 BH17 BH18A BH19 BH20

+51.00m +50.00m +49.00m +48.00m +47.00m

Woodhouse Farm

Pond

Pump

Pond

Borehole Coordinates

Ref.	Easting (m)	Northing (m)	Level (mAOD)
BH01	582030	220583	50.3
BH02	582263	220663	44.5
BH03	582193	220580	36.3
BH04	582116	220495	37.7
BH05	582327	220597	43.9
BH06	582262	220520	30.1
BH07	582193	220436	47.9
BH08	582409	220557	48.5
BH09	582363	220492	38.2
BH13	582300	220417	46.8
BH11	582443	220499	48.5
BH12	582409	220463	37.8
BH10	582263	220350	48.7
BH14	582434	220441	48.1
BH15	582397	220392	48.5
BH16	582355	220342	48.9
BH17	582472	220410	48.1
BH18A	582512	220442	47.3
BH19	582411	220320	47.2
BH20	582351	220274	47.5

Rev	Revision	Ini	Chk	Date
=	BH18 revised to BH18A	ABM		29.10.14
=	AS BUILT ISSUE.	CL		17.09.14
A	BH19 & BH20 re-located.	CL	ABM	16.07.14

Melia Smith & Jones
Consulting Civil & Structural Engineers
Vinery Court, 58 Cardigan Lane, LEEDS LS4 2LD.
Tel: 0113 2306080 Website: www.msj.co.uk

Rivenhall Airfield IWMF

As-Built Borehole Locations

Scales	Sheet Size
1:1000	A1

Drawn	Checked	Approved	Date
CL	ABM		14.07.14

Drg No	Rev
213033-150	=C

APPENDIX B

Appendix B – Exploratory Hole Data

CC Ground Investigations Ltd

KEY TO EXPLORATORY HOLE LOGS

Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:1999 (Amendment No.2, 2010).

Sample no/type

C	Core run / sample
X	Dynamic sample
D	Small disturbed sample
B	Large disturbed sample
U	Undisturbed sample
UT	Thin walled undisturbed sample
W	Water sample
ES	Environmental
SPT	Standard Penetration Test carried out
CPT	Solid Cone Penetration Test carried out

Water levels

Initial Water Strike Level after monitoring **3.00m** Standing Level

Insitu Tests

S 30	Split spoon sampler (SPT) followed by N Value (EN ISO 22476-3:2005)
C 30	Solid cone (CPT) followed by N Value (EN ISO 22476-3:2005)
*240	Where full test drive not completed, linearly extrapolated N value reported.
**	No effective penetration
H 30	Hand Vane – direct reading in kPa. Re* denotes refusal (i.e. >140 kPa)

Sample range

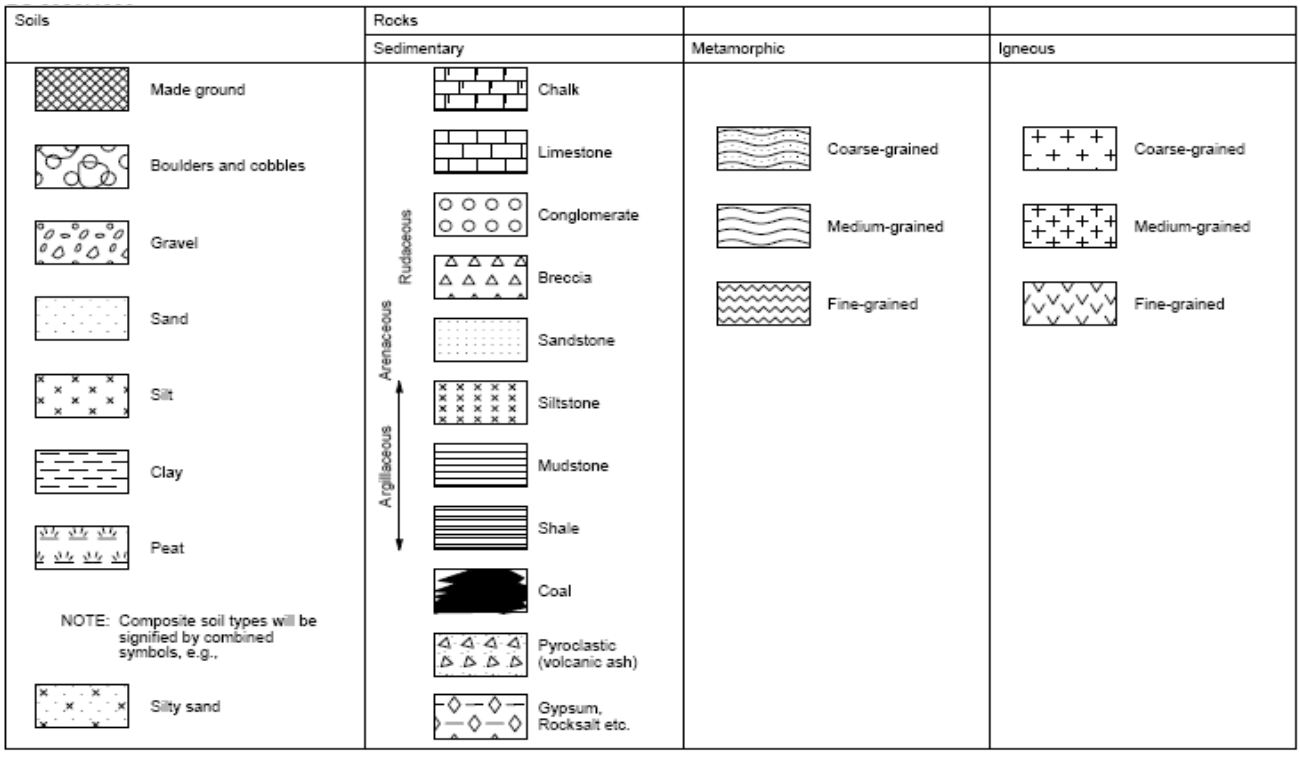
Undisturbed sample Core run UT100 Undisturbed sample

Installation Details

Porous Tip Screened Standpipe Bentonite seal

Plain standpipe Granular response zone Concrete

Grout Arisings backfill



CC GROUND INVESTIGATIONS LTD

BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH01**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582030 N 220583	Hole Type CP
Location: Kelvedon, Essex		Level: 50.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 21/07/2014 End: 22/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50				MADE GROUND: Rough vegetation over stiff dark greyish brown mottled orangish brown sandy very gravelly CLAY with frequent rootlets. Gravel is angular to sub-rounded fine to coarse chalk and siliceous material.	0.30	50.00	
							Stiff friable orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk.			
1		B	1.00				1.00-3.70m: Mottled grey.			1
		UT100	1.20 - 1.65							
		D	1.70							
2		SPT	2.20 - 2.65	S 24						2
		D	2.70							
3		UT100	3.20 - 3.65							3
		D	3.70				3.70-4.70m: Stiff light brown.	(6.70)		
4		SPT	4.20 - 4.65	S 24						4
		D	4.70				4.70-7.00m: Mottled orangish brown.			
5		UT100	5.20 - 5.65							5
		D	5.70				5.50-6.20m: With extremely closely spaced randomly orientated discontinuities. Discontinuities have an orangish brown coating with occasional black specks.			
6		D	6.20							6
		SPT	6.50 - 6.95	S 20						
7							Stiff brownish grey slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk, quartzite and siliceous material.	7.00	43.30	7
		D	7.50					(1.50)		
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-19.00m.
CASING: 150mm to 8.50m.
GROUNDWATER: Possible groundwater strike at 14.50m.
BACKFILL: Borehole backfilled with arisings: 0.00-25.00m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

CC GROUND INVESTIGATIONS LTD

BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH01**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582030 N 220583	Hole Type CP
Location: Kelvedon, Essex		Level: 50.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 21/07/2014 End: 22/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		UT100	8.00 - 8.45				Stiff brownish grey slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk, quartzite and siliceous material. *(continued from previous sheet)*			
		D	8.50					8.50	41.80	
							Stiff brown mottled yellowish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium chalk, sandstone and siliceous material.	(0.80)		
9		D	9.00							9
								9.30	41.00	
		B SPT	9.50 - 10.00 9.50 - 9.70	C*86			Very dense brown slightly clayey sandy GRAVEL. Gravel is angular to sub-rounded fine to coarse sandstone, quartzite and siliceous material.			
10										10
		D	10.50							
11		B SPT	11.00 - 11.50 11.00 - 11.33	C*86			11.00-11.50m: Brown gravelly SAND.			11
12		D	12.00				12.00m: 1 no. sub-rounded quartzite cobble recovered in sandy gravel. Gravel is sub-angular to sub-rounded fine to coarse.	(5.40)		12
		B SPT	12.50 - 13.00 12.50 - 12.90	C*61						
13										13
		D	13.50							
14		B SPT	14.00 - 14.50 14.00 - 14.38	C*86			14.00-14.50m:Slightly sandy gravel. Gravel is medium to coarse.			14
		B	14.70 - 15.00				Stiff to very stiff locally slightly micaceous dark brown CLAY with rare light grey silty partings (<2mm).	14.70	35.60	
15		D UT100 D	15.00 15.00 - 15.25 15.30				Stiff to very stiff extremely closely fissured greyish brown CLAY. 15.30m: Low angle fissures	15.00	35.30	15
16		UT100	16.00 - 16.30							16
		D	16.35				16.35m: Traces of pyrite.			
17		SPT	17.00 - 17.45	C 47			17.00m: Silty with occasional pyrite nodules.			17
		D	17.50				17.50m: Grey thinly laminated with rare light grey silty partings			

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
21/07/2014	8.50	2.50	Dry
22/07/2014	8.50	2.50	Dry

CC GROUND INVESTIGATIONS LTD

BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH01**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582030 N 220583	Hole Type CP
Location: Kelvedon, Essex		Level: 50.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 21/07/2014 End: 22/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
18		UT100	18.00 - 18.30				(<2mm) and traces of pyrite. Stiff to very stiff extremely closely fissured greyish brown CLAY. *(continued from previous sheet)*			
		D	18.35				18.35m: Very closely to closely spaced sub-horizontal to 60° smooth discontinuities.			
19		UT100	19.00 - 19.30							
		D	19.35							
20		SPT	20.00 - 20.43	C*53				(10.00)		
		D	20.50				20.50m: Indistinctly thinly laminated silty clay with rare light grey silty partings (1-3mm).			
21		UT100	21.00 - 21.35							
		D	21.40				21.40m: Very closely spaced randomly orientated smooth discontinuities with rare sand infill.			
22		UT100	22.00 - 22.30							
		D	22.35				22.35m: Very closely spaced sub-horizontal to sub-vertical discontinuities.			
23		SPT	23.00 - 23.38	C*65			23.00m: With rare slightly micaceous sandy partings. 23.00-25.00m: Hard.			
		D	23.50							
24		UT100	24.00 - 24.25							
		D	24.30				24.30m: Extremely close to very closely spaced 45° smooth discontinuities.			
25		UT100	25.00 - 25.30				Borehole completed at 25.00m	25.00	25.30	
		D	25.35							
26										
27										

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
22/07/2014	25.00	15.00	Dry

CC GROUND INVESTIGATIONS LTD

ROTARY BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH02**

Sheet 1 of 3

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220663	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 44.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 14/08/2014	Logged By SA/WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20					MADE GROUND: Soft to firm light brown mottled light grey locally dark brown slightly sandy gravelly CLAY with a low cobble content. Gravel is sub-angular to sub-rounded fine to coarse chalk and siliceous material. Cobbles are sub-rounded chalk.			
		B	0.50								
1		B	1.00								
		SPT	1.20 - 1.65	S<1							
		D	1.50 - 1.60								
2											
		UT100	2.30 - 2.75								
3											
		SPT	3.20 - 3.65	S 9							
		D	3.65 - 3.75					3.50-3.85m: Very gravelly.			
4											
		UT100	4.20 - 4.65								
		D	4.50 - 4.60						(9.20)		
5											
		SPT	5.20 - 5.65	S 6				5.40-6.00m: Slightly gravelly.			
6		D	5.90 - 6.00								
		UT100	6.70 - 7.15								
7											
		D	7.20 - 7.30								
8								7.80-7.85m: Dark grey.			

REMARKS:

EQUIPMENT: Hand digging tools. Fraste ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam): 0.00-11.70m. Waterflush rotary core drilled (116mm diam): 11.70-25.40m.
CASING: 140mm to 11.70m.
GROUNDWATER: Encountered during sample run 8.20-9.70m. Standing at 9.01m following five minute monitoring period, 8.60m following ten minutes, 8.43m following fifteen minutes and 8.30m after twenty minutes.
INSTALLATION: Vibrating wire piezometer with tip at 25.10m set in a hard soils bentonite grout mix: 0.50-25.40m. Bentonite pellet seal: 0.20-0.50m. Raised 150mm steel cover set in concrete: 0.00-0.20m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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ROTARY BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH02**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220663	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 44.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 14/08/2014	Logged By SA/WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
9		SPT	8.20 - 8.65	S 11				MADE GROUND: Soft to firm light brown mottled light grey locally dark brown slightly sandy gravelly CLAY with a low cobble content. Gravel is sub-angular to sub-rounded fine to coarse chalk and siliceous material. Cobbles are sub-rounded chalk. *(continued from previous sheet)* 8.20-9.20m: Locally mottled dark grey.			
		D	8.40 - 8.50								
									9.20	35.30	
		D	9.50 - 9.60					Orangish brown clayey sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse siliceous material.	9.55	34.95	
10		UT100	9.70 - 10.00					Stiff indistinctly thinly laminated orangish brown mottled brown CLAY. Fissures are extremely closely to closely spaced horizontal to sub-horizontal planar smooth.	(1.25)		10
		D	10.10 - 10.20								
		SPT	10.80 - 11.25	S 43				Very stiff indistinctly thinly laminated grey CLAY. Fissures are closely to very closely spaced horizontal to sub-vertical planar to undulating smooth.	10.80	33.70	
11		D	11.25 - 11.35								11
		C	11.70 - 13.00	S 38	C	-%		11.50-25.40m: Locally silty.			
12		SPT	11.70 - 12.15			-%					12
		D	12.15 - 12.25			-%		11.95-25.40m: With rare pyritic traces.			
13		C	13.00 - 14.50			-%					13
		D	13.30 - 13.40			-%					
		CS	13.80 - 14.10		C						
14		D	14.25 - 14.35					14.10m: 1no. medium strong yellowish brown phosphatic nodule recovered (<50mm).			14
		C	14.50 - 16.00	S*167		-%					
		SPT	14.50 - 14.74			-%					
15						-%		14.80-14.85m: Band of medium stong light grey siltstone.			15
					C						
16		D	16.00 - 16.10								16
		D	16.70 - 16.80								
		C	16.80 - 18.10			-%		16.85-17.80m: Fissures are extremely closely spaced randomly orientated.			
17		D	17.05 - 17.15			-%					17
					C	-%					

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
12/08/2014	10.80	Nil	8.00
13/08/2014	10.80	Nil	8.01

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ROTARY BOREHOLE LOG

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Borehole No. **BH02**

Sheet 3 of 3

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220663	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 44.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 14/08/2014	Logged By SA/WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		D	17.80 - 17.90		C			Very stiff indistinctly thinly laminated grey CLAY. Fissures are closely to very closely spaced horizontal to sub-vertical planar to undulating smooth. *(continued from previous sheet)*			
		C	18.10 - 19.60	S 43		-%			(14.60)		
		SPT	18.10 - 18.55			-%		17.75m: 1no. pyritised fossil fragment recovered.			
						-%		17.80m: 1no. medium strong yellowish brown phosphatic nodule recovered (<40mm).			
		CS	18.65 - 19.15		C			18.60-19.75m: Thinly laminated.			
19		D	19.15 - 19.25								
		D	19.50 - 19.60								
		C	19.60 - 21.10			-%					
						-%					
20		CS	20.10 - 20.60		C	-%					
		D	20.60 - 20.70								
21		D	21.00 - 21.10								
		C	21.10 - 22.60	S 44		-%					
		SPT	21.10 - 21.55			-%					
						-%		21.50-25.40m: Closely spaced impersistent sub-vertical fissures, locally infilled with sand. Locally with traces of pyrite.			
22		CS	21.85 - 22.25		C						
		C	22.60 - 23.90			-%					
		D	22.80 - 22.90			-%					
23						-%					
		CS	23.25 - 23.75		C			23.20m: With occasional bioturbation (<2mm diam x <10mm length).			
		C	23.90 - 25.40	S 47		-%					
24		SPT	23.90 - 24.45			-%					
						-%					
		CS	24.70 - 25.20		C						
25								25.40m: Locally sandy with fine mica crystals. Borehole completed at 25.40m	25.40	19.10	
26											
27											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
13/08/2014	21.10	11.70	3.00
14/08/2014	21.10	11.70	3.92
14/08/2014	25.40	11.70	3.00

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BOREHOLE LOG

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Borehole No. **BH03**

Sheet 1 of 2

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220580	Hole Type CP
Location: Kelvedon, Essex		Level: 36.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 23/07/2014 End: 23/07/2014	Logged By SA/MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
							MADE GROUND: Stiff orangish brown very gravelly CLAY. Gravel is sub-angular to rounded fine to coarse siliceous material.	0.20	36.10	
		B	0.50				Stiff brown mottled orangish brown CLAY with extremely closely spaced randomly orientated discontinuities with occasional orangish brown staining on surfaces.	0.50	35.80	
1		B	1.00				Stiff greyish brown locally mottled orangish brown CLAY.	0.80	35.50	1
		UT100	1.20 - 1.55				Stiff greyish brown silty CLAY with extremely closely spaced sub-horizontal discontinuities and occasional siltstone nodules.			
		D	1.60				1.50-1.60m: Claystone band. 1.60m: Occasional medium gravel sized fragments of light brown weak siltstone.			
2		UT100	2.20 - 2.55							2
		D	2.60				2.60m: Indistinctly thinly laminated with occasional silty partings, rare traces of pyrite and occasional medium gravel sized fragments of light brown weak siltstone.			
3		SPT	3.20 - 3.65	S 42			3.20-11.00m: Very stiff to hard.			3
		D	3.70							
4		UT100	4.20 - 4.65							4
		D	4.70							
5		UT100	5.20 - 5.55							5
		D	5.60				5.60m: Finely laminated silty clay with traces of pyrite.			
6		SPT	6.20 - 6.40	S*64				(10.70)		6
		D	6.70				6.70m: Band of weak light grey siltstone/claystone.			
7		UT100	7.20 - 7.65							7
		D	7.70				7.70m: Slightly sandy.			
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-11.00m.
CASING: 150mm to 2.50m.
GROUNDWATER: None encountered.
BACKFILL: Borehole backfilled with arisings: 0.00-11.00m.
REMARKS: All UT100's taken using two weights.

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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BOREHOLE LOG

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Borehole No. **BH03**

Sheet 2 of 2

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220580	Hole Type CP
Location: Kelvedon, Essex		Level: 36.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 23/07/2014 End: 23/07/2014	Logged By SA/MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
9		UT100	8.20 - 8.65				Stiff greyish brown silty CLAY with extremely closely spaced sub-horizontal discontinuities and occasional siltstone nodules. *(continued from previous sheet)*			
		D	8.70				8.70m: Extremely closely spaced sub-horizontal discontinuities.			
		SPT	9.20 - 9.65	S 46			9.20m: Slightly micaceous with occasional silty partings and frequent traces of pyrite.			
10		D	9.70							
		UT100	10.20 - 10.65							
11	Dry	UT100	11.00 - 11.45							
		D	11.50				11.50m: Very closely spaced sub-vertical discontinuities. Borehole completed at 11.50m	11.50	24.80	
12										
13										
14										
15										
16										
17										

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
23/07/2014	11.00	2.50	Dry

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Borehole No. **BH04**

Sheet 1 of 3

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582116 N 220495	Hole Type CP
Location: Kelvedon, Essex		Level: 37.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By SA/CS

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20 - 0.60				MADE GROUND: Soft becoming firm light brown mottled orangish brown and light grey slightly sandy gravelly CLAY with a low cobble content. Gravel is sub-angular to rounded fine to coarse siliceous material and chalk with occasional black specks. Cobbles are sub-rounded medium density chalk with occasional black specks.	(1.20)		
1		B	1.00 - 1.20							1
		UT100	1.50 - 1.95				MADE GROUND: Soft light brown locally light greyish brown sandy gravely CLAY. Gravel is sub-rounded fine to coarse flint and chalk.	1.20	36.50	
2		D	2.00							2
		D	2.25							
		SPT	2.50 - 2.95	S 5				(3.10)		
3										3
		D	3.25							
		UT100	3.50 - 3.95							
4		D	4.00							4
		D	4.25				Stiff reddish brown CLAY with rare sub-rounded fine to coarse chalk gravel.	4.30	33.40	
		SPT	4.50 - 4.95	S 17			Stiff brown indistinctly fissured silty CLAY.	4.50	33.20	
5								(1.20)		5
		D	5.50							
							Stiff indistinctly fissured grey and greyish brown silty CLAY with occasional off white comminuted fossil shell fragments.	5.70	32.00	
6		UT100	6.00 - 6.45							6
		D	6.50							
7		B	7.00 - 7.50				7.00-23.00m: Very Stiff.			7
		SPT	7.50 - 7.95	S 37						
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Pilcon 1500 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Cable percussive boring using 150mm diam tools: 1.20-23.00m.
CASING: 200mm to 2.50m, 150mm to 6.00m.
GROUNDWATER: None encountered.
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-23.00m.

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
31/07/2014	1.20	Nil	Dry
15/08/2014	1.20	Nil	Dry

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BOREHOLE LOG

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Borehole No. **BH04**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582116 N 220495	Hole Type CP
Location: Kelvedon, Essex		Level: 37.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By SA/CS

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		D	8.50				Stiff indistinctly fissured grey and greyish brown silty CLAY with occasional off white comminuted fossil shell fragments. *(continued from previous sheet)*			
9		UT100	9.00 - 9.30							9
		D	9.40							
10										10
		SPT	10.50 - 10.95	S 34						
11										11
		S	11.50							
12		UT100	12.00 - 12.45							12
		D	12.50							
13		D	13.00							13
		SPT	13.50 - 13.95	S 48						
14								(17.30)		14
		D	14.50							
15		UT100	15.00 - 15.45							15
		D	15.50				15.50m: 15mm pyrite nodule.			
16		D	16.00							16
		SPT	16.50 - 16.95	S 47						
17										17
		D	17.50							

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH04**

Sheet 3 of 3

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582116 N 220495	Hole Type CP
Location: Kelvedon, Essex		Level: 37.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By SA/CS

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
18		UT100	18.00 - 18.45				Stiff indistinctly fissured grey and greyish brown silty CLAY with occasional off white comminuted fossil shell fragments. *(continued from previous sheet)*			
		D	18.50							
19		D	19.00							
		SPT	19.50 - 19.95	S 34						
20		D	20.50							
21		UT100	21.00 - 21.45							
		D	21.50							
22		D	22.22							
		SPT	22.50 - 22.95	S 48						
23	Dry						Borehole completed at 23.00m	23.00	14.70	
24										
25										
26										
27										

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
15/08/2014	23.00	6.00	Dry

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Borehole No. **BH05**

Sheet 1 of 3

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582327 N 220597	Hole Type CP
Location: Kelvedon, Essex		Level: 43.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 30/07/2014 End: 30/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50				MADE GROUND: Firm light greyish brown gravelly CLAY. Gravel is sub-angular to rounded fine to medium chalk.	(1.10)		
1		B	1.00							1
		UT100	1.20 - 1.65				MADE GROUND: Soft to firm yellowish brown mottled grey and orangish brown sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium chalk and brick.	1.10	42.80	
		D	1.70							
2		SPT	2.20 - 2.65	S 8			2.20m: With occasional sub-angular medium flint.			2
		D	2.70				2.70m: Light brown mottled yellowish brown gravelly clay with occasional brick fragments.			
3		UT100	3.20 - 3.55							3
		D	3.60					(5.40)		
4		SPT	4.20 - 4.65	S 6			4.20m: With small pockets of dark brown sandy clay.			4
		D	4.70				4.70m: Light brown gravelly clay. Gravel is sub-angular to rounded fine to coarse brick.			
5		UT100	5.20 - 5.65							5
		D	5.70				5.70m: Firm light brown mottled yellowish brown gravelly clay. With traces of brick and dark brown clay.			
6		D	6.00				6.00m: Firm yellowish brown mottled light brown and light greyish brown with rare angular flint.			6
		SPT	6.50 - 6.95	S 5			MADE GROUND: Firm brown mottled orangish brown slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium chalk.	6.50	37.40	
7								(0.90)		7
		B	7.50 - 8.00				MADE GROUND: Stiff to firm orangish brown sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse chalk and flint.	7.40	36.50	
		D	7.50					(0.70)		
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-19.00m.
CASING: 150mm to 8.50m.
GROUNDWATER: None encountered.
INSTALLATION: 50mm ID HDPE slotted pipe with washed gravel response zone: 16.00-19.00m. Plain 50mm ID HDPE pipe with a bentonite pellet seal: 0.20-16.00m. Raised 150mm steel cover set in concrete: 0.00-0.20m. Gas valve fitted.

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH05**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582327 N 220597	Hole Type CP
Location: Kelvedon, Essex		Level: 43.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 30/07/2014 End: 30/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		UT100	8.00 - 8.45				Stiff brown mottled orangish brown indistinctly fissured CLAY.	8.10	35.80	
								(0.40)		
		B	8.50 - 9.00				Stiff to very stiff greyish brown indistinctly fissured CLAY.	8.50	35.40	
		D	8.50							
9		D	9.00							9
		UT100	9.00 - 9.55				9.40m: With light grey silty spots.			
		D	9.60							
10		SPT	10.00 - 10.45	S 33						10
		D	10.50							
11		UT100	11.00 - 11.40							11
		D	11.45				11.45m: Indistinctly thinly laminated with occasional light grey silty partings.			
12		UT100	12.00 - 12.35							12
		D	12.40							
13		SPT	13.00 - 13.45	S 46			13.00m: With pyrite traces.			13
		D	13.50					(10.50)		
14		UT100	14.00 - 14.45							14
		D	14.50				14.50m: Extremely closely spaced sub-horizontal fissuring.			
15		UT100	15.00 - 15.35							15
		D	15.40				15.40m: Indistinctly thinly laminated with pyritic traces.			
16		SPT	16.00 - 16.45	S 49						16
17		UT100	17.00 - 17.30							17
		D	17.35				17.35m: Becoming silty and sandy.			

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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BOREHOLE LOG

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Borehole No. **BH05**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582327 N 220597	Hole Type CP
Location: Kelvedon, Essex		Level: 43.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 30/07/2014 End: 30/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
18		UT100	18.00 - 18.45				Stiff to very stiff greyish brown indistinctly fissured CLAY. *(continued from previous sheet)*			
		D	18.50				18.50m: Silty with extremely closely spaced fissures.			
19	Dry	SPT	19.00 - 19.45	S 42			19.00-19.45m: Slightly silty clay.	19.00	24.90	
							Borehole completed at 19.00m			
20										
21										
22										
23										
24										
25										
26										
27										

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
30/07/2014	19.00	8.50	Dry

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BOREHOLE LOG

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Borehole No. **BH06**

Sheet 1 of 2

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582262 N 220520	Hole Type CP
Location: Kelvedon, Essex		Level: 30.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 28/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50				MADE GROUND: Orange brown slightly clayey gravelly SAND. Gravel is fine to coarse flint, quartz and sandstone.			
1		B	1.00					(2.20)		1
		B	1.20 - 1.70	S 5			1.20-2.20m: Loose slightly clayey very gravelly sand.			
		SPT	1.20 - 1.65							
							1.70m: Very clayey gravelly sand.			
2										2
		B	2.20 - 2.70	S 6			MADE GROUND: Loose to medium dense orangish brown very gravelly clayey SAND with occasional pockets of darker greyish brown gravelly clay. Gravel is sub-angular to rounded fine to coarse flint, quartzite and sandstone.	2.20	27.90	
		SPT	2.20 - 2.65							
		D	2.70				2.70m: Pockets of orangish brown sandy clay.	(1.30)		
3										3
		SPT	3.20 - 3.65	S 17						
							Firm to stiff indistinctly fissured orangish brown mottled dark brown CLAY.	3.50	26.60	
		B	3.70 - 4.00							
		D	3.70				Very stiff greyish brown silty CLAY with extremely closely spaced sub-horizontal fissures.	3.80	26.30	
4										4
		UT100	4.20 - 4.65							
		D	4.70							
5										5
		UT100	5.20 - 5.60							
		D	5.65				5.65m: With white silty tubules <5mm.			
6										6
		SPT	6.20 - 6.65	S 42			6.20m: Occasional pyrite traces.			
		D	6.70							
7										7
		UT100	7.20 - 7.60							
		D	7.65				7.65m: Indistinctly thinly laminated.			
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-17.50m.
CASING: 150mm to 4.00m.
GROUNDWATER: Water was struck and remained at 3.30m. Borehole dry on completion.
BACKFILL: Borehole backfilled with arisings: 0.00-17.50m.

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
24/07/14	3.30	2.50	3.30

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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BOREHOLE LOG

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Borehole No. **BH06**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582262 N 220520	Hole Type CP
Location: Kelvedon, Essex		Level: 30.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 28/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
		UT100	8.20 - 8.65				Very stiff greyish brown silty CLAY with extremely closely spaced sub-horizontal fissures. *(continued from previous sheet)*	(9.05)		
9		SPT	9.20	S 40						9
		D	9.70				9.70m: Indistinctly thinly laminated greyish brown clay.			
10		UT100	10.20 - 10.65							10
		D	10.70							
11		UT100	11.20 - 11.65							11
		D	11.70				11.70m: Very closely spaced sub-vertical fissuring.			
12		SPT	12.20 - 12.65	S 43			12.20m: Occasional white silt spots and forams.			12
		D	12.70							
13		UT100	13.20 - 13.55				Very stiff greyish brown slightly sandy silty CLAY.	12.85	17.25	13
		D	13.60				13.60m: Indistinctly thinly laminated.			
14		UT100	14.20 - 14.60							14
		D	14.65				14.65m: Closely spaced sub-vertical fissures with occasional pyrite traces.			
15		SPT	15.20 - 15.65	S 45				(4.65)		15
		D	15.70							
16		UT100	16.20 - 16.65							16
		D	16.70				16.70m: Very closely spaced randomly orientated fissures.			
17		UT100	17.00 - 17.45							17
	Dry	D	17.50				17.50m: Indistinctly thinly laminated with frequent pyrite traces. Borehole completed at 17.50m	17.50	12.60	

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	12.00	4.00	Dry
28/07/2014	12.00	4.00	Dry
28/07/2014	17.00	4.00	Dry

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Borehole No. **BH07**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220436	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 18/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
1		SPT	1.20 - 1.65	S 4				MADE GROUND: Soft orangish brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse siliceous material brick and chalk.			
2		D UT100 D	1.90 - 2.00 2.00 - 2.50 2.45 - 2.55					2.60-11.45m: Firm to stiff. 2.65-3.00m: Becoming yellowish brown.			
3		H H SPT H	2.85 2.90 3.00 - 3.45 3.20	H 88 H 83 S 13 H 110							
4		D UT100	3.85 - 4.00 4.00 - 4.50					3.70-4.20m: Very gravelly. 3.70-11.45m: Locally mottled light grey. 3.85-3.95m: 1no flint cobble recovers (<85mm)			
5		D SPT	4.70 - 4.80 5.00 - 5.45	S 15				4.70-5.05m: Orangish brown sandy gravelly clay.			
6		D H H H D H UT100	5.40 - 5.50 5.55 5.80 6.00 6.30 - 6.40 6.30 6.50 - 7.00	H 81 H 79 H 90 H 104				5.50-6.25m: Gravel of chalk with occasional black specks. 5.60-5.65m: Sandy clay. 6.15m: 1no. brick fragment recovered (<35mm). 6.35-6.50m: Very gravelly.	(11.45)		
7		H D H H	7.00 7.10 - 7.20 7.20 7.40	H 99 H 34 H 62				7.15-7.35m: Soft. 7.40-7.50m: Gravelly.			
8		H	7.80	H 65							

REMARKS:

EQUIPMENT: Hand digging tools. Comacchio MC305 multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam) 0.00-12.30m. Waterflush rotary core drilled (116mm diam) 12.30-32.60m.
CASING: 140mm to 12.00m.
GROUNDWATER: None encountered prior to using water flush to advance casing to 12.00m.
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-32.60m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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ROTARY BOREHOLE LOG

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Borehole No. **BH07**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220436	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 18/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		SPT	8.00 - 8.45	S 26				MADE GROUND: Soft orangish brown mottled grey slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse siliceous material brick and chalk. *(continued from previous sheet)*			
9								9.10m: Very sandy.			
		UT100	9.50 - 10.00								
10								10.20-10.30m: Very sandy. 10.25-10.30m: 1no. flint cobble recovered (<85mm).			
		D	10.80 - 10.90					10.65-11.05m: Very sandy.			
11		SPT	11.00 - 11.45	S 20							
		D	11.25 - 11.35								
		D	11.55 - 11.65					Stiff indistinctly thinly laminated orangish brown occasionally mottled grey CLAY.	11.45 (0.55)	36.45	
12		D	11.90 - 12.00					Stiff indistinctly thinly laminated grey CLAY.	12.00	35.90	
		C	12.30 - 13.00			-%		Very stiff tending towards hard greyish brown CLAY with extremely closely spaced randomly orientated fissures, occasional white silty spots (<5mm) and occasional phosphatic nodules.	12.30	35.60	
		UT100	12.30 - 12.60			-%					
		D	12.70			-%					
13		C	13.00 - 13.30			-%					
		D	13.20 - 13.30			-%					
		C	13.30 - 14.30			-%					
		D	13.60 - 13.70			-%					
14		D	14.20 - 14.30			-%		14.20m: Ovoid pyritised nodules.			
		C	14.30 - 15.80	C*52		-%					
		SPT	14.30 - 14.74			-%					
		D	14.60 - 14.70			-%					
15		CS	15.05 - 15.50					15.05m: Ovoid phosphatic nodules. 15.50m: 45° tight stepped listric fissure.			
		C	15.80 - 17.10			-%					
16		D	15.80 - 15.90			-%					
		CS	16.15 - 16.60			-%					
17		C	17.10 - 18.30	C*54		-%					
		D	17.10 - 17.20			-%					
		SPT	17.10 - 17.53			-%					
		CS	17.45 - 17.90								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
12/08/2014	13.00	Nil	Dry
13/08/2014	13.00	Nil	1.90

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ROTARY BOREHOLE LOG

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Borehole No. **BH07**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220436	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 18/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28					C			Very stiff tending towards hard greyish brown CLAY with extremely closely spaced randomly orientated fissures, occasional white silty spots (<5mm) and occasional phosphatic nodules. *(continued from previous sheet)*			
		C	28.30 - 29.80	C 46		-%					
		SPT	28.30 - 28.75			-%					
		D	28.40 - 28.50			-%					
		CS	28.50 - 28.95								
29					C						
		D	29.50 - 29.60								
		C	29.80 - 30.80			-%					
30						-%					
					C	-%					
		C	30.80 - 31.00		C	-%					
31		C	31.00 - 32.60	C 45		-%					
		SPT	31.00 - 31.45			-%					
						-%					
					C						
32		CS	31.85 - 32.30								
		D	32.30 - 32.40								
		SPT	32.60 - 33.03	C*54				Borehole completed at 32.60m	32.60	15.30	
33											
34											
35											
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
15/08/2014	31.00	12.00	3.10
18/08/2014	31.00	12.00	18.20
18/08/2014	32.60	12.00	6.20

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Borehole No. **BH07**

Sheet 3 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582193 N 220436	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 12/08/2014 End: 18/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18					C			Very stiff tending towards hard greyish brown CLAY with extremely closely spaced randomly orientated fissures, occasional white silty spots (<5mm) and occasional phosphatic nodules. *(continued from previous sheet)*			
		D	18.20 - 18.30					17.90-17.95m: Claystone band.			
		C	18.30 - 18.40		C	-% -% -%					
		C	18.40 - 19.80								
19		CS	18.85 - 19.30		C	-% -% -%					
		D	19.70 - 19.80								
		C	19.80 - 21.10	C*56		-% -% -%					
20		SPT									
		CS	20.40 - 20.85		C						
21		C	21.10 - 22.60			-% -% -%					
		D	21.60 - 21.70		C						
22								22.00-25.00m: Extremely closely spaced randomly orientated fissures.			
		CS	22.30 - 22.60						(20.30)		
		C	22.60 - 22.70	C*52	C	-% -% -%					
		SPT	22.60 - 23.04								
23		C	22.70 - 24.10			-% -% -%					
		D	23.20 - 23.30		C						
		CS	23.50 - 23.80								
24		C	24.10 - 24.50		C	-% -% -%					
		D	24.40 - 24.50								
		C	24.50 - 25.30		C	-% -% -%					
25		D	25.15 - 25.25								
		C	25.30 - 26.80	C*52		-% -% -%					
		SPT	25.30 - 25.84								
26		D	26.10 - 26.20		C						
		D	26.60 - 26.70					26.55-26.80m: Thinly laminated.			
		CS	26.70 - 27.15		C	-% -% -%					
27		C	26.80 - 28.30								
		D	27.15 - 27.25					27.20m: 1no pyrite nodule recovered (<5mm).			

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
13/08/2014	22.60	12.00	7.20
14/08/2014	22.60	12.00	13.40
14/08/2014	26.80	12.00	8.20
15/08/2014	26.80	12.00	2.93

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ROTARY BOREHOLE LOG

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Borehole No. **BH08**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220557	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 05/08/2014 End: 19/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								MADE GROUND: Concrete.			
		B	0.20					MADE GROUND: Orangish brown slightly clayey very gravelly SAND with a low cobble content. Gravel is angular to sub-rounded fine to coarse flint, brick and siliceous material. Cobbles are angular to sub-angular brick.	0.20 (0.40) 0.60 (0.60)	48.30 47.90	
1		B	1.00					Firm to stiff orangish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint.	1.20	47.30	
		D	1.20					Stiff light brown slightly sandy gravelly CLAY. Gravel is sub-angular to rounded fine to medium chalk.			
		UT100	1.50 - 1.95								
2		B	2.00 - 2.50								
		D	2.00								
		SPT	2.50 - 2.95	S 26							
3											
		D	3.25						(4.30)		
		UT100	3.50 - 3.95								
4											
		D	4.25								
		SPT	4.50 - 4.95	S 16							
5											
		D	5.50					Stiff brown to orangish brown slightly gravelly slightly sandy CLAY. Gravel is sub-angular to rounded chalk and siliceous material.	5.50	43.00	
6		UT100	6.00 - 6.45					6.00m: Firm to stiff.	(1.40)		
		D	6.50					6.50m: With orangish brown sandy bands.			
7		D	7.00					Very dense light brown sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse siliceous material.	6.90	41.60	
		SPT	7.50 - 7.95	C*149					(1.80)		
8											

REMARKS:

EQUIPMENT: Hand digging tools. Pilcon 1500 cable percussion drilling rig. Comacchio MC300 multi purpose drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Cable percussive boring using 150mm diam tools: 1.20-14.20m. Continuous dynamic sampled (113mm diam) 14.20-14.50m. Waterflush rotary core drilled (116 and 101mm diam) 14.50-33.00m.
CASING: 150mm to 13.20m. 140mm to 14.50m.
GROUNDWATER: Standing at 7.30m following SPT 7.50-7.75m.
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-33.00m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH08**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220557	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 05/08/2014 End: 19/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								Very dense light brown sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse siliceous material. *(continued from previous sheet)*			
		D	8.50								
		D	8.70						8.70	39.80	
9		B	9.00 - 9.50					Firm orangish brown slightly sandy silty CLAY.	(0.75)		9
		UT100	9.00 - 9.45						9.45	39.05	
		D	9.50					Brown mottled light grey clayey sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse siliceous material.	(0.85)		
10		D	10.00						10.30	38.20	10
		SPT	10.50 - 10.95	S 20				Stiff brown sandy CLAY with occasional orangish brown sandy partings.	(0.90)		
11									11.20	37.30	11
		D	11.50					Very dense greyish brown gravelly SAND. Gravel is sub-angular to rounded fine to coarse siliceous material.			
12		SPT	12.00 - 12.45	S 41				12.00-12.45m: Light brown slightly gravelly sand.	(1.60)		12
		B	12.80 - 13.20						12.80	35.70	
13								Stiff brown sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse siliceous material.			13
		UT100	13.50 - 13.95						(1.40)		
14		D	14.00								14
		D	14.20						14.20	34.30	
		D	14.40 - 14.50					Very stiff greyish brown silty CLAY with extremely closely spaced randomly orientated fissures.			
		C	14.50 - 16.00	S 34		-%					
		SPT	14.50 - 14.95			-%					
15		D	15.00 - 15.10			-%					15
					C						
		D	15.85 - 15.95								
16		C	16.00 - 17.50			-%					16
		D	16.20 - 16.30			-%					
		CS	16.50 - 17.00		C	-%					
17											17
		D	17.40 - 17.50								
		C	17.50 - 19.00	S 35	C	-%					

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
05/08/2014	13.20	12.00	11.40
06/08/2014	13.20	12.00	Dry
06/08/2014	14.20	14.20	Dry
13/08/2014	14.20	14.20	9.80
13/08/2014	16.00	14.50	2.40
14/08/2014	16.00	14.50	2.50

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ROTARY BOREHOLE LOG

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Borehole No. **BH08**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220557	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 05/08/2014 End: 19/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		SPT	17.50 - 17.95			-% -%		Very stiff greyish brown silty CLAY with extremely closely spaced randomly orientated fissures. *(continued from previous sheet)*			18
		D	18.05 - 18.55		C						
19		C	19.00 - 20.50			-%					19
		CS	19.00 - 19.42			-% -%					
					C			19.60m: Claystone nodules (<6mm).			
20		D	19.85 - 19.95								20
		S	20.50 - 22.00	S 33							
		SPT	20.50 - 20.95								
21		D	20.90 - 21.00					20.90m: 1no. crinoid stem recovered.			21
		CS	21.50 - 22.00								
22		C	22.00 - 23.50			-% -%					22
		D	22.30 - 22.40			-%					
		CS	22.75 - 23.20		C						
23											23
		C	23.50 - 25.00	S 46		-%			(18.80)		
		SPT	23.50 - 23.95			-% -%					
24		D	23.90 - 24.00								24
					C						
		CS	24.50 - 25.00								
25		C	25.00 - 26.50			-% -%					25
		D	25.30 - 25.40			-%		25.25m: 1no. pyritised wood fragment recovered (<40mm).			
		CS	25.60 - 26.05		C						
26		D	26.15 - 26.25								26
		C	26.50 - 28.00	S 35		-% -%		26.50m: Locally slightly sandy.			
		SPT	26.50 - 26.95			-%					
27					C						27

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
14/08/2014	25.00	14.50	4.00
15/08/2014	25.00	14.50	4.00

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ROTARY BOREHOLE LOG

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Borehole No. **BH08**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220557	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 05/08/2014 End: 19/08/2014	Logged By WS/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		D	27.85 - 27.95		C			Very stiff greyish brown silty CLAY with extremely closely spaced randomly orientated fissures. *(continued from previous sheet)*			
		C	28.00 - 29.50			-% -% -%					
		D	28.50 - 28.60					28.35-28.40m: With frequent pyrite nodules (<4mm).			
29		CS	28.60 - 28.90		C						
		D	29.40 - 29.50								
		C	29.50 - 31.00	S 35		-% -% -%					
		SPT	29.50 - 29.95								
30					C						
31		C	31.00 - 31.70			-% -% -%					
					C						
		C	31.70 - 33.00			-% -% -%					
32					C						
33		SPT	33.00 - 33.45	C 40				Borehole completed at 33.00m	33.00	15.50	
34											
35											
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
15/08/2014	29.50	14.50	5.80
18/08/2014	29.50	14.50	12.96
18/08/2014	31.50	14.50	-
19/08/2014	31.50	14.50	12.55
19/08/2014	33.00	14.50	-

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BOREHOLE LOG

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Borehole No. **BH09**

Sheet 1 of 2

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582363 N 220492	Hole Type CP
Location: Kelvedon, Essex		Level: 38.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 23/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
							Orangish brown sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse chalk flint and siliceous material.	0.20	38.00	
		B	0.50				Stiff becoming very stiff greyish brown slightly micaceous CLAY with extremely closely spaced randomly orientated fissures and rare light grey silty spots.			
1		B	1.00							1
		UT100	1.20 - 1.60							
		D	1.65							
2										2
		UT100	2.20 - 2.65							
		D	2.70							
3										3
		SPT	3.20 - 3.65	S 35			3.20m: Thin laminae with foram microfossils.			
		D	3.70							
4										4
		UT100	4.20 - 4.55							
		D	4.60				4.60m: Indistinctly thinly laminated greyish brown clay with occasional white silty spots and pyrite traces.			
5										5
		UT100	5.20 - 5.55							
		D	5.60							
6										6
		SPT	6.20 - 6.65	S 43				(12.30)		
		D	6.70				6.70-6.85m: Claystone band.			
7										7
		UT100	7.20 - 7.60							
		D	7.65							
8										8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-12.50m.
CASING: 150mm to 2.50m.
GROUNDWATER: None encountered.
BACKFILL: Borehole backfilled with arisings: 0.00-12.50m.

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
23/07/2014	4.70	2.50	Dry
24/07/2014	4.70	2.50	Dry

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BOREHOLE LOG

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Borehole No. **BH09**

Sheet 2 of 2

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582363 N 220492	Hole Type CP
Location: Kelvedon, Essex		Level: 38.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 23/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Sample	Install	Description	Depth (m)	Level (mAD)	Legend
9		UT100	8.20 - 8.65				Stiff becoming very stiff greyish brown slightly micaceous CLAY with extremely closely spaced randomly orientated fissures and rare light grey silty spots. *(continued from previous sheet)*			
		D	8.70							
		D	9.00							
		SPT	9.20 - 9.65	S 46						
10							9.70m: With occasional pyrite nodules.			
		UT100	10.20 - 10.65							
		D	10.70				10.70m: Indistinctly thinly laminated silty clay.			
11		UT100	11.20 - 11.60							
		D	11.65							
12		SPT	12.20 - 12.65	S 43			12.20-12.60m: With pyritic traces.			
	Dry						Borehole completed at 12.50m	12.50	25.70	
13										
14										
15										
16										
17										

Groundwater: Dry

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	12.50	2.50	Dry

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Borehole No. **BH10**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220350	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 12/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50					MADE GROUND: Firm yellowish brown mottled yellowish grey slightly sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse chalk.	(0.80)		
									0.80	47.90	
1		B	1.00					MADE GROUND: Stiff yellowish brown slightly sandy gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint.			1
		UT100	1.20 - 1.65						(0.95)		
		D	1.65 - 1.75						1.75	46.95	
		H	1.80	H 31				MADE GROUND: Soft becoming firm yellowish brown gravelly CLAY. Gravel is fine to coarse sub-angular to rounded chalk and flint. Chalk has occasional black specks and orangish brown staining. 2.20-2.65m: Very soft.			
2		D	1.90 - 2.00	H 25							2
		H	1.90	H 50							
		H	2.00	S 1							
		SPT	2.20 - 2.65								
		D	2.60 - 2.90								
		H	2.70	H 34							
3		H	2.90	H 36							3
		H	3.00	H 35							
		UT100	3.20 - 3.65								
		D	3.65 - 3.75						(4.00)		
4		D	4.00 - 4.10	H 52							4
		H	4.00	H 50							
		H	4.10	S 3				4.20-4.65m: Very soft.			
		SPT	4.20 - 4.65								
		D	4.60 - 4.70								
		H	4.80	H 79				4.80-5.75m: Stiff.			
5		D	5.00 - 5.10								5
		H	5.10	H 107							
		UT100	5.20 - 5.65								
		H	5.50	H 78							
		D	5.65 - 5.75						5.75	42.95	
		H	5.80	H 57				Firm to stiff yellowish brown slightly sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse chalk and siliceous material.			
6		D	5.90 - 6.00								6
		H	6.40	H 68							
		D	6.60 - 6.70								
		SPT	6.70 - 7.15	S 9							
7									(2.45)		7
		D	7.55 - 7.65	H 96							
		H	7.60								
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Fraste ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam) 0.00-15.30m. Waterflush rotary core drilled (116mm diam) 15.30-35.10m.
CASING: 140mm to 15.15m.
GROUNDWATER: Water was initially struck at 9.70m. This had then risen to 9.41m after 5mins, 8.66m after 10mins, 8.39m after 15mins, 8.22m after 20mins.
INSTALLATION: Borehole backfilled with bentonite pellets: 13.00-35.10m. 50mm ID HDPE slotted pipe with washed gravel response zone: 10.00-13.00m. Plain 50mm ID HDPE pipe with gravel surround: 9.80-10.00m and bentonite pellet seal: 0.40-9.80m. Raised 150mm steel cover set in concrete: 0.00-0.40m. Gas valve fitted.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	5.20	Nil	Dry
25/07/2014	5.20	Nil	Dry

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ROTARY BOREHOLE LOG

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Borehole No. **BH10**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220350	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 12/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
	1	H	7.90	H 116							
		H	8.10	H 124				Very dense brown to orangish brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to coarse siliceous material.	8.20	40.50	
		UT100	8.20 - 8.65					8.20-8.60m: Brown sand.			
		D	8.65 - 8.75					8.60-9.20m: Brown very gravelly sand. Gravel is sub-angular to sub-rounded fine to coarse flint, quartzite and sandstone.			
		SPT	8.75 - 9.09	S*79				9.20-9.70m: Orangish brown fine to coarse gravelly sand. Gravel is sub-angular to sub-rounded fine to medium flint, quartzite and sandstone.			
9		B	9.20 - 9.70								9
	1	SPT	9.70 - 9.96	S*136				9.70-10.10m: Brown sand and gravel.			
10		B	10.30 - 11.00								10
									(5.20)		
11		SPT	11.20 - 11.55	S*68							11
		B	11.50 - 12.70								
12											12
		B	12.70 - 13.45	S*500							
		SPT	12.70 - 12.77								
13											13
		D	13.45 - 13.55	H 114				Stiff brown mottled orangish brown CLAY.	13.40	35.30	
		H	13.45	H 128				Stiff to very stiff indistinctly fissured greyish brown CLAY.	13.60	35.10	
		H	13.55						(0.50)		
		D	13.75 - 13.85								
14		H	14.00	H>130							14
		UT100	14.10 - 14.35					Very stiff dark greyish brown tending to dark grey CLAY with extremely closely spaced sub-horizontal to sub-vertical fissuring.	14.10	34.60	
		D	14.35 - 14.45					14.45m: Indistinctly thinly laminated with occasional white silt spots.			
		SPT	14.45 - 14.90	S 42							
15											15
		C	15.30 - 16.60			-% -% -%					
16											16
		C	16.60 - 18.10	S 41		-% -% -%		16.60m: Thinly laminated silty clay with occasional light grey silt spots.			
		SPT	16.60 - 17.05								
17											17
		CS	17.25 - 17.70								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
25/07/14	9.70	Nil	8.22

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
25/07/2014	12.70	11.20	3.28
28/07/2014	12.70	11.20	8.93
28/07/2014	14.10	13.80	3.40
07/08/2014	14.10	13.80	8.30

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ROTARY BOREHOLE LOG

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Borehole No. **BH10**

Sheet 3 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220350	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 12/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18								Very stiff dark greyish brown tending to dark grey CLAY with extremely closely spaced sub-horizontal to sub-vertical fissuring. *(continued from previous sheet)*			
		C	18.10 - 19.60			-% -% -%		17.75m: Phosphatic nodules recovered (<6mm).			
		D	18.30 - 18.40					18.30-18.32m: Claystone band.			
		CS	18.75 - 19.20								
19											
		D	19.45 - 19.55								
		C	19.60 - 21.10	S 36		-% -% -%					
		SPT	19.60 - 20.05								
20											
		D	20.10 - 20.20								
		CS	20.75 - 21.05								
21											
		C	21.10 - 22.60			-% -% -%					
22											
		C	22.60 - 24.10	S 46		-% -% -%					
		SPT	22.60 - 23.05						(17.50)		
23		D	22.90 - 23.00								
		CS	23.65 - 24.10								
24											
		C	24.10 - 25.60			-% -% -%		24.25-24.27m: Claystone band.			
		CS	24.45 - 24.80								
25											
		D	25.20 - 25.30								
		C	25.60 - 27.10	S 43		-% -% -%					
		SPT	25.60 - 26.05					25.90-26.00m: Claystone band.			
26											
		CS	26.35 - 26.65								
27											
		D	26.90 - 27.00								
		C	27.10 - 28.60			-% -%					

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
07/08/2014	21.10	15.15	2.48
08/08/2014	21.10	15.15	3.12

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Borehole No. **BH10**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582263 N 220350	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.70mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 24/07/2014 End: 12/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		CS	27.55 - 28.00		C	-%		Very stiff dark greyish brown tending to dark grey CLAY with extremely closely spaced sub-horizontal to sub-vertical fissuring. *(continued from previous sheet)*			
		D	28.55 - 28.65	S*54							
		C	28.60 - 30.10			-%					
		SPT	28.60 - 29.03			-%					
29		D	28.90 - 29.00		C	-%					
		D	29.85 - 29.95								
30		C	30.10 - 31.60			-%					
						-%					
		CS	30.80 - 31.25		C	-%					
31											
		C	31.60 - 33.10	S 44		-%		Very stiff greyish brown sandy CLAY.	31.60	17.10	
		SPT	31.60 - 32.05			-%					
32					C	-%					
		D	32.95 - 33.05								
		C	33.10 - 33.90			-%					
33		CS	33.30 - 33.75		C	-%			(3.50)		
		C	33.90 - 35.10			-%					
34		CS	33.90 - 34.35		C	-%					
		D	34.70 - 34.80								
35		SPT	35.10 - 35.55	S 47				Borehole completed at 35.10m	35.10	13.60	
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
08/08/2014	28.60	15.15	3.00
11/08/2014	28.60	15.15	5.19
11/08/2014	33.90	15.15	3.04
12/08/2014	33.90	15.15	5.30
12/08/2014	35.10	15.15	2.12

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ROTARY BOREHOLE LOG

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Borehole No. **BH11**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								MADE GROUND: Tarmacadam.	0.02	48.48	
								MADE GROUND: Concrete.	(0.58)		
		B	0.50						0.60	47.90	
								MADE GROUND: Firm friable greyish brown slightly gravelly sandy CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint.	(0.55)		
1		B	1.00						1.15	47.35	1
		UT100	1.20 - 1.65					MADE GROUND: Firm friable light brown gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint.	1.50	47.00	
		D	1.65 - 1.71					Stiff light orangish brown mottled light grey gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium chalk.			
		D	1.80 - 1.90								
2											2
		SPT	2.20 - 2.65	S 26				2.35-2.90m: Occasionally mottled dark orangish brown.			
		D	2.60 - 2.70					2.70-2.95m: Locally fissured. Fissures are closely spaced horizontal to sub-vertical rough planar occasionally stained light grey.			
3		D	3.00 - 3.10								3
		SPT	3.20 - 3.65	S 26				3.30-3.35m: 1no fissure sub-vertical rough planar infilled with light grey clay (<4mm).			
		D	3.70 - 3.80					3.65-4.10m: Gravelly clay.			
4									(4.95)		4
		D	4.10 - 4.20								
		SPT	4.20 - 4.65	S 17							
5		D	4.90 - 5.00								5
		SPT	5.20 - 5.65	S 23				5.35-6.45m: Slightly sandy.			
		D	5.50 - 5.60								
6								5.90-6.45m: Becoming dark greyish brown.			6
		D	6.10 - 6.20								
		SPT	6.45 - 6.90	S 32					6.45	42.05	
		D	6.65 - 6.75					Stiff light brown mottled brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk, flint and siliceous material.	(0.60)		
7									7.05	41.45	7
		B	7.15 - 7.85					Very dense light orangish brown slightly silty gravelly SAND. Gravel is angular to sub-rounded fine to coarse siliceous material.			
								7.35-7.55m: Very gravelly. Gravel is sub-rounded fine to medium.			
		SPT	7.85 - 8.06	S*136				7.70-7.80m: Very gravelly.			
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Fraste PL/ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam) 0.00-17.85m. Waterflush rotary core drilled (116mm diam) 17.85-51.60m.
CASING: 140mm to 17.85m.
GROUNDWATER: None encountered prior to using water flush to advance casing to 6.45m..
INSTALLATION: Borehole backfilled with bentonite pellets: 15.00-51.60m. 50mm ID HDPE slotted pipe with washed gravel response zone: 12.00-15.00m. Plain 50mm ID HDPE pipe with gravel surround: 11.80-12.00m and bentonite pellet seal: 0.20-11.80m. Raised 150mm steel cover set in concrete: 0.00-0.20m. Gas valve fitted.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
22/07/2014	6.45	Nil	Dry
23/07/2014	6.45	Nil	Dry

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ROTARY BOREHOLE LOG

Telephone: 01452 739165 , Fax: 01452 739220 , Email: info@ccground.co.uk

Borehole No. **BH11**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	8.00 - 8.50					Very dense light orangish brown slightly silty gravelly SAND. Gravel is angular to sub-rounded fine to coarse siliceous material. *(continued from previous sheet)* 8.15-8.20m: Slightly gravelly.			
									(3.30)		
9		B	8.85 - 9.35					8.85-10.35m: Light grey mottled orangish brown.			9
		SPT	9.35 - 9.61	C*115							
		B	9.75 - 10.00								
10								9.95-10.35m: clayey gravelly sand.			10
		D	10.35 - 10.45					Stiff light grey mottled light greyish brown locally orangish red CLAY.	10.35	38.15	
		H	10.45	H 82							
		H	10.50	H 97				10.50-10.60m: Becoming orangish brown.	10.60	37.90	
		H	10.55	H 90				Very stiff light yellowish grey slightly clayey slightly gravelly SAND. Gravel is angular to sub-rounded fine to coarse flint.	(0.60)		
11		D	10.65 - 10.75	C 34				11.10-11.15m: Very gravelly.	11.20	37.30	11
		SPT	10.85 - 11.30					Firm orangish brown mottled yellowish grey CLAY.	11.50	37.00	
		D	11.30 - 11.40	H 54				Very dense yellowish brown mottled greyish brown gravelly SAND. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.			
		H	11.35								
12		B	11.85 - 12.55					11.50-11.75m: Slightly clayey very gravelly sand. 11.50-13.00m: Becoming light grey			12
									(1.50)		
		SPT	12.70 - 13.08	S*75							
		D	12.80 - 12.90								
13		B	13.00 - 13.50					Light grey mottled grey thickly laminated to thinly bedded gravelly SAND. Gravel is sub-angular to sub-rounded fine to medium flint.	13.00	35.50	13
								13.10-13.55m: Very gravelly. 13.55-13.85m: Slightly gravelly.	(0.90)		
								Firm light grey mottled orangish brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium siliceous material.	13.90	34.60	
14		SPT	14.20 - 14.65	S 48					(0.40)		14
		D	14.30 - 14.40					13.90-14.15m: Indistinctly thinly laminated. 14.05-14.25m: Slightly clayey sandy gravel.	14.30	34.20	
									(0.40)		
								Dense greyish brown mottled orangish brown clayey slightly gravelly SAND. Gravel is sub-angular to sub-rounded fine to medium siliceous material.	14.70	33.80	
15											15
		D	15.20 - 15.30					Stiff orangish brown mottled yellowish brown and grey CLAY. 15.10-15.17m: Claystone band.	(1.00)		
		CS	15.30 - 15.70								
								Stiff thinly laminated grey CLAY with occasional pyrite traces (<20mm).	15.70	32.80	
16		UT100	15.85 - 16.30								16
		D	16.10 - 16.20								
		D	16.30 - 16.36								
17		UT100	16.85 - 17.30								17
		D	17.30 - 17.36								
		D	17.40 - 17.50								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
23/07/2014	14.20	10.35	10.45
24/07/2014	14.20	10.35	10.90

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ROTARY BOREHOLE LOG

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Borehole No. **BH11**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		C SPT	17.85 - 18.38 17.85 - 18.30	S 46	C	-% -% -%		Stiff thinly laminated grey CLAY with occasional pyrite traces (<20mm). *(continued from previous sheet)* 17.85-39.40m: Very stiff.			18
		C D	18.65 - 20.53 18.78 - 18.90			-% -% -%					
19		CS	19.36 - 19.84		C						19
20		D	20.30 - 20.40								20
		C SPT	20.53 - 22.03 20.53 - 20.98	S 36		-% -% -%					
21		CS	21.41 - 21.86		C						21
22		C	22.03 - 23.55			-% -% -%					22
		D CS	22.65 - 22.75 22.75 - 23.20		C			22.55-23.20m: With frequent pyrite nodules (<3mm)			
23		C SPT	23.55 - 25.05 23.55 - 24.00	S 44		-% -% -%					23
24		CS	24.10 - 24.55		C			23.95-37.00m: Very stiff. Fissures are very close to closely spaced horizontal to sub-vertical smooth planar. 24.50m: 1no. pyritic concretion recovered (<45mm).			24
25		D C	24.90 - 25.00 25.05 - 26.55			-% -% -%					25
		D	25.55 - 25.65		C						
26		CS	26.14 - 26.43						(21.30)		26
		C SPT	26.55 - 28.05 26.55 - 27.00	S 46		-% -% -%					
27		CS	27.20 - 27.65		C						27

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	17.85	17.85	0.00
25/07/2014	17.85	17.85	0.75
25/07/2014	23.55	17.85	3.28
28/07/2014	23.55	17.85	2.40

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Borehole No. **BH11**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		D	27.75 - 27.85		C			Stiff thinly laminated grey CLAY with occasional pyrite traces (<20mm). *(continued from previous sheet)*			
		C	28.05 - 29.55			-% -% -%					
		D	28.65 - 28.75		C						
29		CS	28.85 - 29.30								
		C	29.55 - 31.05	S 43		-% -% -%		29.60-37.00m: With frequent sandy partings and pyritic concretions (<65mm).			
		SPT	29.55 - 30.00								
30		D	30.10 - 30.20		C						
		CS	30.30 - 30.75								
31		C	31.05 - 32.55			-% -% -%					
		D	31.45 - 31.55								
		CS	31.80 - 32.25		C						
32		C	32.55 - 34.05	S 41		-% -% -%					
		SPT	32.55 - 33.00								
		D	32.70 - 32.80								
33		CS	33.15 - 33.60		C						
34		C	34.05 - 35.55			-% -% -%					
		CS	34.20 - 35.15								
		D	34.50 - 34.60		C						
35		D	35.30 - 35.40								
		C	35.55 - 37.05	S 39		-% -% -%					
		SPT	35.55 - 36.00								
		D	35.70 - 35.80		C						
36								36.50-37.00m: Silty clay.			
37					C				37.00	11.50	

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
28/07/2014	29.55	17.85	3.75
29/07/2014	29.55	17.85	4.10
29/07/2014	35.55	17.85	4.65
01/08/2014	35.55	17.85	10.90
01/08/2014	37.05	17.85	3.75
04/08/2014	37.05	17.85	5.95

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Borehole No. **BH11**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		C CS	37.05 - 38.55 37.15 - 37.60			-% -% -%		Stiff indistinctly thinly laminated grey silty CLAY with rare sandy traces. *(continued from previous sheet)*			
38		D	38.00 - 38.15						(2.40)		38
		C SPT	38.55 - 40.05 38.55 - 39.00	S 43		-% -% -%		38.45-39.40m: With occasional sandy partings (<10mm). 38.50-39.40m: With rare sandy partings <10mm. 38.60-39.40m: Fissures are vertical to horizontal rough planar with a silty infill.			
39											39
								Very stiff indistinctly thinly laminated grey slightly sandy silty CLAY with occasional light grey silty partings (<15mm).	39.40	9.10	
40		C	40.05 - 41.55			-% -% -%					40
41											41
		C SPT	41.55 - 43.05 41.55 - 42.00	S 32		-% -% -%					
42											42
								42.50-45.60m: With rare off white silty pockets <4mm.			
43		C	43.05 - 44.55			-% -% -%					43
44											44
								44.20-4560m: With occasional off white silty pocket <4mm.			
		C SPT D	44.55 - 46.05 44.55 - 45.00 44.70 - 44.85	S 35		-% -% -%					
45		CS	45.40 - 45.85						(12.20)		45
46		C	46.05 - 47.55			-% -% -%					46
		D	46.40 - 46.50								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
04/08/2014	38.55	17.85	11.45
05/08/2014	38.55	17.85	11.32
05/08/2014	46.05	17.85	7.10
06/08/2014	46.05	17.85	6.10

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Borehole No. **BH11**

Sheet 6 of 6

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582443 N 220499	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 06/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
47		CS	46.90 - 47.35		C			Very stiff indistinctly thinly laminated grey slightly sandy silty CLAY with occasional light grey silty partings (<15mm). *(continued from previous sheet)*			47
		C	47.55 - 49.05	S 35		-%					
		SPT	47.55 - 48.00			-%					
48						-%					48
		CS	48.15 - 48.60		C			48.60m: 1no. lignite nodule recovered (<60mm).			
								48.65m: 1no. pyrite nodule recovered (<5mm).			
		D	48.85 - 48.95					48.85-49.25m: Very stiff indistinctly thinly bedded greyish			
49		C	49.05 - 50.60			-%		green sandy silty clay with occasional lignite fragments			49
						-%		(<20mm).			
						-%					
		D	49.45 - 49.55								
		CS	49.55 - 50.00		C			49.55-50.55m: Slightly sandy with occasional sand lenses (<40mm).			
50											50
		D	50.30 - 50.40					50.35-51.60m: Sandy.			
		C	50.60 - 51.60			-%					
		CS	50.60 - 51.05		C	-%					
51						-%					51
		D	51.30 - 51.40								
		SPT	51.60 - 52.05	C 46				Borehole completed at 51.60m	51.60	-3.10	
52											52
53											53
54											54
55											55
56											56

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
06/08/2014	51.60	17.85	5.95

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Borehole No. **BH12**

Sheet 1 of 5

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220463	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 37.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 29/07/2014 End: 06/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
	1.1	B	0.40					MADE GROUND: Orangish brown sandy GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse chalk flint and siliceous material.	(1.20)		
1		SPT	1.20 - 1.65	S 14				MADE GROUND: Soft to firm light brown silty CLAY.	1.20	36.60	
		D	1.40 - 1.60					MADE GROUND: Light brown very clayey silty SAND.	1.40	36.40	
								MADE GROUND: Orangish brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to medium siliceous material.	1.70	36.10	
		H	1.85	H 119					1.75	36.05	
2		D	1.90 - 2.00	H 115					(0.55)		
		H	1.90	H 102				Stiff indistinctly fissured brown mottled orangish brown CLAY.	2.30	35.50	
		H	2.10								
		UT100	2.20 - 2.65					Very stiff greyish brown CLAY. Fissures are extremely closely spaced sub-horizontal smooth planar.			
		D	2.65 - 2.75								
3		D	2.90 - 3.00								
		H	3.00	H>130							
		C	3.20 - 4.70	S 31		-%					
		SPT	3.20 - 3.65			-%					
						-%					
4		CS	4.10 - 4.55		C						
		C	4.70 - 6.20			-%					
		D	4.70 - 4.80			-%					
5						-%					
		CS	5.20 - 5.50		C						
6		D	5.95 - 6.05								
		C	6.20 - 7.70	S 31		-%		6.20m: Very closely spaced sub-vertical to sub-horizontal smooth planar fissures.			
		SPT	6.20 - 6.65			-%					
						-%					
7					C						
		D	7.10 - 7.20					7.45m: Phosphate nodule recovered.			
		C	7.70 - 9.20		C	-%					
8						-%					

REMARKS:

EQUIPMENT: Hand digging tools. Fraste ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128mm diam) 1.20-3.20m. Waterflush rotary core drilled (116mm diam) 3.20-40.10m.
CASING: 150mm to 2.50m.
GROUNDWATER: Encountered at 0.40m. Rising and settling at 0.35m following five minute monitoring period.
BACKFILL: Borehole backfilled with bentonite pellets: 0.50-40.10m. Arisings: 0.00-0.50m.
REMARKS: Self boring pressure meter testing carried out by Cambridge In-Situ at: 19.70-20.70m, 29.40-30.40m and 39.10-40.10m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
29/07/14	0.40	Nil	0.35

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH12**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220463	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 37.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 29/07/2014 End: 06/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		CS	8.15 - 8.60			-%		Very stiff greyish brown CLAY. Fissures are extremely closely spaced sub-horizontal smooth planar. *(continued from previous sheet)*			
9		D	8.90 - 9.00								9
		C	9.20 - 10.70	S 35		-%					
		SPT	9.20 - 9.65			-%					
						-%		9.70m: Silty clay.			
		D	9.80 - 9.90								
10											10
		CS	10.25 - 10.55								
		C	10.70 - 12.20			-%					
						-%					
11						-%					11
		D	11.80 - 12.20								
12											12
		C	12.20 - 13.70	S 41		-%					
		SPT	12.20 - 12.65			-%					
						-%			(21.10)		
		CS	12.85 - 13.30								
13											13
		C	13.70 - 15.20			-%					
						-%					
14		D	14.05 - 14.15			-%					14
								14.20m: Very closely spaced sub-vertical to sub-horizontal smooth planar fissures with frequent pyrite traces.			
		CS	14.40 - 14.80								
15											15
		C	15.20 - 16.70	S 43		-%					
		SPT	15.20 - 15.65			-%		15.20m: Slightly silty, slightly micaceous clay with extremely closely spaced sub-horizontal fissures.			
						-%					
16		CS	15.90 - 16.35					15.90m: Slightly sandy.			16
								16.50m: Extremely closely spaced sub-vertical fissures.			
		D	16.60 - 16.70								
		C	16.70 - 18.20			-%					
17						-%					17
						-%					
		D	17.15 - 17.25								
		CS	17.40 - 17.90								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
29/07/2014	13.70	2.50	2.15
30/07/2014	13.70	2.50	0.34
05/08/2014	12.00	2.50	2.40

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Borehole No. **BH12**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220463	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 37.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 29/07/2014 End: 06/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		C	18.20 - 19.70	S 44	C	-% -% -%		Very stiff greyish brown CLAY. Fissures are extremely closely spaced sub-horizontal smooth planar. *(continued from previous sheet)*			
		SPT	18.20 - 18.65					17.95-17.97m: Claystone band.			
								18.20m: Greyish brown indistinctly thinly laminated sandy clay.			
19		CS	19.10 - 19.43		C						
		SBPM	19.70 - 20.70								
20		C	20.70 - 21.90			-% -% -%					
		D	20.95 - 21.05		C						
21		CS	21.55 - 21.90								
								21.72-21.77m: Claystone band.			
22		C	21.90 - 23.40	S 50		-% -% -%					
		SPT	21.90 - 22.35								
					C			22.60m: Pyritised gastropod shell recovered.			
		D	22.70 - 22.80								
23		CS	22.95 - 23.40					22.90m: Slightly sandy.			
									23.40	14.40	
		C	23.40 - 24.90			-% -% -%		Very stiff greyish brown sandy silty CLAY with occasional sandy partings.			
		D	23.40 - 23.50								
24		CS	23.90 - 24.35		C						
		D	24.70 - 24.80								
25		C	24.90 - 26.40	S 46		-% -% -%					
		SPT	24.90 - 25.35								
		CS	25.50 - 25.95		C						
26								26.25m: With occasional sandy partings.			
		C	26.40 - 27.90			-% -% -%					
		D	26.50 - 26.60								
27					C				(7.00)		

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
30/07/2014	19.70	2.50	1.45
31/07/2014	19.70	2.50	2.46

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Borehole No. **BH12**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220463	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 37.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 29/07/2014 End: 06/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		CS	27.45 - 27.65					Very stiff greyish brown sandy silty CLAY with occasional sandy partings. *(continued from previous sheet)*			
28		C	27.90 - 29.40	S 49		-%					28
		SPT	27.90 - 28.35			-%					
						-%					
		CS	28.65 - 28.95								
29											29
		SBPM	29.40 - 30.40								
30											30
		C	30.40 - 31.60			-%		Very stiff to hard dark grey sandy CLAY with occasional pyrite nodules.	30.40	7.40	
		D	30.60 - 30.70			-%					
31						-%					31
		CS	31.20 - 31.50								
		C	31.60 - 33.10	S 50		-%					
		SPT	31.60 - 32.05			-%					
32						-%					32
		CS	32.25 - 32.70								
33		D	33.00 - 33.10								33
		C	33.10 - 34.60			-%					
						-%					
		D	33.60 - 33.70			-%					
34											34
		CS	34.14 - 34.50								
		C	34.60 - 36.10	S*56		-%			(8.60)		
		SPT	34.60 - 35.02			-%		34.80m: Pyrite and lignite fragments recovered.			
35		CS	35.00 - 35.40			-%					35
		D	35.80 - 35.90								
36		C	36.10 - 37.60			-%					36
		CS	36.25 - 36.55			-%					
						-%					
37											37

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
31/07/2014	29.40	2.50	2.34
01/08/2014	29.40	2.50	2.40
01/08/2014	34.60	2.50	2.82
05/08/2014	34.60	2.50	1.83
06/08/2014	34.60	2.50	2.43

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Borehole No. **BH12**

Sheet 5 of 5

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582409 N 220463	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 37.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 29/07/2014 End: 06/08/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		D	37.15 - 37.25		C			Very stiff to hard dark grey sandy CLAY with occasional pyrite nodules. *(continued from previous sheet)* 37.30-40.10m: With occasional pockets of light grey silt.			
		C	37.60 - 39.10	S*58		-%					
		SPT	37.60 - 38.01			-%					
38		D	37.90 - 38.00			-%					38
		CS	38.45 - 38.90		C						
39		D	39.00 - 39.10					Stiff greenish grey very sandy glauconitic CLAY.	39.00	-1.20	39
		SBPM	39.10 - 40.10						(1.10)		
40								Borehole completed at 40.10m	40.10	-2.30	40
41											41
42											42
43											43
44											44
45											45
46											46

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
06/08/2014	40.10	2.50	2.40

CC ROTARY LOG C4237.GPJ GINT STD AGS 3_1.GDT 29/10/14

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ROTARY BOREHOLE LOG

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Borehole No. **BH13**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582300 N 220417	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 46.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50					MADE GROUND: Firm friable dark brown gravelly CLAY. Gravel is sub-angular to sub-rounded fine to medium chalk and flint. 0.25-0.40m: Mottled yellowish brown.	(1.20)		
1		B	1.00								
		SPT	1.20 - 1.65	S 7					1.20	45.60	
		D	1.60 - 1.70					MADE GROUND: Soft brown to orangish brown sandy gravelly CLAY with occasional sandy partings. Gravel is sub-angular to sub-rounded fine to coarse brick, flint, sandstone and quartzite. 1.75-1.85m: Very gravelly.			
2		UT100	2.20 - 2.65								
		D	2.65 - 2.75								
3		SPT	3.20 - 3.65	S 4				3.05-3.80m: Very sandy.			
		D	3.40 - 3.50								
4		UT100	4.20 - 4.65								
		D	4.65 - 4.75								
5		D	5.05 - 5.20						(7.60)		
		SPT	5.20 - 5.65	S 6							
6											
		D	6.60 - 6.70								
		SPT	6.70 - 7.15	S 10				6.70-8.80m: Firm.			
7								7.30m: Flint cobble recovered.			
8											

REMARKS:

EQUIPMENT: Hand digging tools. Fraste ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam) 1.20-11.20m. Waterflush rotary core drilled (116mm diam) 11.20-27.70m.
CASING: 140mm to 11.20m.
GROUNDWATER: Groundwater was initially struck at 9.70m. This then rose to 9.00m after 5mins, 8.43m after 10mins, 8.22m after 15mins and 8.20m after 20mins.
BACKFILL: Borehole backfilled with bentonite pellets: 0.70-27.7m. Arisings: 0.00-0.70m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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ROTARY BOREHOLE LOG

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Borehole No. **BH13**

Sheet 2 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582300 N 220417	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 46.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		UT100	8.20 - 8.65					MADE GROUND: Soft brown to orangish brown sandy gravelly CLAY with occasional sandy partings. Gravel is sub-angular to sub-rounded fine to coarse brick, flint, sandstone and quartzite. *(continued from previous sheet)*			
		D	8.65 - 8.75								
9		D	8.80 - 9.00					MADE GROUND: Soft light brown gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk. 8.80-9.00m: Soft yellowish brown gravelly clay. Gravel is fine to medium chalk.	8.80	38.00	9
									(0.90)		
		B	9.70 - 10.70	S 25				Medium dense orangish brown SAND.	9.70	37.10	
10		SPT	9.70 - 10.15								10
									(1.00)		
		D	10.80 - 10.90					Firm to stiff orangish brown CLAY.	10.70	36.10	
11		D	11.10 - 11.20						(0.50)		11
		C	11.20 - 12.70	S 37		-% -% -%		Stiff brown CLAY with a medium cobble content. Cobbles are sub-angular flint.	11.20	35.60	
		SPT	11.20 - 11.65					Very stiff greyish brown indistinctly thinly laminated CLAY with extremely closely spaced randomly orientated fissures.	11.38	35.42	
12		CS	11.80 - 12.25		C						12
		C	12.70 - 14.20			-% -% -%					
13		D	13.03 - 13.13								13
		CS	13.40 - 13.85		C						
14		C	14.20 - 15.70	S 36		-% -% -%					14
		SPT	14.20 - 14.65								
15		CS	15.00 - 15.45		C			15.00m: Extremely closely spaced sub-horizontal fissures.			15
		C	15.70 - 17.20			-% -% -%					
16		D	15.70 - 15.80								16
		CS	16.25 - 16.70		C						
17		D	17.10 - 17.20					16.95-17.00m: Siltstone band.			17
		C	17.20 - 18.70	S 39		-% -% -%					
		SPT	17.20 - 17.65		C						

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
22/07/14	9.70	Nil	8.20

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
22/07/2014	11.20	11.20	1.83
23/07/2014	11.20	11.20	3.48

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Borehole No. **BH13**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582300 N 220417	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 46.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18								Very stiff greyish brown indistinctly thinly laminated CLAY with extremely closely spaced randomly orientated fissures. *(continued from previous sheet)*			
		CS	18.20 - 18.60								
		C	18.70 - 20.20			-% -% -%					
19		D	19.20 - 19.30								
		CS	19.75 - 20.20						(16.32)		
20		C	20.20 - 21.70	S 44		-% -% -%					
		SPT	20.20 - 20.65								
		D	20.85 - 20.95								
21		CS	21.05 - 21.50								
		C	21.70 - 23.20			-% -% -%					
22		D	22.00 - 22.10								
		CS	22.55 - 23.00								
23								23.00-27.70m: With frequent pyrite traces.			
		C	23.20 - 24.70	S 42		-% -% -%					
		SPT	23.20 - 23.65								
24		CS	23.95 - 24.40								
		D	24.50 - 24.60								
		C	24.70 - 26.20			-% -% -%					
25		CS	25.05 - 25.50								
26		D	25.95 - 26.05								
		C	26.20 - 27.70	S 42		-% -% -%					
		SPT	26.20 - 26.65								
		CS	26.55 - 27.00								
27		D	27.20 - 27.30								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
23/07/2014	23.20	11.20	3.08
24/07/2014	23.20	11.20	3.41

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Borehole No. **BH13**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582300 N 220417	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 46.80mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 24/07/2014	Logged By MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
					C			Borehole completed at 27.70m	27.70	19.10	

28 29 30 31 32 33 34 35 36 37

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	27.70	11.20	3.00

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Borehole No. **BH14**

Sheet 1 of 6

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.50					MADE GROUND: Dark grey slightly clayey SAND and GRAVEL. Gravel is angular to rounded fine to coarse brick, clinker, ash and siliceous material. 0.05: Occasional rootlets.	0.20	48.30	
								MADE GROUND: Orangish brown gravelly SAND. Gravel is sub-angular to sub-rounded fine to coarse brick and siliceous material.	0.30	48.20	
1		B	1.00						(1.10)		1
		UT100	1.20 - 1.65					MADE GROUND: Stiff greyish brown mottled greenish grey slightly gravelly CLAY. Gravel is sub-angular to sub-rounded siliceous material.	1.40	47.10	
		B	1.70 - 2.00					Stiff yellowish brown gravelly CLAY with occasional pockets of orangish brown sandy clay.. Gravel is sub-angular to rounded fine to coarse chalk.			
2		D	1.70								2
		SPT	2.20 - 2.65	S 23							
		D	2.70								
3		UT100	3.20 - 3.60								3
		D	3.65						(4.30)		
4		SPT	4.20 - 4.65	S 23							4
		D	4.70								
5		UT100	5.20 - 5.65								5
		D	5.70					Stiff brown gravelly CLAY. Gravel is sub-angular to rounded fine to coarse sandstone, quartzite, chalk and flint.	5.70	42.80	
6		D	6.00						(0.80)		6
		B	6.50 - 7.00	S*111				Very dense brown mottled orangish brown and light greyish brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.	6.50	42.00	
		SPT	6.50 - 6.76								
7											7
		D	7.50								
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig. Comacchio MC305 multi purpose drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-14.00m. Continuous dynamic sampled (113mm diam) 13.50-14.10m. Waterflush rotary core drilled (116 and 101mm diam) 14.50-47.60m.
CASING: 150mm to 13.50m. 140mm to 14.50m.
GROUNDWATER: Possible groundwater strike at 13.00m
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-47.60m.
REMARKS: Self boring pressure meter testing carried out by Cambridge In-Situ at: 19.90-20.90m, 29.70-30.70m and 40.00-41.00m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
28/07/2014	5.70	2.50	Dry
29/07/2014	5.70	2.50	Dry

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Borehole No. **BH14**

Sheet 2 of 6

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B SPT	8.00 - 8.50 8.00 - 8.25	S*130				Very dense brown mottled orangish brown and light greyish brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to coarse flint and siliceous material. *(continued from previous sheet)*			
9		D	9.00						(5.50)		9
		B SPT	9.50 - 10.00 9.50 - 9.82	S 28				9.50-9.82m: Medium dense.			
10		D	10.50								10
11		B SPT	11.00 - 11.50 11.00 - 11.45	S 34				11.00-11.45m: Dense.			11
12		D	12.00					Soft to firm light brown sandy SILT.	12.00	36.50	12
		B SPT	12.50 - 13.00 12.50 - 12.95	S 34				Dense grey mottled orangish brown sandy GRAVEL with a low cobble content. Gravel is sub-angular to rounded fine to coarse siliceous material. COBbles are sub-angular siliceous material.	12.30 (1.00)	36.20	
13		D UT100 D D	13.50 13.50 - 13.75 13.70 - 13.80 13.80					Stiff to very stiff greyish brown locally orangish brown CLAY with extremely closely spaced sub-horizontal fissuring and occasional light grey silty pockets (<6mm).	13.30	35.20	13
14		C SPT	14.10 - 15.50 14.10 - 14.55	S 46		-% -% -%					14
15		CS	14.90 - 15.35								15
		D C CS	15.40 - 15.50 15.50 - 17.00 15.50 - 16.15			-% -% -%					
16		D	16.55 - 16.65					16.30m: 1no. pyritised crinoid stem recovered.			16
17		C SPT	17.00 - 18.40 17.00 - 17.42	S*56		-% -% -%		17.00-17.42m: Hard.			17

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
29/07/2014	14.00	13.50	Dry
31/07/2014	13.50	13.50	13.10

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Borehole No. **BH14**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		CS	17.85 - 18.20		C			Stiff to very stiff greyish brown locally orangish brown CLAY with extremely closely spaced sub-horizontal fissuring and occasional light grey silty pockets (<6mm). *(continued from previous sheet)*			18
		C	18.40 - 18.70		C	-% -% -%					
		D	18.40 - 18.50								
		C	18.70 - 19.90								
19		CS	18.90 - 19.35		C	-% -% -%					19
		D	19.80 - 19.90								
20		SBPM	19.90 - 20.90								20
		CS	20.60 - 21.00		C						
21		C	20.90 - 21.10			-% -% -%					21
		C	21.10 - 22.00								
		D	21.50 - 21.60		C	-% -% -%					
22		C	22.00 - 22.10	C 41	C	-% -% -%		21.90m: With rare phosphatic nodules (<20mm).			22
		SPT	22.00 - 22.45								
		C	22.10 - 23.50								
		CS	22.30 - 22.75		C	-% -% -%					
23		D	23.30 - 23.40								23
		C	23.50 - 23.80		C	-% -% -%					
		C	23.80 - 24.10		C	-% -% -%					
24		C	24.10 - 25.00								24
		D	24.25 - 24.35								
		CS	24.52 - 25.00		C	-% -% -%					
25		C	25.00 - 26.50	C*56		-% -% -%		25.00-25.42m: Hard.	(23.70)		25
		SPT	25.00 - 25.42					25.40m: With rare phosphatic nodules (<20mm). 25.50m: Indistinctly thinly laminated.			
		D	25.60 - 25.70		C						
26		CS	26.00 - 26.45								26
		C	26.50 - 28.00			-% -% -%					
27		CS	27.00 - 27.45		C						27

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
31/07/2014	20.90	14.00	2.40
01/08/2014	20.90	14.00	2.60
01/08/2014	23.50	15.00	7.50
04/08/2014	23.50	15.00	11.10
08/08/2014	24.00	15.00	16.30

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Borehole No. **BH14**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		D	27.85 - 27.95					Stiff to very stiff greyish brown locally orangish brown CLAY with extremely closely spaced sub-horizontal fissuring and occasional light grey silty pockets (<6mm). *(continued from previous sheet)*			
		C	28.00 - 29.00	C 50		-% -% -%					
		SPT	28.00 - 28.45								
29		CS	28.95 - 29.40								
		C	29.00 - 29.70			-% -% -%					
								29.45-29.48m: Claystone band.			
		D	29.60 - 29.70								
		SBPM	29.70 - 30.70								
30											
		C	30.70 - 31.30			-% -% -%					
31		D	31.05 - 31.15								
		C	31.30 - 32.80	C*52		-% -% -%					
		SPT	31.30 - 31.74								
		D	31.70 - 31.90								
32								32.20m: Sub-horizontal sandy parting with thin pyritic lens.			
		CS	32.30 - 32.75								
		C	32.80 - 34.30			-% -% -%					
33											
34		D	34.00 - 34.10								
		C	34.30 - 35.60	C*56		-% -% -%					
		SPT	34.30 - 34.73								
		CS	34.55 - 35.00								
35								35.10m: 1no pyritised wood fragment recovered.			
		D	35.40 - 35.50								
		C	35.60 - 37.00			-% -% -%					
36								35.90-36.05m: Claystone band.			
		D	36.05 - 36.15								
		CS	36.45 - 36.80								
37									37.00	11.50	

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
04/08/2014	28.00	15.00	6.10
05/08/2014	28.00	15.00	10.10
05/08/2014	32.80	15.00	11.50
06/08/2014	32.80	15.00	12.15

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Borehole No. **BH14**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		C	37.00 - 37.50	C*60	C	-% -% -%		Hard brown mottled greyish brown sandy silty CLAY with pyritic nodules (<15mm) and closely spaced sandy partings. *(continued from previous sheet)*			
		SPT	37.00 - 37.40								
		D	37.25 - 37.35								
		C	37.50 - 38.70			-% -% -%		37.40m: With closely spaced thin sandy partings.			
38		CS	38.00 - 38.40		C						38
		C	38.70 - 40.00			-% -% -%					
		D	38.80 - 38.90								
39					C						39
		CS	39.55 - 40.00								
40		SBPM	40.00 - 41.00								40
		C	41.00 - 41.70			-% -% -%					
41					C						41
		D	41.50								
		C	41.70 - 43.10			-% -% -%					
42					C				(10.60)		42
		D	42.90 - 43.00								
43		C	43.10 - 44.60	C*58		-% -% -%					43
		SPT	43.10 - 43.51								
44					C						44
		D	44.40 - 44.50								
		C	44.60 - 46.10			-% -% -%					
45		CS	45.05 - 45.50		C						45
		D	45.80 - 45.90								
46		C	46.10 - 47.60			-% -% -%					46
					C						
		CS	46.65 - 47.10								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
06/08/2014	40.00	15.00	12.20
07/08/2014	40.00	15.00	16.10
07/08/2014	44.60	15.00	15.70
08/08/2014	44.60	15.00	17.40
11/08/2014	44.60	15.00	15.30

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Borehole No. **BH14**

Sheet 6 of 6

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 28/07/2014 End: 11/08/2014	Logged By MO/WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
47								Hard brown mottled greyish brown sandy silty CLAY with pyritic nodules (<15mm) and closely spaced sandy partings. *(continued from previous sheet)*			
		D	47.30 - 47.45		C						
		SPT	47.60 - 48.02	C*54				Borehole completed at 27.60m	47.60	0.90	
48											
49											
50											
51											
52											
53											
54											
55											
56											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
11/08/2014	47.60	44.60	15.30

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Borehole No. **BH15**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 07/08/2014 End: 20/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20 - 0.43					MADE GROUND: Concrete.	0.20	48.30	
								MADE GROUND: Reddish brown mottled orangish brown slightly clayey, slightly sandy, slightly gravelly COBBLES. Gravel is subangular to subrounded, fine to coarse, brick, concrete and siliceous material. Cobbles are subangular brick and concrete.	0.45	48.05	
		B	0.80 - 1.00						0.80	47.70	
1								Firm dark orangish brown mottled light grey slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk and siliceous material.			1
		UT100	1.50 - 1.95					Stiff light brown gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk with some black staining on clasts.			
2		B	2.00 - 2.50								2
		D	2.00								
								2.50 - 2.95: Stiff light yellowish brown			
3		SPT	3.00 - 3.45	S 23							3
		D	3.25								
		UT100	3.50 - 3.95						(6.00)		
4		D	4.00	S 17							4
		D	4.25								
		SPT	4.50 - 4.95					4.50m: Yellowish brown slightly gravelly clay			
5											5
		D	5.50					5.50m: Some grey mottling			
6		UT100	6.00 - 6.45								6
		D	6.50					6.50m: Stiff grey mottled light brown gravelly clay			
								Stiff orangish brown to brown slightly gravelly very sandy CLAY with occasional pockets of brown sand (<20mm).	6.80	41.70	
7		D	7.00						(0.50)		7
								Very dense sandy GRAVEL. Sand is fine to coarse, gravel is subangular to subrounded of flint and siliceous material.	7.30	41.20	
		B CPT	7.50 - 7.80	C*69							
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Pilcon 1500 cable percussion drilling rig. Comacchio MC305 multi purpose drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Cable percussive boring using 150mm diam tools: 1.20-14.00m. Continuous dynamic sampled (113mm diam) 14.00-14.60m. Waterflush rotary core drilled (116 and 101mm diam) 14.60-38.10m.
CASING: 200mm to 2.50m. 150mm to 13.00m. 140mm to 14.60m.
GROUNDWATER: Standing at 4.60m following SPT 7.50-7.80m.
BACKFILL: Borehole backfilled with bentonite pellets: 0.20-38.10m. The surface was reinstated with concrete: 0.00-0.20m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH15**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 07/08/2014 End: 20/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								Very dense sandy GRAVEL. Sand is fine to coarse, gravel is subangular to subrounded of flint and siliceous material. *(continued from previous sheet)*			
		D	8.50								
9		B CPT	9.00 - 9.30	C*87				9.00 - 9.30m: Pockets of firm light brown clayey silt			
10		D	10.00						(5.50)		
		B CPT	10.50 - 10.80	C*115							
11		D	11.50					11.50m: Pockets of light brown sandy silt			
12		B CPT	12.00 - 12.45	S 46							
		D	12.80					Stiff orangish brown mottled dark brown CLAY. Fissures are extremely closely spaced.	12.80 (0.60)	35.70	
13		UT100	13.50 - 13.95					Stiff greyish brown CLAY. Extremely closely fissure with occasional white silty pockets, <10mm	13.40	35.10	
14		D	14.00								
		CPT	14.60 - 15.02	C*83		100% -% -%					
15											
16						100% -% -%					
17		CPT	17.10 - 17.54	C*77		100% -% -%					
		D	17.50								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH15**

Sheet 3 of 5

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 07/08/2014 End: 20/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		D	18.00					Stiff greyish brown CLAY. Extremely closely fissure with occasional white silty pockets, <10mm *(continued from previous sheet)*			18
								18.45 - 19.10: With rare silty partings			
						100% % %					
19		D	19.10								19
		CS	19.20 - 19.50								
		D	19.60								
20		CPT	20.10 - 20.52	C*83				19.95 - 20.20m: Thinly laminated			20
		D	20.15			87% % %		20.25 - 20.30m: With frequent pyritic nodules			
21		D	21.20								21
		D	21.70			400% % %					
22		CS	21.80 - 22.25			100% % %					22
23		D	23.00					22.85m: Brownish grey			23
		CPT	23.20 - 23.62	C*83		100% % %					
		D	23.65					23.50m: With rare light grey silty partings, <15mm			
24		D	24.40								24
						100% % %					
25		CS	25.25								25
									(24.70)		
26		D	25.95								26
		CPT	26.20 - 26.75	C*100		100% % %		26.50 - 29.05m: Fissures are predominantly sub-vertical to subhorizontal, closely to medium spaced.			
27		D	26.95								27

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH15**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 07/08/2014 End: 20/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28						67% % %		Stiff greyish brown CLAY. Extremely closely fissure with occasional white silty pockets, <10mm *(continued from previous sheet)*			28
		CS	28.30 - 28.60								
		D	28.60								
29											29
		D	29.20			183% % %					
		CPT	29.80 - 30.19	C*63							
30		D	29.95			33% % %					30
		D	30.40								
31											31
						600% % %		31.30m: With occasional silty partings 31.45m: 1No phoshatic nodule			
32						67% % %					32
		D	32.30								
		CS	32.55 - 33.00					32.50 - 35.15m: Silty			
33		CPT	33.10 - 33.50	C*60		600% % %					33
						40% % %					
34											34
		D	34.20								
						140% % %					
35		D	34.90								35
		CPT	35.10 - 35.50	C*60		100% % %					
								35.55 - 35.58m: Grey			
36		D	35.80					35.80m: 1No. pyritised wood fragment, <40mm			36
						67% % %					
37											37

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH15**

Sheet 5 of 5

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582397 N 220392	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 07/08/2014 End: 20/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
38		D	37.90					Stiff greyish brown CLAY. Extremely closely fissure with occasional white silty pockets, <10mm *(continued from previous sheet)*			
		CPT	38.10 - 38.51	C*58				Borehole completed at 38.10m	38.10	10.40	
39											
40											
41											
42											
43											
44											
45											
46											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH16**

Sheet 1 of 5

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582355 N 220342	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 05/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								MADE GROUND: Concrete.	(0.60)		
		B	0.50						0.60	48.30	
								Firm light orangish brown mottled dark reddish brown slightly sandy CLAY with occasional rootlets. 0.90-1.20m: Becoming dark orangish brown. 0.95-1.50m: Sandy.			
1		B	1.00						(1.30)		1
		SPT	1.20 - 1.65	S 13				1.50-1.90m: Predominantly clay.			
		D	1.70 - 1.80						1.90	47.00	
2		SPT	2.00 - 2.45	S 22				Stiff light brown mottled orangish brown gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and flint. 2.30-3.50m: Very gravelly. 2.30-3.00m: Light yellowish grey mottled orangish brown. 2.50-3.00m: Locally very closely fissured. 2.70-4.50m: Chalk gravel frequently speckled dark grey.			2
		D	2.60 - 2.70								
3		SPT	3.00 - 3.45	S 18							3
		D	3.50 - 3.60								
4		SPT	4.00 - 4.45	S 16							4
		D	4.60 - 4.70					4.70-6.15m: slightly gravelly. 4.70-4.80m: 1no. angular flint cobble.	(5.60)		
5		SPT	5.00 - 5.45	S 20				4.80-8.00m: Becoming dark brown.			5
		D	5.70 - 5.80								
6		D	6.00 - 6.10								6
		SPT	6.00 - 6.45					6.10-7.40m: Slightly sandy.			
				S 22							
								6.80-7.50m: Slightly gravelly.			
7											7
								7.15-7.25m: Band of chalk.			
		D	7.50 - 7.60					Orangish brown slightly gravelly SAND. Gravel is sub-angular to sub-rounded fine to coarse flint 7.80-8.00m: Tending to sand.	7.50 (0.50)	41.40	
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Fraste ML multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128 and 113mm diam) 0.00-13.60m. Waterflush rotary core drilled (116mm and 101mm diam) 13.60-39.80m.
CASING: SW to 13.60m.
GROUNDWATER: None encountered prior to the using water flush to advance casing to 4.00m.
INSTALLATION: Borehole backfilled with bentonite pellets: GL - 39.80m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
22/07/2014	1.20	-	Dry
23/07/2014	1.20	-	Dry
23/07/2014	8.00	5.00	2.30
24/07/2014	8.00	5.00	4.00

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Borehole No. **BH16**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582355 N 220342	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 05/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		SPT	8.00 - 8.45	S*103				Light grey indistinctly thinly bedded SAND.	8.00	40.90	
								8.25-8.50m: Locally gravelly.			
		B	8.60 - 9.10					8.50-9.10m: Light grey locally mottled orangish brown. 8.65-9.00m: Very gravelly.	(1.10)		
9		B	9.10 - 9.50					Light yellowish brown mottled grey slightly clayey sandy GRAVEL. Gravel is angular to sub-rounded fine to coarse flint.	9.10	39.80	9
		SPT	9.50 - 9.95	C*103					(0.85)		
10		D	10.10 - 10.20					Firm thinly laminated orangish brown slightly sandy CLAY.	9.95	38.95	10
								Light greyish brown mottled grey and brown slightly sandy GRAVEL. Gravel is angular to sub-rounded fine to coarse siliceous material and flint.	10.30	38.60	
								10.50-10.75m: Sandy. Gravel is predominantly fine to medium.	(0.45) 10.75	38.15	
11		B	10.85 - 11.50					Light brownish grey locally indistinctly thinly laminated gravelly SAND. Gravel is angular to rounded fine to coarse siliceous material and flint.	(1.00)		11
		CPT	11.50 - 11.71	C*107				11.05-11.10m: Clayey.			
								Stiff orangish brown mottled brown indistinctly thinly laminated CLAY.	11.75	37.15	
12		H	11.90	H 75				11.75-11.85m: Slightly gravelly.	12.05	36.85	12
		D	11.95 - 12.05	H 104				Orangish brown mottled brown slightly clayey locally gravelly SAND. Gravel is sub-angular to sub-rounded fine to coarse flint.	(0.40) 12.45	36.45	
		H	11.95	H 120				Stiff orangish brown mottled brown tending to greyish brown CLAY.	(0.75)		
		H	12.00								
		D	12.60 - 12.70								
13		UT100	13.00 - 13.45					Very stiff fissured locally thinly laminated grey CLAY. Fissures are very closely to closely spaced horizontal to sub-vertical planar smooth. 13.60-26.20m: with occasional pyritic nodules <12mm.	13.20	35.70	13
		CPT	13.60 - 14.01	C*58							
		D	13.70 - 13.80								
14		CS	14.15 - 14.60								14
15		D	14.95 - 15.05								15
		CS	15.35 - 15.80					15.50-21.70m: With rare silty spots (<2mm). 15.60-21.70m: Fissures are very closely spaced and randomly orientated. Frequent pyritic concretions (<55mm).			
16		CPT	16.00 - 16.44	C*52							16
		CS	16.70 - 17.15								
17		D	17.25 - 17.35								17

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
24/07/2014	13.00	12.00	3.20
28/07/2014	13.00	12.00	
28/07/2014	16.00	13.60	2.20
29/07/2014	16.00	13.60	5.10

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Borehole No. **BH16**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582355 N 220342	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 05/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		CS	18.00 - 18.45					Very stiff fissured locally thinly laminated grey CLAY. Fissures are very closely to closely spaced horizontal to sub-vertical planar smooth. *(continued from previous sheet)*			
		D	18.50 - 18.60								
		CPT	18.70 - 19.13	C*58							
19		D	19.40 - 19.50								
									(13.00)		
20		D	19.95 - 20.05								
		CS	20.40 - 20.85								
21		D	21.10 - 21.20								
		CPT	21.70 - 22.11	C*58							
22		D	21.75 - 21.85								
23								23.20-23.90m: Fissures are predominantly closely spaced.			
		D	23.45 - 23.55								
24		CS	24.05 - 24.50					24.50-26.20m: Fissures are predominantly closely spaced.			
		CPT	24.70 - 25.07	C*68				24.70-26.20m: Locally silty.			
25		CS	24.90 - 25.35								
26		D	25.80 - 25.90						26.20	22.70	
								Very stiff fissured locally thinly laminated grey silty CLAY, with frequent sandy partings. Fissures are very closely to closely spaced horizontal to sub-vertical planar smooth occasionally with a sandy infill.			
		CS	26.55 - 27.00								
		D	26.60 - 26.70								
27											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
29/07/2014	24.70	13.60	3.70
30/07/2014	24.70	13.60	4.20

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Borehole No. **BH16**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582355 N 220342	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 05/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		CPT	27.30 - 28.11	C*58				Very stiff fissured locally thinly laminated grey silty CLAY, with frequent sandy partings. Fissures are very closely to closely spaced horizontal to sub-vertical planar smooth occasionally with a sandy infill. *(continued from previous sheet)*			
		D	27.70 - 27.80								
28		CS	28.00 - 28.45								28
		D	28.55 - 28.65								
29		D	29.20 - 29.30								29
		D	29.70 - 29.80								
30		CS	30.00 - 30.45					30.00-31.90m: Indistinctly thinly laminated.			30
		D	30.55 - 30.65								
31		CPT	30.90 - 31.33	C*54							31
		D	31.70 - 31.80					31.60-31.90m: Fissure is subvertical, planar, smooth, persistent for 300mm.			
32		CS	31.90 - 32.35								32
		D	32.60 - 32.70					32.40-32.45m: Medium strong siltstone band (50mm). 32.50-35.30m: With sandy partings (<10mm). 32.60-35.30m: Fissures are predominantly subvertical to vertical, planar, smooth.			
33		CS	33.30 - 33.75						(13.60)		33
34											34
35		D	35.20 - 35.30								35
		CPT	35.30 - 35.75	C*51							
36		CS	36.05 - 36.50					36.20-39.80m: Very stiff.			36
		D	36.50 - 36.60								
37		CS	36.90 - 37.35								37

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
30/07/2014	32.40	13.60	4.80
04/08/2014	32.40	13.60	5.80
04/08/2014	35.30	13.60	4.20
05/08/2014	35.30	13.60	4.80
05/08/2014	29.80	13.60	6.00

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ROTARY BOREHOLE LOG

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Borehole No. **BH16**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582355 N 220342	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 48.90mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 22/07/2014 End: 05/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
38		D	37.45 - 37.55					Very stiff fissured locally thinly laminated grey silty CLAY, with frequent sandy partings. Fissures are very closely to closely spaced horizontal to sub-vertical planar smooth occasionally with a sandy infill. *(continued from previous sheet)*			
		D	37.70 - 37.80								
		CPT	38.30 - 38.72	C*54							
39		D	38.90 - 39.00								
		D	39.70 - 39.80								
40								Borehole completed at 39.80m	39.80	9.10	
41											
42											
43											
44											
45											
46											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH17**

Sheet 1 of 6

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								MADE GROUND: Flint rich concrete.	0.15	47.95	
								MADE GROUND: Dark reddish brown mottled dark brown and light grey sandy very gravelly COBBLES with frequent rootlets. Gravel is sub-angular to sub-rounded fine to coarse brick, concrete, siliceous material and mudstone. Cobbles are sub-angular brick and concrete.	(0.40) 0.55	47.55	
1		UT100	1.20 - 1.65					MADE GROUND: Stiff dark greyish brown mottled orangish brown sandy gravelly CLAY with a low cobble content and rare rootlets. Gravel is sub-angular to sub-rounded fine to coarse chalk and siliceous material.	(1.45)		1
		B	1.70 - 2.00					2.70-4.20m: Firm.			
		D	1.70								
2		SPT	2.20 - 2.65	S 22				Stiff yellowish brown mottled light grey gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse chalk and siliceous material.	2.00	46.10	2
		D	2.70								
3		UT100	3.20 - 3.65								3
		D	3.60						(3.70)		
4		SPT	4.20 - 4.65	S 18				4.20-5.70m: Brown mottled grey. Predominantly medium gravel.			4
		D	4.70								
5		UT100	5.20 - 5.65								5
		D	5.70					Stiff orangish brown gravelly sandy CLAY. Gravel is sub-angular to rounded medium to coarse flint and siliceous material.	5.70	42.40	
6		D	6.00					6.00-6.20m: Chalk gravel frequently speckled dark grey.	(0.50) 6.20	41.90	6
		B	6.50 - 7.00	C*88				Very dense light brown very sandy to sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.			
7		D	7.50								7
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Dando 2000 cable percussion drilling rig. Fraste PL multi purpose drilling rig.
METHOD: Hand dug inspection pit: 0.00-1.00m. Cable percussive boring using 150mm diam tools: 1.00-14.00m. Continuous dynamic sampled (113mm diam) 13.50-14.10m. Waterflush rotary core drilled (116 and 101mm diam) 14.50-47.60m.
CASING: 150mm to 13.50m. 140mm to 14.50m.
GROUNDWATER: "Free draining" 9.50-10.70m (Drillers observation). Water encountered at 13.00m. No rise recorded.
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-47.60m.
REMARKS: Self boring pressure meter testing carried out by Cambridge In-Situ at: 19.90-20.90m, 29.70-30.70m and 40.00-41.00m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH17**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	8.00 - 8.50	C 43				Very dense light brown very sandy to sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse flint and siliceous material. *(continued from previous sheet)* 8.00-10.70m: Very sandy.	(4.50)		
9		D	9.00								
		B	9.50 - 10.00	C*55							
10		D	10.50								
								Dense light greyish brown very sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.	10.70	37.40	
11		B	11.00 - 11.50	C 36					(1.80)		
12		D	12.00								
		B	12.50 - 13.00	C 29				Dense light brown slightly gravelly SAND. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.	12.50	35.60	
13	1	D	13.50								
14		B	14.00 - 14.50	C 33					(3.10)		
15		D	15.00					15.00-15.50m: With occasional pockets of light orangish brown sandy clay.			
		UT100	15.50 - 15.95					Dense light brown gravelly SAND. Gravel is sub-angular to rounded fine to coarse flint and siliceous material.	15.60	32.50	
16		D	16.00						(0.50)		
		D	16.20					Stiff orangish brown tending to greyish brown indistinctly thinly laminated CLAY.	16.10	32.00	
		D	16.50					Stiff indistinctly thinly laminated fissured grey CLAY, with occasional silty partings and pyritic nodules <50mm.	16.30	31.80	
		C	16.65 - 18.15		C	80% 0% 0%					
17		D	17.25								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)
01/08/14	13.00	12.50	

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
31/07/2014	11.50	11.50	Dry
01/08/2014	11.50	11.50	Dry
01/08/2014	16.50	16.50	12.50
07/08/2014	16.50	16.50	Dry

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ROTARY BOREHOLE LOG

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Borehole No. **BH17**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		D	17.95		C			Stiff indistinctly thinly laminated fissured grey CLAY, with occasional silty partings and pyritic nodules <50mm. *(continued from previous sheet)*			
		C	18.15 - 19.65			100% 0% 0%		19.50-19.55m: 1no. claystone <50mm.			
19		D	18.85		C						
		C	19.65 - 21.20	S 38		0% 0% 0%					
20		D	20.25		C						
21		D	21.10								
		C	21.30 - 22.80			100% 0% 0%					
		D	21.70								
22		CS	21.80 - 22.30		C						
		C	22.80 - 24.30	S 39		100% 0% 0%					
23		D	23.45		C						
		CS	23.55 - 24.00								
24		D	24.20								
		C	24.30 - 25.80			100% 0% 0%		24.30-24.55m: Highly fissured.			
25		CS	25.00 - 25.45		C						
		D	25.45					25.60-30.25m: Locally tending to silty clay.			
		C	25.80 - 27.30	S 37		100% 0% 0%		25.75m: 1no. claystone <50mm.			
26		CS	26.70 - 27.15		C						
27		D	27.15		C						

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
07/08/2014	19.65	16.40	4.10
08/08/2014	19.65	16.40	3.42
08/08/2014	25.80	16.40	3.27
11/08/2014	25.80	16.40	4.80

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ROTARY BOREHOLE LOG

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Borehole No. **BH17**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		C	27.30 - 28.80			100% 0% 0%		Stiff indistinctly thinly laminated fissured grey CLAY, with occasional silty partings and pyritic nodules <50mm. *(continued from previous sheet)* 27.50-43.10m: With frequent pyritic nodules <30mm. 27.80-27.85m: Dark grey, slightly sandy. 27.95m: 1no. pyritised wood fragment <70mm.			
28											28
		C	28.80 - 30.30	S 38		100% 0% 0%					
29											29
									(26.80)		
30		C	30.30 - 31.80			100% 0% 0%					30
31											31
		C	31.80 - 33.10	C*51		92% 0% 0%					
32		D	32.45								32
33		C	33.10 - 34.60			100% 0% 0%					33
		D	33.80								
34		CS	34.00 - 34.45								34
		C	34.60 - 35.80	C 40		100% 0% 0%					
35		D	35.50								35
		C	35.80 - 37.30			100% 0% 0%					
36											36
37		D	36.90					36.80-43.10m: With rare off white silty pockets <2mm.			37

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
11/08/2014	28.80	16.40	2.70
12/08/2014	28.80	16.80	8.22
12/08/2014	35.80	16.80	6.47
13/08/2014	35.80	16.80	7.91

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ROTARY BOREHOLE LOG

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Borehole No. **BH17**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		C	37.30 - 38.80	C 40		100% 0% 0%		Stiff indistinctly thinly laminated fissured grey CLAY, with occasional silty partings and pyritic nodules <50mm. *(continued from previous sheet)*			
38		D	38.40								
		C	38.80 - 40.30			100% 0% 0%					
39											
40		D	40.10								
		C	40.30 - 41.80	C 44		100% 0% 0%					
		D	40.60								
41								41.20-43.10m: Becoming slightly sandy.			
		C	41.80 - 43.30			100% 0% 0%					
42											
		CS	42.60 - 43.00								
43		D	43.00						43.10	5.00	
		C	43.30 - 44.90	C 44		94% 0% 0%		Stiff fissured indistinctly thinly laminated slightly sandy silty CLAY, with occasional sandy partings and pyritic nodules <50mm.			
44		D	43.95					43.95-51.30m: With frequent persistent sandy partings.			
		CS	44.05 - 44.50								
45		C	44.90 - 46.40			87% 0% 0%		44.90-45.60m: Stiff.			
46		CS	46.10 - 46.40								
		C	46.40 - 47.90	C*54		100% 0% 0%					

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
13/08/2014	44.90	16.40	5.91
14/08/2014	44.90	16.40	6.08

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ROTARY BOREHOLE LOG

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Borehole No. **BH17**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582472 N 220410	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 48.10mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 31/07/2014 End: 15/08/2014	Logged By WS/MO/SA

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
47		D	46.90					Stiff fissured indistinctly thinly laminated slightly sandy silty CLAY, with occasional sandy partings and pyritic nodules <50mm. *(continued from previous sheet)*	(8.20)		
		CS	47.50 - 47.90		C						
48		C	47.90 - 49.00			81% 0% 0%					
					C						
49		D	48.90								
		C	49.00 - 50.00	C 49		90% 0% 0%					
		D	49.40		C						
50		D	49.90								
		C	50.00 - 51.50			100% 0% 0%					
					C						
51		D	51.00					51.10-51.30m: Becoming very sandy with frequent pyritised wood fragments <25mm, lignitic material <30mm and partings of green sandy clay.	51.30	-3.20	
				C 44				Borehole completed at 51.30m			
52											
53											
54											
55											
56											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
14/08/2014	51.50	16.40	5.55

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TRIAL PIT LOG

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Pit No **BH18**

Sheet 1 of 1

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E N Level: mAD	Date 31/07/2014
Location: Kelvedon, Essex		Dimensions: m Depth 1.20m	Scale 1 : 12.5
Client: Gent Fairhead & Co.			Logged By SA

(m)	Water Levels	Samples & In Situ Testing No/Type	Depth (m)	Result	Description	Depth (m)	Level (mAD)	Legend
					MADE GROUND: Concrete.	(0.25)		
		B	0.20			0.25		
					MADE GROUND: Reddish brown slightly sandy very clayey GRAVEL. Gravel is sub-angular to sub-rounded fine to coarse of flint.	(0.25)		
		B	0.50		Firm to stiff orangish brown gravelly CLAY with occasional fine rootlets. Gravel is sub-angular to sub-rounded fine to coarse to flint and chalk.	0.50		
1		B	1.00			(0.70)		1
					Trial pit completed at 1.20m	1.20		
2								2

REMARKS:

EQUIPMENT: Hand digging tools.

METHOD: Hand dug inspection pit: 0.00-1.20m.

GROUNDWATER: None encountered.

BACKFILL: Inspection pit backfilled with compacted arisings.

COMMENTS: Re-located to BH18A - see separate borehole log.

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ROTARY BOREHOLE LOG

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Borehole No. **BH18A**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582512 N 220442	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 04/08/2014 End: 11/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20					MADE GROUND: Concrete			
		B	0.50					Stiff light orangish brown mottled off white slightly sandy gravely CLAY. Gravel is subangular to subrounded fine to coarse of chalk and flint.	0.30	47.00	
1		B	1.00								1
		UT100	1.20 - 1.65					1.50 - 3.20m: Occasionally mottled grey			
								1.80 - 2.90m: With occasional rootlets			
2		SPT	2.20 - 2.65	S 21							2
		D	2.50 - 2.60					2.75 - 2.85m: 1No. flint cobble recovered as angular gravel			
3		UT100	3.20 - 3.65					3.20 - 5.70m: Tending to orangish brown	(5.80)		3
		D	3.80 - 3.90								
4		SPT	4.20 - 4.65	S 18							4
5		SPT	5.20 - 5.65	S 28							5
		D	5.60 - 5.70					5.70 - 5.80m: Light yellowish grey			
6								5.90 - 6.10m: Frequently speckled dark grey 5.95 - 6.10m: Locally mottled reddish brown 6.10 - 6.20: Clayey	6.10	41.20	6
		CPT	6.40 - 6.50	S*250				Very dense orangish brown gravelly SAND. Gravel is subangular to rounded fine to coarse flint.			
		D	6.65 - 6.75					6.65 - 6.85: Slightly gravelly, indistinctly thinly bedded, sand is predominantly medium, occasionally fine			
7		B	6.85 - 7.80								7
8		B	7.80 - 8.50	S*120				7.80 - 8.55: Slightly gravelly, sand is predominantly			8

REMARKS:

EQUIPMENT: Hand digging tools. Comacchio Geo205 multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128, 113 and 98mm diam) 0.00-16.20m. Waterflush rotary core drilled (116mm and 101mm diam) 16.20-33.00m.
CASING: PW to 19.20m.
GROUNDWATER: None encountered prior to the using water flush to advance casing to 6.40m.
INSTALLATION: Vibrating wire piezometer installed with the tip at 33.00m using the fully grouted method.
COMMENTS: Re-located from BH18 - see separate borehole log.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
04/08/2014	4.20	-	Dry
05/08/2014	4.20	-	Dry

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Borehole No. **BH18A**

Sheet 2 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582512 N 220442	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 04/08/2014 End: 11/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		CPT	7.80 - 9.93					medium Very dense orangish brown gravelly SAND. Gravel is subangular to rounded fine to coarse flint. *(continued from previous sheet)*			
								8.70 - 9.30: Becoming grey			
9		CPT	9.30 - 9.40	S*130							9
									(7.60)		
10		B	10.05 - 10.70					10.05 - 10.20m: Very gravelly			10
		B	10.70 - 12.20	C*143							
		CPT	10.70 - 10.78					10.85 - 12.20: Slightly gravelly			
11											11
12											12
		B	12.20 - 13.50	C*111							
		CPT	12.20 - 12.31								
13											13
		D	13.50 - 13.70					13.5 - 13.7: Light yellowish brown, locally greenish grey silty sand	13.70	33.60	
		CPT	13.70 - 13.78	C*83				Very stiff orangish brown mottled orange locally indistinctly thinly laminated CLAY	(0.55)		
14		D	14.15 - 14.25						14.25	33.05	14
								Very stiff grey occasionally locally mottled greyish brown locally indistinctly thinly laminated CLAY.			
		D	14.65 - 14.95								
15											15
		UT100	15.20 - 15.65								
		D	15.60 - 15.70								
								15.80 - 16.10: Thinly laminated			
16											16
		SPT	16.20 - 16.65	S 40				16.15: 1No. yellowish brown concretion, <40mm			
17		CS	16.95 - 17.45					16.90 - 33.00: Very closely to closely fissured			17
		D	17.45 - 17.55								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
05/08/2014	15.00	15.00	3.17
06/08/2014	15.00	15.00	3.20

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ROTARY BOREHOLE LOG

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Borehole No. **BH18A**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582512 N 220442	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 04/08/2014 End: 11/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18								17.60: 1No. ironstone concretion, <35mm Very stiff grey occasionally locally mottled greyish brown locally indistinctly thinly laminated CLAY. *(continued from previous sheet)*			18
		CS	18.35 - 18.80								
		D	18.80 - 18.90					18.80 - 18.90: 2No. ironstone concretions, <25mm			
19		CPT	19.20 - 19.65	C*57				19.25 - 33.00: Grey silty			19
		D	19.50								
20		CS	20.00 - 20.45								20
								20.50 - 20.55: Slightly gravelly. Gravel is subrounded to rounded fine to medium of mudstone			
21		D	21.10								21
		CS	21.55 - 22.00					21.45 - 21.55: 1No. mudstone band, < 70mm and 1No. pyritised wood fragment, <35mm			
22		CPT	22.00 - 22.45	C 41							22
								24.35: 1No pyritised wood fragment, <50mm			
23		CS	23.20 - 23.65								23
		D	23.60						(18.75)		
24		D	24.00								24
								24.40: 1No. pyrite nodule, <30mm			
		CS	24.70 - 25.15								
25		CPT	25.20 - 25.65	C*59				25.00 - 33.00: Grey			25
		D	25.45								
		CS	25.75 - 26.20								
26		D	26.40								26
		CPT	26.70 - 27.15								
27		CS	27.20 - 27.65								27

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
06/08/2014	20.70	19.20	3.33
07/08/2014	20.70	19.20	0.42

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Borehole No. **BH18A**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582512 N 220442	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.30mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 04/08/2014 End: 11/08/2014	Logged By WS

(m)	Water Levels	Core Run, Samples & Testing No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		D	27.85 - 27.95					Very stiff grey occasionally locally mottled greyish brown locally indistinctly thinly laminated CLAY. *(continued from previous sheet)*			
				C*53							
29		CS	28.80 - 29.25								
		D	28.85					29.25 - 33.00: With occasional silty partings, <25mm			
		D	29.60 - 29.70								
30											
		D	30.55 - 30.65								
31		CS	30.85 - 31.30					31.30 - 33.00: Thinly laminated			
32											
		CS	32.10 - 32.40								
		D	32.50 - 32.60								
33		CPT	33.00 - 33.45	C 33				Borehole completed at 33.00m	33.00	14.30	
34											
35											
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
07/08/2014	28.20	19.20	7.86
08/08/2014	28.20	19.20	8.41
08/08/2014	33.00	19.20	9.36
11/08/2014	33.00	19.20	8.44

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Borehole No. **BH19**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582411 N 220320	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 06/08/2014 End: 13/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20					MADE GROUND: Rough vegetation over soft to firm dark brown mottled orangish brown and light gray slightly sandy gravelly CLAY with frequent rootlets. Gravel is subangular to subrounded fine to coarse brick, concrete, chalk, siliceous material and metal fragments.	0.25	46.95	
		B	0.50						(0.95)		
1		B	1.00					Firm to stiff orangish brown mottled dark brown slightly sandy gravelly CLAY with occasional rootlets. Gravel is subangular to subrounded fine to medium chalk and siliceous material.	1.20	46.00	1
		SPT	1.20 - 1.65	S 14				Stiff to very stiff orangish brown mottled dark brown slightly gravelly CLAY with rare rootlets. Gravel is subangular to subrounded fine to coarse chalk and flint.	(0.80)		
		D	1.60 - 1.70						2.00	45.20	
2		UT100	2.00 - 2.45					Firm to stiff light brown mottled mottled brown gravelly CLAY with rare rootlets (<4mm). Gravel is subangular to subrounded fine to coarse chalk, flint and siliceous material.	(1.00)		2
		D	2.45 - 2.55						3.00	44.20	
3		SPT	3.00 - 3.45	S 17				Firm light brown locally mottled orangish brown and dark brown gravelly CLAY with rare rootlets (<5mm). Gravel is subangular to subrounded fine to coarse chalk and flint. 3.00-5.30m: Dessicated.			3
		D	3.65 - 3.75	H 39							
				H 40							
4		UT100	4.00 - 4.45								4
		D	4.45 - 4.55								
		H	4.60	H 65					(3.40)		
		H	4.75	H 66							
5		SPT	5.00 - 5.45	S 39				5.30-5.50m: Coarse gravel sized chalk clasts with occasional black staining.			5
		D	5.75 - 5.85					5.75-6.00m: Pockets of orangish brown silt.			
6		D	6.20 - 6.30					6.00-6.40m: Tending to brown slightly gravelly clay with occasional rootlets. Dessicated.			6
		B	6.50 - 7.20	S*150				Orangish brown gravelly SAND. Gravel is subangular to subrounded fine to coarse flint and siliceous material.	6.40	40.80	
		SPT	6.50 - 6.71						(0.80)		
7		B	7.20 - 8.00					Orangish brown SAND.	7.20	40.00	7
									(0.80)		
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Comacchio MC300 multi purpose track mounted rig.
METHOD: Hand dug inspection pit: 0.00-1.20m. Continuous dynamic sampled (128, 113 and 98mm diam) 0.00-14.50m. Waterflush rotary core drilled (116 and 101mm diam) 14.50-33.10m.
CASING: 140mm to 13.50m.
GROUNDWATER: None encountered prior to using water flush to advance casing to 6.00m.
INSTALLATION: Bentonite pellet seal: 12.75-33.10m, 50mm ID HDPE slotted pipe with washed gravel response zone: 9.75-12.75m, plain pipe with bentonite pellet seal: 0.20-9.75m, flush 150mm steel cover/raised borehole helmet set in concrete 0.20-0.00m. Gas valve fitted.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
06/08/2014	8.00	6.00	Dry

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Borehole No. **BH19**

Sheet 2 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582411 N 220320	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 06/08/2014 End: 13/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								Orangish brown and brown clayey SAND.	8.00	39.20	
									(0.50)		
		SPT	8.50 - 8.66	S*250				Light grey very silty SAND.	8.50	38.70	
9									(0.80)		9
		D	9.20 - 9.30								
								Orangish brown SAND tending to gravelly sand.	9.30	37.90	
		B	9.50 - 10.90					Brown tending to greyish brown gravelly SAND.	9.50	37.70	
									(0.50)		
10		SPT	10.00 - 10.14	S*273				Greyish brown gravelly SAND. Gravel is subangular to rounded fine to medium flint and siliceous material.	10.00	37.20	10
11								10.90-11.50m: Pockets of silty sand.	(2.00)		11
		SPT	11.50 - 11.76	S*136							
12		D	12.00 - 12.20					Light greenish brown SAND.	12.00	35.20	12
								Dense to very dense light greyish brown gravelly SAND. Gravel is subangular to subrounded fine to coarse flint and siliceous material.	12.30	34.90	
									(0.45)		
		D	12.85 - 12.95					12.50-12.65m: Band of orangish brown tending to greenish brown SAND.	12.75	34.45	
13		UT100	13.00 - 13.45					Stiff orangish brown CLAY.	13.10	34.10	13
								Stiff dark greyish brown CLAY.			
		D	13.45 - 13.55						(0.90)		
		D	13.70 - 13.80								
14		SPT	14.00 - 14.45	S 30				Stiff dark greyish brown CLAY. Fissures are extremely closely spaced, randomly orientated.	14.00	33.20	14
		C	14.50 - 16.00								
		CS	14.80 - 15.25								
15											15
		D	15.60 - 15.70					15.70-15.72m: 20mm band of medium strong grey mudstone.			
16		C	16.00 - 17.50	S 33							16
		SPT	16.00 - 16.45								
		CS	16.45 - 17.00								
17											17
		D	17.20 - 17.30								
		C	17.50 - 19.00								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
07/08/2014	13.00	13.00	5.20

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Borehole No. **BH19**

Sheet 3 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582411 N 220320	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 06/08/2014 End: 13/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		CS	18.00 - 18.45					Stiff dark greyish brown CLAY. Fissures are extremely closely spaced, randomly orientated. *(continued from previous sheet)* 18.00-23.50m: Fissures are very closely spaced, subvertical, smooth, polished and tight.			
		D	18.75 - 18.85						(9.50)		
19		C	19.00 - 20.50	S 40							
		SPT	19.00 - 19.45								
		D	19.10 - 19.20								
20		C	20.50 - 22.50								
21		D	21.10 - 21.20								
		CS	21.55 - 21.90								
22		C	22.00 - 23.50	S 36							
		SPT	22.00 - 22.45								
		CS	22.55 - 23.00								
23		D	23.40 - 23.50								
		C	23.50 - 23.60					Strong light grey MUDSTONE.	23.50	23.70	
		C	23.60 - 25.00					Stiff greyish brown CLAY. Fissures are very closely to closely spaced, subvertical locally randomly orientated, frequently listric, impersistent and tight.	23.60	23.60	
		D	23.80 - 23.90								
24		CS	24.20 - 24.65						(1.40)		
25		C	25.00 - 26.50	S 36				Stiff greyish brown sandy CLAY with frequent mica crystals. Sand is fine grained.	25.00	22.20	
		SPT	25.00 - 25.45								
		D	25.60 - 25.70								
26		CS	25.90 - 26.35								
		C	26.50 - 28.00								
		D	26.70 - 26.80								
27		CS	27.20 - 27.70								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
08/08/2014	19.00	13.50	6.05
11/08/2014	23.60	13.50	3.15

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Borehole No. **BH19**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582411 N 220320	Hole Type DS+RC
Location: Kelvedon, Essex		Level: 47.20mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 06/08/2014 End: 13/08/2014	Logged By SA/MO

(m)	Water Levels	Core Run, Samples & Testing No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		C SPT	28.00 - 29.50 28.00 - 28.45	S 37	C			Stiff greyish brown sandy CLAY with frequent mica crystals. Sand is fine grained. *(continued from previous sheet)*			
		D	28.50 - 28.60		C						
29		CS	28.95 - 29.40					28.75-33.10m: Fissures are closely spaced, subvertical, smooth, tight, polished and persistent for <100mm.	(8.10)		
		C	29.50 - 30.80								
30		CS	29.90 - 30.35		C						
		D	30.55 - 30.65								
31		C SPT	30.80 - 32.20 30.80 - 31.25	S 37							
		D	31.40 - 31.50		C						
32		D C D	32.10 - 32.20 32.20 - 33.10 32.40 - 32.50		C						
33		D SPT	33.00 - 33.10 33.10 - 33.55	S 42				Borehole completed at 33.10m	33.10	14.10	
34											
35											
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
12/08/2014	32.20	13.50	4.90
13/08/2014	33.10	13.50	5.00

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Borehole No. **BH20**

Sheet 1 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582351 N 220274	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 47.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 11/08/2014 End: 22/08/2014	Logged By MO/CS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
		B	0.20 - 0.60					MADE GROUND: Topsoil (Drillers description)			
								MADE GROUND: Brown sandy gravelly CLAY.	0.20	47.30	
									(0.40)		
								Very stiff light brown gravelly CLAY. Gravel is sub-angular to rounded fine to coarse of chalk.	0.60	46.90	
1		B	1.00 - 1.20								1
		SPT	1.50 - 1.95	S 34							
2											2
		D	2.25								
		UT100	2.50 - 2.95								
3		D	3.00								3
		D	3.25								
		SPT	3.50 - 3.95	S*51					(5.90)		
4											4
		D	4.25								
		SPT	4.50 - 4.95	S*51				4.50-4.95m: With occasional flint gravel.			
5											5
		D	5.50					5.50m: Cobble of flint noted.			
6		UT100	6.00 - 6.45								6
		D	6.50						6.50	41.00	
								Stiff orangish brown sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse of flint and chalk.	(0.50)		
7		B	7.00 - 7.20						7.00	40.50	7
		D	7.00					Stiff brown sandy gravelly CLAY. Gravel is sub-angular to rounded fine to coarse of siliceous lithologies.	7.20	40.30	
		CPT	7.50 - 7.95	C 48				Dense brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to coarse of siliceous lithologies.			
8											8

REMARKS:

EQUIPMENT: Hand digging tools. Pilcon 1500 cable percussion drilling rig. Comacchio MC300 multi purpose drilling rig and Comacchio MC305 multi purpose drilling rig
METHOD: Hand dug inspection pit: 0.00-1.20m. Cable percussive boring using 200mm diam tools: 1.20-7.50m and 150mm diam tools: 7.50-14.00m. Continuous dynamic sampled (113mm diam) 14.00-14.50m. Waterflush rotary core drilled (116mm diam) 14.50-34.00m.
CASING: 200mm to 2.50m 150mm to 13.30m. 140mm to 14.00m.
GROUNDWATER: None encountered prior to adding water to assist drilling 7.50-12.90m.
BACKFILL: Borehole backfilled with bentonite pellets: 0.00-34.00m.

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH20**

Sheet 2 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582351 N 220274	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 47.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 11/08/2014 End: 22/08/2014	Logged By MO/CS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
								Dense brown SAND and GRAVEL. Gravel is sub-angular to rounded fine to coarse of siliceous lithologies. *(continued from previous sheet)*	(1.80)		
		D	8.50					8.50m: Lens of stiff greyish brown sandy silty clay.			
9		B	9.00 - 9.50	S*85				Very dense light brown gravelly SAND. Gravel is sub-angular to rounded of siliceous lithologies.	9.00	38.50	9
		SPT	9.00 - 9.33						(1.00)		
10		D	10.00					Very dense light brown sandy GRAVEL. Gravel is sub-angular to rounded fine to coarse of siliceous lithologies.	10.00	37.50	10
		CPT	10.50 - 10.78	C*116							
11		D	11.50						(2.90)		11
12		CPT	12.00 - 12.27	C*132							12
13		B	13.00 - 13.50					Firm to stiff brown mottled orange CLAY.	12.90	34.60	13
									(0.60)		
		UT100	13.50 - 13.95					Very stiff very closely to closely fissured locally thinly laminated greyish brown silty CLAY with rare off white comminuted fossil/shell fragments.	13.50	34.00	
14		D	14.00								14
		C	14.50 - 14.95	S 43	C	100% 0% 0%					
		SPT									
15		C	14.95 - 16.20		C	100% 0% 0%					15
16		C	16.20 - 16.70		C	100% 0% 0%					16
		D	16.60								
		C	16.70 - 18.20	C 38		100% 0% 0%					
17		CPT	16.70 - 17.15		C						17
		CS	17.20 - 17.50								

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
11/08/2014	14.00	13.30	Wet
15/08/2014	14.00	Nil	-
15/08/2014	14.00	14.00	5.00
20/08/2014	14.00	14.00	4.75
20/08/2014	16.70	16.70	6.50
21/08/2014	16.70	16.70	6.77

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Borehole No. **BH20**

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582351 N 220274	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 47.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 11/08/2014 End: 22/08/2014	Logged By MO/CS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
18		D	17.80					Very stiff very closely to closely fissured locally thinly laminated greyish brown silty CLAY with rare off white comminuted fossil/shell fragments. *(continued from previous sheet)*			
		C	18.20 - 19.70	C 36		95% 0% 0%					
		CPT	18.20 - 18.65								
		D	18.60					18.78-18.84m: Phosphatic nodule.			
19		CS	19.00 - 19.30								
		C	19.70 - 21.20			97% 0% 0%					
20		D	20.20					20.45-20.49m: With frequent pyritised fossil fragments.			
		CS	20.60 - 20.90								
21		C	21.20 - 22.70	C 43		97% 0% 0%					
		CPT	21.20 - 21.65								
		D	21.60								
22		CS	22.05 - 22.35								
		C	22.70 - 24.20			100% 0% 0%		22.55m: Coarse gravel sized siltstone nodule. 22.70-23.90m: Firm/wet. (Possible drilling disturbance)			
23		D	23.50					23.70m: 10mm lignite fragment.	(20.50)		
24		D	24.00								
		C	24.20 - 25.70	C 42		98% 0% 0%					
		CPT	24.20 - 24.65								
		D	24.70								
25		CS	25.10 - 25.40								
		C	25.70 - 27.20			98% 0% 0%					
26		D	26.10								
		CS	26.45 - 26.75								
27		C	27.20 - 28.80	C 39		100%					

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)

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Borehole No. **BH20**

Sheet 4 of 4

Project Name: Rivenhall Airfield IWMF	Project No: **C4237**	Co-ords: E 582351 N 220274	Hole Type CP+RC
Location: Kelvedon, Essex		Level: 47.50mAD	Scale 1 : 50.00
Client: Gent Fairhead & Co.		Dates: Start: 11/08/2014 End: 22/08/2014	Logged By MO/CS

(m)	Water Levels	Core Run, Samples & Testing: No/Type	Depth (m)	Result	Core Run & Sample	TCR SCR RQD	Install	Description	Depth (m)	Level (mAD)	Legend
28		CPT	27.20 - 27.65			0% 0%		Very stiff very closely to closely fissured locally thinly laminated greyish brown silty CLAY with rare off white comminuted fossil/shell fragments. *(continued from previous sheet)*			
		D	27.70		C						
29		C	28.80 - 30.40			97% 0% 0%					
		CS	29.20 - 29.50		C						
30		D	29.80					29.90m: 15mm Pyritic nodule. Recovered as angular fine to coarse gravel fragments.			
		C	30.40 - 32.00	C 47		86% 0% 0%					
		CPT	30.40 - 30.85								
31		D	30.90								
		CS	31.10 - 31.40		C						
32		C	32.00 - 33.60			86% 0% 0%					
		D	32.30								
33		CS	32.60 - 32.90		C						
		C	33.60 - 34.00		C	100% 0% 0%					
34		CPT	34.00 - 34.45	C 46				Borehole completed at 34.00m	34.00	13.50	
35											
36											
37											

Groundwater:

Date	Strike Depth (m)	Casing Depth (m)	Depth After Observation (m)

Hole Progress:

Date	Hole Depth (m)	Casing Depth (m)	Water Depth (m)
21/08/2014	30.40	16.70	4.80
22/08/2014	30.40	16.70	7.01
22/08/2014	34.00	16.70	4.55

APPENDIX C

Appendix C – Laboratory Test Results

PSL
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LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/3857

Client's Reference: Report Date: 21 August 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester
GL3 1DL

For the attention of: Simon Arinze

Contract Title: Rivenhall Airfield IWMF

Date Received: 31/7/2014
Date Commenced: 31/7/2014
Date Completed: 21/8/2014

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

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

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

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Doncaster DN4 0AR
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fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH1	2	B	1.00	Light brown slightly gravelly slightly sandy silty CLAY.
BH1	3	U	1.20-1.65	Very stiff light brown gravelly slightly sandy silty CLAY.
BH1	7	U	3.20-3.65	Very stiff light brown gravelly slightly sandy silty CLAY.
BH1	8	D	3.70	Light brown slightly gravelly slightly sandy silty CLAY.
BH1	11	U	5.20-5.65	Very stiff brown gravelly slightly sandy silty CLAY.
BH1	12	D	5.55	Brown gravelly sandy silty CLAY.
BH1	16	U	8.00-8.45	Stiff brown very gravelly sandy silty CLAY.
BH1	21	B	11.00-11.50	Brown very gravelly slightly silty SAND.
BH1	23	B	12.50-13.00	Brown sandy slightly silty GRAVEL.
BH1	30	U	16.00-16.30	Very stiff dark brown slightly sandy silty CLAY.
BH1	33	D	17.50	Dark brown slightly sandy silty CLAY.
BH1	37	D	19.35	Dark brown slightly sandy silty CLAY.
BH1	40	U	21.00-21.35	Very stiff dark brown slightly sandy silty CLAY.
BH1	47	D	24.30	Dark brown slightly sandy silty CLAY.
BH3	9	U	4.20-4.65	Dark brown slightly sandy silty CLAY.
BH3	13	D	6.20	Dark brown slightly sandy silty CLAY.
BH3	17	U	8.20-8.65	Dark brown slightly sandy silty CLAY.
BH3	23	D	11.50	Dark brown slightly sandy silty CLAY.
BH9	9	U	4.20-4.55	Very stiff dark brown slightly sandy silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	20/08/14		21/08/14		21/08/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3857

Client Ref: C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH9	10	D	4.60	Dark brown silty CLAY.
BH11		D	4.10-4.20	White CHALK.
BH11		B	7.15-7.85	Brown very gravelly slightly silty SAND.
BH11		B	11.85-12.55	Brown very gravelly slightly silty SAND.
BH13		C	11.80-12.25	Stiff dark brown slightly sandy silty CLAY.
BH13		D	14.20	Dark brown slightly sandy silty CLAY.
BH13		C	15.00-15.45	Dark brown slightly sandy silty CLAY.
BH13		D	17.10-17.20	Dark brown slightly sandy silty CLAY.
BH13		C	18.20-18.60	Dark brown slightly sandy silty CLAY.
BH13		C	19.75-20.2	Stiff dark brown slightly sandy silty CLAY.
BH13		D	20.20-20.65	Dark brown slightly sandy silty CLAY.
BH13		D	22.00-22.10	Dark brown slightly sandy silty CLAY.
BH13		C	22.55-23.00	Dark brown slightly sandy silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	20/08/14		21/08/14		21/08/14

RIVENHALL AIRFIELD IWMF.

Contract No:	PSL14/3857
Client Ref:	C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH1	2	B	1.00	17								
BH1	8	D	3.70	18								
BH1	12	D	5.55	20				42	20	22	83	Intermediate plasticity CI.
BH1	33	D	17.50	28								
BH1	37	D	19.35	28				57	25	32	100	High plasticity CH.
BH1	47	D	24.30	27				56	26	30	100	High plasticity CH.
BH3	13	D	6.20	27								
BH3	23	D	11.50	29				53	23	30	100	High plasticity CH.
BH9	10	D	4.60	28				52	23	29	100	High plasticity CH.
BH11		D	4.10-4.20	24								
BH13		D	14.20	28								
BH13		D	17.10-17.20	28				53	24	29	100	High plasticity CH.
BH13		D	20.20-20.65	29				55	25	30	100	High plasticity CH.
BH13		D	22.00-22.10	30								

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

PSL Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	20/08/14		21/08/14		21/08/14

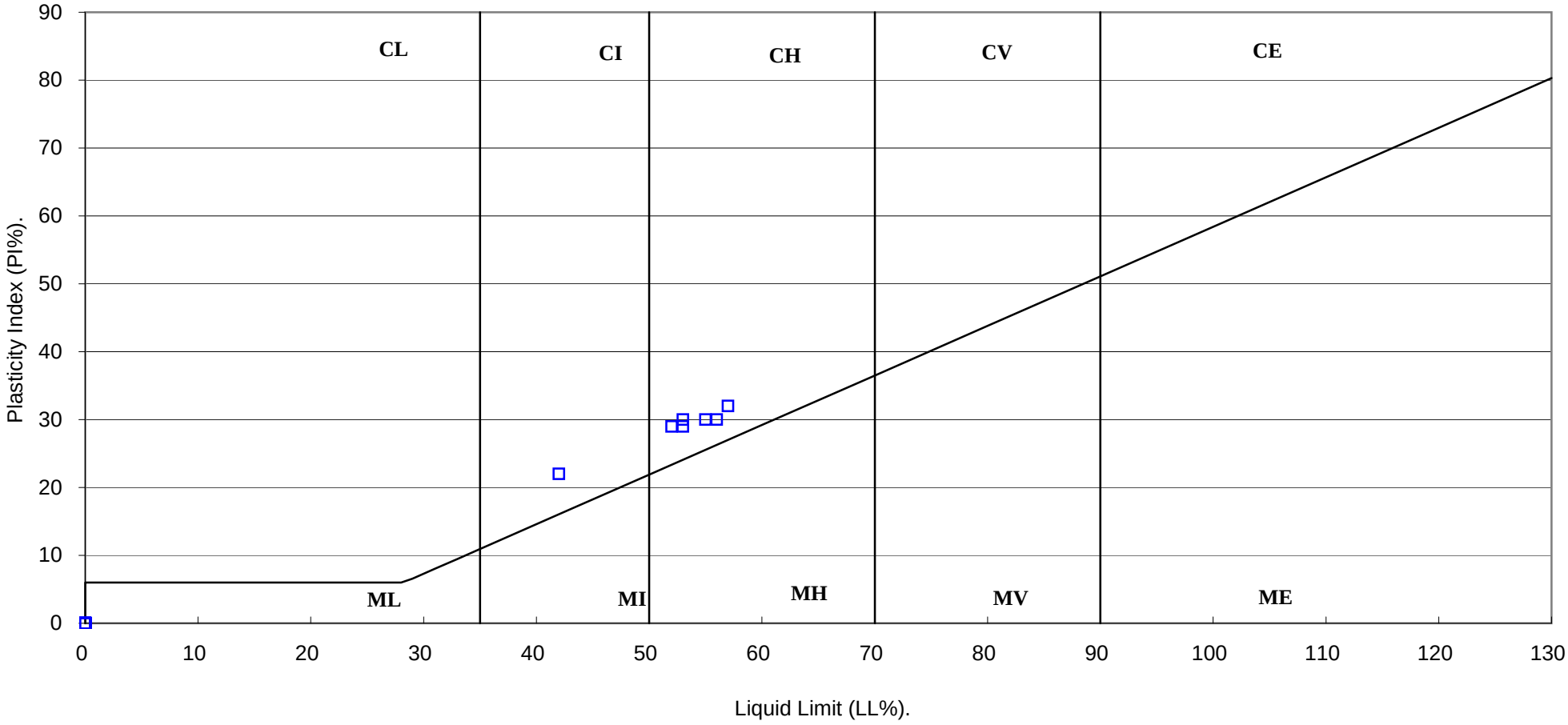
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/3857**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	**Compiled by**	**Date**	**Checked by**	**Date**	**Approved by**	**Date**
		20/08/14		21/08/14		21/08/14
	RIVENHALL AIRFIELD IWMF.				**Contract No:**	**PSL14/3857**
					Client Ref:	**C4237**

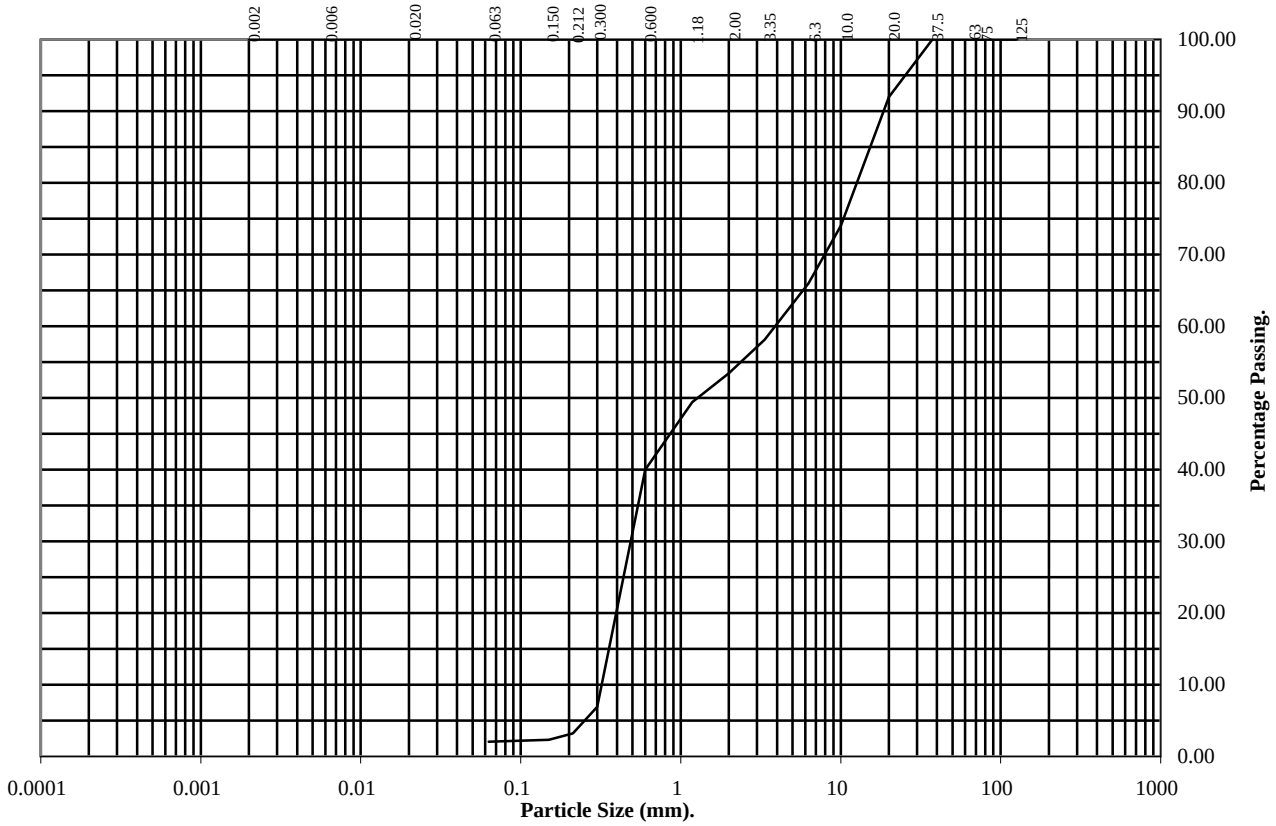
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH1** **Depth (m):** **11.00-11.50**

Sample Number: **21** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	74
6.3	66
3.35	58
2	53
1.18	49
0.6	40
0.3	7
0.212	3
0.15	2
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	47
Sand	51
Silt / Clay	2

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	20/08/14		20/08/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3857**

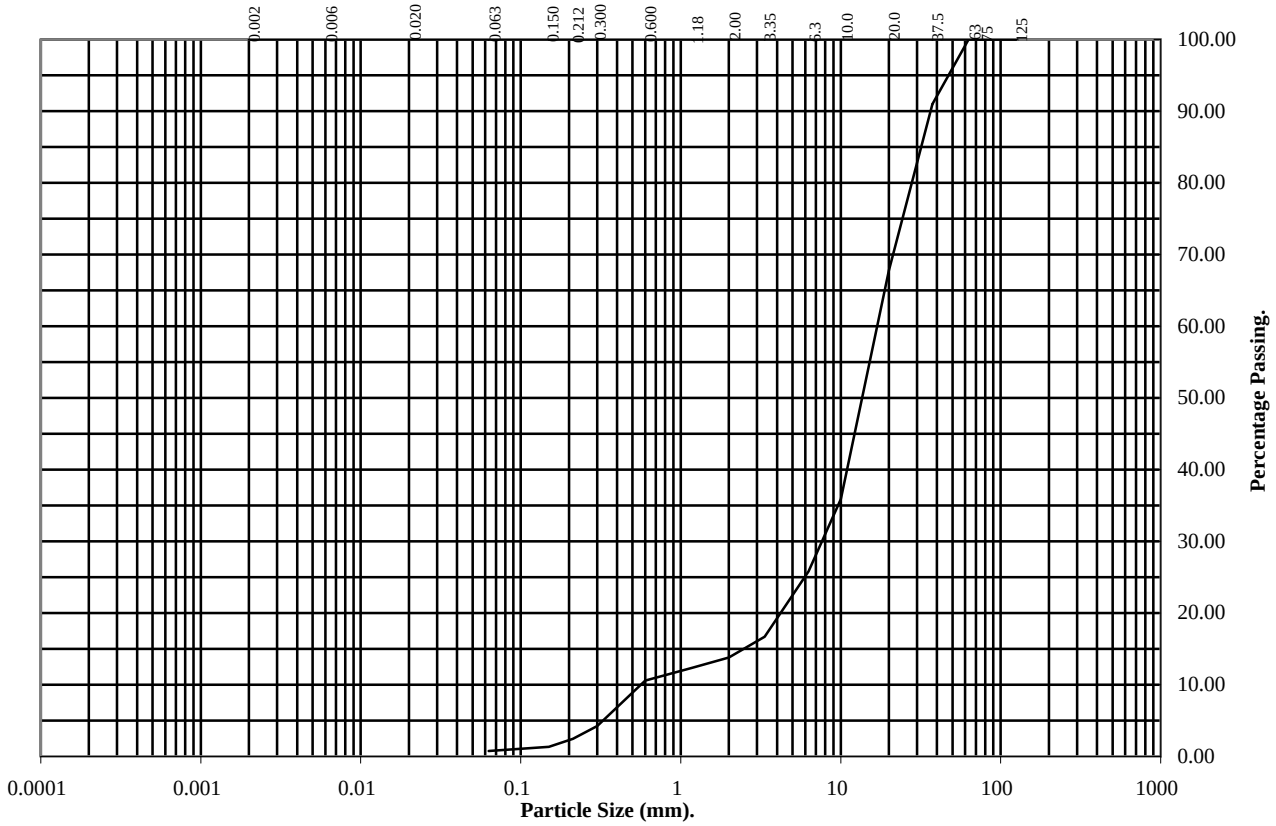
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH1** **Depth (m):** **12.50-13.00**

Sample Number: **23** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	91
20	68
10	36
6.3	26
3.35	17
2	14
1.18	12
0.6	11
0.3	4
0.212	2
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	86
Sand	13
Silt / Clay	1

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	20/08/14		20/08/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3857**

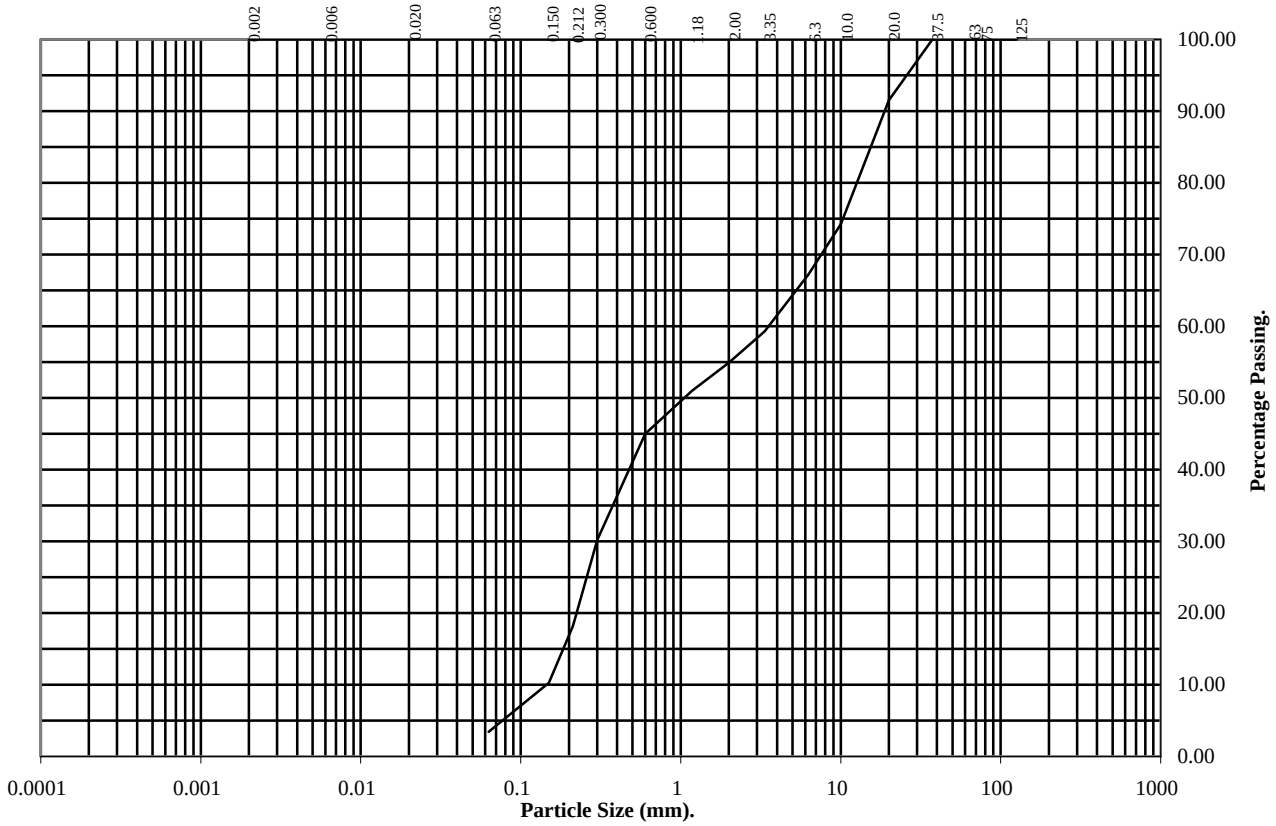
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH11** **Depth (m):** **7.15-7.85**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	74
6.3	67
3.35	59
2	55
1.18	51
0.6	45
0.3	30
0.212	18
0.15	10
0.063	3

Soil Fraction	Total Percentage
Cobbles	0
Gravel	45
Sand	52
Silt / Clay	3

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	21/08/14		21/08/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3857**

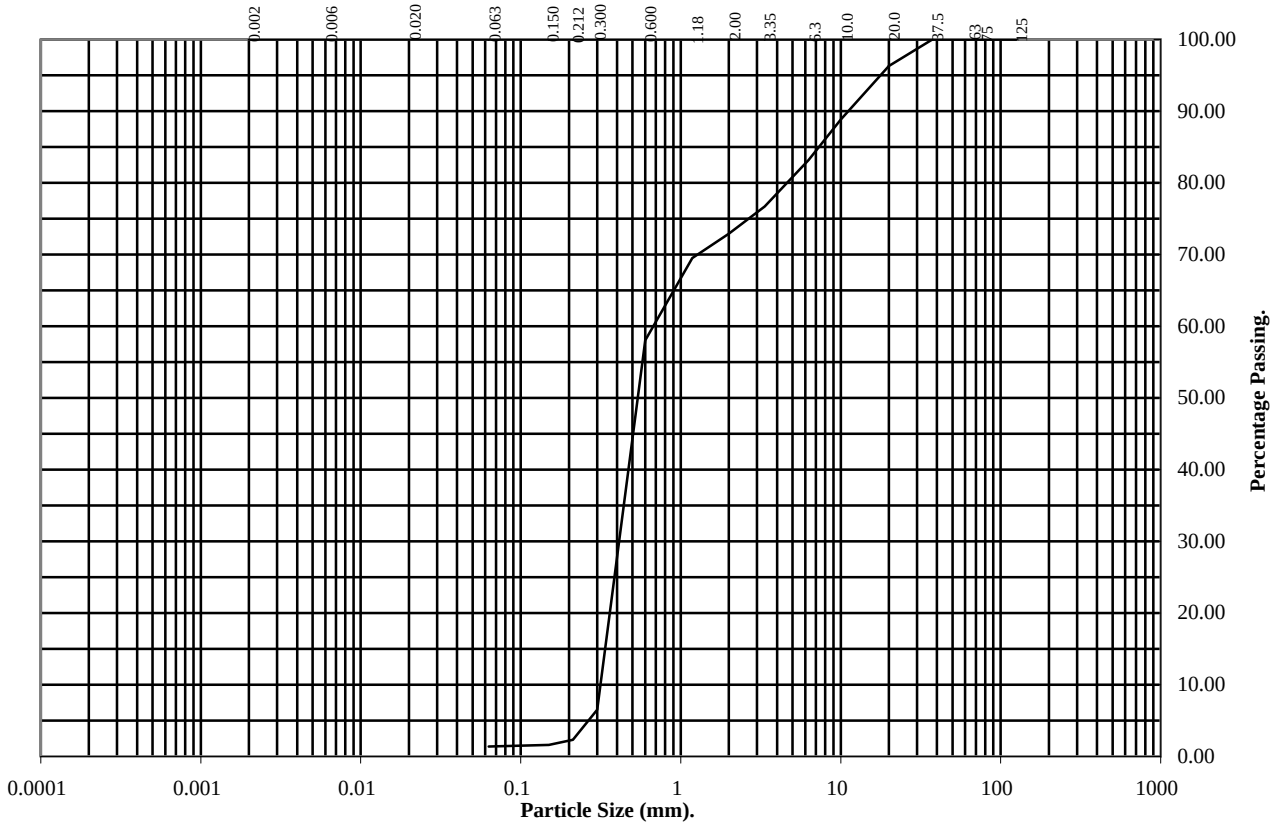
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH11** **Depth (m):** **11.85-12.55**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	89
6.3	83
3.35	77
2	73
1.18	70
0.6	58
0.3	6
0.212	2
0.15	2
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	27
Sand	72
Silt / Clay	1

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	21/08/14		21/08/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3857**

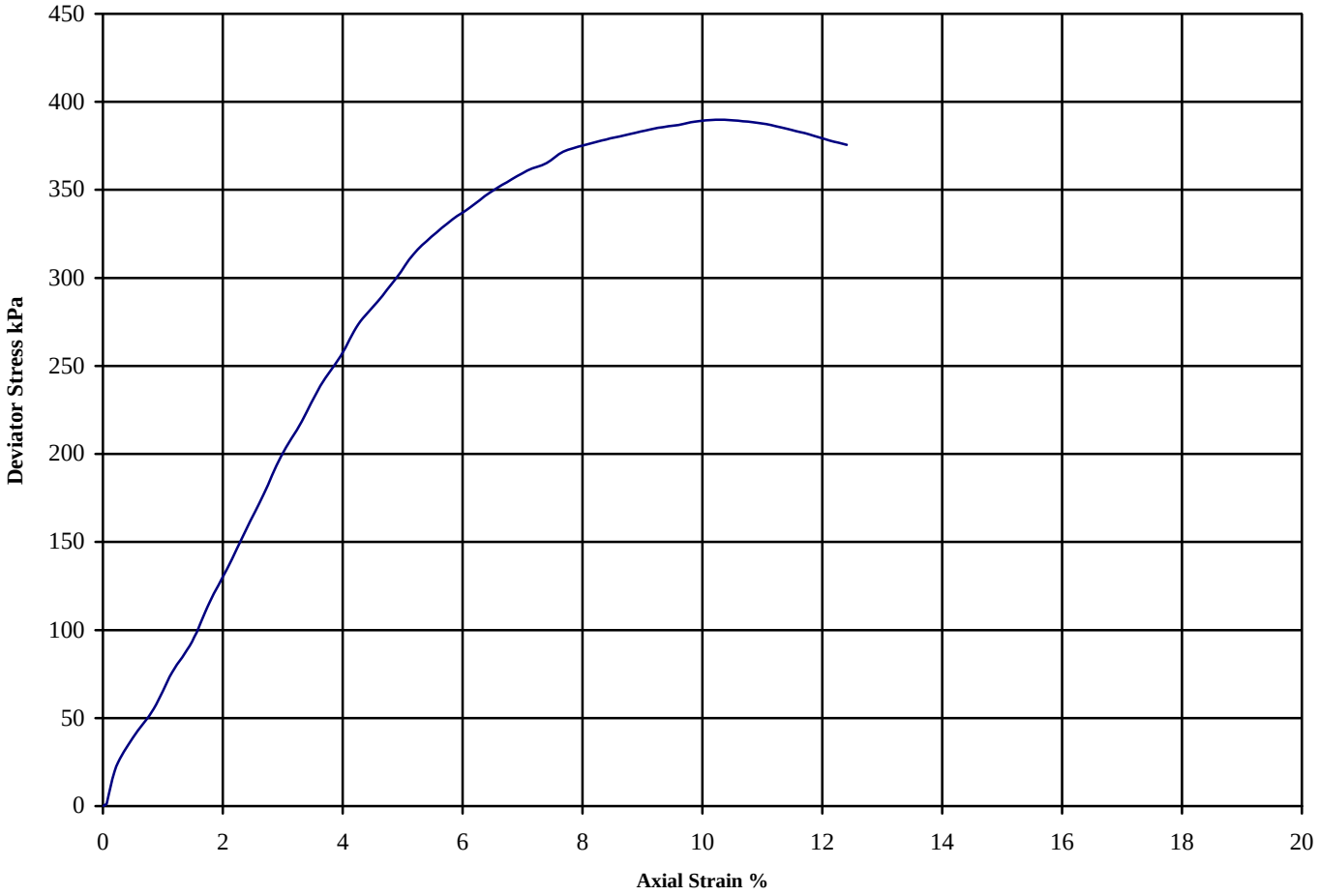
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH01 **Depth (m):** 1.20-1.65

Sample Number: 3 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.11	1.80	32	390	195	10.5	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	20/08/14	ES	20/08/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

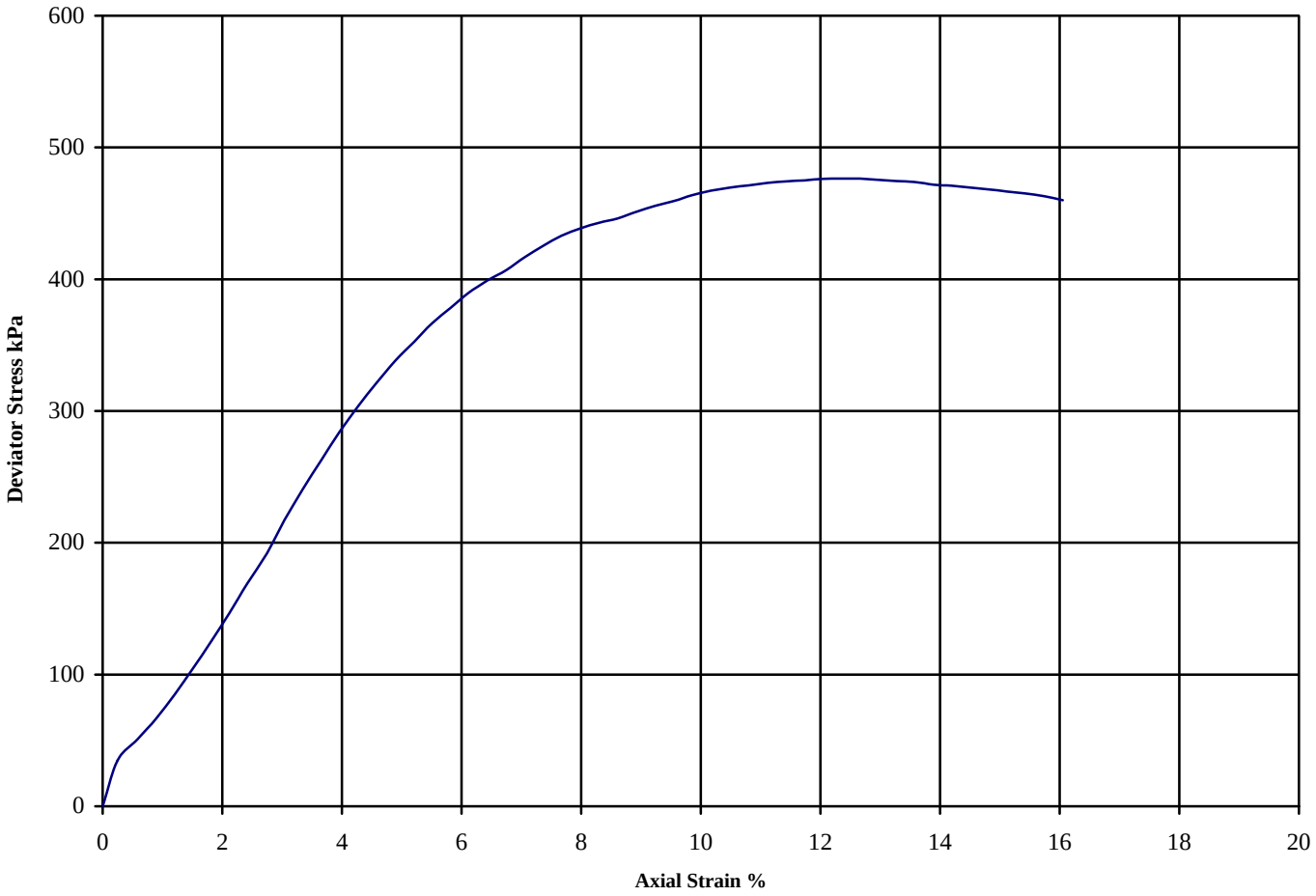
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH01 **Depth (m):** 3.20-3.65

Sample Number: 7 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.11	1.79	75	476	238	12.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	20/08/14	ES	20/08/14

Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

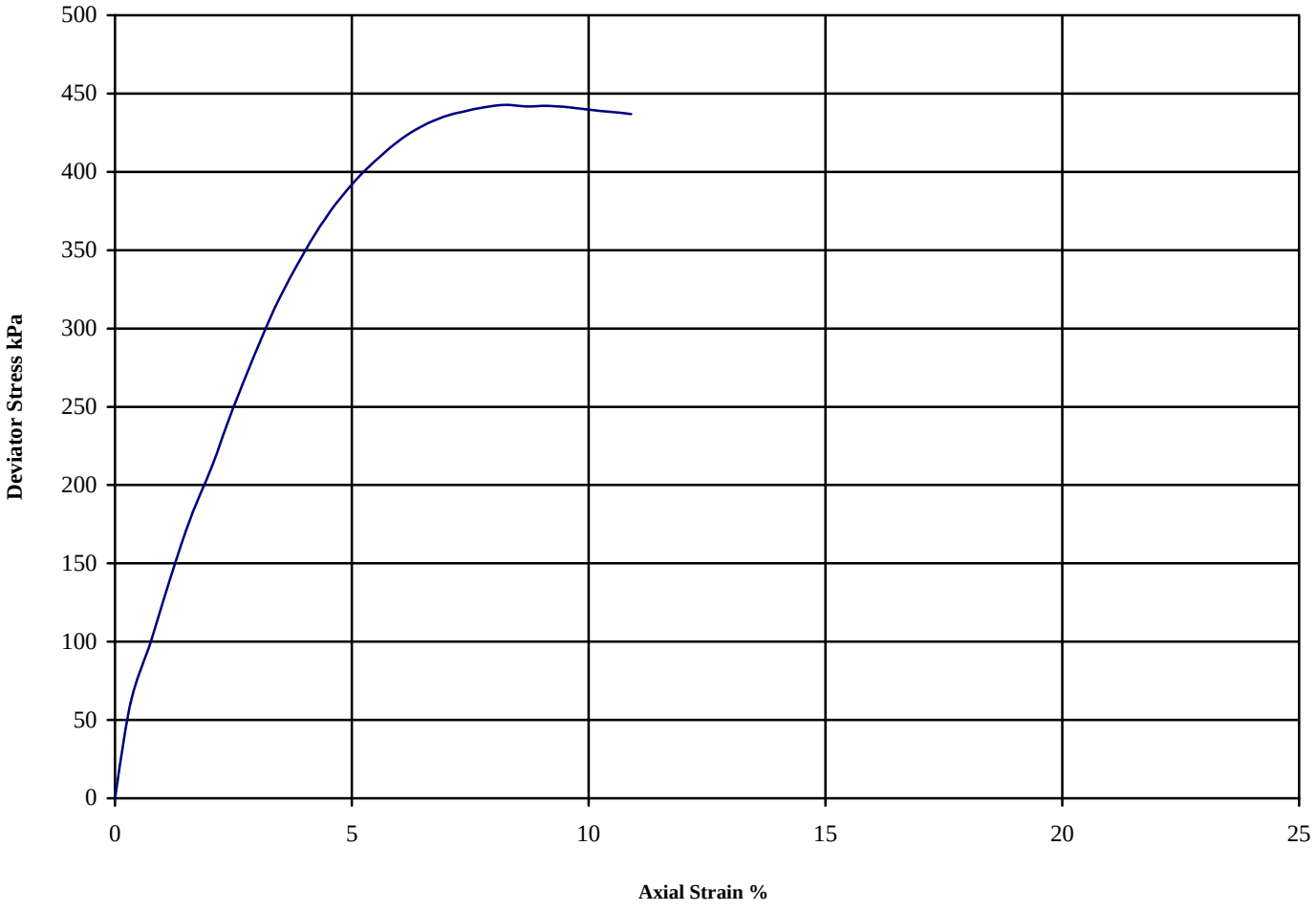
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH01 **Depth (m):** 5.20-5.65

Sample Number: 11 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		150.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.19	1.86	115	443	221	8.2	Brittle	Sample taken from top of tube Rate of strain = 2.6 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	20/08/14	ES	20/08/14

Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

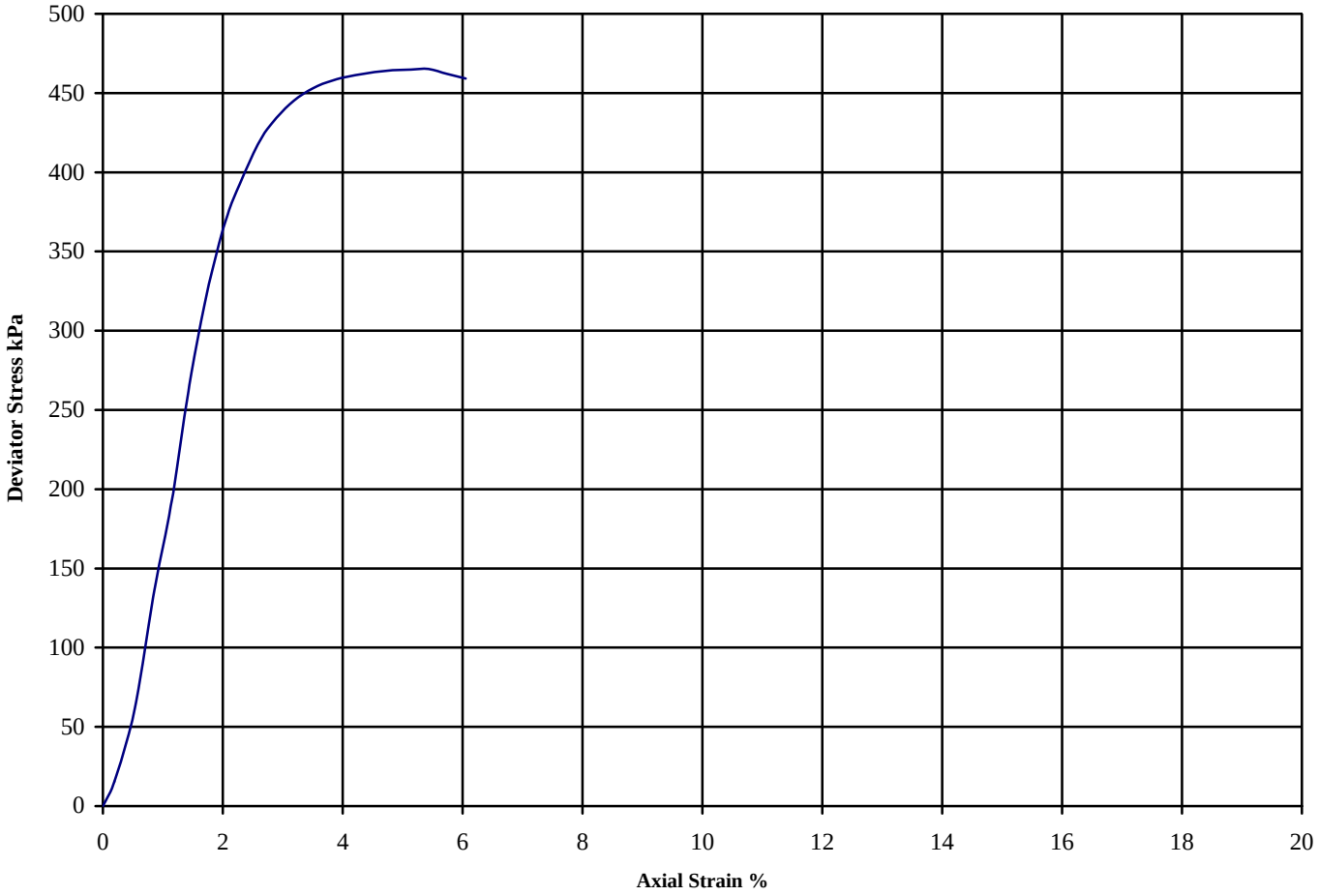
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH01 **Depth (m):** 16.0-16.30

Sample Number: 30 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.03	1.61	325	465	233	5.4	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	21/08/14	ES	21/08/14

Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

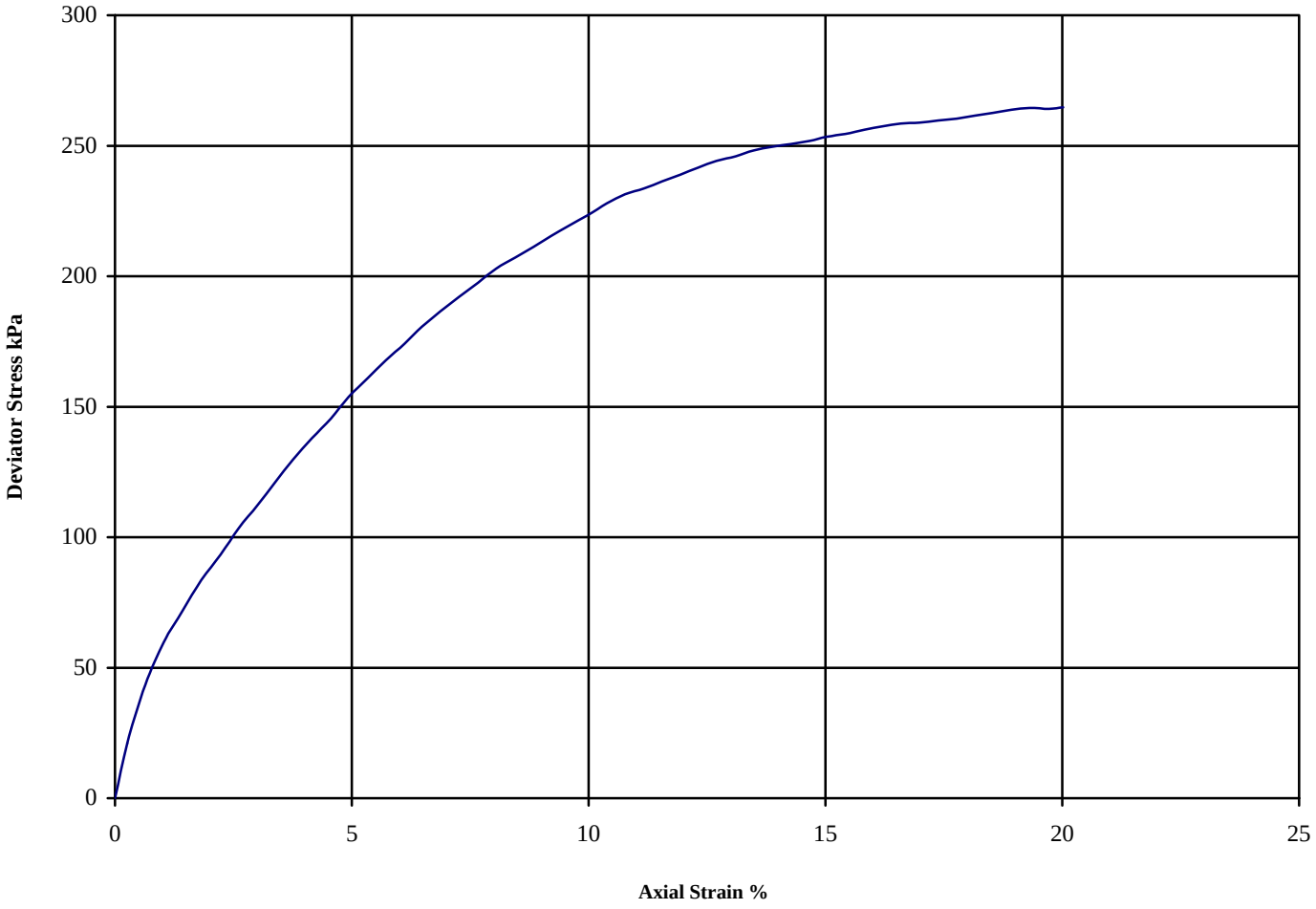
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH01 **Depth (m):** 8.00-8.45

Sample Number: 16 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		167.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	16	2.18	1.88	175	265	132	20.0	Compound	Sample taken from top of tube Rate of strain = 2.3 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.33 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	20/08/14	ES	20/08/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

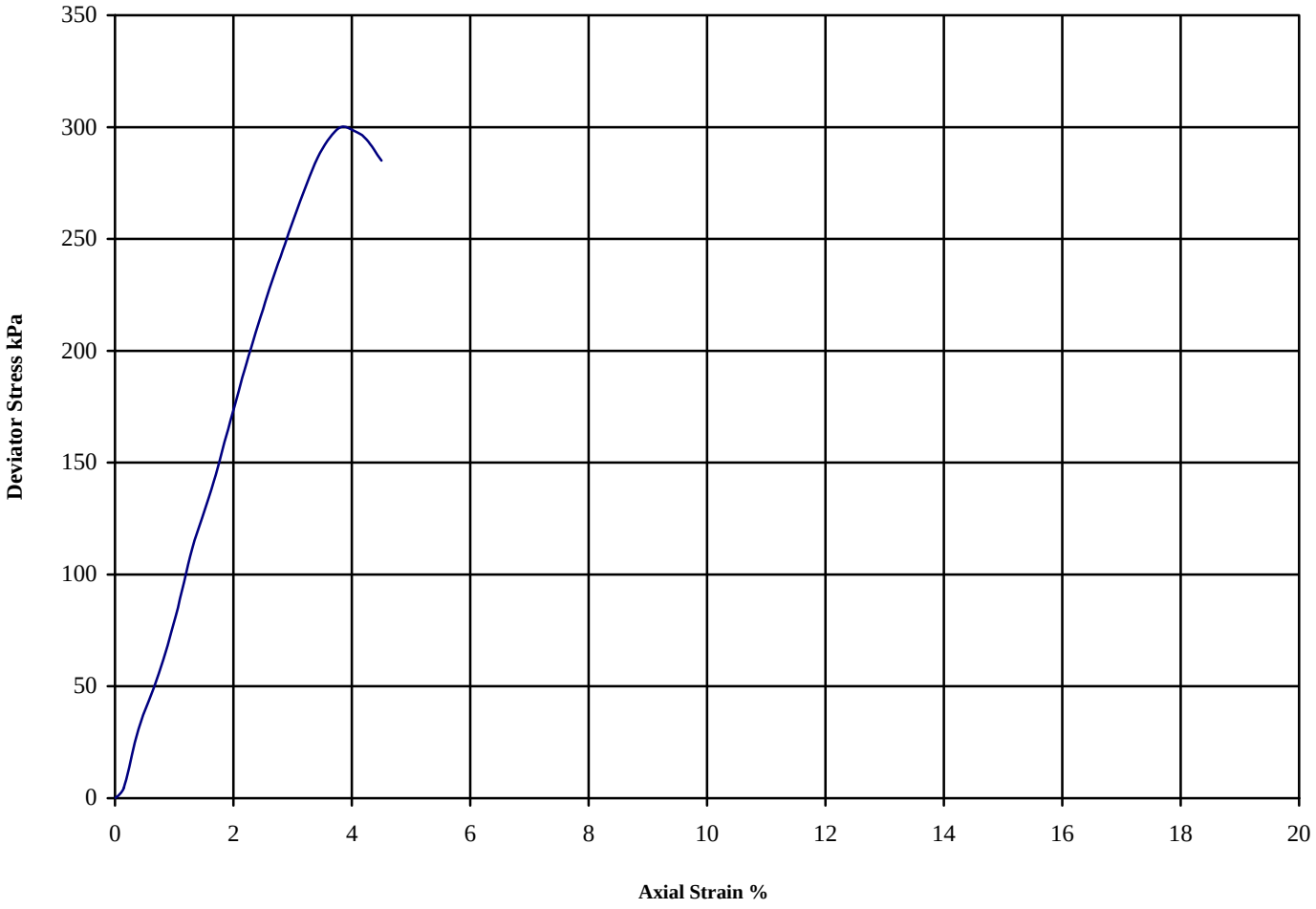
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH1 **Depth (m):** 21.00-21.35

Sample Number: 40 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	2.00	1.57	435	300	150	3.8	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.37 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	21/08/14	ES	21/08/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF

Contract No: PSL14/3857

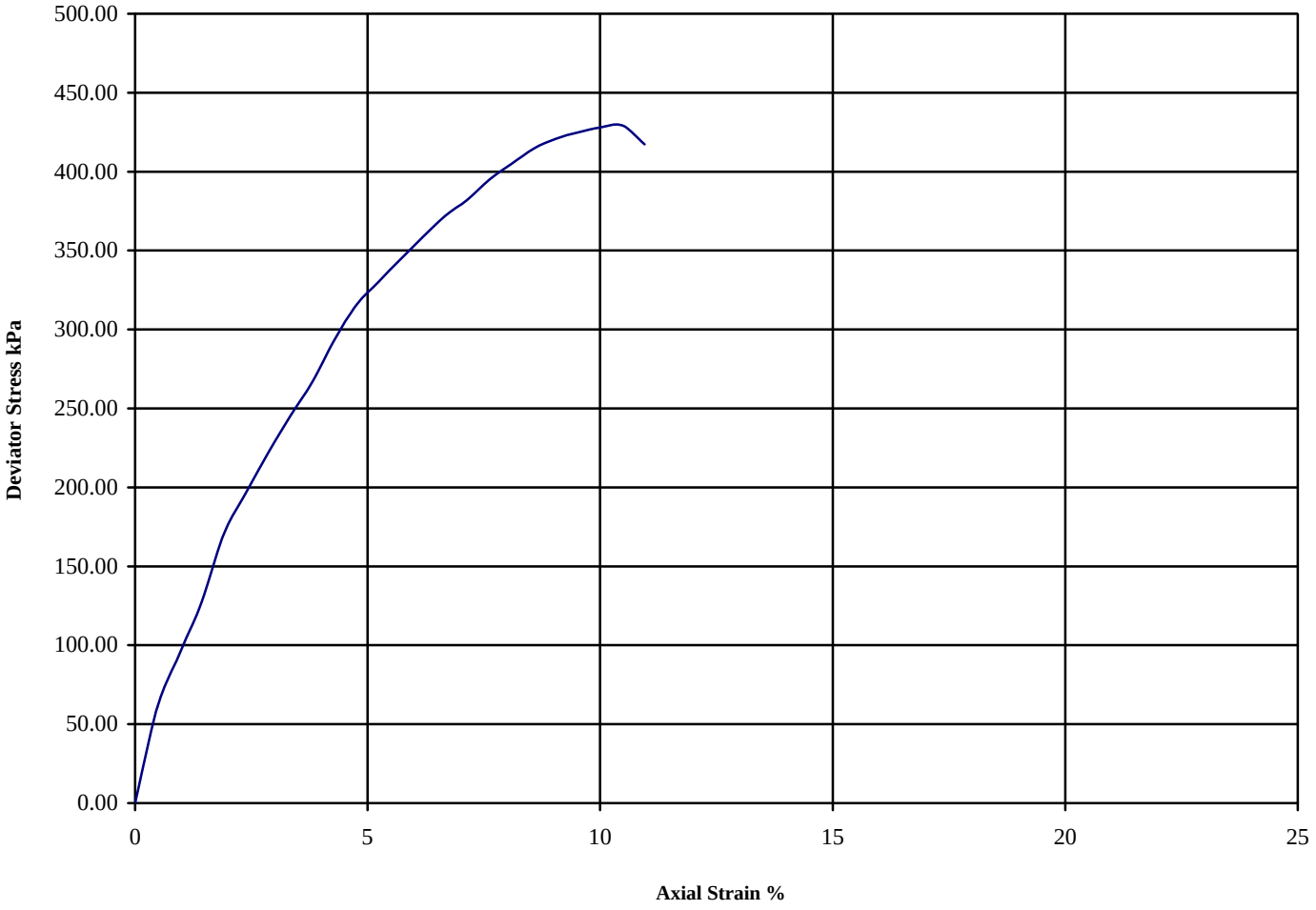
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH9 **Depth (m):** 4.20-4.55

Sample Number: 9 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.02	1.60	340	429	215	10.5	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
CS	21/08/14	CS	21/08/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3857

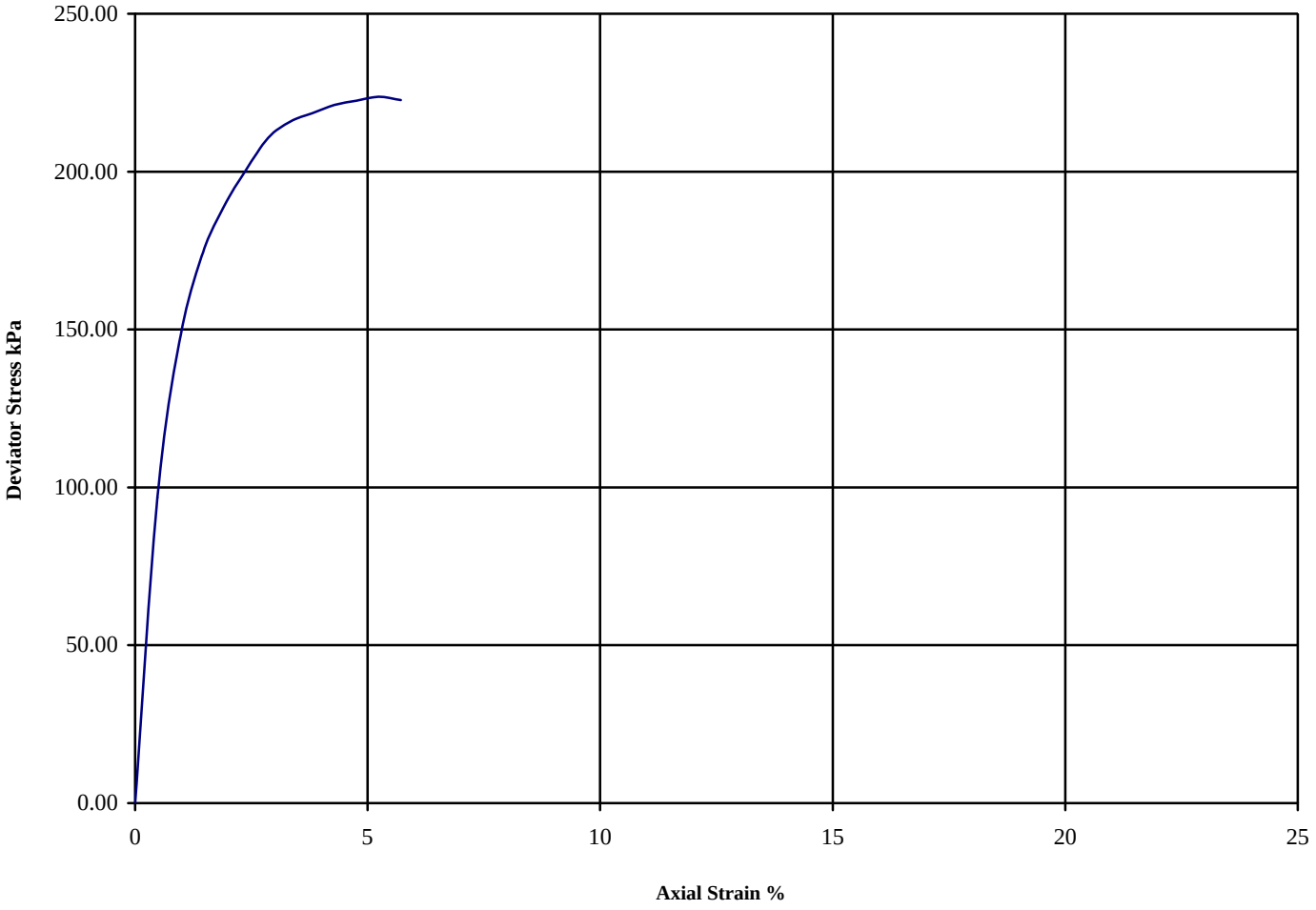
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH13** **Depth (m):** **11.80-12.25**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.98	1.55	305	224	112	5.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	21/08/14		21/08/14

PSL
Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3857

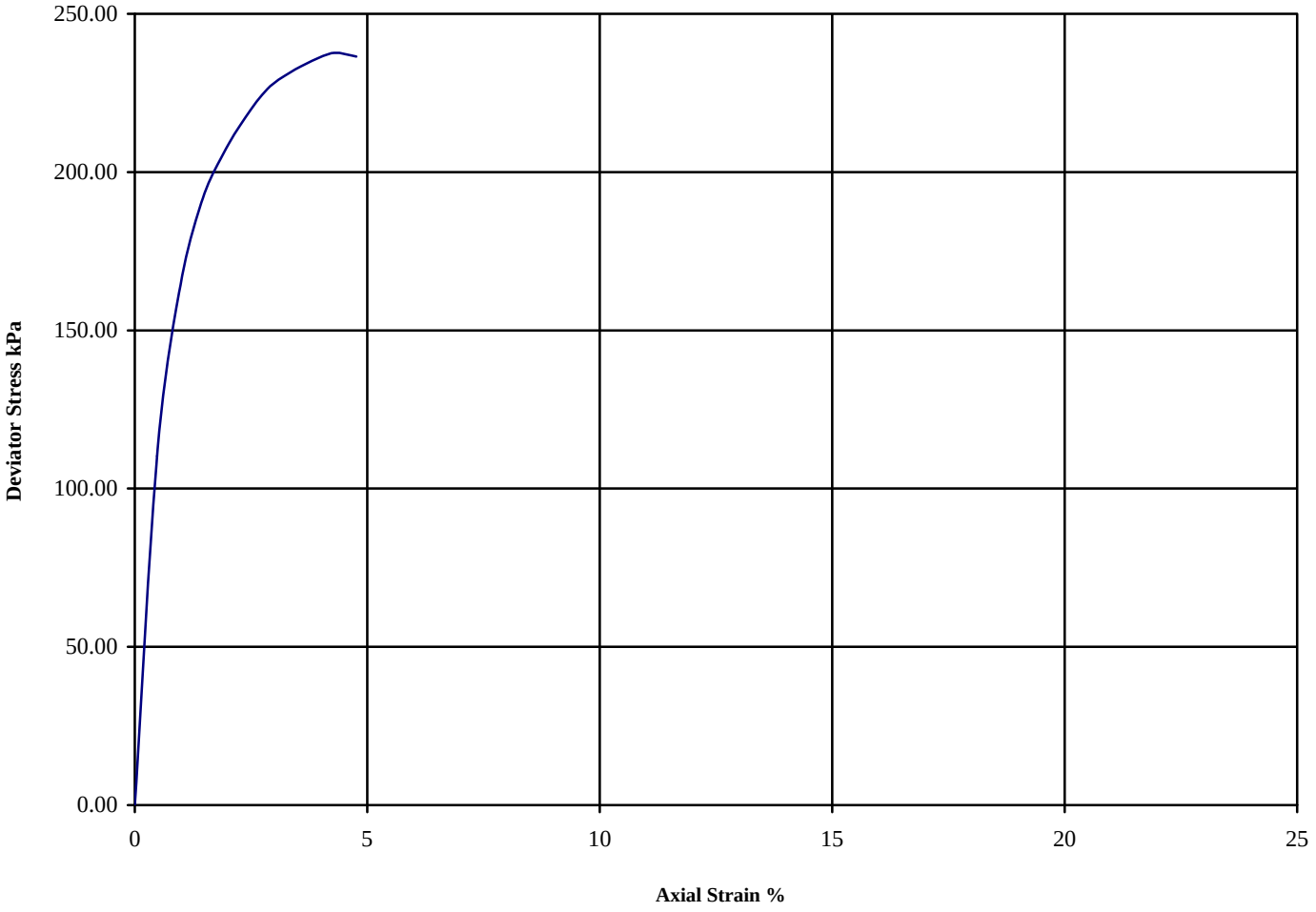
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH13** **Depth (m):** **19.75-20.20**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.03	1.59	480	238	119	4.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
ES	21/08/14	ES	21/08/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3857

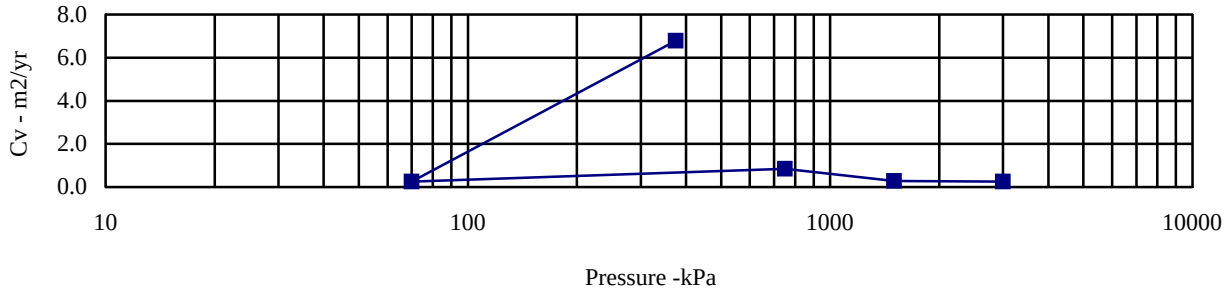
One Dimensional Consolidation Properties

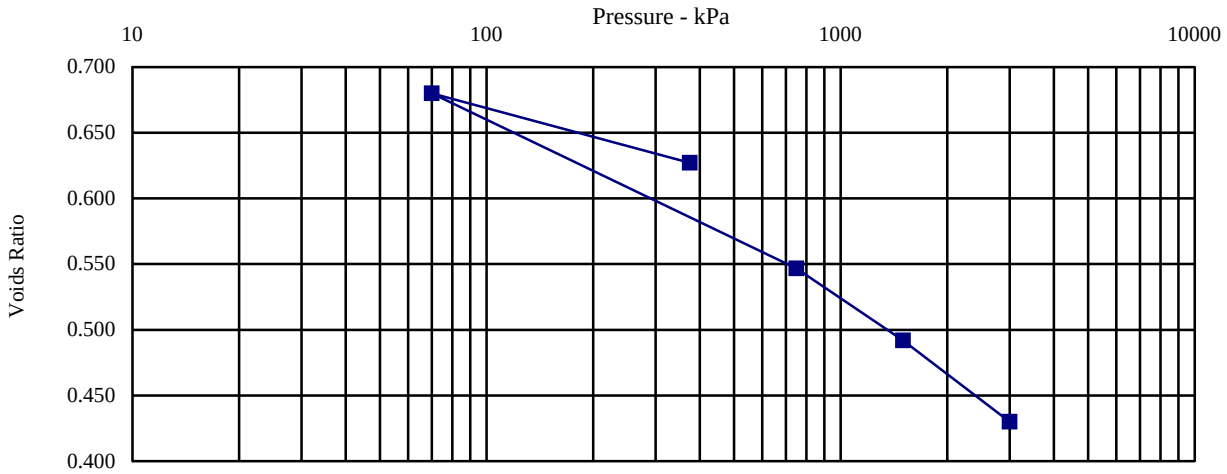
BS 1377: Part 5: 1990

Hole Number: **BH3** **Depth (m):** **4.20-4.65**

Sample Number: **9** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	23							
Bulk Density (Mg/m3):	1.90	0	-	375	0.129	6.785	Method used to	
Dry Density (Mg/m3):	1.55	375	-	70	0.107	0.252	determine CV:	t90
Voids Ratio:	0.710	70	-	750	0.117	0.840	Nominal temperature	
Degree of saturation:	85.2	750	-	1500	0.047	0.285	during test ' C:	20
Height (mm):	20.11	1500	-	3000	0.028	0.258	Remarks:	
Diameter (mm)	75.15						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





Checked by	Date	Approved by	Date
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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/3857** Page of

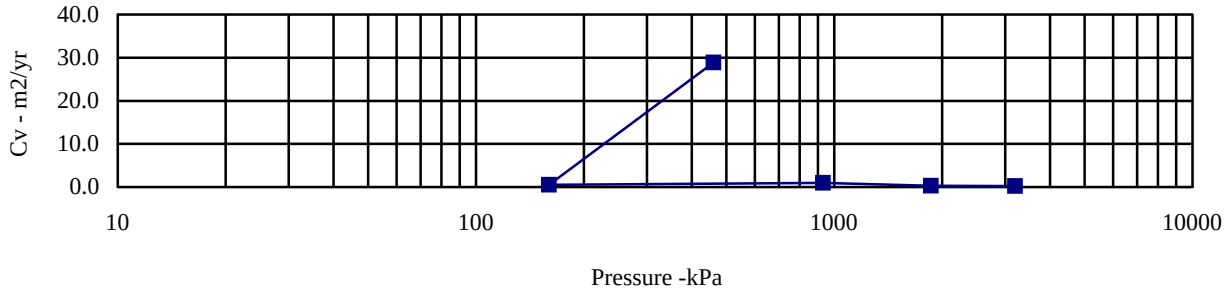
One Dimensional Consolidation Properties

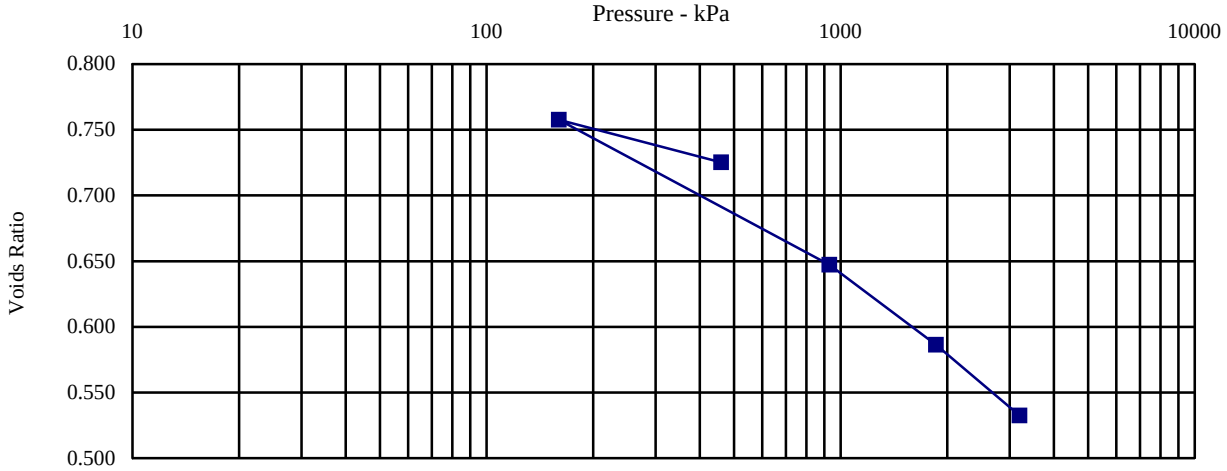
BS 1377: Part 5: 1990

Hole Number: **BH3** **Depth (m):** **8.20-8.65**

Sample Number: **17** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.87	0	-	460	0.100	28.840	Method used to	
Dry Density (Mg/m3):	1.47	460	-	160	0.063	0.505	determine CV:	t90
Voids Ratio:	0.808	160	-	930	0.082	0.987	Nominal temperature	
Degree of saturation:	89.6	930	-	1860	0.040	0.287	during test ' C:	20
Height (mm):	20.21	1860	-	3200	0.025	0.258	Remarks:	
Diameter (mm)	75.17						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





Checked by	Date	Approved by	Date
	21/08/14		21/08/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/3857** Page of

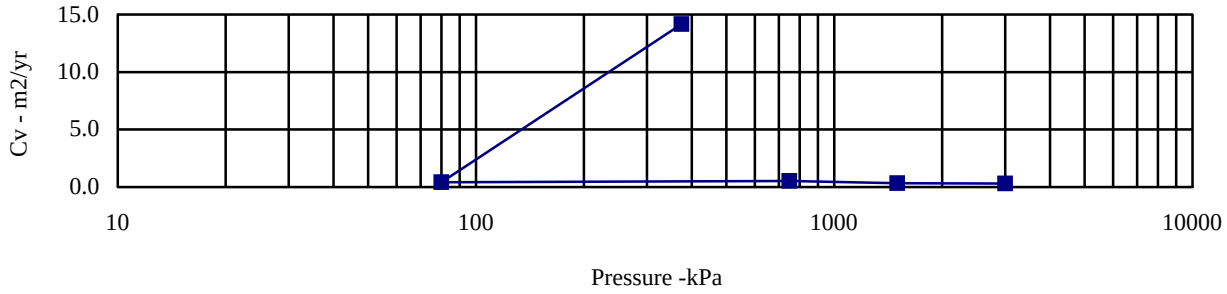
One Dimensional Consolidation Properties

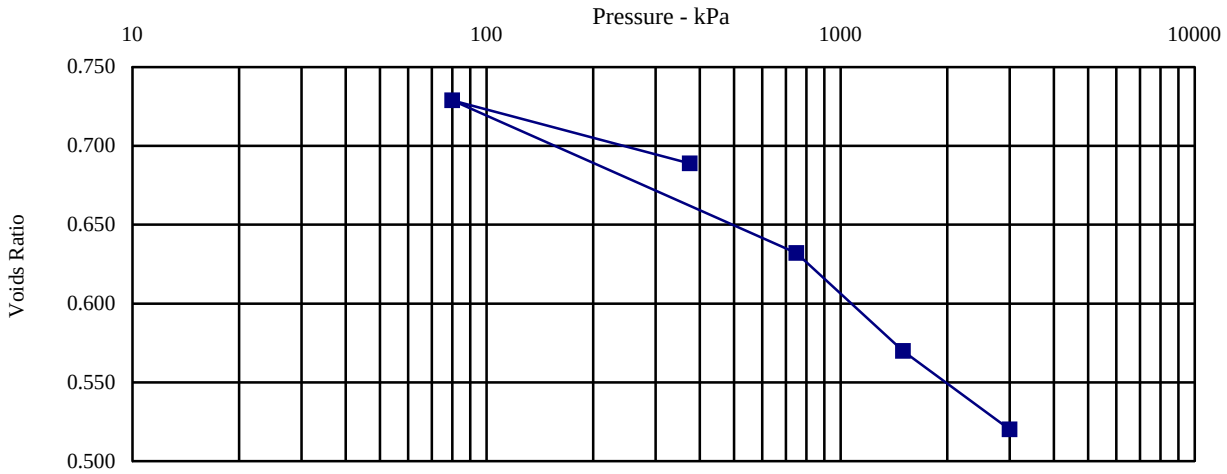
BS 1377: Part 5: 1990

Hole Number: **BH13** **Depth (m):** **15.00-15.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	1.93	0	-	375	0.070	14.168	Method used to	
Dry Density (Mg/m3):	1.53	375	-	80	0.080	0.416	determine CV:	t90
Voids Ratio:	0.734	80	-	750	0.084	0.532	Nominal temperature	
Degree of saturation:	94.8	750	-	1500	0.051	0.345	during test ' C:	20
Height (mm):	20.16	1500	-	3000	0.021	0.297	Remarks:	
Diameter (mm)	75.16						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





Checked by	Date	Approved by	Date
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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/3857** Page of

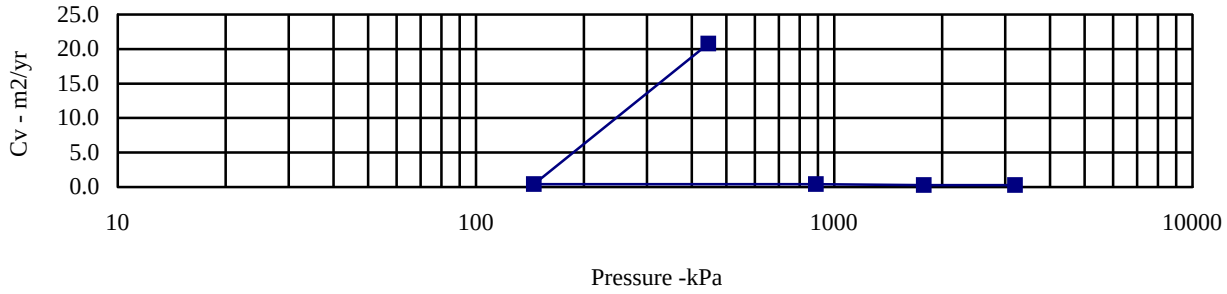
One Dimensional Consolidation Properties

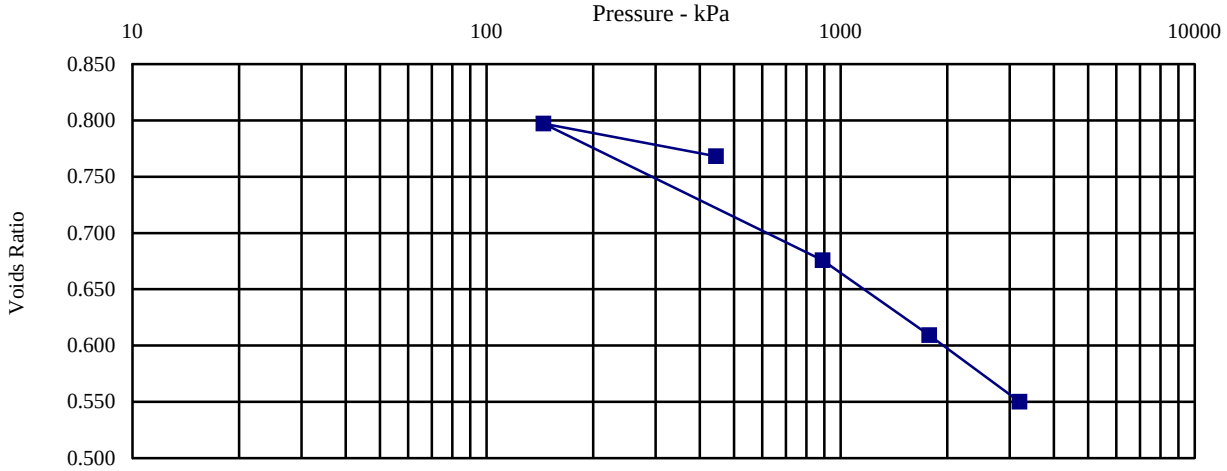
BS 1377: Part 5: 1990

Hole Number: BH13 **Depth (m): 18.20-18.60**

Sample Number: **Sample Type: U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	29							
Bulk Density (Mg/m3):	1.76	0	-	445	0.209	20.787	Method used to	
Dry Density (Mg/m3):	1.36	445	-	145	0.055	0.399	determine CV:	t90
Voids Ratio:	0.949	145	-	890	0.091	0.419	Nominal temperature	
Degree of saturation:	81.6	890	-	1780	0.045	0.296	during test ' C:	20
Height (mm):	19.99	1780	-	3200	0.026	0.294	Remarks:	
Diameter (mm)	50.05						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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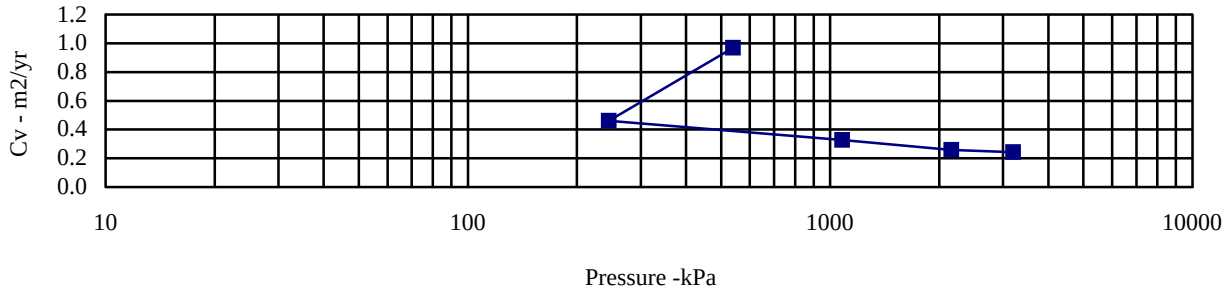
One Dimensional Consolidation Properties

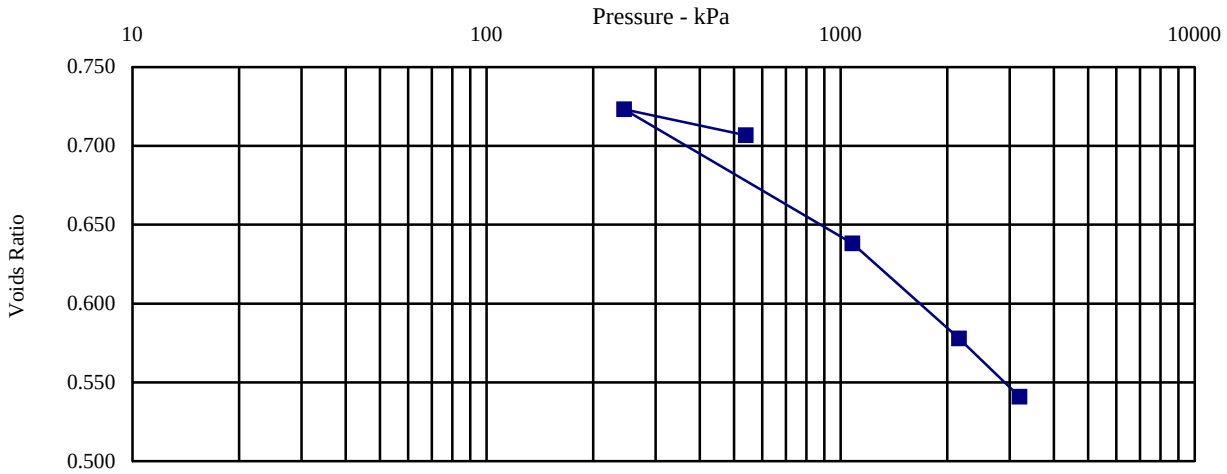
BS 1377: Part 5: 1990

Hole Number: **BH13** **Depth (m):** **22.55-23.00**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	29							
Bulk Density (Mg/m3):	1.91	0	-	540	0.084	0.968	Method used to	
Dry Density (Mg/m3):	1.48	540	-	245	0.033	0.461	determine CV:	t90
Voids Ratio:	0.788	245	-	1080	0.059	0.327	Nominal temperature	
Degree of saturation:	97.0	1080	-	2160	0.034	0.258	during test ' C:	20
Height (mm):	20.05	2160	-	3200	0.022	0.244	Remarks:	
Diameter (mm)	50.07						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/3857** Page of

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-13088

20-Aug-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-13088
Client Reference	PSL14/3857
Contract Title	Rivenhall Airfield IWMF
Description	2 Soil samples.
Date Received	14-Aug-14
Date Started	14-Aug-14
Date Completed	20-Aug-14
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13088
Client Ref PSL14/3857
Contract Title Rivenhall Airfield IWMF

			Lab No	685742	685743
			Sample ID	BH3	BH11
			Depth	4.70	3.00-3.10
			Other ID		
			Sample Type	SOIL	SOIL
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	11	< 10
Inorganics					
pH	DETSC 2008#			8.2	8.5
Chloride Aqueous Extract	DETSC 2055	1	mg/l	14	12
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	1.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	490	26
Total Sulphur as S	DETSC 2320	0.01	%	0.32	0.02
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.13	0.04

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-13088
Client Ref PSL14/3857
Contract Rivenhall Airfield IWMF

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
685742	BH3 4.70 SOIL		PT 1L	Sample date not supplied	
685743	BH11 3.00-3.10 SOIL		PT 1L	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

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LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/3950

Client's Reference: Report Date: 02 September 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester

GL3 1DL

For the attention of: Simon Arinze

Contract Title: Rivenhall Airfield IWMF

Date Received: 06/08/2014
Date Commenced: 06/08/2014
Date Completed: 02/09/2014

Notes: Observations and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

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

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

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH5	21	U	9.00-9.55	Grey silty CLAY.
BH5	24	D	10.50	Brown silty CLAY
BH5	28	D	12.40	Brown silty CLAY.
BH5	31	U	14.00-14.45	Brown silty CLAY.
BH5	33	U	15.00-15.55	Very stiff brown slightly sandy silty CLAY.
BH5	36	D	16.50	Brown silty CLAY
BH5	38	D	17.35	Brown silty CLAY
BH5	39	U	18.00-18.45	Brown silty CLAY
BH6	11	D	4.70	Brown silty CLAY
BH6	13	D	5.65	Brown silty CLAY
BH6	16	U	7.20	Brown silty CLAY
BH6	19	D	8.65	Brown silty CLAY
BH6	22	D	10.20	Brown silty CLAY
BH6	23	D	10.70	Brown silty CLAY
BH6	31	D	14.65	Brown silty CLAY
BH6	34	U	16.20-16.65	Hard brown slightly sandy silty CLAY.
BH6	35	D	16.70	Brown silty CLAY.
BH6	36	U	17.00-17.45	Grey silty CLAY.
BH9	11	U	5.20	Grey silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	28/08/14		02/09/14		02/09/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

Client Ref: C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH9	14	D	6.70	Brown slightly sandy GRAVEL.
BH9	16	D	7.65	Brown silty CLAY.
BH9	17	U	8.20	Grey silty CLAY.
BH9	22	D	10.70	Brown silty CLAY.
BH10		D	6.60-6.70	Brown mottled grey gravelly sandy silty CLAY.
BH10		D	7.55-7.65	Brown gravelly slightly sandy very silty CLAY.
BH10		B	9.20-9.70	Brown very gravelly slightly silty SAND.
BH10		B	11.50-12.70	Brown sandy GRAVEL.
BH11		C	24.10-24.55	Very stiff brown slightly sandy silty CLAY.
BH11		D	24.40-25.00	Brown silty CLAY.
BH11		D	25.55-25.65	Brown silty CLAY.
BH11		D	27.75-27.85	Brown silty CLAY.
BH11		C	31.80-32.25	Very stiff brown slightly sandy silty CLAY.
BH11		D	34.50-34.60	Brown silty CLAY.
BH11		C	33.15-33.6	Brown silty CLAY.
BH11		C	34.20-35.15	Stiff brown slightly sandy silty CLAY.
BH12		D	4.70-4.80	Brown silty CLAY.
BH12		C	5.20-5.50	Stiff brown slightly sandy silty CLAY.
BH12		D	5.95-6.05	Brown silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
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RIVENHALL AIRFIELD IWMF.

Contract No:	PSL14/3950
Client Ref:	C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH12		C	10.25-10.55	Stiff brown slightly sandy silty CLAY.
BH12		D	16.60-16.70	Brown silty CLAY.
BH12		D	17.15-17.25	Brown silty CLAY.
BH12		C	17.40-17.90	Brown silty CLAY.
BH12		C	25.50-25.95	Grey silty CLAY.
BH13		C	26.55-27.00	Stiff brown slightly sandy silty CLAY.
BH14		U	1.25-1.65	Stiff brown slightly gravelly slightly sandy silty CLAY.
BH14	4	D	1.70	Brown gravelly slightly sandy silty CLAY.
BH14	7	D	2.70	Brown slightly gravelly slightly sandy very silty CLAY.
BH14	8	U	3.20-3.60	Very stiff brown slightly gravelly slightly sandy silty CLAY.
BH14	12	U	5.20-5.65	Very stiff brown slightly gravelly slightly sandy silty CLAY.
BH14	15	B	6.50-7.00	Brown very sandy slightly silty GRAVEL.
BH14	22	B	11.00-11.50	Brown very sandy clayey silty GRAVEL.
BH16		B	9.10-9.50	Brown very gravelly slightly silty SAND.
BH16		B	10.85-11.50	Brown gravelly slightly clayey silty SAND.
BH16		C	14.15-14.60	Grey silty CLAY.
BH16		C	20.40-20.85	Brown silty CLAY.
BH16		C	28.00-28.45	Grey silty CLAY.
BH16		D	29.20-29.30	Brown silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

Client Ref: C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH16		D	29.70-29.80	Brown silty CLAY.
BH16		C	31.90-32.35	Very stiff brown slightly sandy silty CLAY.
BH17	1	U	1.20-1.65	Stiff brown slightly gravelly slightly sandy silty CLAY.
BH17	2	D	1.70	Brown gravelly slightly sandy silty CLAY.
BH17	5	D	2.70	Brown gravelly slightly sandy very silty CLAY.
BH17	6	U	3.20-3.65	Very stiff brown slightly gravelly slightly sandy silty CLAY.
BH17	10	U	5.20-5.65	Very stiff brown slightly gravelly slightly sandy silty CLAY.
BH17	11	D	5.70	Brown very gravelly sandy silty CLAY.
BH17	13	B	6.50-7.00	Brown slightly silty SAND & GRAVEL.
BH17	17	B	9.50-10.00	Brown slightly sandy GRAVEL.

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RIVENHALL AIRFIELD IWMF.

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Client Ref:	C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH5	24	D	10.50	28								
BH5	28	D	12.40	27				78	29	49	100	Very high plasticity CV.
BH5	36	D	16.50	27								
BH5	38	D	17.35	29				76	28	48	100	Very high plasticity CV.
BH6	11	D	4.70	27								
BH6	13	D	5.65	26				80	30	50	100	Very high plasticity CV.
BH6	19	D	8.65	26								
BH6	23	D	10.70	26				71	28	43	100	Very high plasticity CV.
BH6	31	D	14.65	26								
BH6	35	D	16.70	27				81	30	51	100	Very high plasticity CV.
BH9	14	D	6.70	7.2								
BH9	16	D	7.65	28				79	30	49	100	Very high plasticity CV.
BH9	22	D	10.70	28				72	28	44	100	Very high plasticity CV.
BH10		D	6.60-6.70	18								
BH10		D	7.55-7.65	19				36	20	16	84	Intermediate plasticity CI.
BH11		D	24.40-25.00	28								
BH11		D	25.55-25.65	31				86	32	54	100	Very high plasticity CV.
BH11		D	27.75-27.85	28				70	29	41	100	Very high plasticity CV.
BH11		D	34.50-34.60	31								

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

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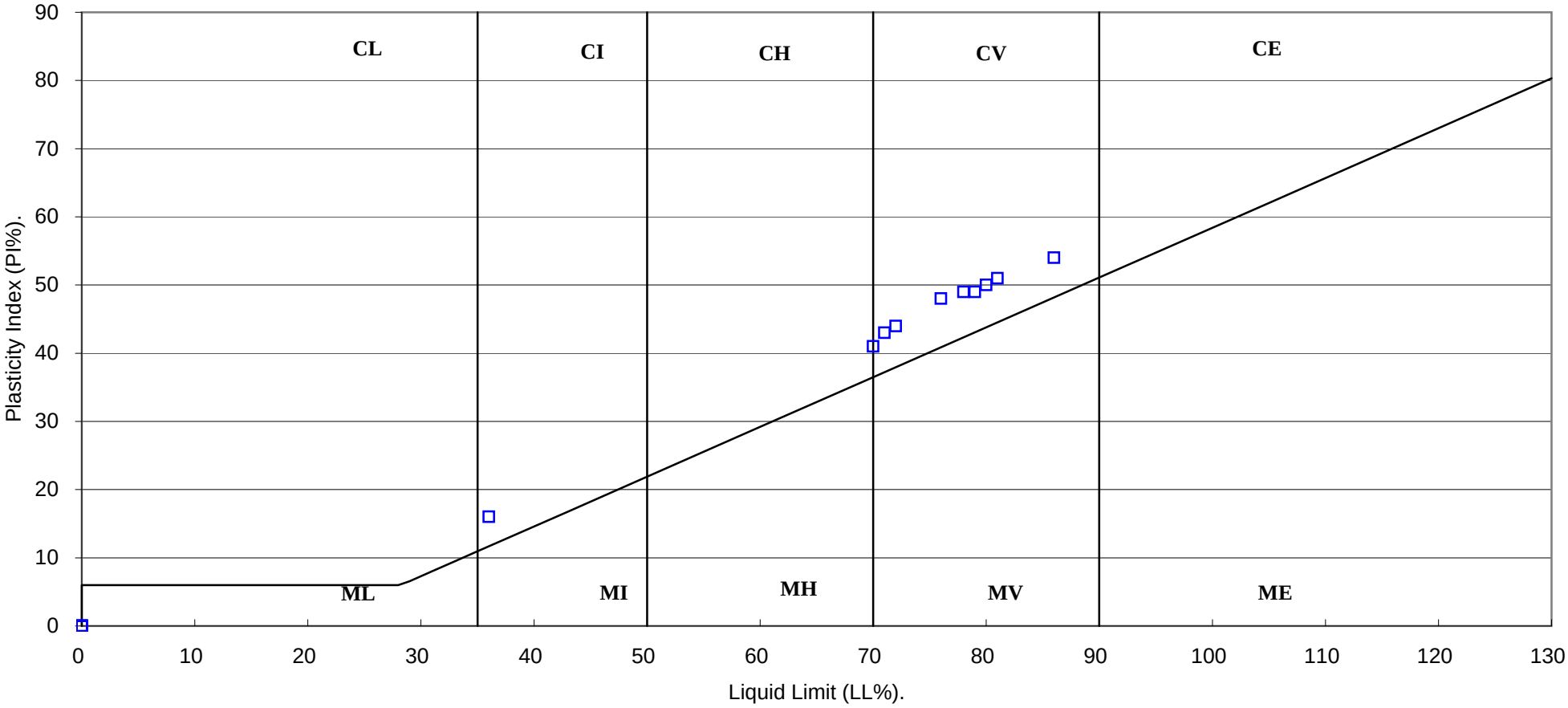
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/3950**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		28/08/14		02/09/14		02/09/14
	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/3950
					Client Ref:	C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH12		D	4.70-4.80	28								
BH12		D	5.95-6.05	28				79	30	49	100	Very high plasticity CV.
BH12		D	16.60-16.70	28								
BH12		D	17.15-17.25	30				87	32	55	100	Very high plasticity CV.
BH14	4	D	1.70	18								
BH14	7	D	2.70	18				36	19	17	90	Intermediate plasticity CI.
BH16		D	29.20-29.30	30								
BH16		D	29.70-29.80	30				73	28	45	100	Very high plasticity CV.
BH17	2	D	1.70	17								
BH17	5	D	2.70	20				36	20	16	82	Intermediate plasticity CI.
BH17	11	D	5.70	14				37	19	18	72	Intermediate plasticity CI.

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

PSL Professional Soils Laboratory

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	28/08/14		02/09/14		02/09/14

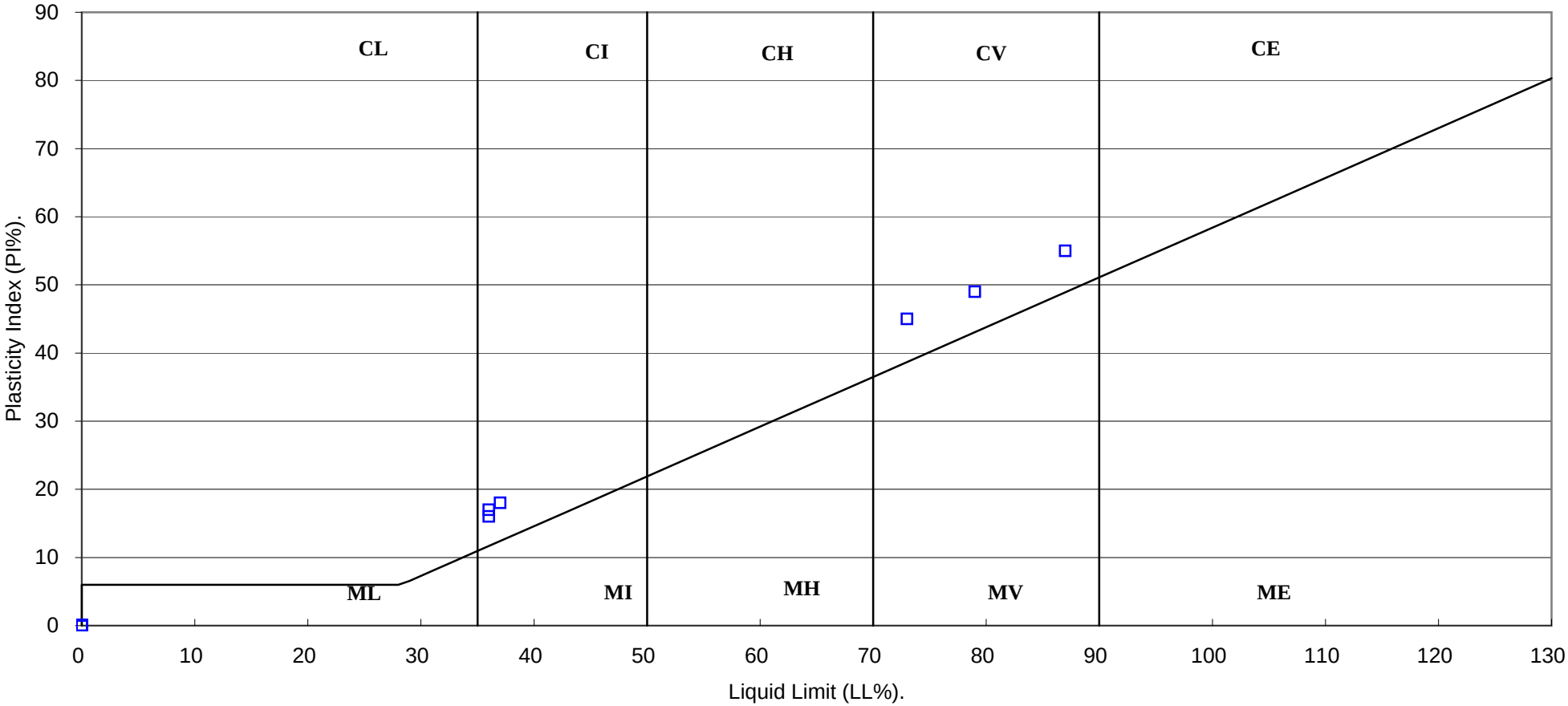
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/3950**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		28/08/14		02/09/14		02/09/14
	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/3950
					Client Ref:	C4237

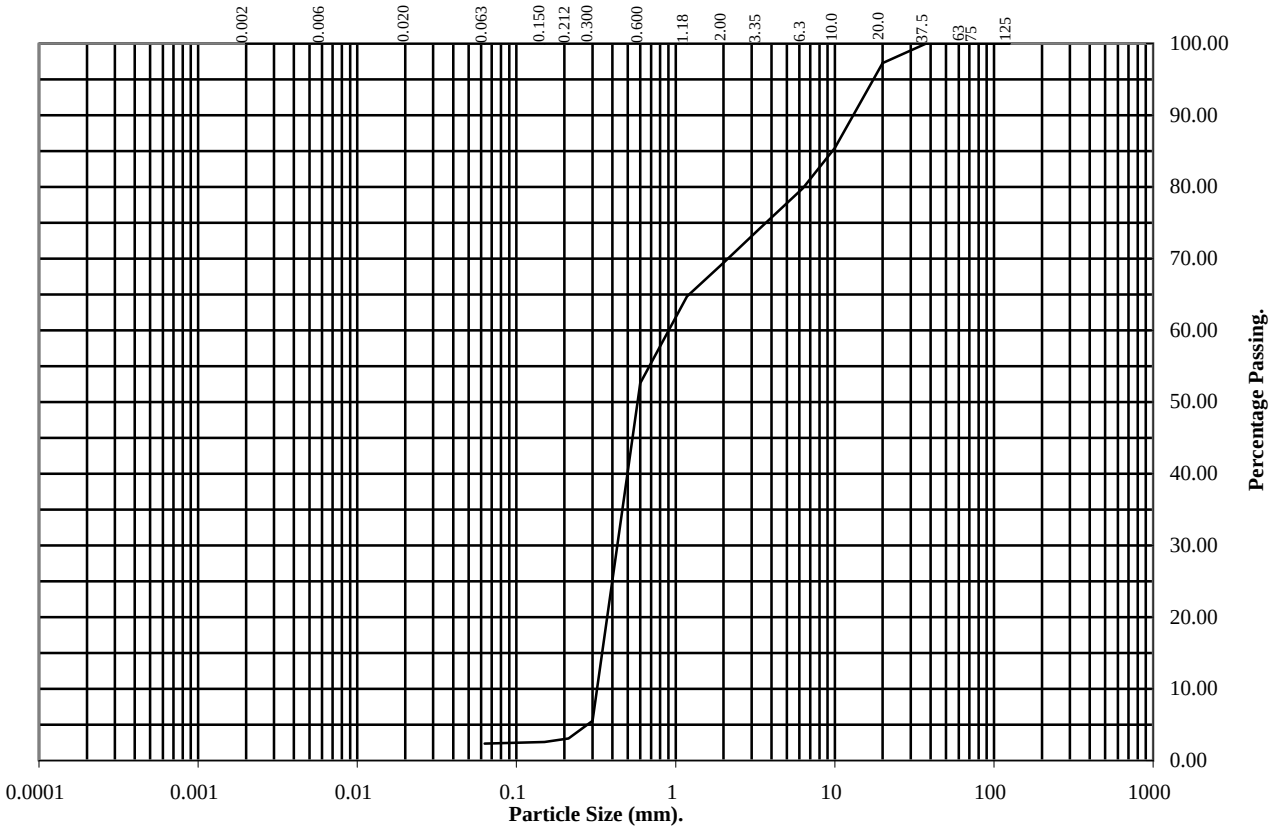
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH10** **Depth (m):** **9.20-9.70**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	97
10	85
6.3	80
3.35	74
2	69
1.18	65
0.6	53
0.3	6
0.212	3
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	31
Sand	67
Silt / Clay	2

Remarks:
See summary of soils descriptions.

Checked By	Date	Approved By	Date
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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3950**

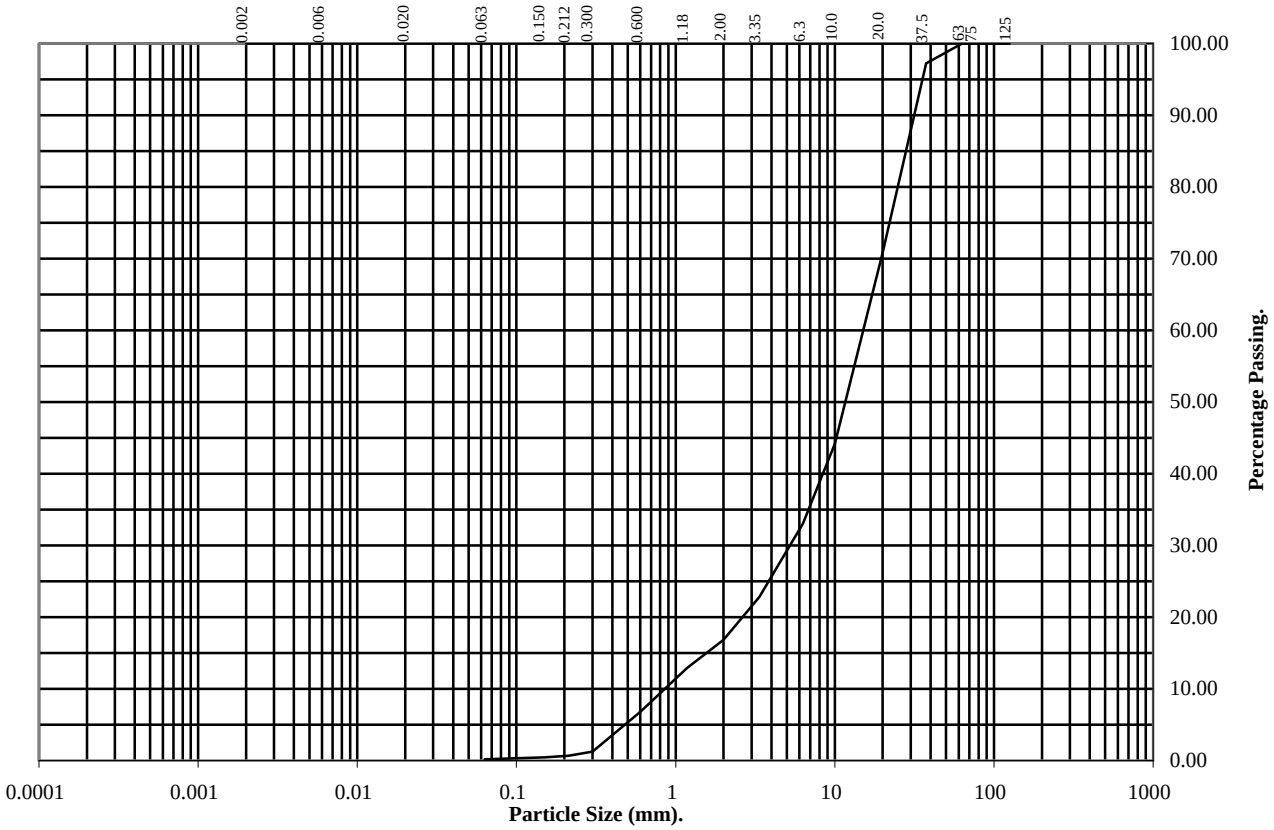
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH10** **Depth (m):** **11.50-12.70**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	97
20	71
10	44
6.3	33
3.35	23
2	17
1.18	13
0.6	7
0.3	1
0.212	1
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	83
Sand	17
Silt / Clay	0

Remarks:

See summary of soils descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3950**

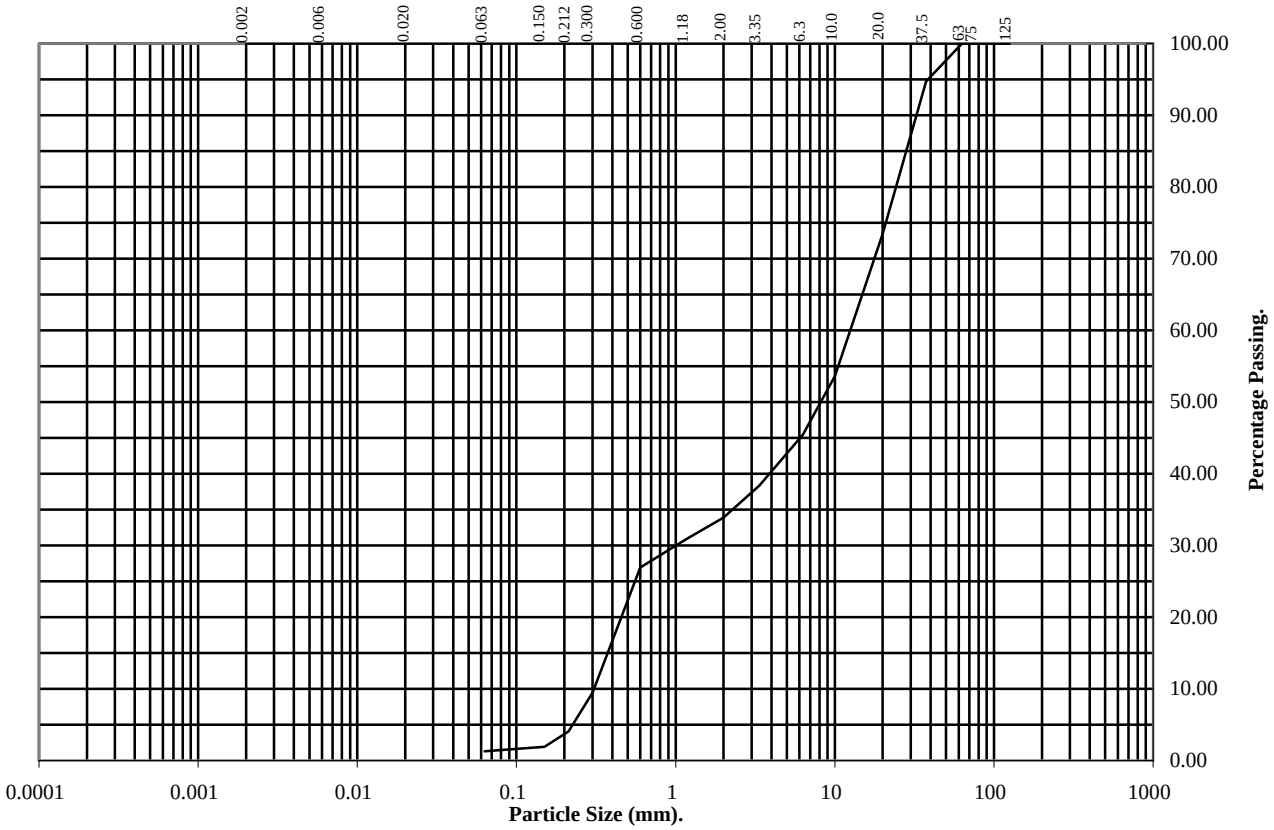
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH14** **Depth (m):** **6.50-7.00**

Sample Number: **15** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	95
20	73
10	54
6.3	45
3.35	38
2	34
1.18	31
0.6	27
0.3	9
0.212	4
0.15	2
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	66
Sand	33
Silt / Clay	1

Remarks:

See summary of soils descriptions.

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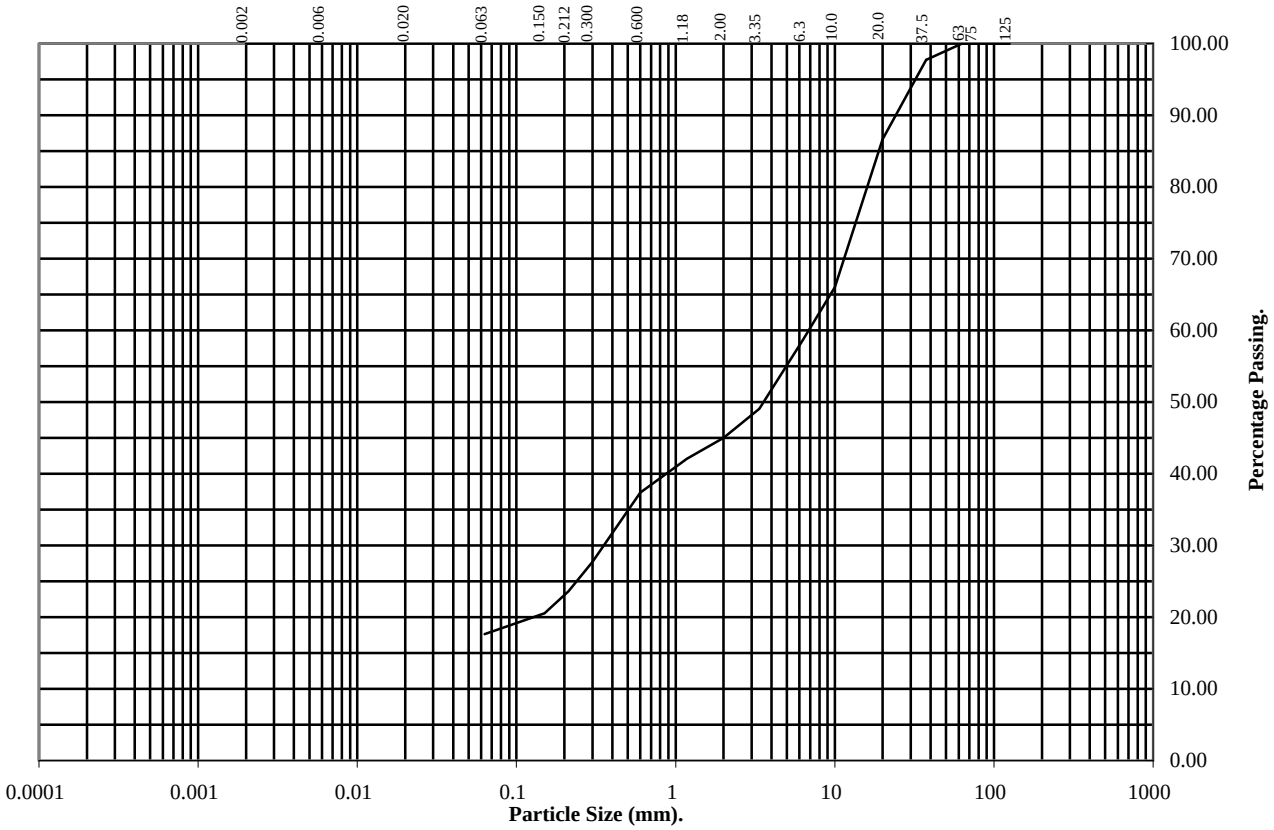
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH14** **Depth (m):** **11.00-11.50**

Sample Number: **22** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	98
20	87
10	66
6.3	59
3.35	49
2	45
1.18	42
0.6	37
0.3	28
0.212	24
0.15	21
0.063	18

Soil Fraction	Total Percentage
Cobbles	0
Gravel	55
Sand	27
Silt / Clay	18

Remarks:
See summary of soils descriptions.

Checked By	Date	Approved By	Date
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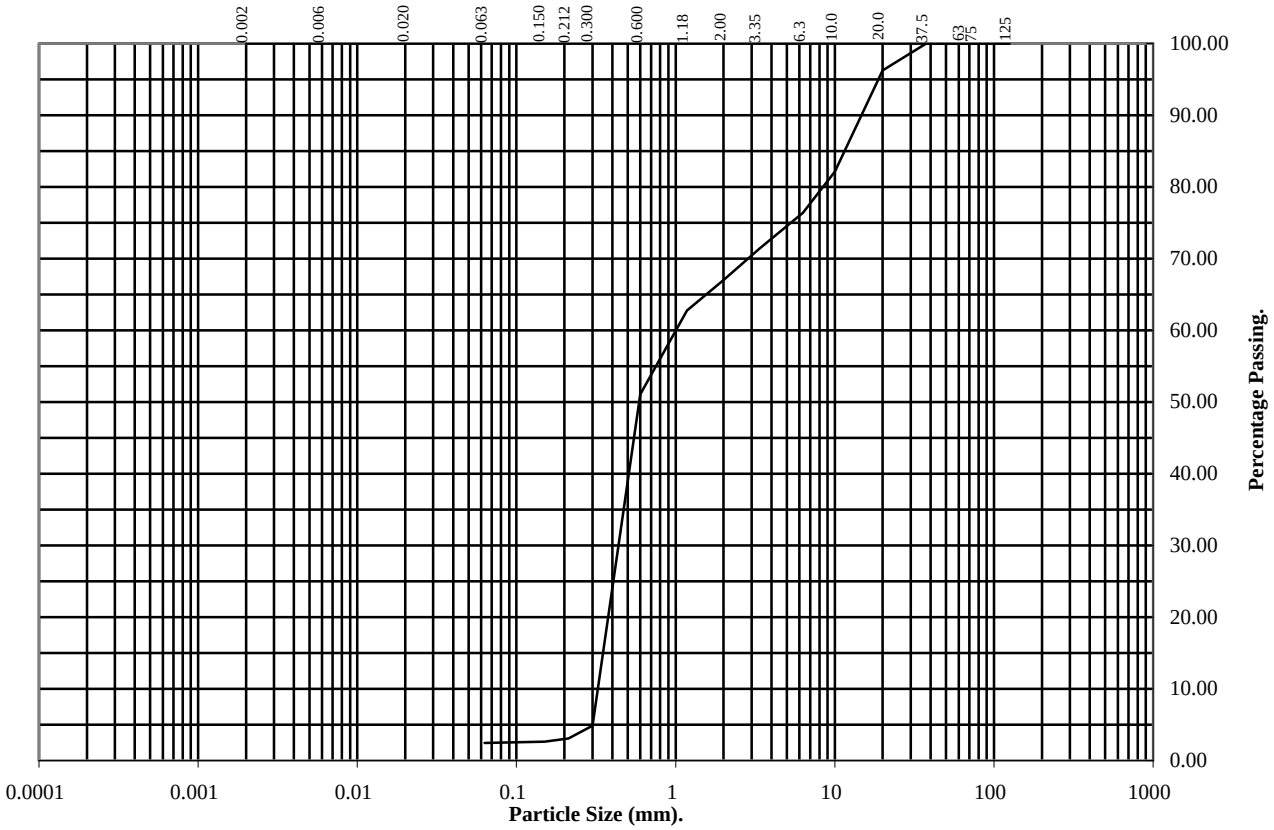
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH16** **Depth (m):** **9.10-9.50**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	96
10	82
6.3	76
3.35	71
2	67
1.18	63
0.6	51
0.3	5
0.212	3
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	33
Sand	65
Silt / Clay	2

Remarks:

See summary of soils descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3950**

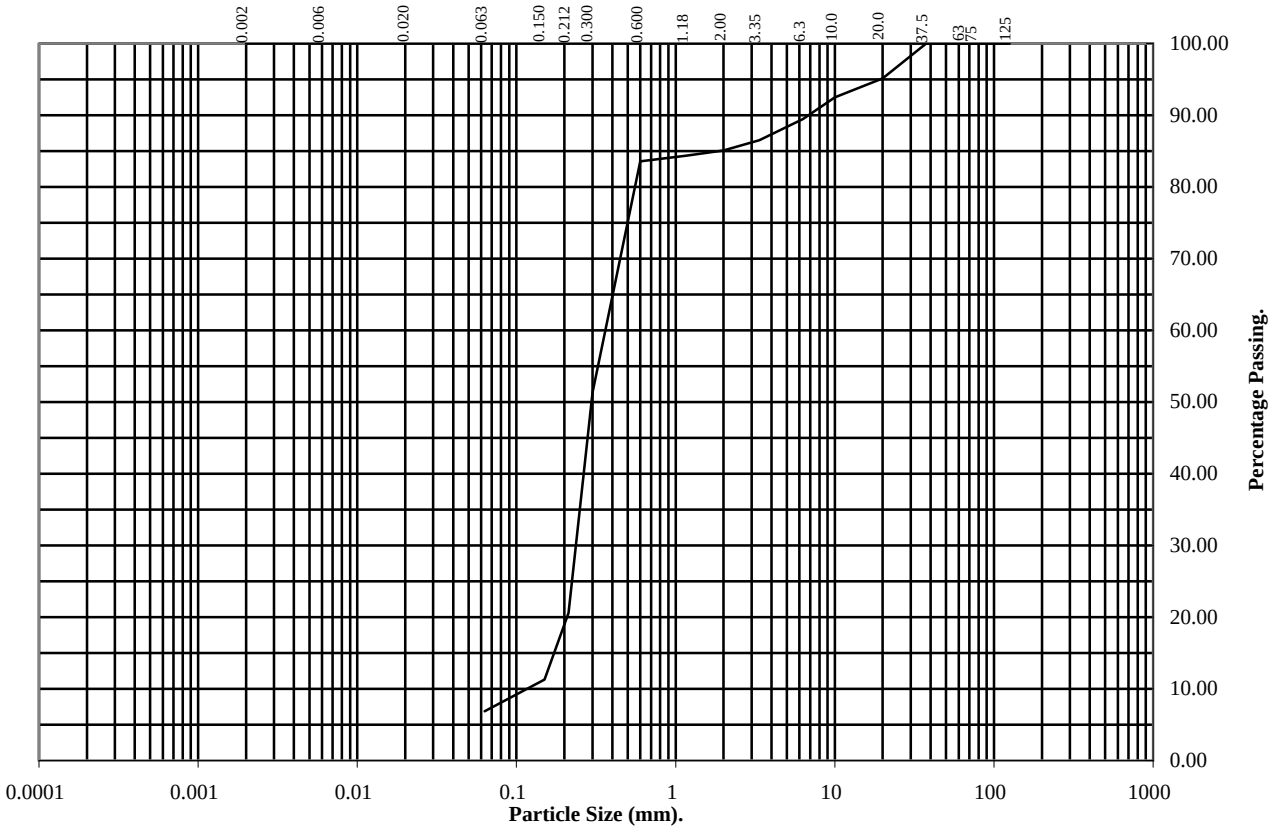
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH16** **Depth (m):** **10.85-11.50**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	95
10	92
6.3	89
3.35	87
2	85
1.18	84
0.6	84
0.3	51
0.212	21
0.15	11
0.063	7

Soil Fraction	Total Percentage
Cobbles	0
Gravel	15
Sand	78
Silt / Clay	7

Remarks:

See summary of soils descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3950**

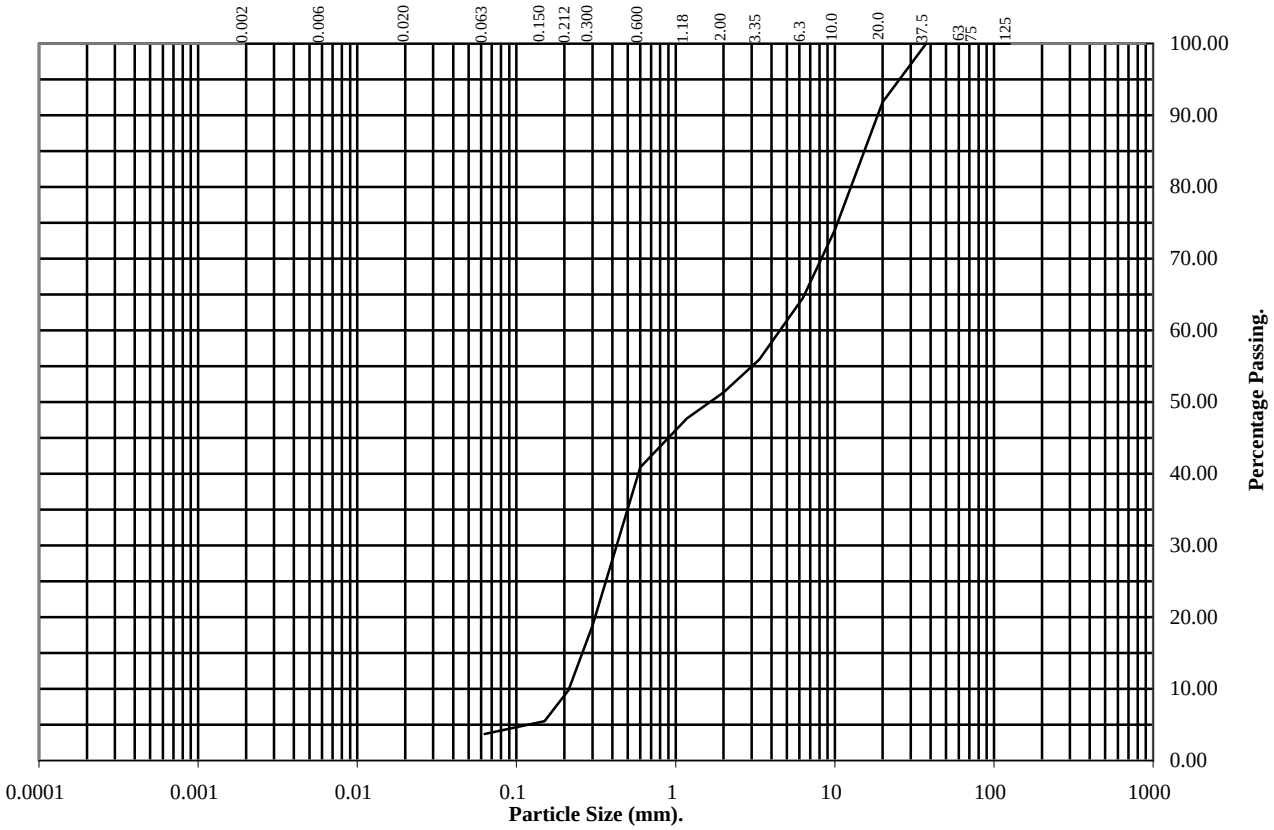
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH17** **Depth (m):** **6.50-7.00**

Sample Number: **13** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	74
6.3	65
3.35	56
2	51
1.18	48
0.6	41
0.3	19
0.212	10
0.15	5
0.063	4

Soil Fraction	Total Percentage
Cobbles	0
Gravel	49
Sand	47
Silt / Clay	4

Remarks:

See summary of soils descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/3950**

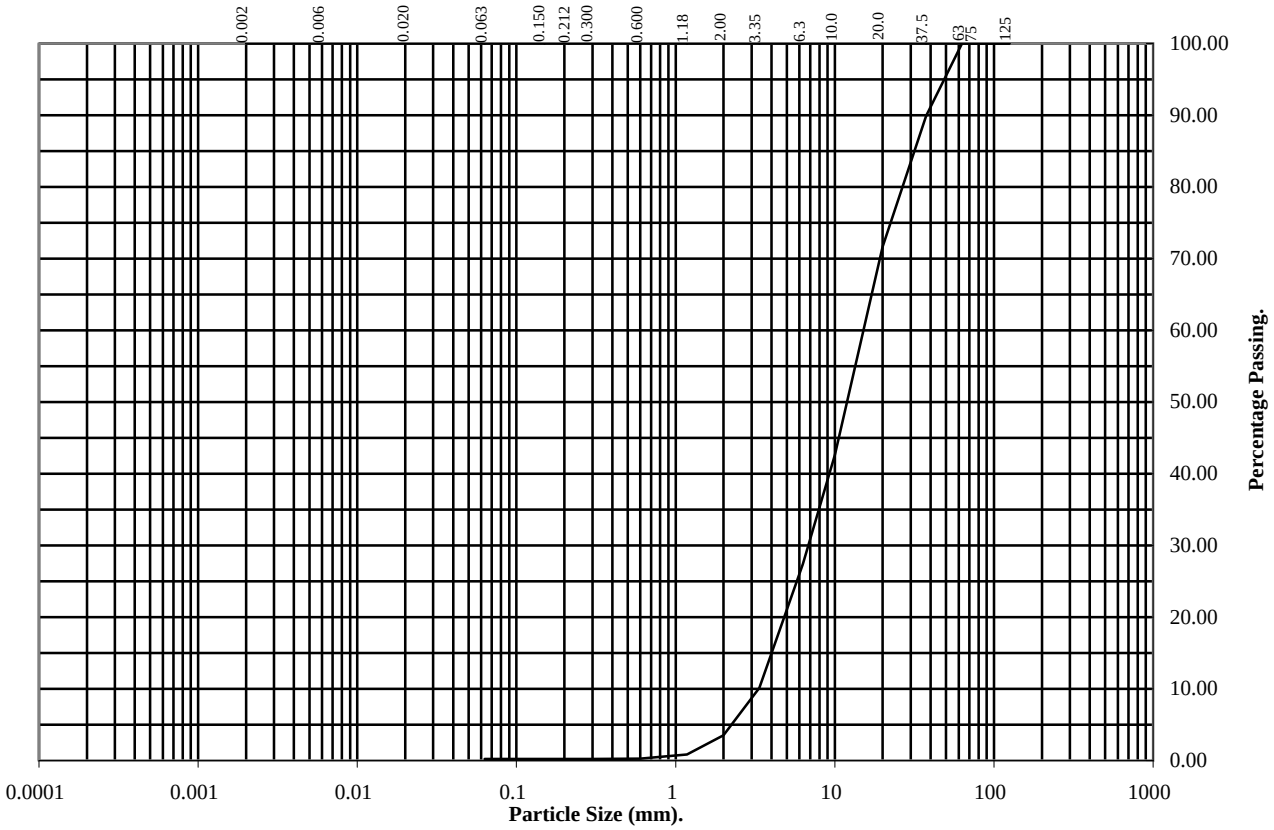
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH17** **Depth (m):** **9.50-10.00**

Sample Number: **17** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	90
20	72
10	43
6.3	27
3.35	10
2	4
1.18	1
0.6	0
0.3	0
0.212	0
0.15	0
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	96
Sand	4
Silt / Clay	0

Remarks:

See summary of soils descriptions.

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RIVENHALL AIRFIELD IWMF.

Contract No.: PSL14/3950

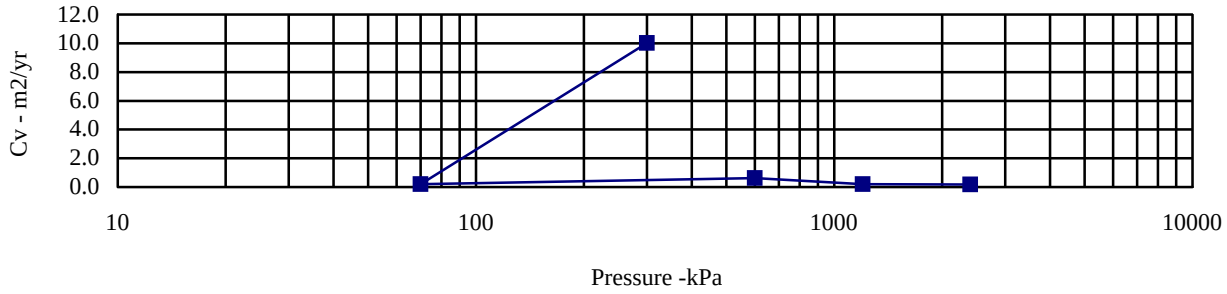
One Dimensional Consolidation Properties

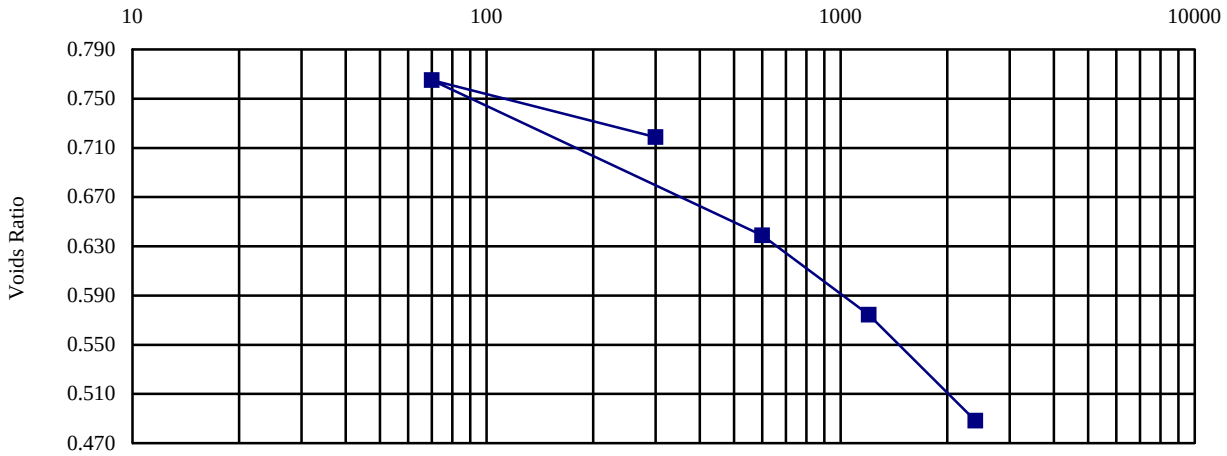
BS 1377: Part 5: 1990

Hole Number: **BH5** **Depth (m):** **9.00-9.55**

Sample Number: **21** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	29							
Bulk Density (Mg/m3):	1.86	0	-	300	0.225	10.018	Method used to	
Dry Density (Mg/m3):	1.44	300	-	70	0.117	0.211	determine CV:	t90
Voids Ratio:	0.843	70	-	600	0.135	0.628	Nominal temperature	
Degree of saturation:	92.3	600	-	1200	0.066	0.209	during test ' C:	20
Height (mm):	20.15	1200	-	2400	0.046	0.180	Remarks:	
Diameter (mm)	75.02						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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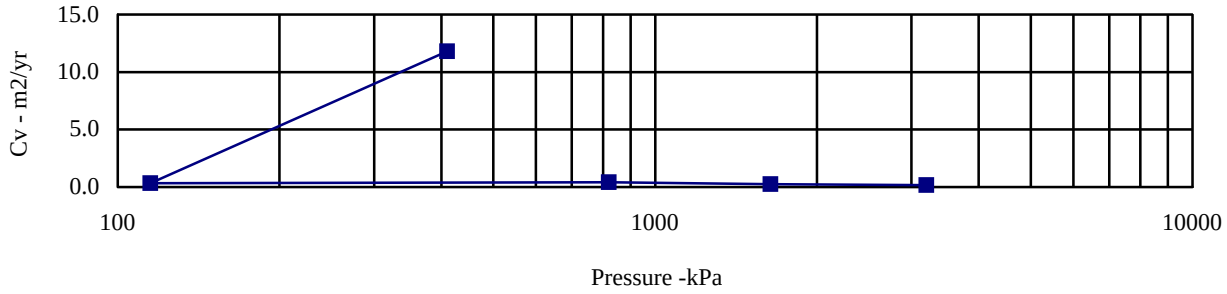
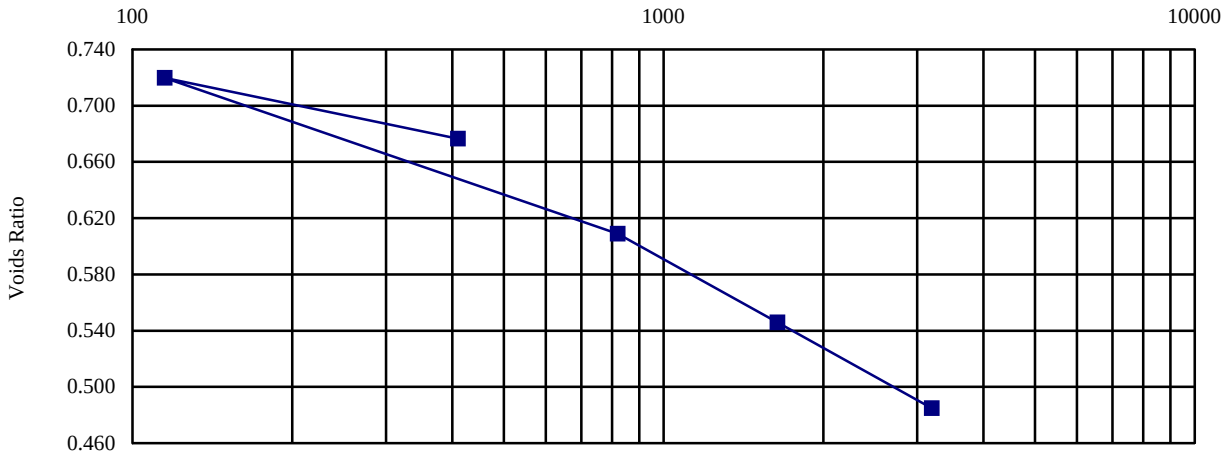
BS 1377: Part 5: 1990

Hole Number: **BH5** **Depth (m):** **14.00-14.50**

Sample Number: **31** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	22							
Bulk Density (Mg/m3):	1.82	0	-	410	0.144	11.798	Method used to	
Dry Density (Mg/m3):	1.49	410	-	115	0.087	0.341	determine CV:	t90
Voids Ratio:	0.782	115	-	820	0.091	0.431	Nominal temperature	
Degree of saturation:	75.6	820	-	1640	0.048	0.256	during test ' C:	20
Height (mm):	19.88	1640	-	3200	0.025	0.174	Remarks:	
Diameter (mm)	50.11						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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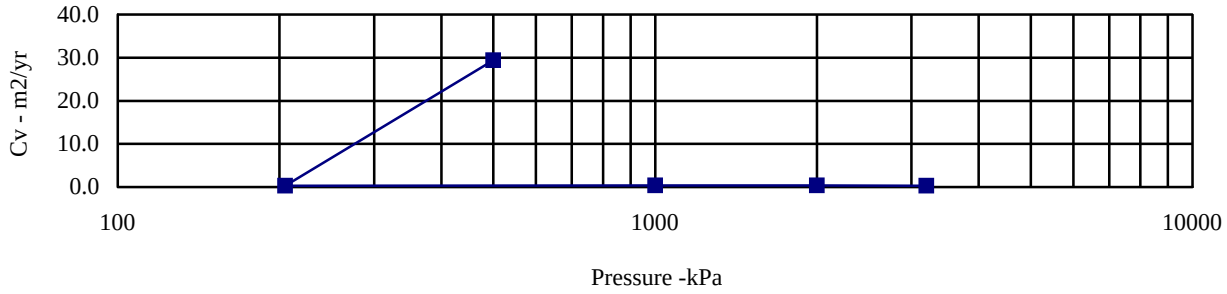
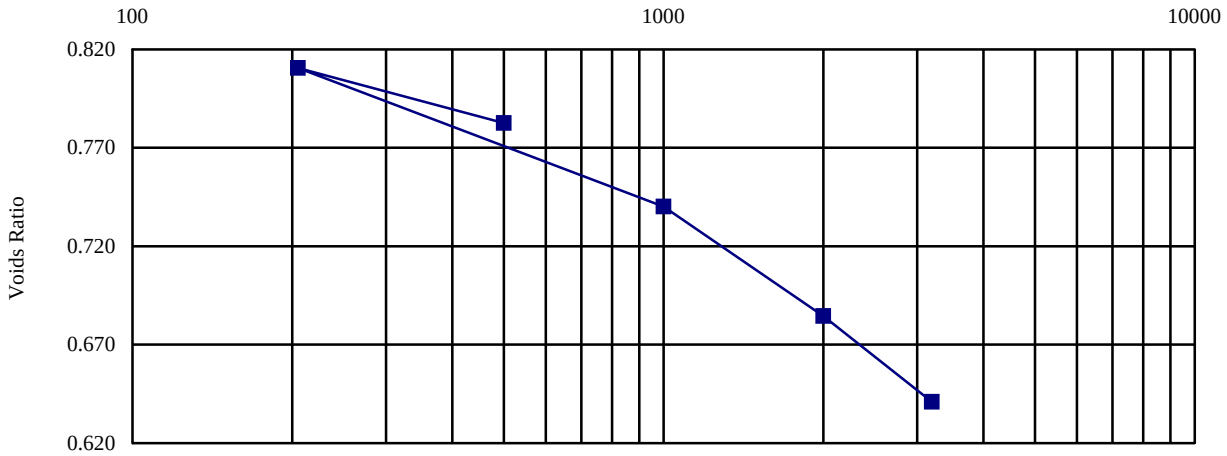
BS 1377: Part 5: 1990

Hole Number: **BH5** **Depth (m):** **18.00-18.45**

Sample Number: **39** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	33							
Bulk Density (Mg/m3):	1.95	0	-	500	0.031	29.381	Method used to	
Dry Density (Mg/m3):	1.46	500	-	205	0.053	0.290	determine CV:	t90
Voids Ratio:	0.810	205	-	1000	0.049	0.384	Nominal temperature	
Degree of saturation:	107.8	1000	-	2000	0.032	0.386	during test ' C:	20
Height (mm):	20.08	2000	-	3200	0.022	0.280	Remarks:	
Diameter (mm)	50.12						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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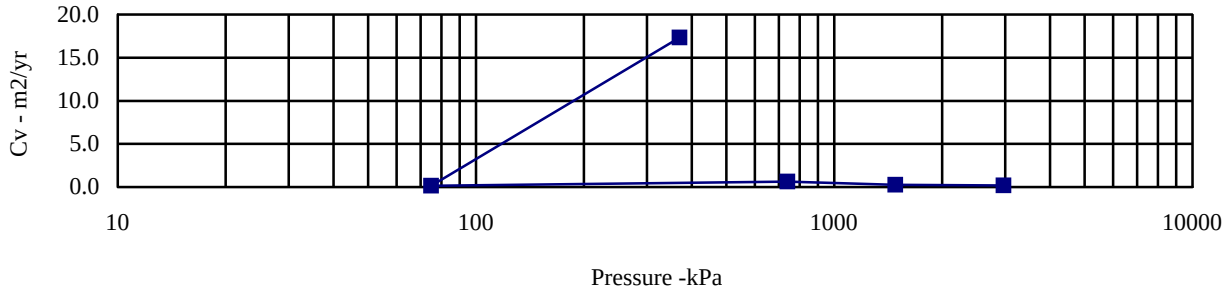
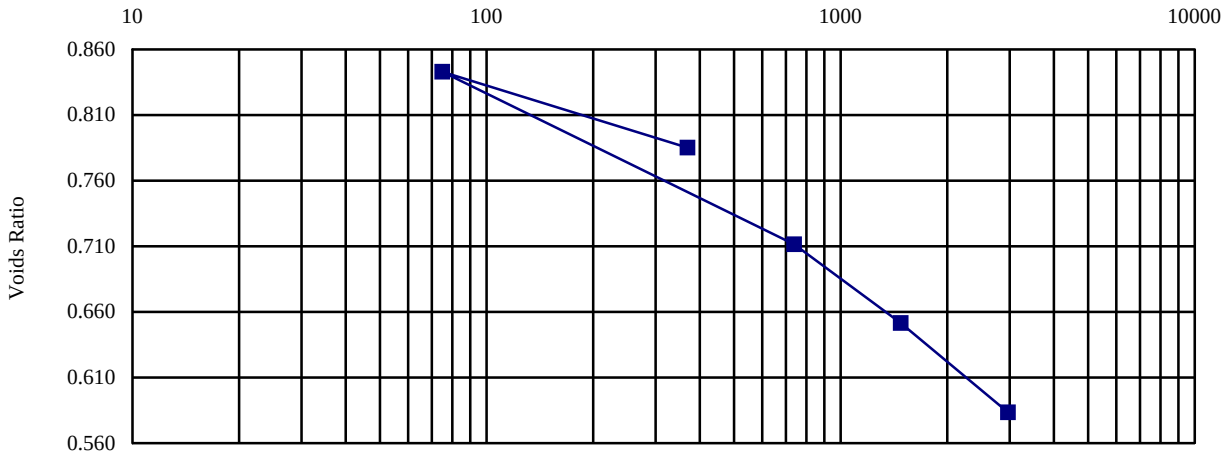
BS 1377: Part 5: 1990

Hole Number: **BH6** **Depth (m):** **7.20**

Sample Number: **16** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	29							
Bulk Density (Mg/m3):	1.88	0	-	370	0.056	17.347	Method used to	
Dry Density (Mg/m3):	1.45	370	-	75	0.110	0.165	determine CV:	t90
Voids Ratio:	0.823	75	-	740	0.107	0.615	Nominal temperature	
Degree of saturation:	94.2	740	-	1480	0.047	0.250	during test ' C:	20
Height (mm):	19.97	1480	-	2970	0.028	0.202	Remarks:	
Diameter (mm)	75.18						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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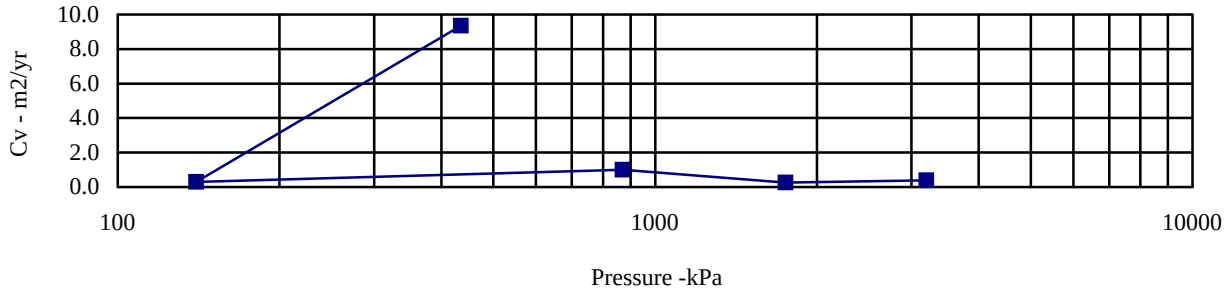
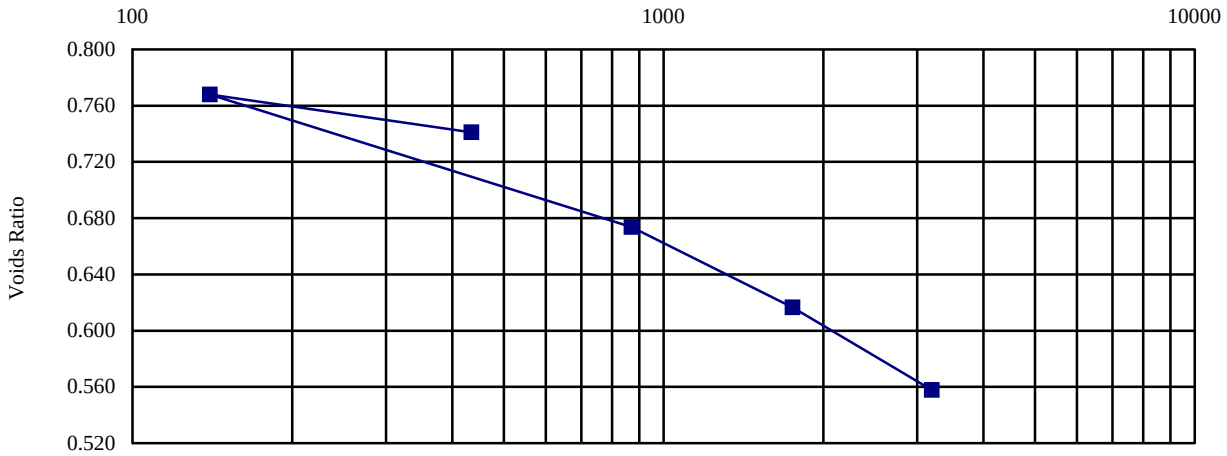
Hole Number: **BH6** **Depth (m):** **10.20**

Sample Number: **22** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.89	0	-	435	0.074	9.349	Method used to	
Dry Density (Mg/m3):	1.47	435	-	140	0.052	0.294	determine CV:	t90
Voids Ratio:	0.799	140	-	870	0.073	1.006	Nominal temperature	
Degree of saturation:	93.8	870	-	1750	0.039	0.256	during test ' C:	20
Height (mm):	20	1750	-	3200	0.025	0.385	Remarks:	
Diameter (mm)	75.21						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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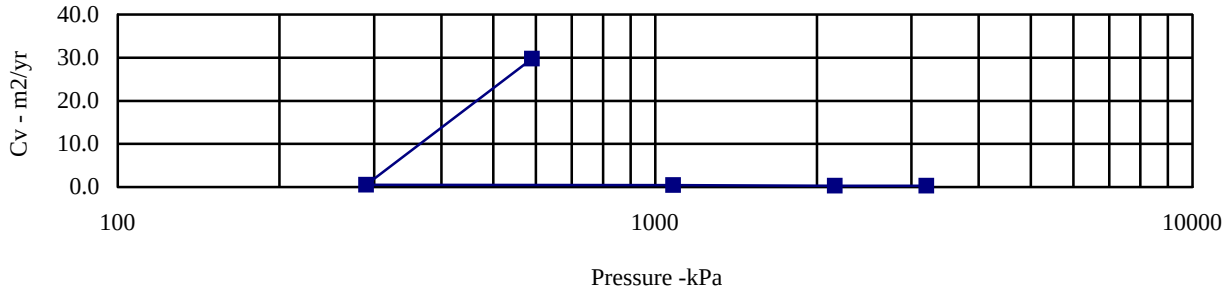
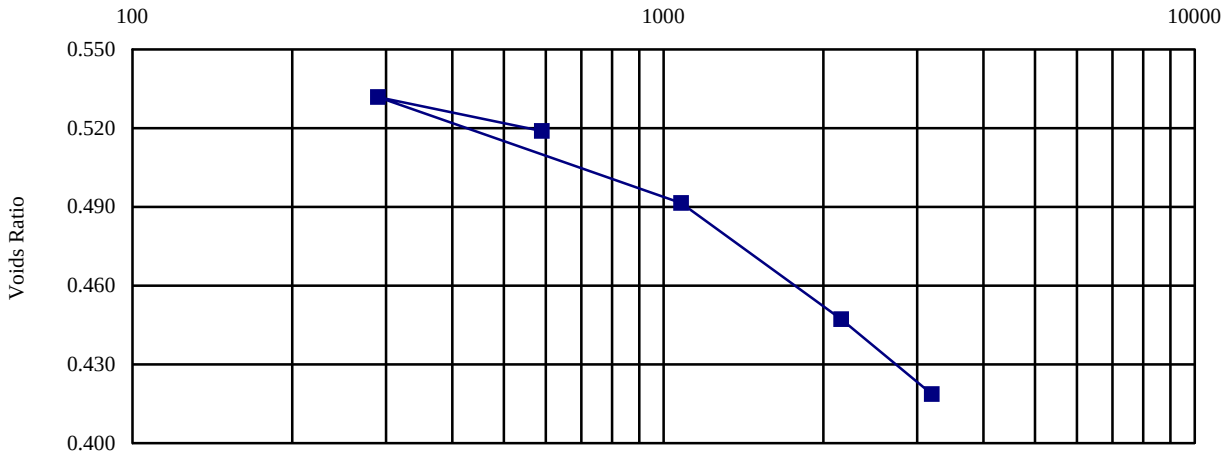
Hole Number: **BH6** **Depth (m):** **17.00-17.45**

Sample Number: **36** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	17							
Bulk Density (Mg/m3):	1.98	0	-	590	0.048	29.783	Method used to	
Dry Density (Mg/m3):	1.70	590	-	290	0.028	0.489	determine CV:	t90
Voids Ratio:	0.563	290	-	1080	0.033	0.478	Nominal temperature	
Degree of saturation:	79.2	1080	-	2160	0.028	0.328	during test ' C:	20
Height (mm):	20.01	2160	-	3200	0.019	0.273	Remarks:	
Diameter (mm)	75.12						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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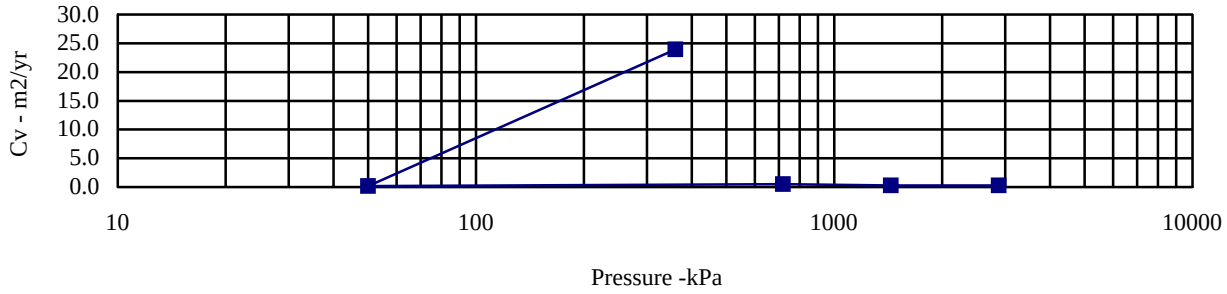
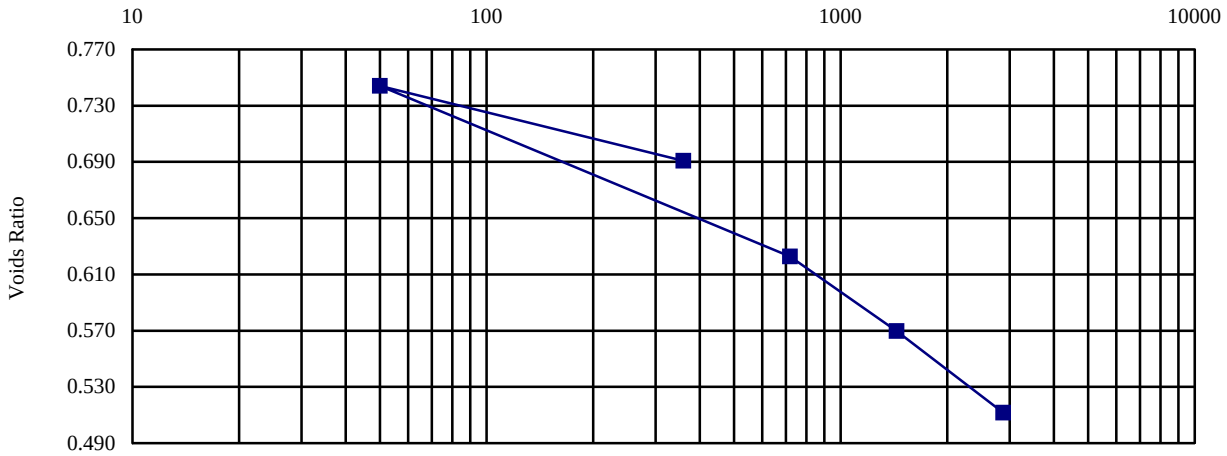
Hole Number: **BH9** **Depth (m):** **5.20**

Sample Number: **11** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	25							
Bulk Density (Mg/m3):	1.91	0	-	360	0.066	23.923	Method used to	
Dry Density (Mg/m3):	1.53	360	-	50	0.101	0.191	determine CV:	t90
Voids Ratio:	0.732	50	-	720	0.104	0.494	Nominal temperature	
Degree of saturation:	88.8	720	-	1440	0.046	0.284	during test ' C:	20
Height (mm):	20.15	1440	-	2880	0.026	0.270	Remarks:	
Diameter (mm)	75.2						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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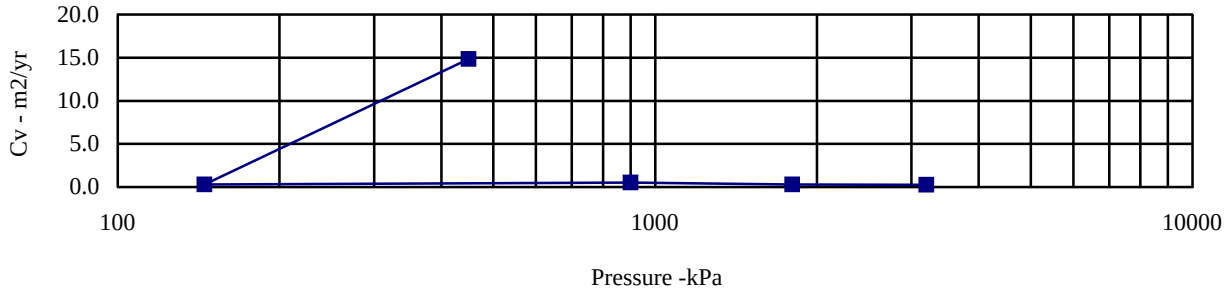
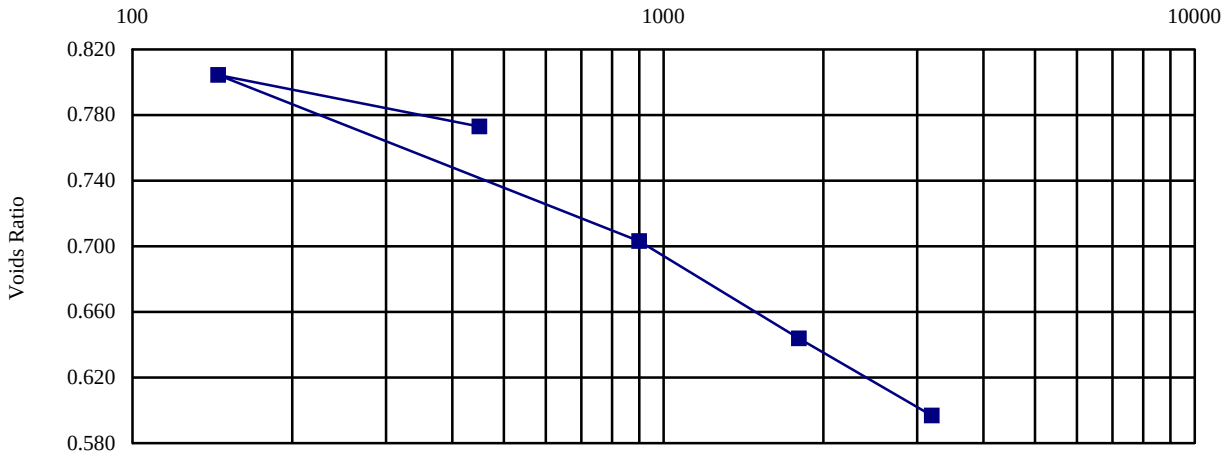
BS 1377: Part 5: 1990

Hole Number: **BH9** **Depth (m):** **8.20**

Sample Number: **17** **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.82	0	-	450	0.089	14.845	Method used to	
Dry Density (Mg/m3):	1.43	450	-	145	0.058	0.290	determine CV:	t90
Voids Ratio:	0.847	145	-	900	0.074	0.512	Nominal temperature	
Degree of saturation:	83.9	900	-	1800	0.039	0.290	during test ' C:	20
Height (mm):	20.1	1800	-	3200	0.020	0.276	Remarks:	
Diameter (mm)	75.2						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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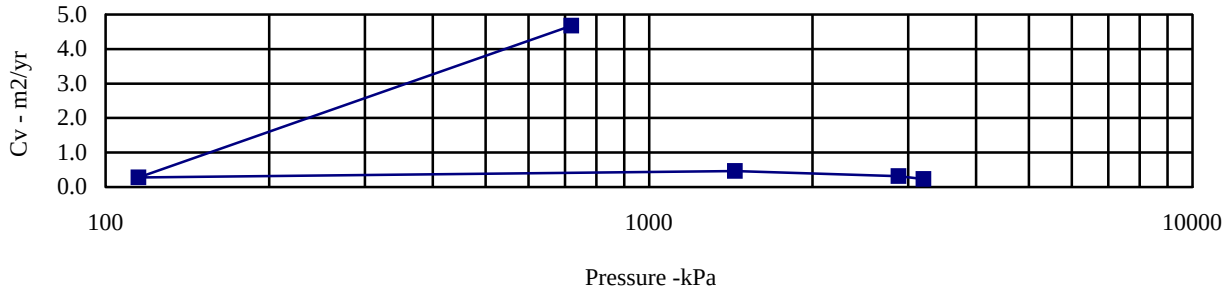
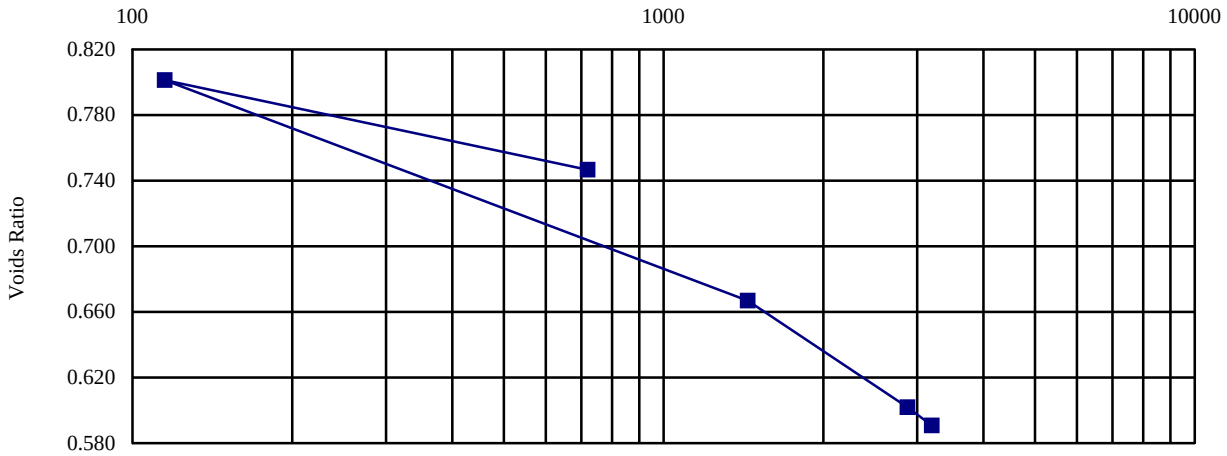
BS 1377: Part 5: 1990

Hole Number: **BH11** **Depth (m):** **33.15-33.60**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	33							
Bulk Density (Mg/m3):	1.91	0	-	720	0.073	4.673	Method used to	
Dry Density (Mg/m3):	1.44	720	-	115	0.052	0.277	determine CV:	t90
Voids Ratio:	0.843	115	-	1440	0.056	0.461	Nominal temperature	
Degree of saturation:	102.7	1440	-	2880	0.027	0.316	during test ' C:	20
Height (mm):	20.1	2880	-	3200	0.022	0.229	Remarks:	
Diameter (mm)	75.01						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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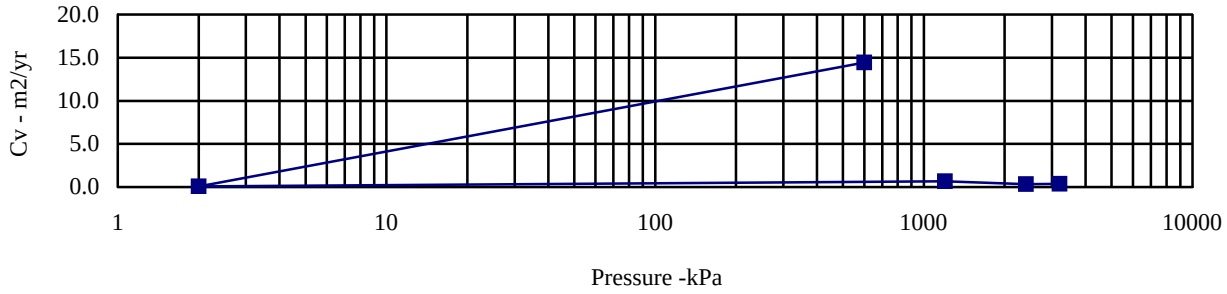
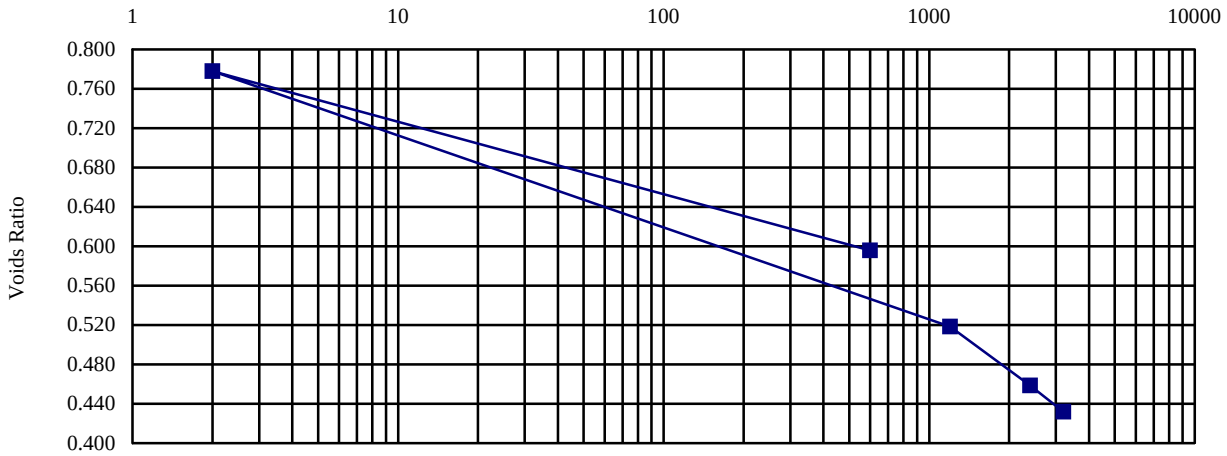
Hole Number: **BH12** **Depth (m):** **17.40-17.90**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	23							
Bulk Density (Mg/m3):	1.95	0	-	600	0.066	14.418	Method used to	
Dry Density (Mg/m3):	1.59	600	-	2	0.191	0.076	determine CV:	t90
Voids Ratio:	0.661	2	-	1200	0.122	0.675	Nominal temperature	
Degree of saturation:	90.4	1200	-	2400	0.033	0.349	during test ' C:	20
Height (mm):	20.14	2400	-	3200	0.023	0.354	Remarks:	
Diameter (mm)	75.05						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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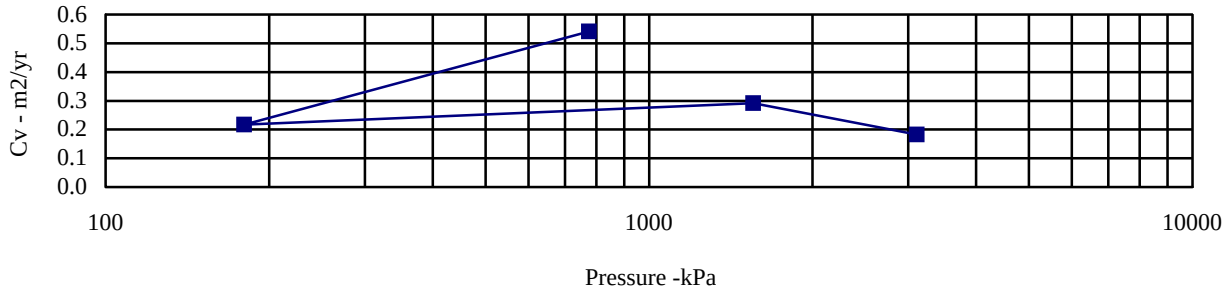
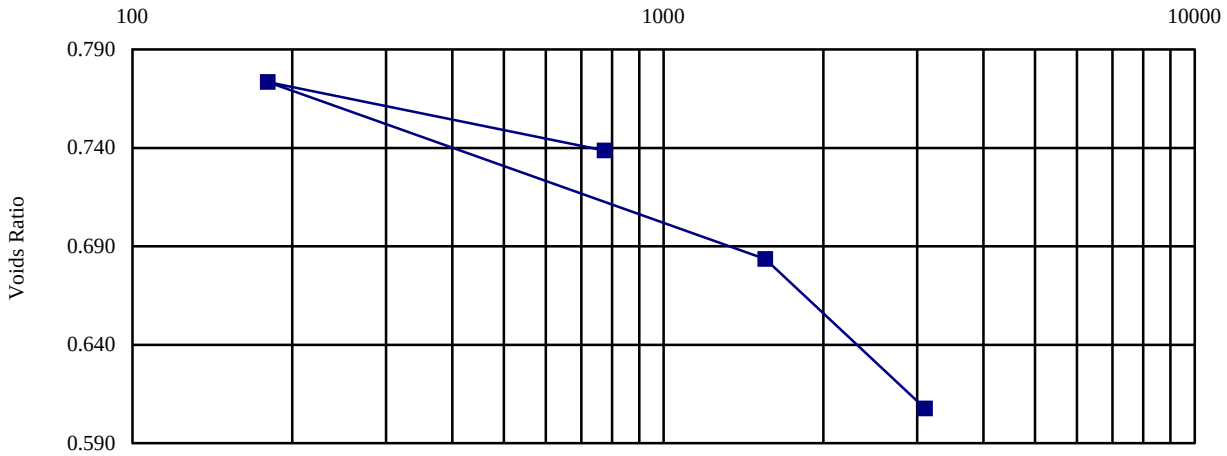
Hole Number: **BH12** **Depth (m):** **25.50-25.95**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	32							
Bulk Density (Mg/m3):	1.94	0	-	775	0.042	0.541	Method used to	
Dry Density (Mg/m3):	1.47	775	-	180	0.034	0.217	determine CV:	t90
Voids Ratio:	0.798	180	-	1555	0.037	0.292	Nominal temperature	
Degree of saturation:	104.8	1555	-	3110	0.029	0.182	during test ' C:	20
Height (mm):	20.12						Remarks:	
Diameter (mm)	75.11						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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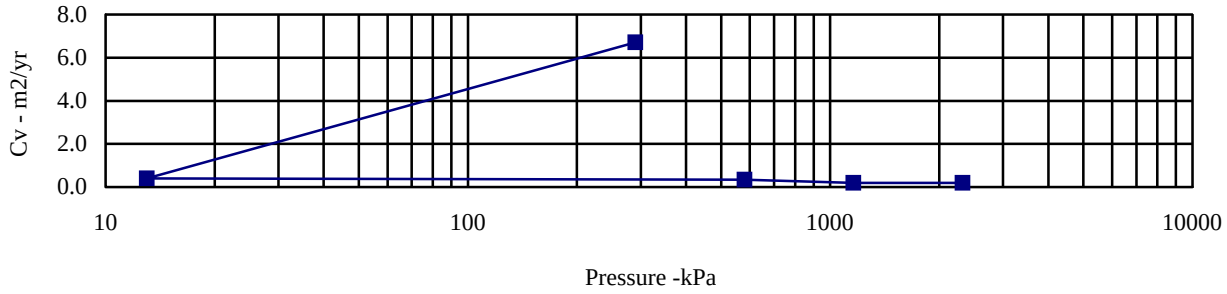
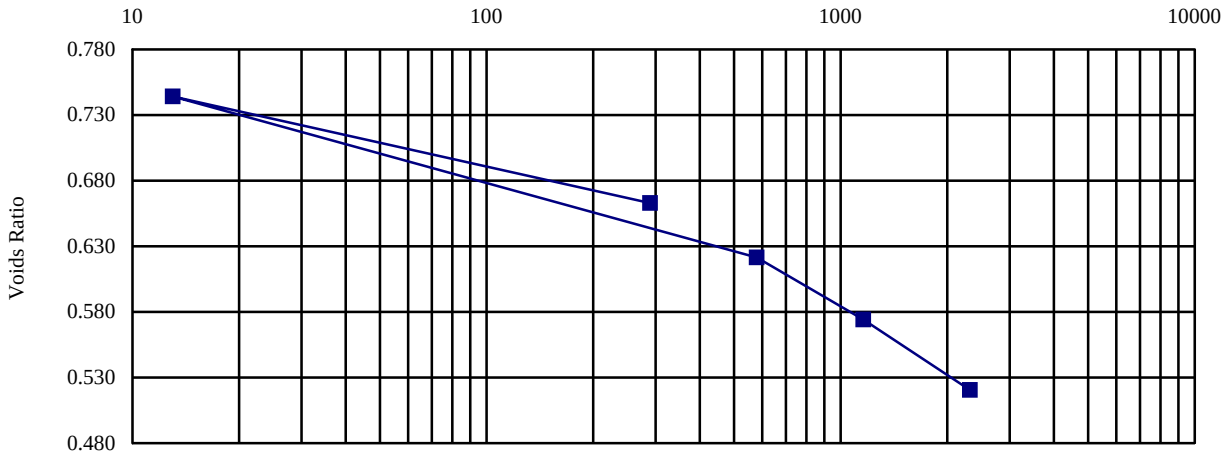
Hole Number: **BH16** **Depth (m):** **14.15-14.60**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.98	0	-	290	0.109	6.703	Method used to	
Dry Density (Mg/m3):	1.54	290	-	13	0.176	0.404	determine CV:	t90
Voids Ratio:	0.717	13	-	580	0.124	0.343	Nominal temperature	
Degree of saturation:	104.2	580	-	1160	0.050	0.200	during test ' C:	20
Height (mm):	19.97	1160	-	2320	0.029	0.199	Remarks:	
Diameter (mm)	75.21						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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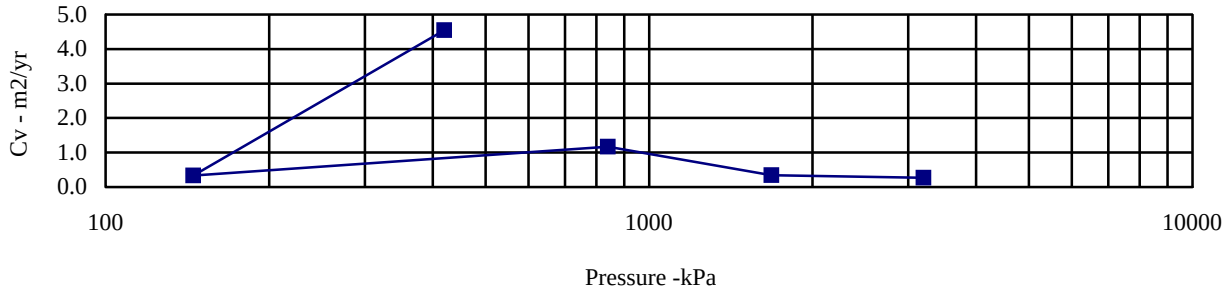
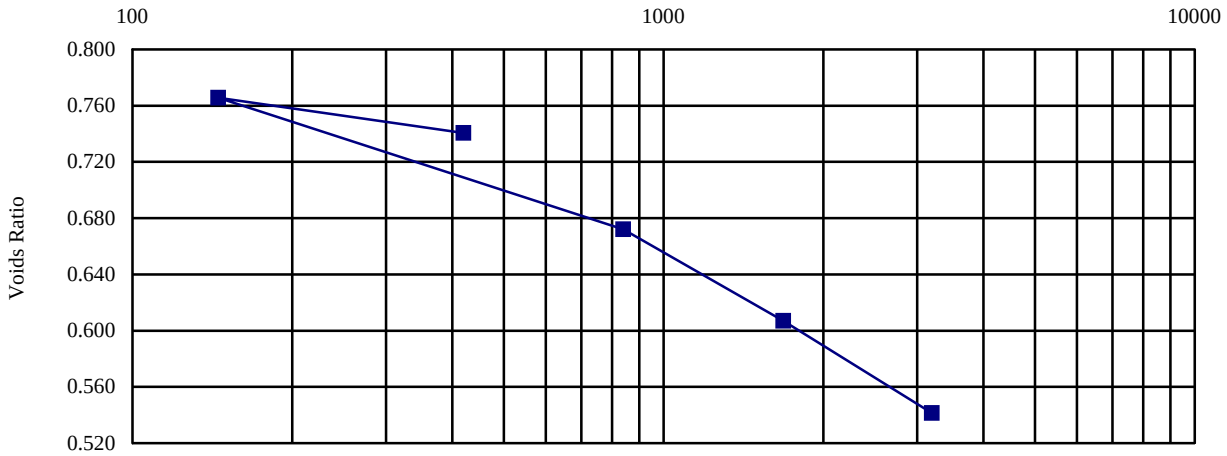
BS 1377: Part 5: 1990

Hole Number: **BH16** **Depth (m):** **20.40-20.85**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.86	0	-	420	0.092	4.549	Method used to	
Dry Density (Mg/m3):	1.46	420	-	145	0.053	0.338	determine CV:	t90
Voids Ratio:	0.810	145	-	840	0.076	1.170	Nominal temperature	
Degree of saturation:	87.5	840	-	1680	0.046	0.340	during test ' C:	20
Height (mm):	19.91	1680	-	3200	0.027	0.268	Remarks:	
Diameter (mm)	50.14						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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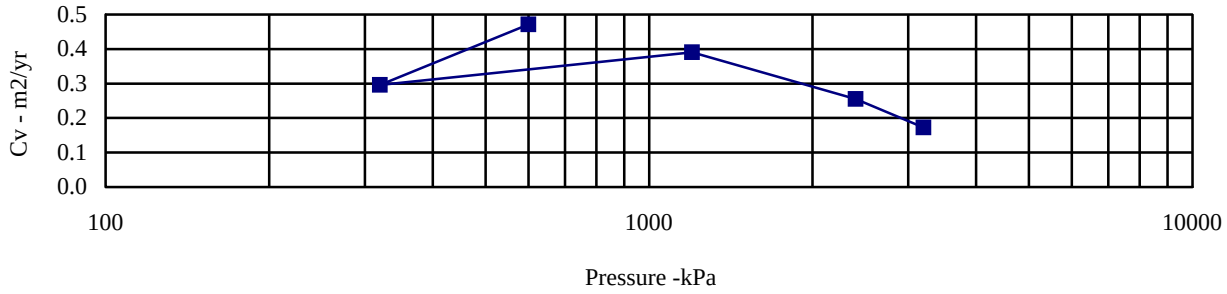
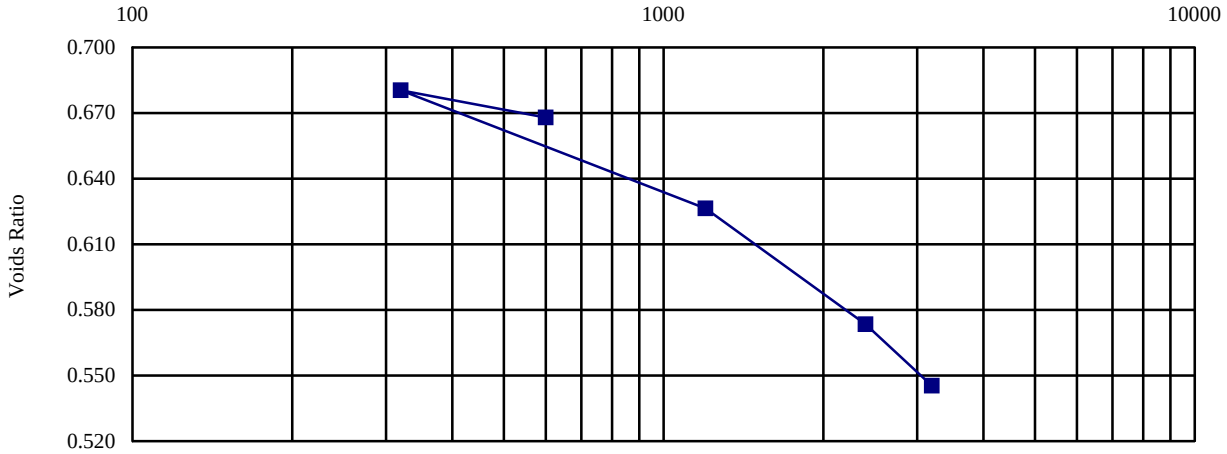
Hole Number: **BH16** **Depth (m):** **28.00-28.45**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.97	0	-	600	0.058	0.471	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.53	600	-	320	0.027	0.296		
Voids Ratio:	0.728	320	-	1200	0.037	0.391	Nominal temperature during test ' C:	20
Degree of saturation:	103.4	1200	-	2400	0.027	0.255		
Height (mm):	19.74	2400	-	3200	0.022	0.173	Remarks: See summary of soils description.	
Diameter (mm)	75.22							
Particle Density (Mg/m3):	2.65							
Assumed								





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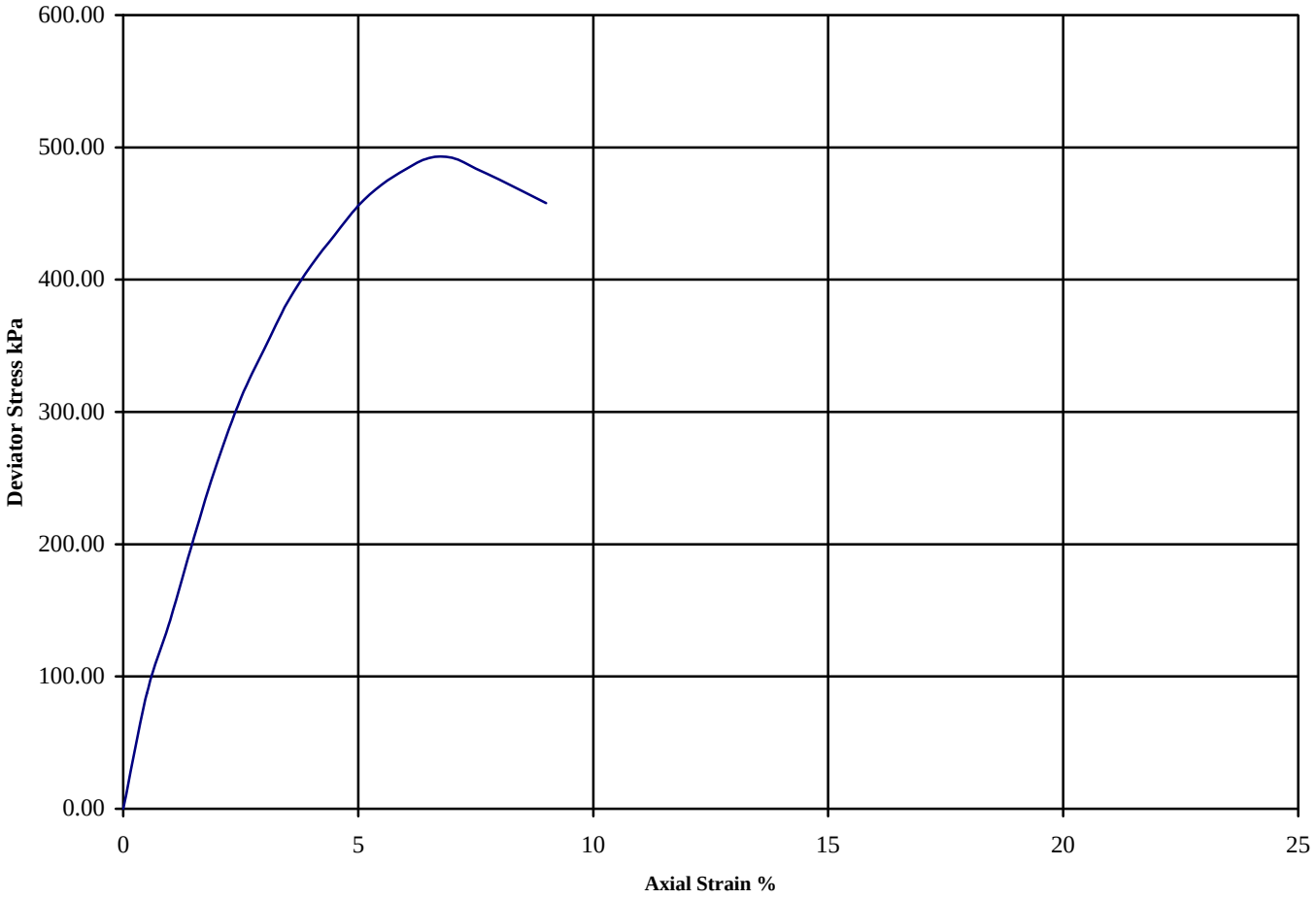
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH5 **Depth (m):** 15.00-15.55

Sample Number: 33 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.11	1.67	435	492	246	7.0	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

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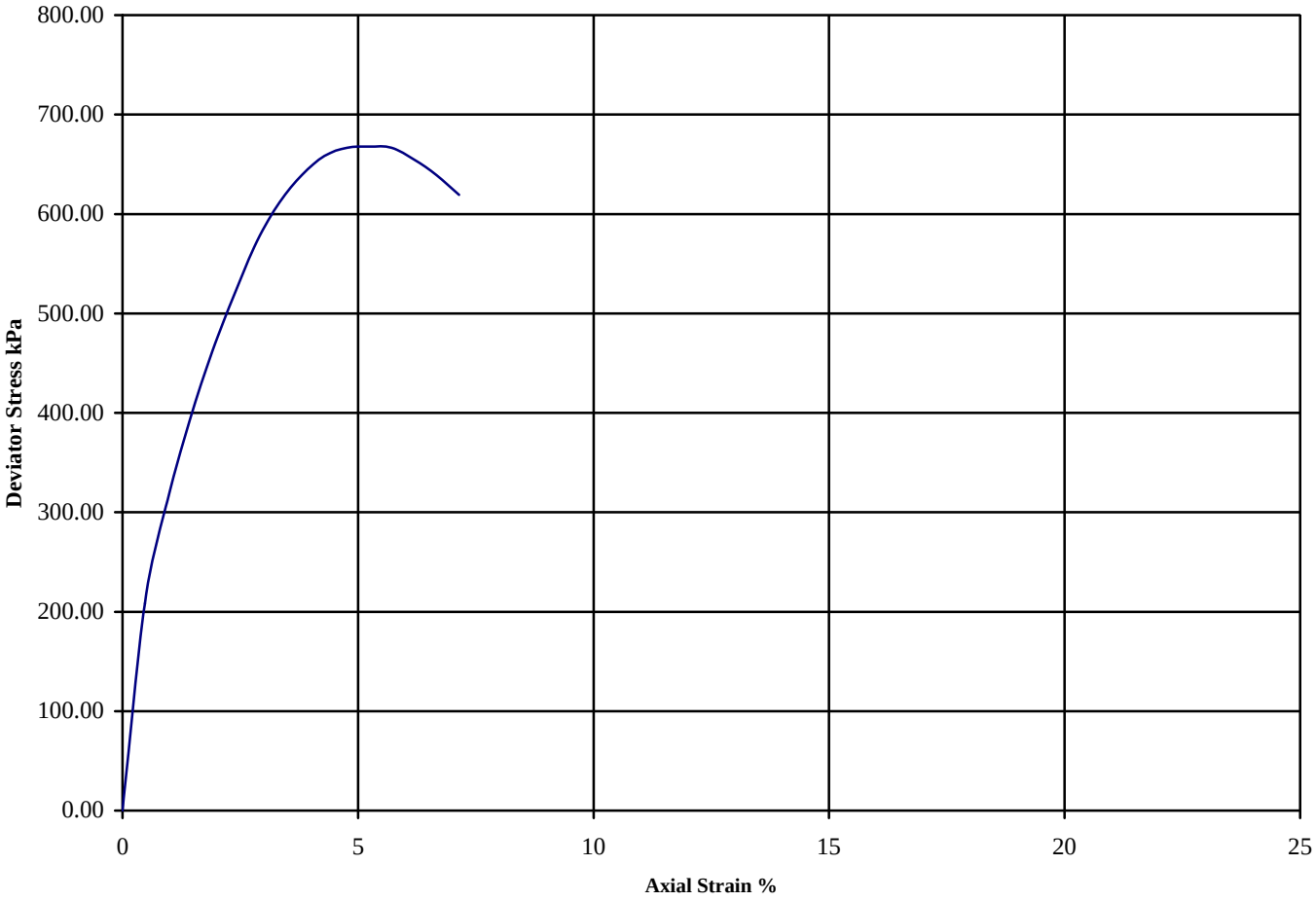
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH6 **Depth (m):** 16.20-16.65

Sample Number: 34 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	2.04	1.62	570	668	334	5.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

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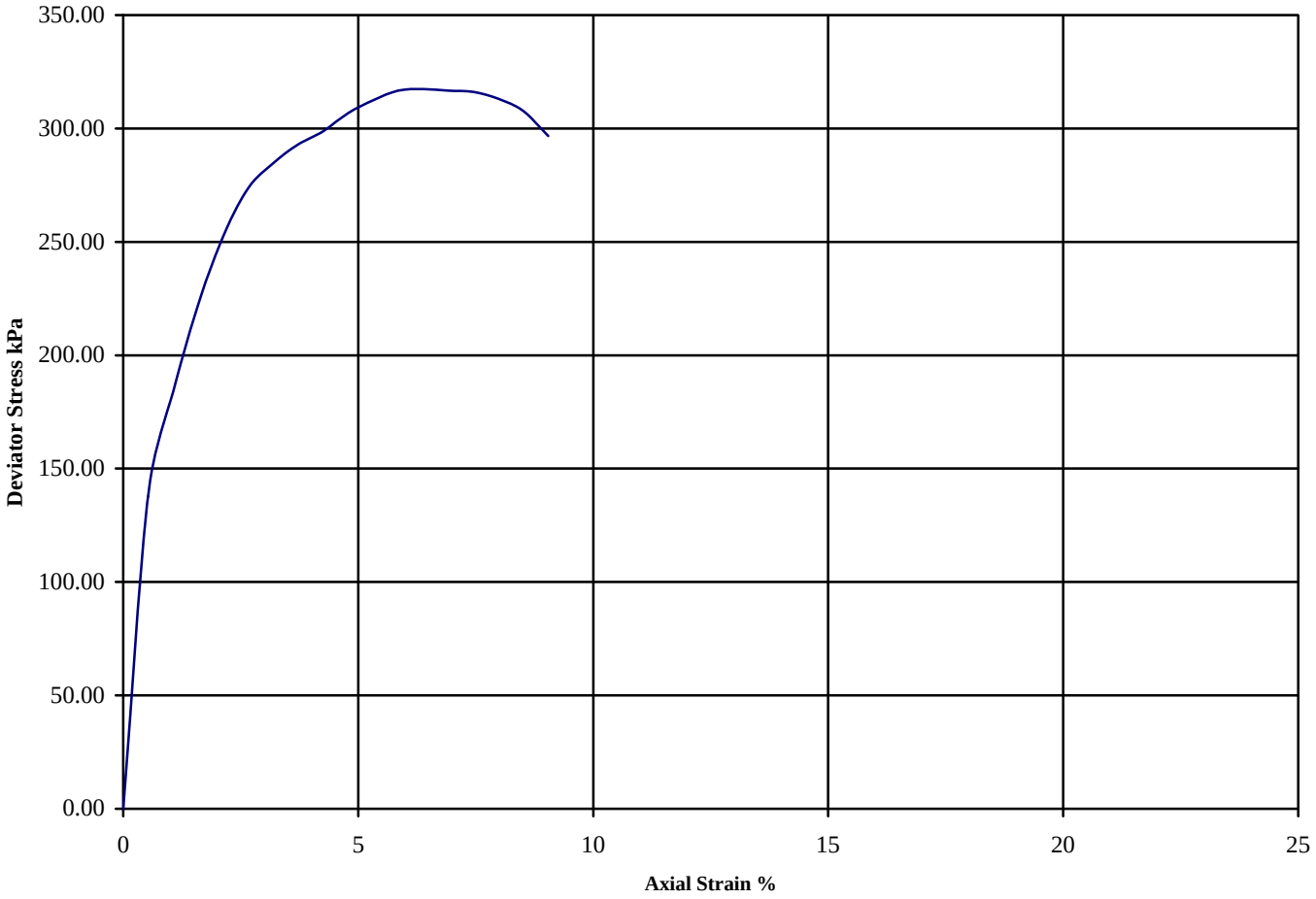
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH11** **Depth (m):** **24.10-24.55**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		188.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.93	1.51	520	317	159	6.4	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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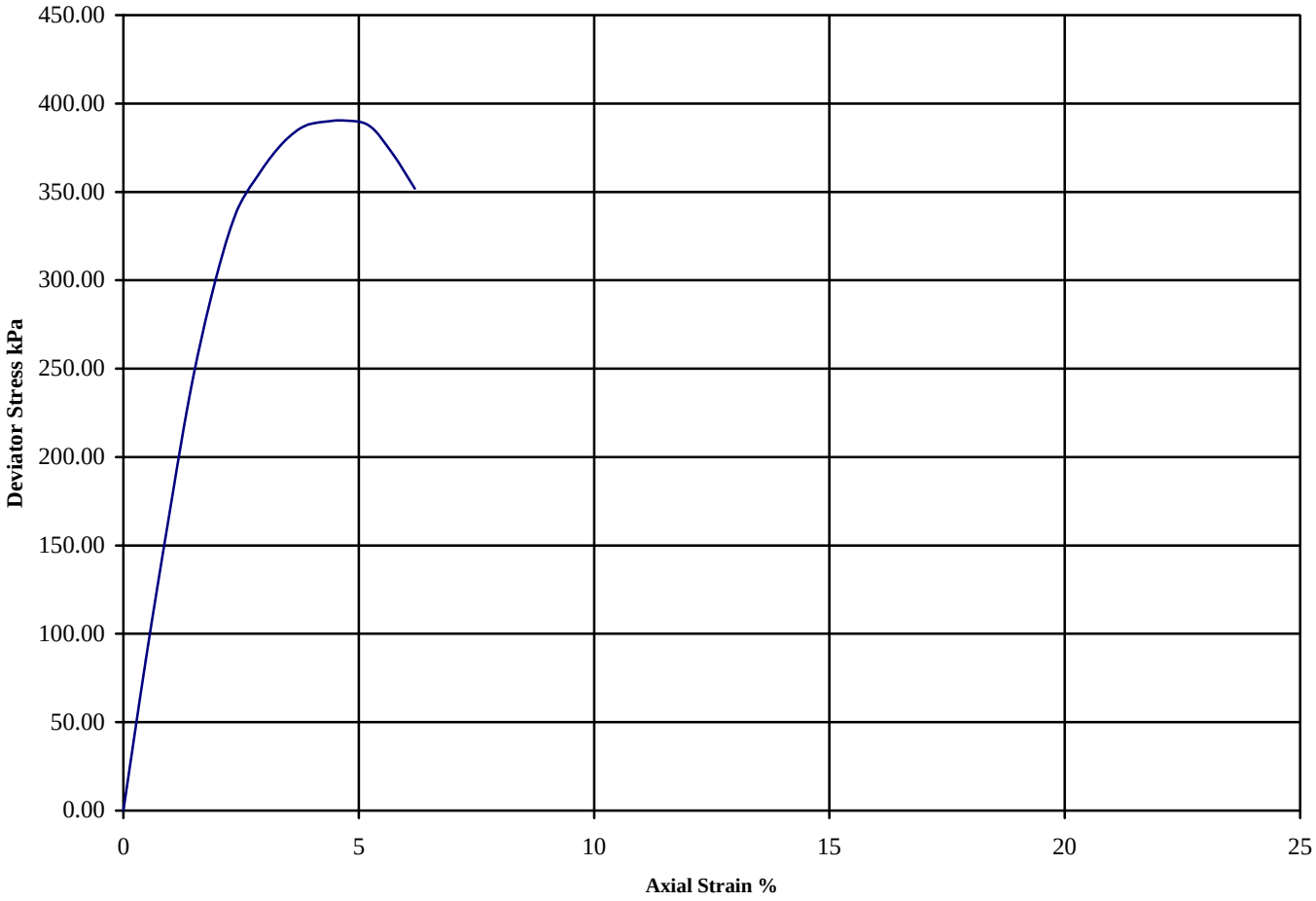
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH11** **Depth (m):** **31.80-32.25**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.90	1.49	690	390	195	4.8	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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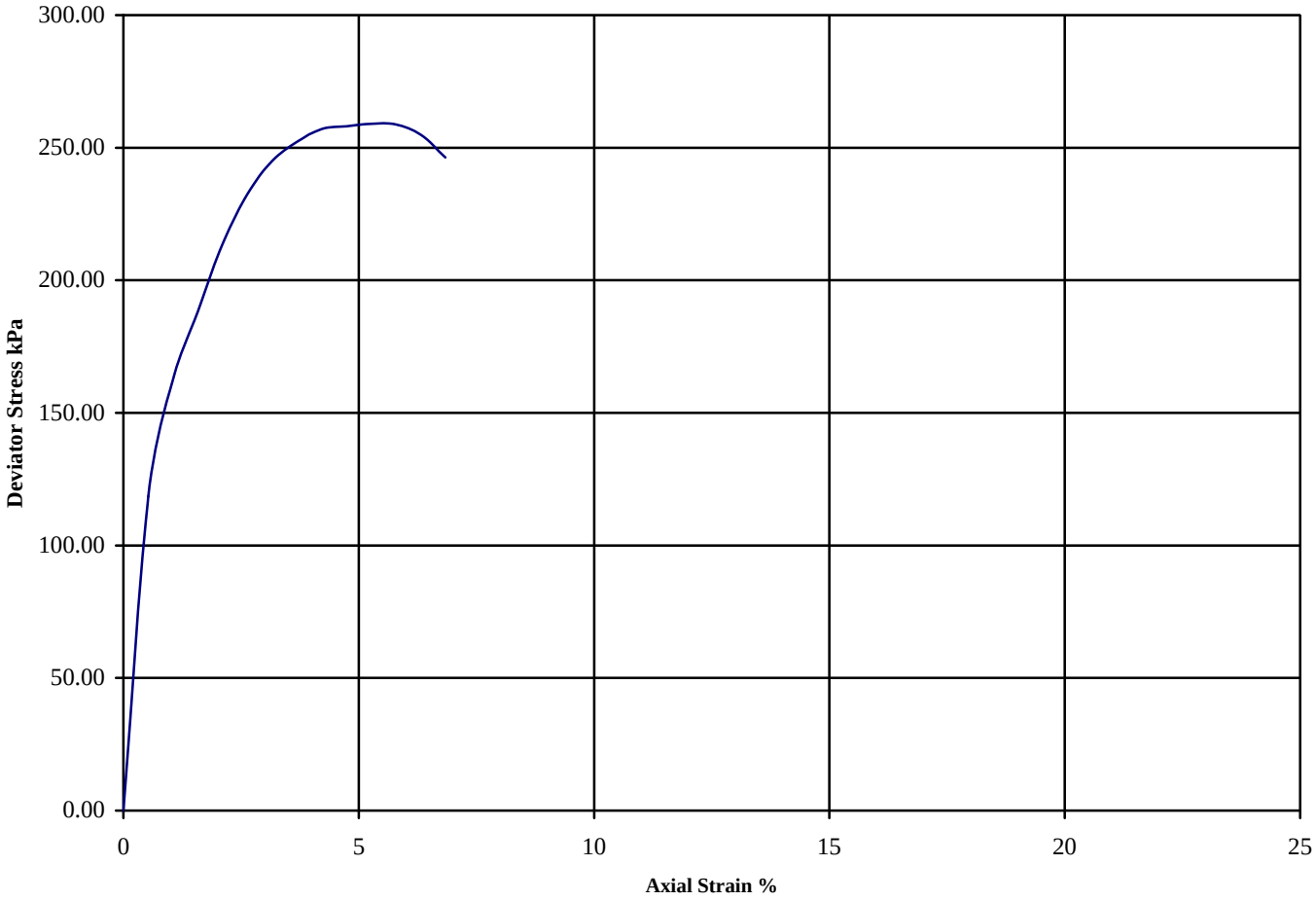
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH11** **Depth (m):** **34.20-35.15**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		190.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	31	1.91	1.46	730	259	130	5.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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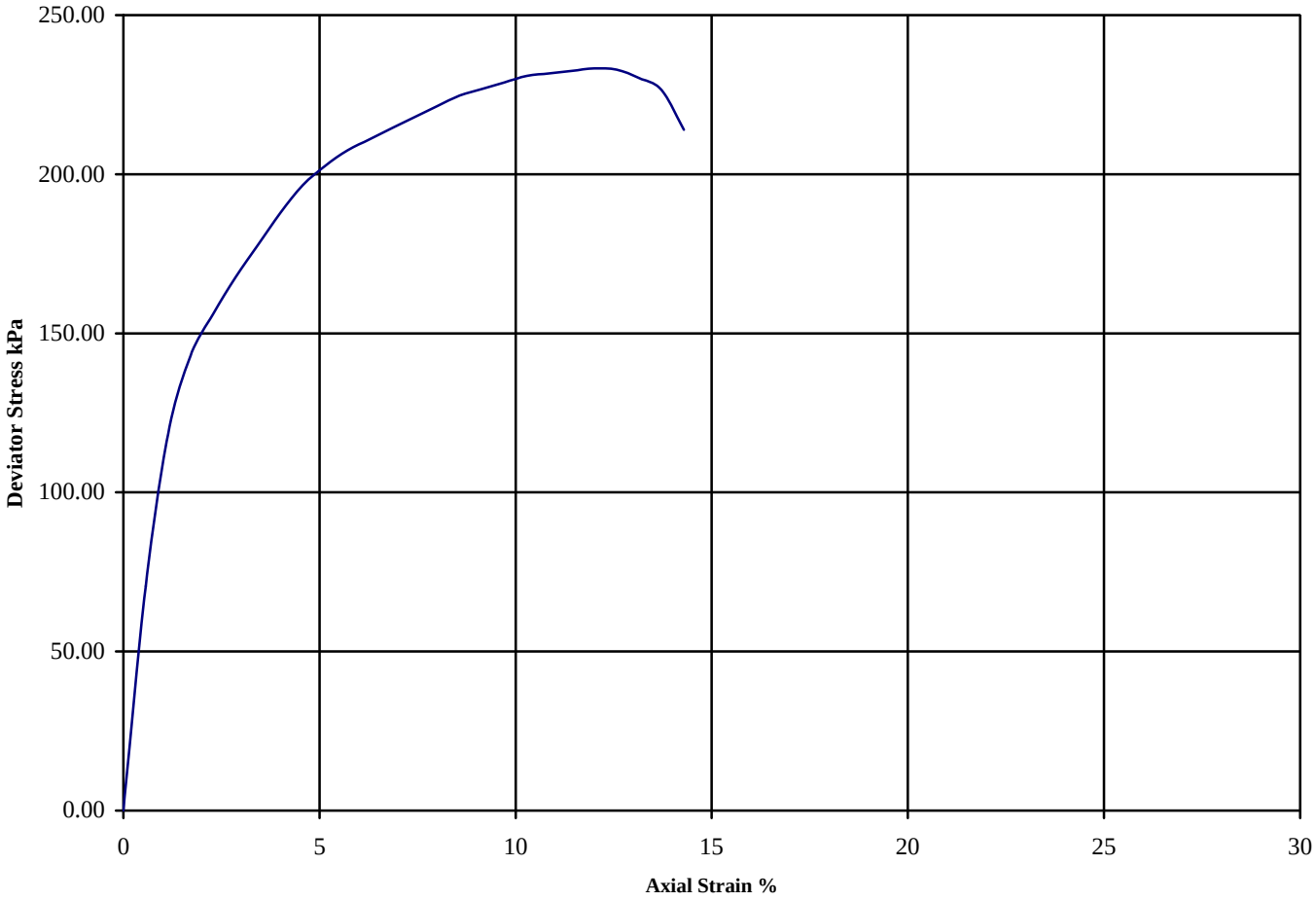
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH12** **Depth (m):** **5.20-5.50**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		175.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.02	1.59	330	233	117	12.0	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.40 kPa See summary of soil descriptions.

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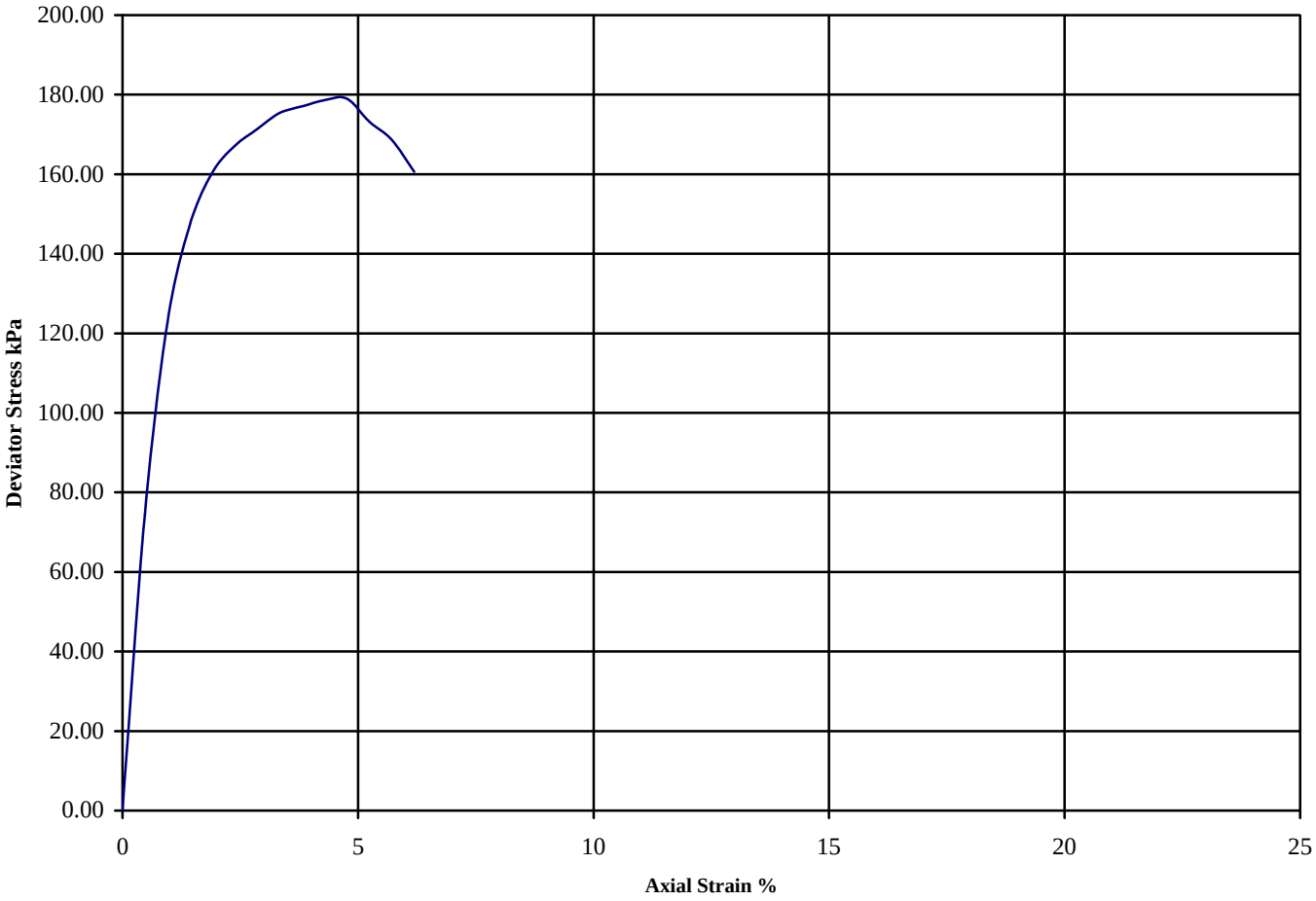
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH12** **Depth (m):** **10.25-10.55**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.99	1.53	440	179	89	4.8	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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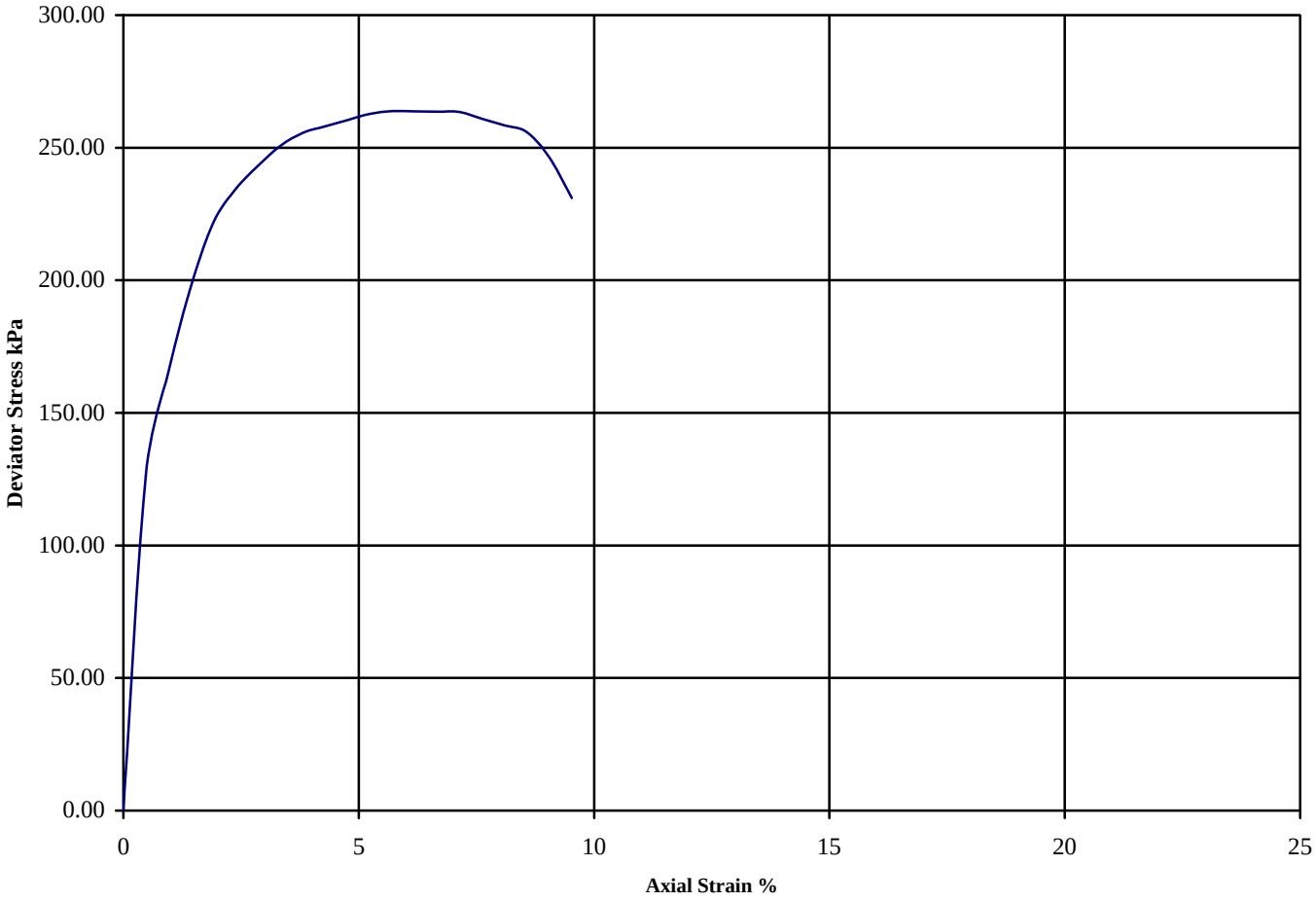
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH13** **Depth (m):** **26.55-27.00**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.97	1.54	560	264	132	5.7	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

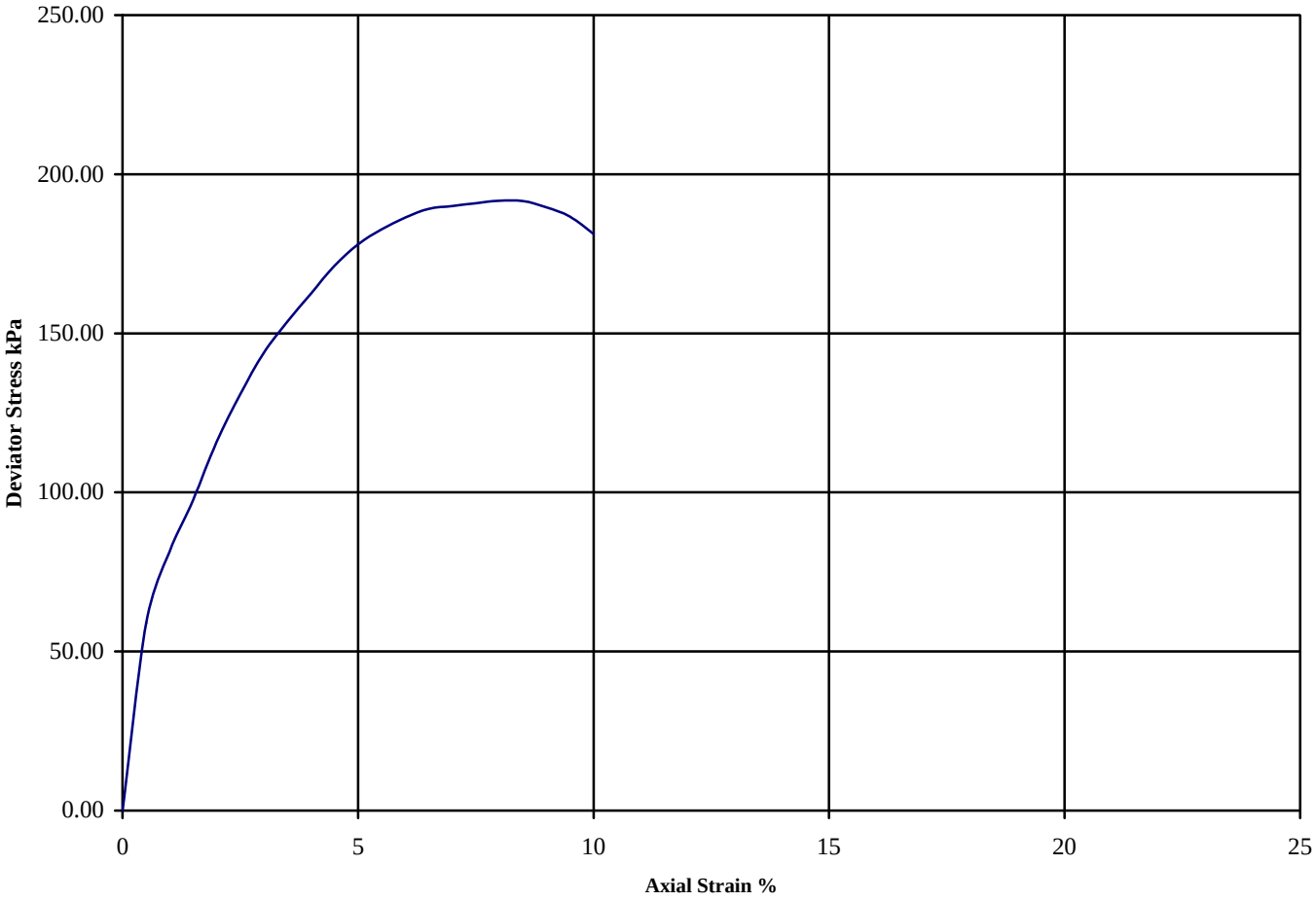
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH14 **Depth (m):** 1.20-1.65

Sample Number: 3 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	20	2.19	1.82	32	192	96	8.0	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

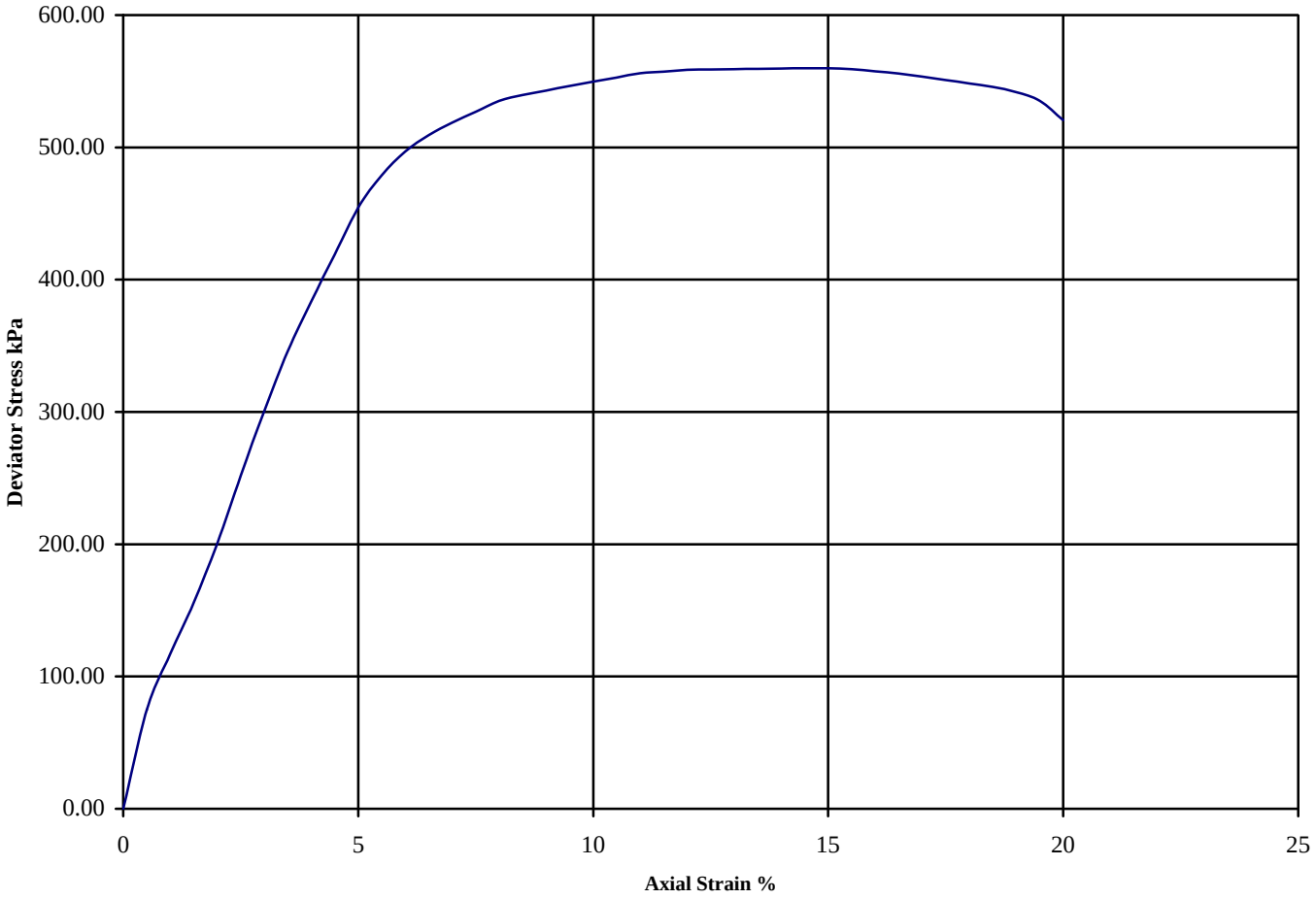
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH14 **Depth (m):** 3.20-3.60

Sample Number: 8 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.24	1.89	74	560	280	15.0	Compound	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.34 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

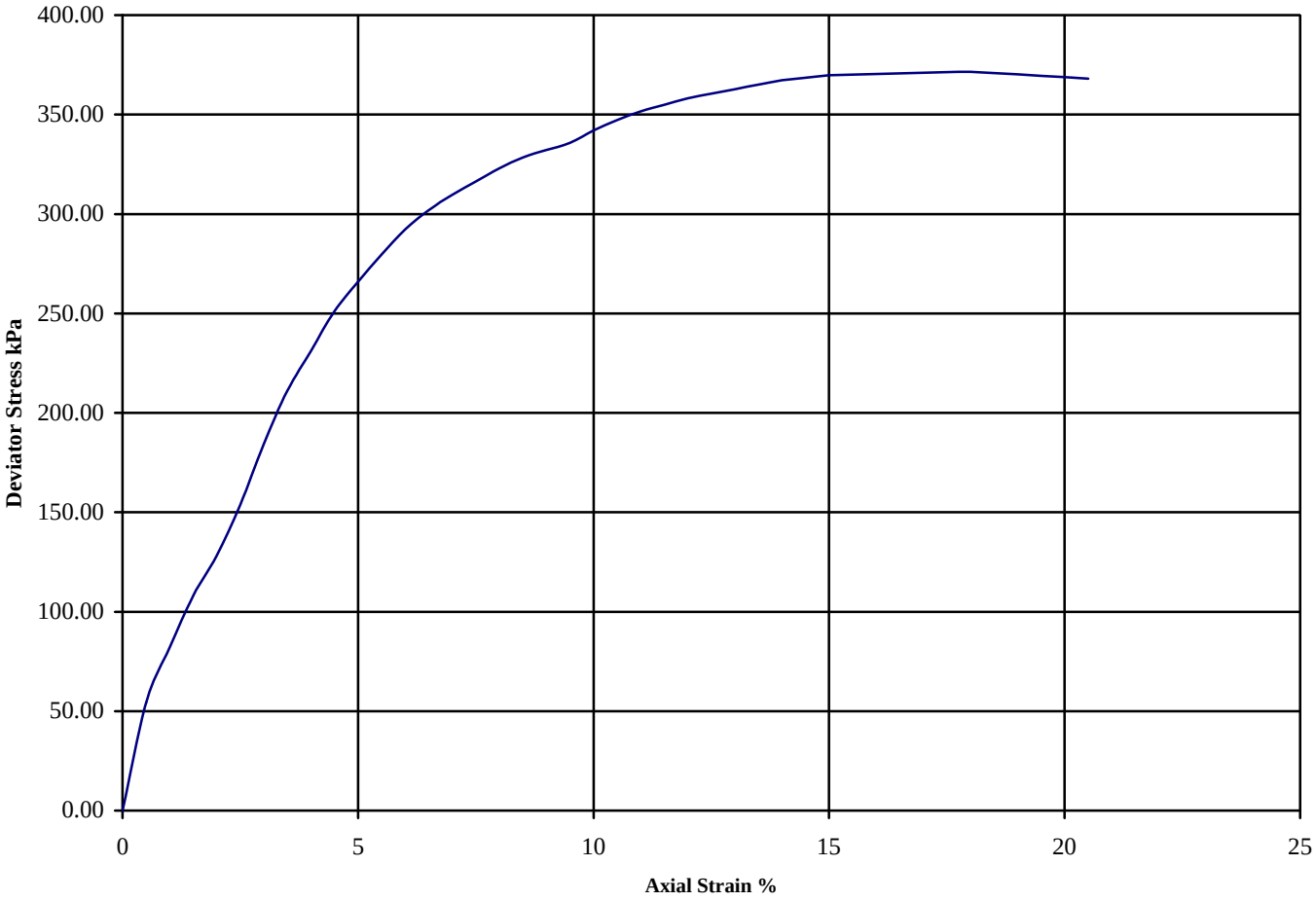
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH14 **Depth (m):** 5.20-5.65

Sample Number: 12 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.27	1.91	115	371	186	18.0	Compound	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.34 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

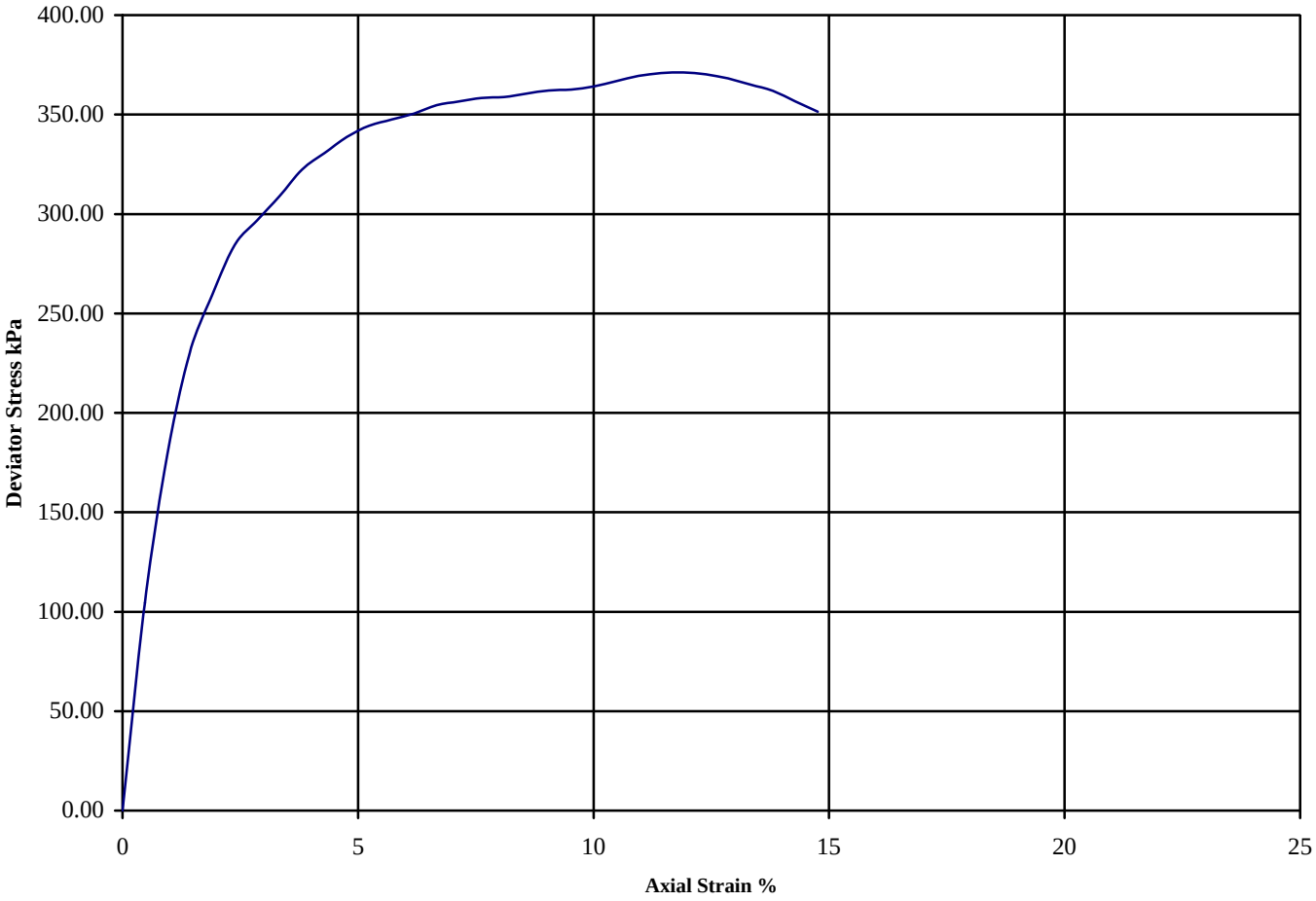
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH16** **Depth (m):** **31.90-32.35**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	2.01	1.57	680	371	186	11.9	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.40 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

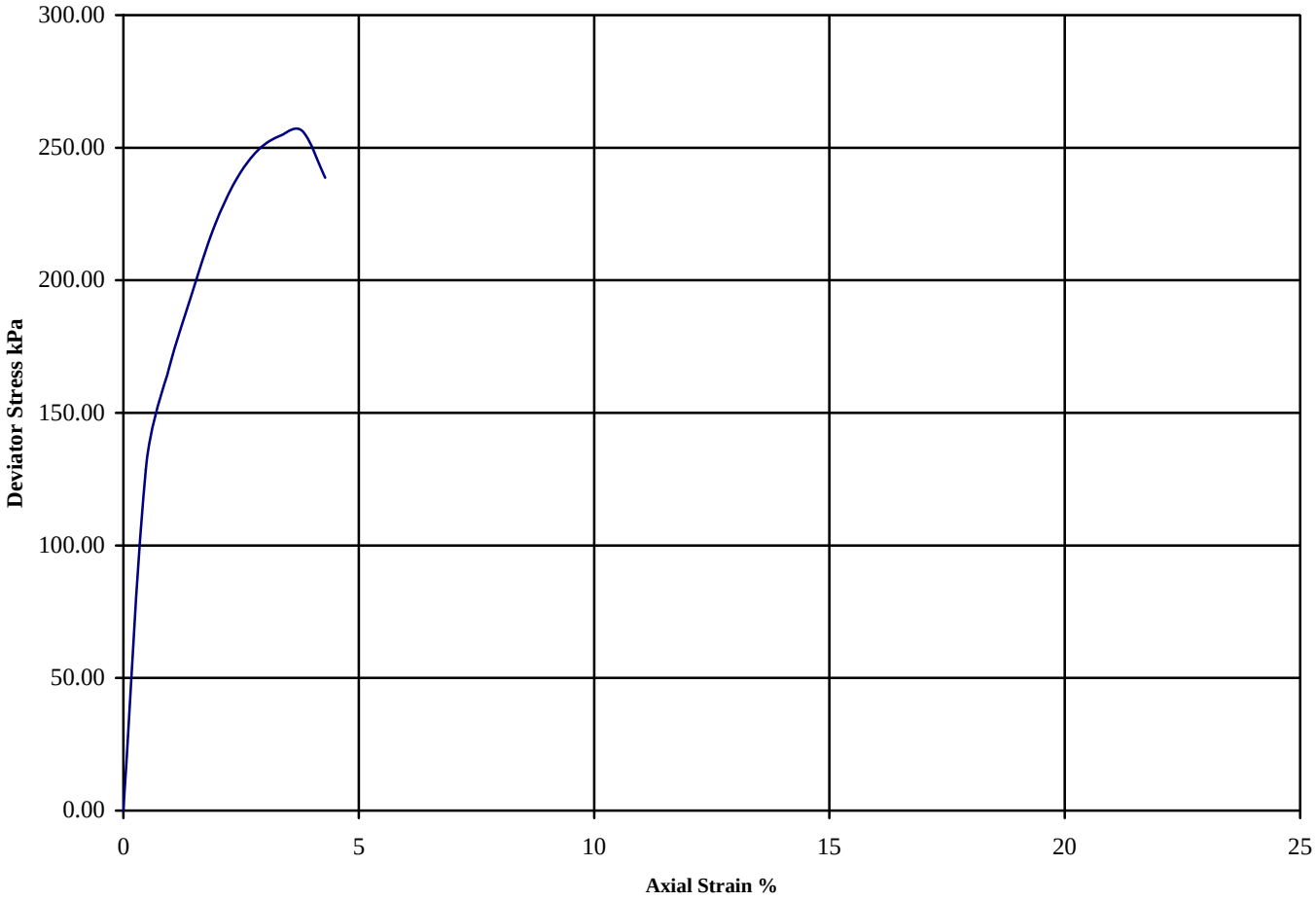
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH17 **Depth (m):** 1.20-1.65

Sample Number: 1 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	24	2.00	1.61	30	256	128	3.8	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.37 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

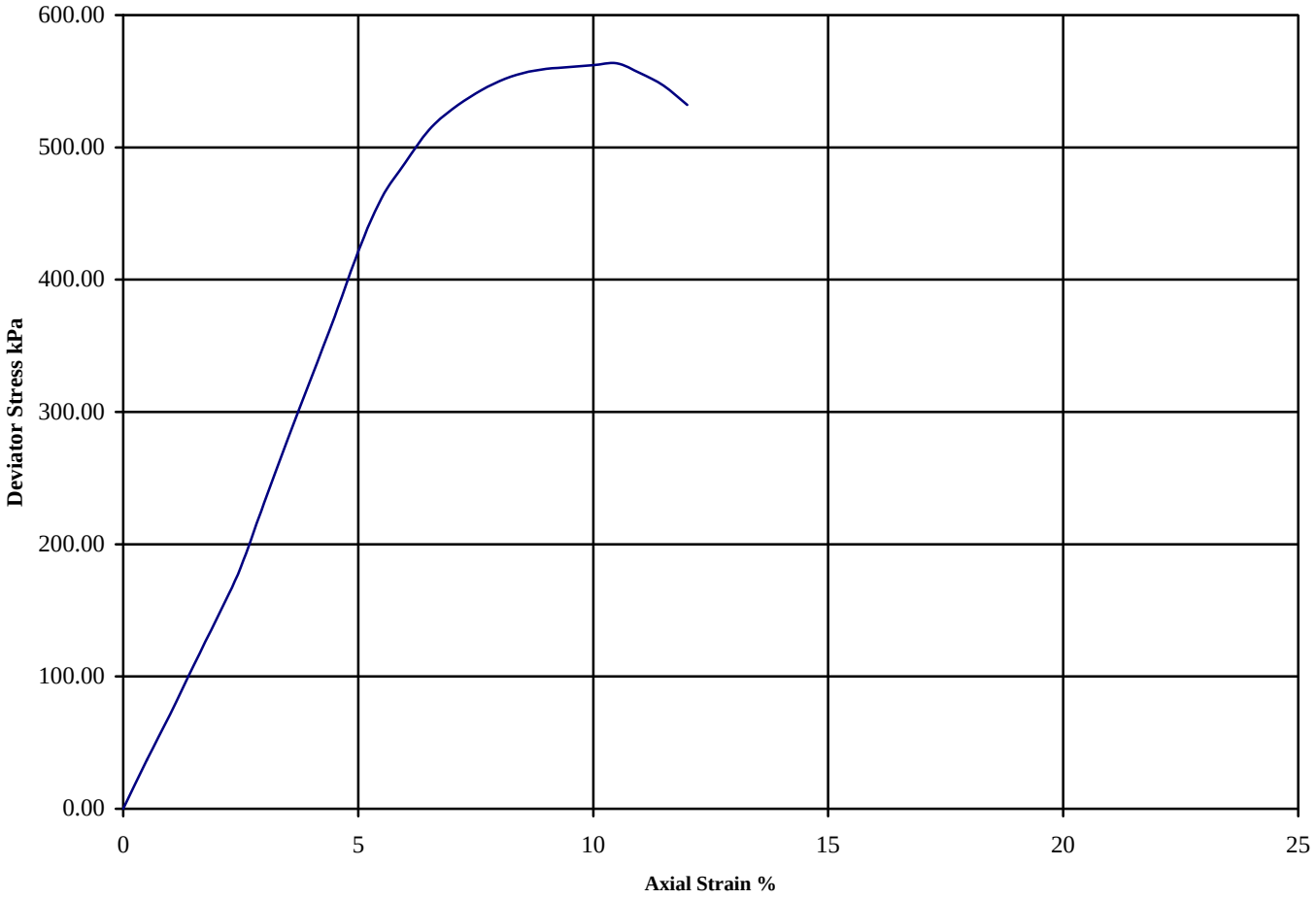
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH17 **Depth (m):** 3.20-3.65

Sample Number: 6 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	17	2.22	1.90	75	564	282	10.5	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

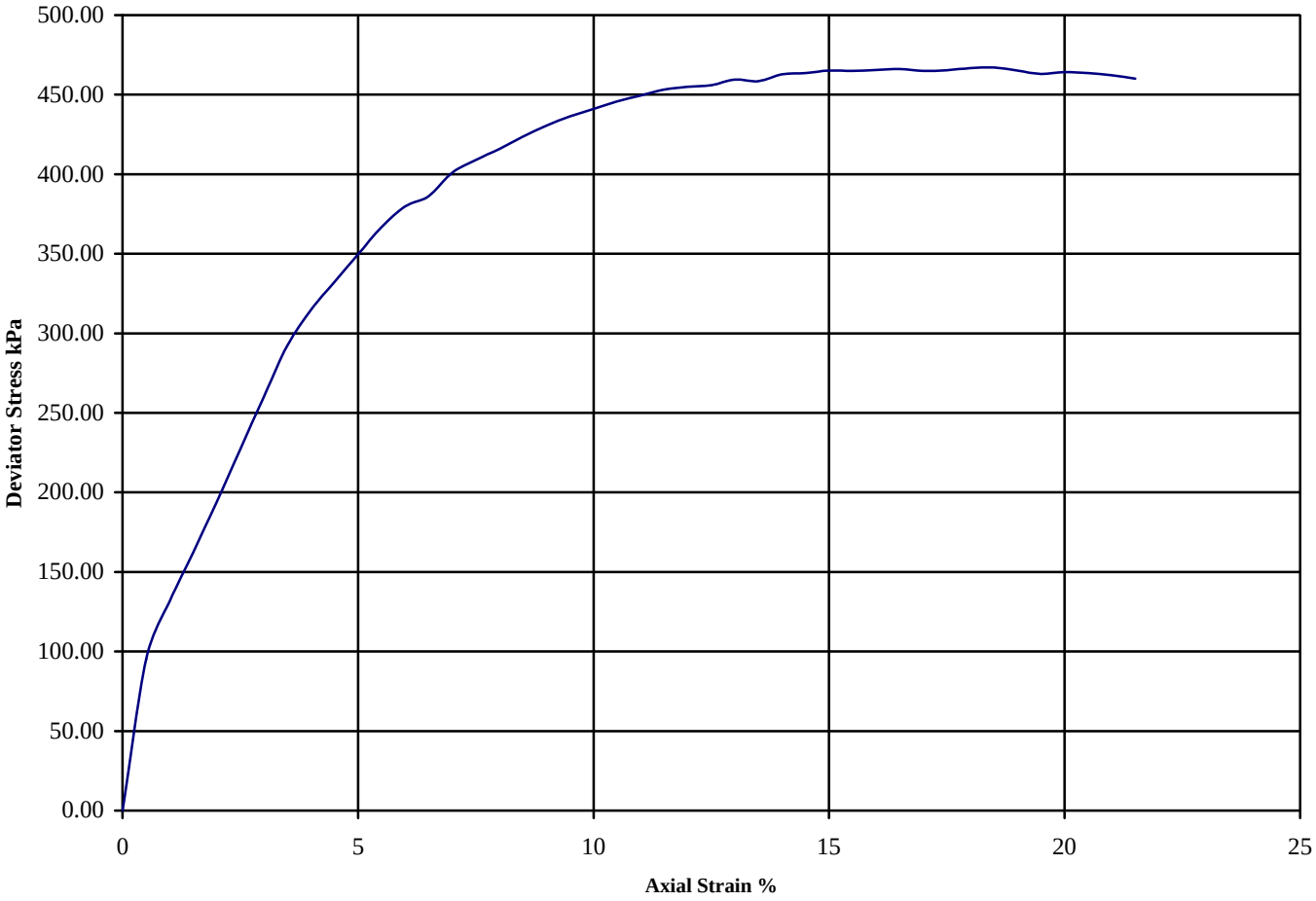
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH17 **Depth (m):** 5.20-5.65

Sample Number: 10 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		200.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	15	2.33	2.03	115	467	234	18.5	Compound	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.34 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	02/09/14		02/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/3950

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-13334

26-Aug-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-13334
Client Reference	PSL14/3950
Contract Title	Rivenhall Airfield IWMF
Description	14 Soil samples.
Date Received	18-Aug-14
Date Started	18-Aug-14
Date Completed	26-Aug-14
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13334
Client Ref PSL14/3950
Contract Title Rivenhall Airfield IWMF

			Lab No	686954	686955	686956	686957	686958	686959	686960	686961	686962	686963	686964	686965
			Sample ID	BH5	BH5	BH6	BH6	BH9	BH9	BH10	BH11	BH12	BH12	BH14	BH16
			Depth	9.00	16.50	7.65	15.70	5.60	9.70	13.75-13.85	30.10-30.20	7.10-7.20	24.70-24.80	4.70	4.60-4.70
			Other ID	20	36	17	33	12	20					11	
			Sample Type	D	D	D	D	D	D	D	D	D	D	D	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**												
Metals															
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	13	26	11	28	13	29	< 10	< 10	16	68	< 10	< 10
Inorganics															
pH	DETSC 2008#			8.2	8.3	8.4	8.4	8.6	8.4	8.4	8.7	8.2	8.1	8.4	8.3
Chloride Aqueous Extract	DETSC 2055	1	mg/l	14	20	16	30	15	21	8.4	35	20	43	4.8	8.9
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.8	< 1.0	< 1.0	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	600	920	450	1000	580	1000	300	500	640	2100	40	84
Total Sulphur as S	DETSC 2320	0.01	%	0.21	0.63	0.27	0.65	0.25	0.39	0.21	0.30	0.35	0.85	0.02	0.03
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.12	0.17	0.11	0.19	0.10	0.18	0.10	0.10	0.14	0.31	0.04	0.04

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 14-13334
Client Ref PSL14/3950
Contract Title Rivenhall Airfield IWMF

			Lab No	686966	686967
			Sample ID	BH16	BH17
			Depth	25.80-25.90	3.60
			Other ID		7
			Sample Type	D	D
			Sampling Date	n/s	n/s
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	26	< 10
Inorganics					
pH	DETSC 2008#			8.4	8.3
Chloride Aqueous Extract	DETSC 2055	1	mg/l	27	8.3
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	< 1.0	1.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	960	52
Total Sulphur as S	DETSC 2320	0.01	%	0.49	0.01
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.15	0.02

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-13334
Client Ref PSL14/3950
Contract Rivenhall Airfield IWMF

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
686954	BH5 9.00 SOIL		PT 1L (1kg)	Sample date not supplied	
686955	BH5 16.50 SOIL		PT 1L (1kg)	Sample date not supplied	
686956	BH6 7.65 SOIL		PT 1L (1kg)	Sample date not supplied	
686957	BH6 15.70 SOIL		PT 1L (1kg)	Sample date not supplied	
686958	BH9 5.60 SOIL		PT 1L (1kg)	Sample date not supplied	
686959	BH9 9.70 SOIL		PT 1L (1kg)	Sample date not supplied	
686960	BH10 13.75-13.85 SOIL		PT 1L (1kg)	Sample date not supplied	
686961	BH11 30.10-30.20 SOIL		PT 1L (1kg)	Sample date not supplied	
686962	BH12 7.10-7.20 SOIL		PT 1L (1kg)	Sample date not supplied	
686963	BH12 24.70-24.80 SOIL		PT 1L (1kg)	Sample date not supplied	
686964	BH14 4.70 SOIL		PT 1L (1kg)	Sample date not supplied	
686965	BH16 4.60-4.70 SOIL		PT 1L (1kg)	Sample date not supplied	
686966	BH16 25.80-25.90 SOIL		PT 1L (1kg)	Sample date not supplied	
686967	BH17 3.60 SOIL		PT 1L (1kg)	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

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Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/4102

Client's Reference: Report Date: 09 September 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester

GL3 1DL

For the attention of: Simon Arinze

Contract Title: Rivenhall Airfield IWMF

Date Received: 14/08/2014
Date Commenced: 14/08/2014
Date Completed: 09/09/2014

Notes: Observations and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

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

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

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH8	4	D	2.50-2.95	Brown slightly gravelly slightly sandy silty CLAY.
BH8	6	D	3.25	Brown slightly gravelly sandy very silty CLAY.
BH8	7	U	3.50-3.95	Very stiff brown gravelly sandy silty CLAY.
BH8	14	B	7.50-7.95	Brown very sandy slightly silty GRAVEL.
BH8	23	B	12.00-12.45	Brown very gravelly slightly silty SAND.
BH10		C	18.75-19.20	Firm brown slightly sandy silty CLAY.
BH11		D	41.15-41.25	Brown silty CLAY.
BH11		D	42.45-42.56	Grey silty CLAY.
BH11		C	42.05-42.45	Stiff brown silty CLAY.
BH11		C	50.60-51.05	Stiff brown silty CLAY.
BH12		C	31.20-31.50	Stiff brown silty CLAY.
BH12		C	38.45-38.90	Grey silty CLAY.
BH14		C	17.85-18.20	Brown slightly gravelly slightly sandy silty CLAY.
BH14		D	19.80-19.90	Brown silty CLAY.
BH14		C	27.00-27.45	Firm brown silty CLAY.
BH14		C	34.55-35.00	Grey silty CLAY.
BH14		D	36.05-36.15	Brown silty CLAY.
BH14		D	37.25-37.35	Brown silty CLAY.
BH15	U	8	3.50-3.75	Very stiff brown gravelly sandy silty CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	08/09/14		09/09/14		09/09/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

Client Ref: C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH15	16	B	7.50	Brown sandy slightly silty GRAVEL.
BH15	18	B	9.00-9.30	Brown very sandy slightly silty GRAVEL.
BH16		C	36.90-37.35	Stiff brown silty CLAY.
BH17	23	B	14.00-14.50	Brown slightly gravelly very silty SAND.
BH18A		U	1.20-1.65	Stiff brown gravelly slightly sandy silty CLAY.
BH18A		D	4.60-4.70	Brown silty CLAY.
BH18A		D	5.60-5.70	Grey silty CLAY.
BH18A		B	6.85-7.80	Brown very sandy GRAVEL.
BH18A		B	12.20-13.50	Brown gravelly slightly silty SAND.
BH18A		C	16.95-17.45	Firm brown silty CLAY.
BH18A		C	20.00-20.45	Brown slightly sandy silty CLAY.
BH18A		D	24.00	Brown silty CLAY.
BH18A		C	25.75-26.20	Very stiff brown silty CLAY.
BH19		U	2.00-2.45	Very stiff brown very gravelly slightly sandy very silty CLAY.
BH19		B	6.50-7.20	Brown very sandy slightly silty GRAVEL.
BH19		B	9.50-10.90	Brown very sandy slightly silty GRAVEL.

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Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	08/09/14		09/09/14		09/09/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

Client Ref: C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH8	4	D	2.50-2.95	18								
BH8	6	D	3.25	17				38	24	14	93	Intermediate plasticity CI.
BH11		D	41.15-41.25	30								
BH11		D	42.45-42.56	29				74	29	45	100	Very high plasticity MV.
BH14		D	19.80-19.90	27				77	30	47	100	Very high plasticity CV.
BH14		D	36.05-36.15	30								
BH14		D	37.25-37.35	37				81	31	50	100	Very high plasticity CV.
BH18A		D	4.60-4.70	31								
BH18A		D	5.60-5.70	30				76	30	46	100	Very high plasticity CV.
BH18A		D	24.00	29				80	31	49	100	Very high plasticity CV.

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

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Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	08/09/14		09/09/14		09/09/14

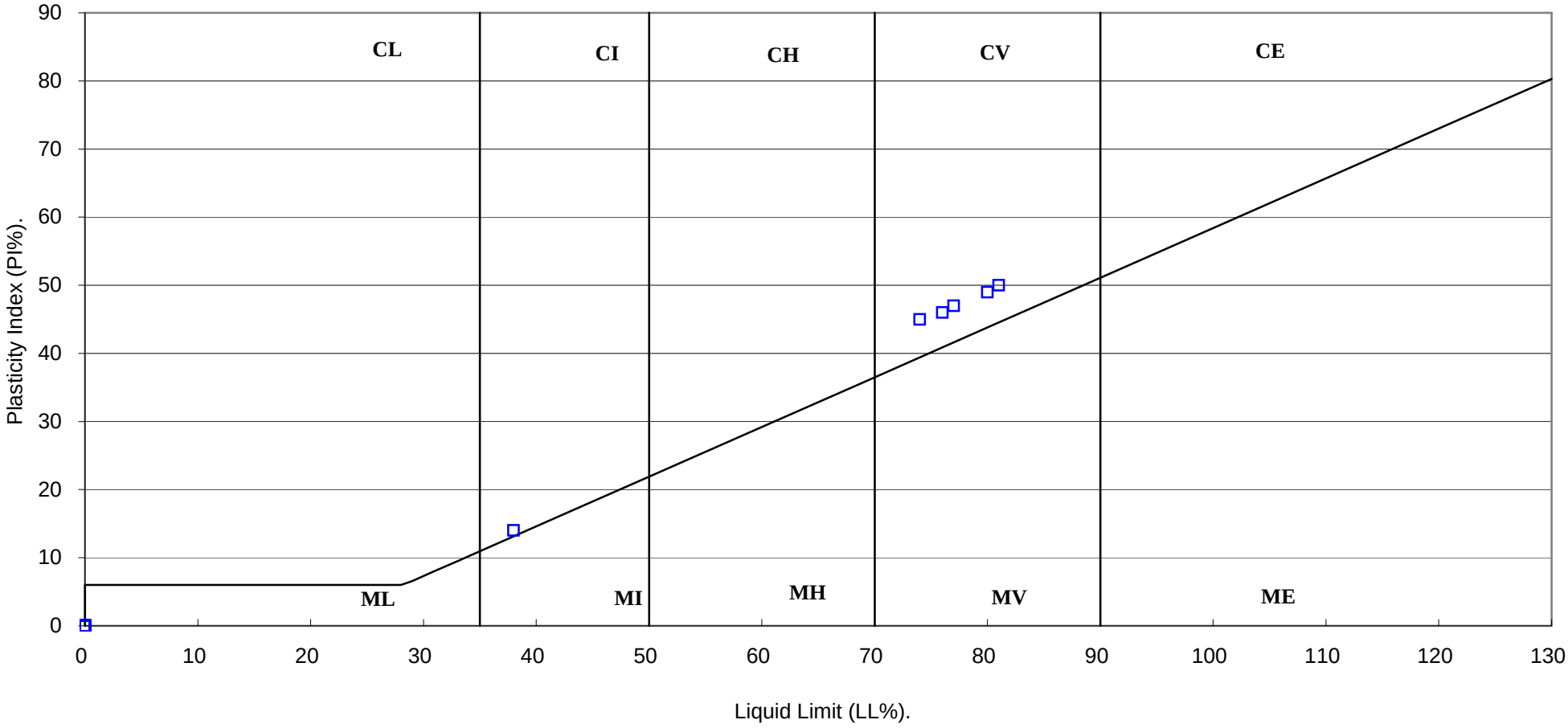
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/4102**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		08/09/14		09/09/14		09/09/14
	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/4102
					Client Ref:	C4237

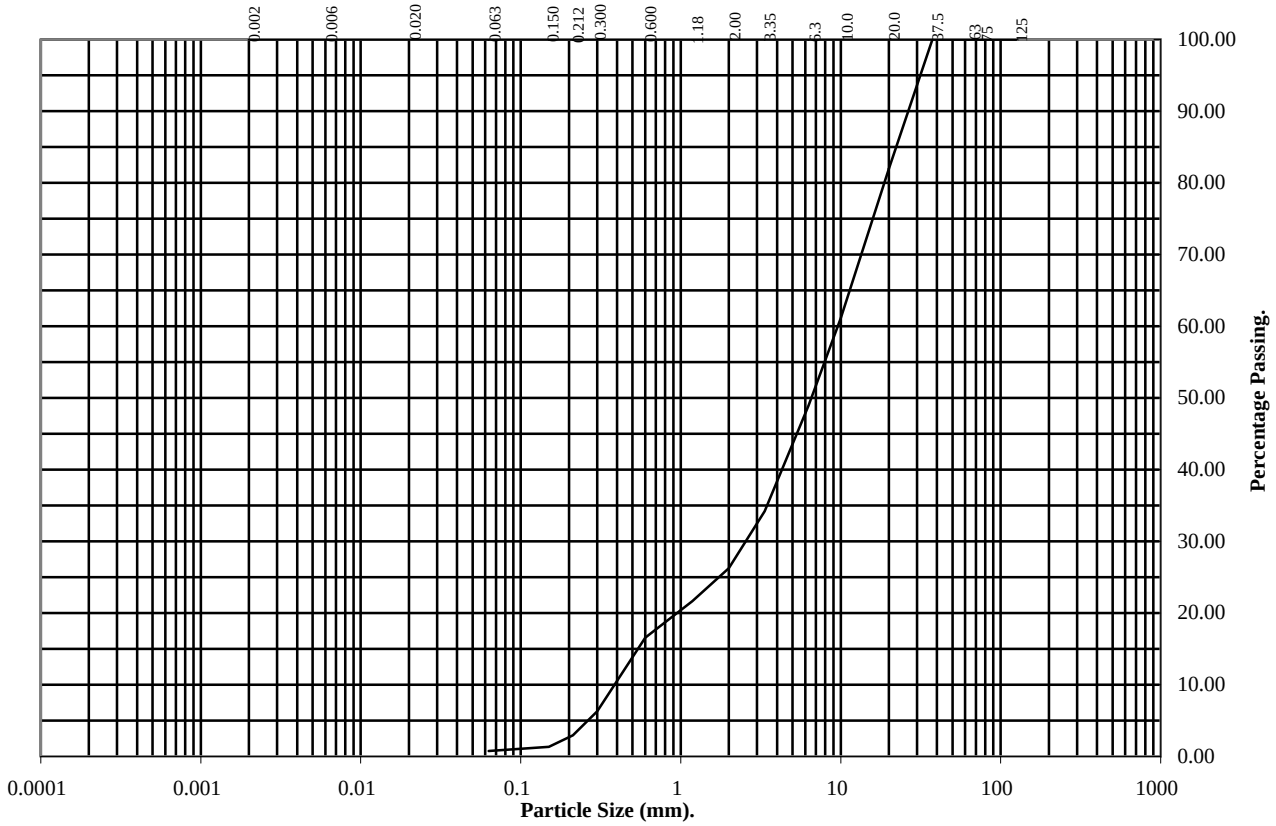
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH8** **Depth (m):** **7.50-7.95**

Sample Number: **14** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	82
10	61
6.3	49
3.35	34
2	26
1.18	22
0.6	17
0.3	6
0.212	3
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	74
Sand	25
Silt / Clay	1

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	09/09/14		09/09/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

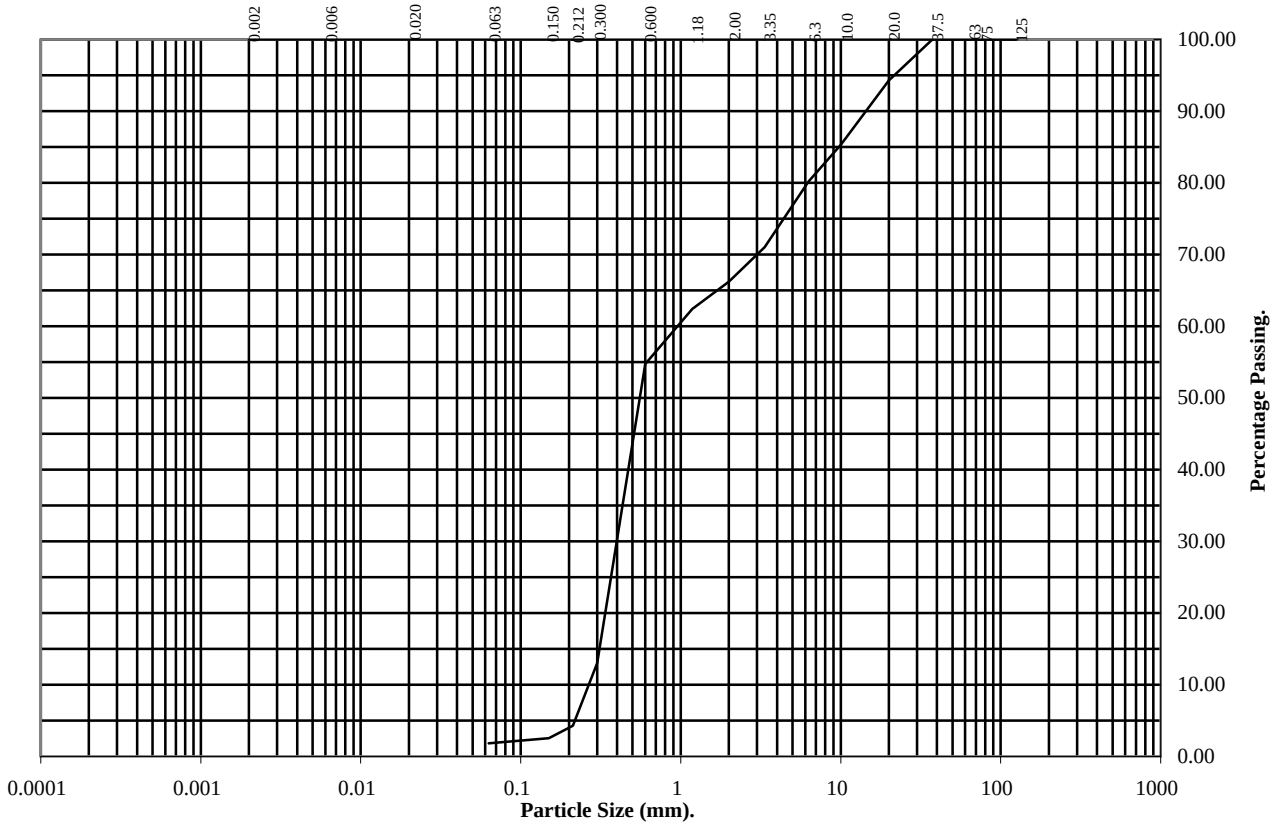
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH8** **Depth (m):** **12.00-12.45**

Sample Number: **23** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	85
6.3	80
3.35	71
2	66
1.18	62
0.6	55
0.3	13
0.212	4
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	34
Sand	64
Silt / Clay	2

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	09/09/14		09/09/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

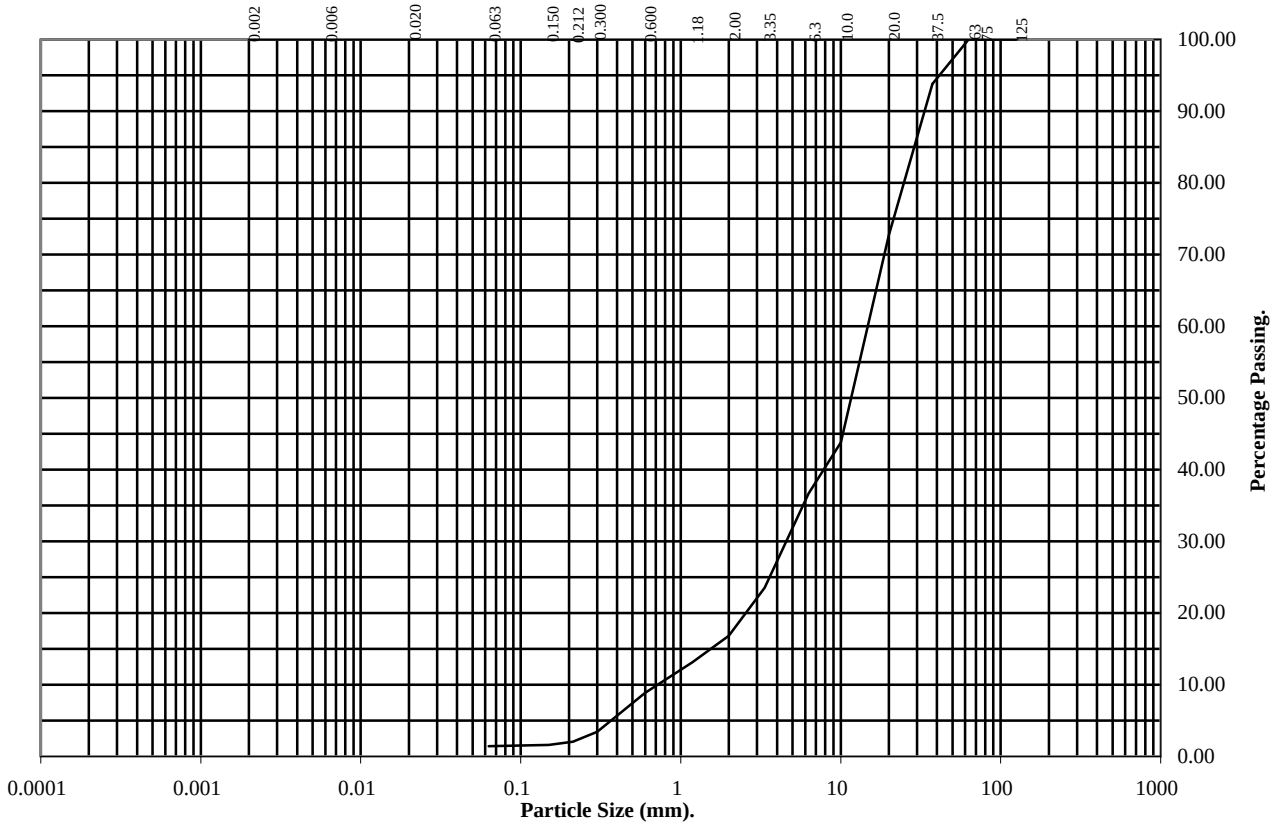
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH15** **Depth (m):** **7.50**

Sample Number: **16** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	94
20	73
10	44
6.3	37
3.35	24
2	17
1.18	13
0.6	9
0.3	3
0.212	2
0.15	2
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	83
Sand	16
Silt / Clay	1

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

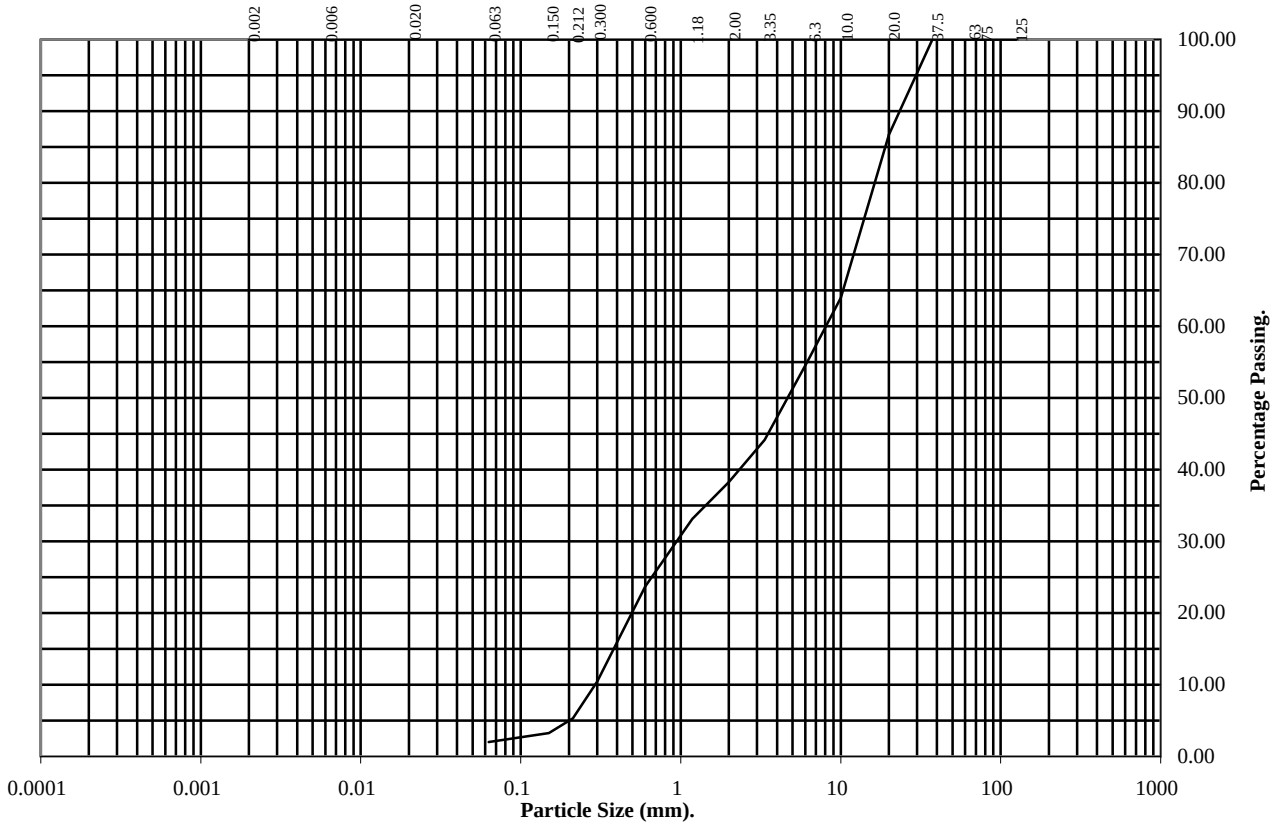
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH15** **Depth (m):** **9.00-9.30**

Sample Number: **18** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	87
10	64
6.3	55
3.35	44
2	38
1.18	33
0.6	24
0.3	10
0.212	5
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	62
Sand	36
Silt / Clay	2

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	09/09/14		09/09/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

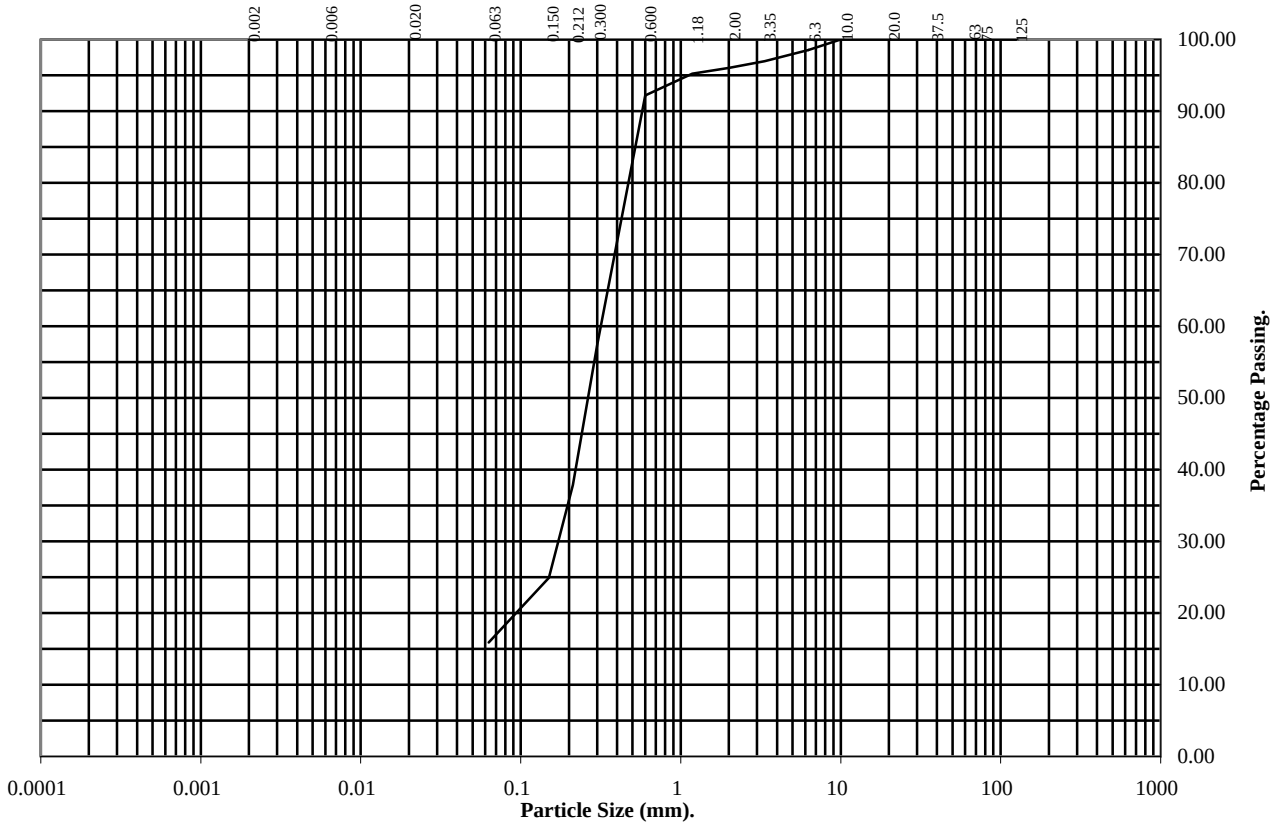
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH17** **Depth (m):** **14.00-14.50**

Sample Number: **23** **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	99
3.35	97
2	96
1.18	95
0.6	92
0.3	57
0.212	38
0.15	25
0.063	16

Soil Fraction	Total Percentage
Cobbles	0
Gravel	4
Sand	80
Silt / Clay	16

Remarks:
See summary of soil descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

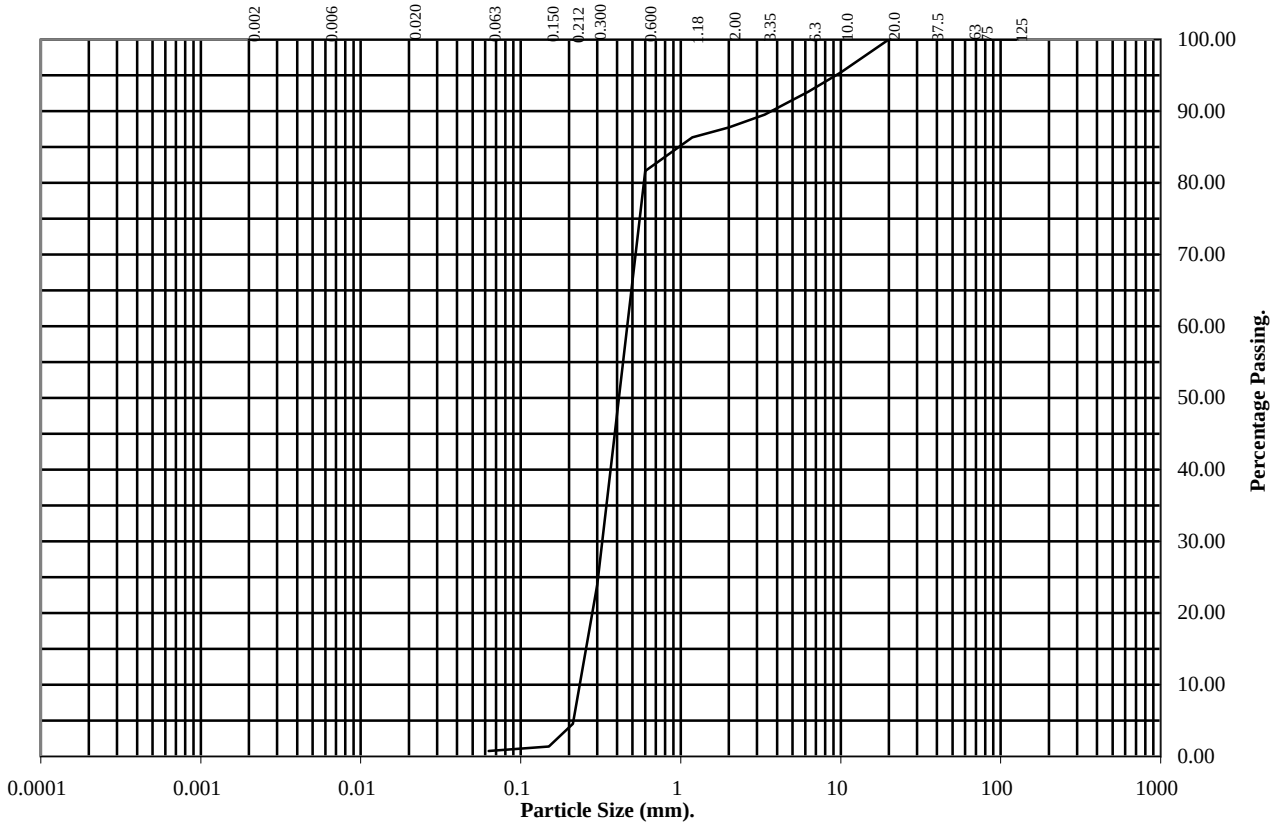
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH18A** **Depth (m):** **12.20-13.50**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	95
6.3	93
3.35	90
2	88
1.18	86
0.6	82
0.3	24
0.212	5
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	12
Sand	87
Silt / Clay	1

Remarks:
See summary of soil descriptions.

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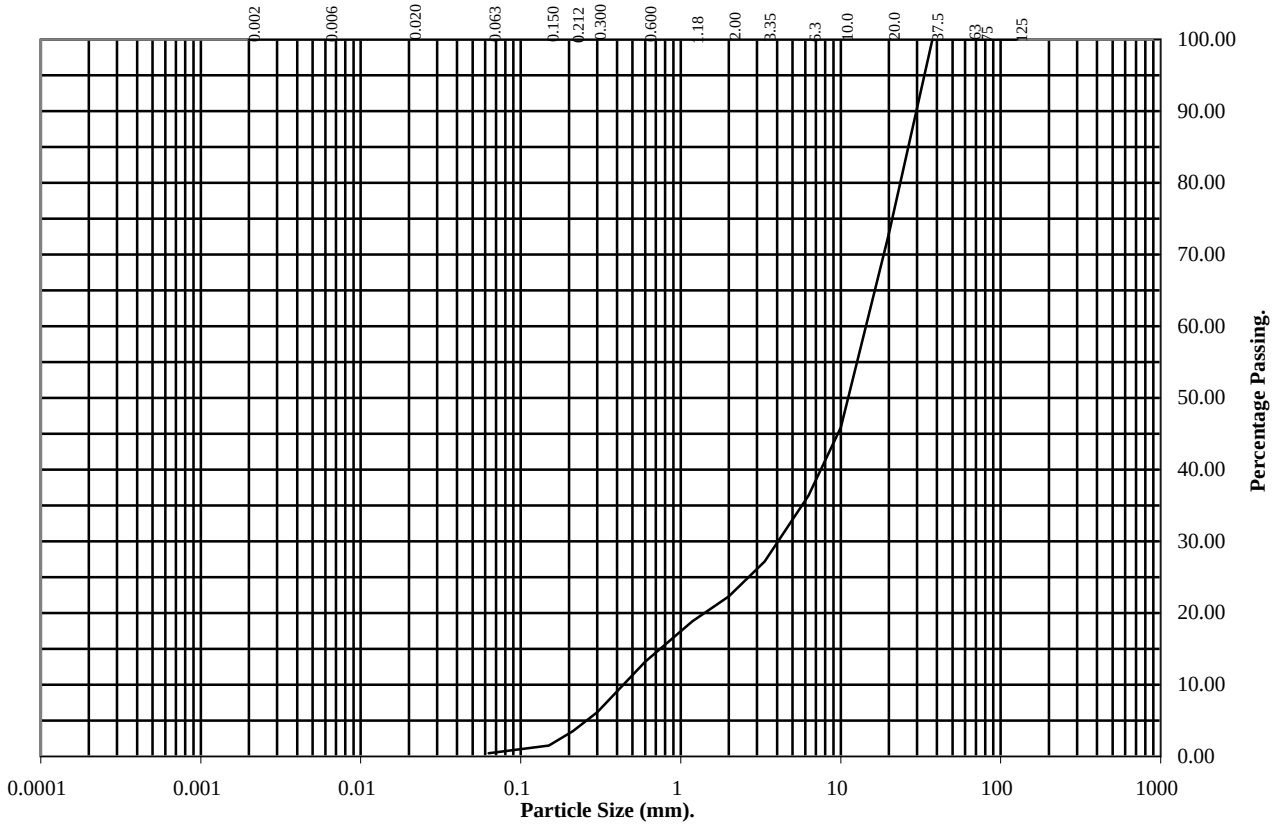
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH18A** **Depth (m):** **6.85-7.80**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	73
10	46
6.3	36
3.35	27
2	22
1.18	19
0.6	13
0.3	6
0.212	4
0.15	2
0.063	0

Soil Fraction	Total Percentage
Cobbles	0
Gravel	78
Sand	22
Silt / Clay	0

Remarks:
See summary of soil descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

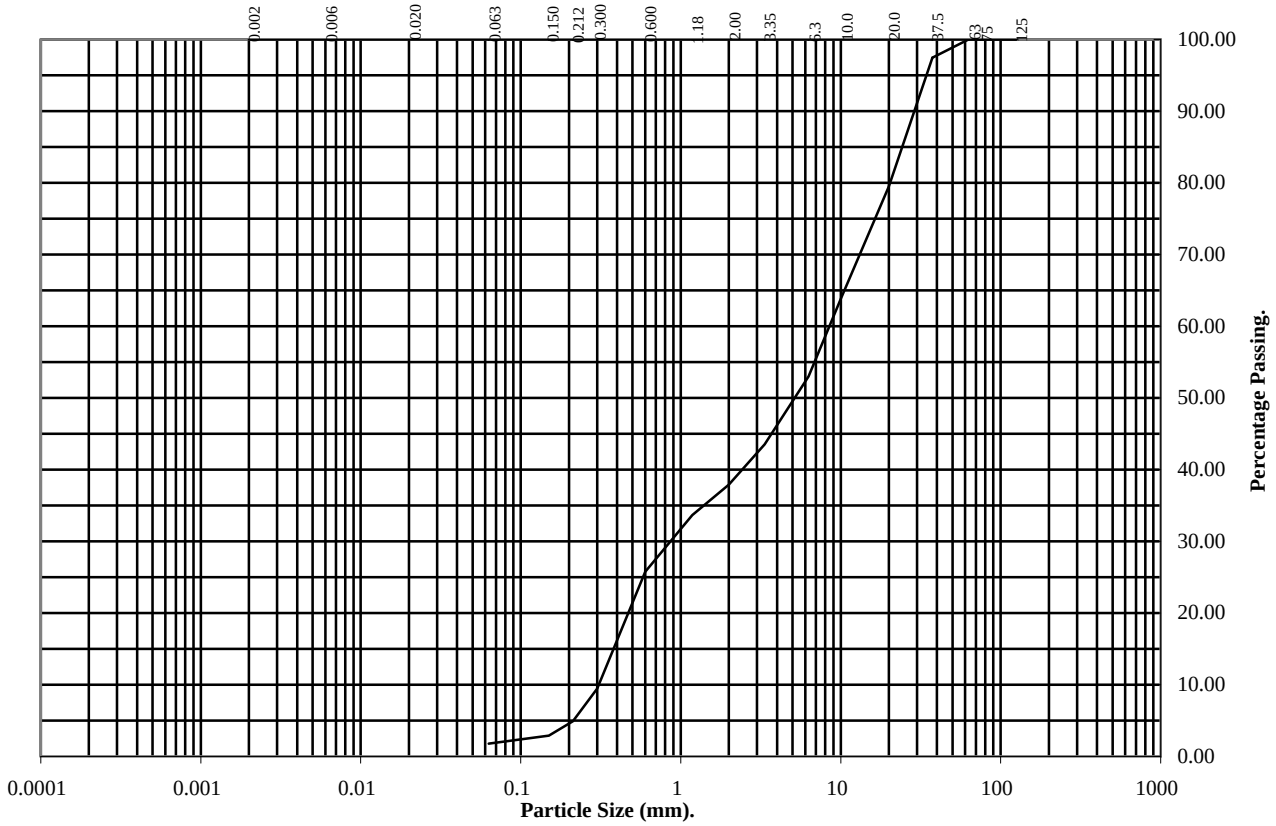
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH19** **Depth (m):** **6.50-7.20**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	97
20	80
10	64
6.3	53
3.35	44
2	38
1.18	34
0.6	26
0.3	9
0.212	5
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	62
Sand	36
Silt / Clay	2

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
	09/09/14		09/09/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

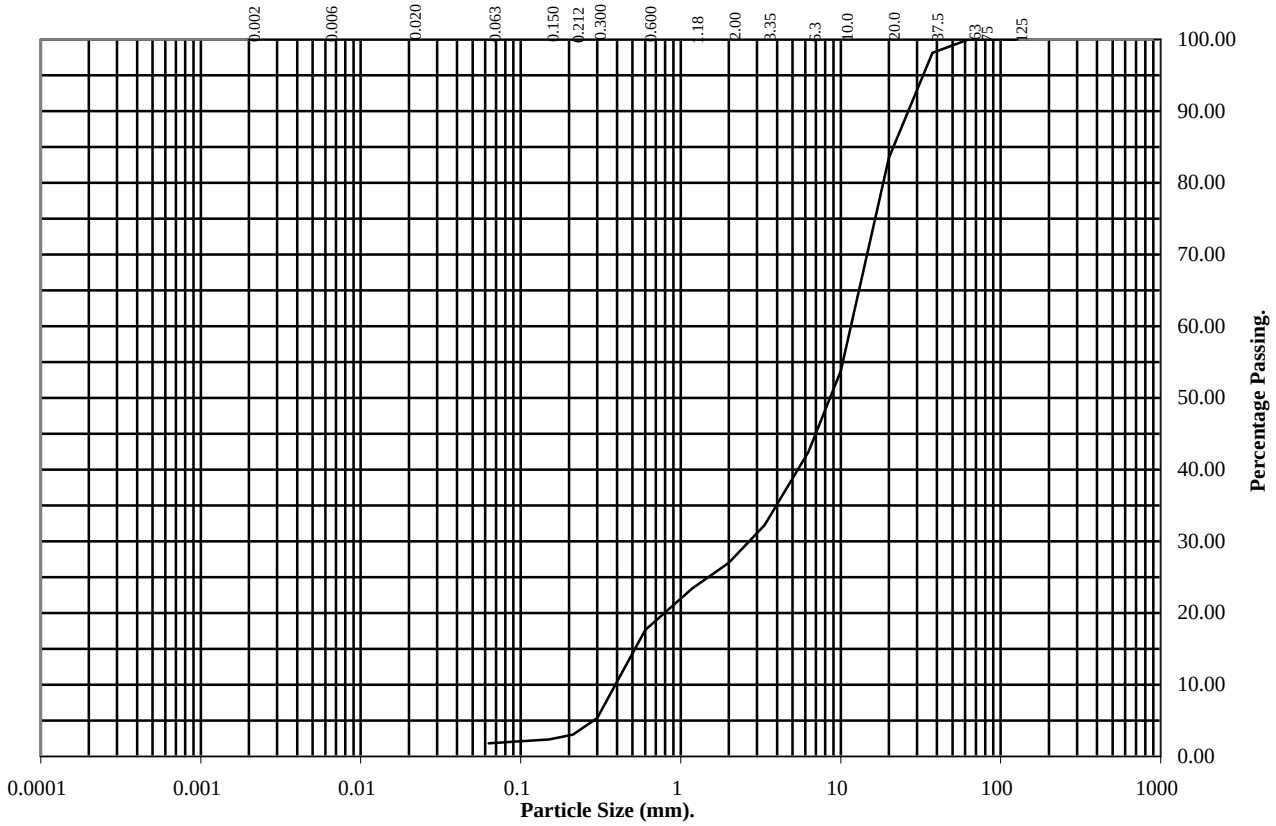
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH19** **Depth (m):** **9.50-10.90**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	98
20	84
10	54
6.3	42
3.35	32
2	27
1.18	23
0.6	18
0.3	5
0.212	3
0.15	2
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	73
Sand	25
Silt / Clay	2

Remarks:
See summary of soil descriptions.

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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.: PSL14/4102**

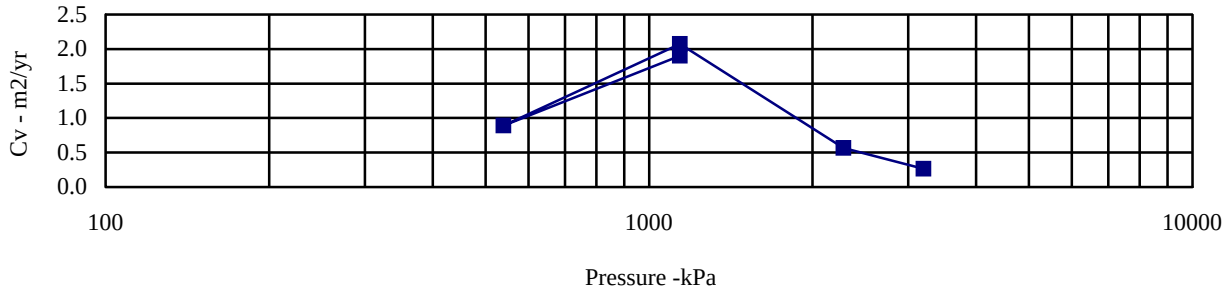
One Dimensional Consolidation Properties

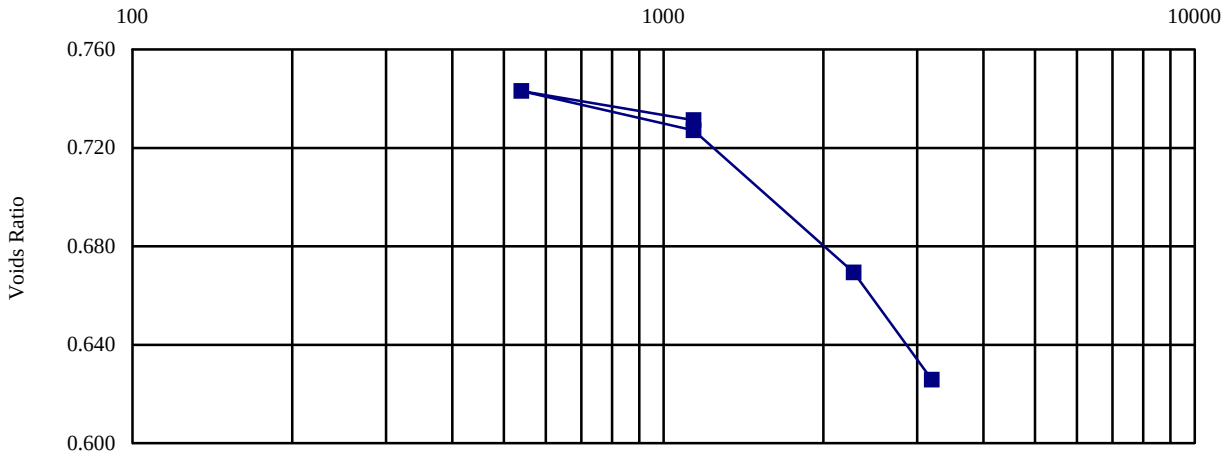
BS 1377: Part 5: 1990

Hole Number: **BH12** **Depth (m):** **38.45-38.90**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	30							
Bulk Density (Mg/m3):	1.89	0	-	1140	0.045	1.903	Method used to	
Dry Density (Mg/m3):	1.45	1140	-	540	0.011	0.892	determine CV:	t90
Voids Ratio:	0.826	540	-	1140	0.015	2.072	Nominal temperature	
Degree of saturation:	96.7	1140	-	2280	0.029	0.566	during test ' C:	20
Height (mm):	20.02	2280	-	3200	0.028	0.262	Remarks:	
Diameter (mm)	75.24						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/4102** Page of

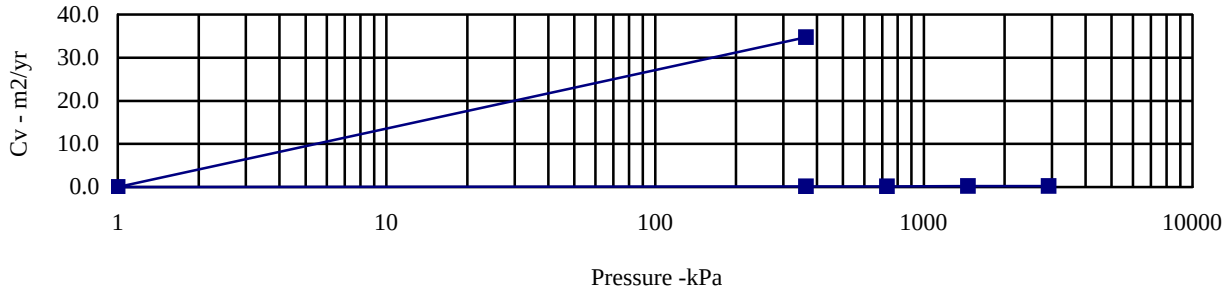
One Dimensional Consolidation Properties

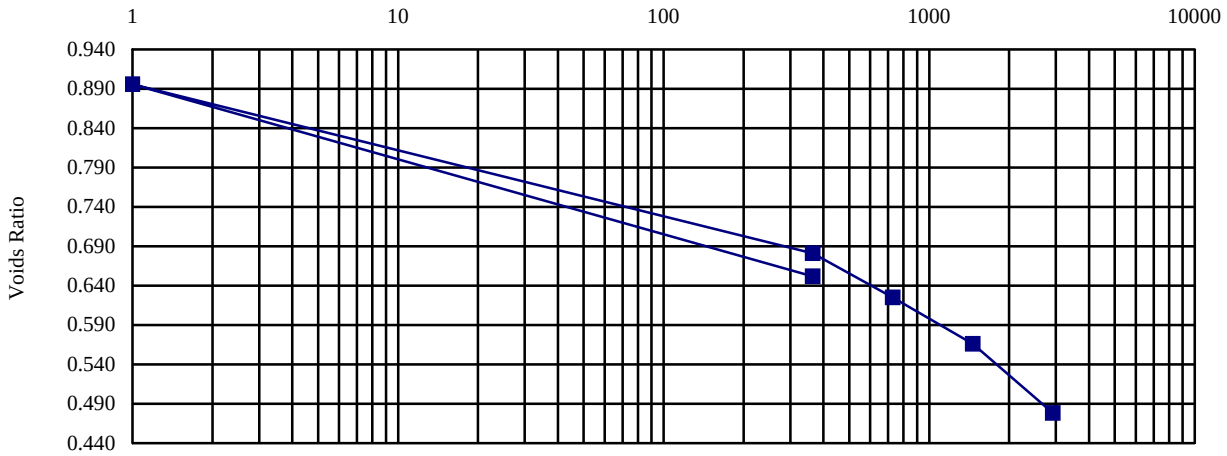
BS 1377: Part 5: 1990

Hole Number: **BH14** **Depth (m):** **17.85-18.20**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.99	0	-	365	0.083	34.727	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.56	365	-	1	0.406	0.022		
Voids Ratio:	0.703	1	-	365	0.311	0.159	Nominal temperature during test ' C:	20
Degree of saturation:	104.4	365	-	730	0.092	0.172		
Height (mm):	19.26	730	-	1460	0.050	0.193	Remarks:	
Diameter (mm)	75.19	1460	-	2920	0.038	0.203	See summary of soils description.	
Particle Density (Mg/m3): Assumed	2.65							





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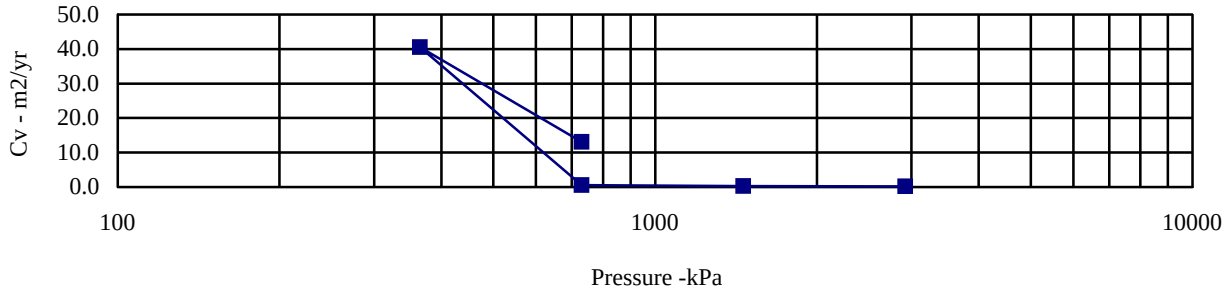
One Dimensional Consolidation Properties

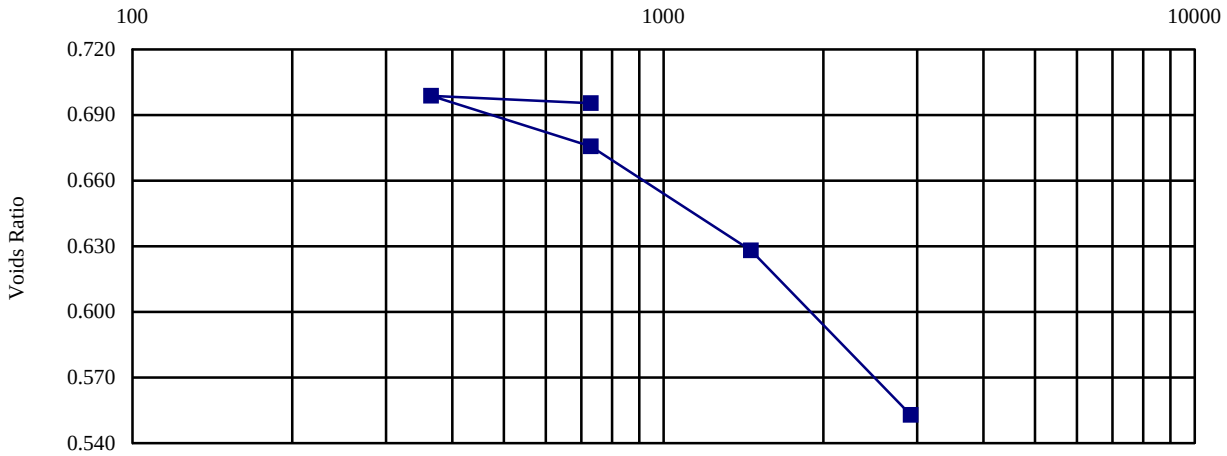
BS 1377: Part 5: 1990

Hole Number: **BH14** **Depth (m):** **34.55-35.00**

Sample Number: **Sample Type:** **C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	31							
Bulk Density (Mg/m3):	1.96	0	-	730	0.066	13.101	Method used to	
Dry Density (Mg/m3):	1.49	730	-	365	0.005	40.522	determine CV:	t90
Voids Ratio:	0.781	365	-	730	0.037	0.592	Nominal temperature	
Degree of saturation:	106.8	730	-	1460	0.039	0.270	during test ' C:	20
Height (mm):	19.44	1460	-	2920	0.032	0.192	Remarks:	
Diameter (mm)	75.19						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No.** **PSL14/4102** Page of

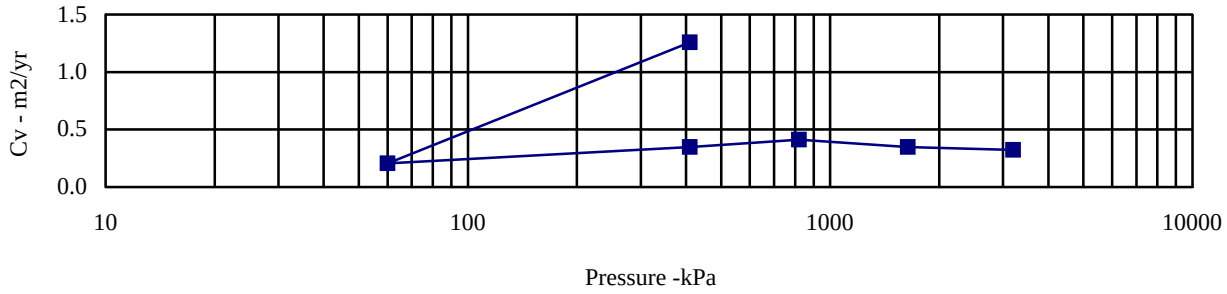
One Dimensional Consolidation Properties

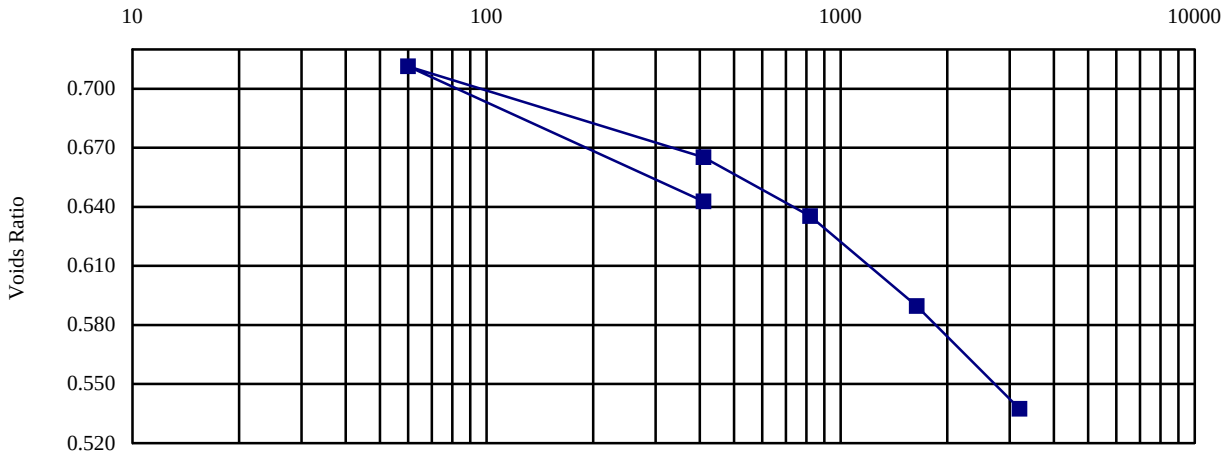
BS 1377: Part 5: 1990

Hole Number: BH18A **Depth (m): 20.00-20.45**

Sample Number: **Sample Type: C**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	1.89	0	-	410	0.167	1.259	Method used to	
Dry Density (Mg/m3):	1.50	410	-	60	0.119	0.206	determine CV:	t90
Voids Ratio:	0.763	60	-	410	0.077	0.348	Nominal temperature	
Degree of saturation:	90.2	410	-	820	0.044	0.412	during test ' C:	20
Height (mm):	19.72	820	-	1640	0.034	0.347	Remarks:	
Diameter (mm)	75.11	1640	-	3200	0.021	0.322	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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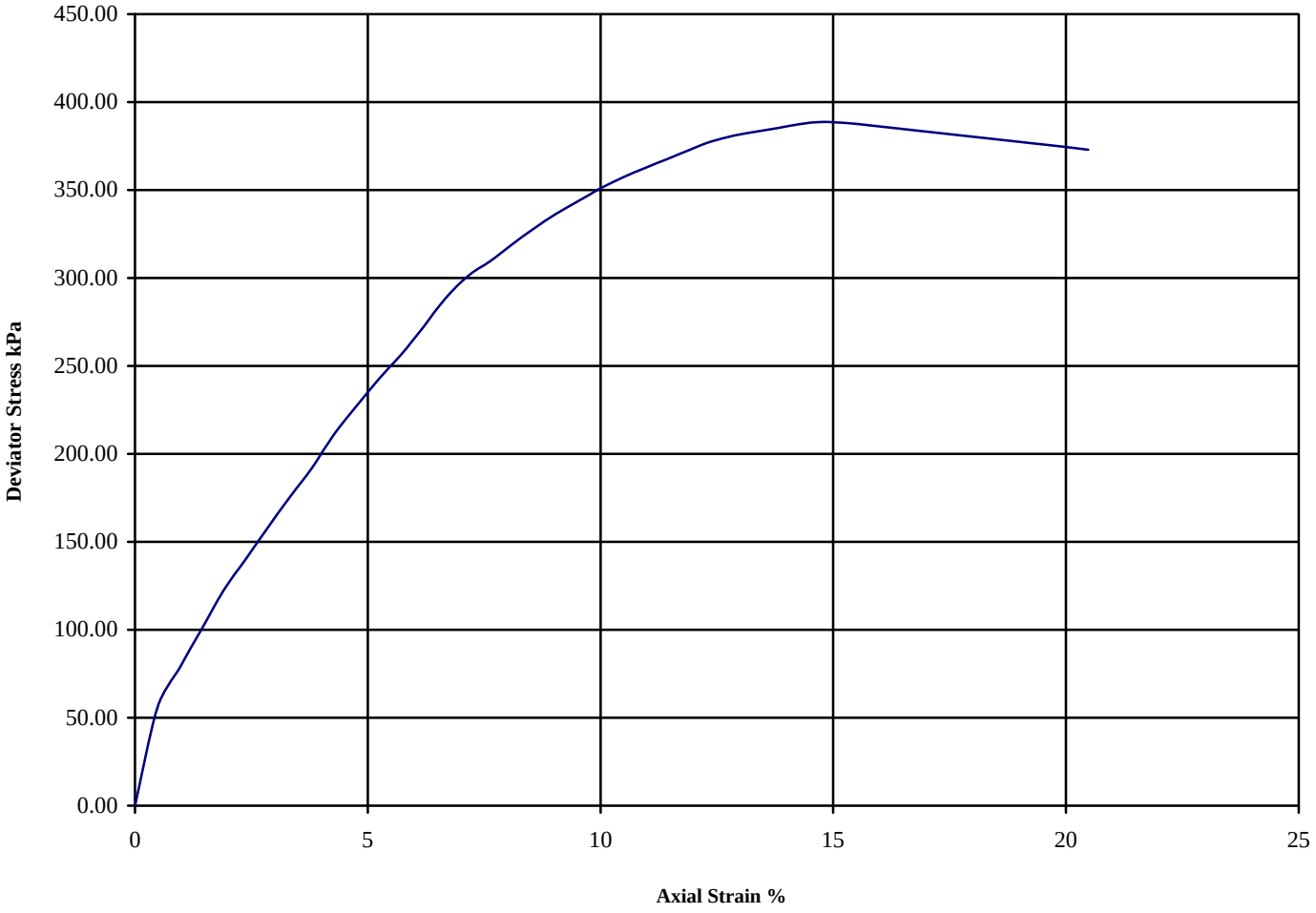
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH8 **Depth (m):** 3.50-3.95

Sample Number: 7 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	17	2.18	1.87	80	389	194	14.8	Compound	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.34 kPa See summary of soil descriptions.

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

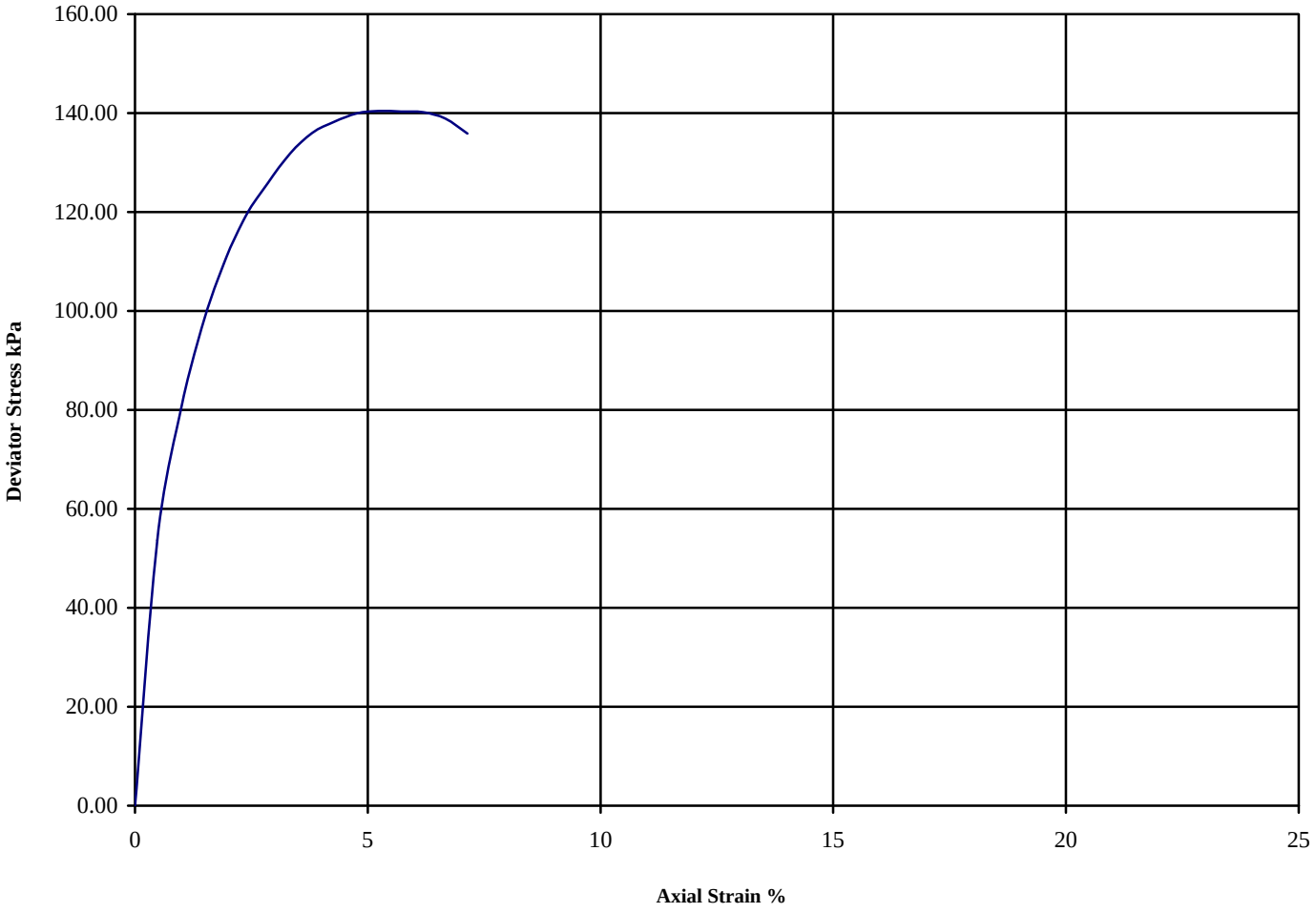
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH10** **Depth (m):** **18.75-19.20**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.03	1.59	420	140	70	5.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
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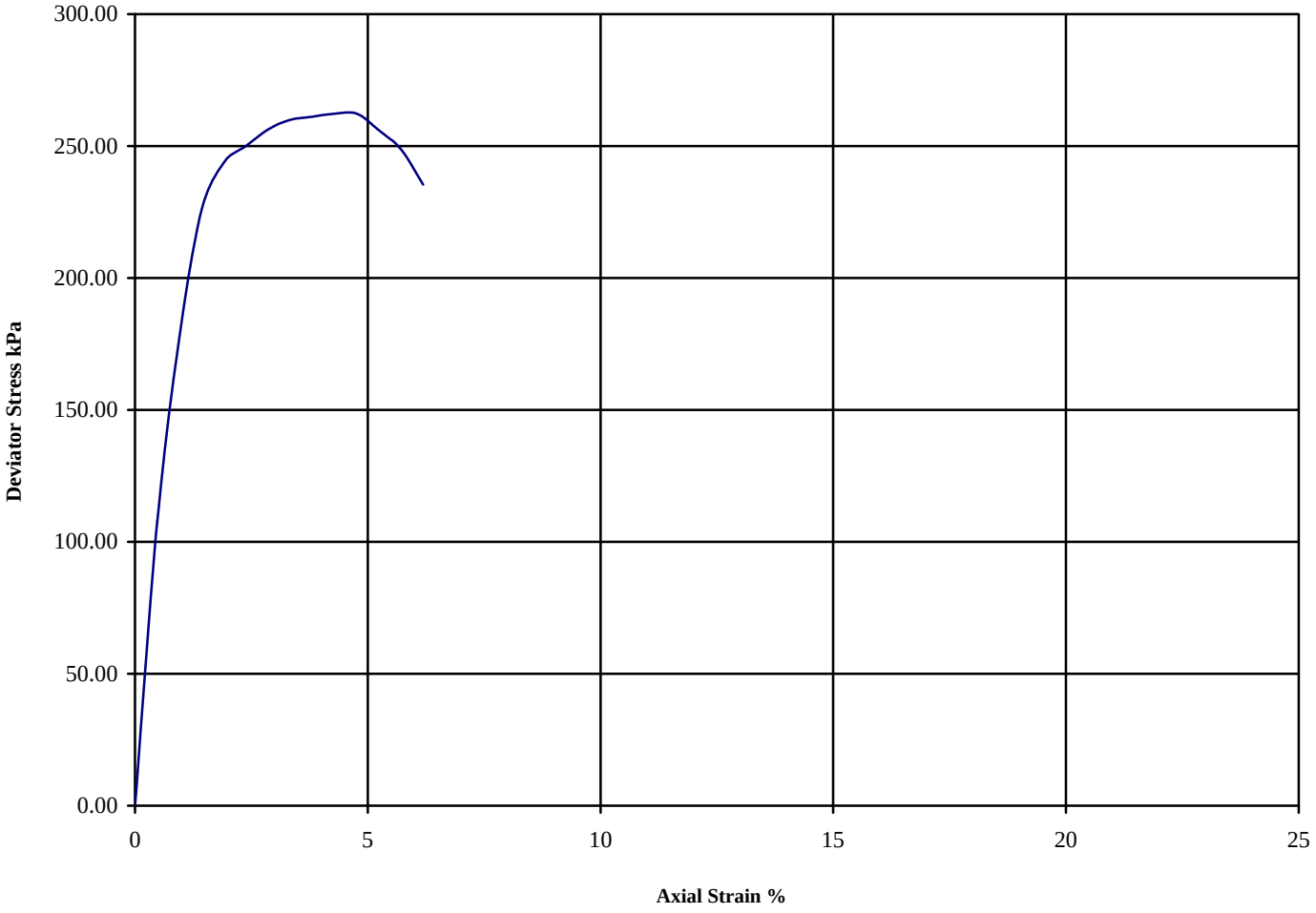
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH11** **Depth (m):** **42.05-42.45**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.87	1.44	900	262	131	4.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

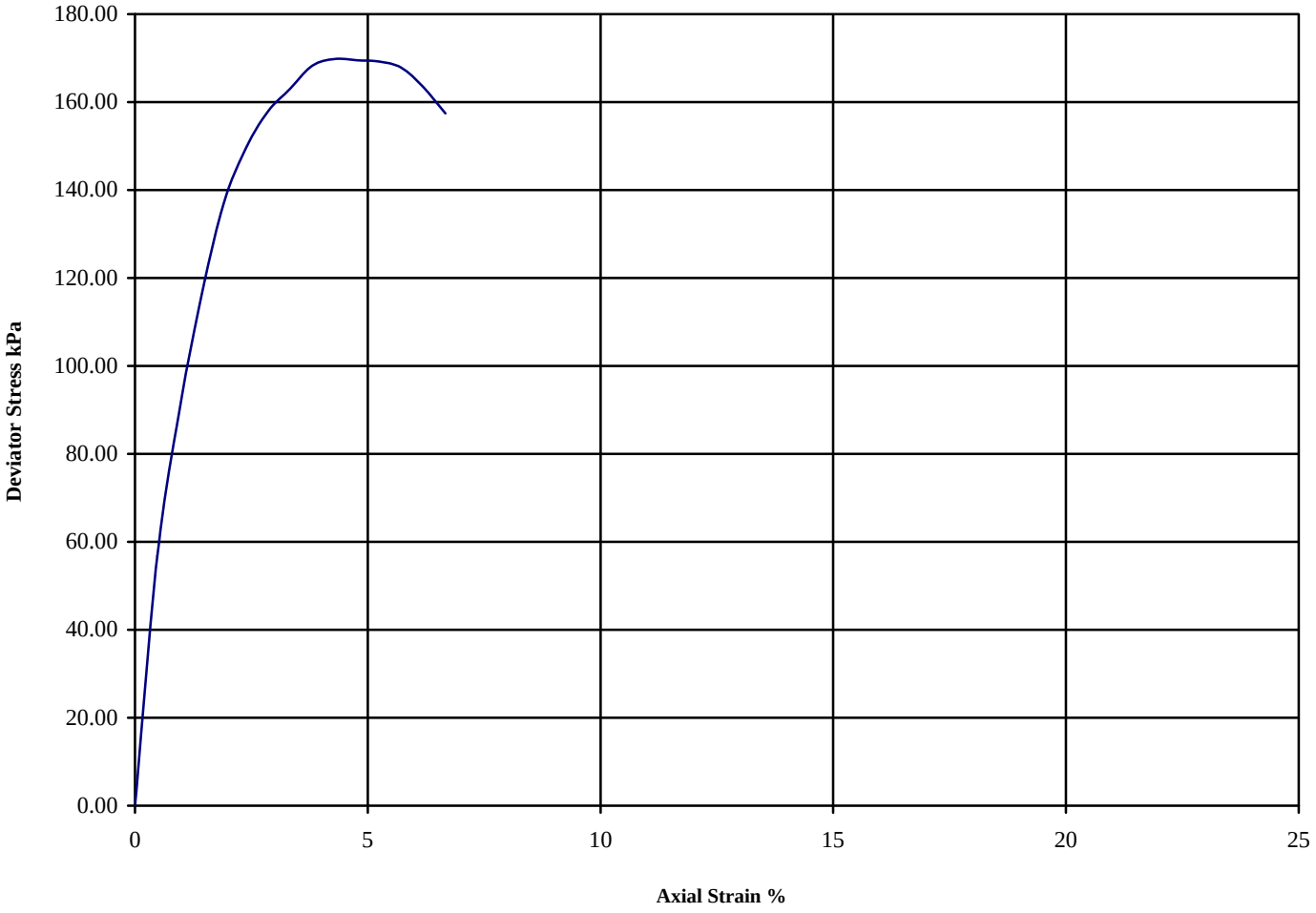
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH11** **Depth (m):** **50.60-51.05**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	33	1.82	1.37	1100	170	85	4.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

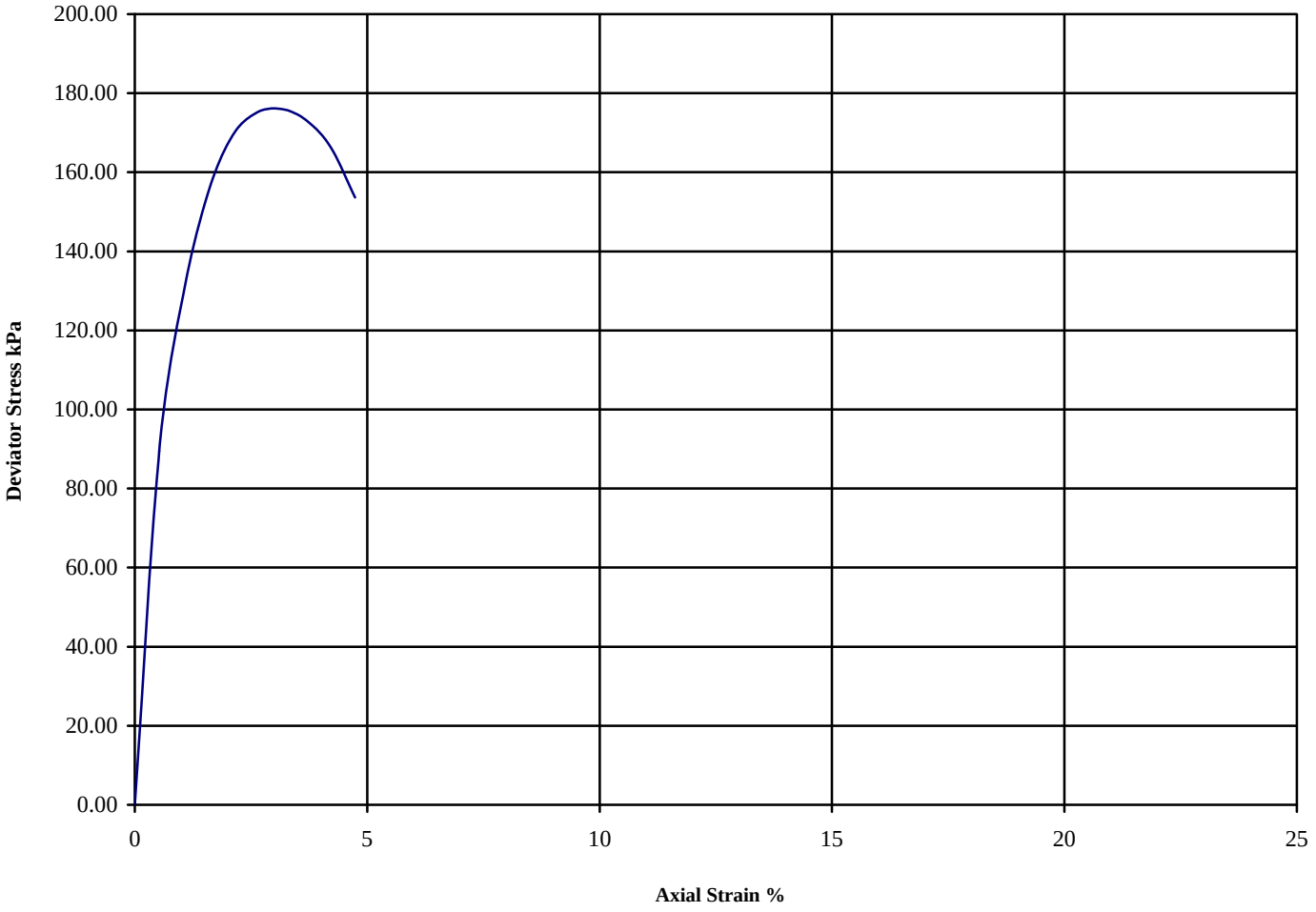
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH12** **Depth (m):** **31.12-31.50**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		190.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	31	1.88	1.43	980	176	88	3.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.42 kPa See summary of soil descriptions. **Early Brittle Failure.**

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	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

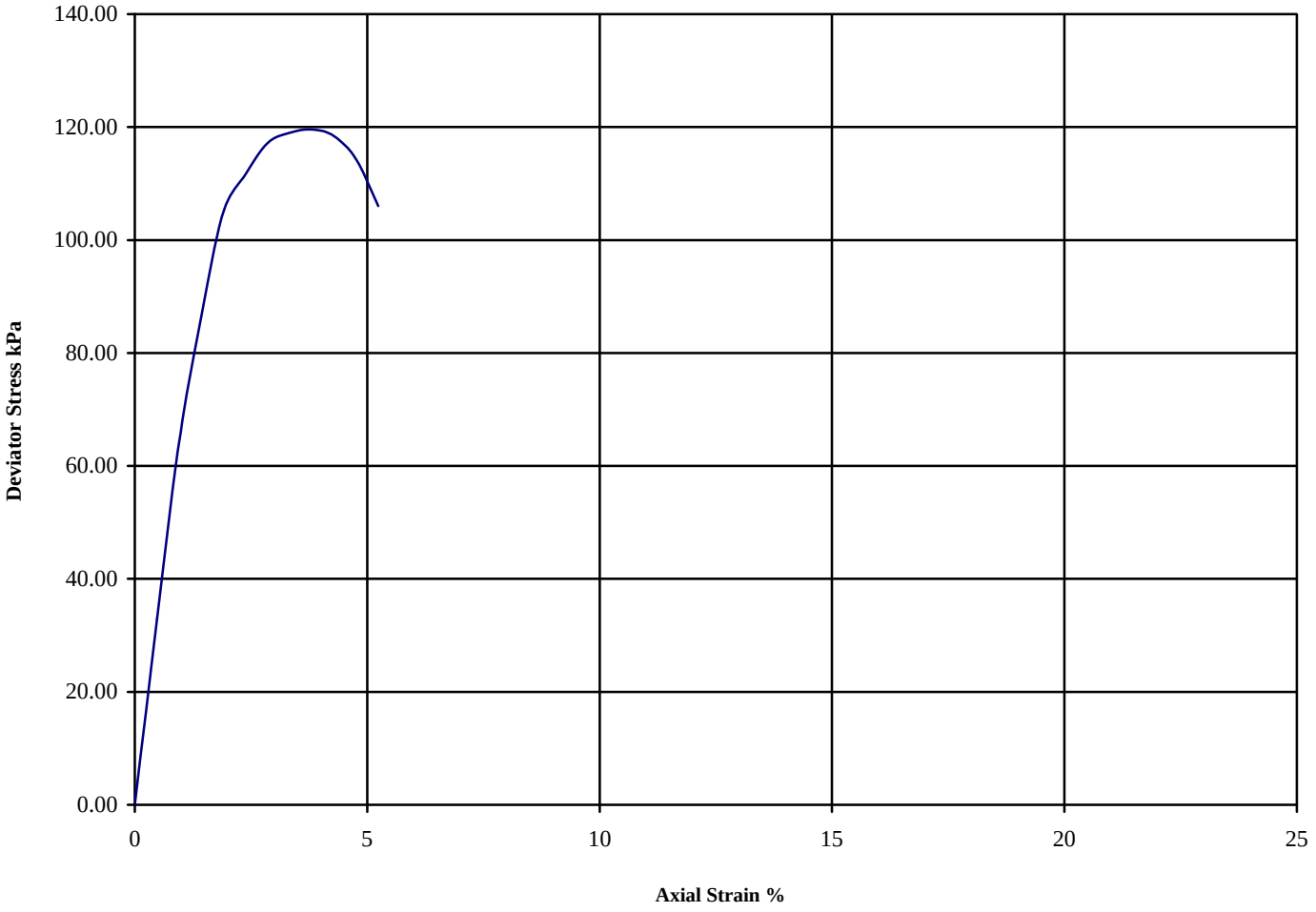
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH14** **Depth (m):** **27.00-27.45**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	1.85	1.46	570	120	60	3.8	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

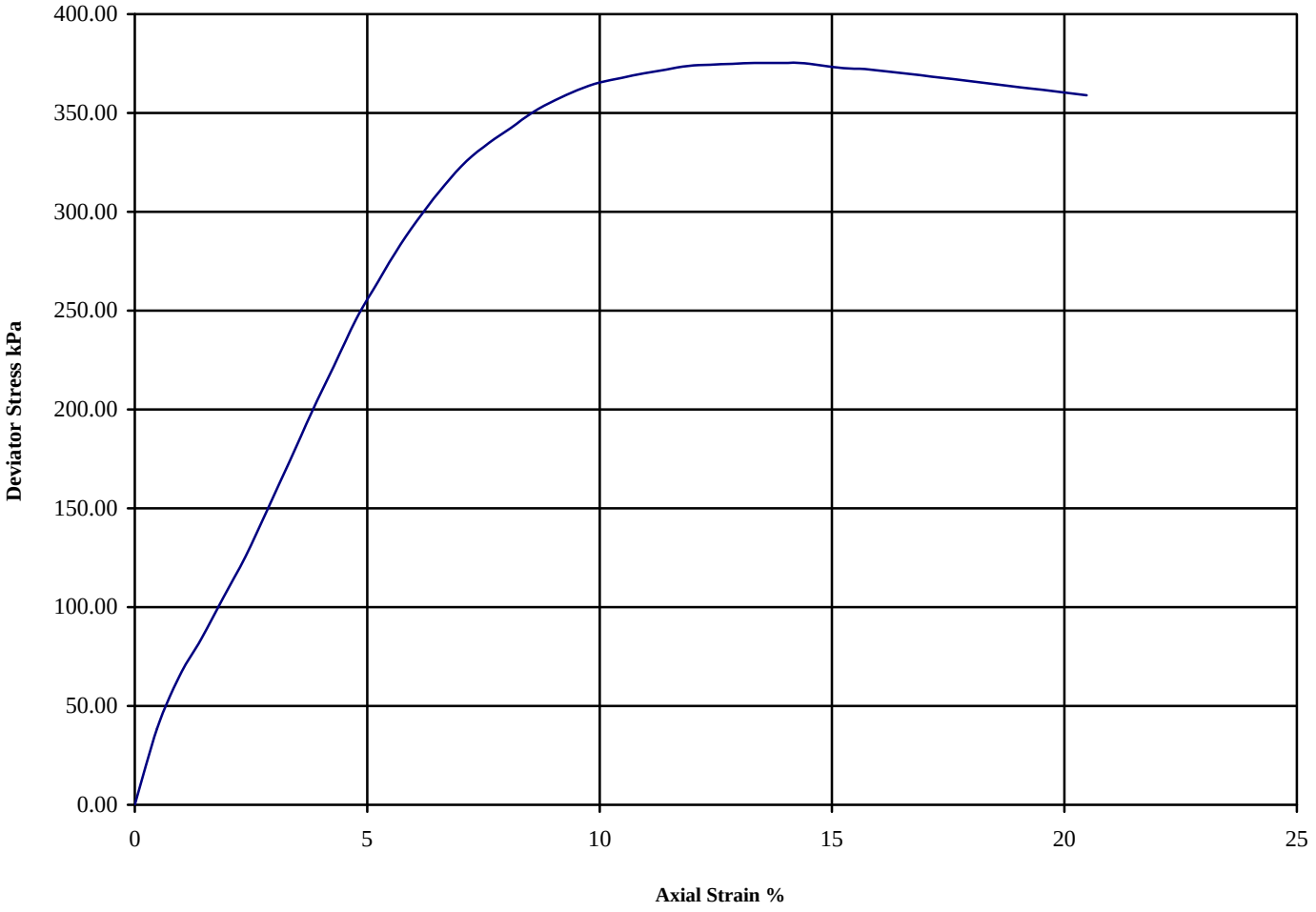
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH15 **Depth (m):** 3.50-3.75

Sample Number: 8 **Sample Type:** U



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	2.12	1.79	80	375	188	13.8	Compound	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.35 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	09/09/14		09/09/14

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Contract No: PSL14/4102

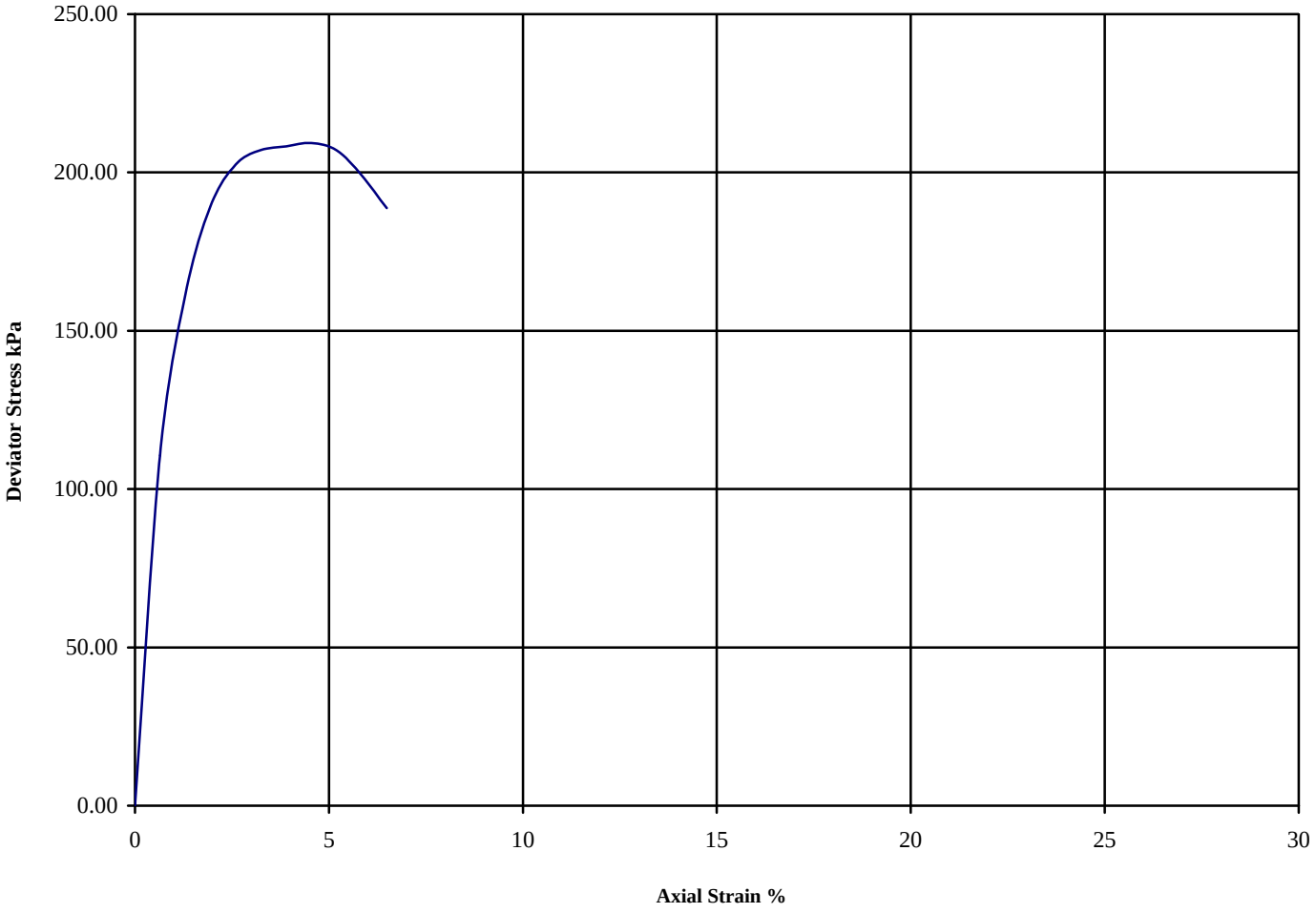
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH16** **Depth (m):** **36.90-37.35**

Sample Number: **Sample Type:** **C**



Diameter (mm):		76.0	Height (mm):		154.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	31	1.82	1.39	790	209	105	4.5	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.49 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

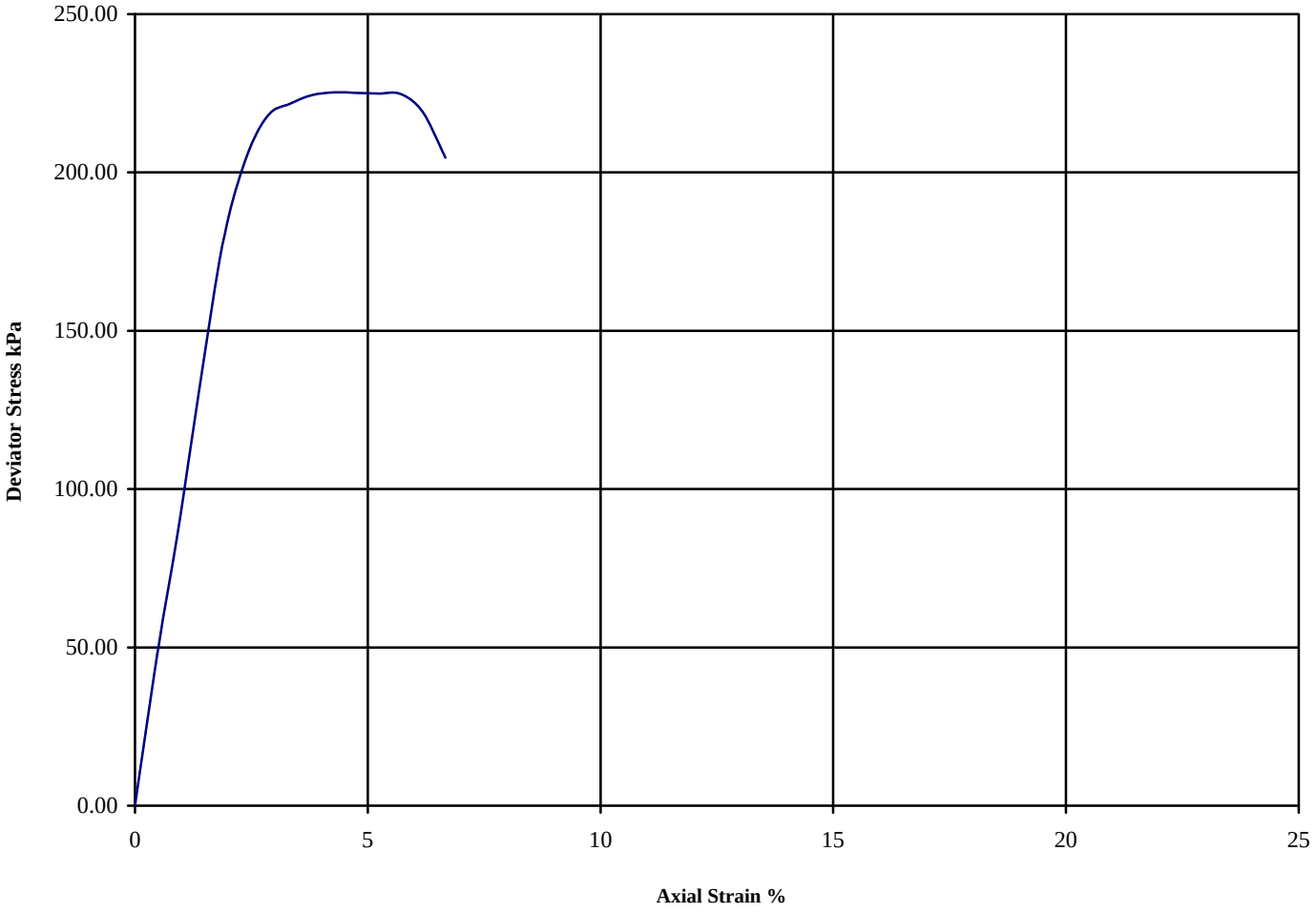
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH18A** **Depth (m):** **1.20-1.65**

Sample Number: **Sample Type:** **C**



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	18	1.96	1.65	35	225	113	4.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

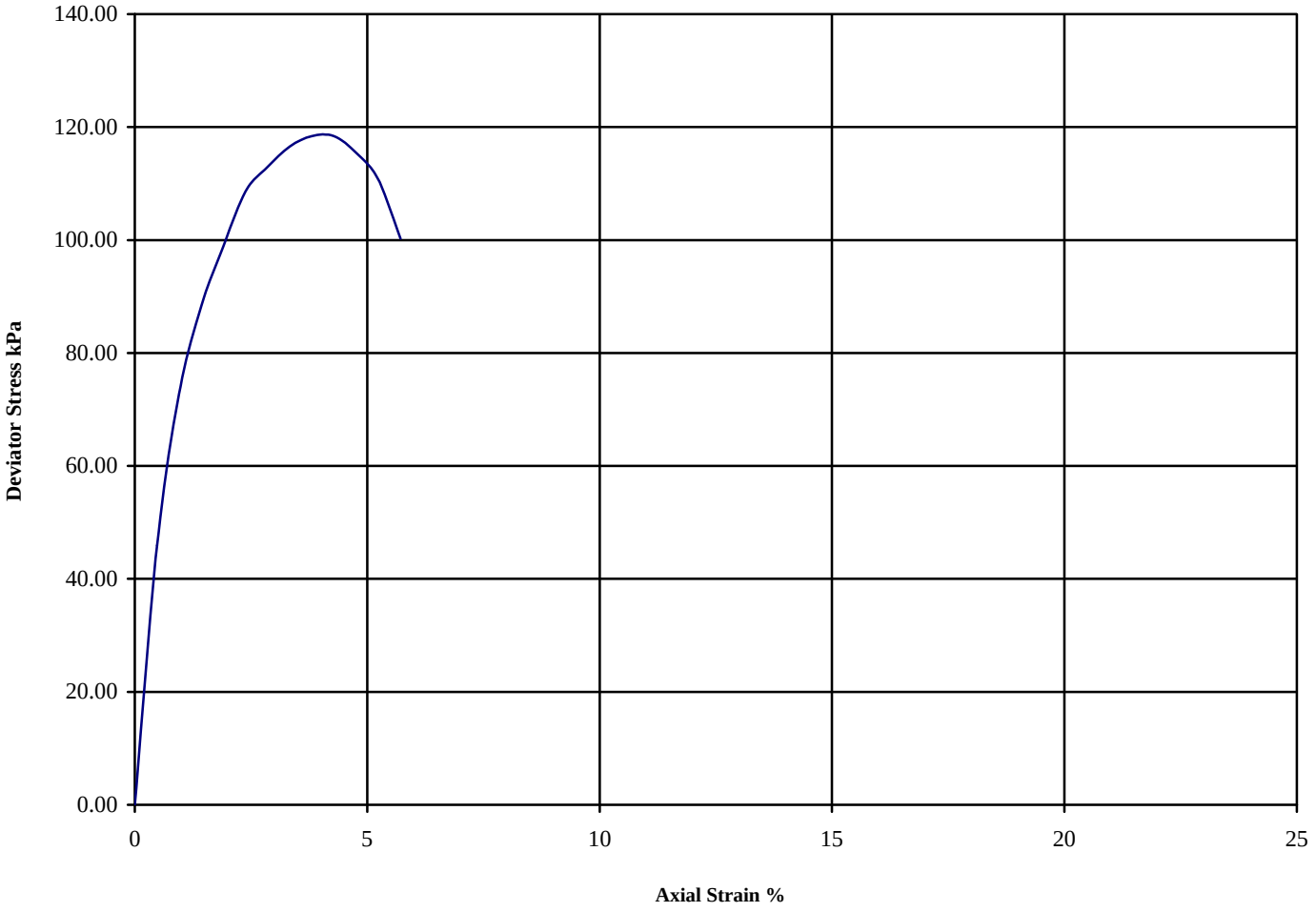
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH18A** **Depth (m):** **16.95-17.45**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	28	1.94	1.52	345	118	59	4.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

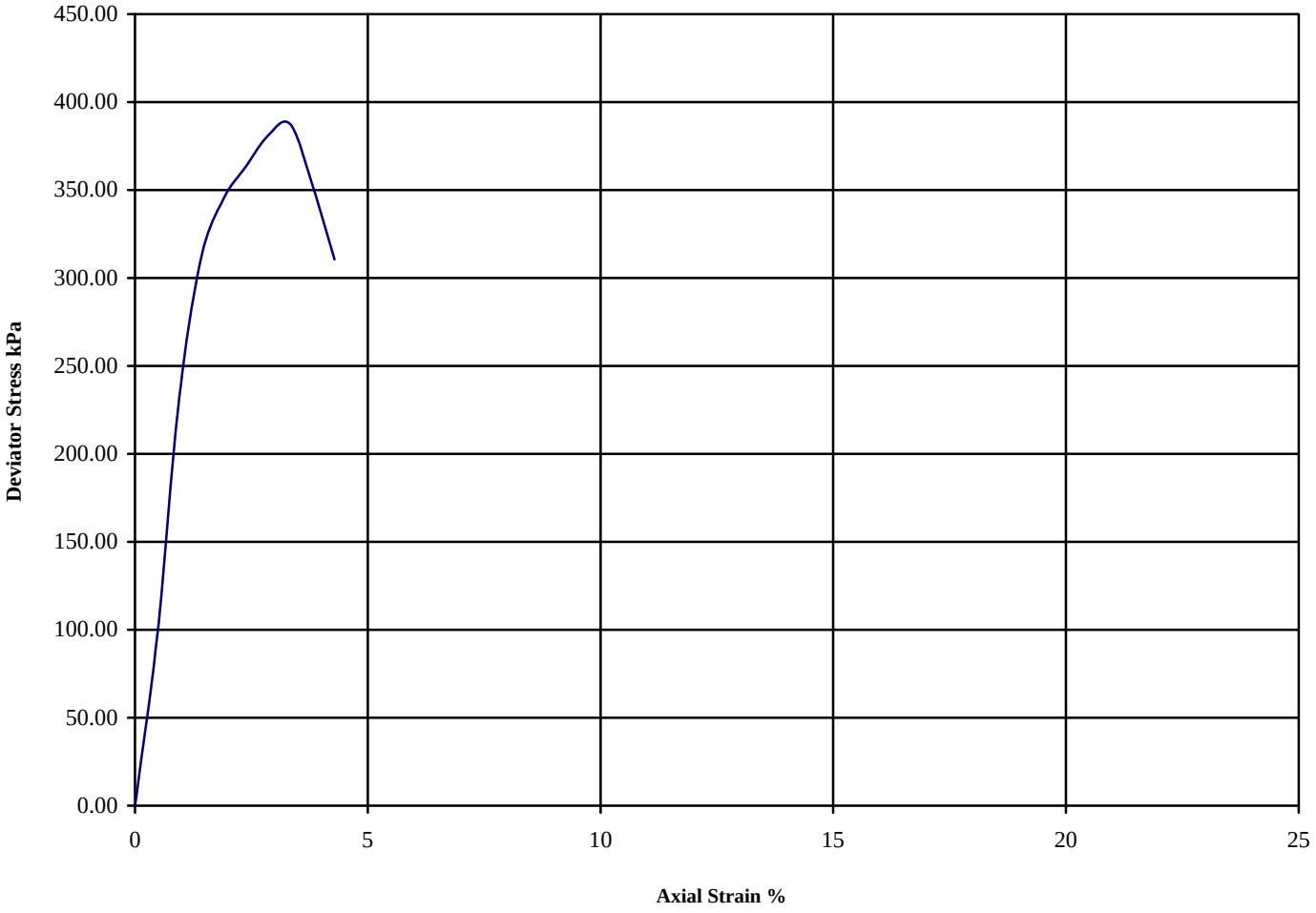
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH18A** **Depth (m):** **25.75-26.20**

Sample Number: **Sample Type:** **C**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	26	1.97	1.56	540	387	194	3.3	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.42 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

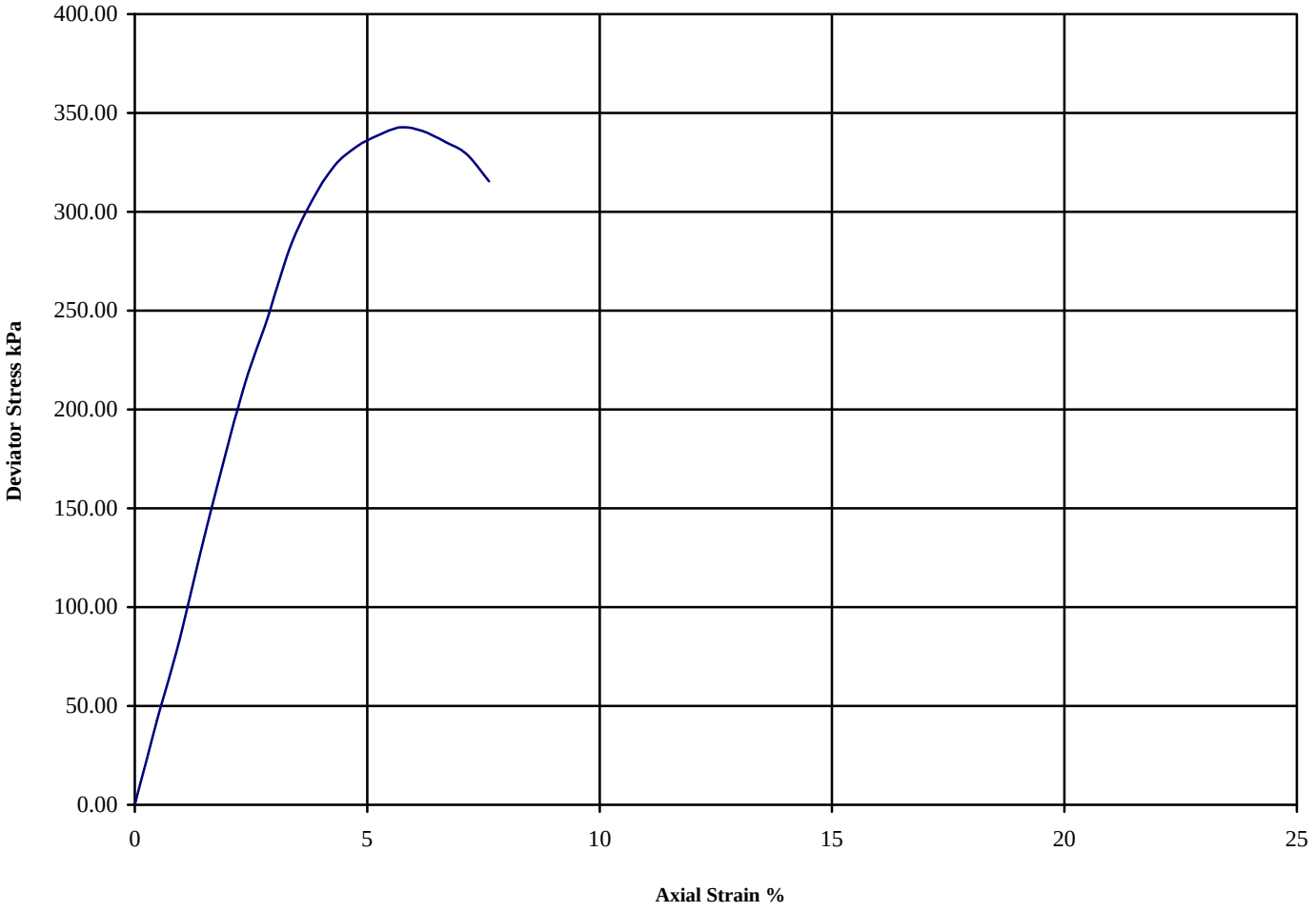
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH19** **Depth (m):** **2.00-2.45**

Sample Number: **Sample Type:** **U**



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	19	1.87	1.56	50	343	171	5.7	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.36 kPa See summary of soil descriptions. **Early Brittle Failure.**

Checked	Date	Approved	Date
	09/09/14		09/09/14

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RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4102

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TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: DANIEL LAMBE

To: SIMON ARINZE

Date: 02 / 09 /2014

Laboratory Ref: PSL14/4102

Contract Number: C4237

Location: RIVENHALL AIRFIELD IWMF

o BH o TP Sample Number

Depth (m):

Sample Type: o U o B o D o W o P o C

Test/s:

Missing Samples BH11 u 19.36-19.84 / BH11u 37.15-37.60 / BH19 D 3.65-3.75
TRI & CHEM TRI MC&ATT

The above sample cannot be tested for the following reasons:

BH19 D 4.45-4.55
MC

✓ The Sample has not been received

o There is insufficient material for BS1377:1990 testing
Maximum Grain Size (Minimum 10%): o Fine o Medium o Coarse
Sample Mass (kg):
Required Mass (kg):

o The Sample has been previously tested. .....

o The Sample has been misplaced in the Laboratory

o The Sample is unsuitable for testing because:

Please advise action required:

o Perform original test on the following alternative Sample:
o BH o TP Sample Number: Depth (m)
Sample Type: o U o B oD oW oP o C

o Combine original Sample with the following Sample:
o BH o TP Sample Number: Depth (m)
Sample Type: o U o B oD oW oP o C

o Perform the following alternative test/s on the original Sample:

o Perform non-standard test on material available
(Written Confirmation is required from the Client).

o Take no further action.

✓ PB 02/09

Signed ..... Date .....

(Project Engineer)

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-14715

16-Sep-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-14715
Client Reference	PSL14/4102
Contract Title	Rivenhall Airfield IWMF
Description	9 Soil samples.
Date Received	04-Sep-14
Date Started	04-Sep-14
Date Completed	11-Sep-14
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-14715
Client Ref PSL14/4102
Contract Title Rivenhall Airfield IWMF

				Lab No	695176	695177	695178	695179	695180	695181	695182	695183	695184
				Sample ID	BH8	BH12	BH14	BH14	BH15	BH16	BH18	BH18A	BH19
				Depth	5.50	31.60-32.05	27.85-27.95	38.00-38.40	4.00	36.50-36.60	2.50-2.60	26.40	1.60-1.70
				Other ID	10				9				
				Sample Type	D	D	D	C	D	D	D	D	D
				Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**										
Metals													
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10	63	22	24	< 10	29	< 10	21	< 10
Inorganics													
pH	DETSC 2008#			8.4	8.2	8.5	8.8	8.4	8.3	8.4	8.3	8.1
Chloride Aqueous Extract	DETSC 2055	1	mg/l	7.4	54	38	58	8.7	47	9.3	38	15
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.6	1.3	1.5	1.8	< 1.0	1.2	1.1	1.9	< 1.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	31	2100	830	1300	59	1300	76	880	56
Total Sulphur as S	DETSC 2320	0.01	%	< 0.01	0.60	0.23	0.56	0.02	1.5	0.02	0.49	0.01
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.02	0.25	0.10	0.15	0.03	0.24	0.04	0.15	0.03

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-14715
Client Ref PSL14/4102
Contract Rivenhall Airfield IWMF

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
695176	BH8 5.50 SOIL		PT 1L	Sample date not supplied	
695177	BH12 31.60-32.05 SOIL		PT 1L	Sample date not supplied	
695178	BH14 27.85-27.95 SOIL		PT 500ml	Sample date not supplied	
695179	BH14 38.00-38.40 SOIL		PT 1L	Sample date not supplied	
695180	BH15 4.00 SOIL		PT 1L	Sample date not supplied	
695181	BH16 36.50-36.60 SOIL		PT 1L	Sample date not supplied	
695182	BH18 2.50-2.60 SOIL		PT 1L	Sample date not supplied	
695183	BH18A 26.40 SOIL		PT 500ml	Sample date not supplied	
695184	BH19 1.60-1.70 SOIL		No containers logged	Sample date not supplied	Cannot evaluate

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

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LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/4378

Client's Reference: C4237 Report Date: 25 September 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester

GL3 1DL

For the attention of: Simon Arinze

Contract Title: Rivenhall Airfield IWMF

Date Received: 1/9/2014
Date Commenced: 1/9/2014
Date Completed: 25/9/2014

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

Checked and Approved Signatories:

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

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

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH2		U	9.70-10.00	Brown CLAY.
BH2		D	12.15-12.25	Brown CLAY.
BH2		C	13.80-14.10	Brown CLAY.
BH2		D	14.25-14.35	Brown CLAY.
BH2		D	16.00-16.10	Brown CLAY.
BH2		C	18.65-19.15	Very stiff brown CLAY.
BH4		U	6.00-6.95	Brown CLAY.
BH4		U	12.00-12.95	Very stiff brown CLAY.
BH4		D	12.50	Brown CLAY.
BH4		U	15.00-15.965	Brown CLAY.
BH4		D	16.50-16.95	Brown CLAY.
BH4		D	19.00	Brown CLAY.
BH4		U	21.00-21.95	Very stiff brown CLAY.
BH7		D	14.20-14.30	Brown CLAY.
BH7		D	14.60-14.70	Brown CLAY.
BH7		C	15.05-15.50	Firm brown CLAY.
BH7		C	18.85-19.30	Brown CLAY.
BH7		C	22.30-22.60	Firm brown CLAY.
BH7		D	23.20-23.30	Brown CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	25/09/14		25/09/14		25/09/14
RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/4378
				Client Ref:	C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH7		C	23.50-23.80	Brown CLAY.
BH8		C	16.50-17.00	Stiff brown CLAY.
BH8		D	19.85-19.95	Brown CLAY.
BH8		C	22.75-23.20	Brown CLAY.
BH8		D	27.35-27.95	Brown CLAY.
BH8		C	28.60-28.90	Stiff brown CLAY.
BH10		C	24.45-24.90	Stiff brown CLAY.
BH10		D	25.20-25.30	Brown CLAY.
BH10		C	30.80-31.25	Stiff brown CLAY.
BH10		D	32.95-33.05	Brown CLAY.
BH14		C	46.65-47.10	Stiff brown CLAY.
BH15		C	19.20-19.50	Brown CLAY.
BH15		C	19.20-19.50	Brown CLAY.
BH15		D	20.50	Brown CLAY.
BH15		D	23.00	Brown CLAY.
BH15		C	28.30-28.60	Brown CLAY.
BH15		D	26.95	Brown CLAY.
BH17		C	21.80-22.80	Brown CLAY.
BH17		D	25.45-25.55	Brown CLAY.

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Compiled by	Date	Checked by	Date	Approved by	Date
	25/09/14				00/01/00

RIVENHALL AIRFIELD IWMF.

Contract No:	PSL14/4378
Client Ref:	C4237

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH17		C	28.00-28.45	Brown CLAY.
BH17		C	34.00-34.45	Brown CLAY.
BH17		C	42.60-43.00	Very stiff brown CLAY.
BH17		C	47.50-47.90	Brown CLAY.
BH17		D	49.90-50.00	Brown CLAY.
BH17		D	51.00-51.10	Brown CLAY.
BH18A		C	30.85-31.80	Very stiff brown CLAY.
BH19		C	18.00-18.45	Stiff brown CLAY.
BH19		C	22.55-23.00	Stiff brown CLAY.
BH19		D	25.60-25.70	Brown CLAY.
BH19		D	26.70-26.80	Brown CLAY.
BH19		D	28.50-28.60	Brown CLAY.
BH19		C	28.95-29.70	Stiff brown CLAY.
BH20		D	1.50-1.60	Brown slightly gravelly sandy CLAY.
BH20		D	2.00	Brown slightly gravelly sandy CLAY.
BH20		D	3.00	Brown gravelly sandy CLAY.
BH20		D	4.25	Brown slightly gravelly sandy CLAY.
BH20		B	7.40-7.95	Brown very sandy slightly silty GRAVEL.
BH20		B	9.00-9.50	Brown very gravelly slightly silty SAND.

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Compiled by	Date	Checked by	Date	Approved by	Date
	25/09/14		25/09/14		25/09/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4378

Client Ref: C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH2		D	12.15-12.25	28				89	28	61	95	Very high plasticity CV.
BH2		D	14.25-14.35	27								
BH2		D	16.00-16.10	29				87	30	57	100	Very high plasticity CV.
BH4		D	12.50	27				86	31	55	100	Very high plasticity CV.
BH4		D	16.50-16.95	28								
BH4		D	19.00	28				84	28	56	100	Very high plasticity CV.
BH7		D	14.20-14.30	22								
BH7		D	14.60-14.70	27				86	30	56	100	Very high plasticity CV.
BH7		D	23.20-23.30	32				89	30	59	100	Very high plasticity CV.
BH8		D	19.85-19.95	29				89	31	58	100	Very high plasticity CV.
BH8		D	27.35-27.95	26				88	31	57	100	Very high plasticity CV.
BH10		D	25.20-25.30	29				89	32	57	100	Very high plasticity CV.
BH10		D	32.95-33.05	28				89	30	59	100	Very high plasticity CV.
BH15		D	20.50	33								
BH15		D	23.00	27				88	31	57	100	Very high plasticity CV.
BH17		D	25.45-25.55	25				84	29	55	100	Very high plasticity CV.
BH17		D	51.00-51.10	29				69	25	44	100	High plasticity CH.
BH19		D	25.60-25.70	31				88	32	56	100	Very high plasticity CV.
BH19		D	26.70-26.80	27								

SYMBOLS : NP : Non Plastic

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Compiled by	Date	Checked by	Date	Approved by	Date
	25/09/14		25/09/14		25/09/14

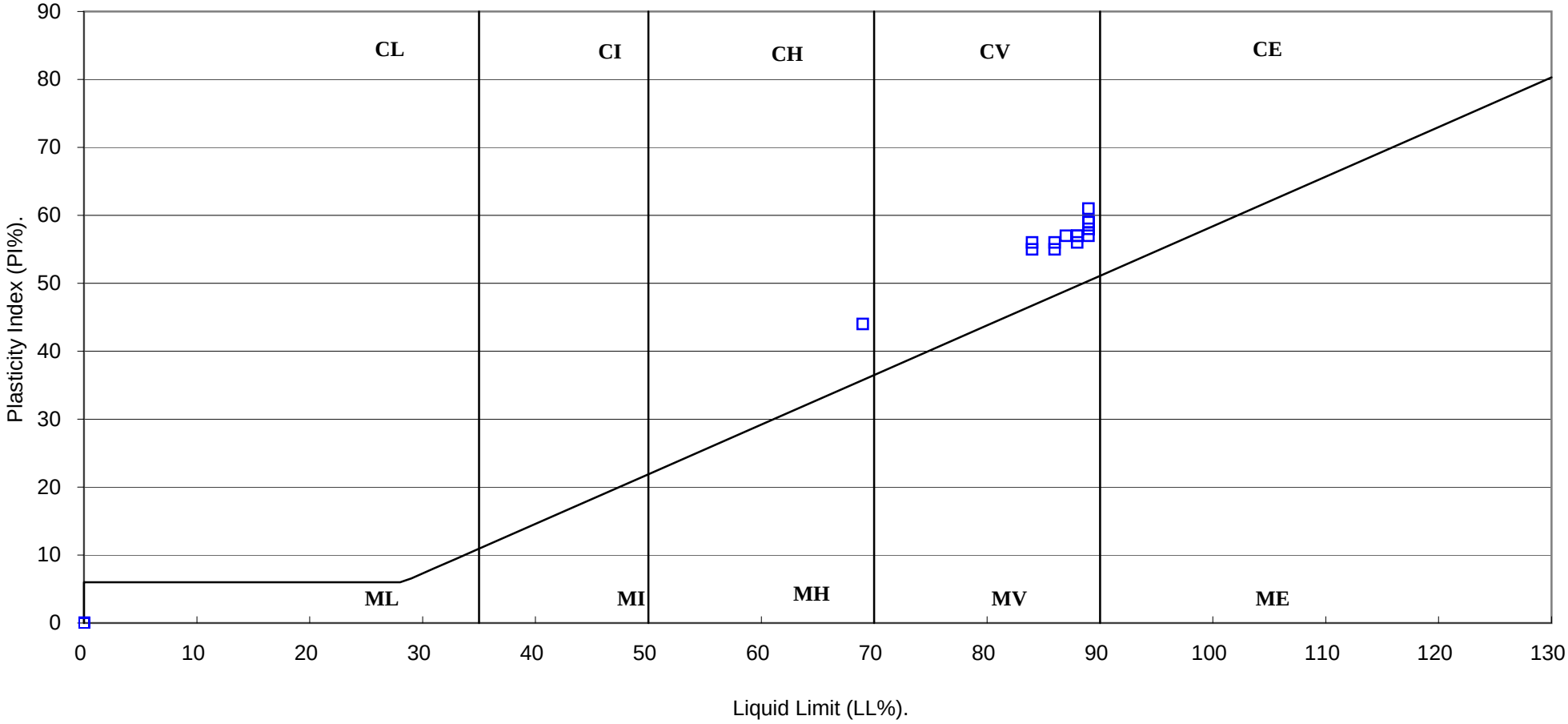
RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/4378

Client Ref: C4237

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		25/09/14		25/09/14		25/09/14
	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/4378
					Client Ref:	C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH19		D	28.50-28.60	30				89	31	58	100	Very high plasticity CV.
BH20		D	1.50-1.60	11								
BH20		D	2.00	13				40	22	18	97	Intermediate plasticity CI.
BH20		D	3.00	11								
BH20		D	4.25	15				37	17	20	88	Intermediate plasticity CI.

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

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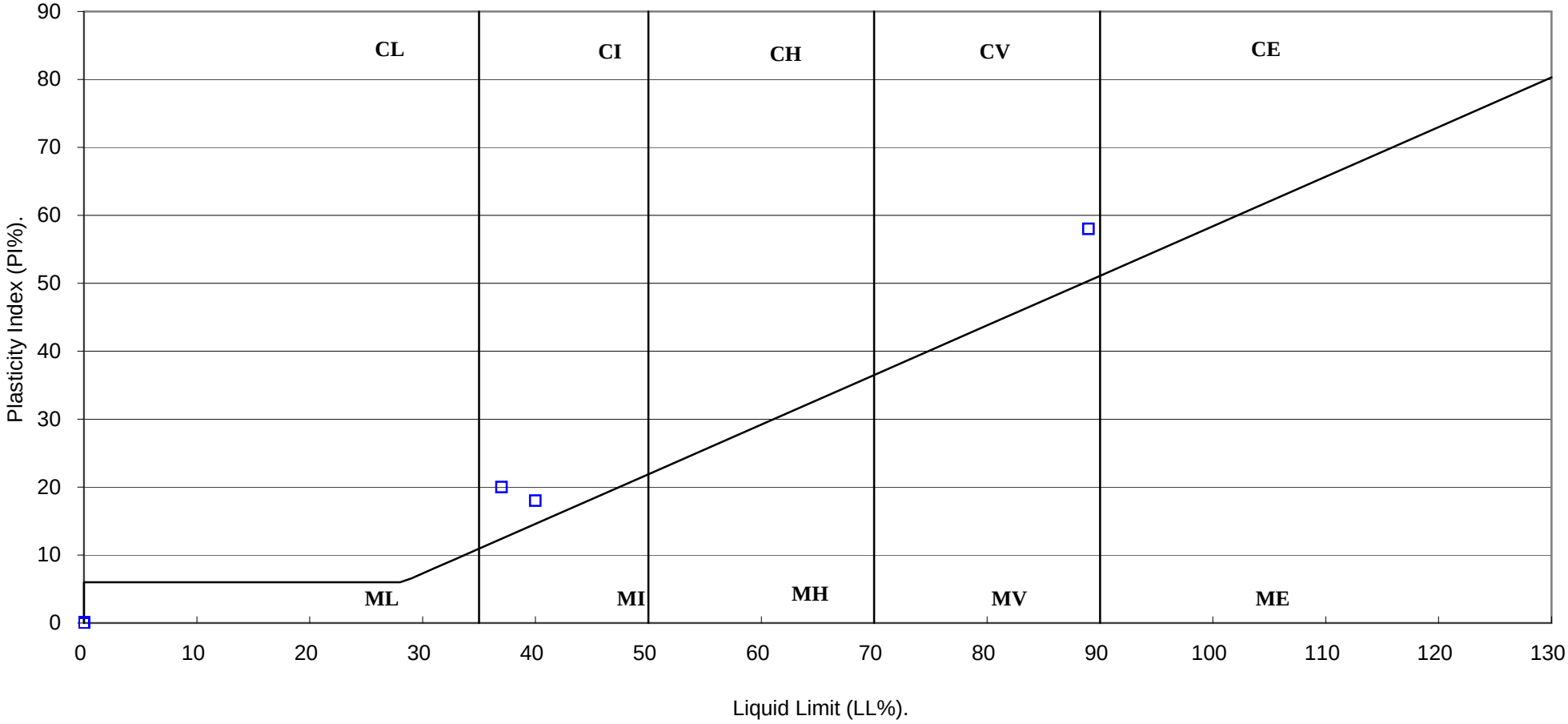
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/4378**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



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	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/4378
					Client Ref:	C4237

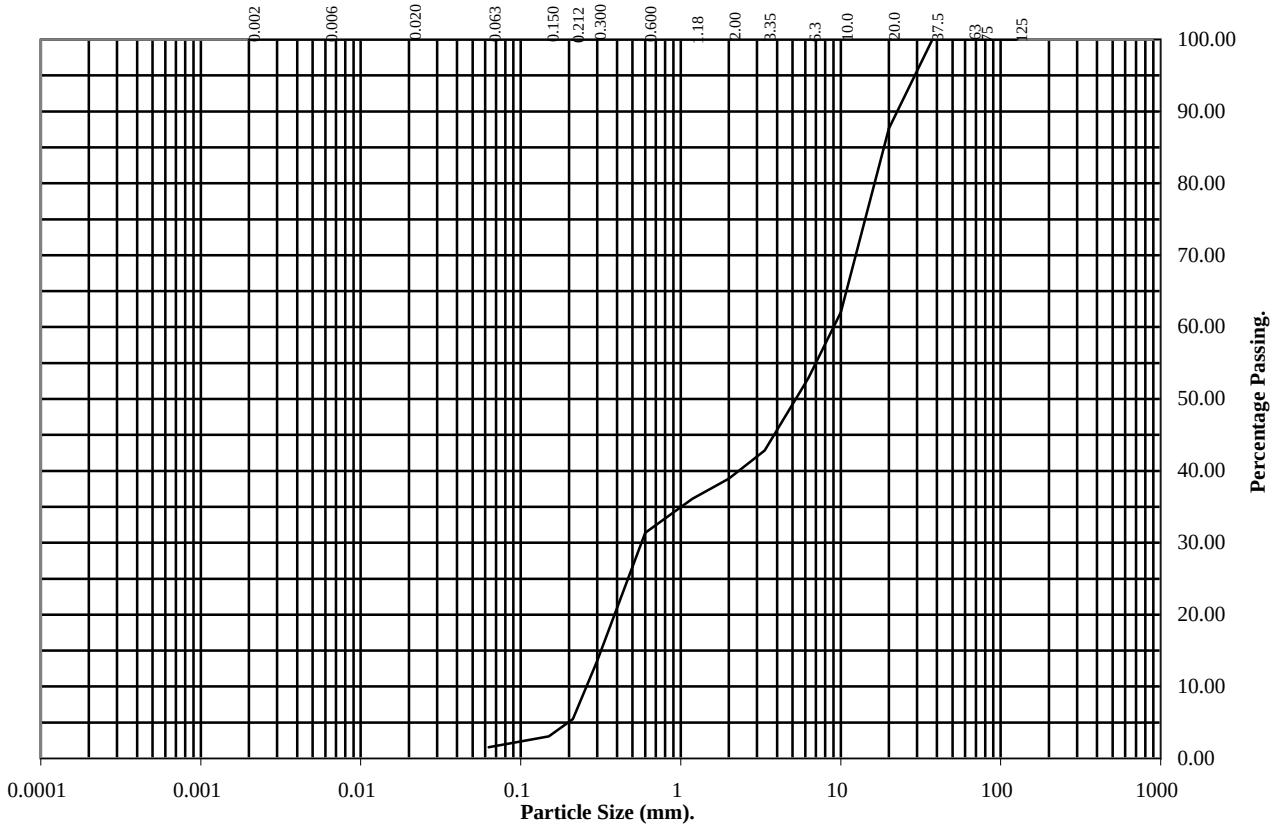
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH20** **Depth (m):** **7.40-7.95**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	88
10	62
6.3	53
3.35	43
2	39
1.18	36
0.6	31
0.3	14
0.212	5
0.15	3
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	61
Sand	37
Silt / Clay	2

Remarks:
See summary of soil descriptions.

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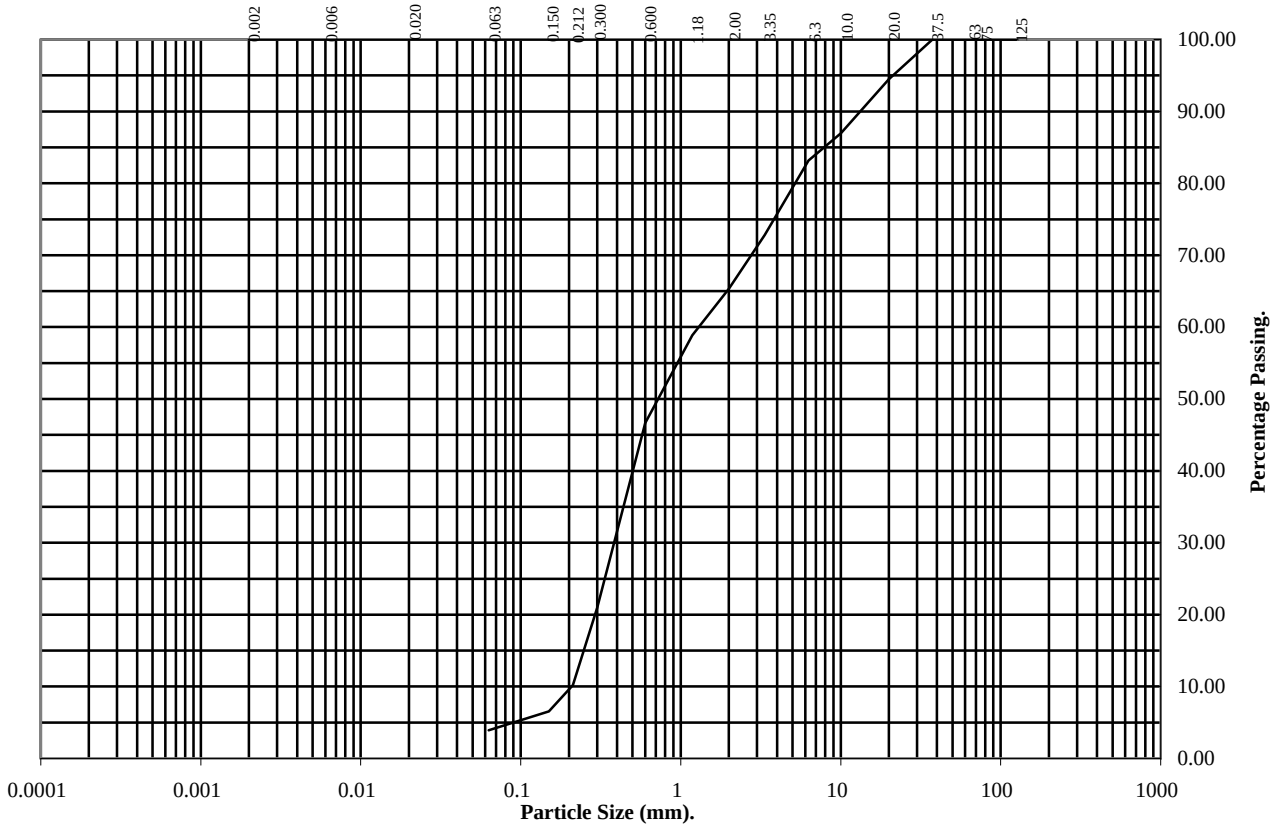
Particle Size Distribution Test

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: **BH20** **Depth (m):** **9.00-9.50**

Sample Number: **Sample Type:** **B**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	87
6.3	83
3.35	73
2	65
1.18	59
0.6	47
0.3	21
0.212	10
0.15	7
0.063	4

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	61
Silt / Clay	4

Remarks:
See summary of soil descriptions.

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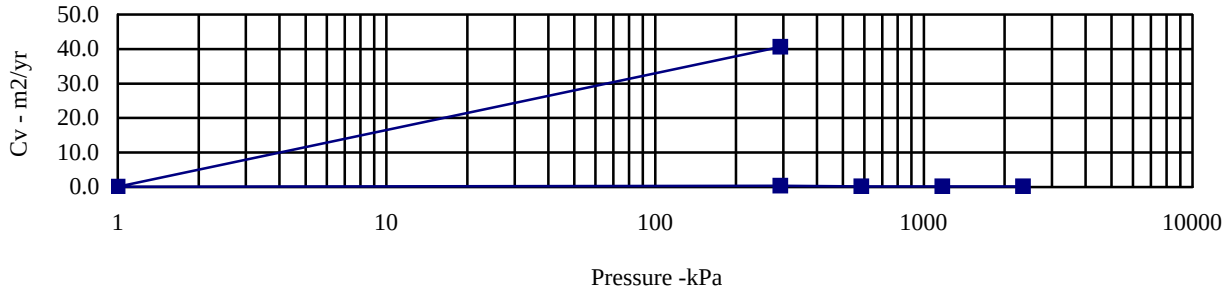
One Dimensional Consolidation Properties

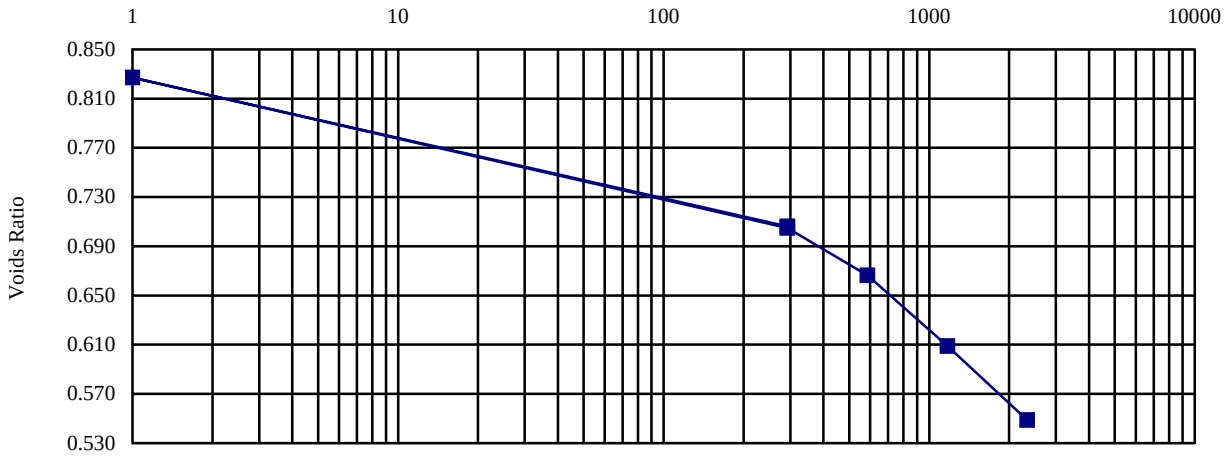
BS 1377: Part 5: 1990

Hole Number: **BH2** **Depth (m):** **9.70-10.00**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	29							
Bulk Density (Mg/m3):	1.96	0	-	293	0.067	40.588	Method used to	
Dry Density (Mg/m3):	1.52	293	-	1	0.243	0.074	determine CV:	t90
Voids Ratio:	0.741	1	-	293	0.229	0.341	Nominal temperature	
Degree of saturation:	103.2	293	-	586	0.077	0.157	during test ' C:	20
Height (mm):	19.88	586	-	1172	0.059	0.150	Remarks:	
Diameter (mm)	50.14	1172	-	2344	0.032	0.150	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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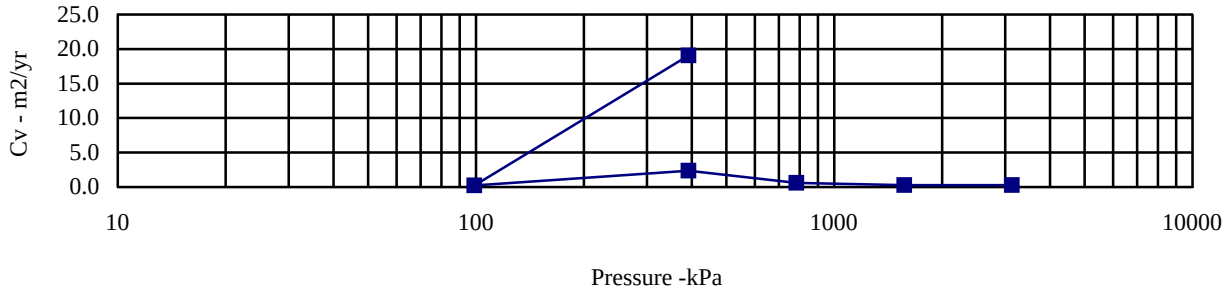
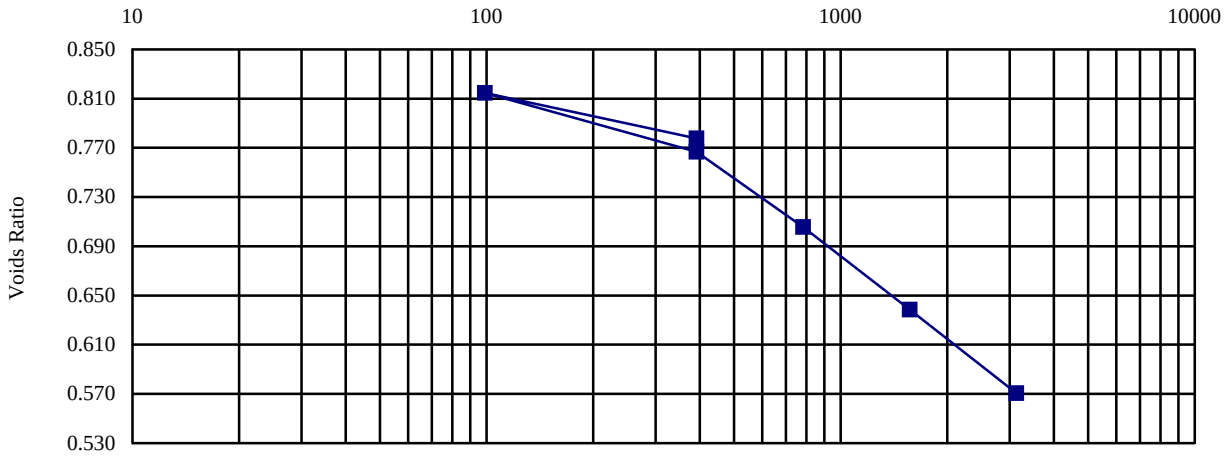
BS 1377: Part 5: 1990

Hole Number: **BH2** **Depth (m):** **13.80-14.10**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	31							
Bulk Density (Mg/m3):	1.86	0	-	392	0.119	19.079	Method used to	
Dry Density (Mg/m3):	1.42	392	-	99	0.071	0.252	determine CV:	t90
Voids Ratio:	0.865	99	-	392	0.090	2.373	Nominal temperature	
Degree of saturation:	95.5	392	-	784	0.088	0.602	during test ' C:	20
Height (mm):	19.91	784	-	1568	0.050	0.283	Remarks:	
Diameter (mm)	50.17	1568	-	3136	0.026	0.277	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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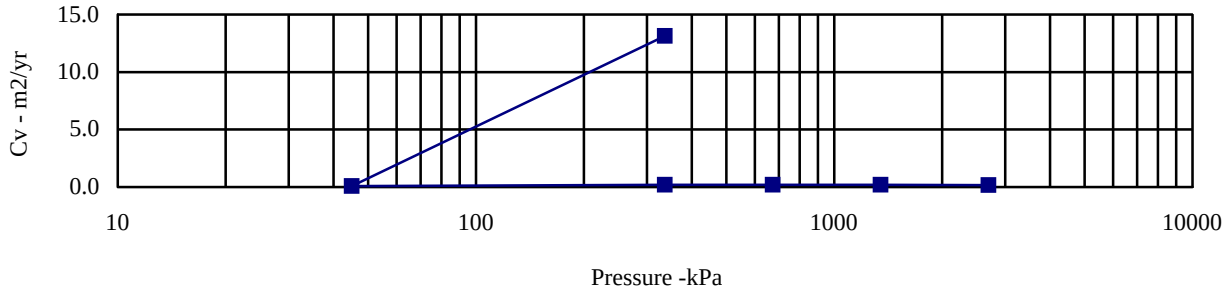
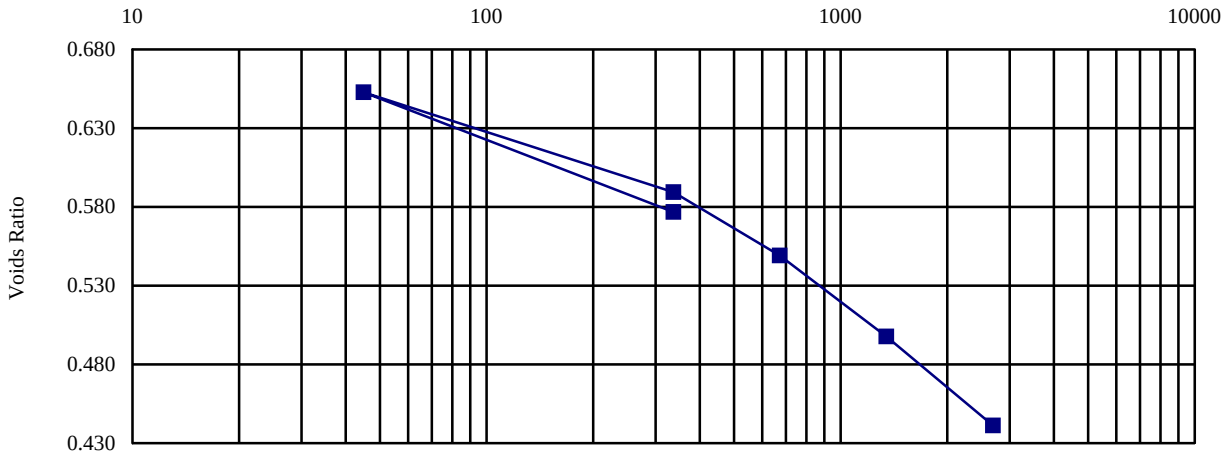
BS 1377: Part 5: 1990

Hole Number: **BH4** **Depth (m):** **6.00-6.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	22							
Bulk Density (Mg/m3):	2.01	0	-	337	0.051	13.141	Method used to	
Dry Density (Mg/m3):	1.65	337	-	45	0.165	0.091	determine CV:	t90
Voids Ratio:	0.604	45	-	337	0.132	0.191	Nominal temperature	
Degree of saturation:	95.6	337	-	674	0.075	0.199	during test ' C:	20
Height (mm):	19.94	674	-	1348	0.049	0.198	Remarks:	
Diameter (mm)	75.19	1348	-	2696	0.028	0.172	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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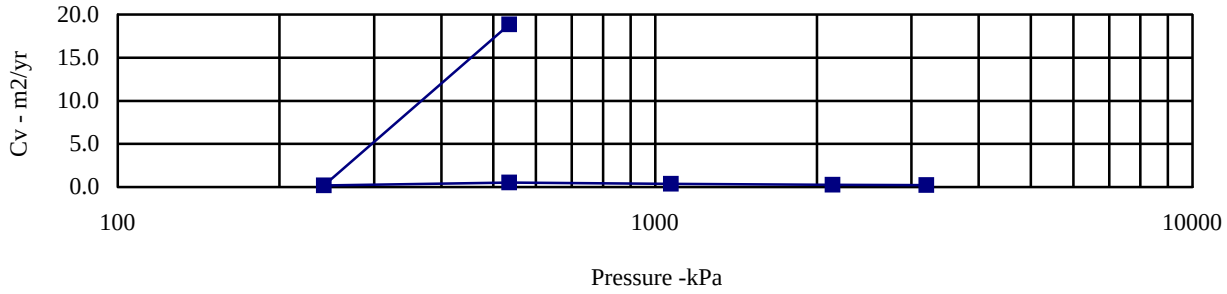
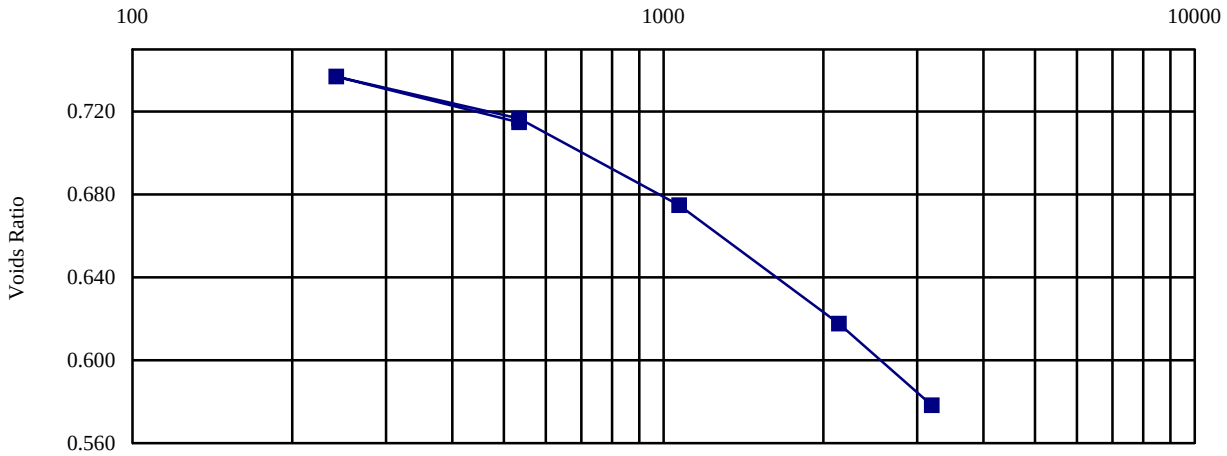
Hole Number: **BH4** **Depth (m):** **15.10-15.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.96	0	-	535	0.020	18.849	Method used to	
Dry Density (Mg/m3):	1.53	535	-	242	0.044	0.200	determine CV:	t90
Voids Ratio:	0.734	242	-	535	0.040	0.513	Nominal temperature	
Degree of saturation:	101.6	535	-	1070	0.046	0.369	during test ' C:	20
Height (mm):	19.87	1070	-	2140	0.032	0.275	Remarks:	
Diameter (mm)	75.21	2140	-	3200	0.023	0.218	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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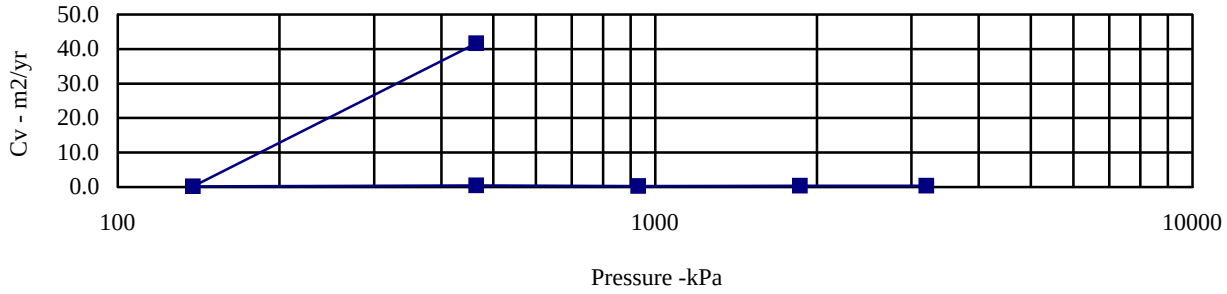
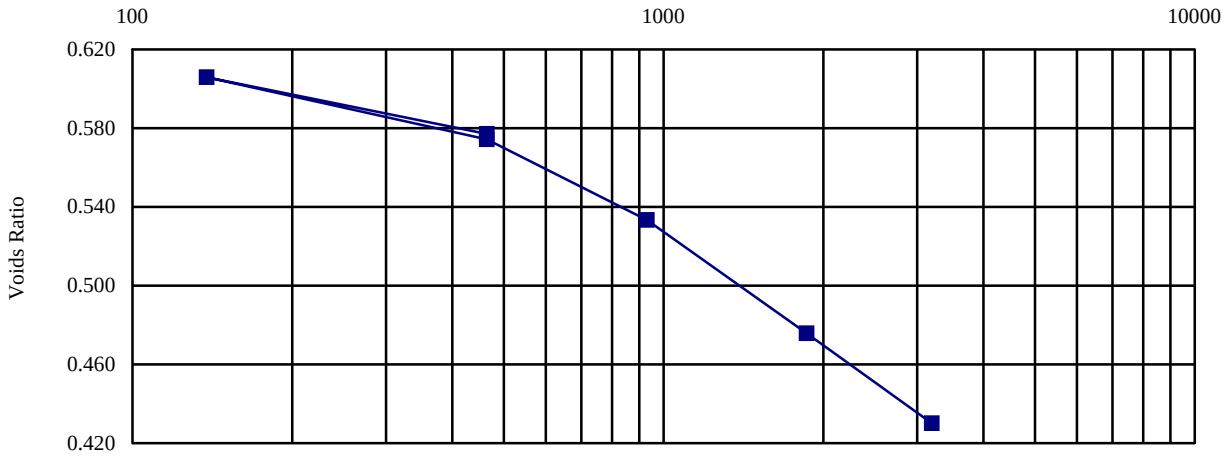
Hole Number: **BH7** **Depth (m):** **18.85-19.30**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	22							
Bulk Density (Mg/m3):	1.98	0	-	465	0.075	41.647	Method used to	
Dry Density (Mg/m3):	1.62	465	-	138	0.056	0.215	determine CV:	t90
Voids Ratio:	0.634	138	-	465	0.060	0.461	Nominal temperature	
Degree of saturation:	93.6	465	-	930	0.056	0.308	during test ' C:	20
Height (mm):	20.01	930	-	1860	0.040	0.374	Remarks:	
Diameter (mm)	75.2	1860	-	3200	0.023	0.342	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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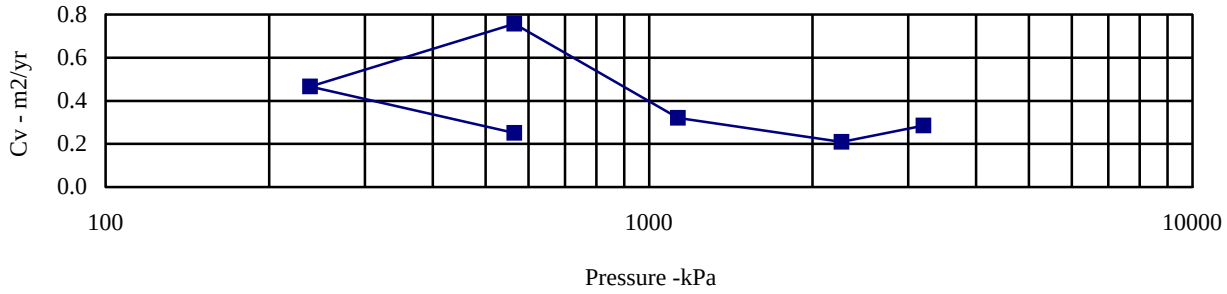
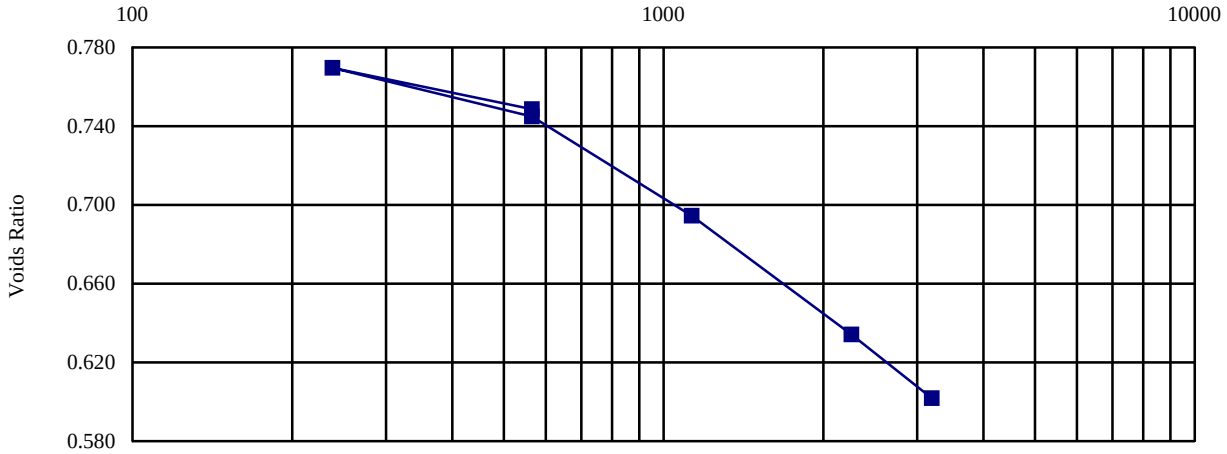
Hole Number: **BH7** **Depth (m):** **23.50-23.80**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	32							
Bulk Density (Mg/m3):	1.92	0	-	565	0.079	0.250	Method used to	
Dry Density (Mg/m3):	1.45	565	-	238	0.037	0.465	determine CV:	t90
Voids Ratio:	0.831	238	-	565	0.043	0.757	Nominal temperature	
Degree of saturation:	103.2	565	-	1130	0.051	0.321	during test ' C:	20
Height (mm):	20.08	1130	-	2260	0.031	0.210	Remarks:	
Diameter (mm)	75.11	2260	-	3200	0.021	0.285	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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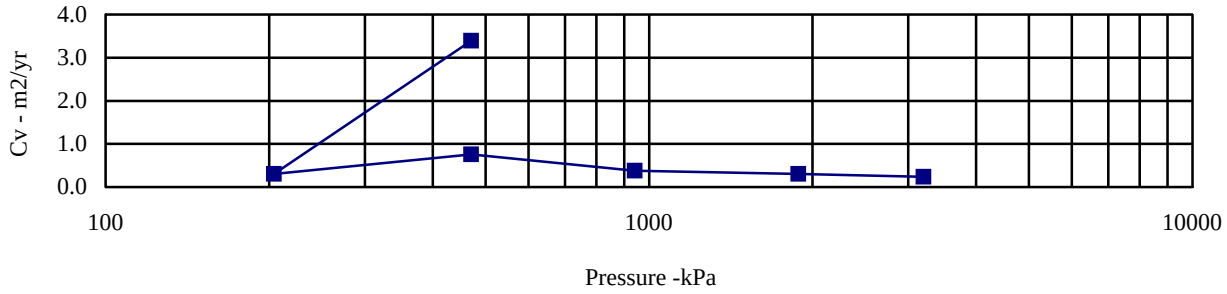
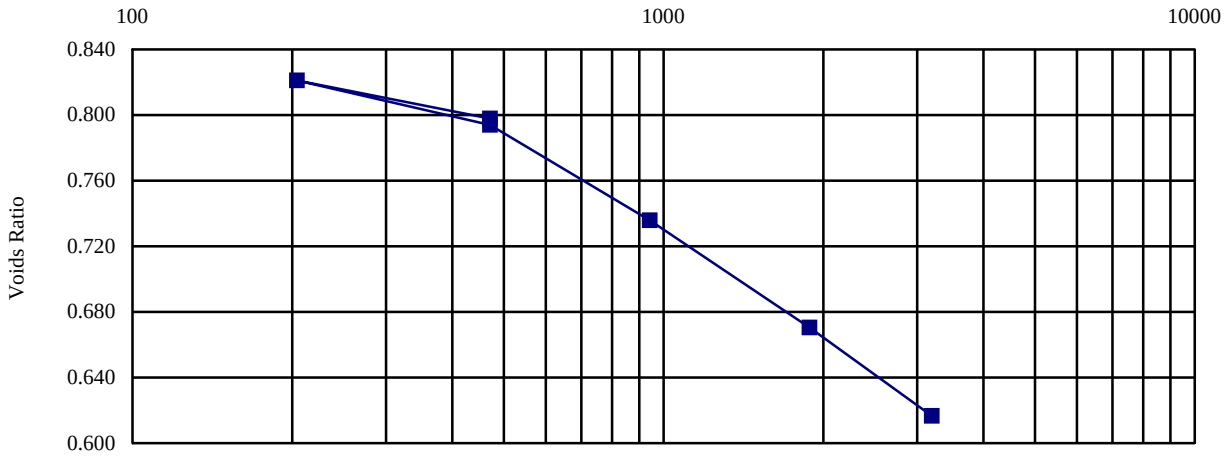
Hole Number: **BH8** **Depth (m):** **22.75-23.20**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	32							
Bulk Density (Mg/m3):	1.86	0	-	471	0.095	3.393	Method used to	
Dry Density (Mg/m3):	1.41	471	-	204	0.049	0.305	determine CV:	t90
Voids Ratio:	0.882	204	-	471	0.056	0.758	Nominal temperature	
Degree of saturation:	96.8	471	-	942	0.069	0.379	during test ' C:	20
Height (mm):	20.08	942	-	1884	0.040	0.301	Remarks:	
Diameter (mm)	75.19	1884	-	3200	0.024	0.237	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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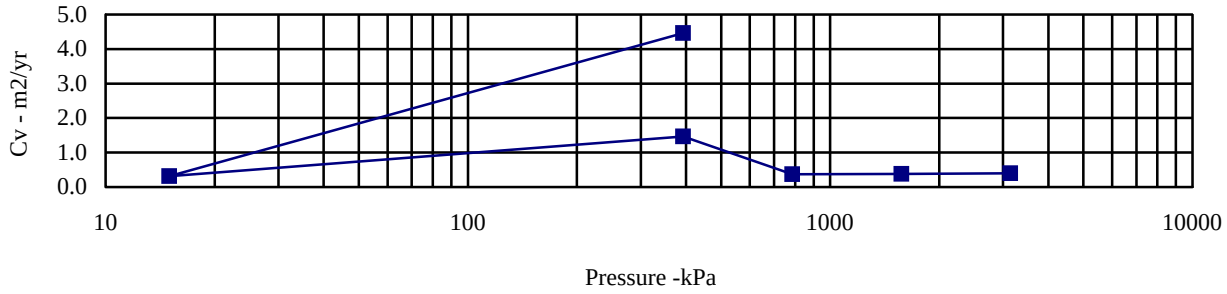
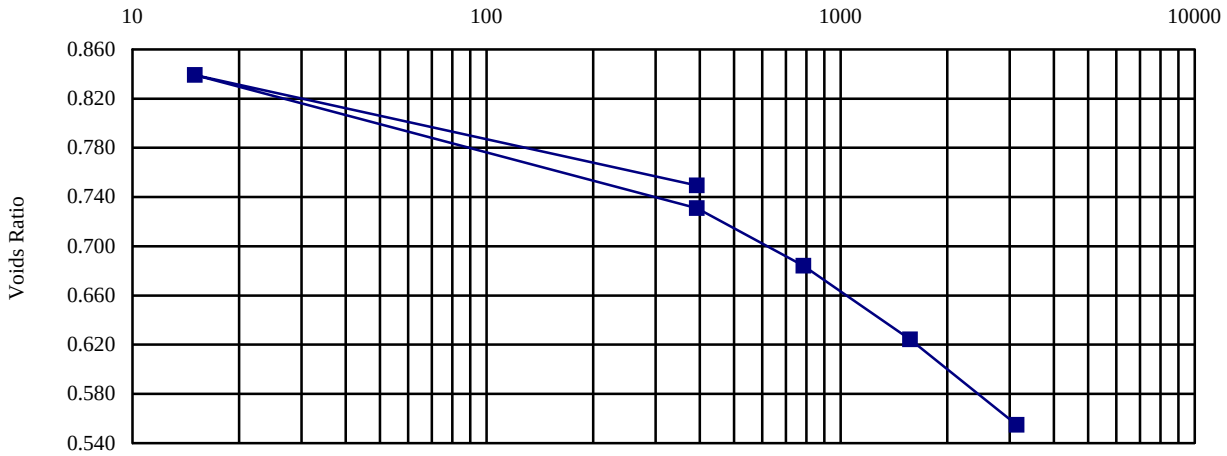
Hole Number: **BH15** **Depth (m):** **19.20-19.50**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	32							
Bulk Density (Mg/m3):	1.90	0	-	393	0.121	4.459	Method used to	
Dry Density (Mg/m3):	1.44	393	-	15	0.136	0.312	determine CV:	t90
Voids Ratio:	0.836	15	-	393	0.155	1.463	Nominal temperature	
Degree of saturation:	100.2	393	-	786	0.069	0.372	during test ' C:	20
Height (mm):	20.11	786	-	1572	0.045	0.380	Remarks:	
Diameter (mm)	75.02	1572	-	3144	0.027	0.399	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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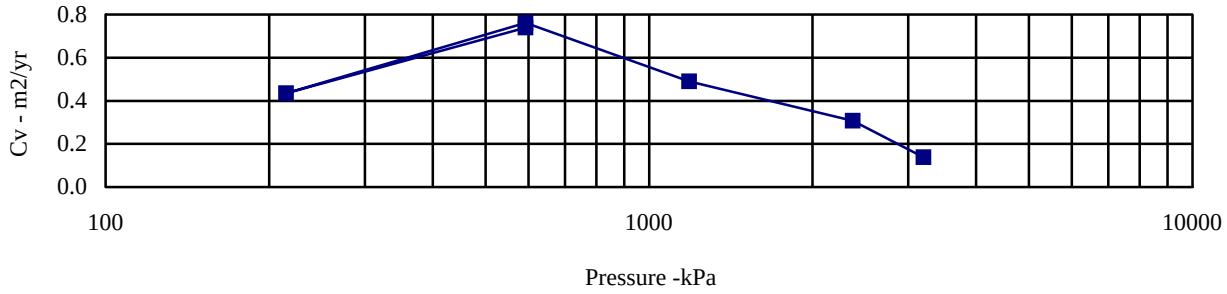
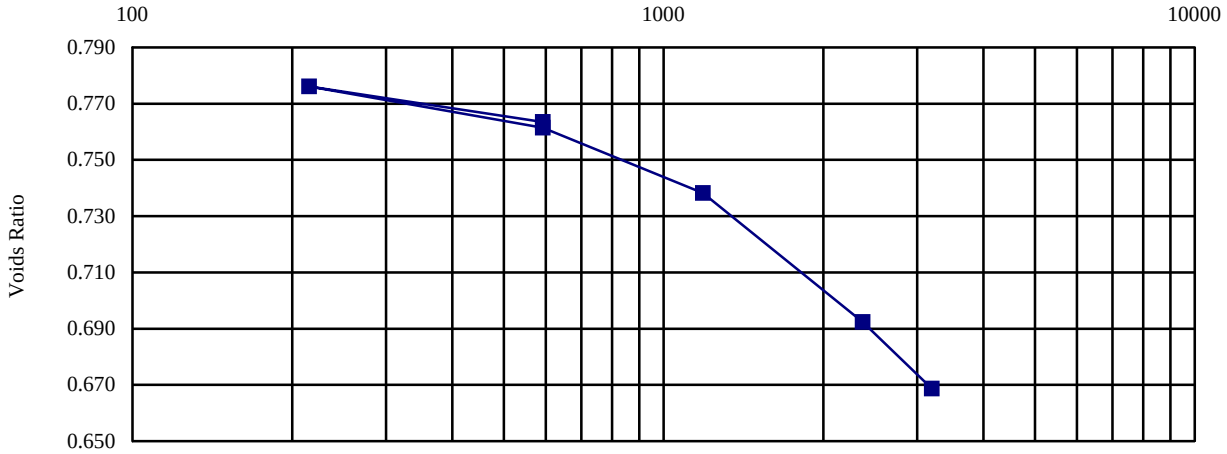
Hole Number: **BH15** **Depth (m):** **28.30-28.60**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	32							
Bulk Density (Mg/m3):	1.93	0	-	593	0.049	0.740	Method used to	
Dry Density (Mg/m3):	1.46	593	-	215	0.019	0.434	determine CV:	t90
Voids Ratio:	0.816	215	-	593	0.022	0.762	Nominal temperature	
Degree of saturation:	105.4	593	-	1186	0.022	0.489	during test ' C:	20
Height (mm):	19.95	1186	-	2372	0.022	0.307	Remarks:	
Diameter (mm)	75.11	2372	-	3200	0.017	0.139	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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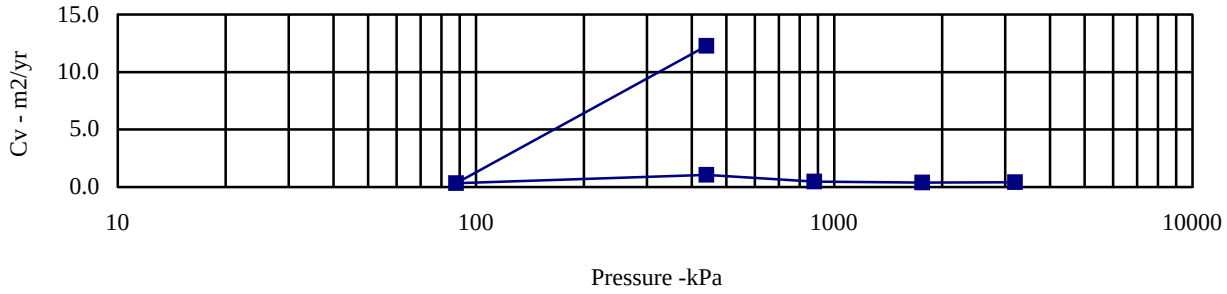
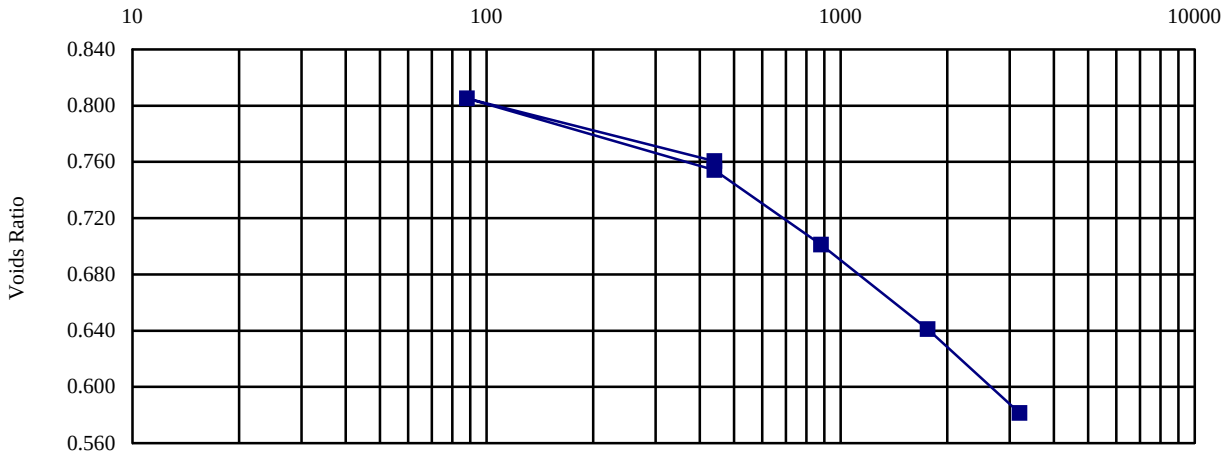
Hole Number: **BH17** **Depth (m):** **21.80-22.30**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	30							
Bulk Density (Mg/m3):	1.88	0	-	440	0.089	12.260	Method used to	
Dry Density (Mg/m3):	1.45	440	-	88	0.072	0.338	determine CV:	t90
Voids Ratio:	0.833	88	-	440	0.080	1.071	Nominal temperature	
Degree of saturation:	95.9	440	-	880	0.069	0.476	during test ' C:	20
Height (mm):	20.06	880	-	1760	0.040	0.378	Remarks:	
Diameter (mm)	75.18	1760	-	3200	0.025	0.412	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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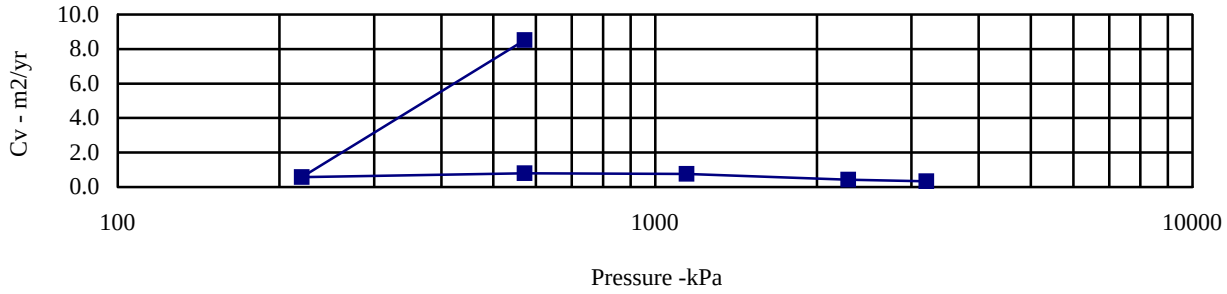
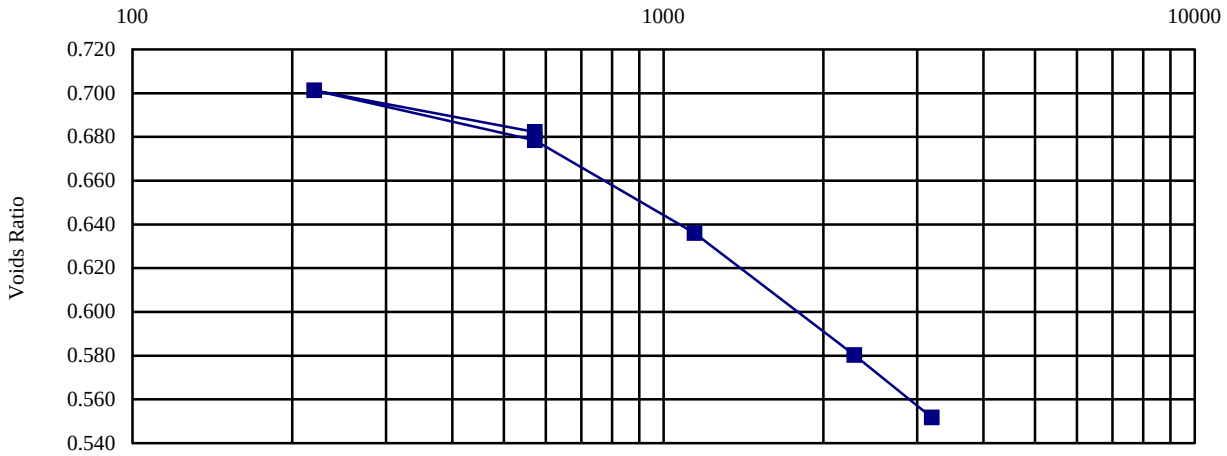
Hole Number: **BH17** **Depth (m):** **28.00-28.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.95	0	-	572	0.055	8.517	Method used to	
Dry Density (Mg/m3):	1.53	572	-	220	0.032	0.574	determine CV:	t90
Voids Ratio:	0.737	220	-	572	0.038	0.801	Nominal temperature	
Degree of saturation:	99.0	572	-	1144	0.044	0.752	during test ' C:	20
Height (mm):	20.1	1144	-	2288	0.030	0.429	Remarks:	
Diameter (mm)	75.22	2288	-	3200	0.020	0.327	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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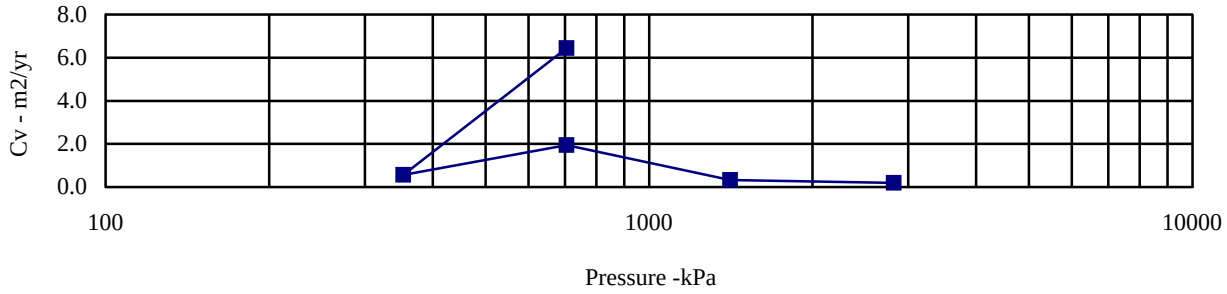
One Dimensional Consolidation Properties

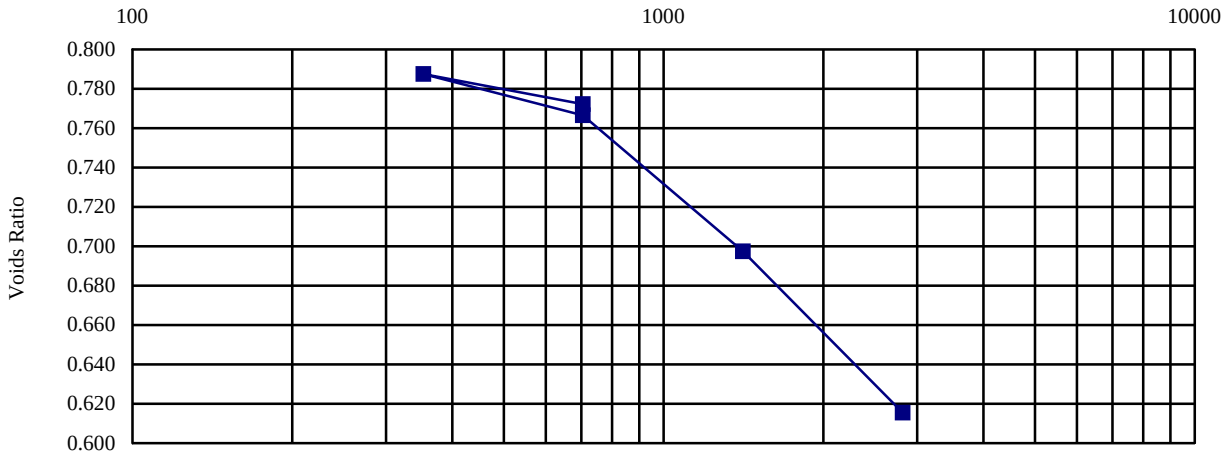
BS 1377: Part 5: 1990

Hole Number: **BH17** **Depth (m):** **34.00-34.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	30							
Bulk Density (Mg/m3):	1.82	0	-	705	0.084	6.446	Method used to	
Dry Density (Mg/m3):	1.41	705	-	353	0.024	0.564	determine CV:	t90
Voids Ratio:	0.883	353	-	705	0.033	1.940	Nominal temperature	
Degree of saturation:	88.6	705	-	1410	0.055	0.321	during test ' C:	20
Height (mm):	19.86	1410	-	2820	0.034	0.192	Remarks:	
Diameter (mm)	50.07						See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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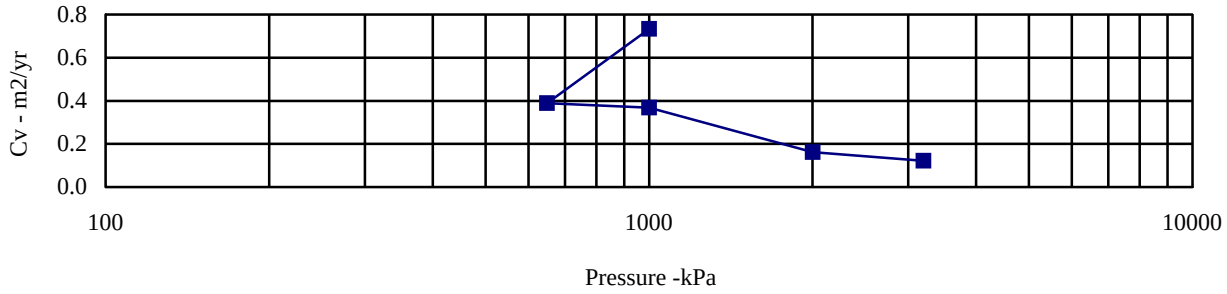
One Dimensional Consolidation Properties

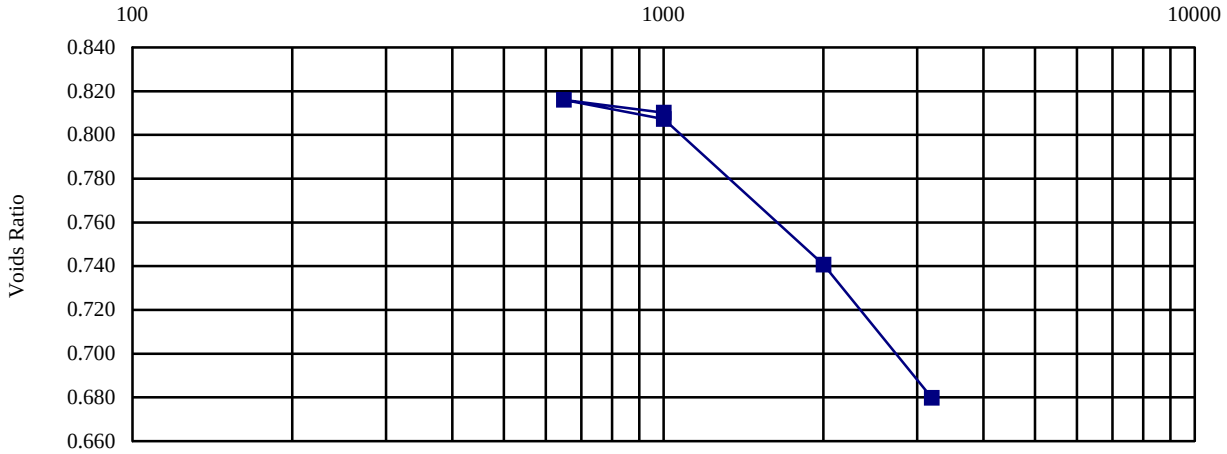
BS 1377: Part 5: 1990

Hole Number: **BH17** **Depth (m):** **47.50-47.90**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	34							
Bulk Density (Mg/m3):	1.85	0	-	1001	0.058	0.732	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.38	1001	-	649	0.009	0.390		
Voids Ratio:	0.922	649	-	1001	0.014	0.368	Nominal temperature during test ' C:	20
Degree of saturation:	97.7	1001	-	2002	0.037	0.162		
Height (mm):	20.12	2002	-	3200	0.029	0.122	Remarks: See summary of soils description.	
Diameter (mm)	75.2							
Particle Density (Mg/m3):	2.65							
Assumed								





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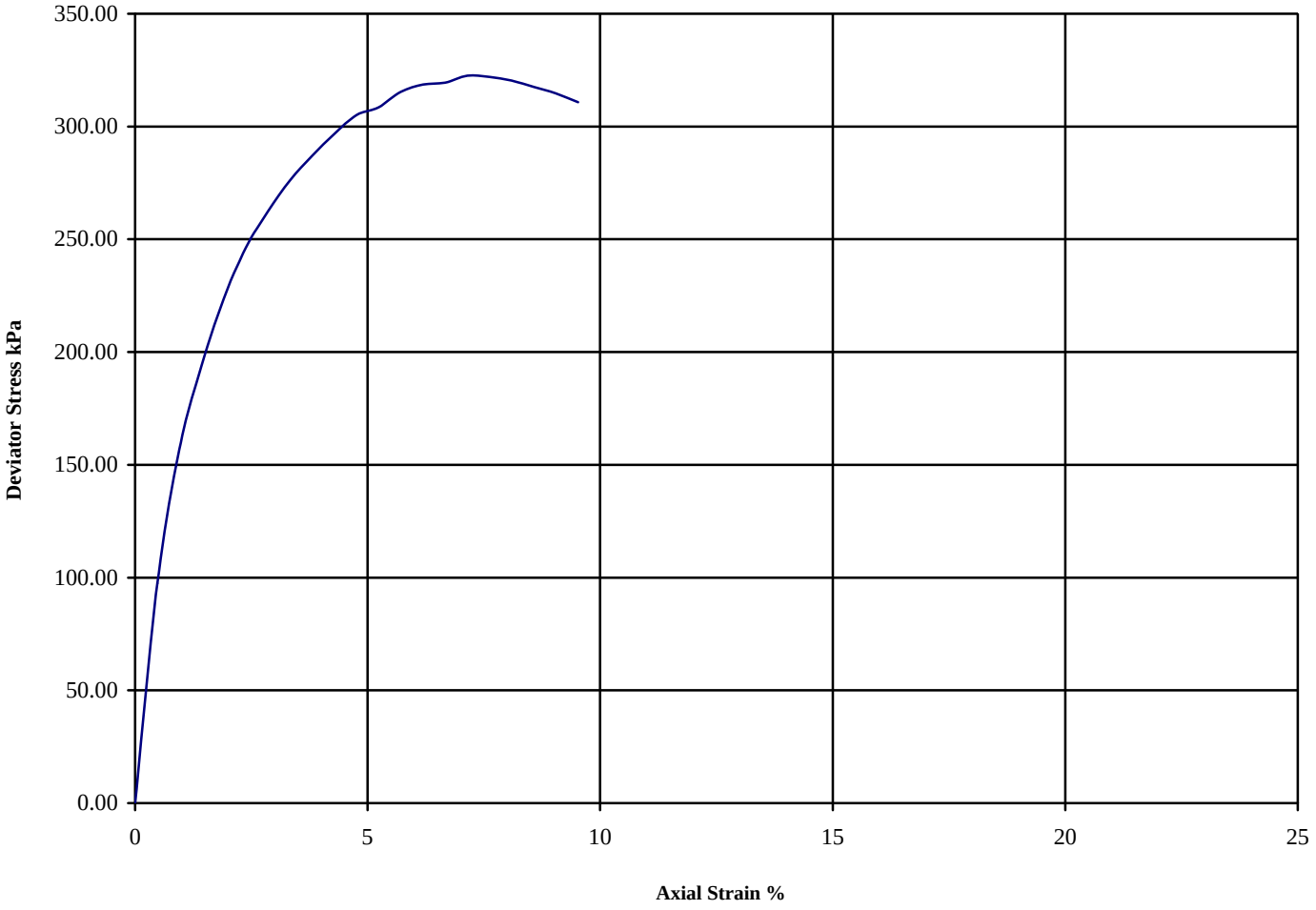
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH2** **Depth (m):** **18.65-19.15**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.92	1.49	568	323	161	7.1	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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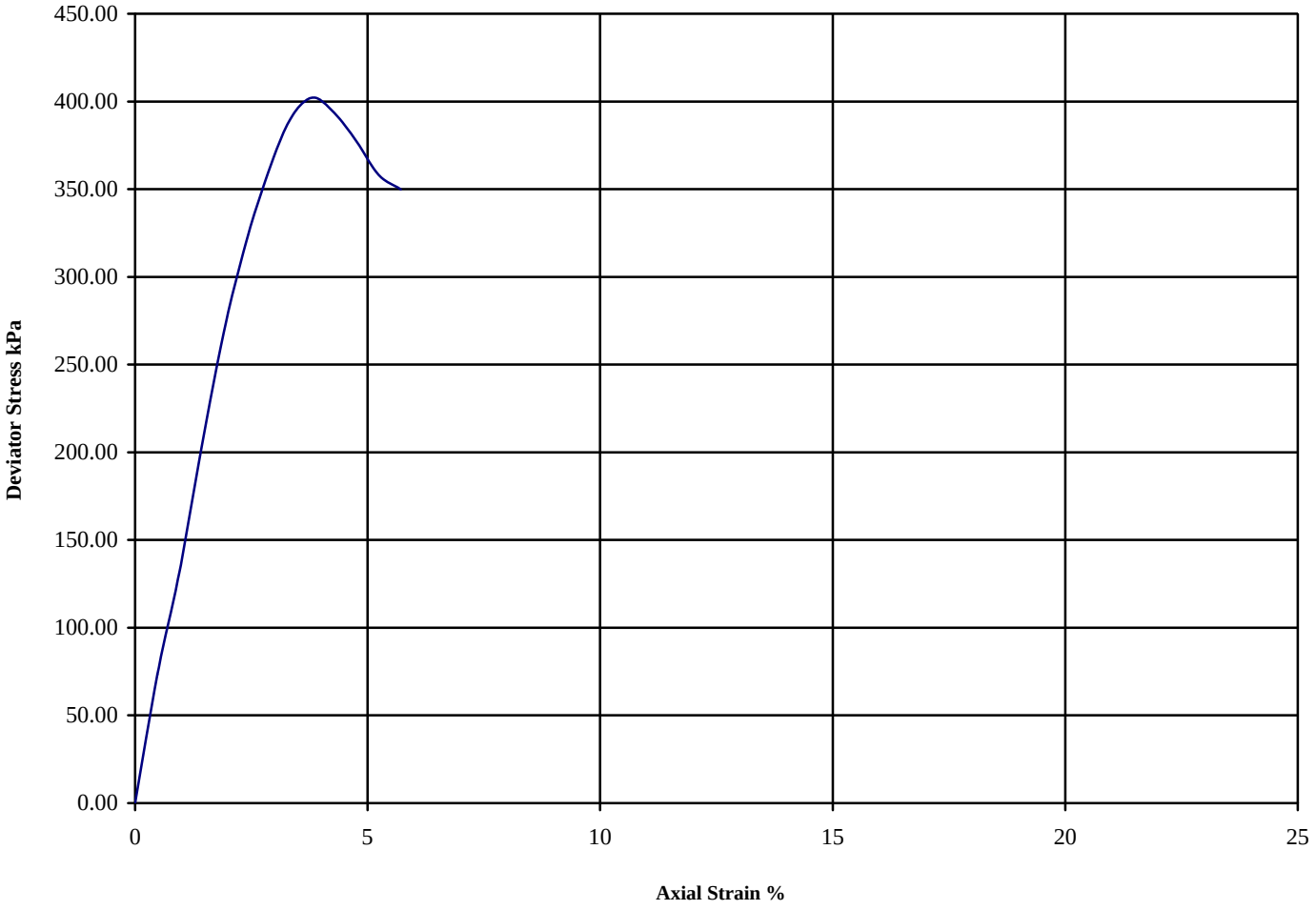
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH4** **Depth (m):** **12.00-12.45**

Sample Number: **Sample Type:** **U**



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.02	1.59	469	402	201	3.8	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.37 kPa See summary of soil descriptions.

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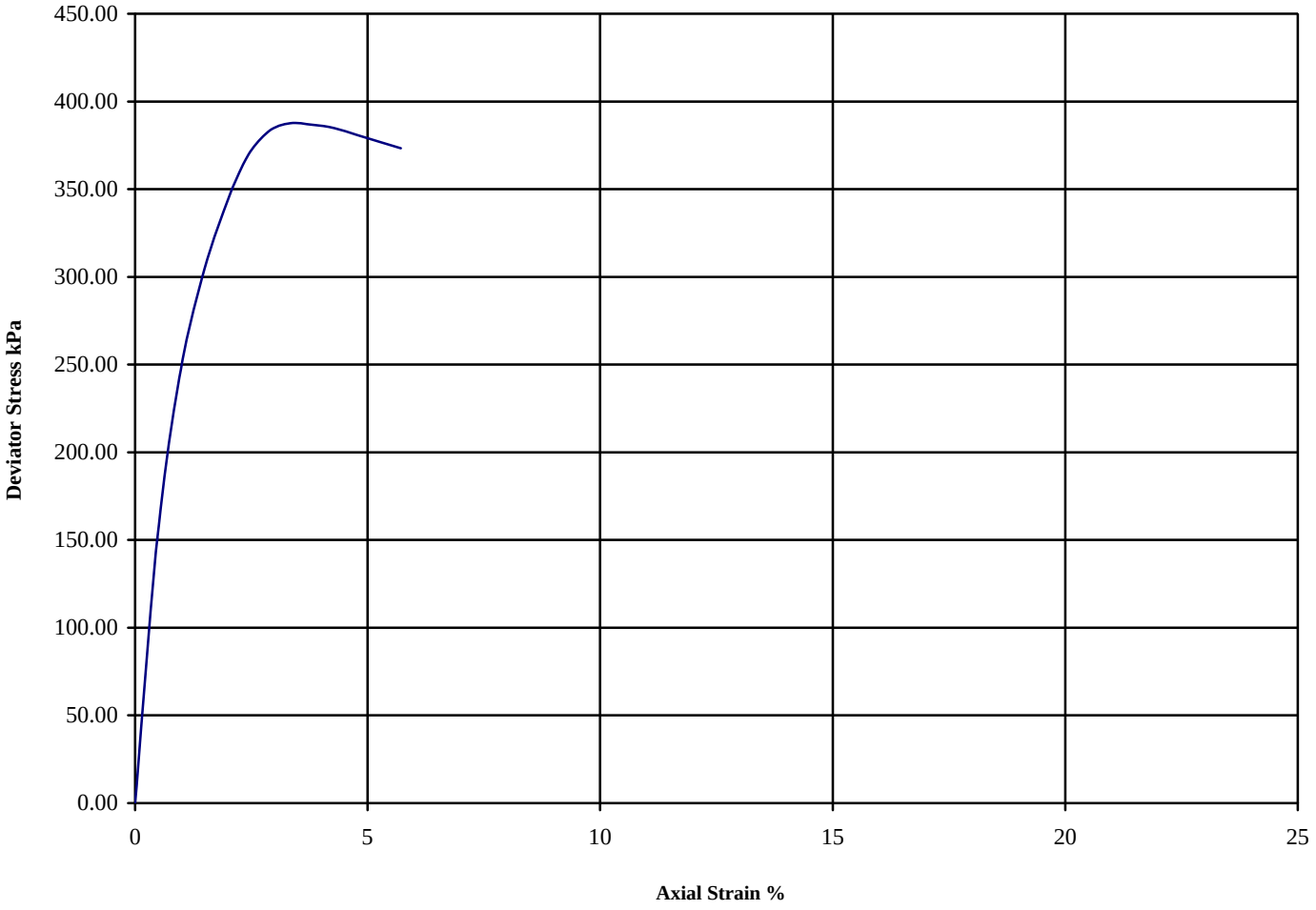
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH4** **Depth (m):** **21.00-21.45**

Sample Number: **Sample Type:** **U**



Diameter (mm):		102.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	27	2.01	1.58	667	388	194	3.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.37 kPa See summary of soil descriptions.

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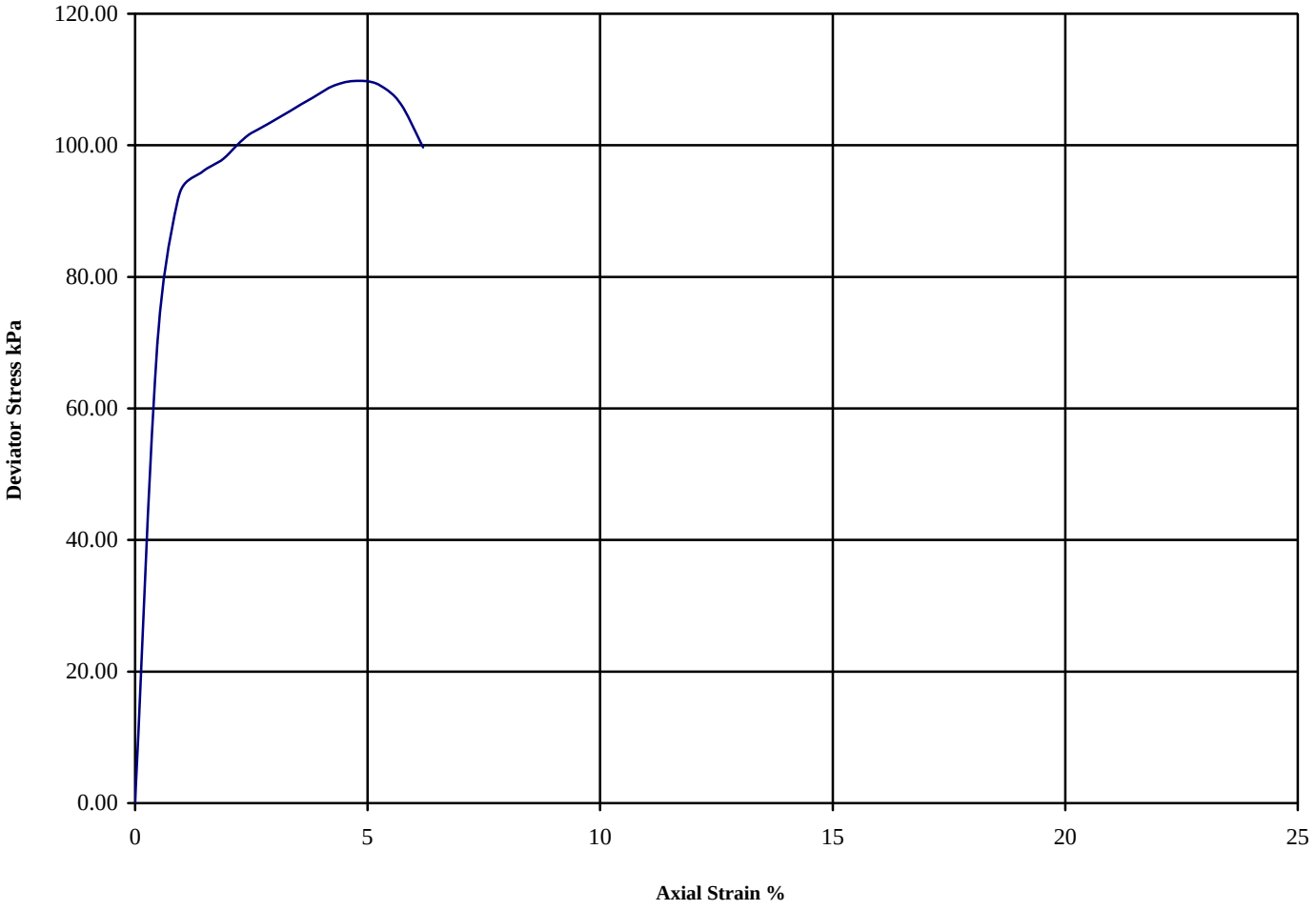
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH7 **Depth (m):** 15.05-15.50

Sample Number: **Sample Type:** U



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.93	1.50	380	110	55	4.8	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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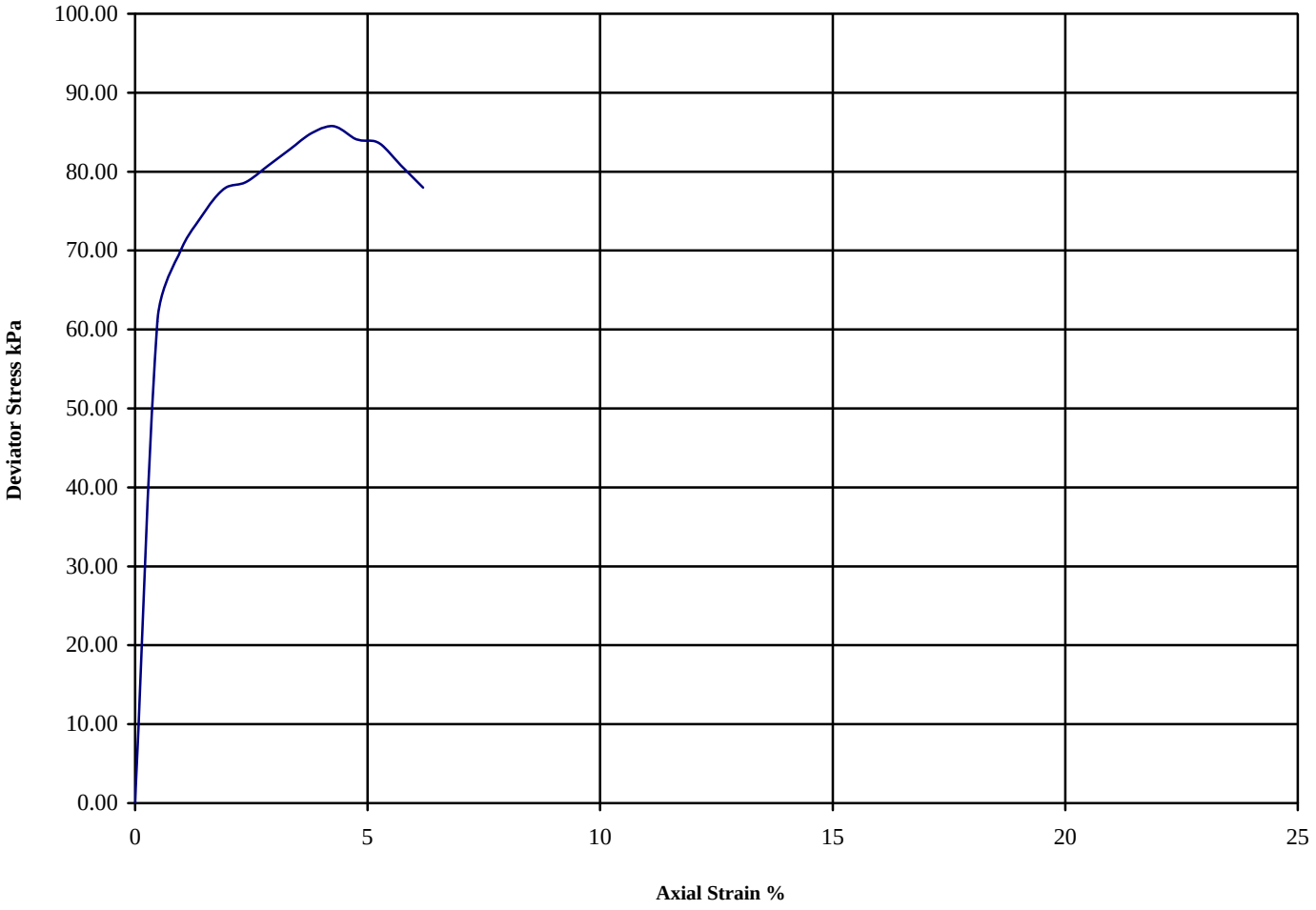
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH7 **Depth (m):** 22.30-22.60

Sample Number: **Sample Type:** U



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	35	2.06	1.52	535	86	43	4.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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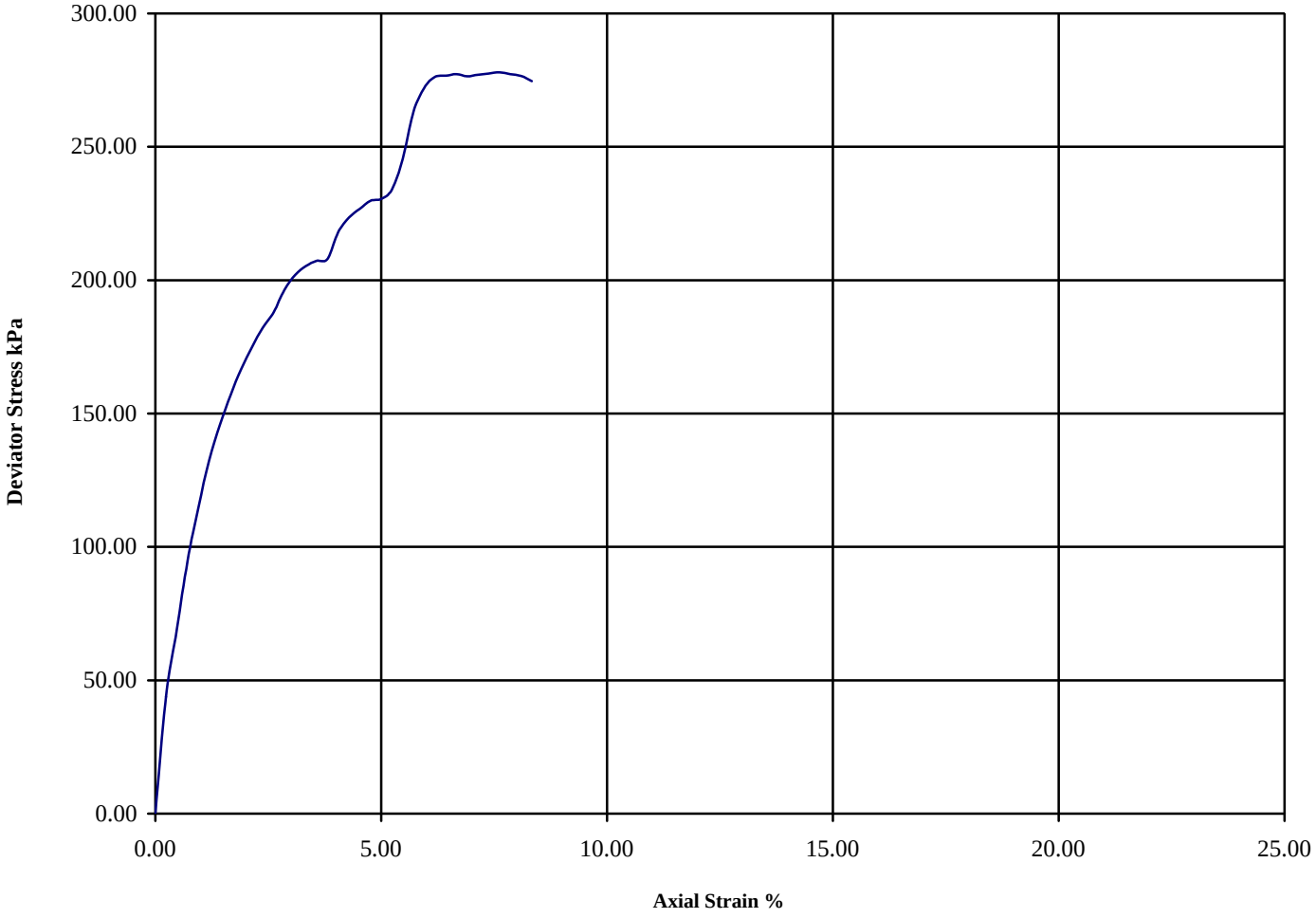
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 9 : 1990

Hole Number: BH8 **Depth (m):** 16.50-17.00

Sample Number: **Sample Type:** U



Diameter (mm):		90	Height (mm):		210	Test:	100mm Multistage		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
									Sample taken from top of tube
									Rate of strain = 1.9 %/min
									Latex Membrane used 0.2 mm thickness
									Membrane Correction applied (kPa)
A	28	1.93	1.50	197	208	104	3.8	Brittle	0.41 0.41 0.41
				393	230	115	5.0		See summary of soil descriptions.
				786	278	139	7.6		

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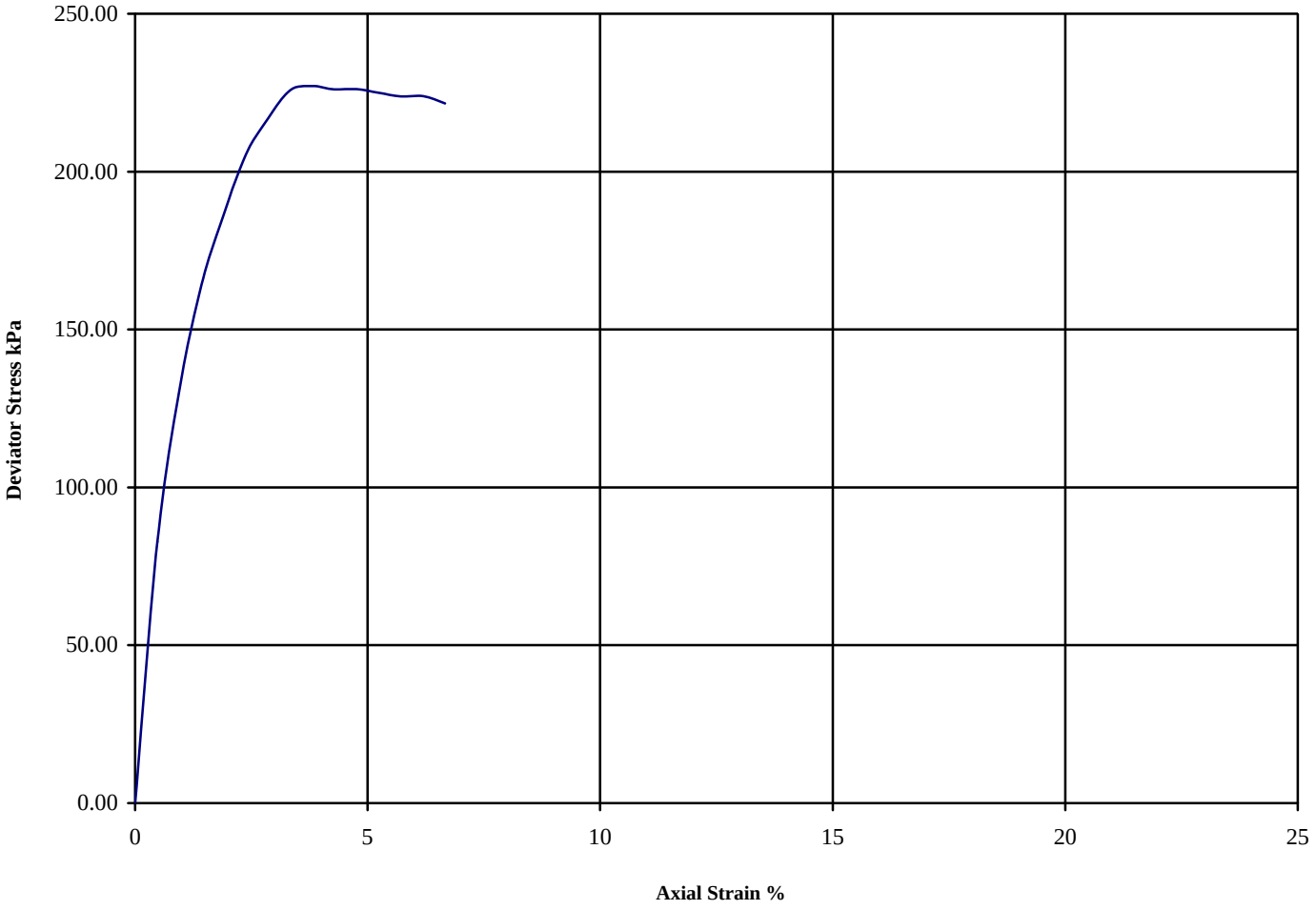
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH8** **Depth (m):** **28.60-28.90**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.78	1.38	587	227	114	3.8	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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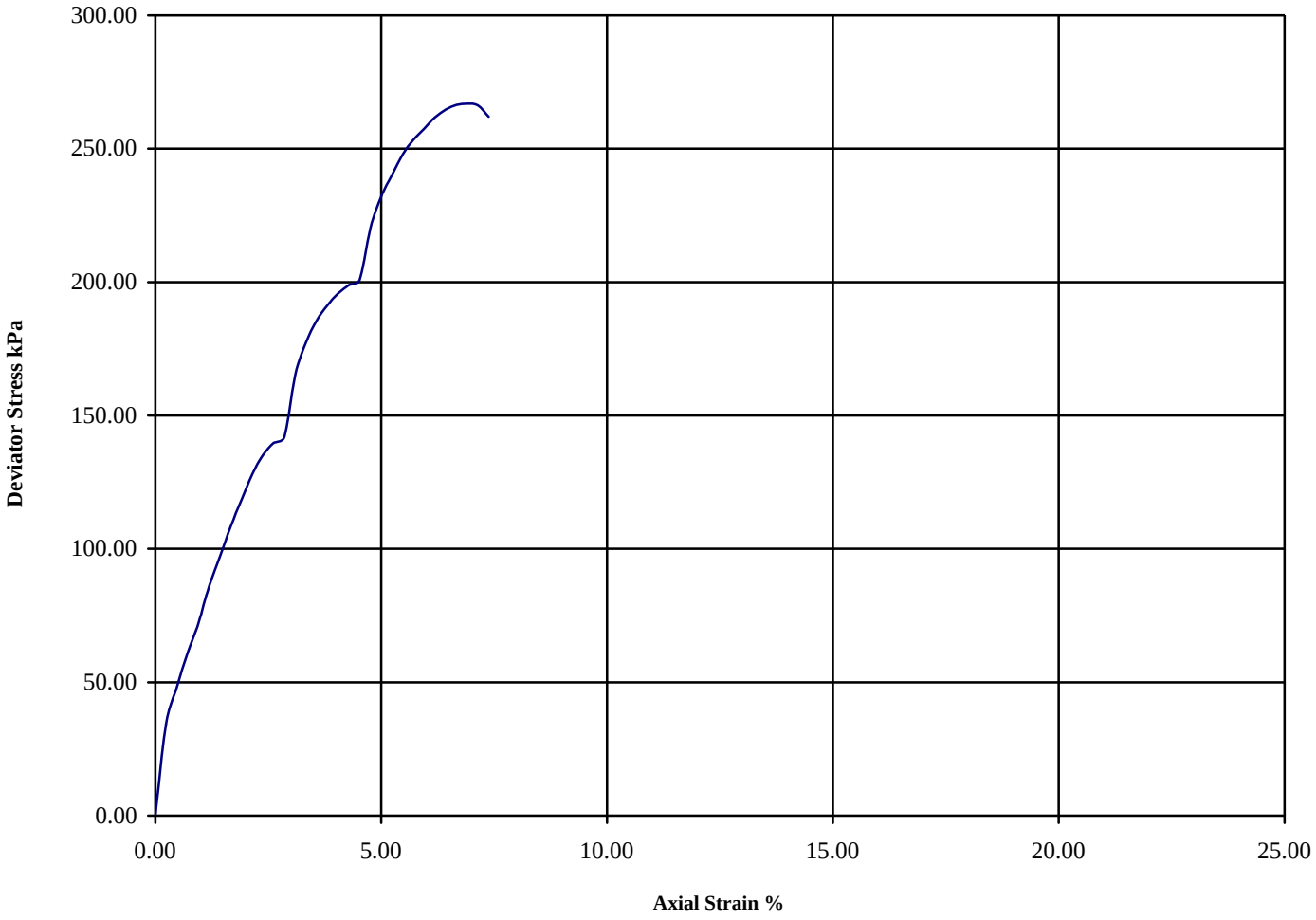
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 9 : 1990

Hole Number: BH19 **Depth (m):** 18.00-18.45

Sample Number: **Sample Type:** U



Diameter (mm):		90	Height (mm):		210	Test:	100mm Multistage		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
									Sample taken from top of tube
									Rate of strain = 1.9 %/min
									Latex Membrane used 0.2 mm thickness
									Membrane Correction applied (kPa)
A	30	1.91	1.47	187	142	71	2.9	Brittle	0.42 0.41 0.41
				374	201	100	4.5		See summary of soil descriptions.
				740	267	133	6.9		

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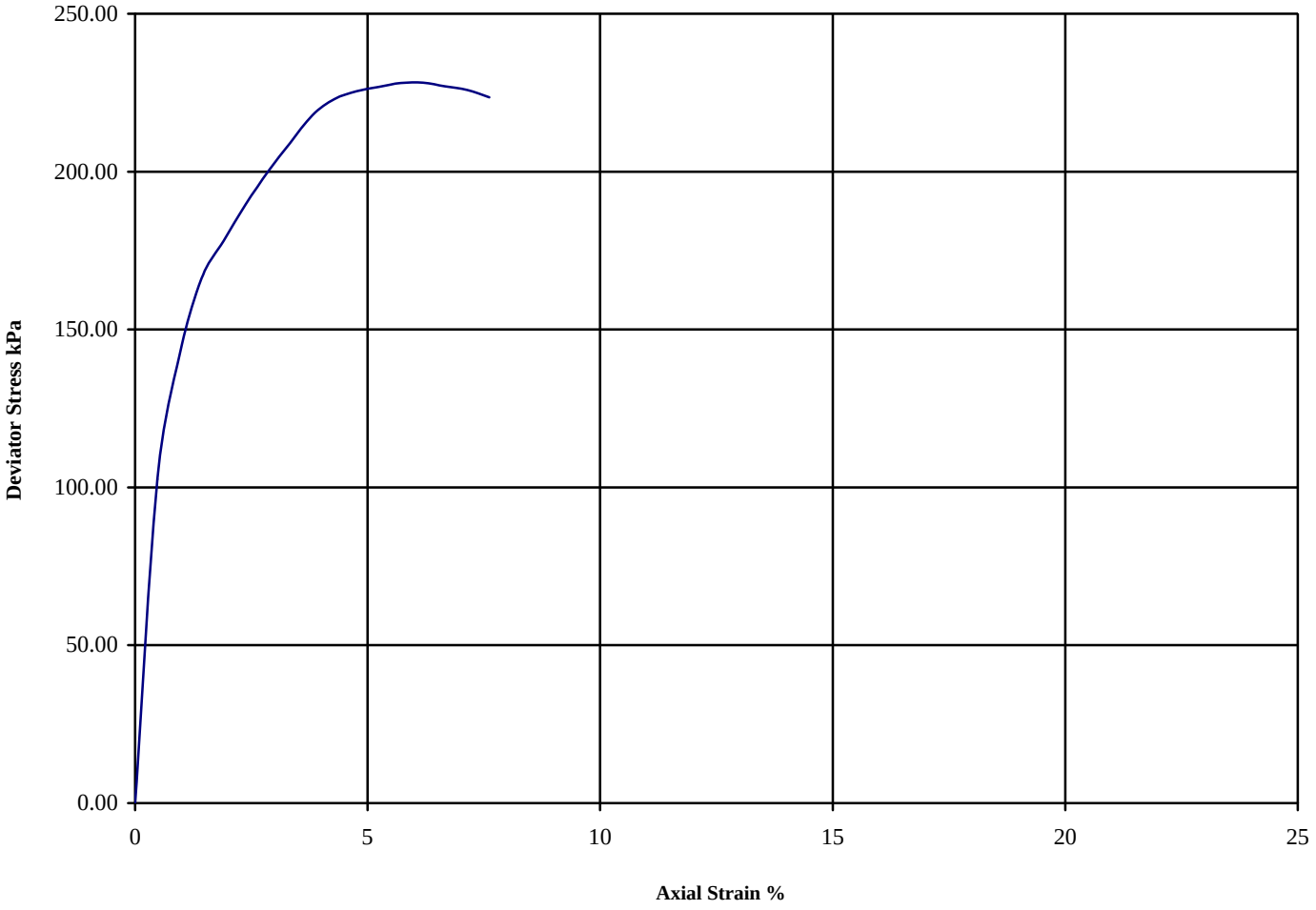
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: BH19 **Depth (m):** 22.55-23.00

Sample Number: **Sample Type:** U



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.66	1.28	469	228	114	6.2	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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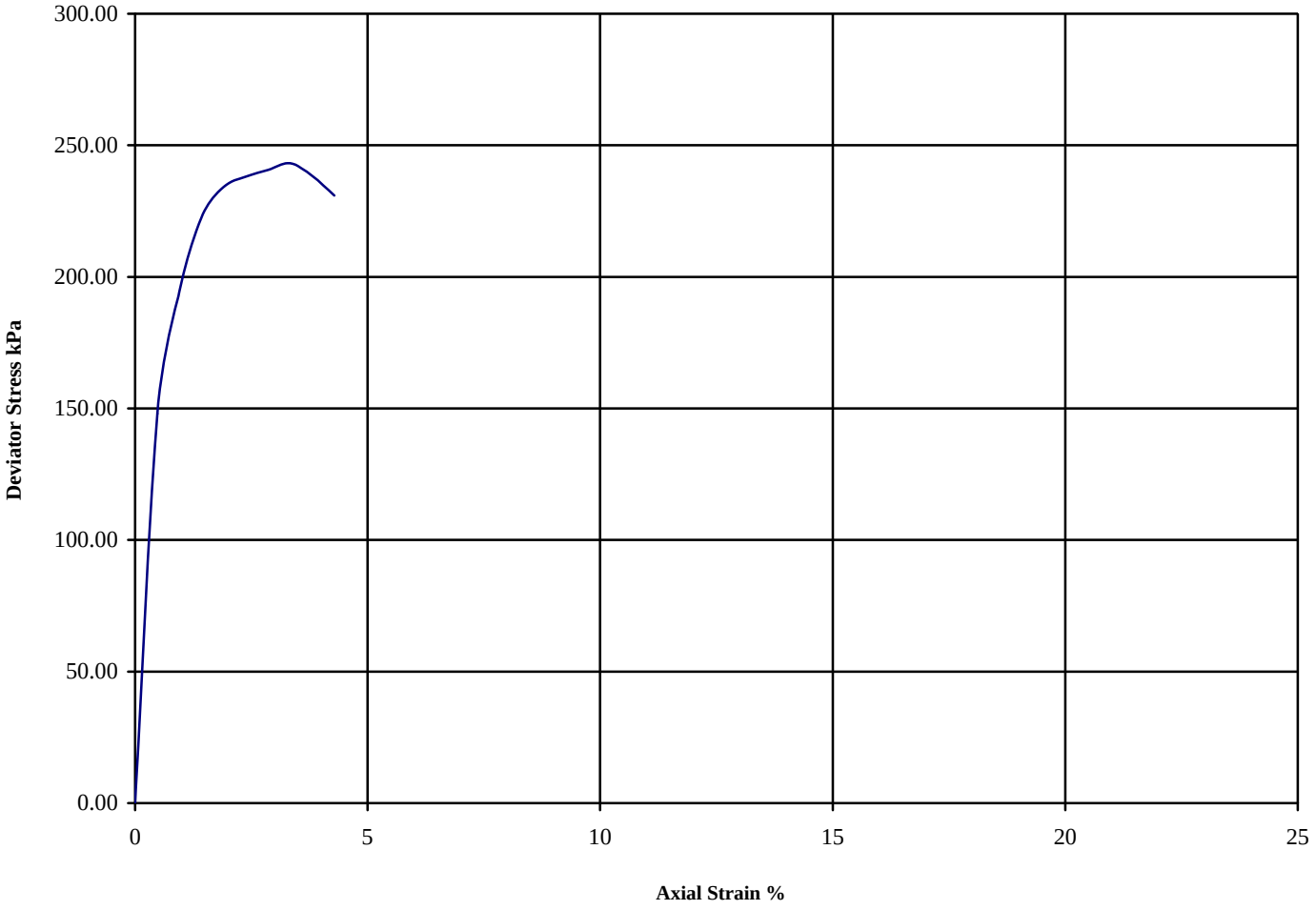
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH19** **Depth (m):** **28.95-29.40**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.92	1.48	606	243	122	3.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.42 kPa See summary of soil descriptions.

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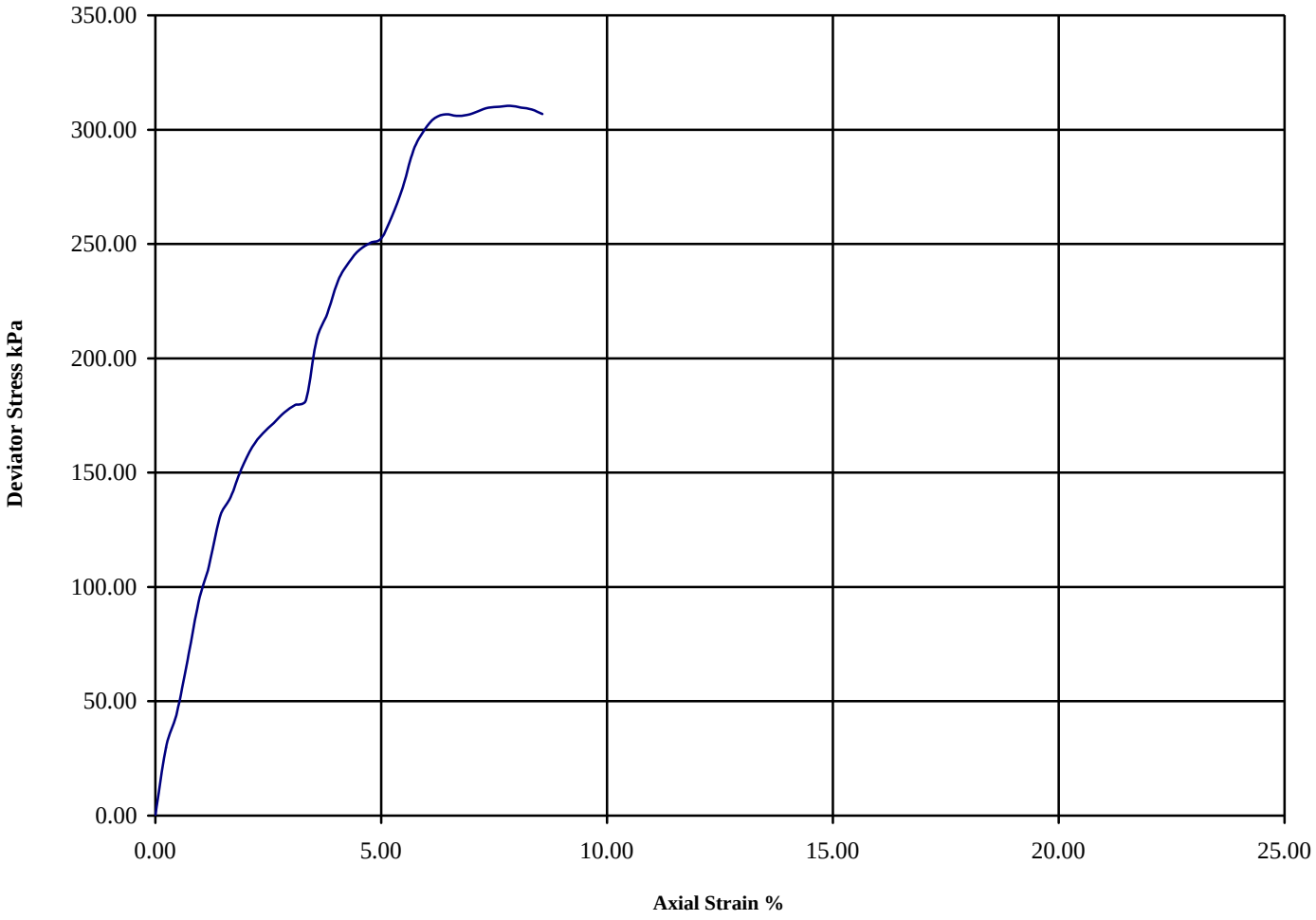
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 9 : 1990

Hole Number: **BH10** **Depth (m):** **24.45-24.90**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90	Height (mm):		210	Test:	100mm Multistage		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.93	1.50	272	182	91	3.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness Membrane Correction applied (kPa) 0.42 0.41 0.41
				543	252	126	5.0		See summary of soil descriptions.
				1086	310	155	7.9		

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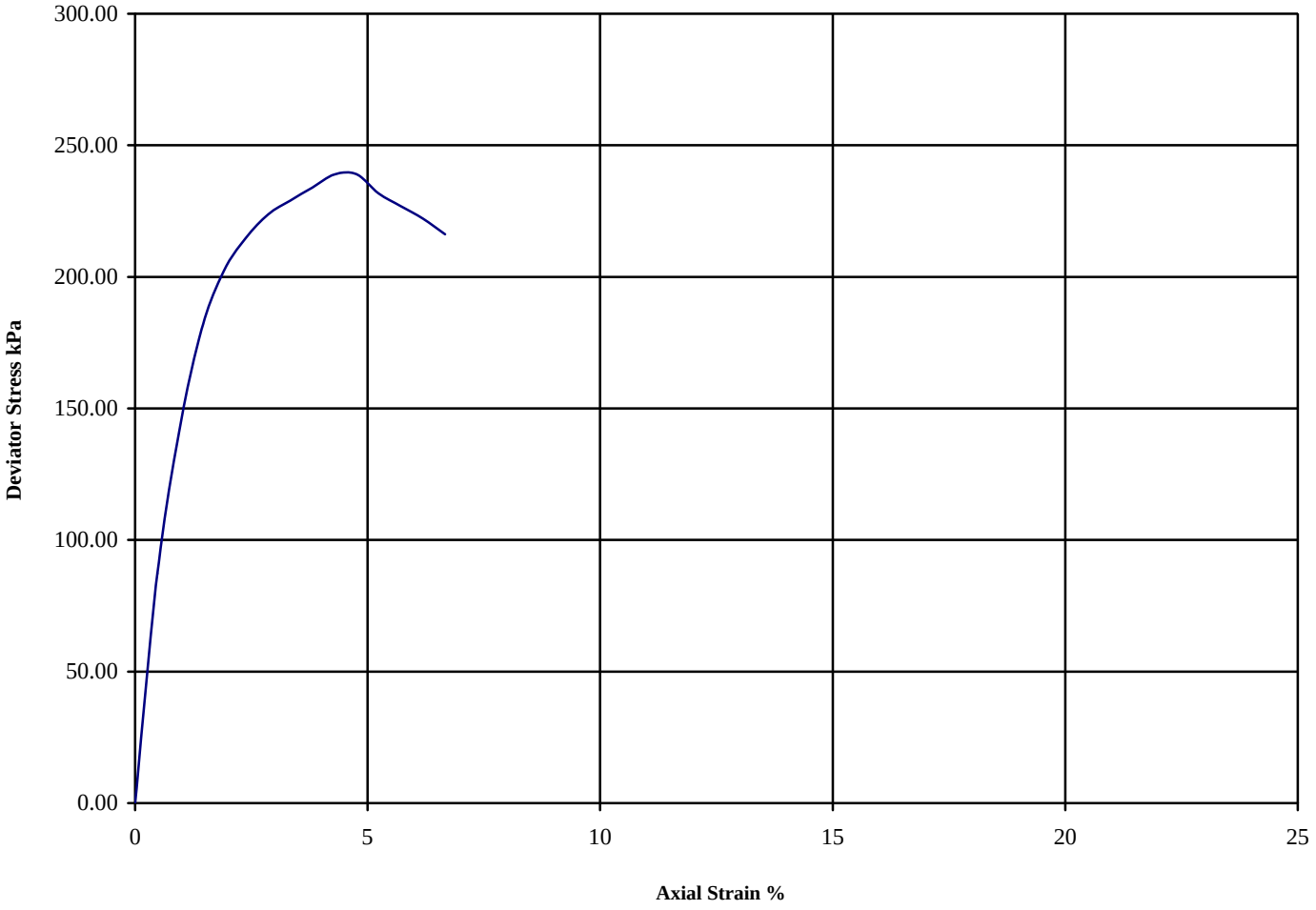
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH10** **Depth (m):** **30.80-31.25**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	30	1.89	1.46	682	239	119	4.8	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

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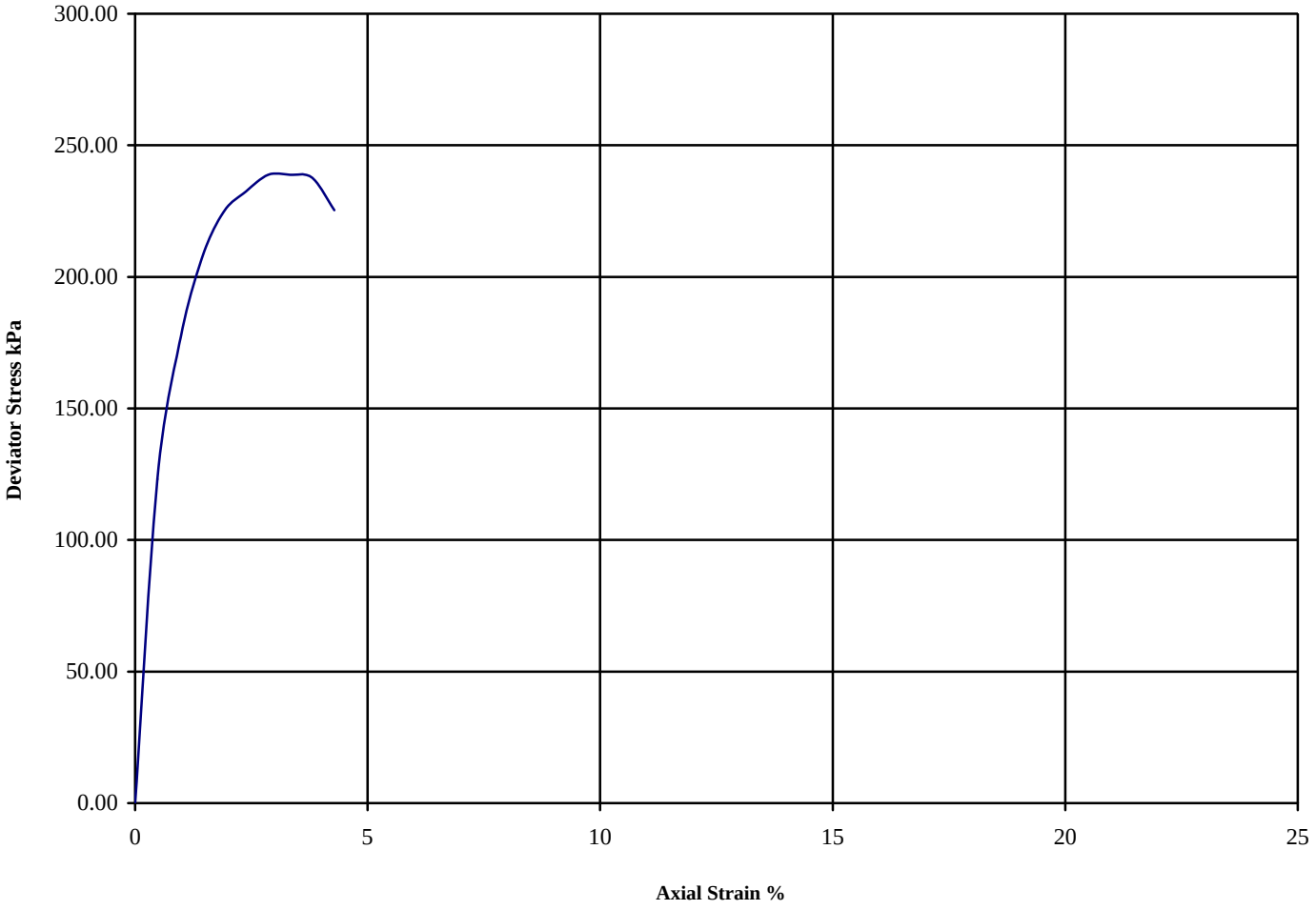
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH14** **Depth (m):** **46.65-47.10**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	24	1.40	1.13	998	239	119	3.3	Brittle	Sample taken from top of tube Rate of strain = 1.9 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.42 kPa See summary of soil descriptions.

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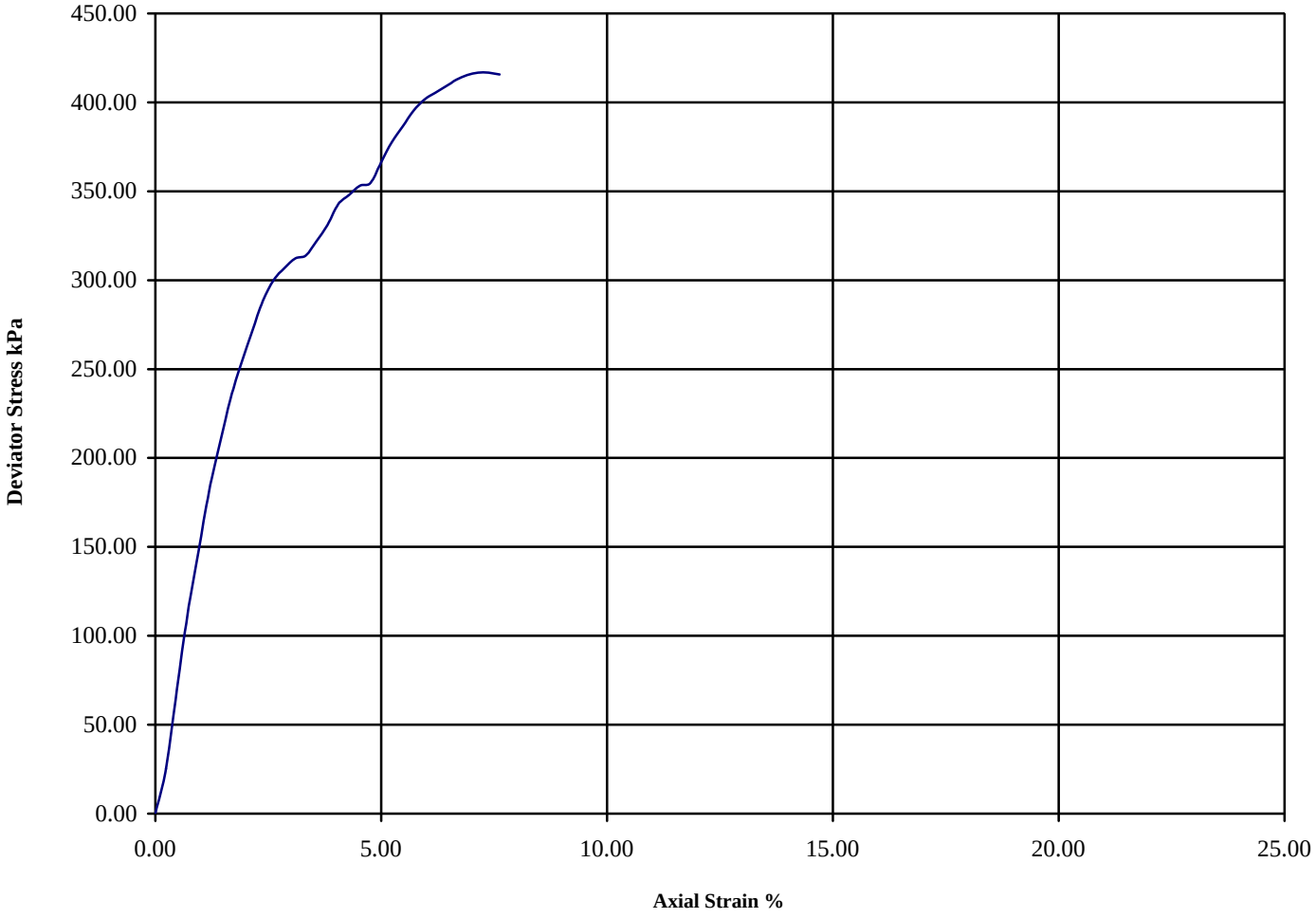
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 9 : 1990

Hole Number: **BH18A** **Depth (m):** **30.85-31.30**

Sample Number: **Sample Type:** **U**



Diameter (mm):		90	Height (mm):		210	Test:	100mm Multistage		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
									Sample taken from top of tube
									Rate of strain = 1.9 %/min
									Latex Membrane used 0.2 mm thickness
									Membrane Correction applied (kPa)
A	27	2.02	1.59	326	314	157	3.3	Brittle	0.42 0.41 0.41
				652	355	177	4.8		See summary of soil descriptions.
				1304	417	208	7.4		**Checked** **Date** **Approved** **Date**
									25/09/14 25/09/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No: PSL14/4378**

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-15062

15-Sep-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-15062
Client Reference	PSL14/4378
Contract Title	Rivenhall Airfield IWMF
Description	10 Soil samples.
Date Received	09-Sep-14
Date Started	09-Sep-14
Date Completed	15-Sep-14
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-15062
Client Ref PSL14/4378
Contract Title Rivenhall Airfield IWMF

			Lab No	696868	696869	696870	696871	696872	696873	696874	696875	696876	696877
			Sample ID	BH2	BH04	BH7	BH8	BH10	BH17	BH17	BH19	BH17	BH20
			Depth	11.25-11.35	9.50	21.60-21.70	20.90-21.00	28.55-28.65	24.20-24.30	32.45-32.55	18.75-18.85	42.60-43.00	3.25
			Other ID										
			Sample Type	D	D	D	D	D	D	D	D	C	D
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**										
Metals													
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	13	12	16	12	16	18	11	16	19	< 10
Inorganics													
pH	DETSC 2008#			8.4	8.5	8.7	8.6	8.7	8.5	8.9	8.3	9.0	8.5
Chloride Aqueous Extract	DETSC 2055	1	mg/l	14	22	28	26	30	32	46	27	57	12
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	2.9	1.9	3.5	2.0	2.3	2.5	2.6	2.3	< 1.0	1.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	460	380	420	430	530	550	440	510	800	92
Total Sulphur as S	DETSC 2320	0.01	%	0.31	0.24	0.34	0.29	0.39	0.48	0.31	0.56	0.60	0.04
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.13	0.11	0.12	0.09	0.14	0.14	0.12	0.17	0.14	0.08

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-15062
Client Ref PSL14/4378
Contract Rivenhall Airfield IWMF

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
696868	BH2 11.25-11.35 SOIL		PT 1L	Sample date not supplied	
696869	BH04 9.50 SOIL		PT 1L	Sample date not supplied	
696870	BH7 21.60-21.70 SOIL		PT 1L	Sample date not supplied	
696871	BH8 20.90-21.00 SOIL		PT 1L	Sample date not supplied	
696872	BH10 28.55-28.65 SOIL		PT 1L	Sample date not supplied	
696873	BH17 24.20-24.30 SOIL		PT 1L	Sample date not supplied	
696874	BH17 32.45-32.55 SOIL		PT 1L	Sample date not supplied	
696875	BH19 18.75-18.85 SOIL		PT 1L	Sample date not supplied	
696876	BH17 42.60-43.00 SOIL		PT 1L	Sample date not supplied	
696877	BH20 3.25 SOIL		PT 1L	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-15134

16-Sep-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-15134
Client Reference	PSL14/4378
Contract Title	Rivenhall Airfield IWMF
Description	One Soil sample.
Date Received	09-Sep-14
Date Started	09-Sep-14
Date Completed	16-Sep-14
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-15134
Client Ref PSL14/4378
Contract Title Rivenhall Airfield IWMF

Lab No	697155
Sample ID	BH15
Depth	26.95
Other ID	
Sample Type	SOIL
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	18
Inorganics				
pH	DETSC 2008#			8.3
Chloride Aqueous Extract	DETSC 2055	1	mg/l	38
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.6
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	670
Total Sulphur as S	DETSC 2320	0.01	%	1.4
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.17

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-15134
Client Ref PSL14/4378
Contract Rivenhall Airfield IWMF

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
697155	BH15 26.95 SOIL		PT 1L	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number 14-19382

04-Nov-14

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference	14-19382
Client Reference	(not supplied)
Contract Title	PSL14/5487
Description	One Soil sample.
Date Received	29-Oct-14
Date Started	29-Oct-14
Date Completed	04-Nov-14
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the scope of UKAS accreditation. 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Rob Brown
Business Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 14-19382
Client Ref
Contract Title PSL14/5487

Lab No	721299
Sample ID	BH20
Depth	20.60-20.90
Other ID	
Sample Type	SOIL
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units	
Metals				
Magnesium Aqueous Extract	DETSC 2076*	10	mg/l	< 10
Inorganics				
pH	DETSC 2008#			8.3
Chloride Aqueous Extract	DETSC 2055	1	mg/l	29
Nitrate Aqueous Extract as NO3	DETSC 2055	1	mg/l	1.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	140
Total Sulphur as S	DETSC 2320	0.01	%	0.20
Total Sulphate as SO4	DETSC 2321#	0.01	%	0.09

Key: * -not accredited. # -MCERTS (accreditation only implied if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 14-19382
Client Ref
Contract PSL14/5487

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
721299	BH20 20.60-20.90 SOIL		PT 500ml	Sample date not supplied	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/5487

Client's Reference: C4237 Report Date: 29 October 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester
GL3 1DL

For the attention of: Chris Scrivens

Contract Title: Rivenhall Airfield IWMF

Date Received: 27/10/2014
Date Commenced: 27/10/2014
Date Completed: 29/10/2014

Notes: Observations and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

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

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

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH20		D	19.00-19.30	Brown CLAY.
BH20		U	20.60-20.90	Stiff brown CLAY.
BH20		D	23.50	Brown CLAY.
BH20		U	26.45-26.75	Very stiff brown CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	29/10/14		29/10/14		29/10/14

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/5487

Client Ref: C4237

SUMMARY OF SOIL CLASSIFICATION TESTS

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

Hole Number	Sample Number	Sample Type	Depth m	Moisture Content % Clause 3.2	Bulk Density Mg/m^3 Clause 7.2	Dry Density Mg/m^3 Clause 7.2	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4.4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	% Passing .425mm	Remarks
BH20		D	19.00-19.30	29				86	32	54	100	Very high plasticity CV.
BH20		D	23.50	36				84	32	52	100	Very high plasticity CV.

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

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	29/10/14		29/10/14		29/10/14

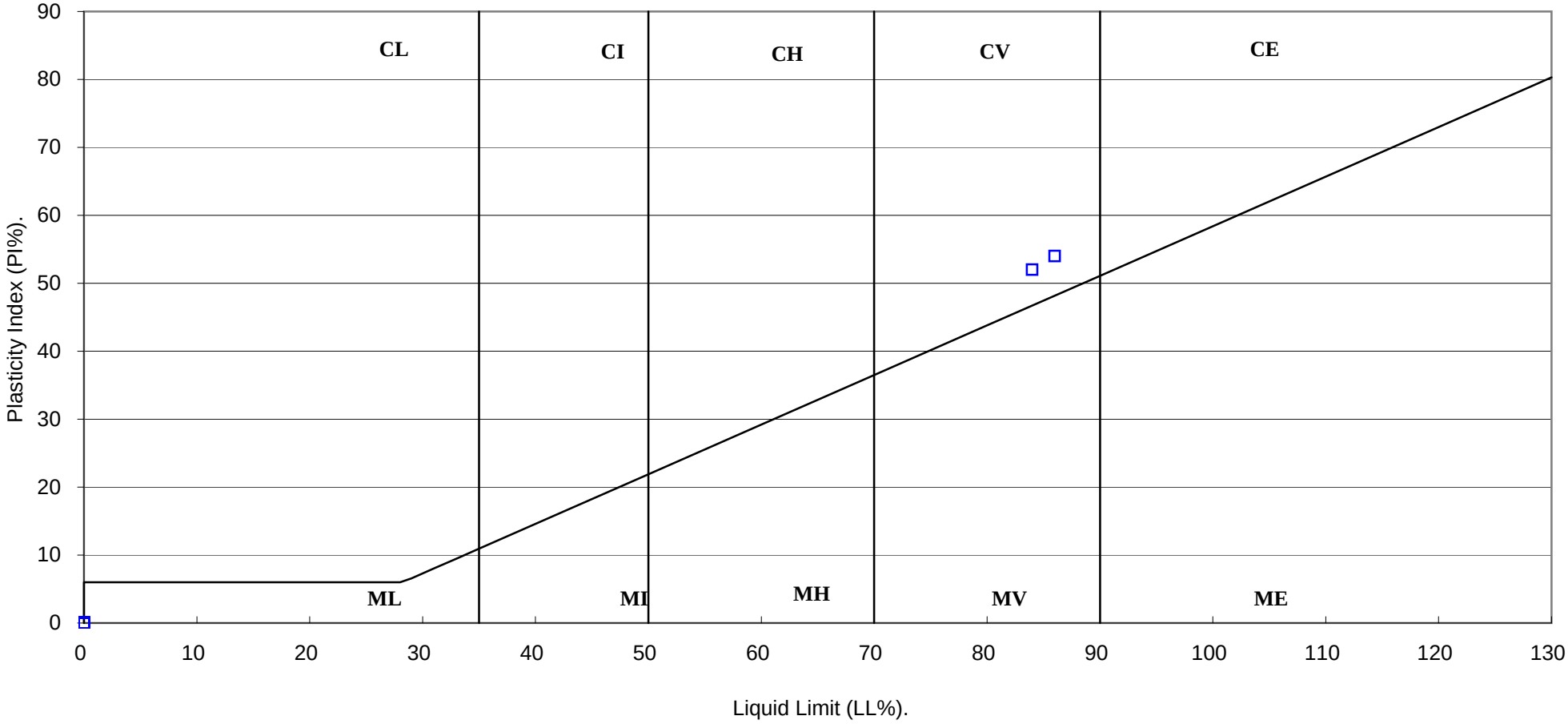
RIVENHALL AIRFIELD IWMF.

Contract No: **PSL14/5487**

Client Ref: **C4237**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(B.S.5930 : 1999)



PSL Professional Soils Laboratory	Compiled by	Date	Checked by	Date	Approved by	Date
		29/10/14		29/10/14		29/10/14
	RIVENHALL AIRFIELD IWMF.				Contract No:	PSL14/5487
					Client Ref:	C4237

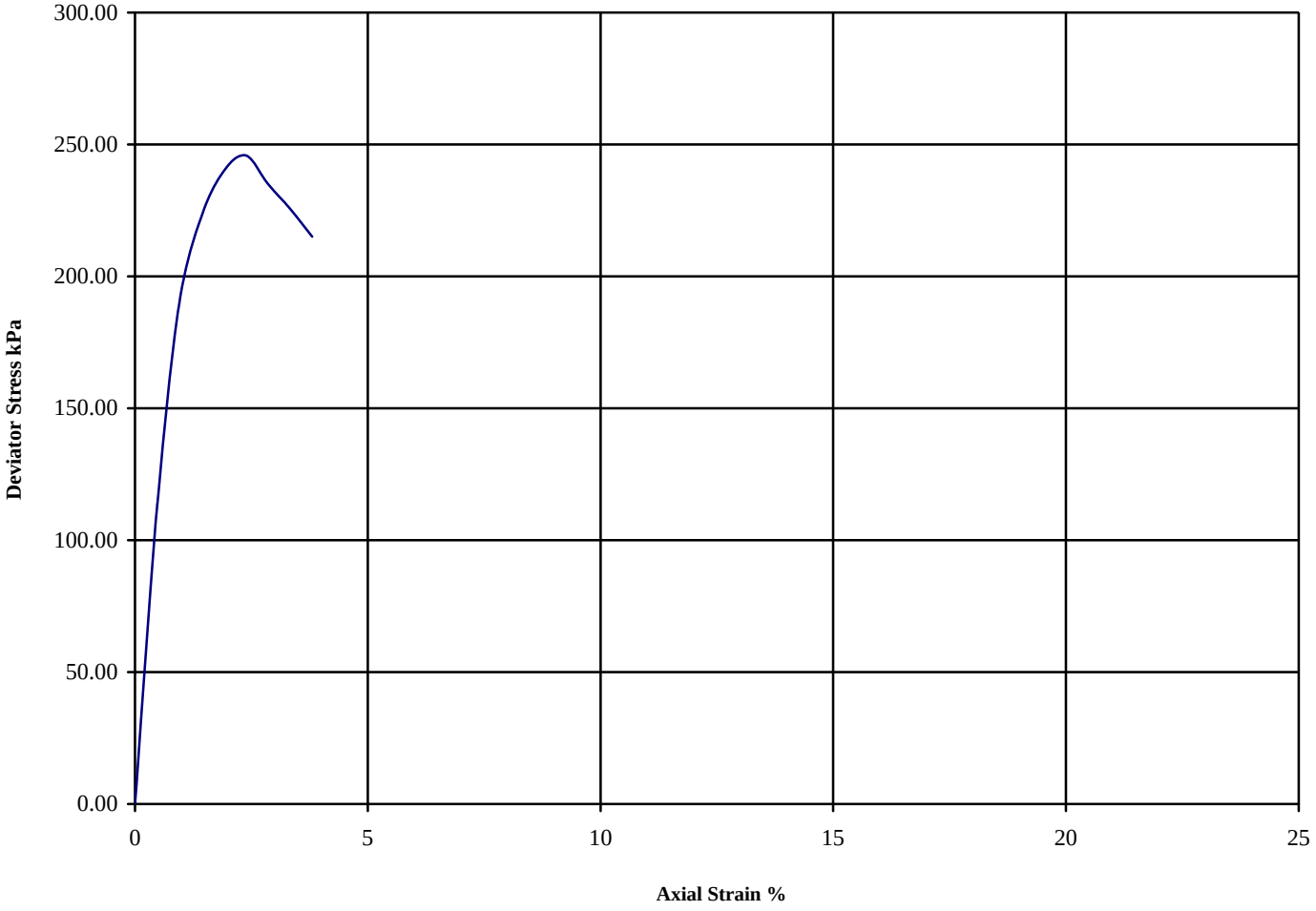
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH20** **Depth (m):** **20.60-20.90**

Sample Number: **Sample Type:** **U**



Diameter (mm):		92.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.95	1.51	409	246	123	2.4	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.41 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	29/10/14		29/10/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/5487

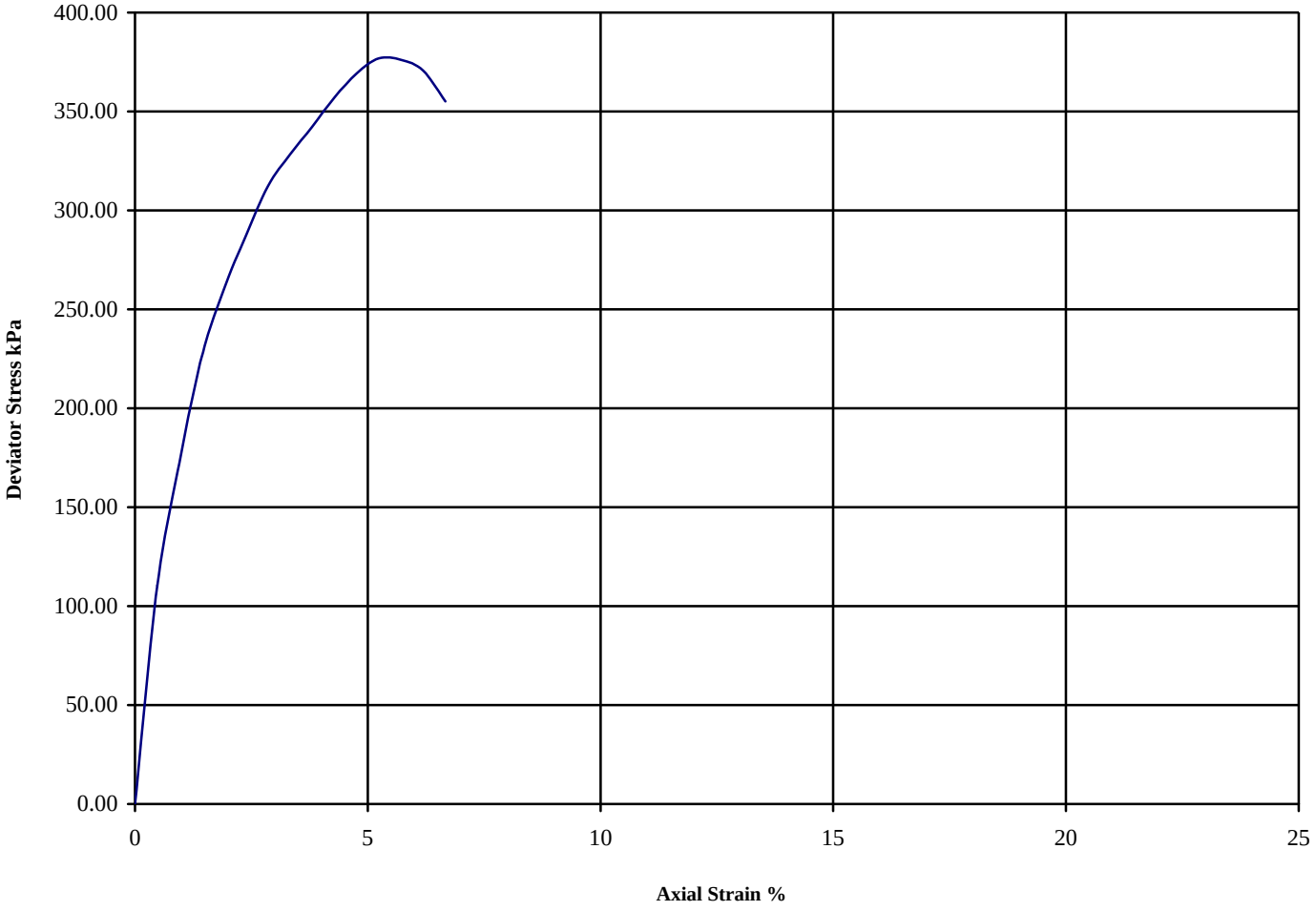
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Number: **BH20** **Depth (m):** **26.45-26.75**

Sample Number: **Sample Type:** **U**



Diameter (mm):		92.0	Height (mm):		210.0	Test:	100 mm Single Stage. Undisturbed		
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa) θ_3	Corr. Max. Deviator Stress (kPa) $(\theta_1-\theta_3)_f$	Shear Strength Cu (kPa) $^1/_2(\theta_1-\theta_3)_f$	Failure Strain (%)	Mode of Failure	Remarks
A	29	1.91	1.48	552	377	188	5.2	Brittle	Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thickness, Correction applied 0.40 kPa See summary of soil descriptions.

Checked	Date	Approved	Date
	29/10/14		29/10/14

PSL Professional Soils Laboratory

RIVENHALL AIRFIELD IWMF.

Contract No: PSL14/5487

PSL
Professional Soils Laboratory

LABORATORY REPORT

UKAS TESTING
4043

Contract Number: PSL14/5669

Client's Reference: Report Date: 04 December 2014

Client Name: CC Ground Investigations Ltd
Unit A2 Innsworth Technology Park.
Innsworth Lane
Gloucester

GL3 1DL

For the attention of: Steve Smith

Contract Title: Rivenhall Airfield IWMF

Date Received: 03/11/2014
Date Commenced: 03/11/2014
Date Completed: 04/12/2014

Notes: Observations and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

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

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

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Depth m	Description of Sample
BH3		U	5.20-5.55	Brown CLAY.
BH3		U	10.20-10.65	Brown CLAY.
BH5		U	11.00-11.40	Brown CLAY.
BH5		U	17.00-17.30	Brown mottled grey CLAY.
BH6		U	8.20-8.65	Brown mottled grey CLAY.
BH6		U	14.20-14.60	Brown mottled grey CLAY.
BH9		U	7.20-7.60	Brown CLAY.
BH9		U	11.20-11.60	Brown CLAY.
BH11		U	30.30-30.75	Grey CLAY.
BH12		U	19.10-19.43	Grey mottled brown CLAY.
BH12		U	28.65-28.95	Grey mottled brown CLAY.
BH13		U	13.40-13.85	Greyish brown CLAY.
BH13		U	21.05-21.50	Brown CLAY.
BH16		U	15.35-15.80	Grey mottled brown CLAY.
BH16		U	24.05-24.50	Brown CLAY.
BH16		U	30.00-30.45	Brown CLAY.

PSL
Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	25/11/14		04/12/14		04/12/14

RIVENHALL AIRFIELD IWMF.

Contract No:	PSL14/5669
Client Ref:	C4237

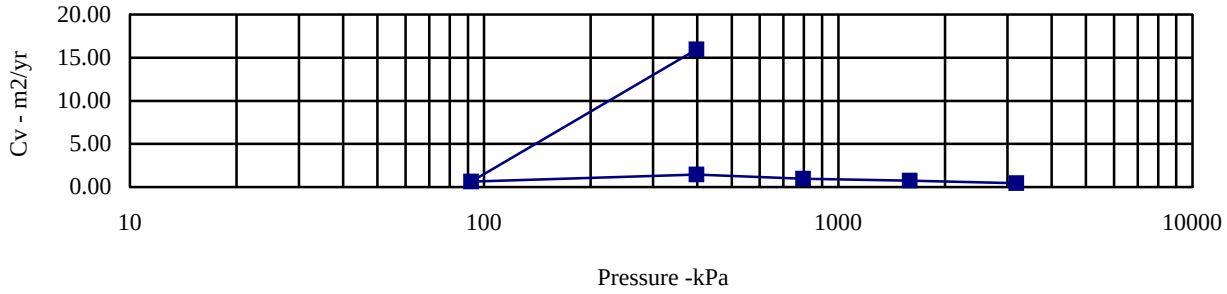
One Dimensional Consolidation Properties

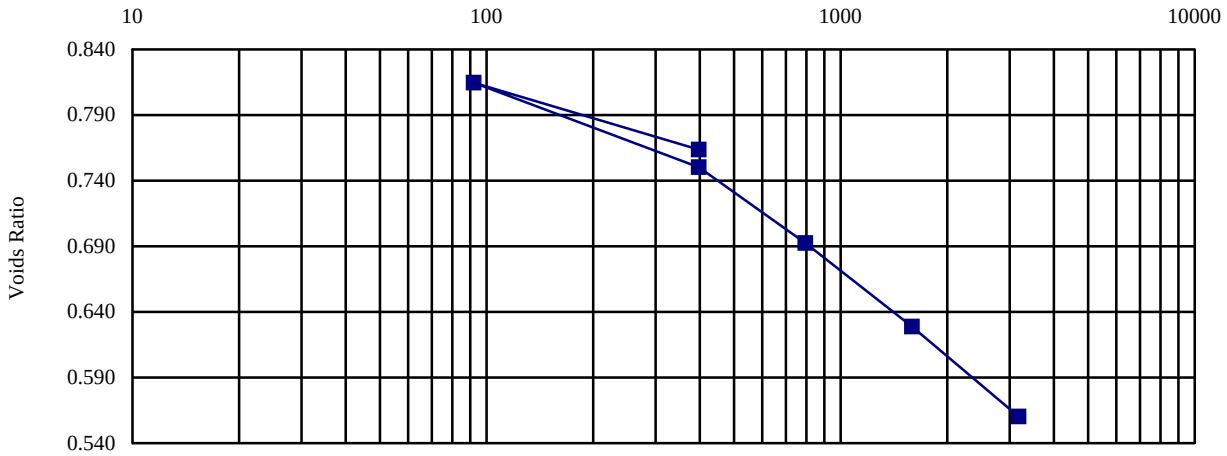
BS 1377: Part 5: 1990

Hole Number: **BH3** **Depth (m):** **5.20-5.55**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.83	0	-	398	0.102	15.949	Method used to	
Dry Density (Mg/m3):	1.44	398	-	92	0.095	0.617	determine CV:	t90
Voids Ratio:	0.838	92	-	398	0.116	1.455	Nominal temperature	
Degree of saturation:	86.2	398	-	796	0.083	0.967	during test ' C:	20
Height (mm):	20.1	796	-	1592	0.047	0.724	Remarks:	
Diameter (mm)	75.21	1592	-	3184	0.026	0.447	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





Checked by	Date	Approved by	Date
	04/12/14		04/12/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No. PSL14/5669** Page of

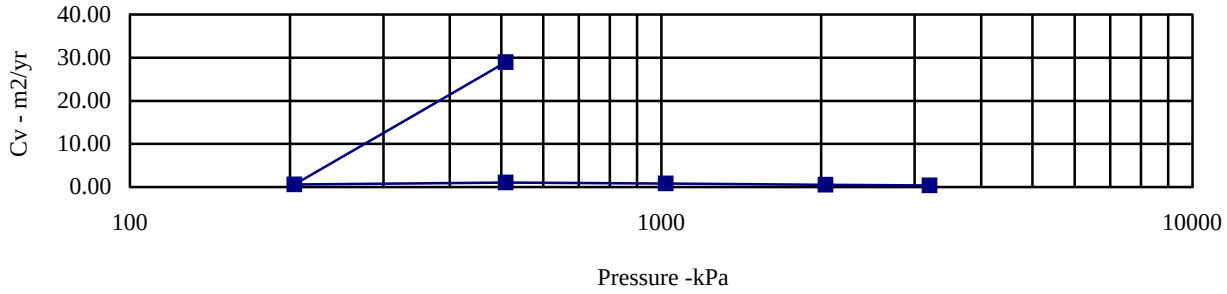
One Dimensional Consolidation Properties

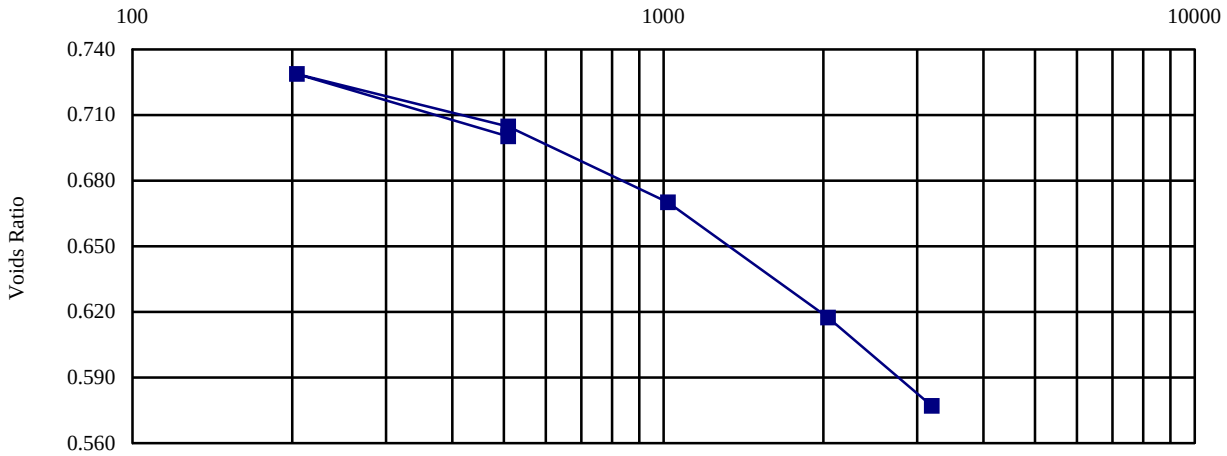
BS 1377: Part 5: 1990

Hole Number: **BH3** **Depth (m):** **10.20-10.65**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	1.92	0	-	510	0.048	28.948	Method used to	
Dry Density (Mg/m3):	1.52	510	-	204	0.055	0.573	determine CV:	t90
Voids Ratio:	0.743	204	-	510	0.046	1.046	Nominal temperature	
Degree of saturation:	93.9	510	-	1020	0.040	0.784	during test ' C:	20
Height (mm):	20.02	1020	-	2040	0.031	0.511	Remarks:	
Diameter (mm)	75.2	2040	-	3200	0.022	0.396	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





Checked by	Date	Approved by	Date
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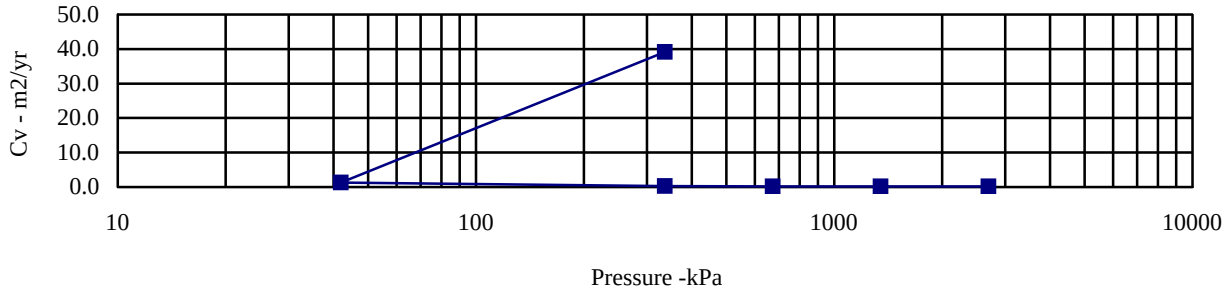
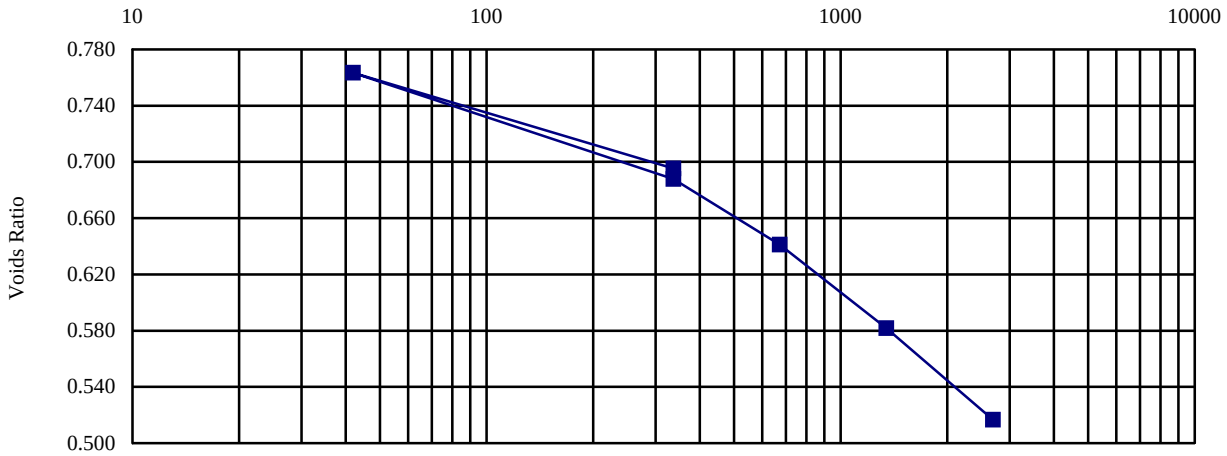
Hole Number: **BH5** **Depth (m):** **11.00-11.40**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.92	0	-	337	0.091	39.148	Method used to	
Dry Density (Mg/m3):	1.52	337	-	42	0.136	1.316	determine CV:	t90
Voids Ratio:	0.749	42	-	337	0.145	0.255	Nominal temperature	
Degree of saturation:	94.7	337	-	674	0.082	0.212	during test ' C:	20
Height (mm):	20	674	-	1348	0.054	0.193	Remarks:	
Diameter (mm)	75.11	1348	-	2696	0.031	0.206	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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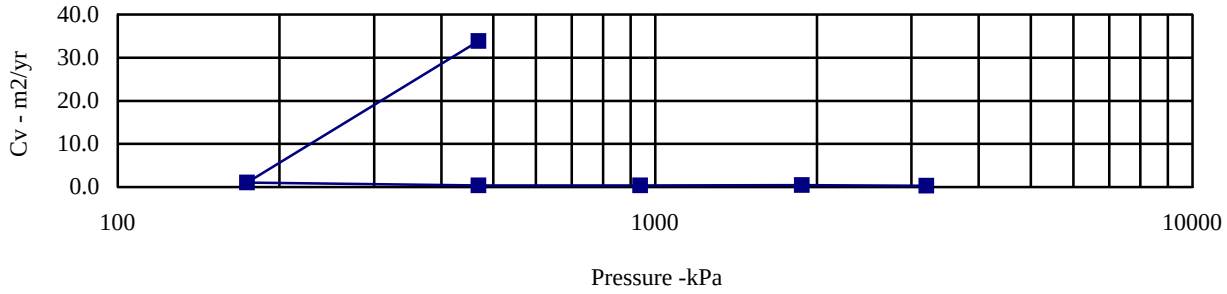
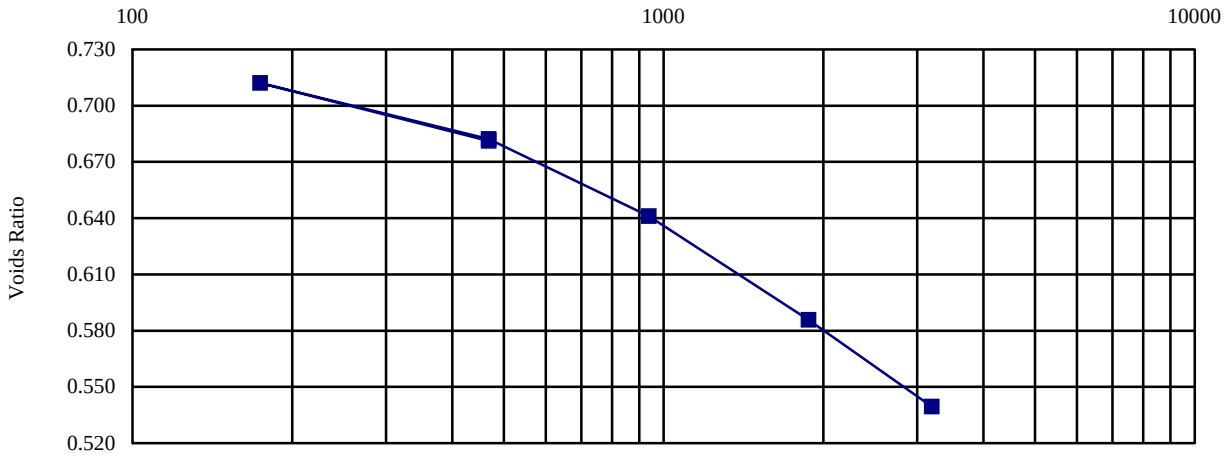
Hole Number: **BH5** **Depth (m):** **17.00-17.30**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.97	0	-	469	0.046	33.853	Method used to	
Dry Density (Mg/m3):	1.54	469	-	174	0.062	1.016	determine CV:	t90
Voids Ratio:	0.718	174	-	469	0.059	0.386	Nominal temperature	
Degree of saturation:	102.6	469	-	938	0.052	0.347	during test ' C:	20
Height (mm):	19.97	938	-	1876	0.036	0.474	Remarks:	
Diameter (mm)	75.16	1876	-	3200	0.022	0.299	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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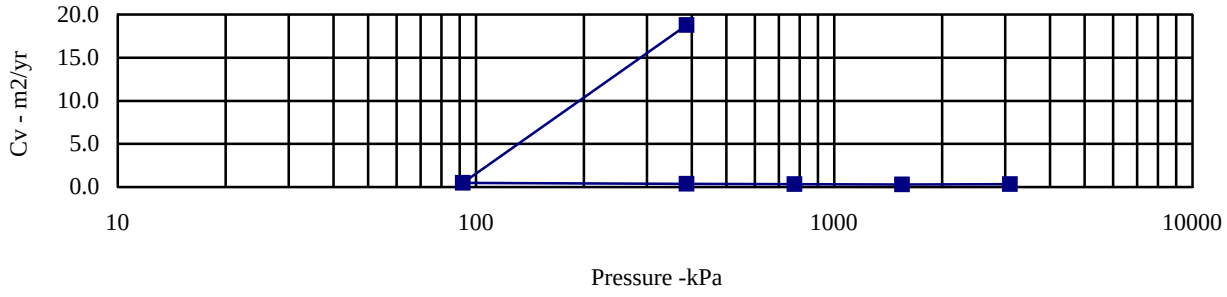
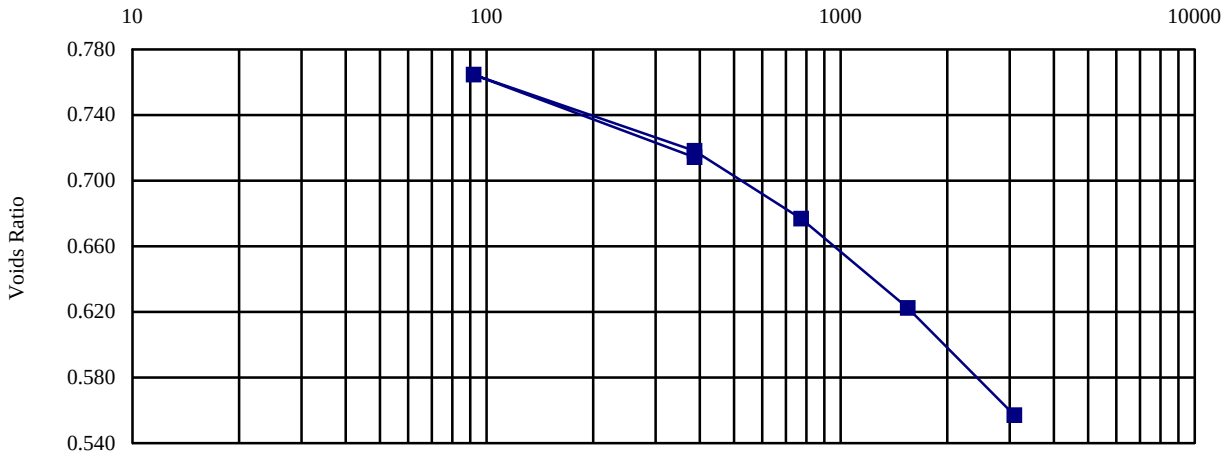
Hole Number: **BH6** **Depth (m):** **8.20-8.65**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	1.91	0	-	387	0.049	18.776	Method used to	
Dry Density (Mg/m3):	1.52	387	-	92	0.099	0.483	determine CV:	t90
Voids Ratio:	0.747	92	-	387	0.089	0.375	Nominal temperature	
Degree of saturation:	91.3	387	-	774	0.062	0.342	during test ' C:	20
Height (mm):	19.91	774	-	1548	0.042	0.281	Remarks:	
Diameter (mm)	75.22	1548	-	3096	0.026	0.349	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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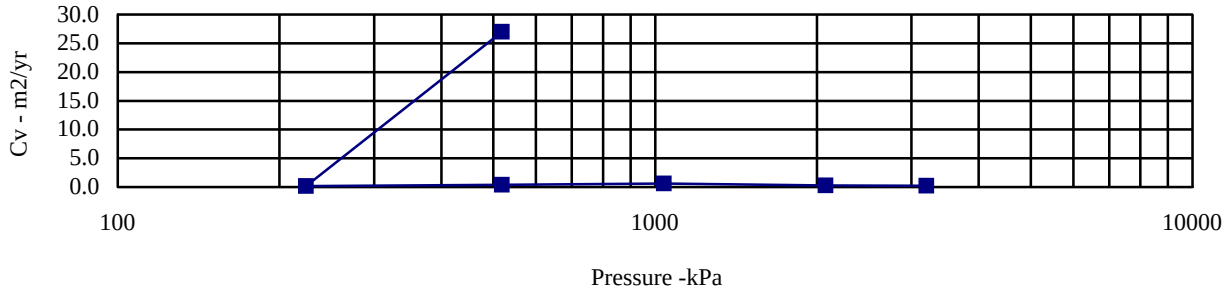
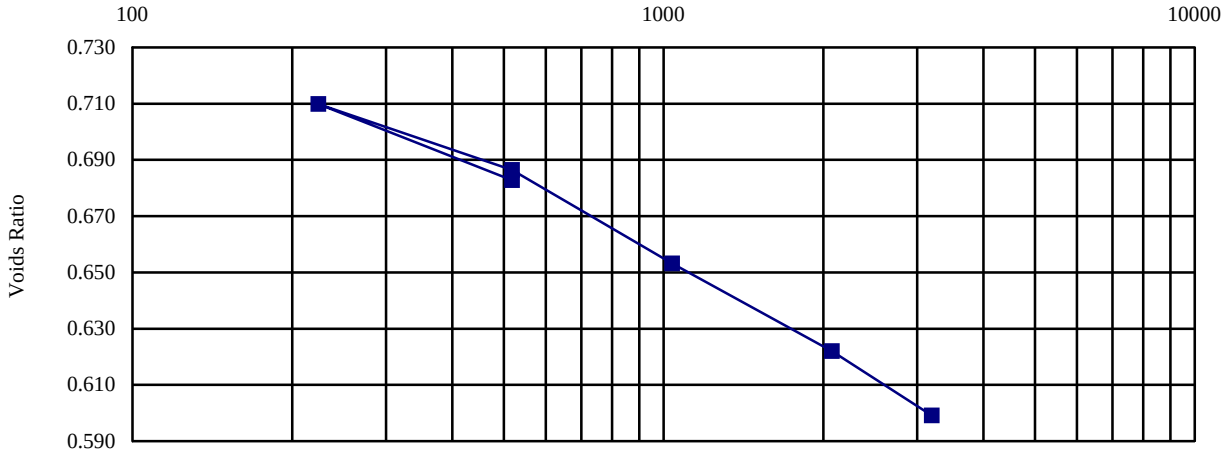
Hole Number: **BH6** **Depth (m):** **14.20-14.60**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.97	0	-	519	0.028	26.992	Method used to	
Dry Density (Mg/m3):	1.55	519	-	224	0.055	0.173	determine CV:	t90
Voids Ratio:	0.708	224	-	519	0.047	0.364	Nominal temperature	
Degree of saturation:	100.0	519	-	1038	0.038	0.622	during test ' C:	20
Height (mm):	19.87	1038	-	2076	0.018	0.272	Remarks:	
Diameter (mm)	75.1	2076	-	3200	0.013	0.208	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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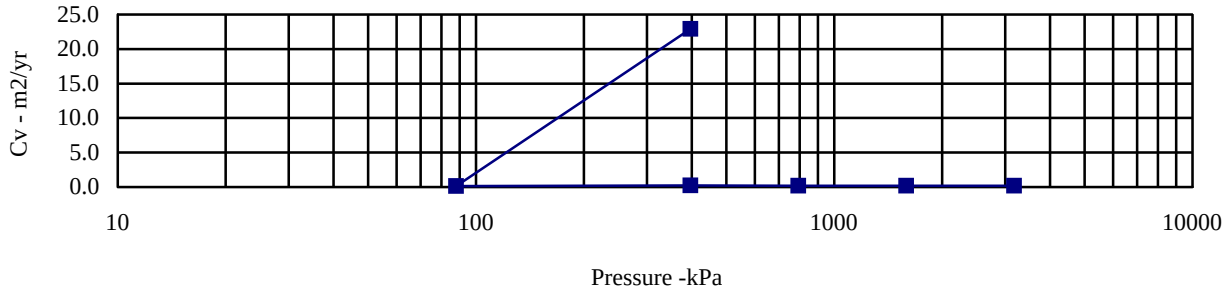
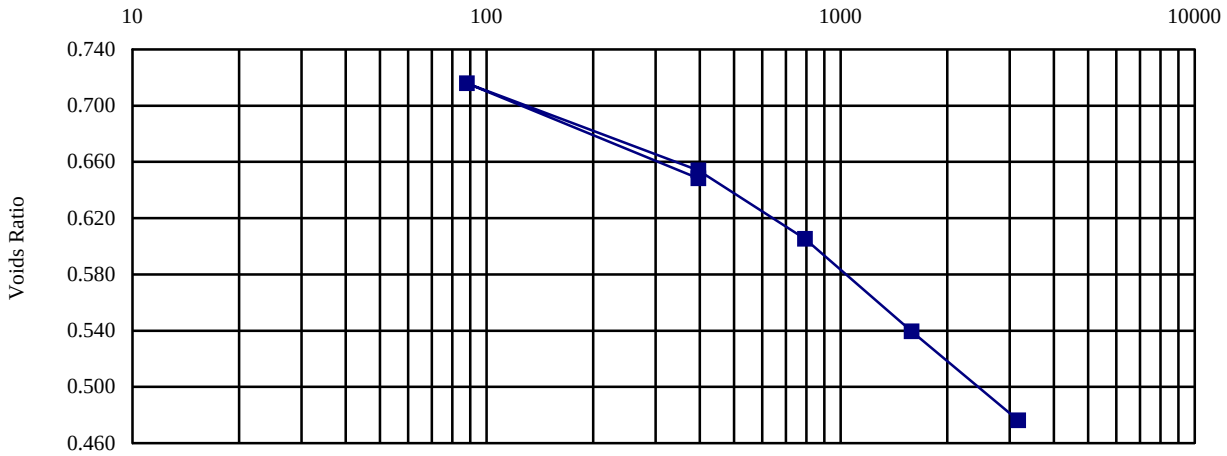
Hole Number: **BH9** **Depth (m):** **7.20-7.60**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	1.99	0	-	397	0.052	22.922	Method used to	
Dry Density (Mg/m3):	1.57	397	-	88	0.133	0.145	determine CV:	t90
Voids Ratio:	0.683	88	-	397	0.117	0.225	Nominal temperature	
Degree of saturation:	101.6	397	-	794	0.074	0.195	during test ' C:	20
Height (mm):	20.02	794	-	1588	0.052	0.188	Remarks:	
Diameter (mm)	75.23	1588	-	3176	0.026	0.170	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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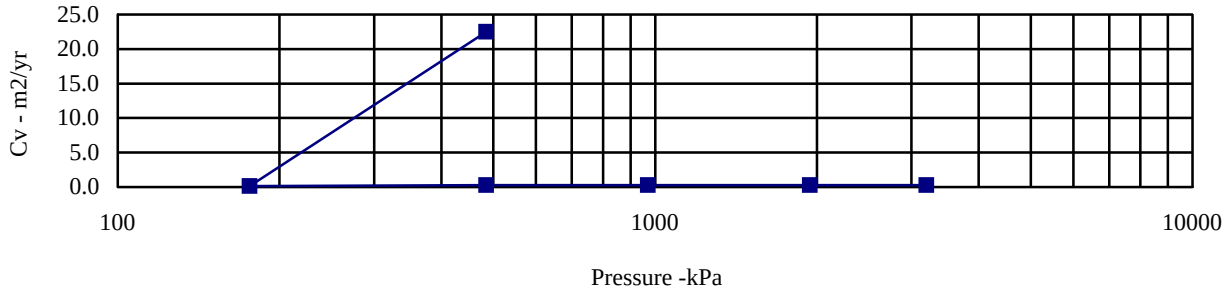
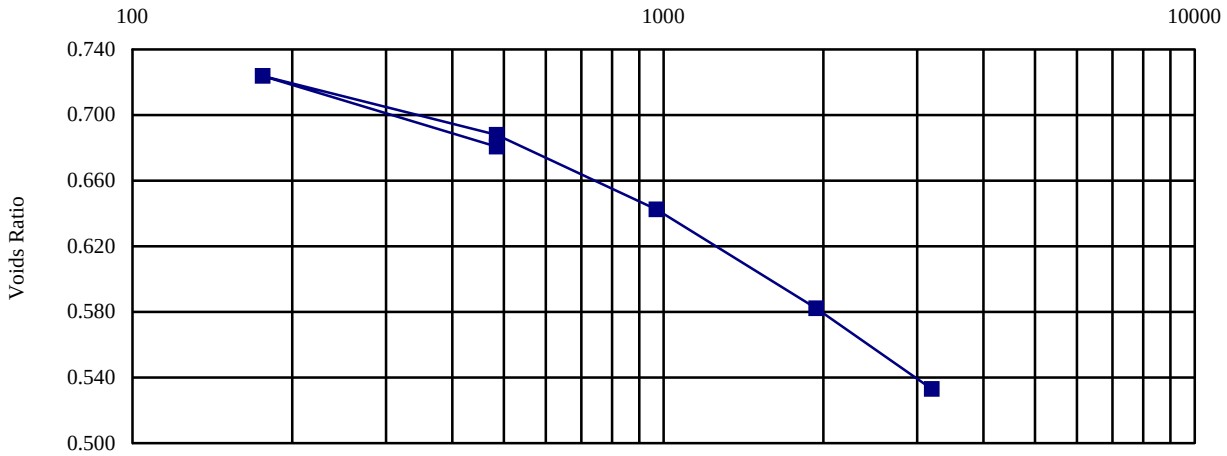
Hole Number: **BH9** **Depth (m):** **11.20-11.60**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	27							
Bulk Density (Mg/m3):	1.95	0	-	485	0.051	22.509	Method used to	
Dry Density (Mg/m3):	1.54	485	-	176	0.083	0.132	determine CV:	t90
Voids Ratio:	0.723	176	-	485	0.067	0.276	Nominal temperature	
Degree of saturation:	98.5	485	-	970	0.056	0.256	during test ' C:	20
Height (mm):	19.88	970	-	1940	0.038	0.270	Remarks:	
Diameter (mm)	75.21	1940	-	3200	0.025	0.279	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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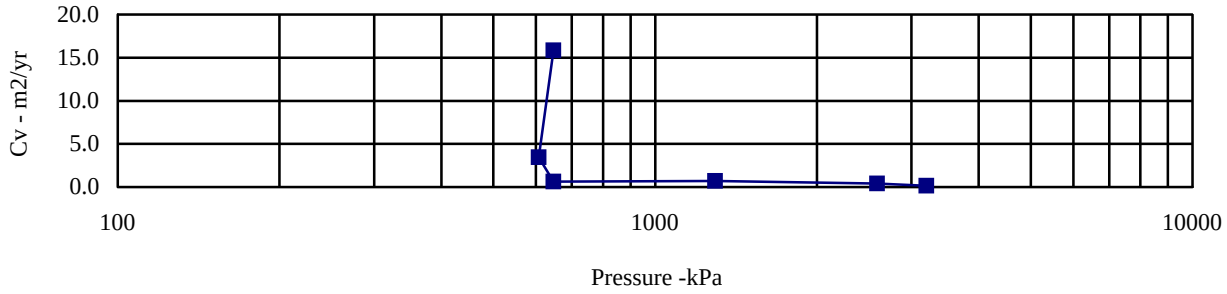
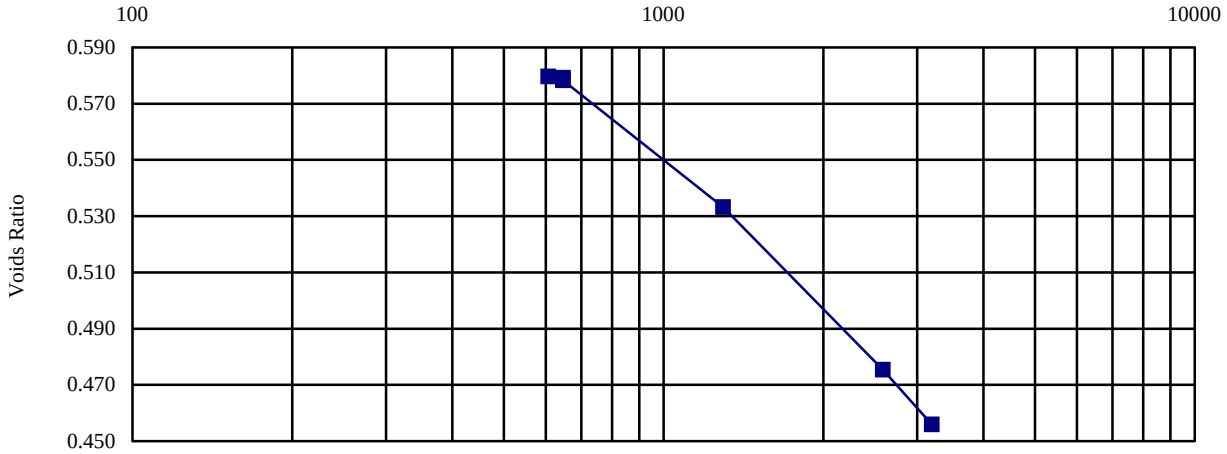
Hole Number: **BH11** **Depth (m):** **30.30-30.75**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	25							
Bulk Density (Mg/m3):	2.01	0	-	647	0.065	15.831	Method used to	
Dry Density (Mg/m3):	1.61	647	-	607	0.008	3.469	determine CV:	t90
Voids Ratio:	0.649	607	-	647	0.022	0.623	Nominal temperature	
Degree of saturation:	102.0	647	-	1294	0.044	0.693	during test ' C:	20
Height (mm):	20.05	1294	-	2588	0.029	0.421	Remarks:	
Diameter (mm)	75.15	2588	-	3200	0.021	0.141	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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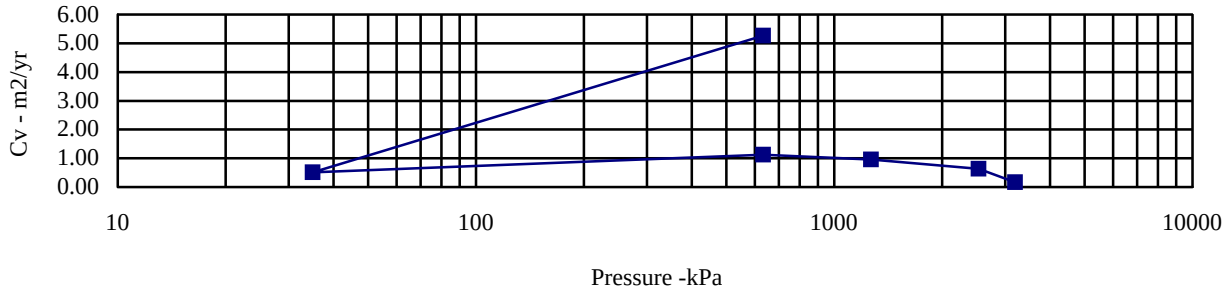
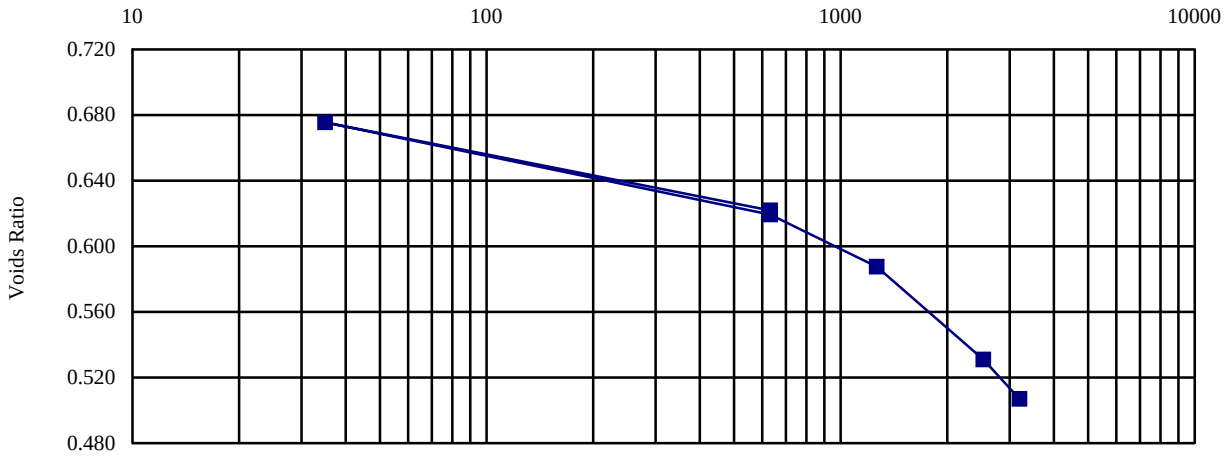
Hole Number: **BH12** **Depth (m):** **19.10-19.43**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	2.01	0	-	633	0.038	5.266	Method used to	
Dry Density (Mg/m3):	1.59	633	-	35	0.055	0.508	determine CV:	t90
Voids Ratio:	0.662	35	-	633	0.056	1.119	Nominal temperature	
Degree of saturation:	104.7	633	-	1266	0.031	0.962	during test ' C:	20
Height (mm):	20.09	1266	-	2532	0.028	0.635	Remarks:	
Diameter (mm)	75.2	2532	-	3200	0.024	0.163	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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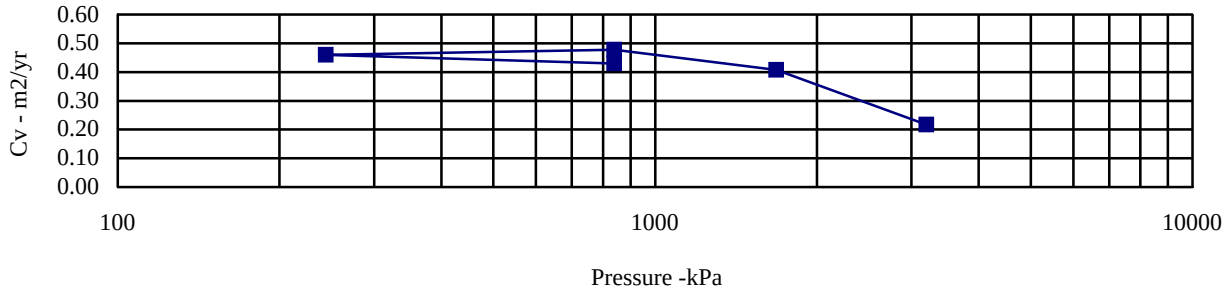
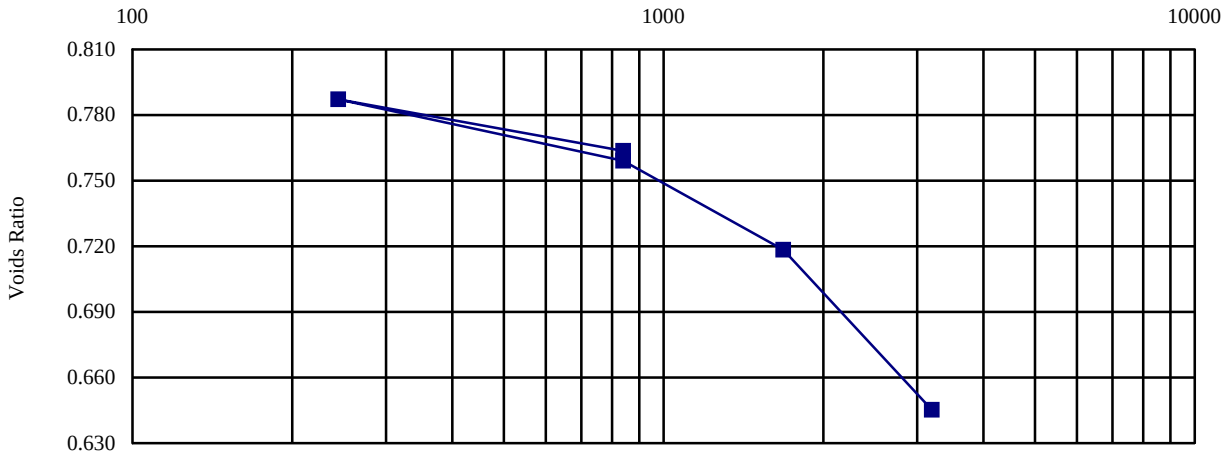
Hole Number: **BH12** **Depth (m):** **28.65-28.95**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	33							
Bulk Density (Mg/m3):	1.91	0	-	840	0.051	0.429	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.44	840	-	244	0.022	0.460		
Voids Ratio:	0.842	244	-	840	0.026	0.478	Nominal temperature during test ' C:	20
Degree of saturation:	103.5	840	-	1680	0.028	0.408		
Height (mm):	20.09	1680	-	3200	0.028	0.217	Remarks: See summary of soils description.	
Diameter (mm)	75.19							
Particle Density (Mg/m3): Assumed	2.65							





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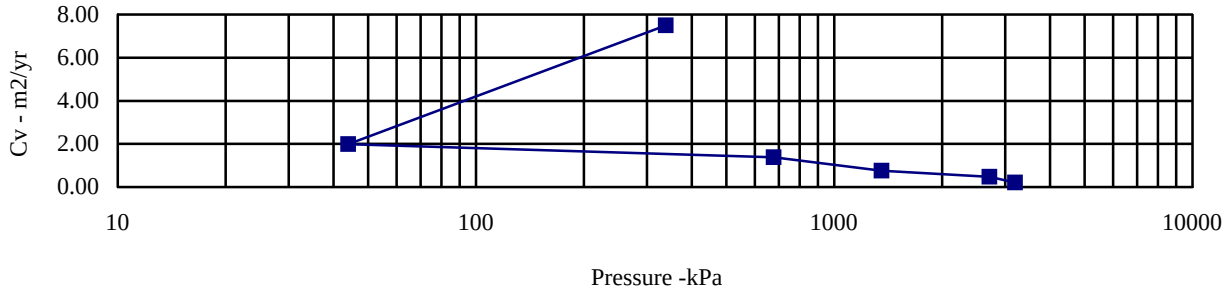
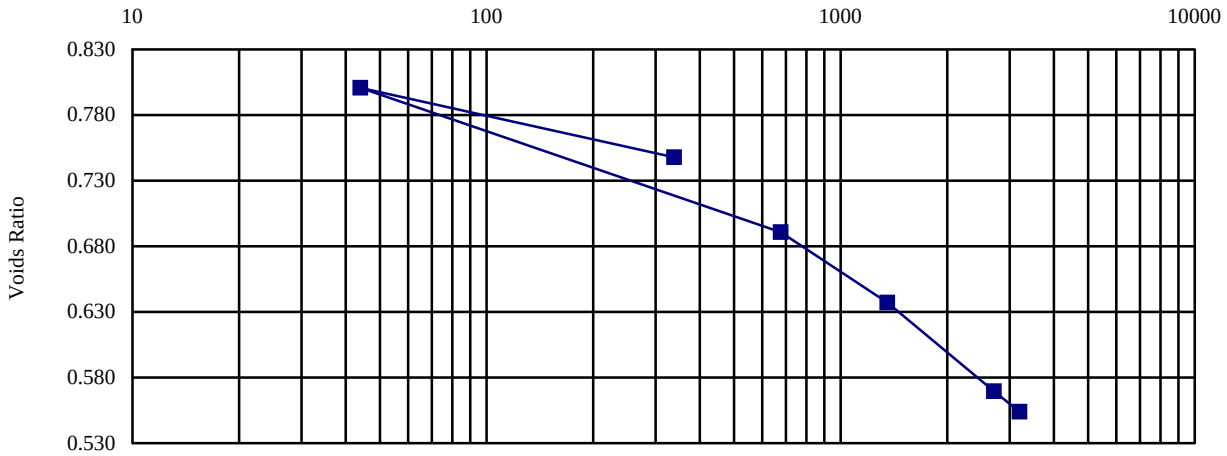
Hole Number: **BH13** **Depth (m):** **13.40-13.85**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	30							
Bulk Density (Mg/m3):	1.91	0	-	339	0.098	7.499	Method used to	
Dry Density (Mg/m3):	1.47	339	-	44	0.103	1.989	determine CV:	t90
Voids Ratio:	0.808	44	-	678	0.096	1.373	Nominal temperature	
Degree of saturation:	99.2	678	-	1356	0.047	0.761	during test ' C:	20
Height (mm):	19.96	1356	-	2712	0.030	0.475	Remarks:	
Diameter (mm)	75.21	2712	-	3200	0.020	0.203	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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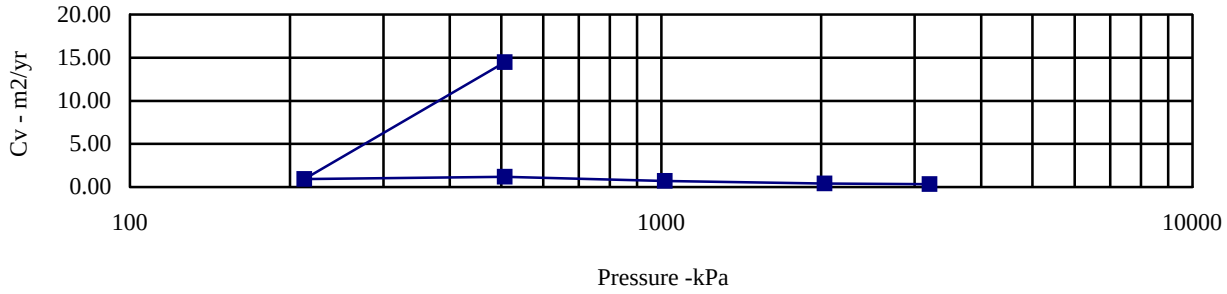
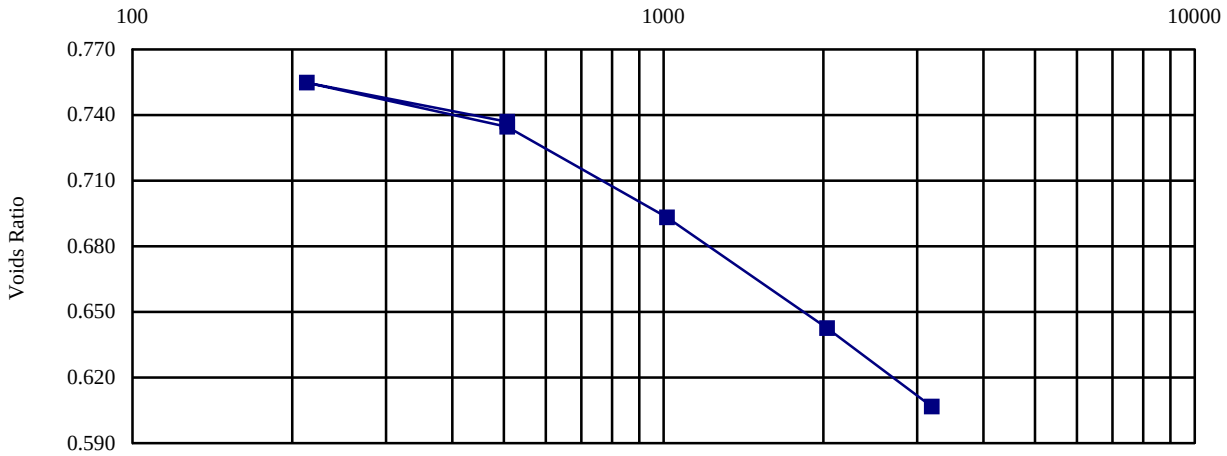
Hole Number: **BH13** **Depth (m):** **21.05-21.50**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	31							
Bulk Density (Mg/m3):	1.95	0	-	508	0.045	14.464	Method used to	
Dry Density (Mg/m3):	1.49	508	-	213	0.035	0.929	determine CV:	t90
Voids Ratio:	0.777	213	-	508	0.039	1.198	Nominal temperature	
Degree of saturation:	105.0	508	-	1016	0.047	0.688	during test ' C:	20
Height (mm):	20	1016	-	2032	0.029	0.413	Remarks:	
Diameter (mm)	75.13	2032	-	3200	0.019	0.325	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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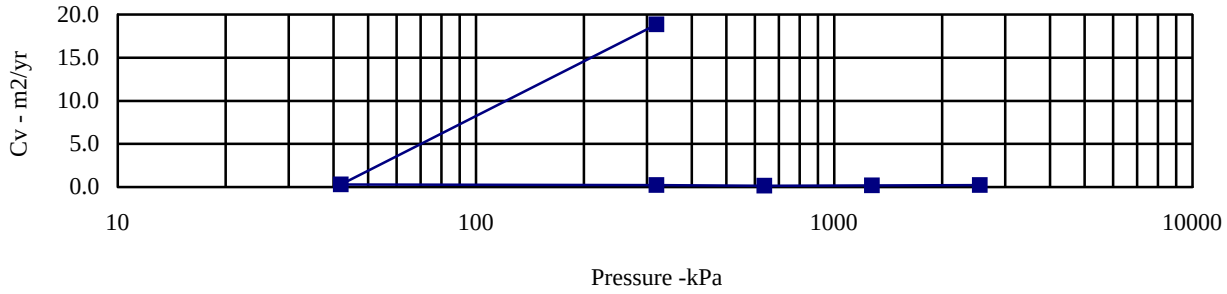
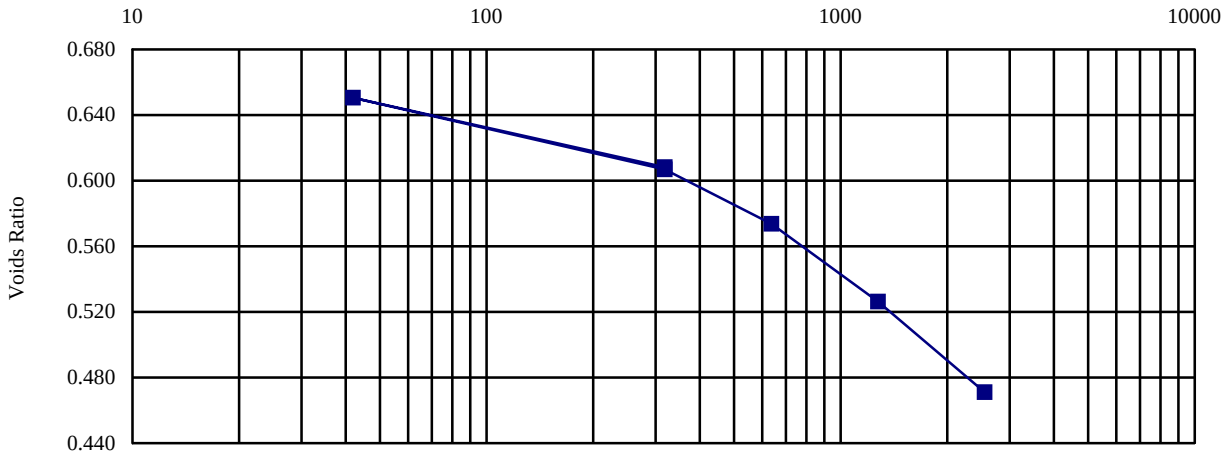
Hole Number: **BH16** **Depth (m):** **15.35-15.80**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	26							
Bulk Density (Mg/m3):	2.02	0	-	319	0.079	18.857	Method used to	
Dry Density (Mg/m3):	1.61	319	-	42	0.095	0.293	determine CV:	t90
Voids Ratio:	0.650	42	-	319	0.095	0.210	Nominal temperature	
Degree of saturation:	105.1	319	-	638	0.065	0.156	during test ' C:	20
Height (mm):	20.02	638	-	1276	0.047	0.168	Remarks:	
Diameter (mm)	75.2	1276	-	2552	0.028	0.214	See summary of soils description.	
Particle Density (Mg/m3):	2.65							
Assumed								





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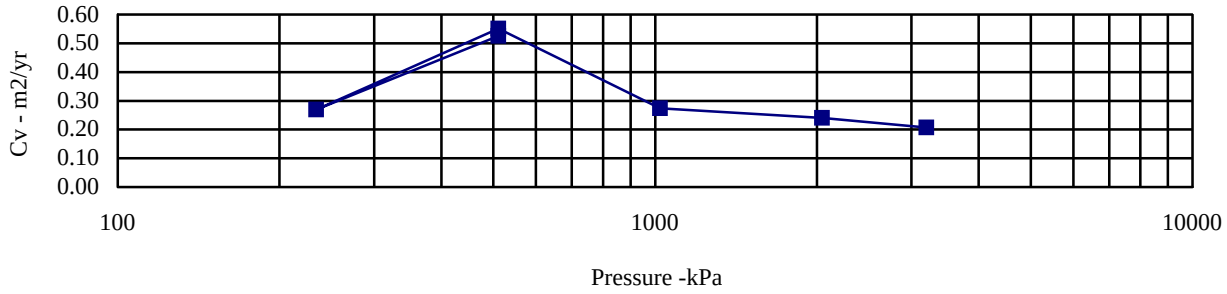
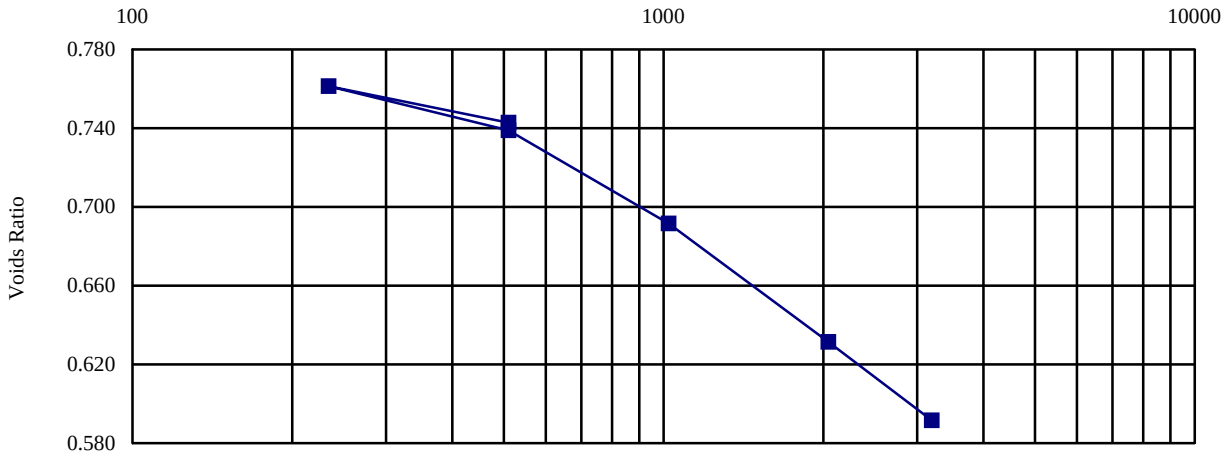
Hole Number: **BH16** **Depth (m):** **24.05-24.50**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	31							
Bulk Density (Mg/m3):	1.92	0	-	511	0.064	0.526	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.47	511	-	234	0.038	0.269		
Voids Ratio:	0.802	234	-	511	0.046	0.551	Nominal temperature during test ' C:	20
Degree of saturation:	101.1	511	-	1022	0.053	0.274		
Height (mm):	19.99	1022	-	2044	0.035	0.240	Remarks:	
Diameter (mm)	75.12	2044	-	3200	0.021	0.208	See summary of soils description.	
Particle Density (Mg/m3): Assumed	2.65							





Checked by	Date	Approved by	Date
	25/11/14		25/11/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No. PSL14/5669** Page of

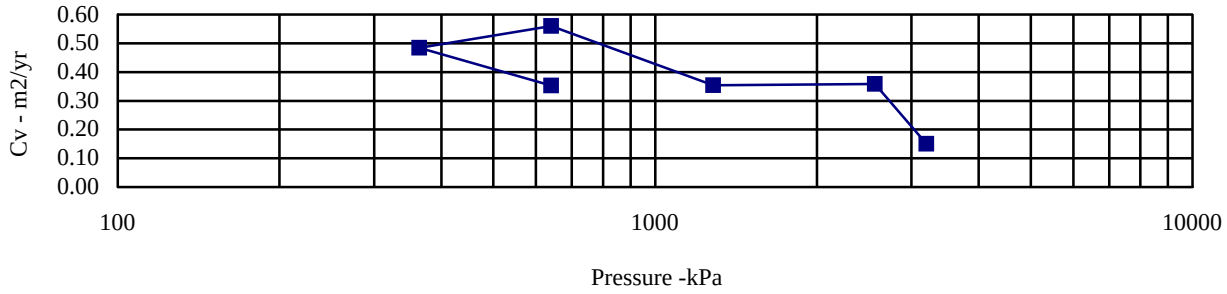
One Dimensional Consolidation Properties

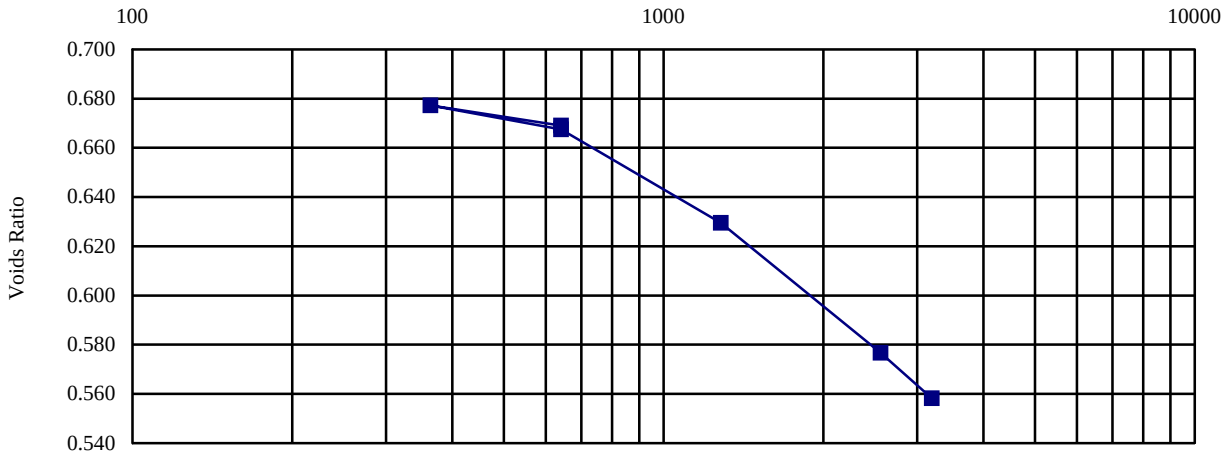
BS 1377: Part 5: 1990

Hole Number: **BH16** **Depth (m):** **30.00-30.45**

Sample Number: **Sample Type:** **U**

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Specimen location within tube:	Top
Moisture Content (%):	28							
Bulk Density (Mg/m3):	1.96	0	-	641	0.054	0.353	Method used to determine CV:	t90
Dry Density (Mg/m3):	1.53	641	-	364	0.018	0.484		
Voids Ratio:	0.729	364	-	641	0.021	0.559	Nominal temperature during test ' C:	20
Degree of saturation:	101.0	641	-	1282	0.036	0.354		
Height (mm):	20.09	1282	-	2564	0.025	0.358	Remarks:	
Diameter (mm)	75.2	2564	-	3200	0.018	0.150	See summary of soils description.	
Particle Density (Mg/m3): Assumed	2.65							





Checked by	Date	Approved by	Date
	25/11/14		25/11/14

PSL Professional Soils Laboratory	**RIVENHALL AIRFIELD IWMF.**	**Contract No. PSL14/5669** Page of

Effective Stress Triaxial Compression

Consolidated Drained

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth			13.50-13.95m
	Description			Brown slightly gravelly CLAY.
	Type			Undisturbed, vertical orientation.
	Initial Length	L_0	(mm)	208.0
	Initial Diameter	D_0	(mm)	104.0
	Initial Weight	W_0	(gr)	3444.0
	Initial Bulk Density	ρ_0	(Mg/m3)	1.95
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3	4
Initial Cell Pressure	σ_{3i}	(kPa)	538	676	952	
Initial Back Pressure	U_{bi}	(kPa)	400	400	400	
Membrane Thickness	m_b	(mm)	0.400			
Displacement Input	L_{IP}	(mm)	CH 2			
Load Input	N_{IP}	(N)	CH 1			
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3			
Sample Volume	V	(cm3)	CH 2			
Initial Moisture	$\omega_i\%$	(%)	25			
Initial Dry Density	ρ_{di}	(Mg/m3)	1.56			
Initial Voids Ratio	e_i	.	0.701			
Initial Degree of Saturation	S_i	(%)	95			
B Value	B	.	0.96			

Final Conditions						
Final Moisture	$\omega_f\%$	(%)	25			
Final Dry Density	ρ_{df}	(Mg/m3)	1.63			
Final Voids Ratio	e_f	.	0.628			
Final Degree of Saturation	S_f	(%)	100.0			
			Stage 1	2	3	4
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	$\varepsilon\%$	(%)	3.13	4.16	5.48	
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	191.9	257.2	337.1	
Minor Stress At Failure	σ_3'	(kPa)	126.0	195.0	289.0	
Major Stress At Failure	σ_1'	(kPa)	317.9	452.2	626.1	
Principal Stress At Failure	σ_1'/σ_3'		2.523	2.319	2.167	

Notes

Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH8 13.50-13.95m.
		Test Date	07/11/2014
Site Reference		Borehole	BH8
Jobfile	Rivenhall	Sample	13.50-13.95m.
Client	CC Ground Investigations Ltd.	Depth	13.50-13.95m

Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

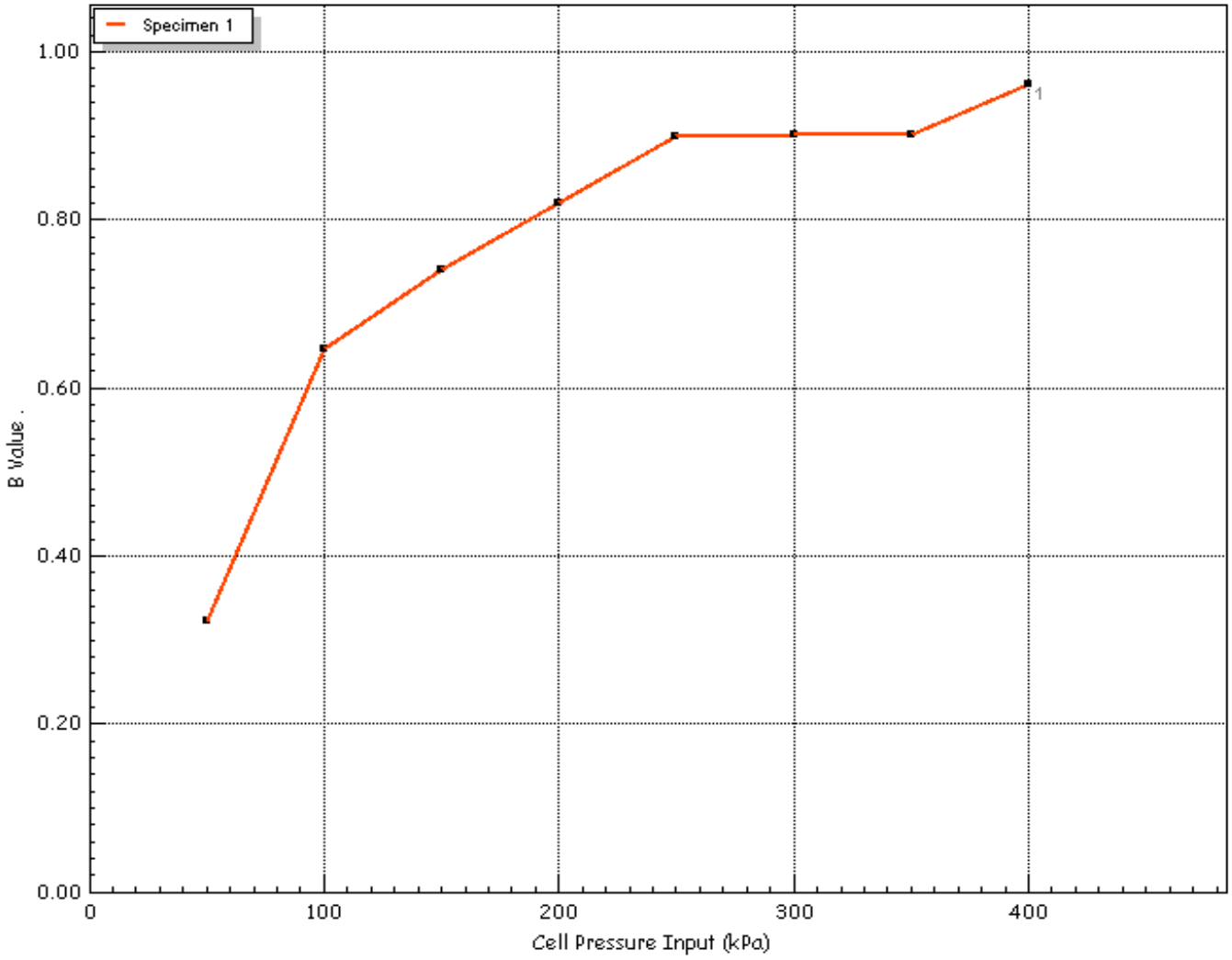
Database: .\SQLEXPRESS \ PSL - System 2

Effective Stress Triaxial Compression

Consolidated Drained

Saturation Plots

			1
Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	400
Pore Water Pressure Input	u pwp	(kPa)	387
B Value	B	.	0.96



Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH8 13.50-13.95m.
Database: .\SQLEXPRESS \ PSL - System 2				Test Date	07/11/2014
Site Reference				Borehole	BH8
Jobfile	Rivenhall			Sample	13.50-13.95m.
Client	CC Ground Investigations Ltd.			Depth	13.50-13.95m
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

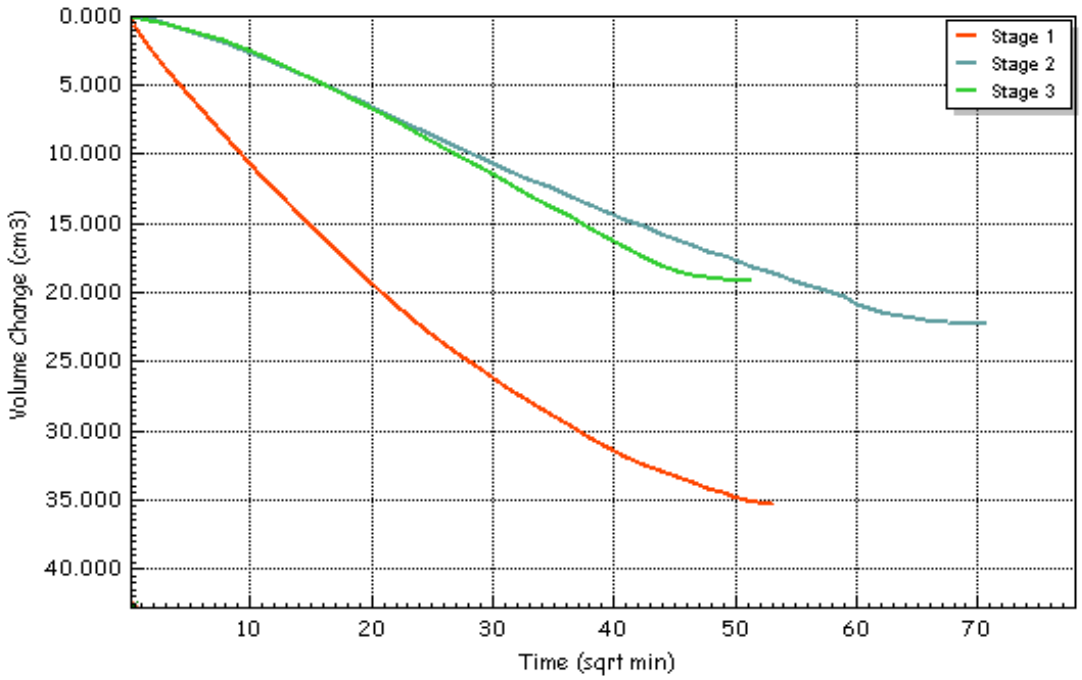
Consolidated Drained

Consolidation Plots

Initial Conditions					
			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	538	676	952
Initial Back Pressure	u_{bi}	(kPa)	400	400	400
Pore Water Pressure Input	u_{pwp}	(kPa)	515	514	742
Drainage Method			Radial+One End		

Final Conditions					
			Stage 1	2	3
PWP Dissipation %	U%	(%)	95.56	95.09	97.79
Volumetric Strain	ε_v%	(%)	2.00	3.23	4.31
Corrected Length	L_c	(mm)	206.6	197.3	185.8
Corrected Area	A_c	83.82	83.82	84.90	88.01
Corrected Volume	V_c	(cm3)	1731.615	1709.944	1690.823
T100 Time to Failure	t_{100}	(min)	527.45	2260.09	1819.96
Consolidation	c_v	(m2/year)	0.423	0.099	0.123
Compressibility	m_v	(m2/MN)	0.093	0.151	0.097
Test Time	t_F	(h:m:s)	123:04:18	527:21:15	424:39:26
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00140	0.00031	0.00036

Notes

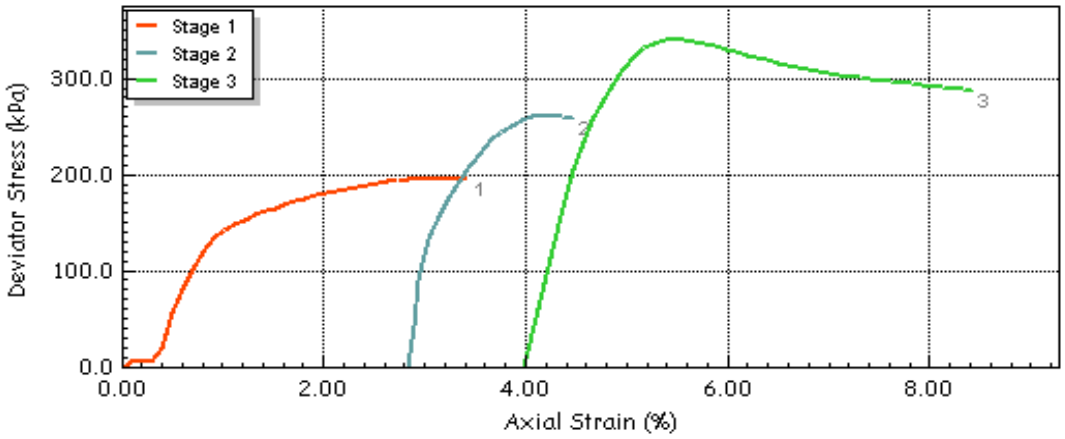


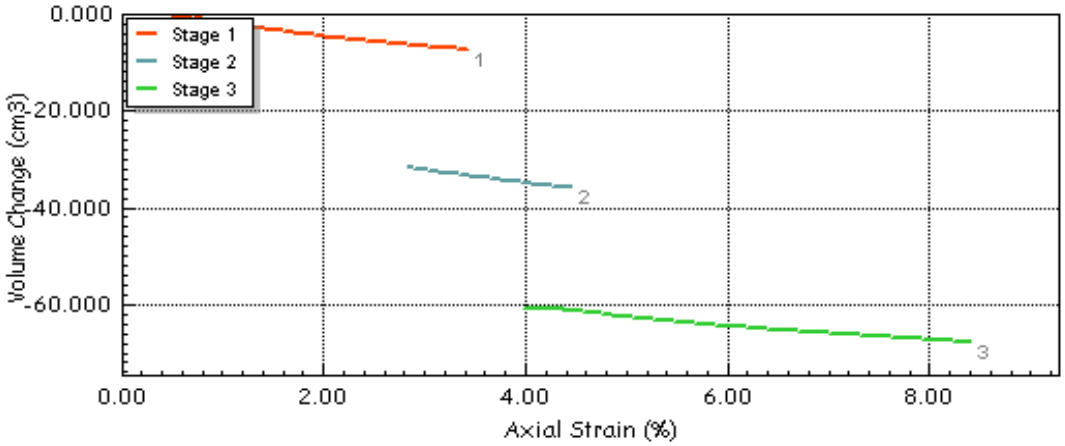
Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH8 13.50-13.95m.	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	07/11/2014	
Site Reference			Borehole	BH8	
Jobfile	Rivenhall		Sample	13.50-13.95m.	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

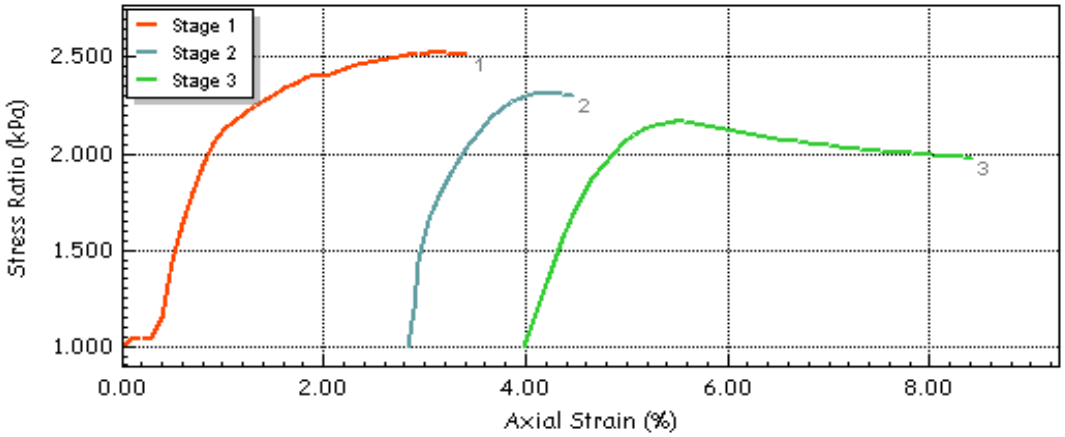
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots







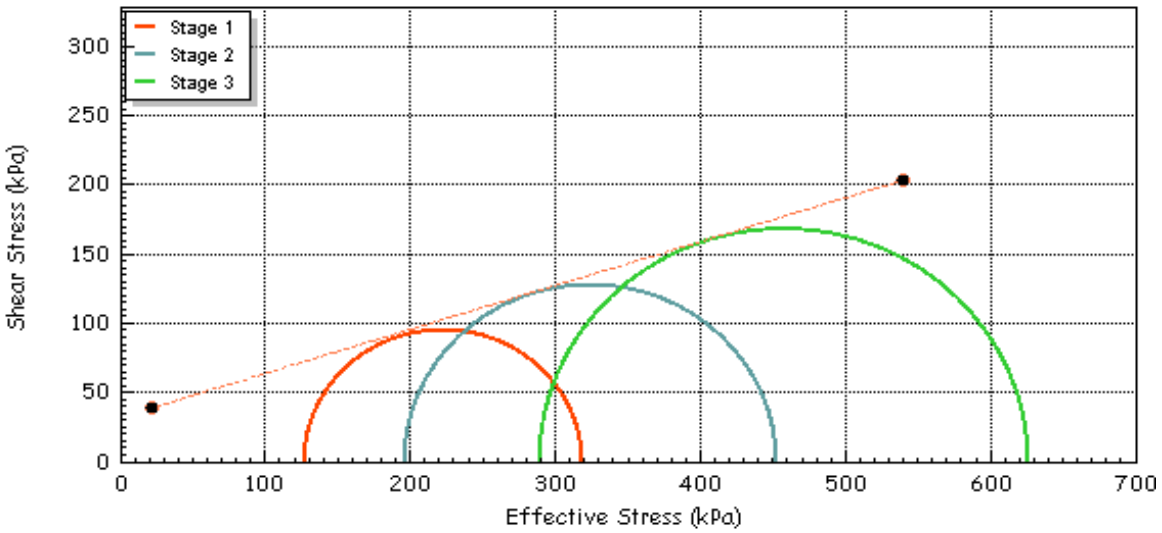
Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH8 13.50-13.95m.	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	01/01/0001	
Site Reference			Borehole	BH8	
Jobfile	Rivenhall		Sample	13.50-13.95m.	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

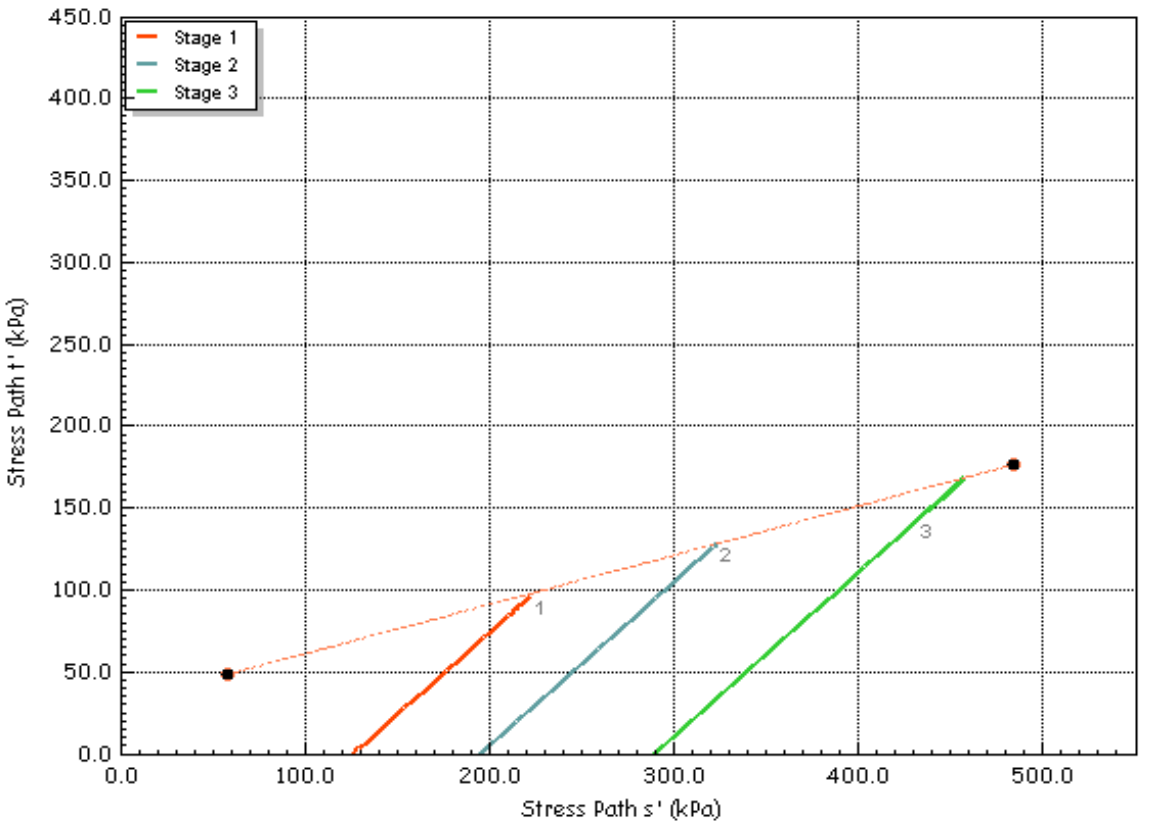
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	31.92	Effective Cohesion	c'	(kPa)	31.92
Effective Friction	ϕ'	(deg)	17.6	Effective Friction	ϕ'	(deg)	17.6





Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH8 13.50-13.95m.	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	07/11/2014	
Site Reference			Borehole	BH8	
Jobfile	Rivenhall		Sample	13.50-13.95m.	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Summary Report

Sample Details

sketch showing specimen location in original sample

Depth			26.35-26.65m
Description			Grey CLAY.
Type			Undisturbed, vertical orientation.
Initial Length	L_0	(mm)	140.0
Initial Diameter	D_0	(mm)	70.0
Initial Weight	W_0	(gr)	1092.8
Initial Bulk Density	ρ_0	(Mg/m3)	2.03
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

			Stage 1	2	3	4
Initial Cell Pressure	σ_{3i}	(kPa)	928	1207	1764	
Initial Back Pressure	U_{bi}	(kPa)	650	650	650	
Membrane Thickness	m_b	(mm)	0.400			
Displacement Input	L_{IP}	(mm)	CH 2			
Load Input	N_{IP}	(N)	CH 4			
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3			
Volume Input	V	(cm3)	CH 2			
Initial Moisture	$\omega_i\%$	(%)	27			
Initial Dry Density	ρ_{di}	(Mg/m3)	1.59			
Initial Voids Ratio	e_i	.	0.662			
Initial Degree of Saturation	S_i	(%)	100			
B Value	B	.	0.96			

Final Conditions

Final Moisture	$\omega_f\%$	(%)	26			
Final Dry Density	ρ_{df}	(Mg/m3)	1.71			
Final Voids Ratio	e_f	.	0.551			
Final Degree of Saturation	S_f	(%)	100.0			
			Stage 1	2	3	4
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	$\varepsilon\%$	(%)	2.53	4.09	6.93	
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	515.0	893.8	1174.5	
Minor Stress At Failure	σ_3'	(kPa)	268.0	575.0	774.0	
Major Stress At Failure	σ_1'	(kPa)	783.0	1468.8	1948.5	
Principal Stress At Failure	σ_1'/σ_3'		2.922	2.554	2.517	

Notes

Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH10 26.35-26.65m
		Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference		Test Date	03/11/2014
Jobfile	Rivenhall	Sample	26.35-26.65m
Client	CC Ground Investigations Ltd.	Borehole	BH10

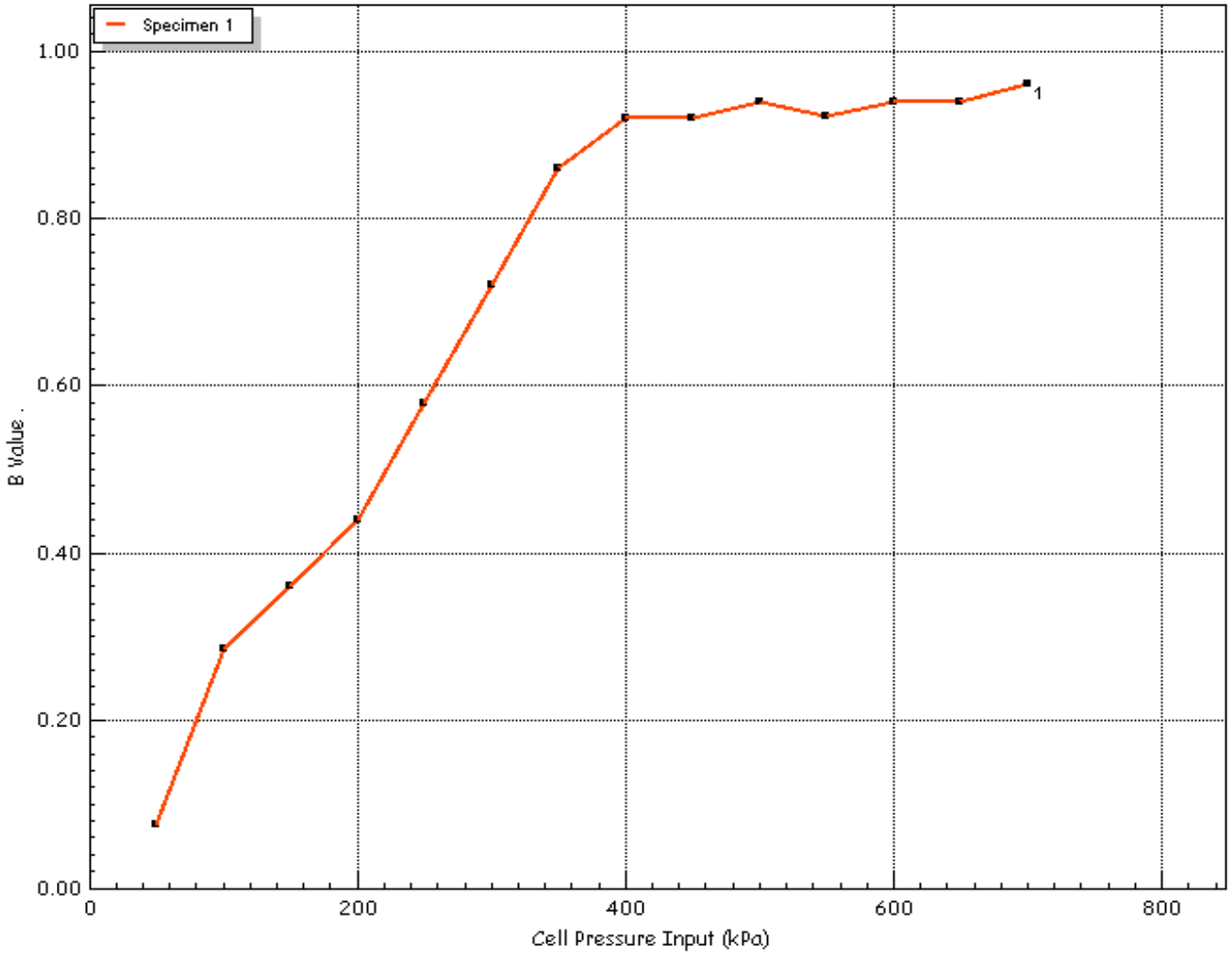
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Saturation Plots

			1
Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	700
Pore Water Pressure Input	u pwp	(kPa)	684
B Value	B	.	0.96



Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH10 26.35-26.65m
				Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference				Test Date	03/11/2014
Jobfile	Rivenhall			Sample	26.35-26.65m
Client	CC Ground Investigations Ltd.			Borehole	BH10
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

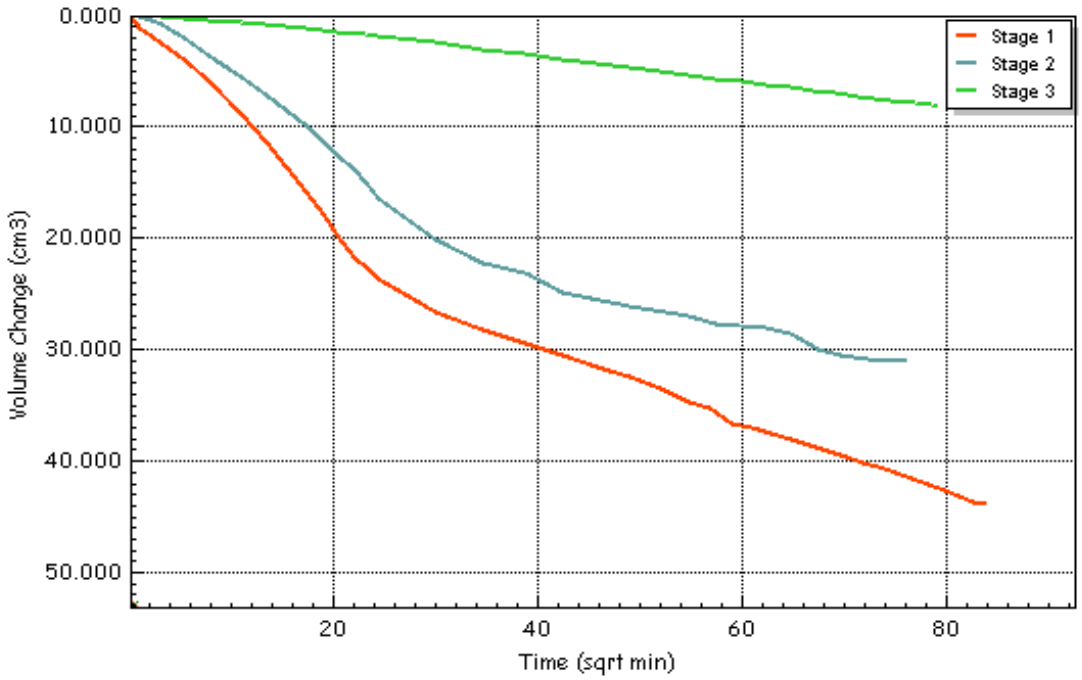
Consolidated Drained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	928	1207	1764
Initial Back Pressure	u_{bi}	(kPa)	650	650	650
Pore Water Pressure Input	u_{pwp}	(kPa)	887	957	1202
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	95.78	97.82	96.38
Volumetric Strain	ε_v%	(%)	8.14	13.89	15.39
Corrected Length	L_c	(mm)	136.2	126.3	114.2
Corrected Area	A_c	36.40	36.40	33.59	33.96
Corrected Volume	V_c	(cm3)	494.924	463.959	455.842
T100 Time to Failure	t_{100}	(min)	1746.56	1750.76	5304.17
Consolidation	c_v	(m2/year)	0.058	0.058	0.019
Compressibility	m_v	(m2/MN)	0.359	0.309	0.289
Test Time	t_F	(h:m:s)	407:31:50	408:30:38	1237:38:22
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00028	0.00026	0.00008

Notes



Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH10 26.35-26.65m
		Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference		Test Date	03/11/2014
Jobfile	Rivenhall	Sample	26.35-26.65m
Client	CC Ground Investigations Ltd.	Borehole	BH10

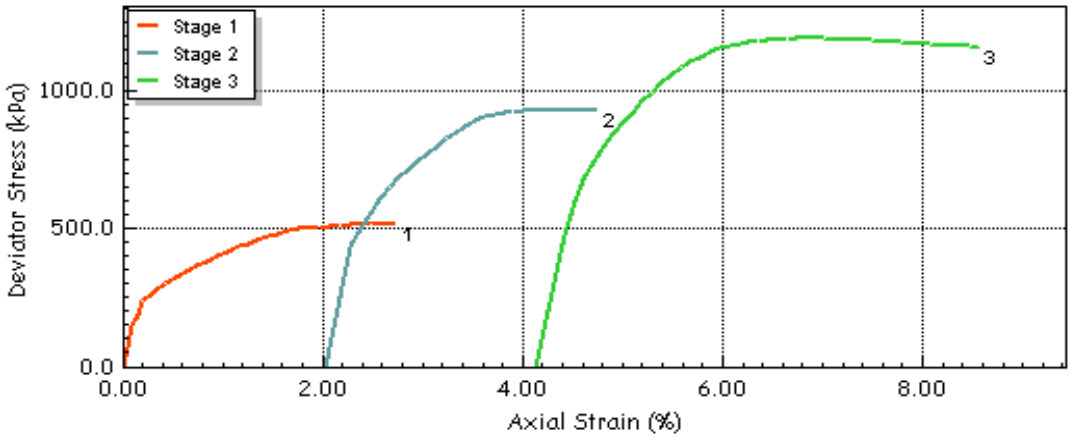
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

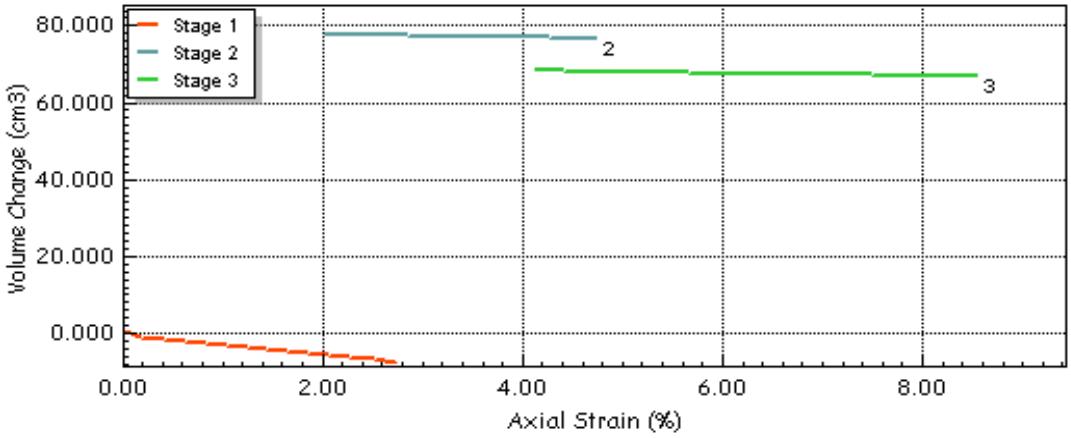
Professional Soils Laboratory

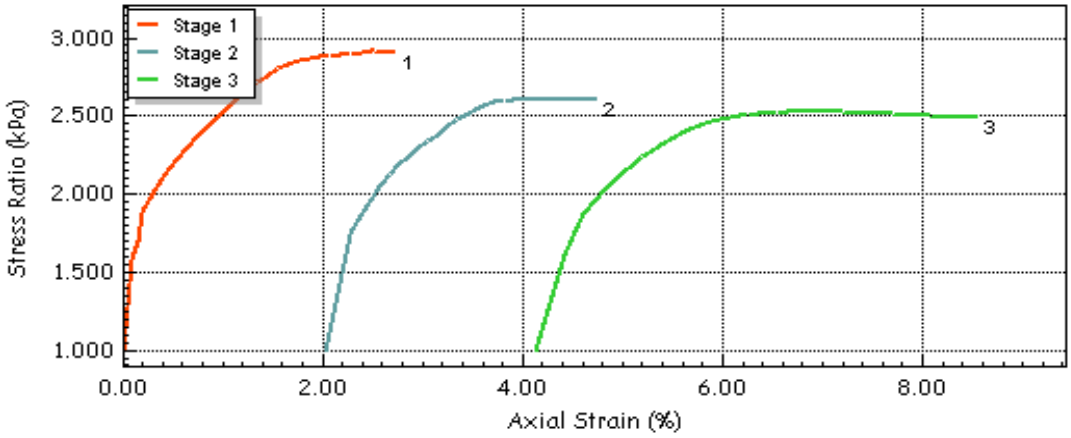
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots







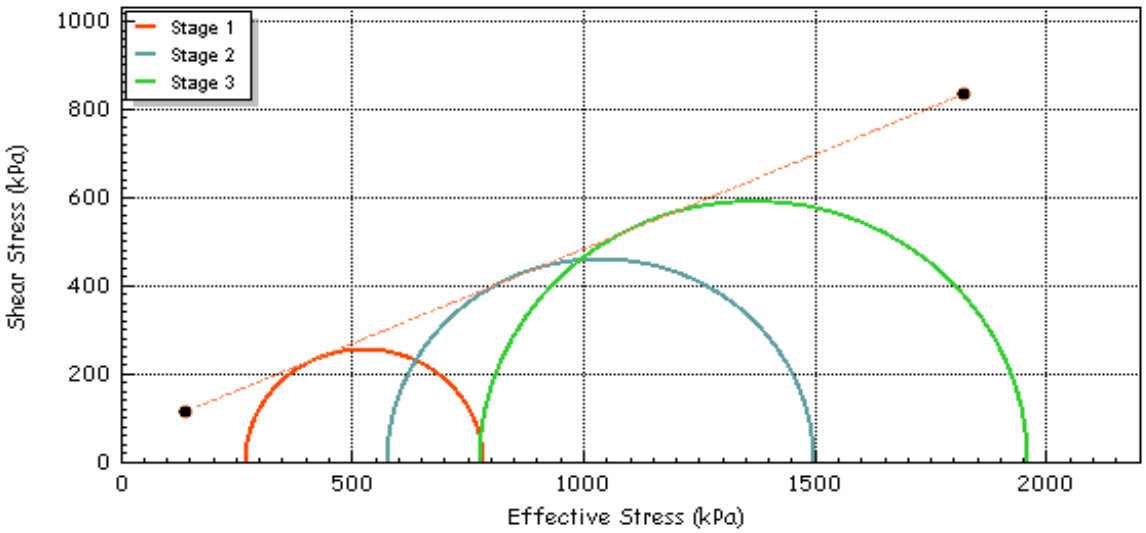
Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH10 26.35-26.65m
				Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference				Test Date	03/11/2014
Jobfile	Rivenhall			Sample	26.35-26.65m
Client	CC Ground Investigations Ltd.			Borehole	BH10
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

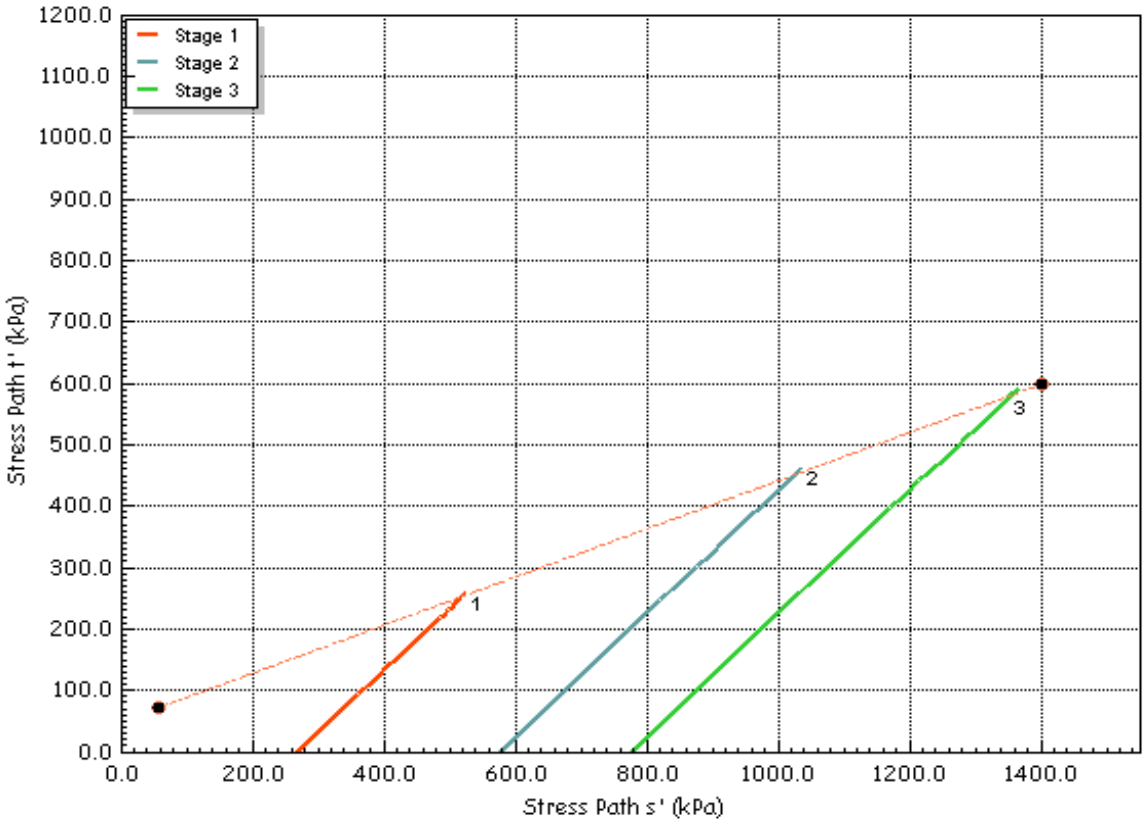
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	55.53	Effective Cohesion	c'	(kPa)	55.53
Effective Friction	ϕ'	(deg)	23.1	Effective Friction	ϕ'	(deg)	23.1





Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH10 26.35-26.65m	
			Database: .\SQLEXPRESS \ 5348-PSL		
Site Reference			Test Date	03/11/2014	
Jobfile	Rivenhall		Sample	26.35-26.65m	
Client	CC Ground Investigations Ltd.		Borehole	BH10	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Summary Report

Sample Details

sketch showing specimen location in original sample

Depth			28.80-29.25m
Description			Grey mottled brown CLAY.
Type			Undisturbed, veretical orientation.
Initial Length	L_0	(mm)	140.0
Initial Diameter	D_0	(mm)	70.0
Initial Weight	W_0	(gr)	1070.9
Initial Bulk Density	ρ_0	(Mg/m3)	1.99
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions

			Stage 1	2	3	4
Initial Cell Pressure	σ_{3i}	(kPa)	601	902	1504	
Initial Back Pressure	U_{bi}	(kPa)	300	300	300	
Membrane Thickness	m_b	(mm)	0.400			
Displacement Input	L_{IP}	(mm)	CH 2			
Load Input	N_{IP}	(N)	CH 1			
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3			
Volume Input	V	(cm3)	CH 2			
Initial Moisture	$\omega_i\%$	(%)	29			
Initial Dry Density	ρ_{di}	(Mg/m3)	1.55			
Initial Voids Ratio	e_i	.	0.714			
Initial Degree of Saturation	S_i	(%)	100			
B Value	B	.	1.00			

Final Conditions

Final Moisture	$\omega_f\%$	(%)	27			
Final Dry Density	ρ_{df}	(Mg/m3)	1.65			
Final Voids Ratio	e_f	.	0.608			
Final Degree of Saturation	S_f	(%)	100.0			
			Stage 1	2	3	4
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	$\varepsilon\%$	(%)	2.44	4.11	5.67	
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	485.0	748.9	968.4	
Minor Stress At Failure	σ_3'	(kPa)	264.0	533.0	734.0	
Major Stress At Failure	σ_1'	(kPa)	749.0	1281.9	1702.4	
Principal Stress At Failure	σ_1'/σ_3'		2.837	2.405	2.319	

Notes

Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH18A 28.80-29.25m
		Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference		Test Date	07/11/2014
Jobfile	Rivenhall	Sample	28.80-29.25m
Client	CC Ground Investigations Ltd.	Borehole	BH18A

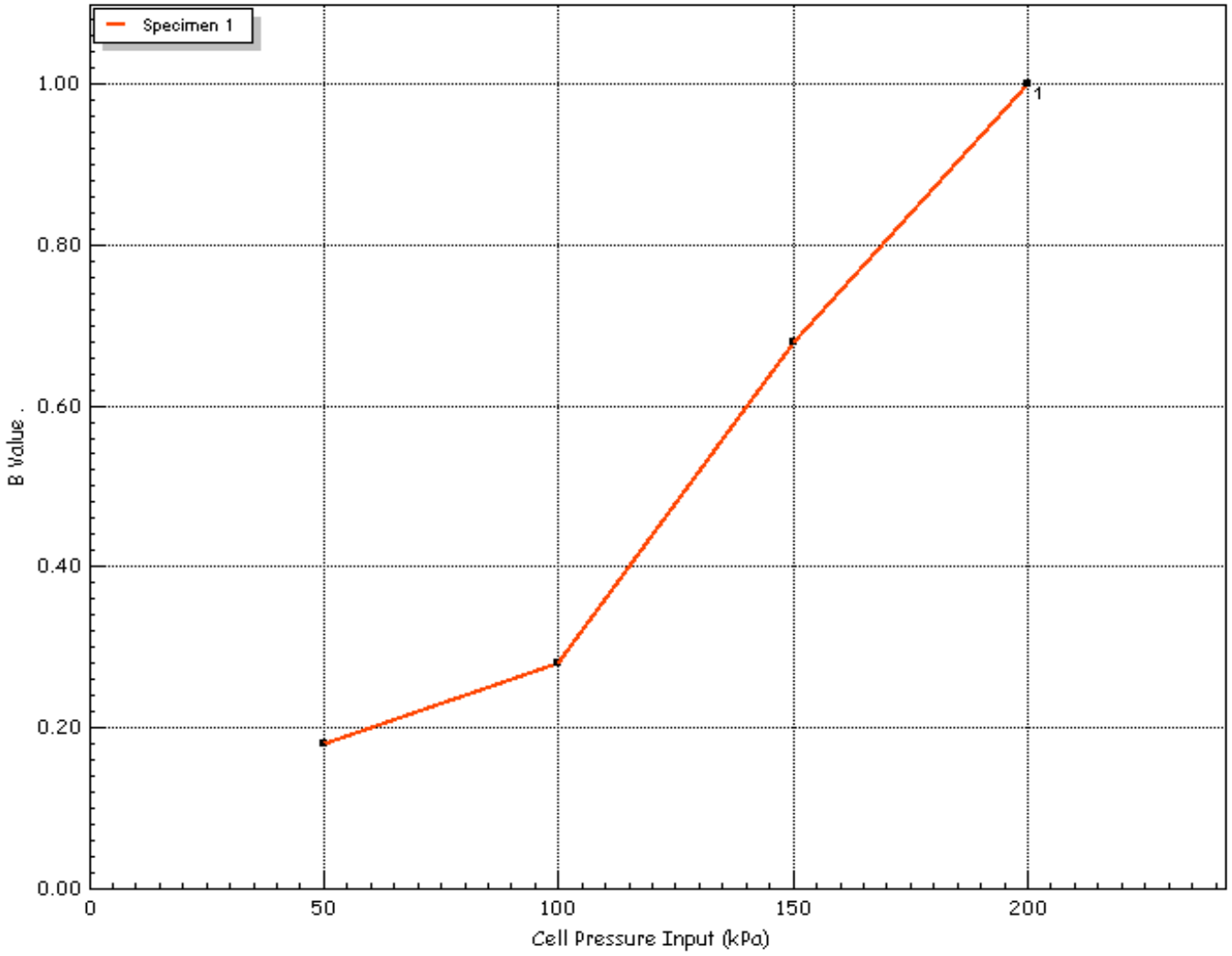
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Saturation Plots

			1
Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	200
Pore Water Pressure Input	u pwp	(kPa)	193
B Value	B	.	1.00



Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH18A 28.80-29.25m
				Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference				Test Date	07/11/2014
Jobfile	Rivenhall			Sample	28.80-29.25m
Client	CC Ground Investigations Ltd.			Borehole	BH18A
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

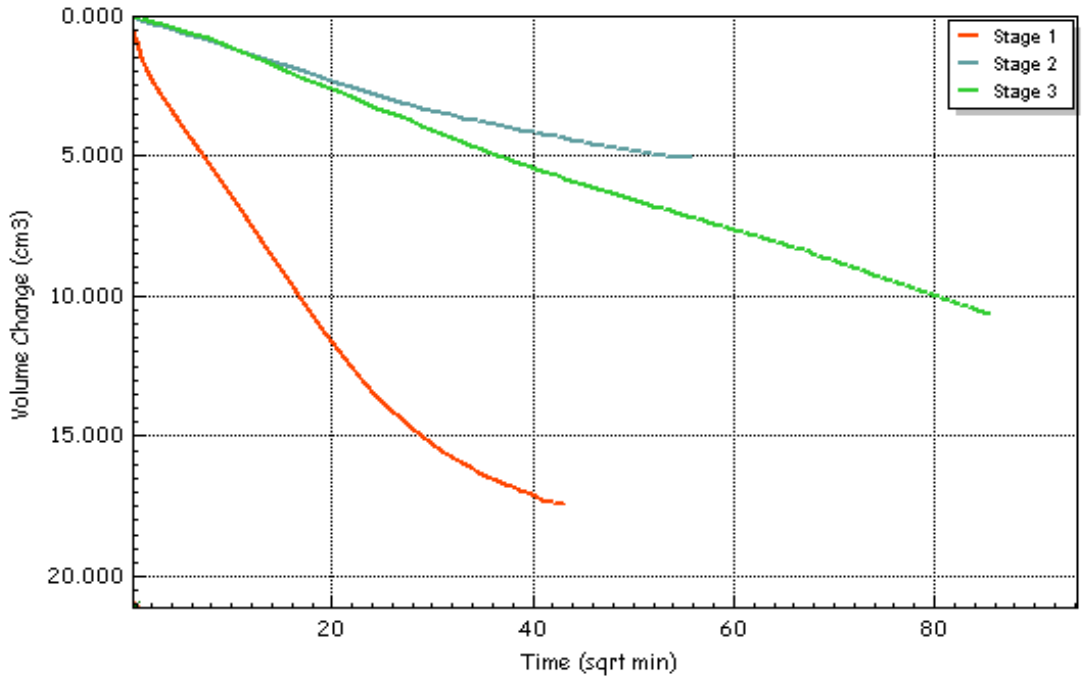
Consolidated Drained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	601	902	1504
Initial Back Pressure	u_{bi}	(kPa)	300	300	300
Pore Water Pressure Input	u_{pwp}	(kPa)	469	578	793
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	97.51	95.38	98.87
Volumetric Strain	ε_v%	(%)	3.23	4.18	6.15
Corrected Length	L_c	(mm)	138.5	133.1	125.0
Corrected Area	A_c	37.65	37.65	37.52	38.72
Corrected Volume	V_c	(cm3)	521.363	516.272	505.661
T100 Time to Failure	t_{100}	(min)	250.20	856.73	3968.06
Consolidation	c_v	(m2/year)	0.404	0.118	0.025
Compressibility	m_v	(m2/MN)	0.247	3.482	2.561
Test Time	t_F	(h:m:s)	58:22:48	199:54:13	925:52:50
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00198	0.00055	0.00011

Notes



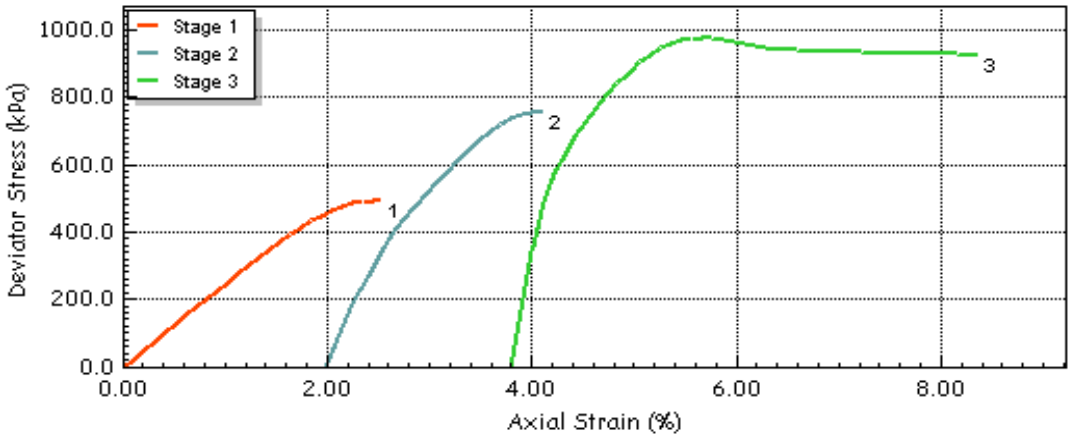
Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH18A 28.80-29.25m
		Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference		Test Date	07/11/2014
Jobfile	Rivenhall	Sample	28.80-29.25m
Client	CC Ground Investigations Ltd.	Borehole	BH18A

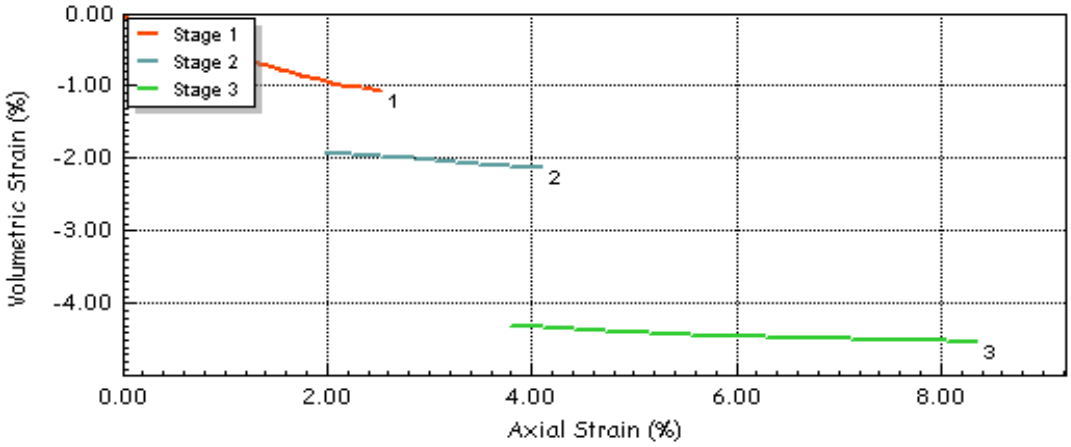
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

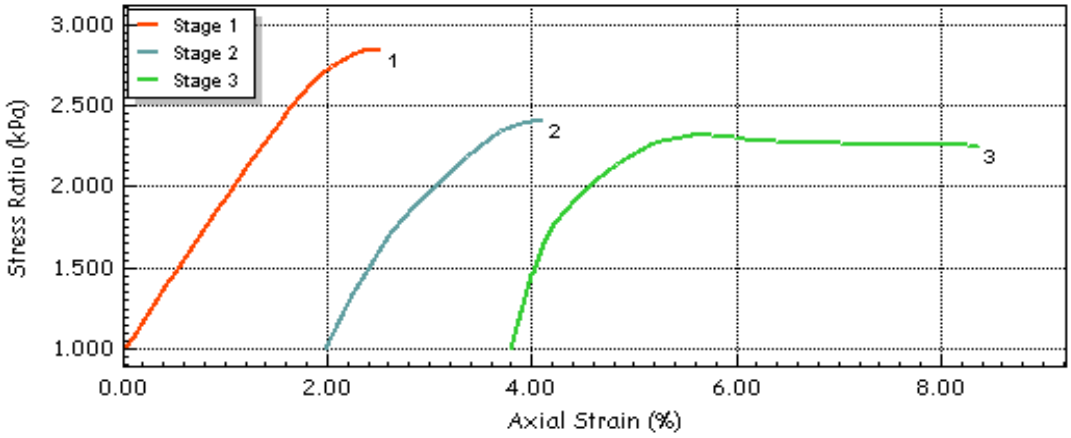
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots







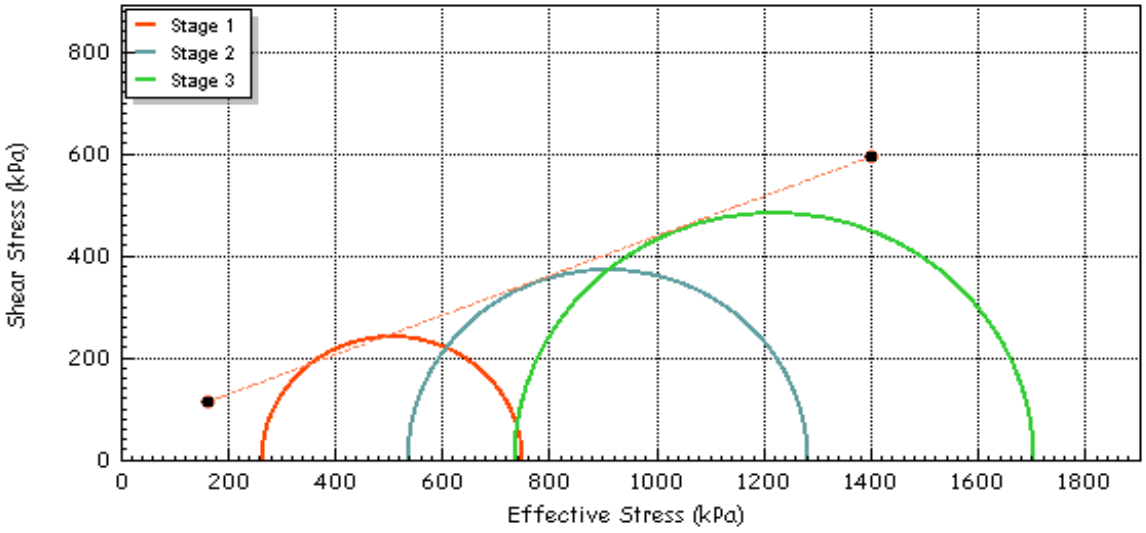
PSL Professional Soils Laboratory	Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH18A 28.80-29.25m	
			Database: .\SQLEXPRESS \ 5348-PSL		
	Site Reference		Test Date	07/11/2014	
	Jobfile	Rivenhall	Sample	28.80-29.25m	
	Client	CC Ground Investigations Ltd.	Borehole	BH18A	
	Operator	David Burton	Checked	Sean Royle	Approved Anthony Watkins

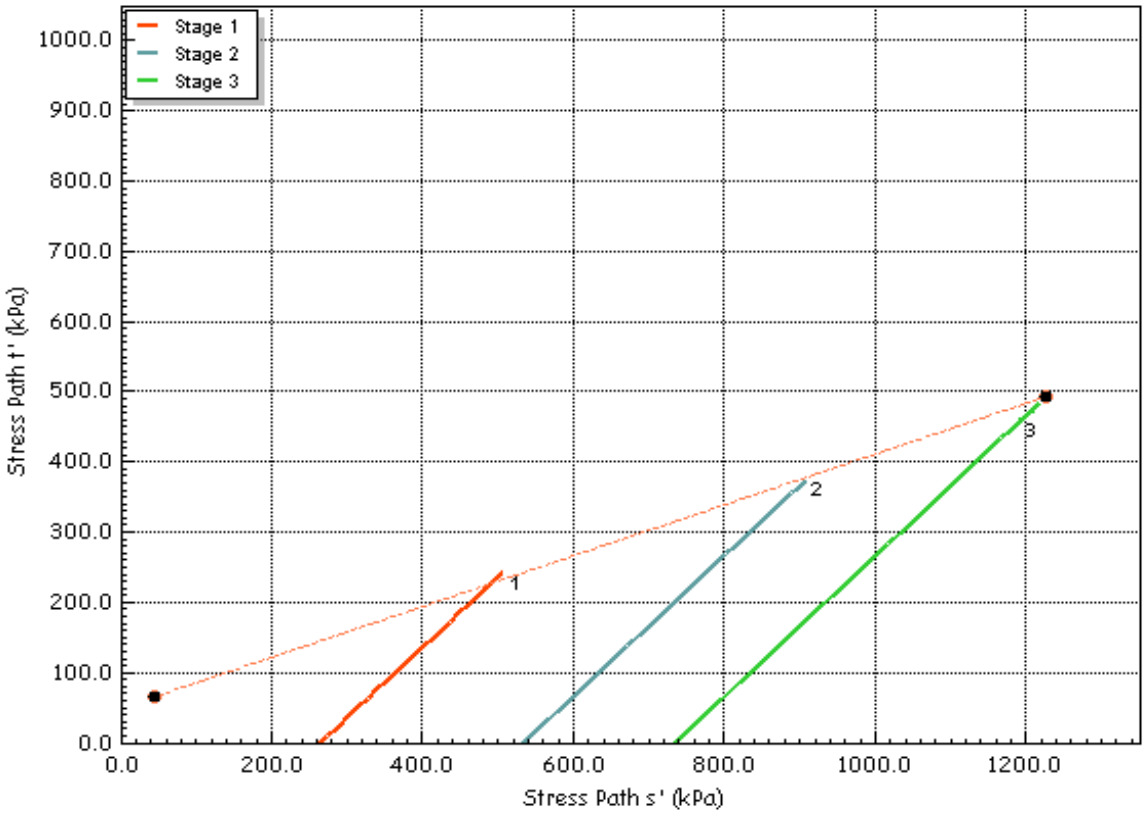
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	52.67	Effective Cohesion	c'	(kPa)	52.67
Effective Friction	ϕ'	(deg)	21.2	Effective Friction	ϕ'	(deg)	21.2





Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH18A 28.80-29.25m	
			Database: .\SQLEXPRESS \ 5348-PSL		
Site Reference			Test Date	07/11/2014	
Jobfile	Rivenhall		Sample	28.80-29.25m	
Client	CC Ground Investigations Ltd.		Borehole	BH18A	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Summary Report

Sample Details

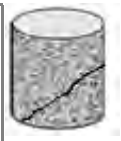
sketch showing specimen location in original sample

Depth			16.45-17.00m
Description			Grey CLAY.
Type			Undisturbed, vertical orientation.
Initial Length	L_0	(mm)	140.0
Initial Diameter	D_0	(mm)	70.0
Initial Weight	W_0	(gr)	1072.6
Initial Bulk Density	ρ_0	(Mg/m3)	1.99
Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3	4
Initial Cell Pressure	σ_{3i}	(kPa)	771	942	1284	
Initial Back Pressure	U_{bi}	(kPa)	600	600	600	
Membrane Thickness	m_b	(mm)	0.400			
Displacement Input	L_{IP}	(mm)	CH 2			
Load Input	N_{IP}	(N)	CH 1			
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3			
Volume Input	V	(cm3)	CH 2			
Initial Moisture	$\omega_i\%$	(%)	28			
Initial Dry Density	ρ_{di}	(Mg/m3)	1.56			
Initial Voids Ratio	e_i	.	0.701			
Initial Degree of Saturation	S_i	(%)	100			
B Value	B	.	0.96			

Final Conditions						
Final Moisture	$\omega_f\%$	(%)	25			
Final Dry Density	ρ_{df}	(Mg/m3)	1.63			
Final Voids Ratio	e_f	.	0.624			
Final Degree of Saturation	S_f	(%)	100.0			
			Stage 1	2	3	4
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	$\varepsilon\%$	(%)	3.23	4.93	7.12	
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	257.5	407.8	668.0	
Minor Stress At Failure	σ_3'	(kPa)	148.0	328.0	607.0	
Major Stress At Failure	σ_1'	(kPa)	405.5	735.8	1275.0	
Principal Stress At Failure	σ_1'/σ_3'		2.740	2.243	2.100	

Notes



Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH19 16.45-17.00m
		Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference		Test Date	07/11/2014
Jobfile	Rivenhall	Sample	16.45-17.00m
Client	CC Ground Investigations Ltd.	Borehole	BH19

Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

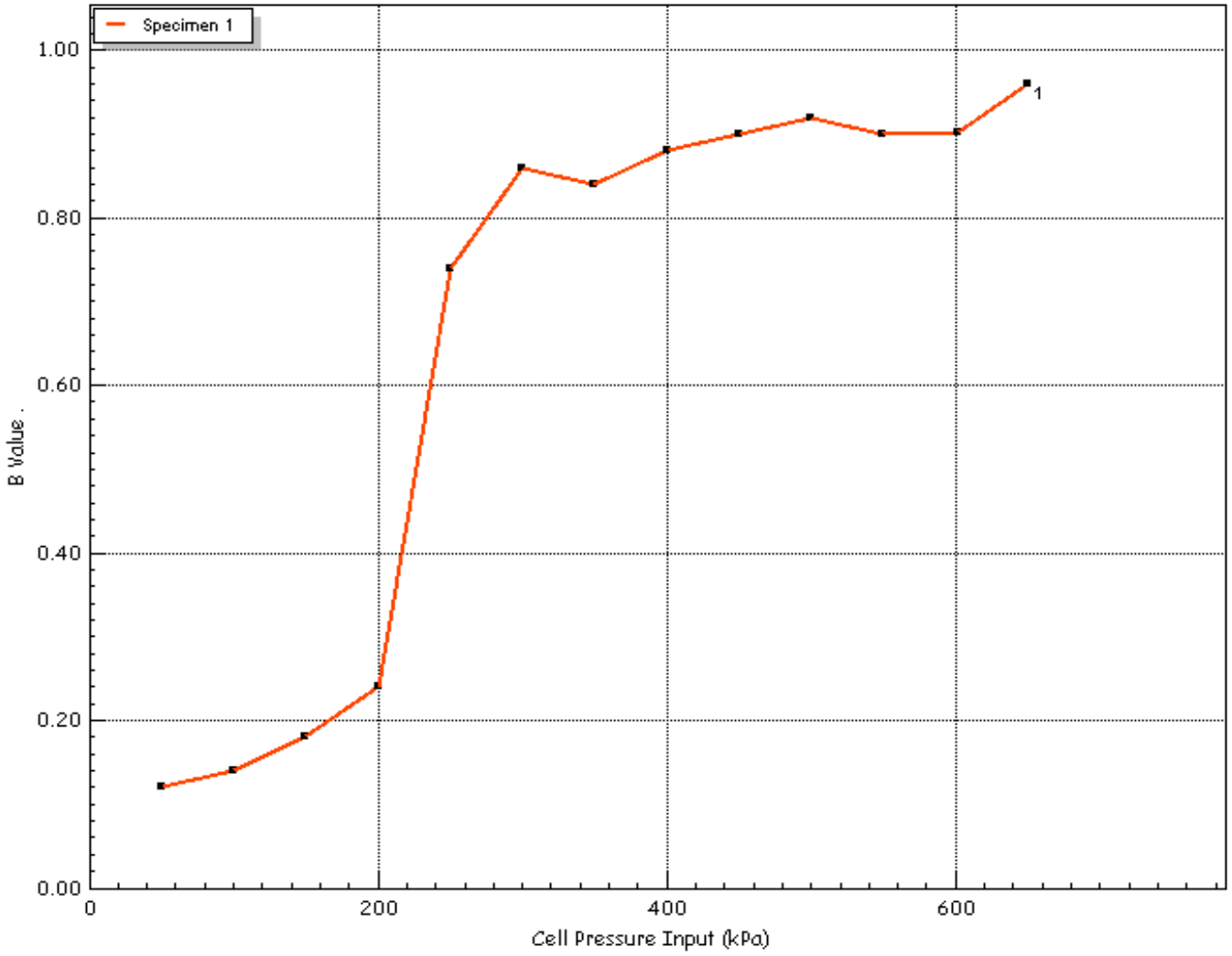
Professional Soils Laboratory

Effective Stress Triaxial Compression

Consolidated Drained

Saturation Plots

			1
Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	650
Pore Water Pressure Input	u pwp	(kPa)	631
B Value	B	.	0.96



Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH19 16.45-17.00m
				Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference				Test Date	07/11/2014
Jobfile	Rivenhall			Sample	16.45-17.00m
Client	CC Ground Investigations Ltd.			Borehole	BH19
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

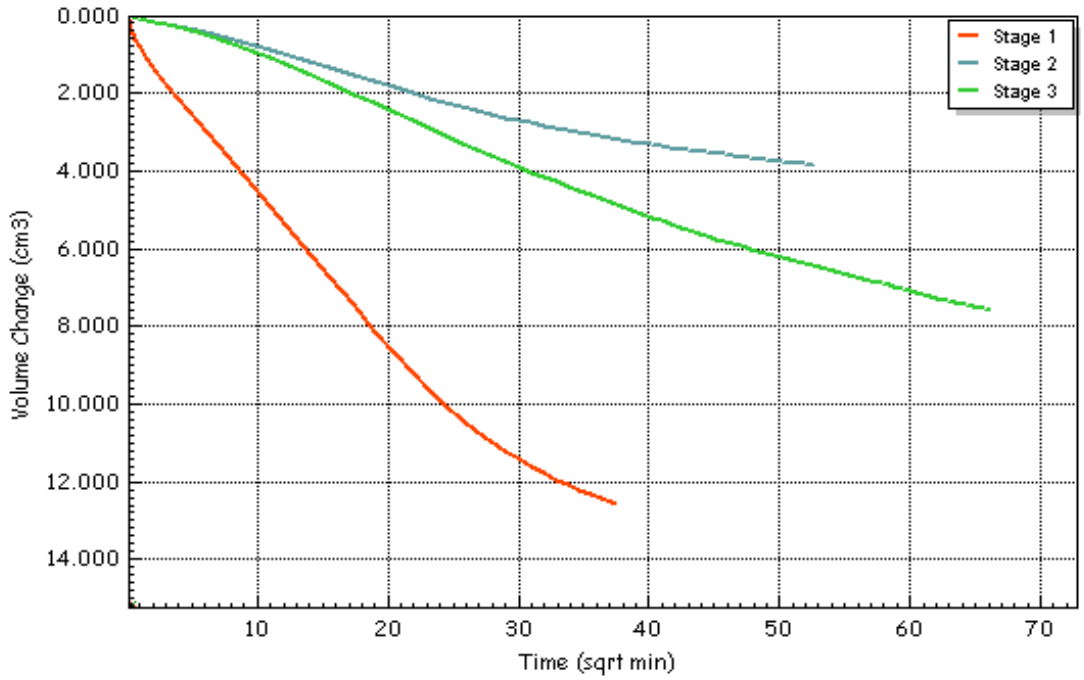
Consolidated Drained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	771	942	1284
Initial Back Pressure	u_{bi}	(kPa)	600	600	600
Pore Water Pressure Input	u_{pwp}	(kPa)	740	761	842
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	98.57	98.69	98.60
Volumetric Strain	ε_v%	(%)	2.35	3.07	4.48
Corrected Length	L_c	(mm)	138.9	132.8	124.0
Corrected Area	A_c	37.88	37.88	38.39	40.22
Corrected Volume	V_c	(cm3)	526.112	522.249	514.663
T100 Time to Failure	t_{100}	(min)	213.46	22.63	22.63
Consolidation	c_v	(m2/year)	0.474	4.471	4.471
Compressibility	m_v	(m2/MN)	0.170	0.639	0.270
Test Time	t_F	(h:m:s)	49:48:26	05:16:49	05:16:49
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00232	0.02096	0.01956

Notes

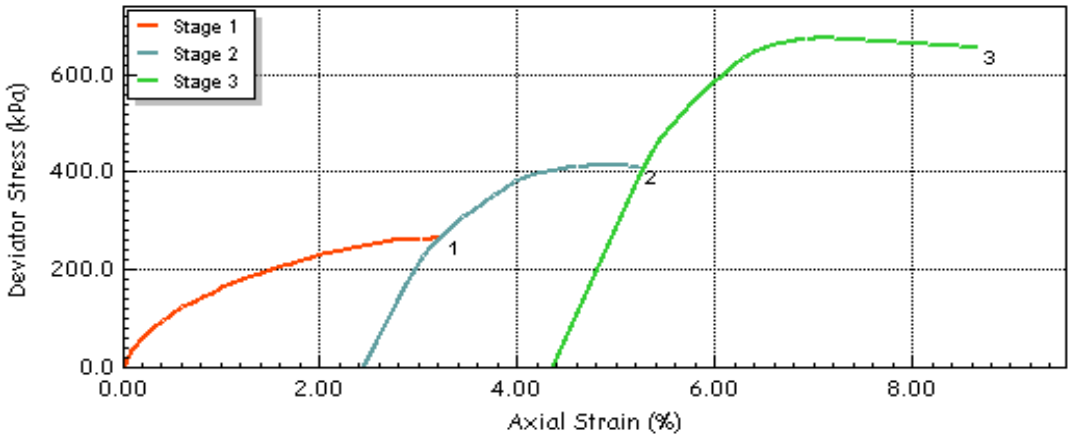


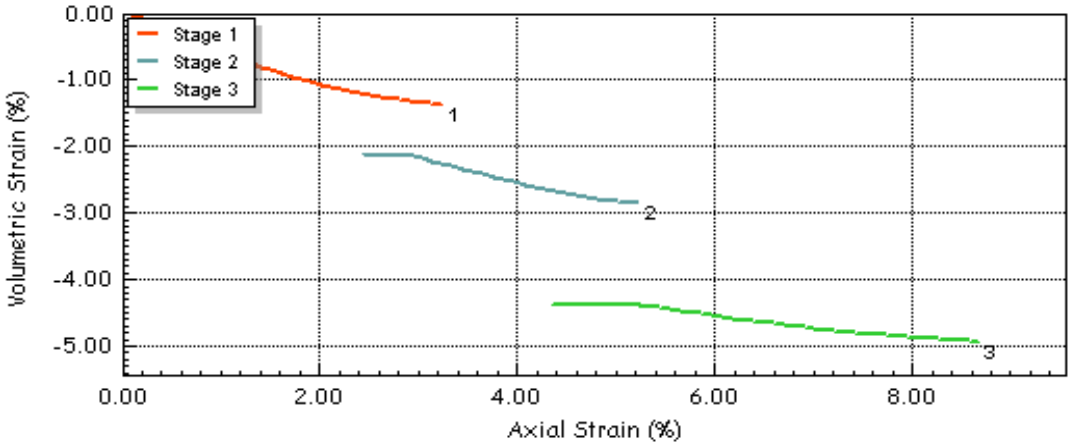
Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH19 16.45-17.00m	
			Database: .\SQLEXPRESS \ 5348-PSL		
Site Reference			Test Date	07/11/2014	
Jobfile	Rivenhall		Sample	16.45-17.00m	
Client	CC Ground Investigations Ltd.		Borehole	BH19	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

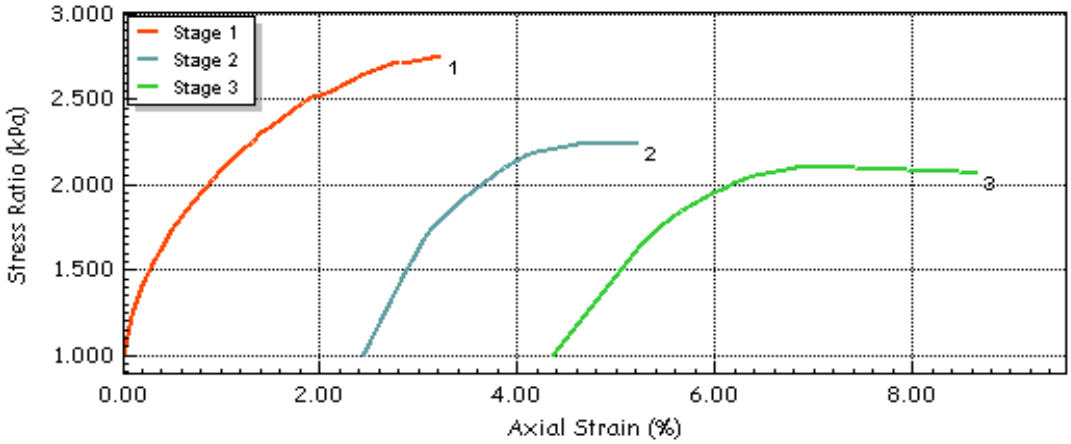
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots







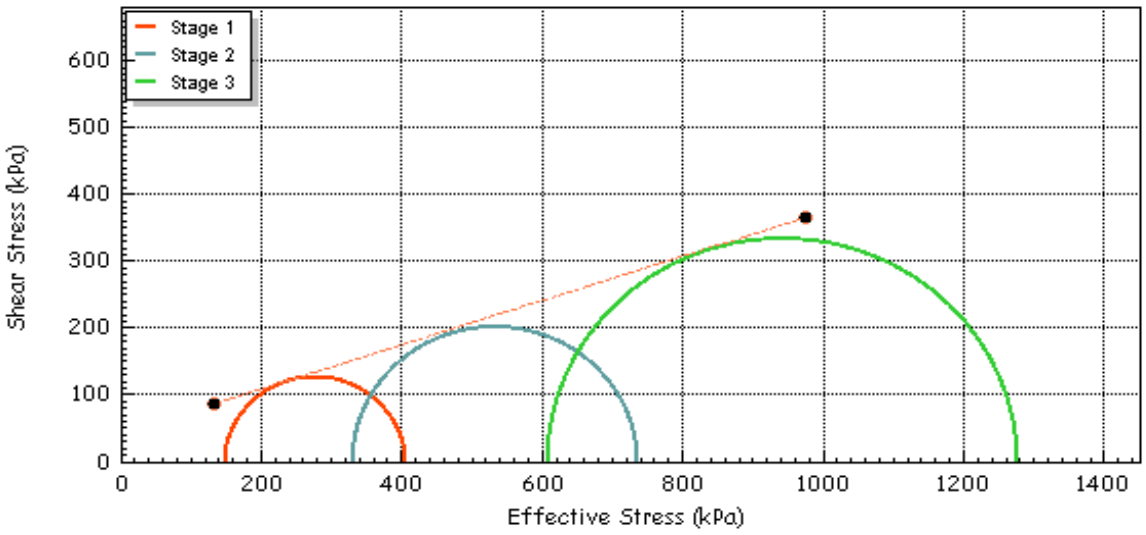
Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH19 16.45-17.00m
				Database: .\SQLEXPRESS \ 5348-PSL	
Site Reference				Test Date	07/11/2014
Jobfile	Rivenhall			Sample	16.45-17.00m
Client	CC Ground Investigations Ltd.			Borehole	BH19
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

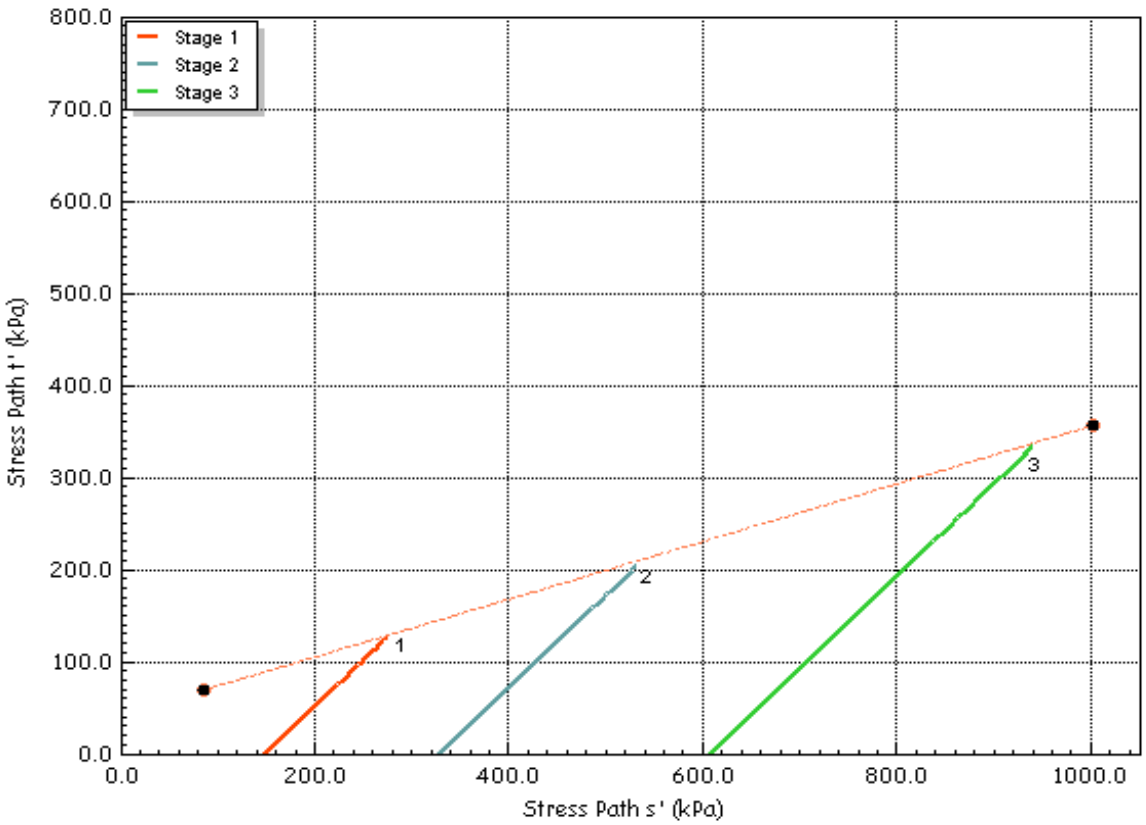
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	44.57	Effective Cohesion	c'	(kPa)	44.57
Effective Friction	ϕ'	(deg)	18.2	Effective Friction	ϕ'	(deg)	18.2





Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH19 16.45-17.00m	
			Database: .\SQLEXPRESS \ 5348-PSL		
Site Reference			Test Date	07/11/2014	
Jobfile	Rivenhall		Sample	16.45-17.00m	
Client	CC Ground Investigations Ltd.		Borehole	BH19	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

Consolidated Drained

Summary Report

Sample Details				
 *sketch showing specimen location in original sample*	Depth			13.50-13.95m
	Description			Brown CLAY.
	Type			Undisturbed, vertical orientation.
	Initial Length	L_0	(mm)	208.0
	Initial Diameter	D_0	(mm)	104.0
	Initial Weight	W_0	(gr)	3482.2
	Initial Bulk Density	ρ_0	(Mg/m3)	1.97
	Particle Density	ρ_s	(Mg/m3)	2.65

Initial Conditions			Stage 1	2	3	4
Initial Cell Pressure	σ_{3i}	(kPa)	538	676	952	
Initial Back Pressure	U_{bi}	(kPa)	400	400	400	
Membrane Thickness	m_b	(mm)	0.400			
Displacement Input	L_{IP}	(mm)	CH 2			
Load Input	N_{IP}	(N)	CH 1			
Pore Water Pressure Input	u_{pwp}	(kPa)	CH 3			
Sample Volume	V	(cm3)	CH 2			
Initial Moisture	$\omega_i\%$	(%)	25			
Initial Dry Density	ρ_{di}	(Mg/m3)	1.57			
Initial Voids Ratio	e_i	.	0.686			
Initial Degree of Saturation	S_i	(%)	98			
B Value	B	.	0.96			

Final Conditions						
Final Moisture	$\omega_f\%$	(%)	25			
Final Dry Density	ρ_{df}	(Mg/m3)	1.62			
Final Voids Ratio	e_f	.	0.637			
Final Degree of Saturation	S_f	(%)	100.0			
			Stage 1	2	3	4
Failure Criteria		.	Max. Dev. Stress	Max. Dev. Stress	Max. Dev. Stress	
Strain At Failure	$\varepsilon\%$	(%)	3.62	6.43	8.79	
Stress At Failure	$(\sigma_1-\sigma_3)$	(kPa)	183.8	274.9	332.0	
Minor Stress At Failure	σ_3'	(kPa)	126.0	231.0	302.0	
Major Stress At Failure	σ_1'	(kPa)	309.8	505.9	634.0	
Principal Stress At Failure	σ_1'/σ_3'		2.459	2.190	2.099	

Notes

Test Method	BS1377-8 : 1990 : Clause 8	Test Name	BH20 13.50-13.95m
		Test Date	03/11/2014
Site Reference		Borehole	BH20
Jobfile	Rivenhall	Sample	13.50-13.95m
Client	CC Ground Investigations Ltd.	Depth	13.50-13.95m

Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

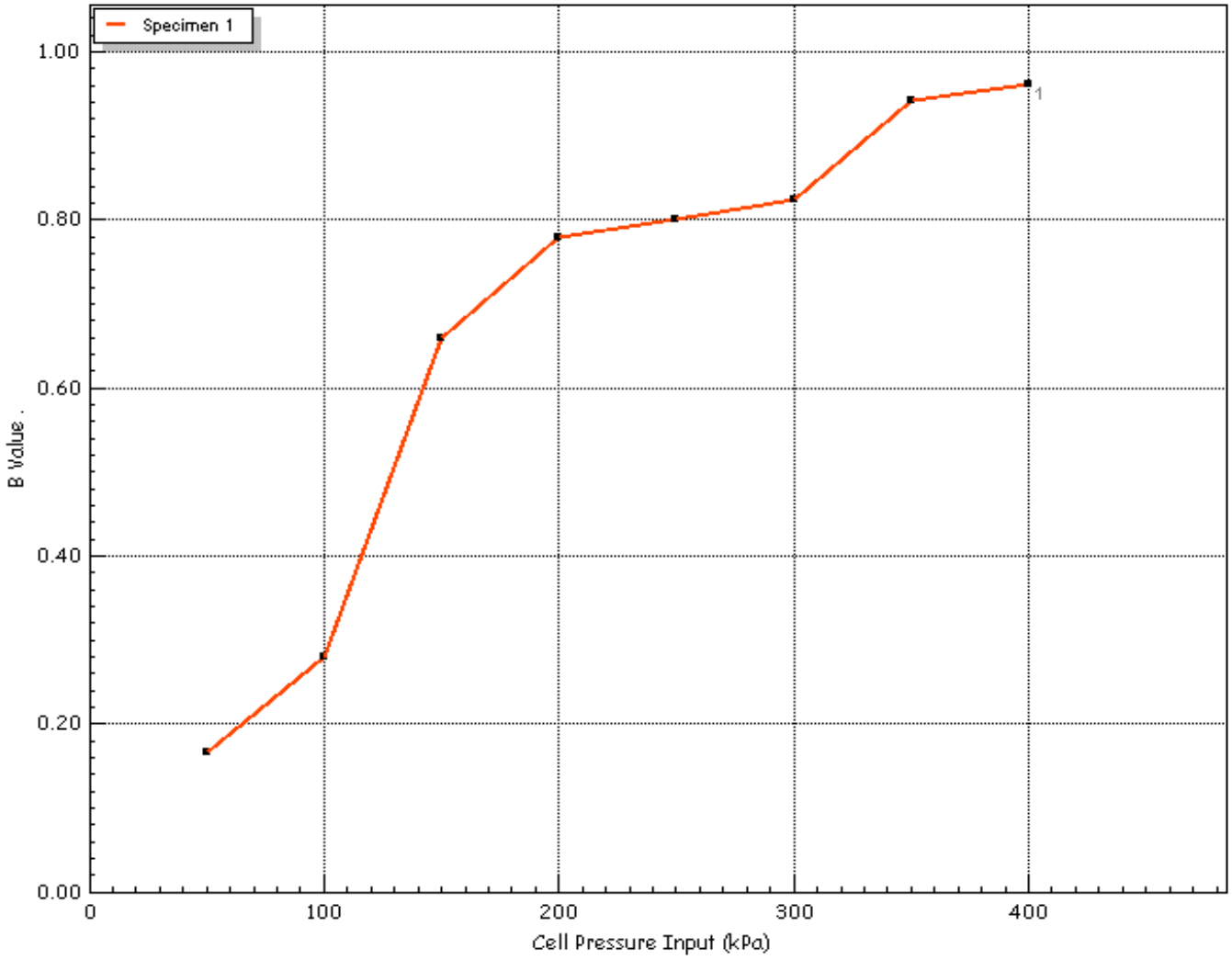
Database: .\SQLEXPRESS \ PSL - System 2

Effective Stress Triaxial Compression

Consolidated Drained

Saturation Plots

			1
Saturation Method			Stepped
Cell Pressure Input	σ	(kPa)	400
Pore Water Pressure Input	u pwp	(kPa)	382
B Value	B	.	0.96



Test Method	BS1377-8 : 1990 : Clause 8			Test Name	BH20 13.50-13.95m
Database: .\SQLEXPRESS \ PSL - System 2				Test Date	03/11/2014
Site Reference				Borehole	BH20
Jobfile	Rivenhall			Sample	13.50-13.95m
Client	CC Ground Investigations Ltd.			Depth	13.50-13.95m
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

Effective Stress Triaxial Compression

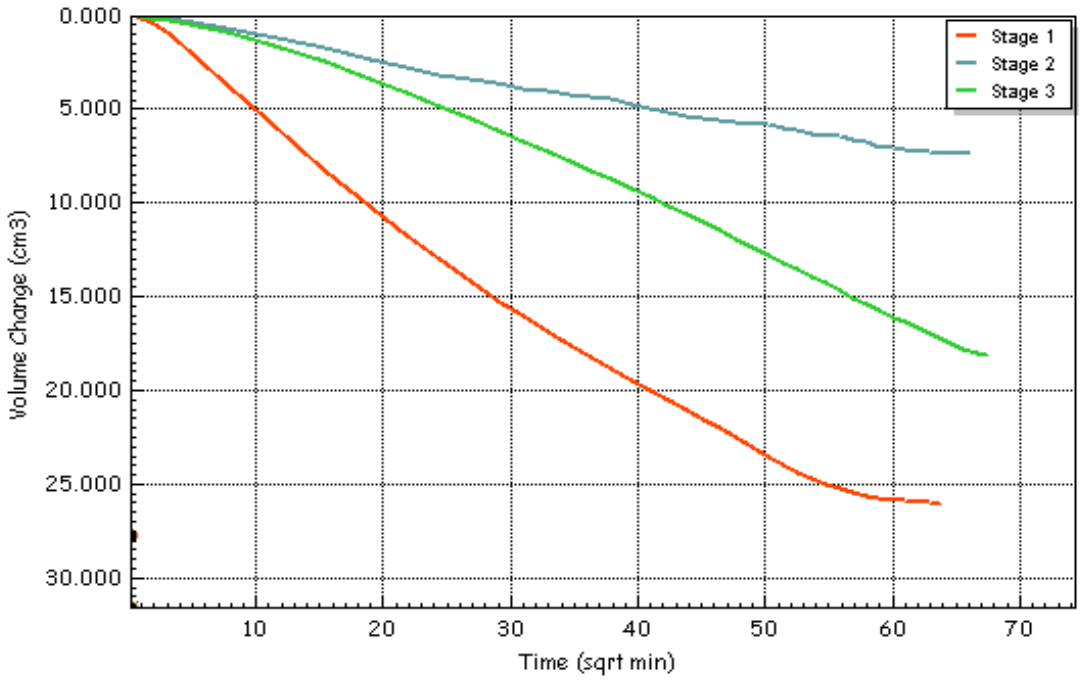
Consolidated Drained

Consolidation Plots

Initial Conditions			Stage 1	2	3
Initial Cell Pressure	σ_3	(kPa)	538	676	952
Initial Back Pressure	u_{bi}	(kPa)	400	400	400
Pore Water Pressure Input	u_{pwp}	(kPa)	498	516	575
Drainage Method			Radial+One End		

Final Conditions			Stage 1	2	3
PWP Dissipation %	U%	(%)	100.00	100.00	98.60
Volumetric Strain	ε_v%	(%)	1.48	1.89	2.92
Corrected Length	L_c	(mm)	207.0	198.2	183.1
Corrected Area	A_c	84.11	84.11	86.15	91.91
Corrected Volume	V_c	(cm3)	1740.866	1733.485	1715.407
T100 Time to Failure	t_{100}	(min)	2183.31	3428.08	4187.62
Consolidation	c_v	(m2/year)	0.102	0.065	0.053
Compressibility	m_v	(m2/MN)	0.168	18.940	0.104
Test Time	t_F	(h:m:s)	509:26:20	799:53:07	977:06:41
Estimated Strain to Failure	ε%	(%)	5.0	5.0	5.0
Shear Machine Speed	d_r	(mm/min)	0.00034	0.00021	0.00016

Notes

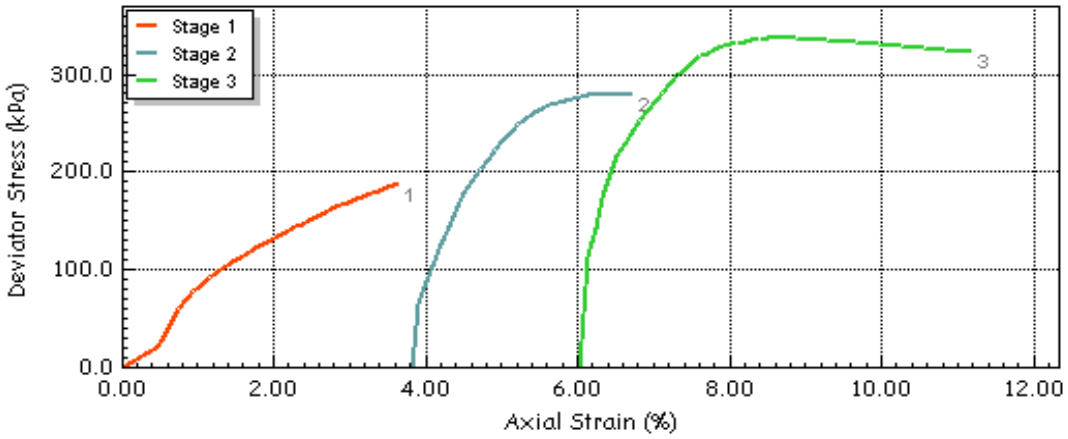


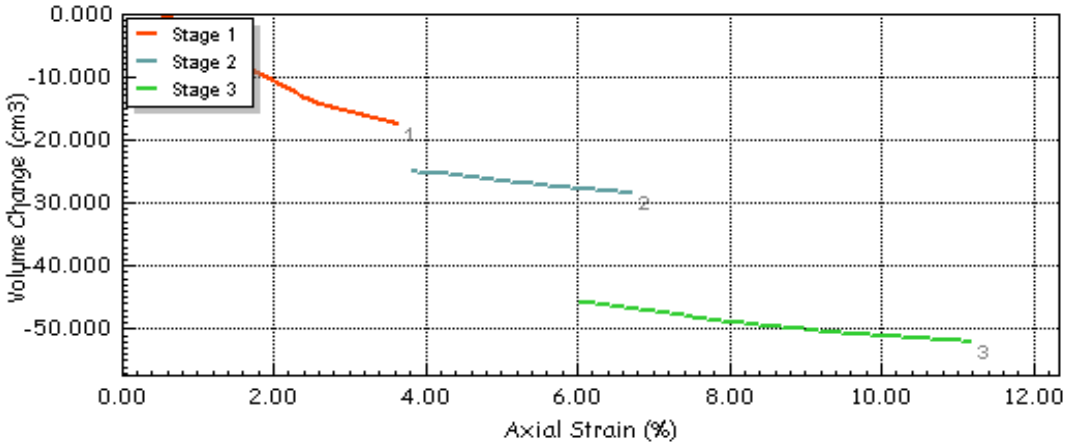
Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH20 13.50-13.95m	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	03/11/2014	
Site Reference			Borehole	BH20	
Jobfile	Rivenhall		Sample	13.50-13.95m	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

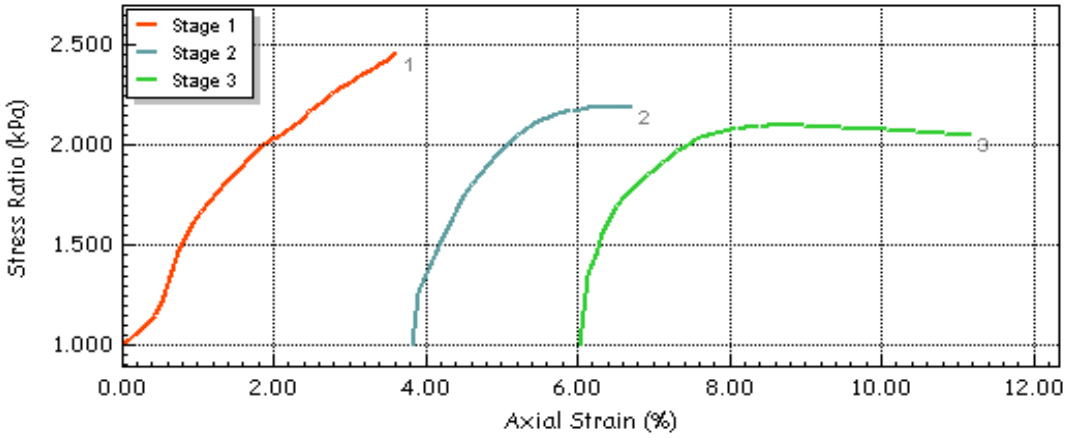
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots







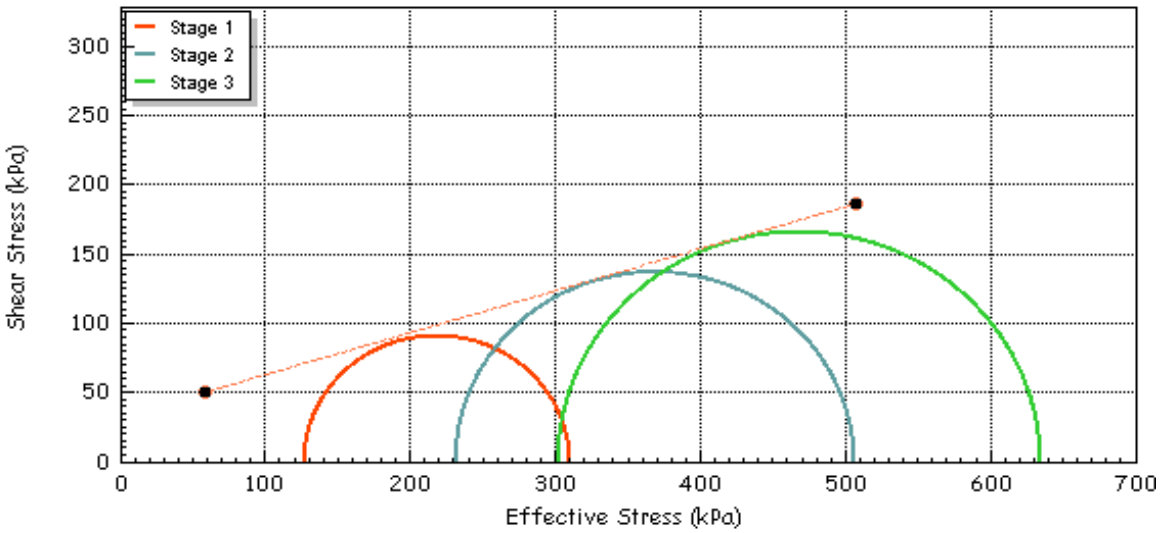
Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH20 13.50-13.95m	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	03/11/2014	
Site Reference			Borehole	BH20	
Jobfile	Rivenhall		Sample	13.50-13.95m	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

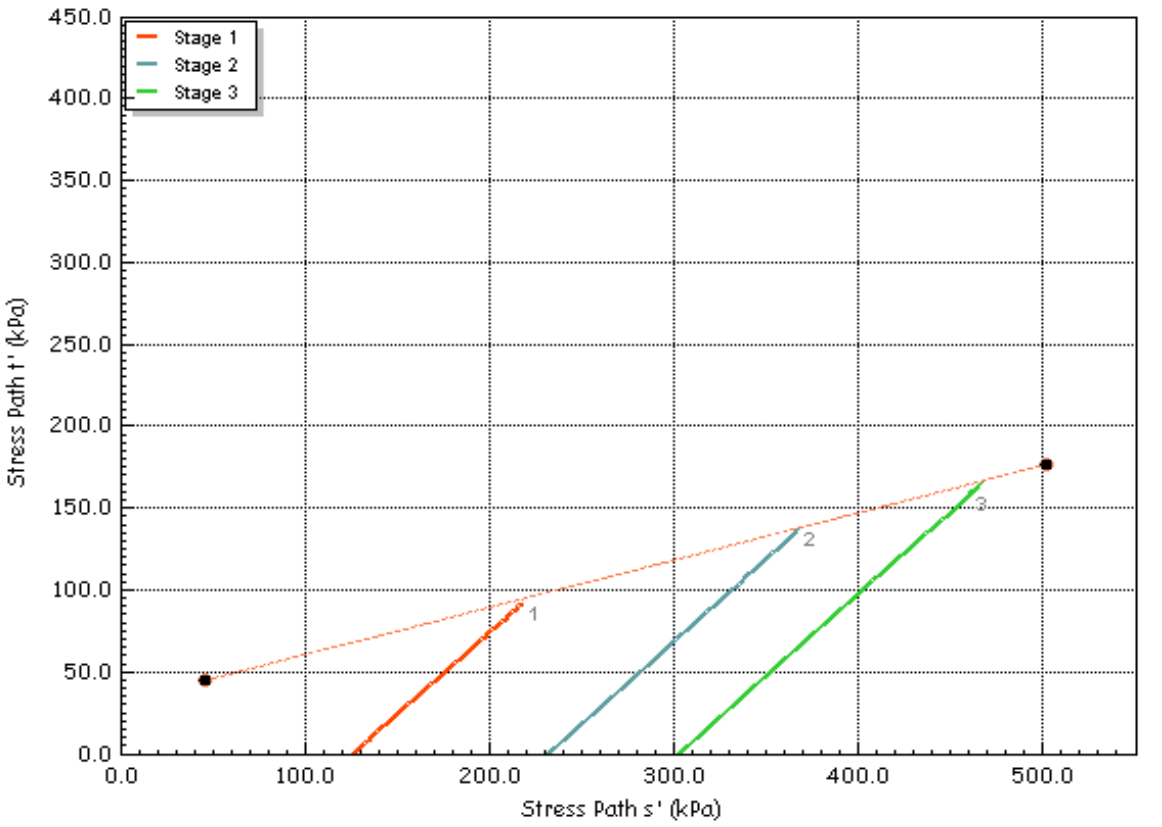
Effective Stress Triaxial Compression

Consolidated Drained

Shear Stage Plots

Effective Cohesion	c'	(kPa)	32.68	Effective Cohesion	c'	(kPa)	32.63
Effective Friction	ϕ'	(deg)	16.9	Effective Friction	ϕ'	(deg)	16.9





Test Method	BS1377-8 : 1990 : Clause 8		Test Name	BH20 13.50-13.95m	
Database: .\SQLEXPRESS \ PSL - System 2			Test Date	03/11/2014	
Site Reference			Borehole	BH20	
Jobfile	Rivenhall		Sample	13.50-13.95m	
Client	CC Ground Investigations Ltd.		Depth	13.50-13.95m	
Operator	David Burton	Checked	Sean Royle	Approved	Anthony Watkins

APPENDIX D

Appendix D – Self Boring Pressure Meter Testing Results

RIVENHALL AIRFIELD
GROUND INVESTIGATION

Results of self bored pressuremeter testing carried out by Cambridge Insitu July-August 2014

Our reference: **CIR1309/14**
Main Contractor's ref: **C4237**
Original report date: **August 2014**
Version: **1.0**

Volume 2 of 2

Data for tests in boreholes BH12 and BH14

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Table 1 Details of the work carried out

Test	Internal reference	Date	Depth	Distance bored	Max Press.	Material
BH12			**(mBGL)**	**(m)**	**(kPa)**	
Test 1	B12T1	31/07/14	20.2	1.0	2055	London Clay
Test 2	B12T2	01/08/14	30.0	1.1	2529	London Clay
Test 3	B12T3	06/08/14	39.6	1.0	3216	London Clay
BH14						
Test 1	B14T1	31/07/14	20.4	1.0	1623	London Clay
Test 2	B14T2	05/08/14	30.2	1.0	2068	London Clay
Test 3	B14T3	07/08/14	40.5	1.0	2650	London Clay

Table 2 – Background details

Probe type	Probe ref.	Operator	Displacement Calibration	Pressure calibration	Stiffness calibration	Compliance calibration
3 Arm SBP	Dougal	RW/JD	20/03/2014	01/04/2014	Z0204T14	Z0204T15

Notes:

1. Test depth is given as metres below ground level. The measure is to the centre of the expanding portion. The pressuremeter membrane is 0.46 metres long for the SBP3. The zone affected by the test is therefore ± 0.23m of the quoted test centre.
2. 'Max Press' refers to the maximum pressure achieved during each test, and is quoted in kilopascals.
3. RW is Robert Whittle and JD is James Dalton.
4. For all tests the drilling device was a small drag bit.

The remainder of this volume is laid out as follows:

- There is a plot of all the field curves on the same axes.
- This is followed by a section where all the stiffness/strain curves are collected.
- Thereafter the individual results and plots showing the derivation of the results are given. For each test the pages are in approximately the following order:

Plots from the analysis program WINSITU:

1. A Results Summary Sheet
2. A plot of total pressure against cavity strain, using the output from the average of all displacement followers.
3. A plot of total pressure against the initial part of the expansion, showing the pressure at which the cavity begins to expand and hence giving a value for the cavity reference pressure P_o.
4. A plot of Total pressure/Radial displacement showing the slope identified as the initial shear modulus, the apparent yield stress and the cavity reference pressure inferred from this yield stress (Marsland & Randolph 1977, Hawkins 1990).
5. For tests showing excess pore water pressure being generated, a plot of excess pore water pressure against total pressure. If the data allow, the total pressure at which excess pore water pressure changes its gradient is identified, hence giving an estimate of the cavity reference pressure P_o.
6. For tests in cohesive soil, a semi-log plot of total pressure against current shear strain at the cavity wall, quoting the slope and intercept. These give the undrained shear strength (c_u) and limit pressure (P_{lim}), respectively (Gibson & Anderson 1961, Bolton & Whittle 1999).
7. For tests in cohesive soil, a semi-log plot of total pressure against current shear strain at the cavity wall using contraction data, quoting the slope and the derived undrained shear strength (c_u) (Jefferies, 1988)
8. For tests in cohesive soil, a plot of shear stress against current shear strain at the cavity wall using loading data (Palmer, 1972).
9. For tests in cohesive soil, a plot of shear stress against current shear strain at the cavity wall using contraction data (Palmer, 1972).
10. Plots on axes of Radial displacement/Total Pressure showing enlarged views of unload/reload cycles and quoting shear modulus G.
11. Plots on axes of Ln[current cavity shear strain]/Ln[Total Pressure] showing loop reloading paths and quoting the gradient and intercept for each loop.
12. A plot on axes of secant shear modulus/Log[Shear strain] showing the decay of stiffness against strain curves derived from fitting a power law function to reloading data, all cycles. Individual data points obtained from applying Palmer (1972) directly to reloading data are also shown.
13. For undrained tests in cohesive soils, a plot on axes of Average Cavity Strain/Total pressure showing the results of curve fitting the field curve with the best set of parameters using a non-linear elastic/perfectly plastic solution (Whittle, '99).

Plots taken from the data collection software package WINLOG:

14. From WINLOG - On axes of Radial Displacement/Total Pressure showing average displacement.
15. From WINLOG - On axes of Radial Displacement/Total Pressure showing all displacement sensors
16. From WINLOG - On axes of Pressure /Time showing all pressure transducers.

Because the information presented here comes from a variety of sources it is not possible to number the pages in a coherent manner, although within a test some pages may be numbered.

Winsitu colour coding

Plots from the analysis program WINSITU use a colour coding scheme to distinguish between different kinds of data. The options are these:

Data description	**Colour**
On the loading path	red
On the unloading path	blue
To be ignored	grey
Loop unloading	yellow
Loop reloading	magenta
Start of a creep hold	light green
End of a creep hold	dark green

When a particular plot displays one colour only then this is arbitrary and the colour has no significance. When more than one colour is shown then the meaning is indicated above.

Figure V2.1 All tests plotted on common axes, BH12

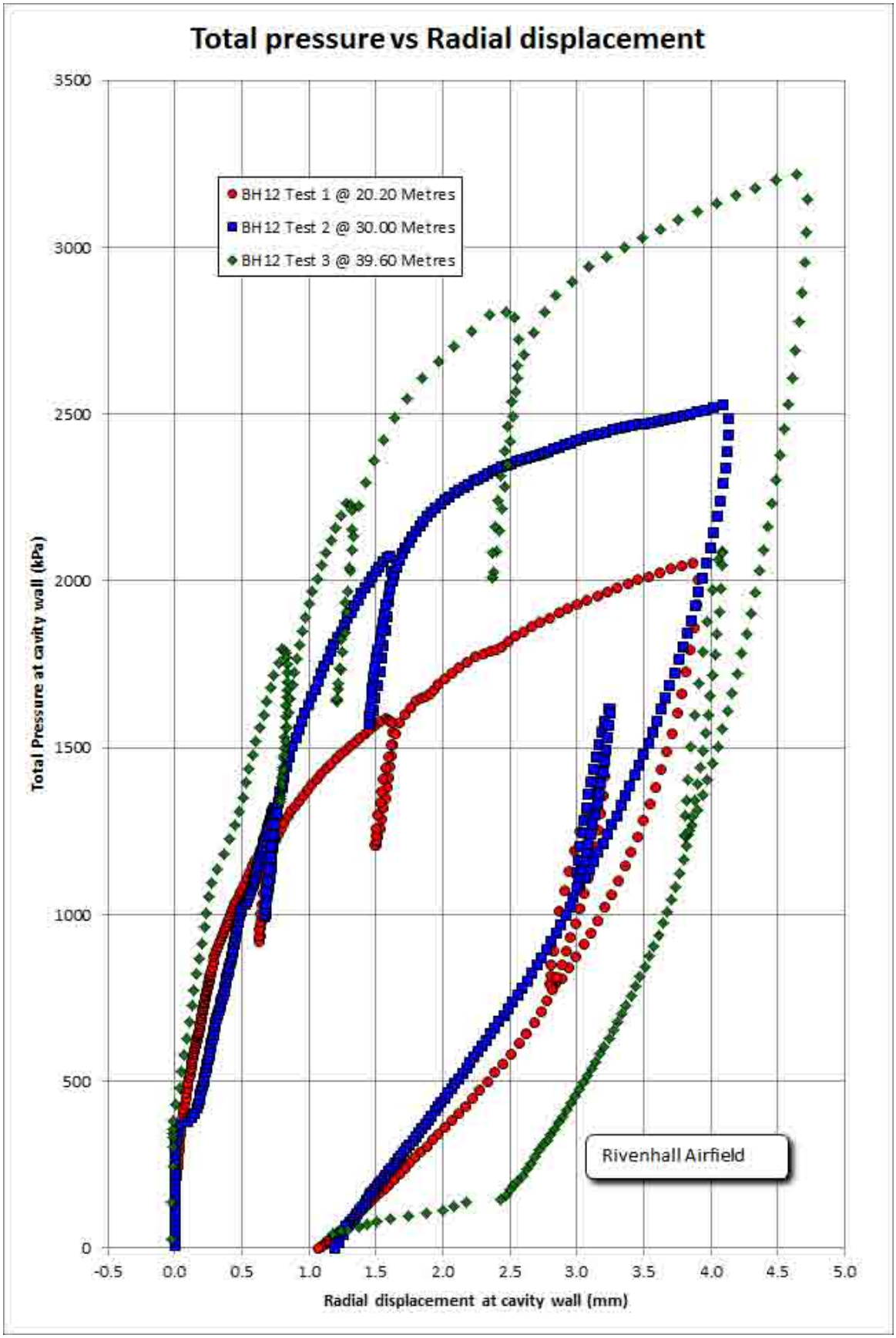
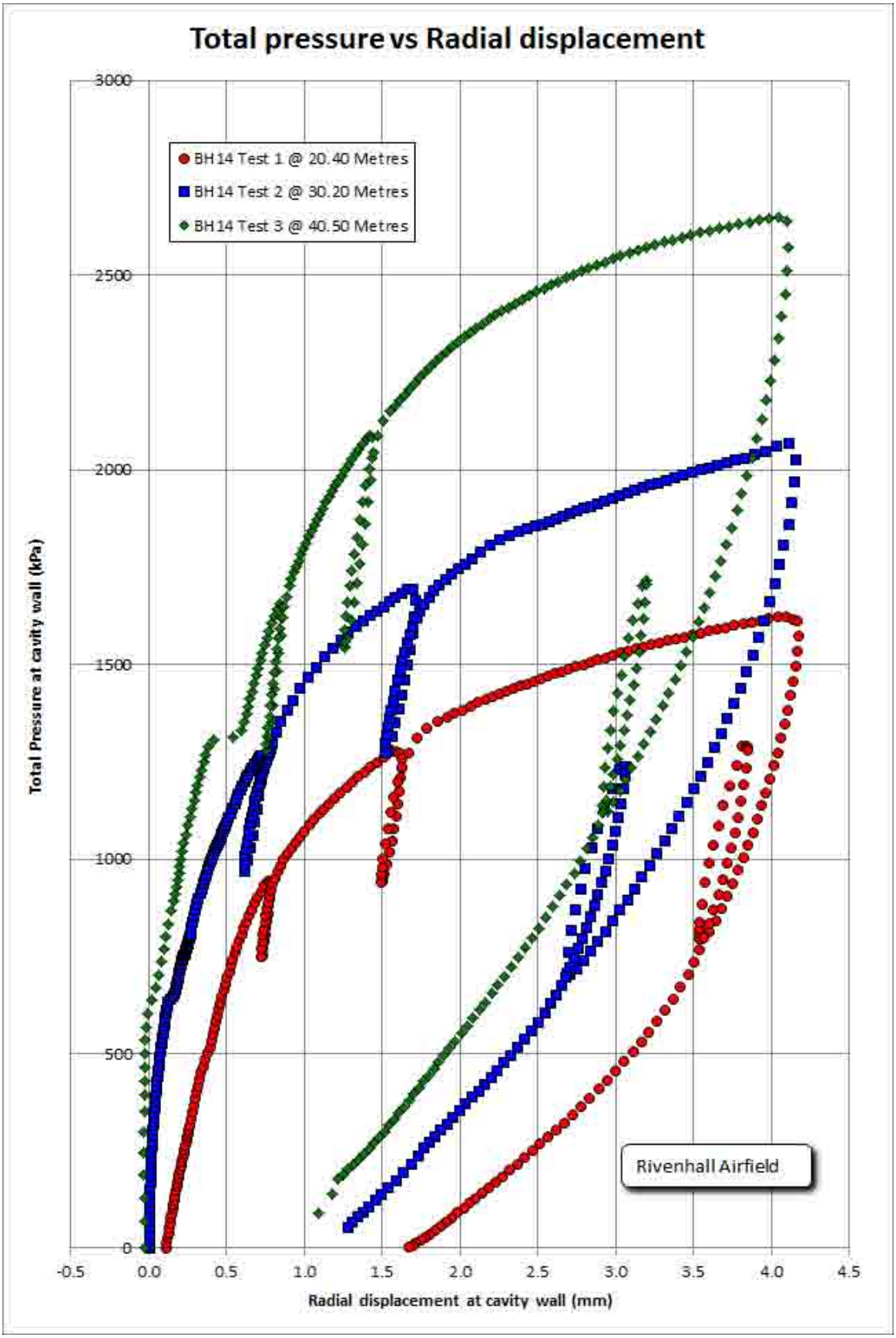
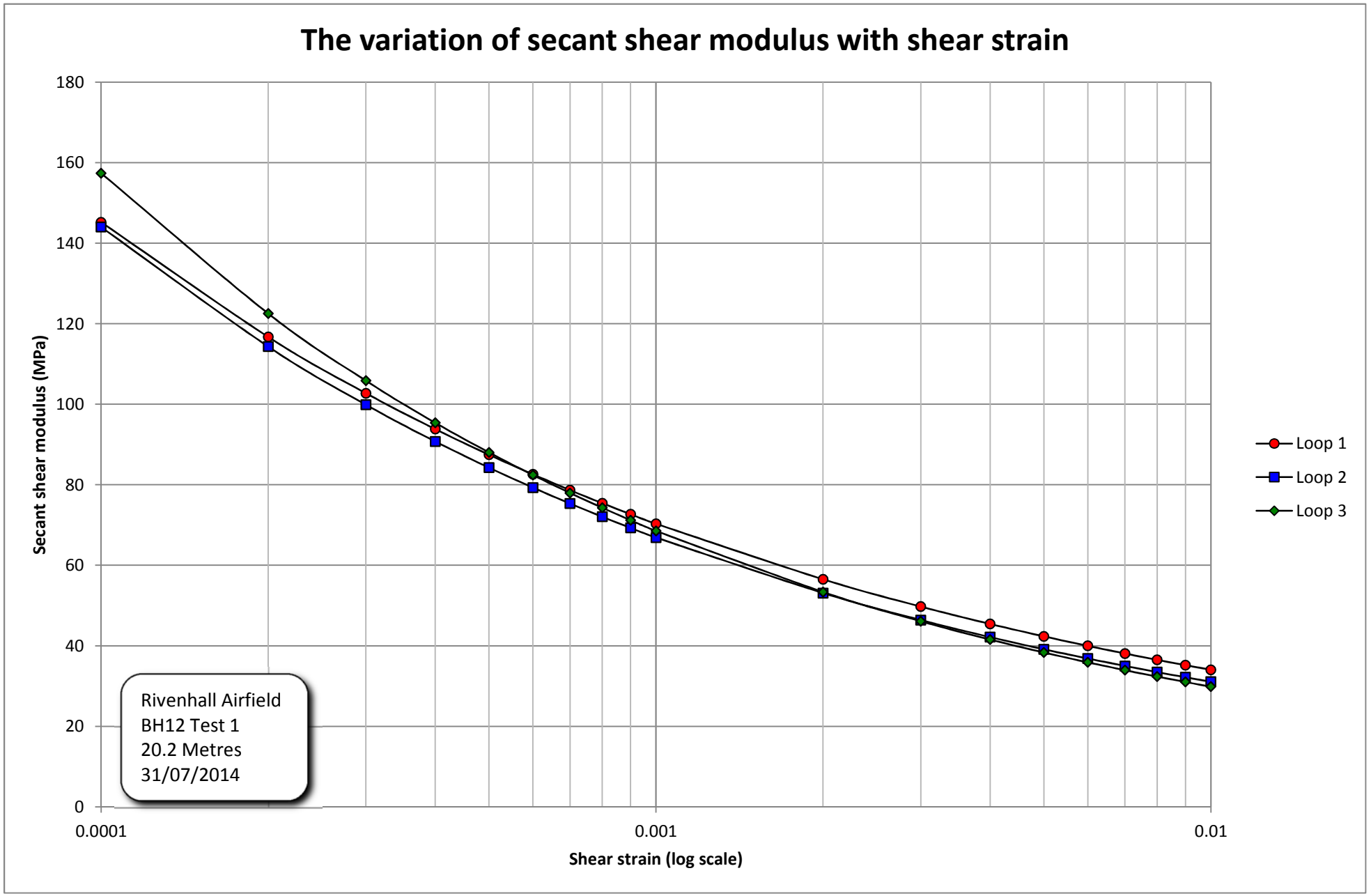


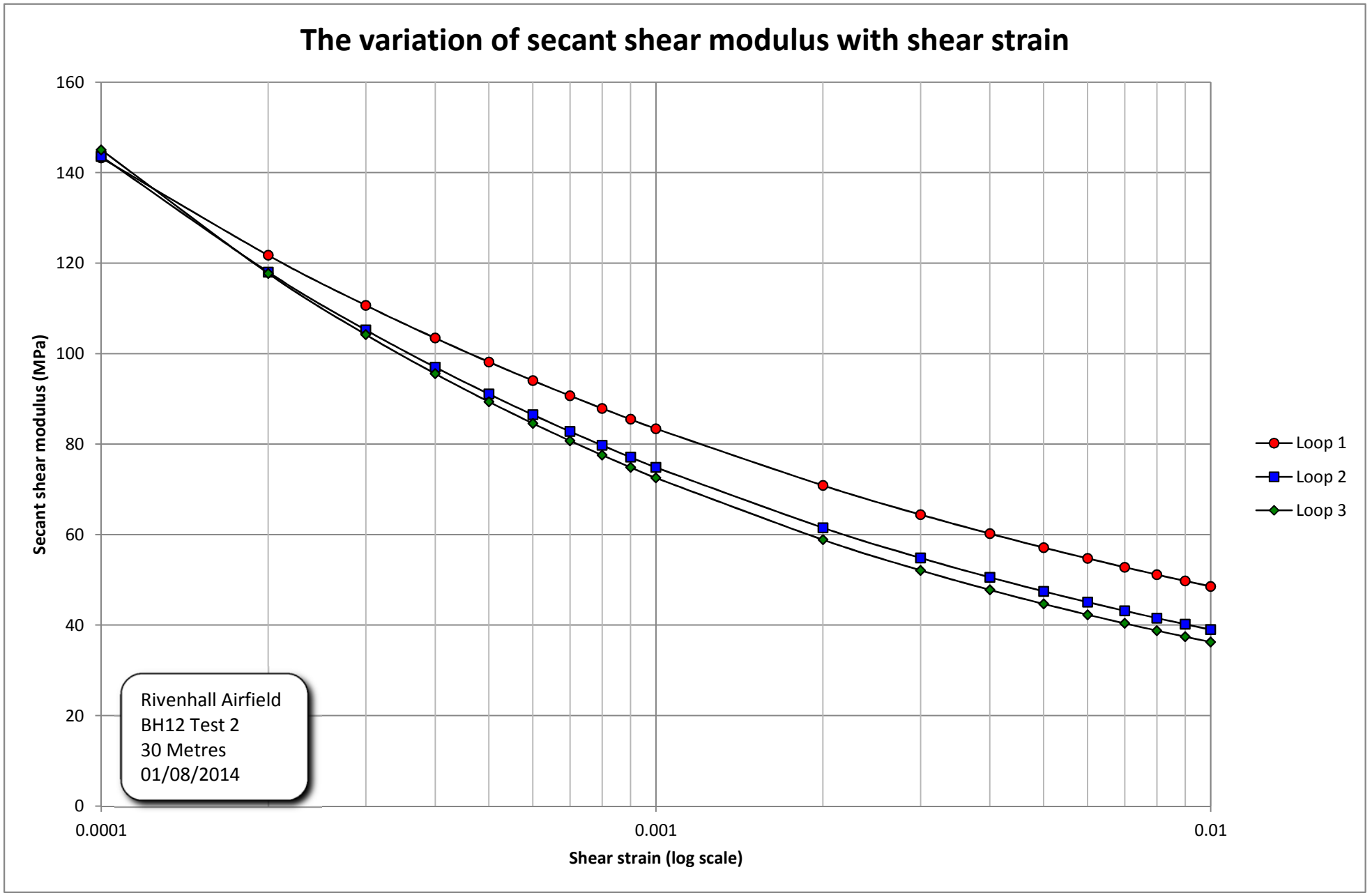
Figure V2.2 All tests plotted on common axes, BH14

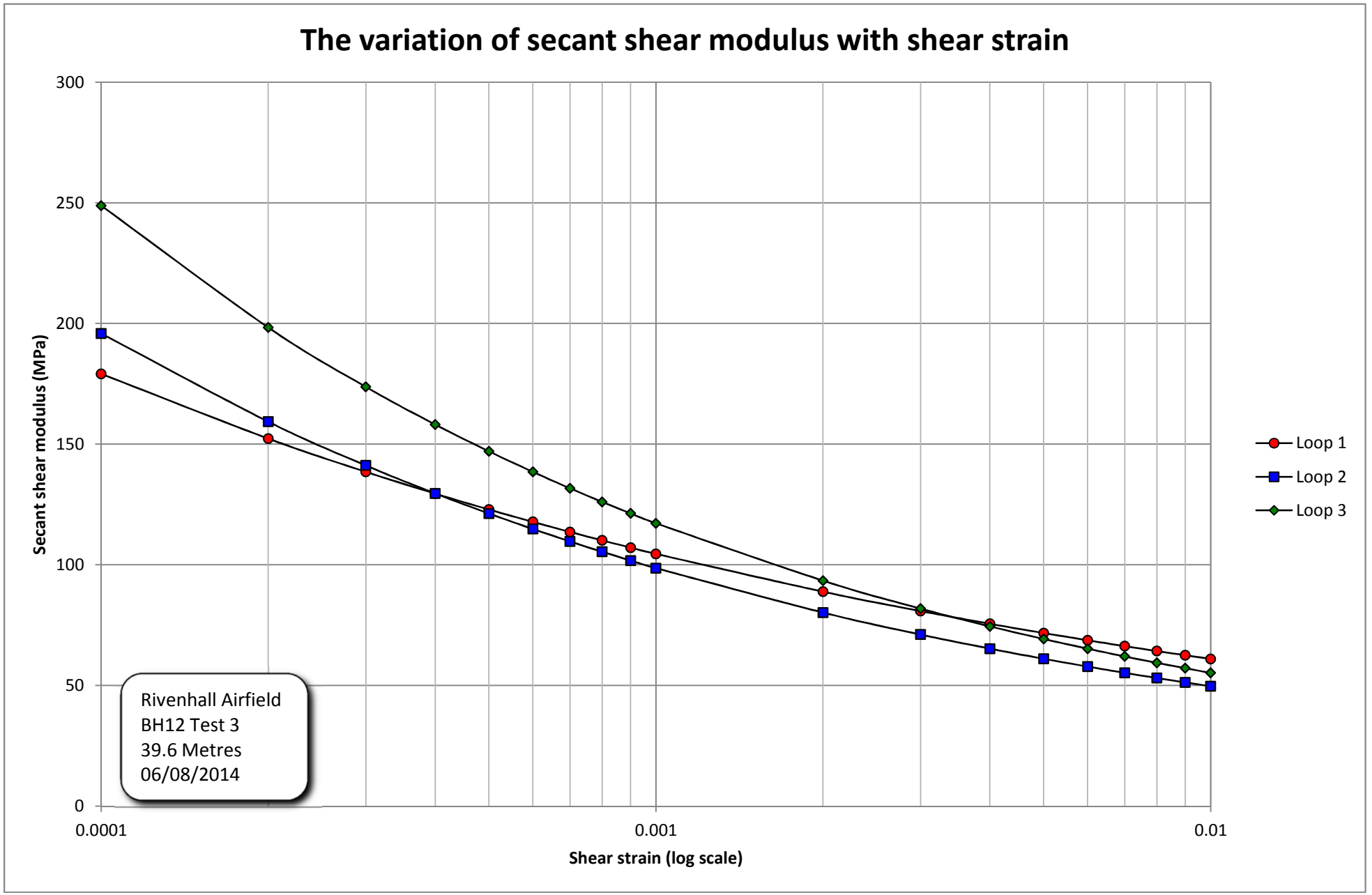


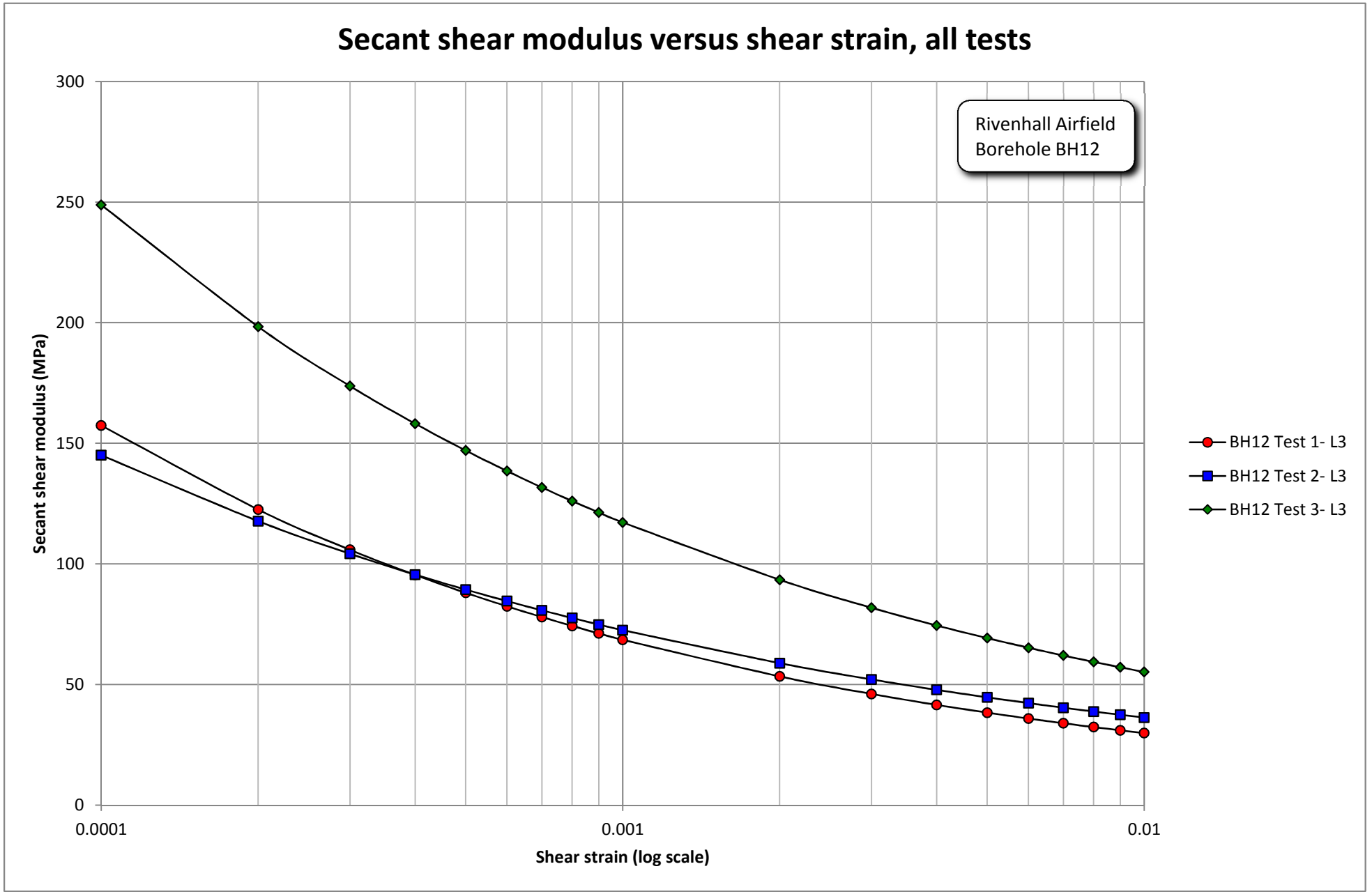
Stiffness/strain curves from unload/reload cycles

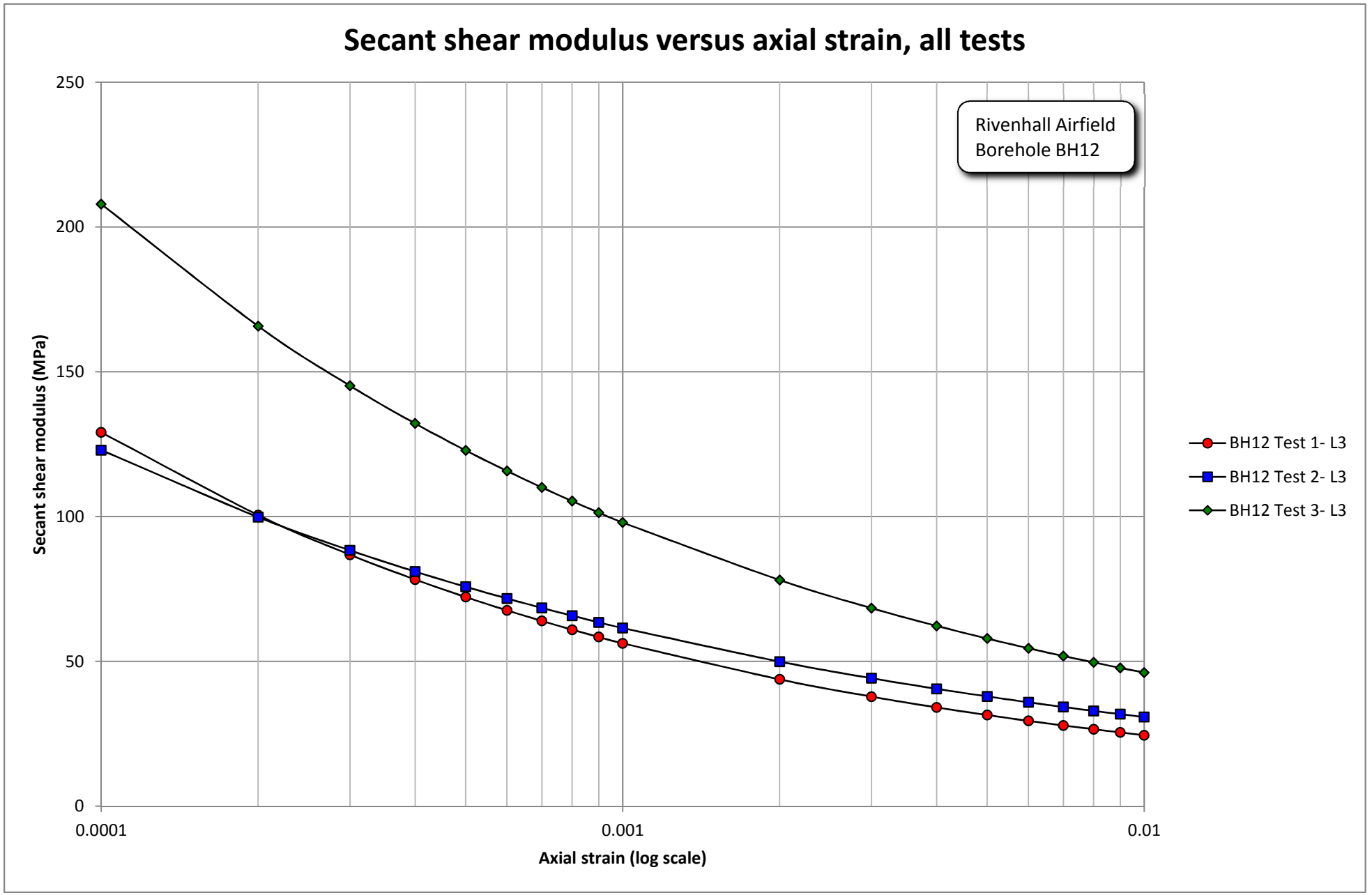
BH12

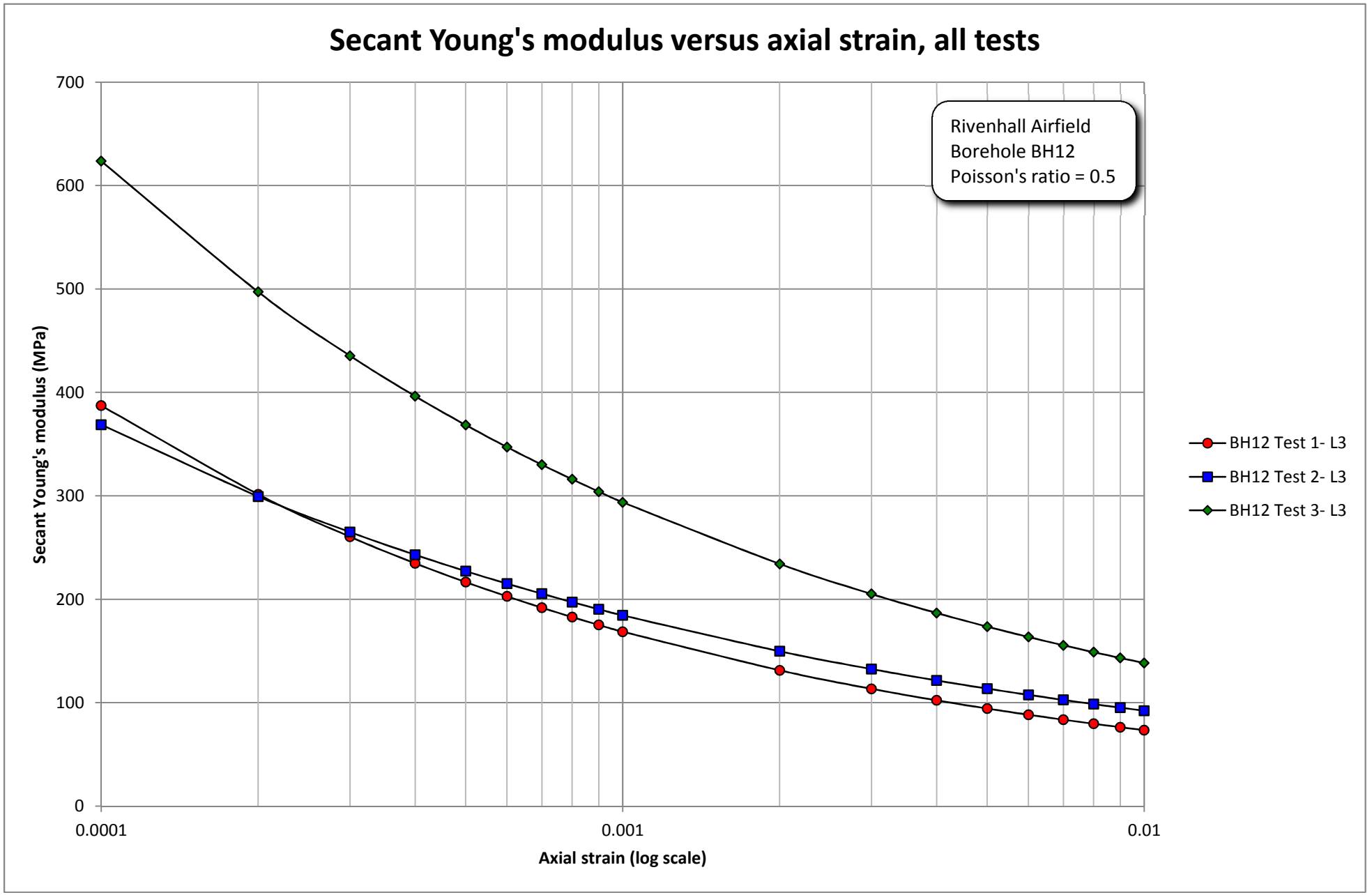

The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
180
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH12 Test 1
20.2 Metres
31/07/2014


The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH12 Test 2
30 Metres
01/08/2014


The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
300
250
200
150
100
50
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH12 Test 3
39.6 Metres
06/08/2014

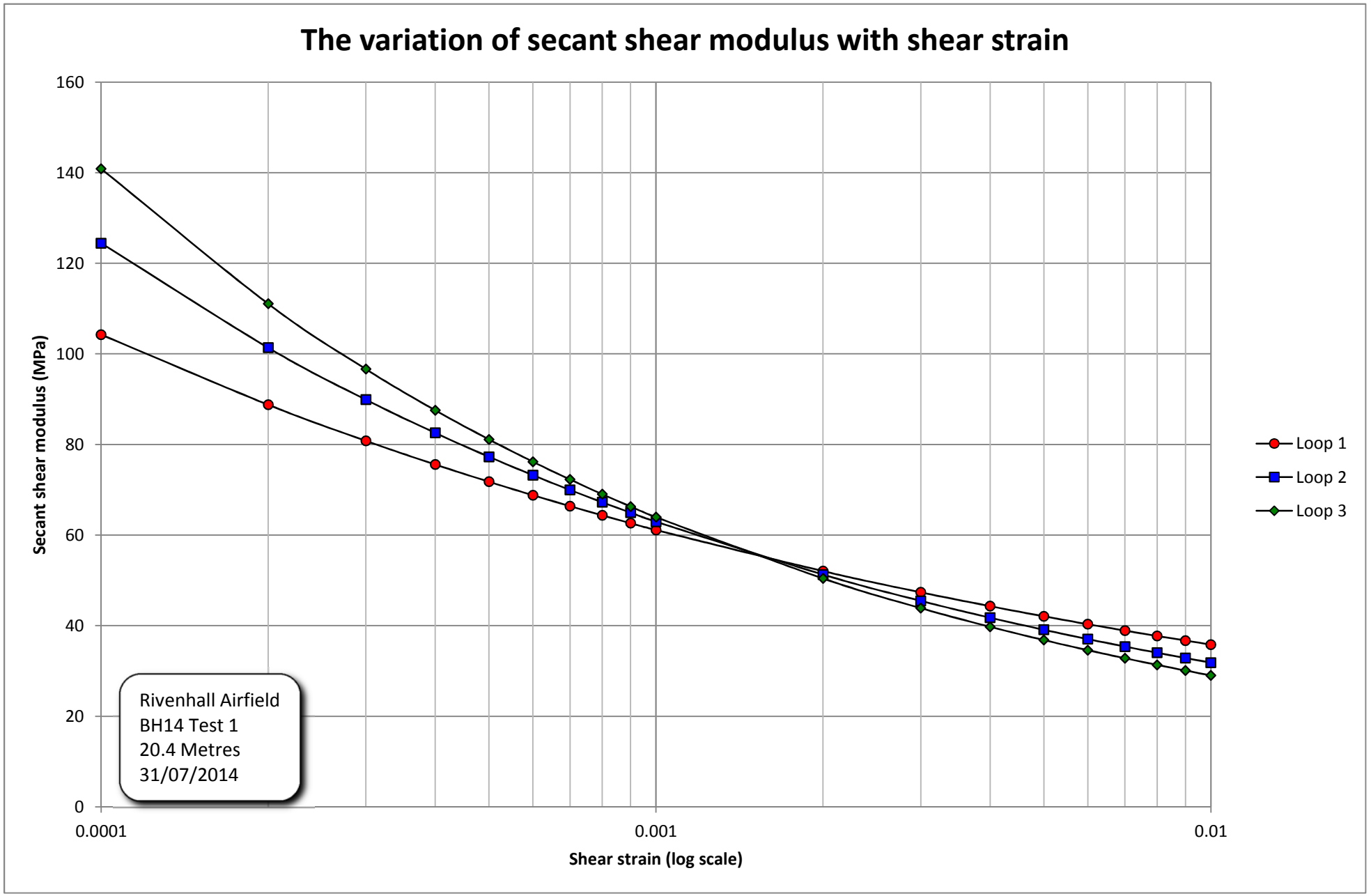

Secant shear modulus versus shear strain, all tests
Rivenhall Airfield
Borehole BH12
Secant shear modulus (MPa)
300
250
200
150
100
50
0
0.0001
0.001
0.01
Shear strain (log scale)
BH12 Test 1- L3
BH12 Test 2- L3
BH12 Test 3- L3

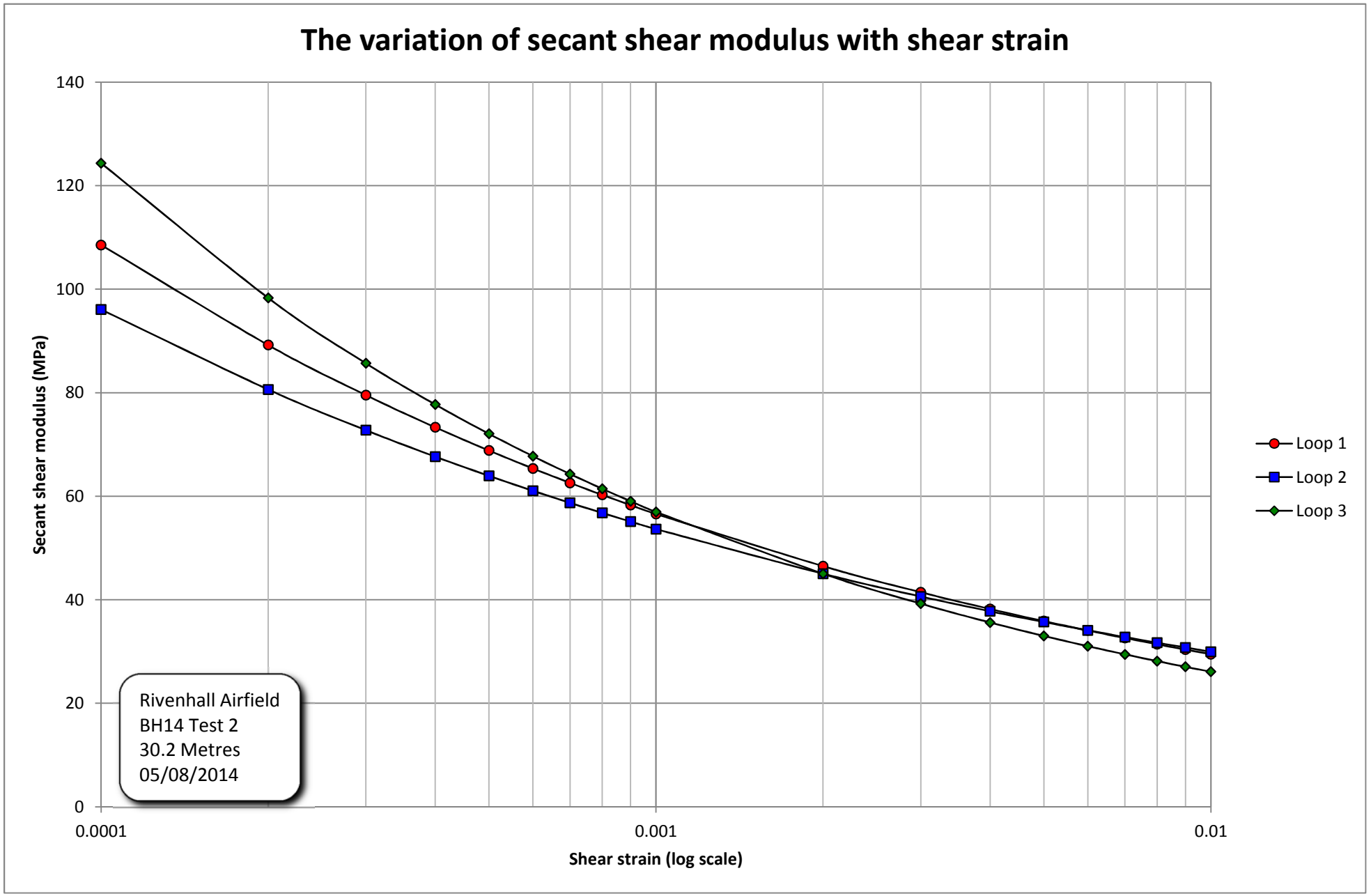

Secant shear modulus versus axial strain, all tests
Rivenhall Airfield
Borehole BH12
Secant shear modulus (MPa)
250
200
150
100
50
0
0.0001
0.001
0.01
Axial strain (log scale)
BH12 Test 1- L3
BH12 Test 2- L3
BH12 Test 3- L3

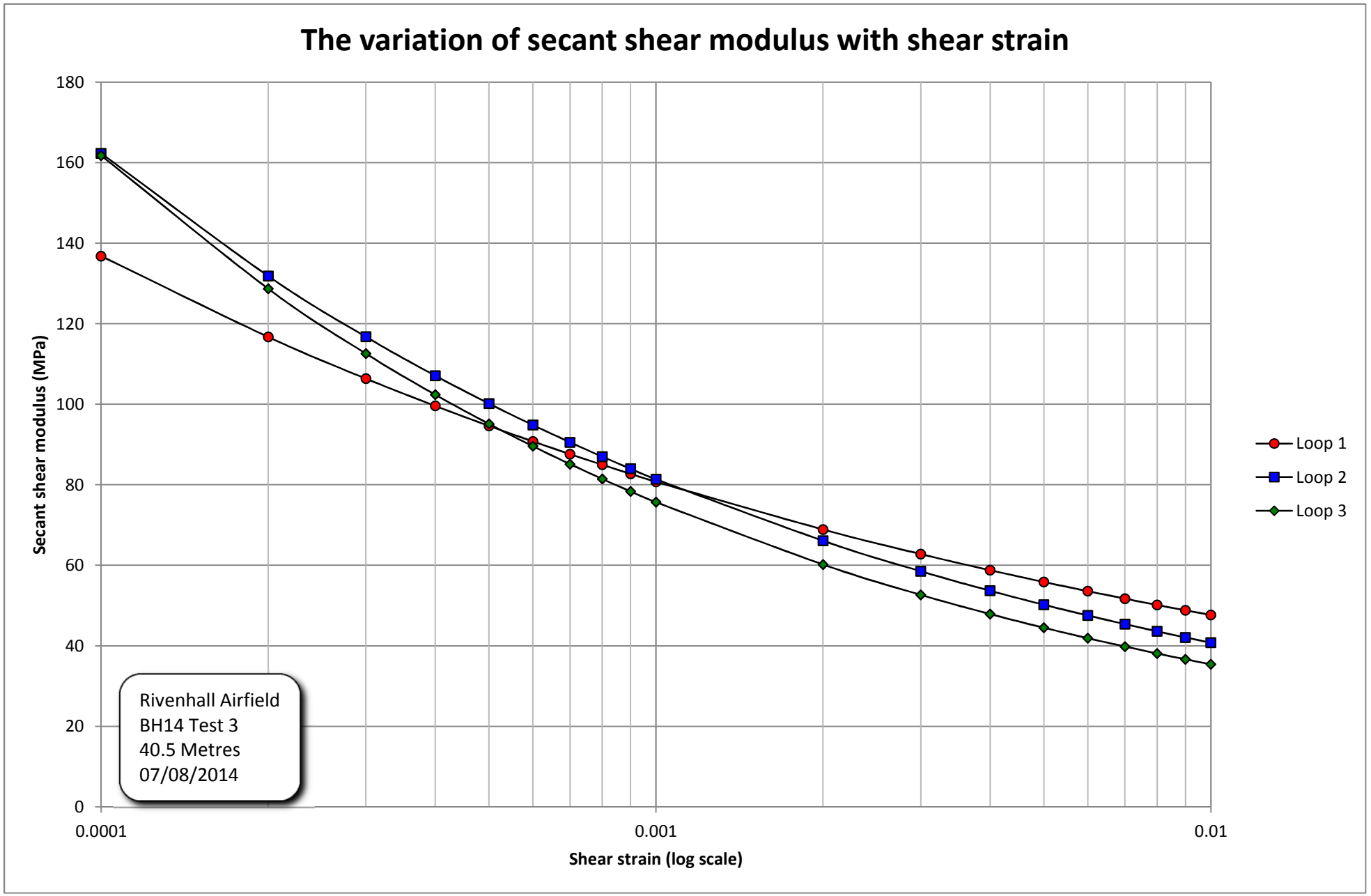

Secant Young's modulus versus axial strain, all tests
Rivenhall Airfield
Borehole BH12
Poisson's ratio = 0.5
Secant Young's modulus (MPa)
700
600
500
400
300
200
100
0
0.0001
0.001
0.01
Axial strain (log scale)
BH12 Test 1- L3
BH12 Test 2- L3
BH12 Test 3- L3

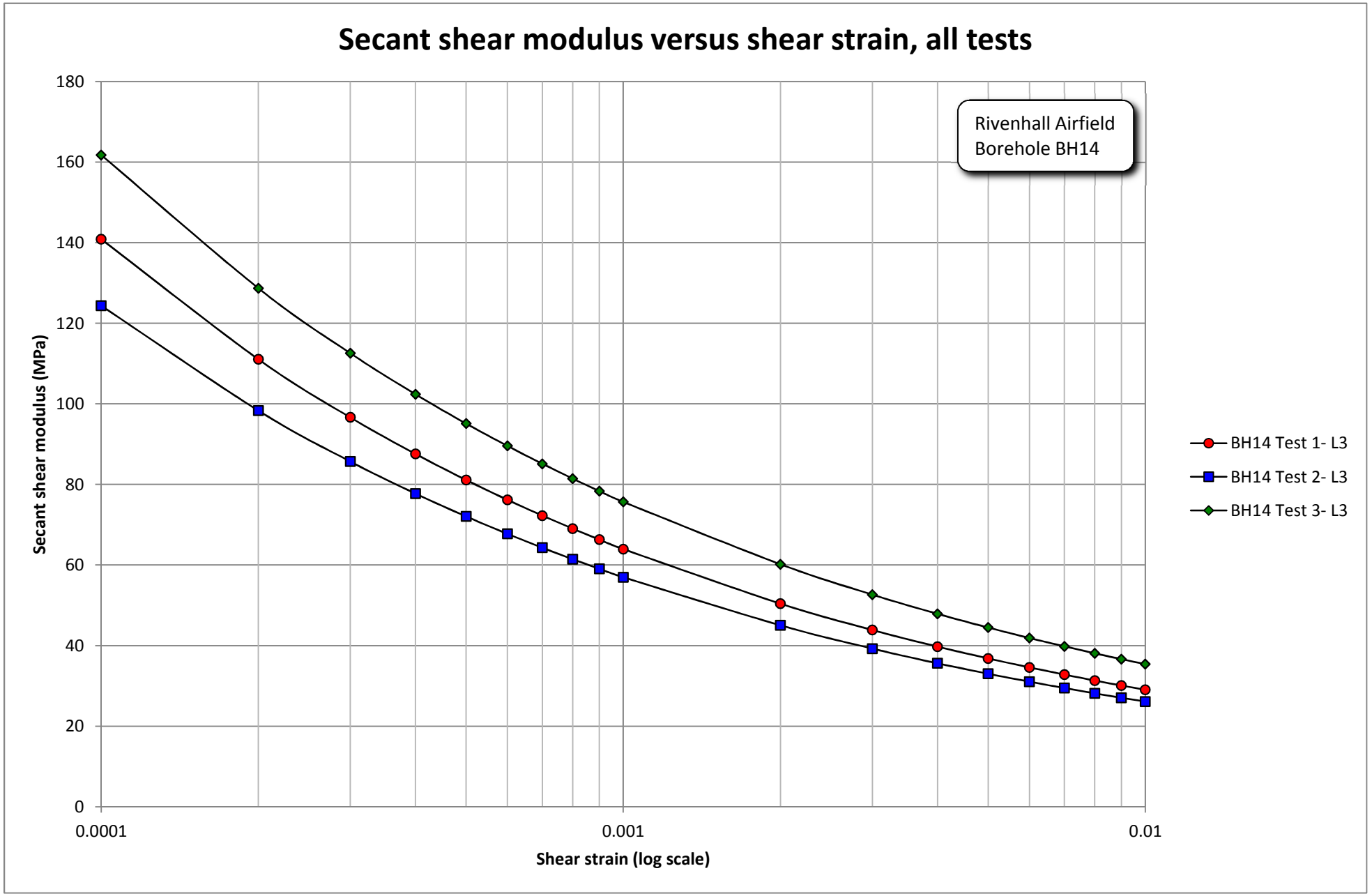
Stiffness/strain curves from unload/reload cycles

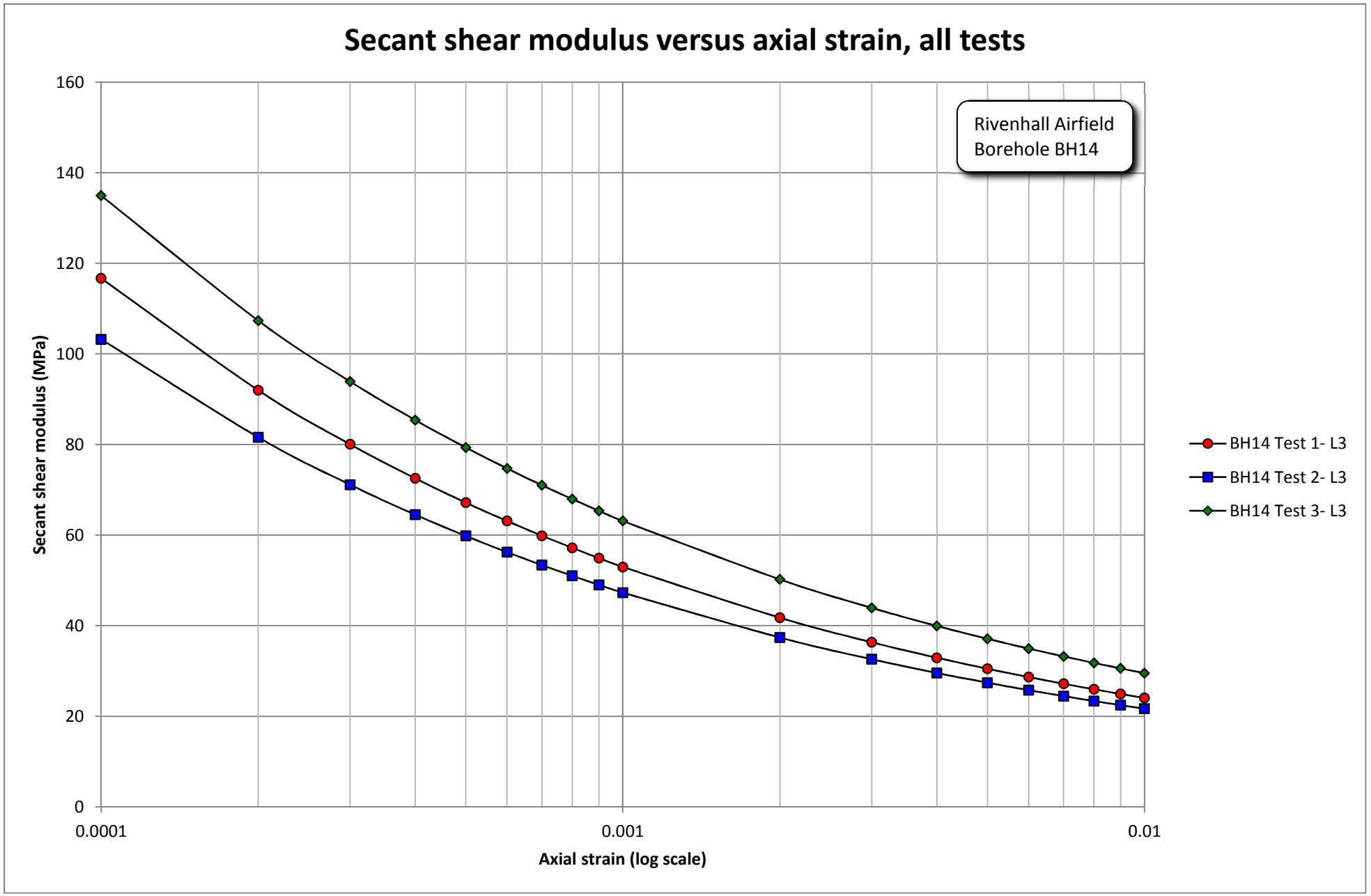
BH14

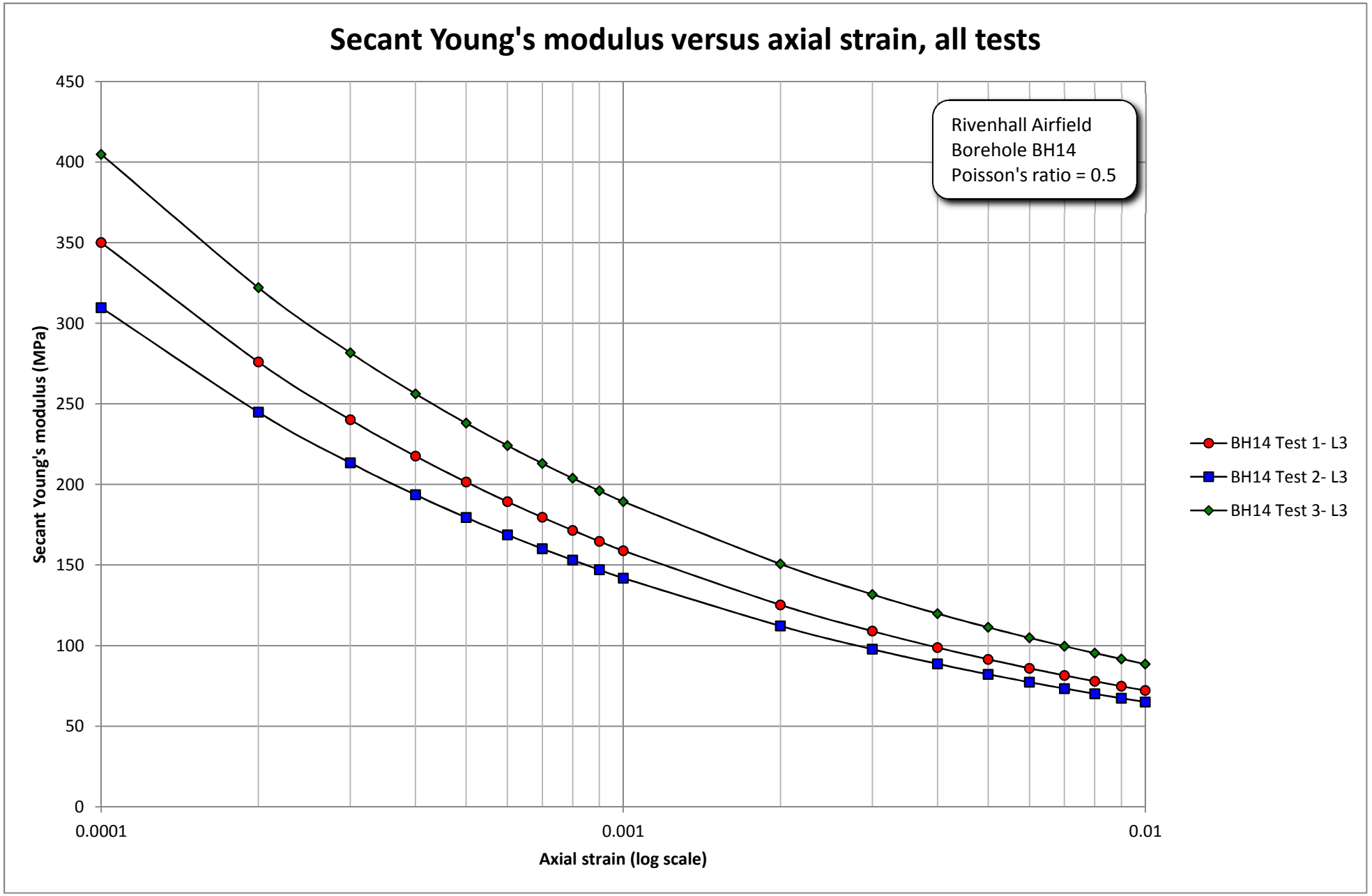

The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH14 Test 1
20.4 Metres
31/07/2014


The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH14 Test 2
30.2 Metres
05/08/2014


The variation of secant shear modulus with shear strain
Secant shear modulus (MPa)
180
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
Loop 1
Loop 2
Loop 3
Rivenhall Airfield
BH14 Test 3
40.5 Metres
07/08/2014


Secant shear modulus versus shear strain, all tests
Rivenhall Airfield
Borehole BH14
Secant shear modulus (MPa)
180
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Shear strain (log scale)
BH14 Test 1- L3
BH14 Test 2- L3
BH14 Test 3- L3


Secant shear modulus versus axial strain, all tests
Rivenhall Airfield
Borehole BH14
Secant shear modulus (MPa)
160
140
120
100
80
60
40
20
0
0.0001
0.001
0.01
Axial strain (log scale)
BH14 Test 1- L3
BH14 Test 2- L3
BH14 Test 3- L3


Secant Young's modulus versus axial strain, all tests
Rivenhall Airfield
Borehole BH14
Poisson's ratio = 0.5
Secant Young's modulus (MPa)
450
400
350
300
250
200
150
100
50
0
0.0001
0.001
0.01
Axial strain (log scale)
BH14 Test 1- L3
BH14 Test 2- L3
BH14 Test 3- L3

TEST DATA FOR INDIVIDUAL TESTS

(TAKEN FROM WINSITU and WINLOG FILES)

BH12

BH12 Test 1 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]

Project	:	C4237
Site	:	Rivenhall Airfield
Borehole	:	BH12
Test name	:	BH12 Test 1
Test date	:	31 Jul 14
Test depth	:	20.20 Metres
Water table	:	0 Metres
Ambient PWP	:	81.0 kPa
Material	:	London Clay
Probe	:	Digital 3 arm weak rock self boring pressuremeter
Diameter	:	88.0 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 31 Jul 14

Remarks: 35min to bore 1m. Hole at base of 8m pit.

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.730"
Po from Marsland & Randolph (kPa)	:	"Arm ave=549.1"
Po from Lift off (kPa)	:	"Arm ave=644.2"
Best estimate of Po (kPa)	:	"Arm ave=579.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=408.9"
Limit pressure (kPa)	:	"Arm ave=2904"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=410.4"
Undrained yield stress (kPa)	:	"Arm ave=851.9"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=44.7"

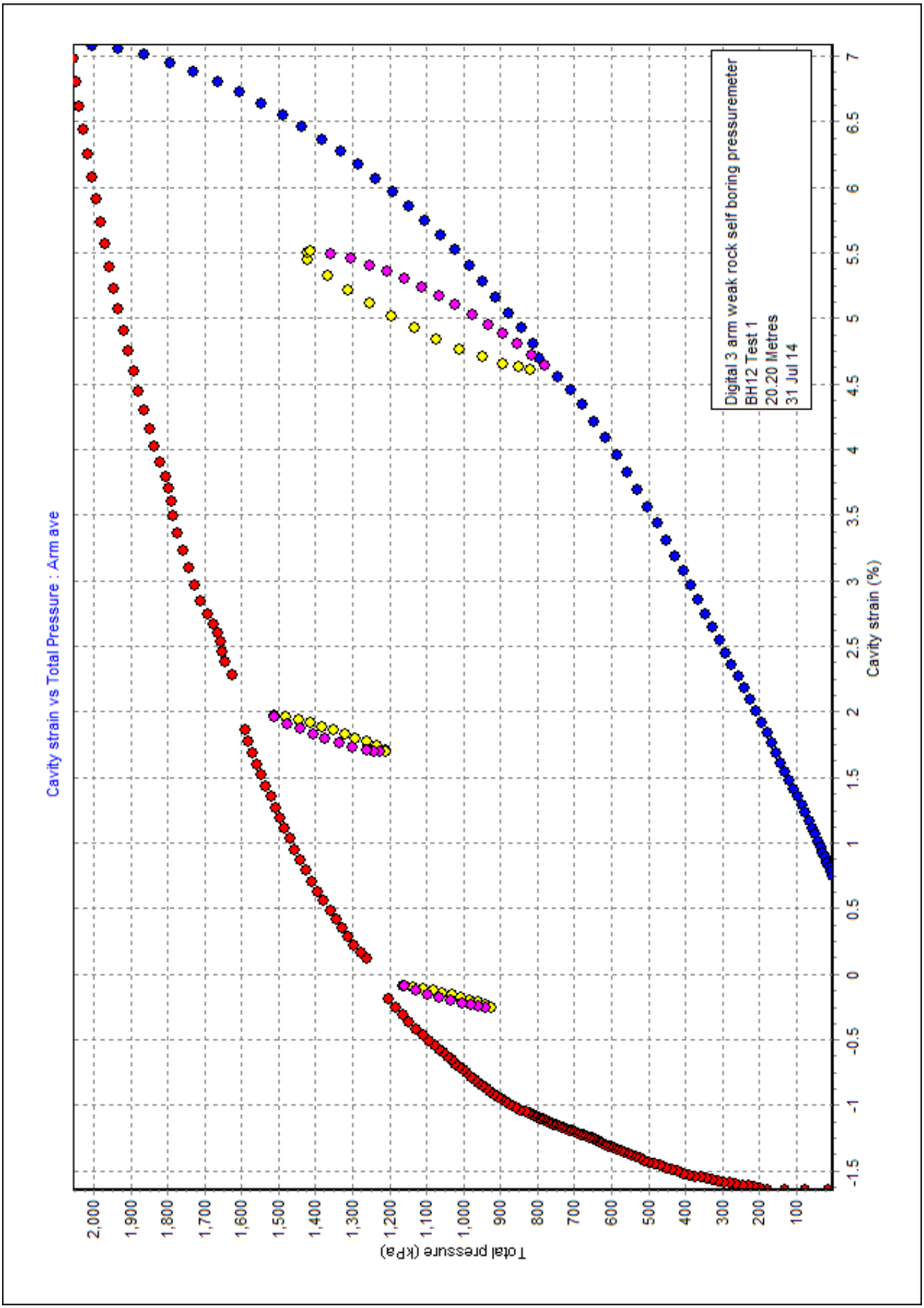
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	70.7	-0.163	1041	0.337	238
Arm ave	2	55.5	1.843	1360	0.541	301
Arm ave	3	36.6	5.071	1101	1.680	620

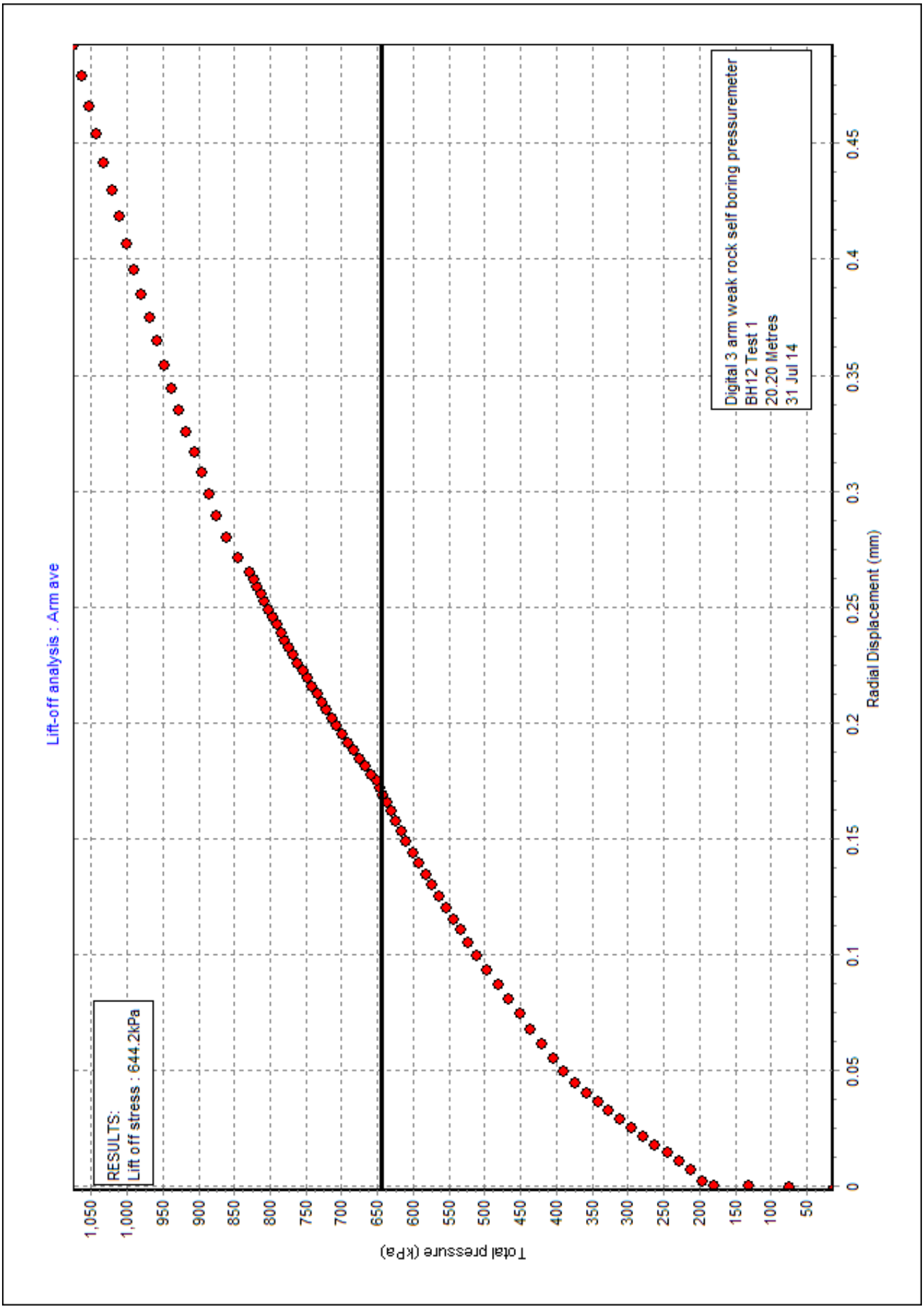
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

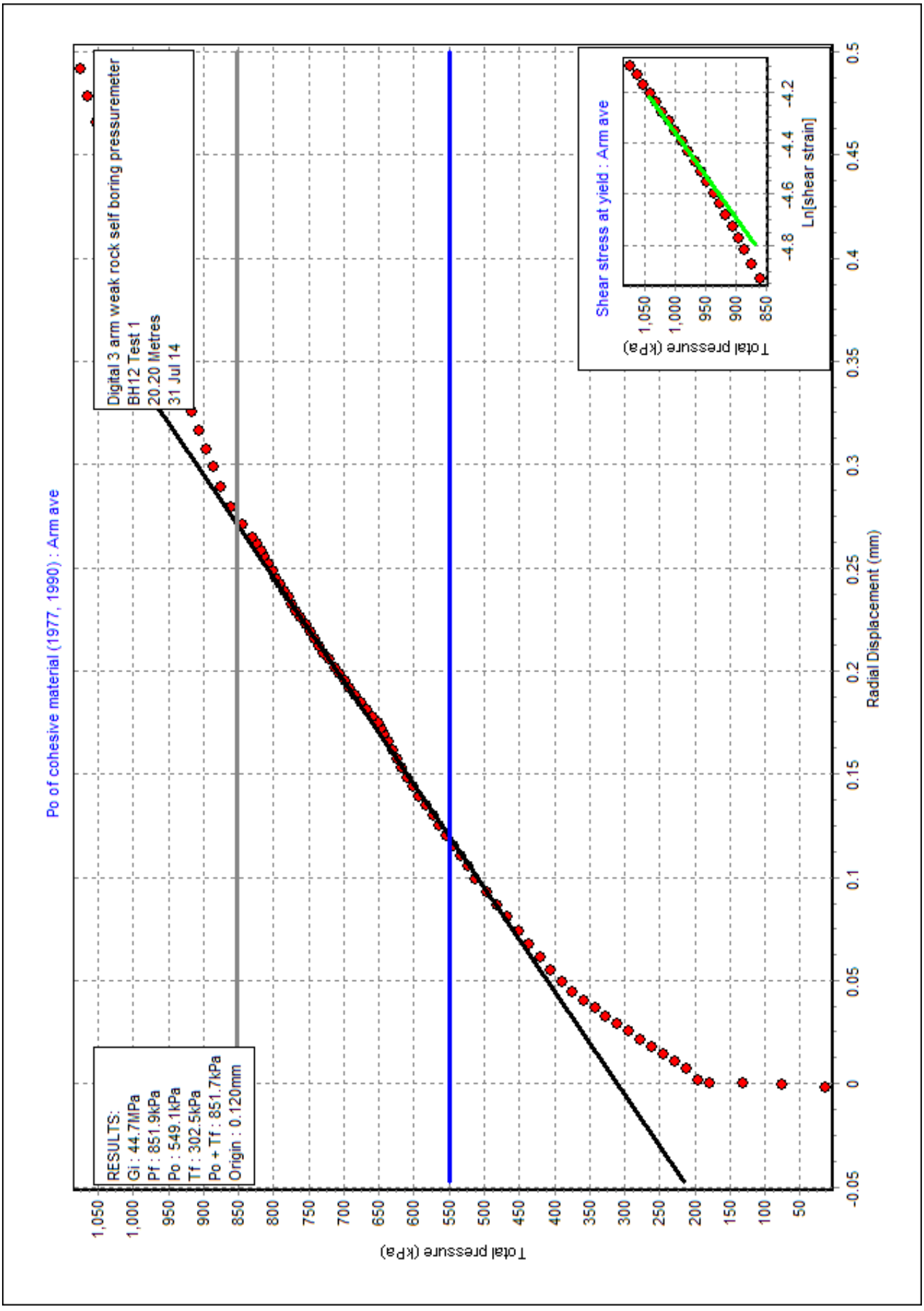
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	11.646	7.979	0.685
Arm ave	2	10.045	6.704	0.667
Arm ave	3	8.861	5.661	0.639

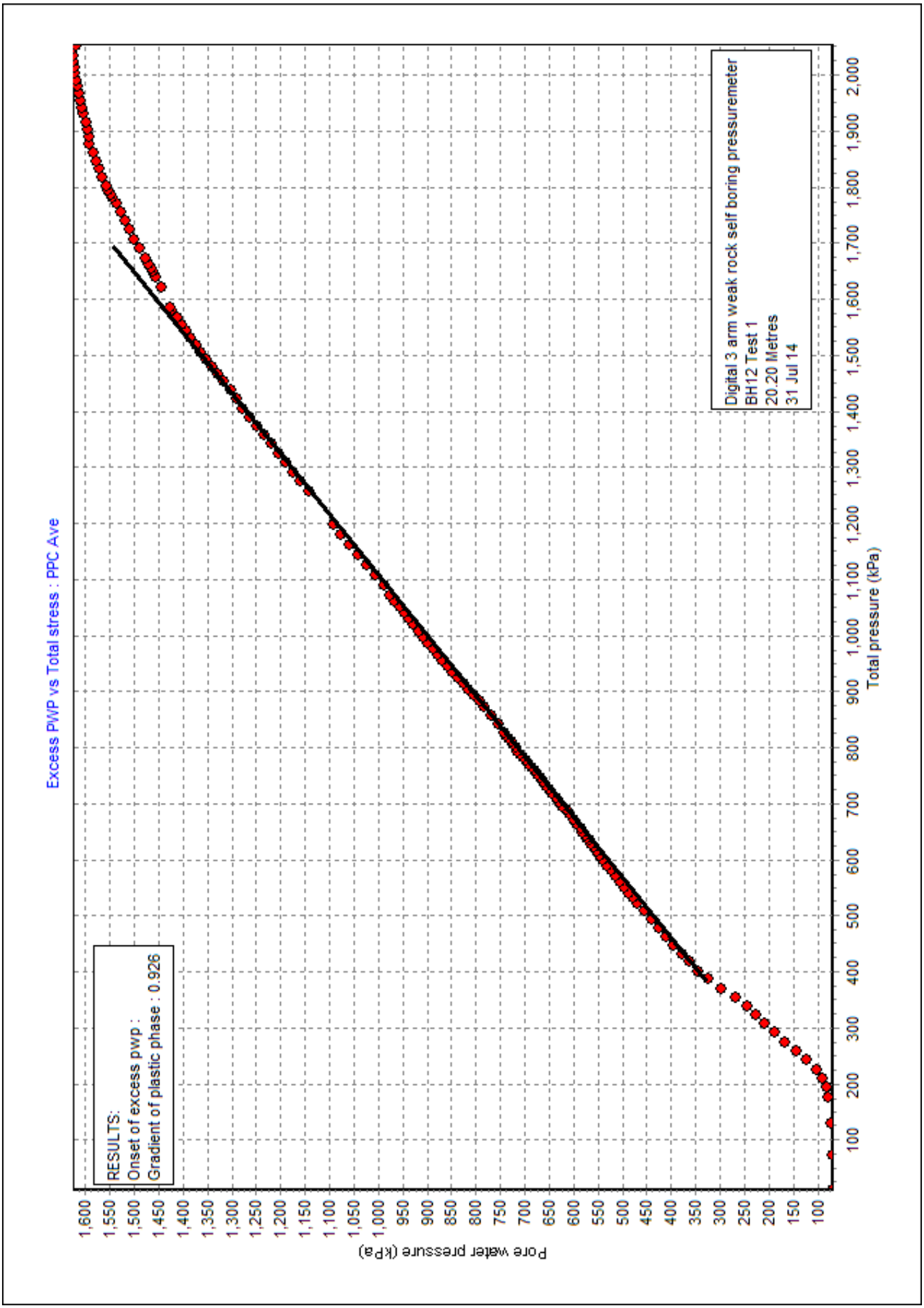
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}

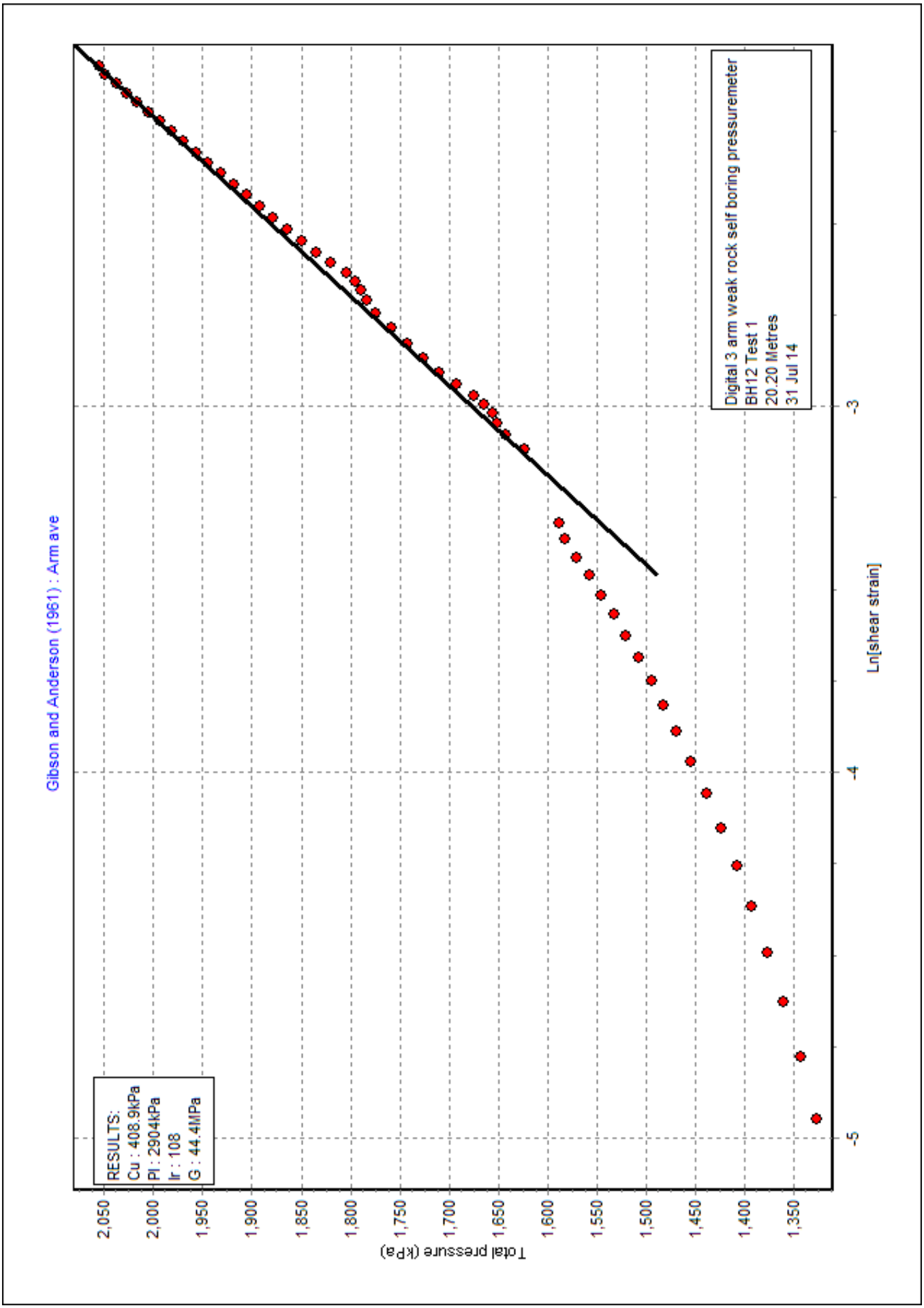
Strain Origin (mm)	:	0.73
Po (kPa)	:	579
Cu (kPa)	:	408.9
Limit pressure (kPa)	:	2904
Non-linear exponent	:	0.639
Calculated alpha (MPa)	:	5.694
G at yield (MPa)	:	25.2

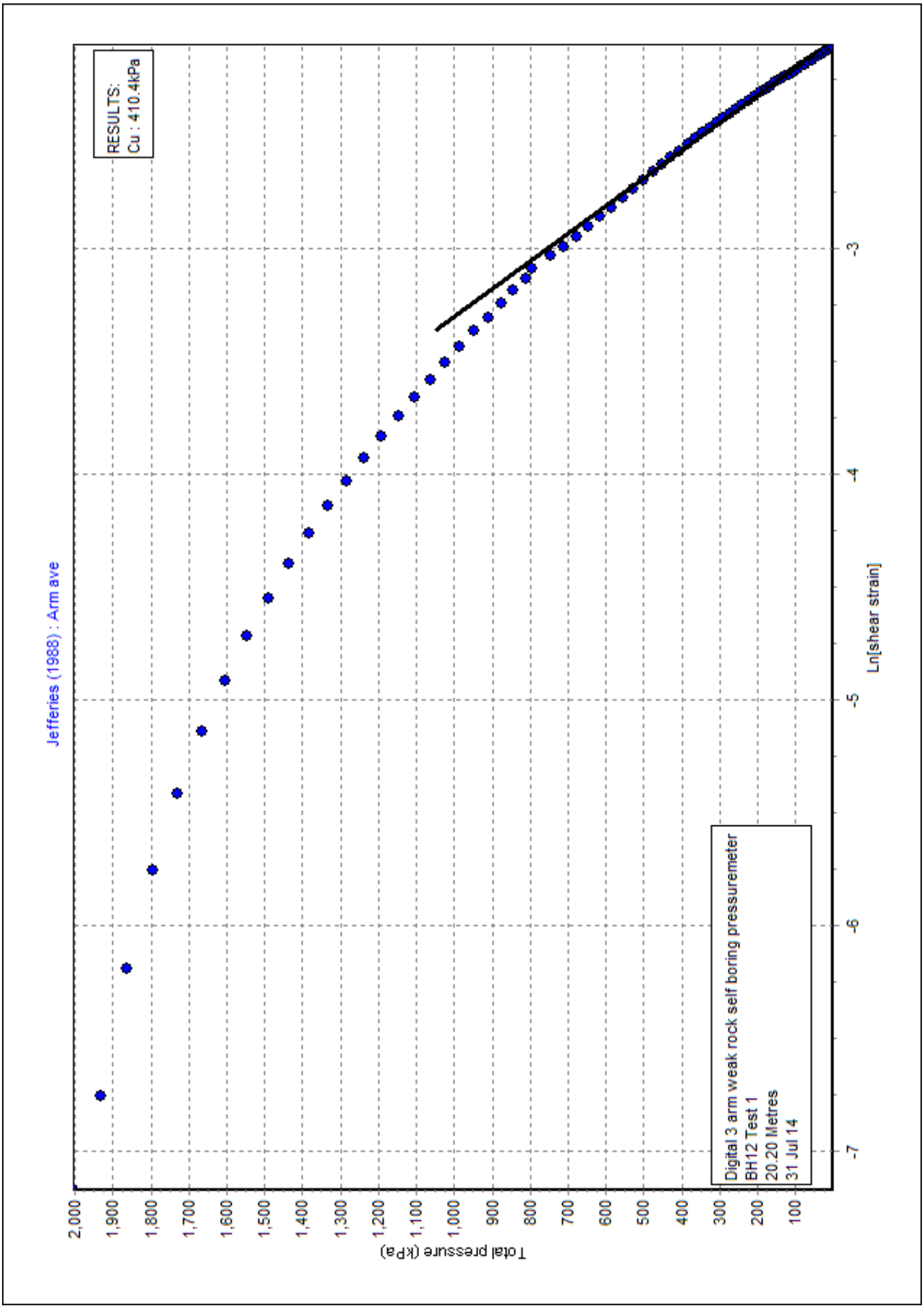

Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Cavity strain (%)
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5

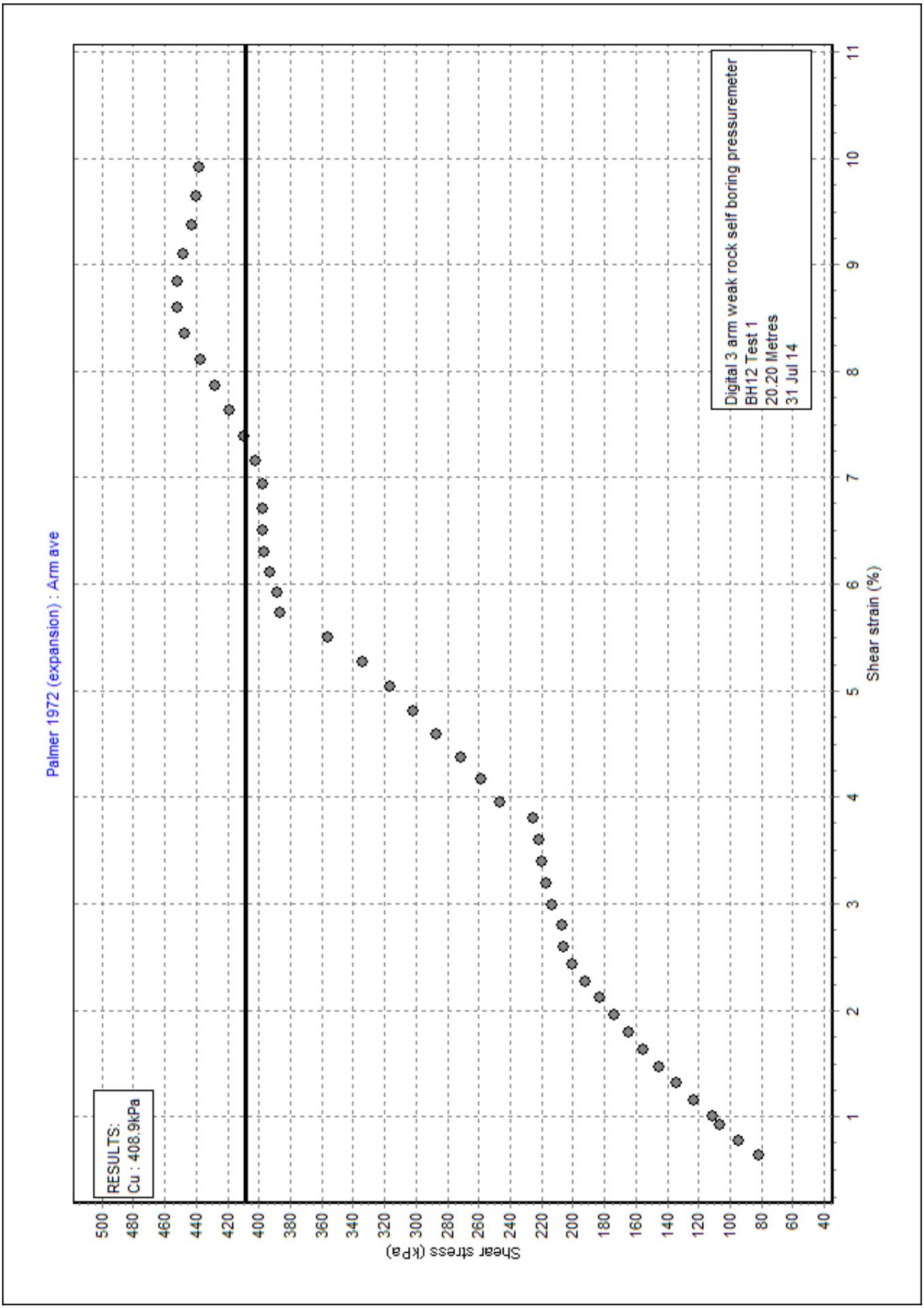

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 644.2kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45

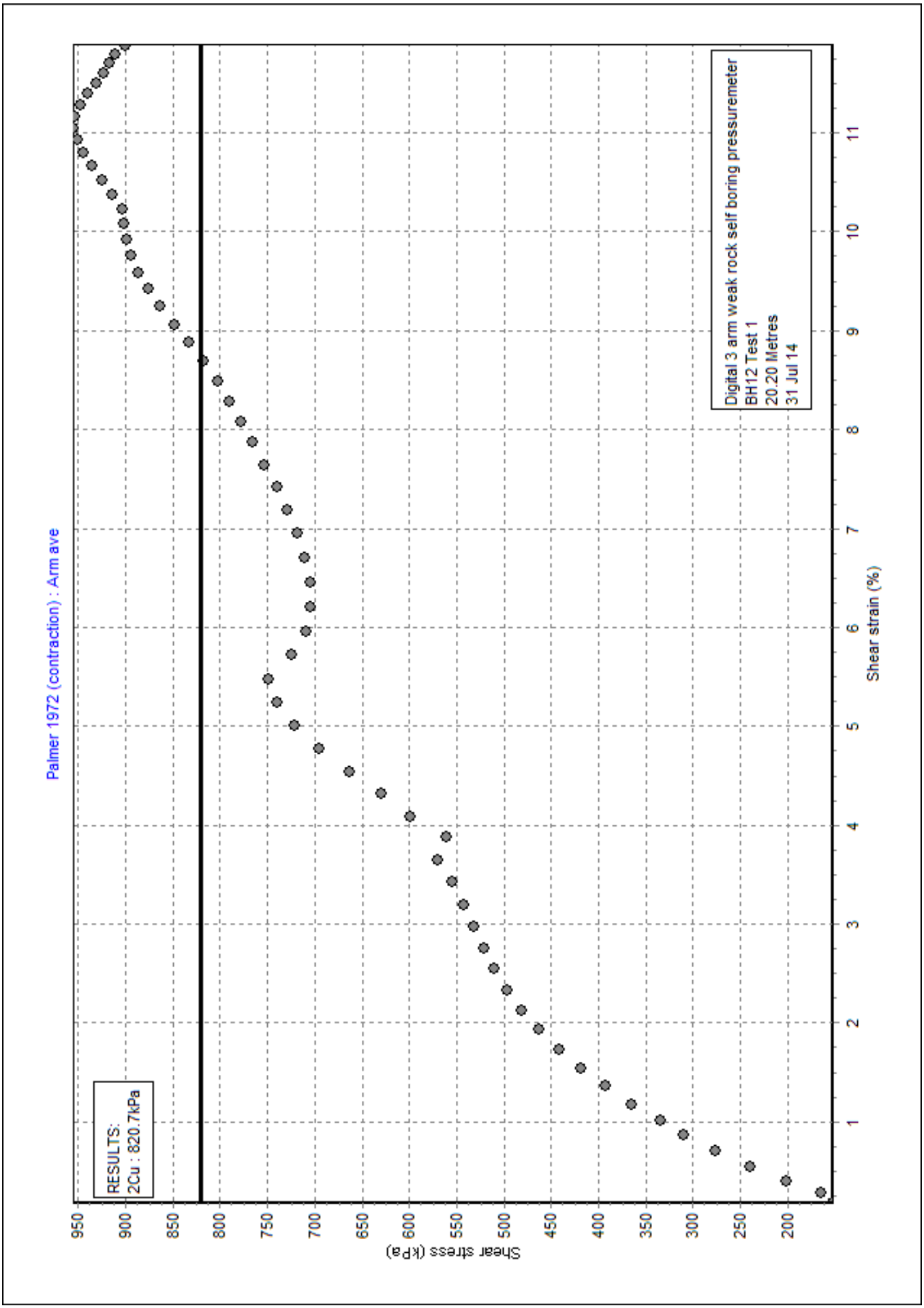

Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
RESULTS:
Gi : 44.7MPa
Pf : 851.9kPa
Po : 549.1kPa
Tf : 302.5kPa
Po + Tf : 851.7kPa
Origin : 0.120mm
Po of cohesive material (1977, 1990) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

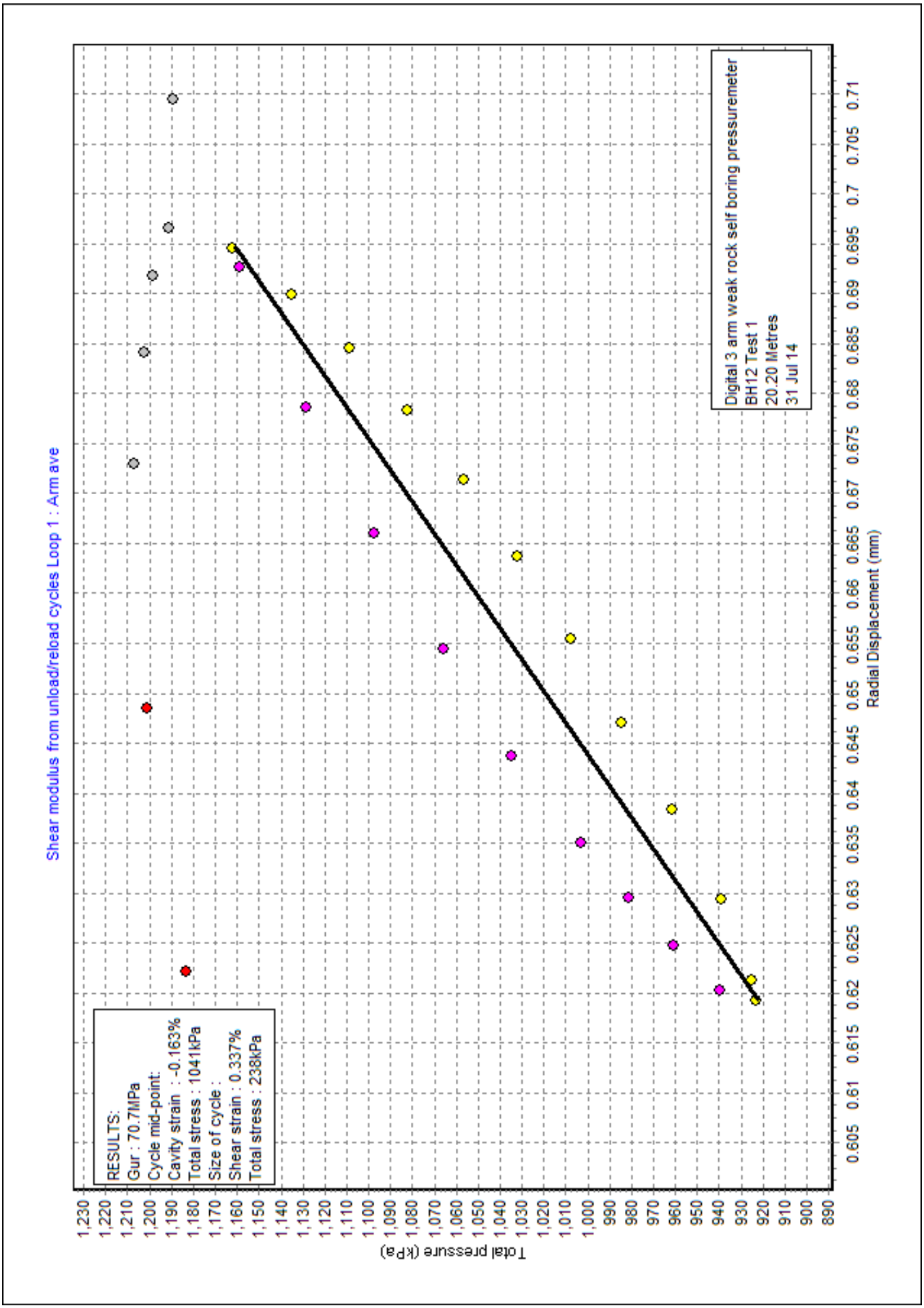

Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp :
Gradient of plastic phase : 0.926
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Pore water pressure (kPa)
Total pressure (kPa)

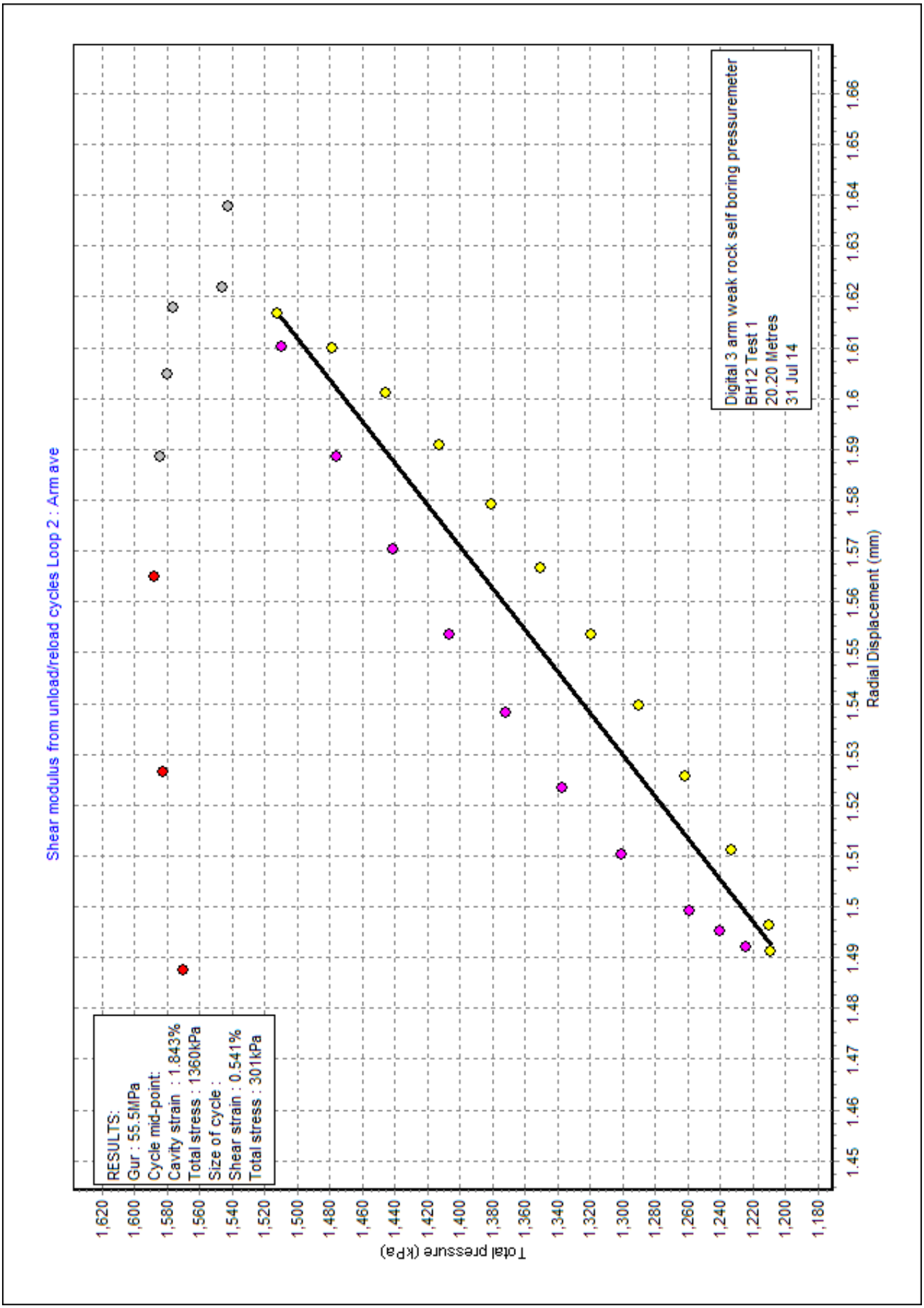

Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
RESULTS:
Cu : 408.9kPa
Pl : 2904kPa
Ir : 108
G : 44.4MPa
Gibson and Anderson (1961) : Arm ave
Total pressure (kPa)
Ln[shear strain]
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1,550
1,500
1,450
1,400
1,350
-3
-4
-5

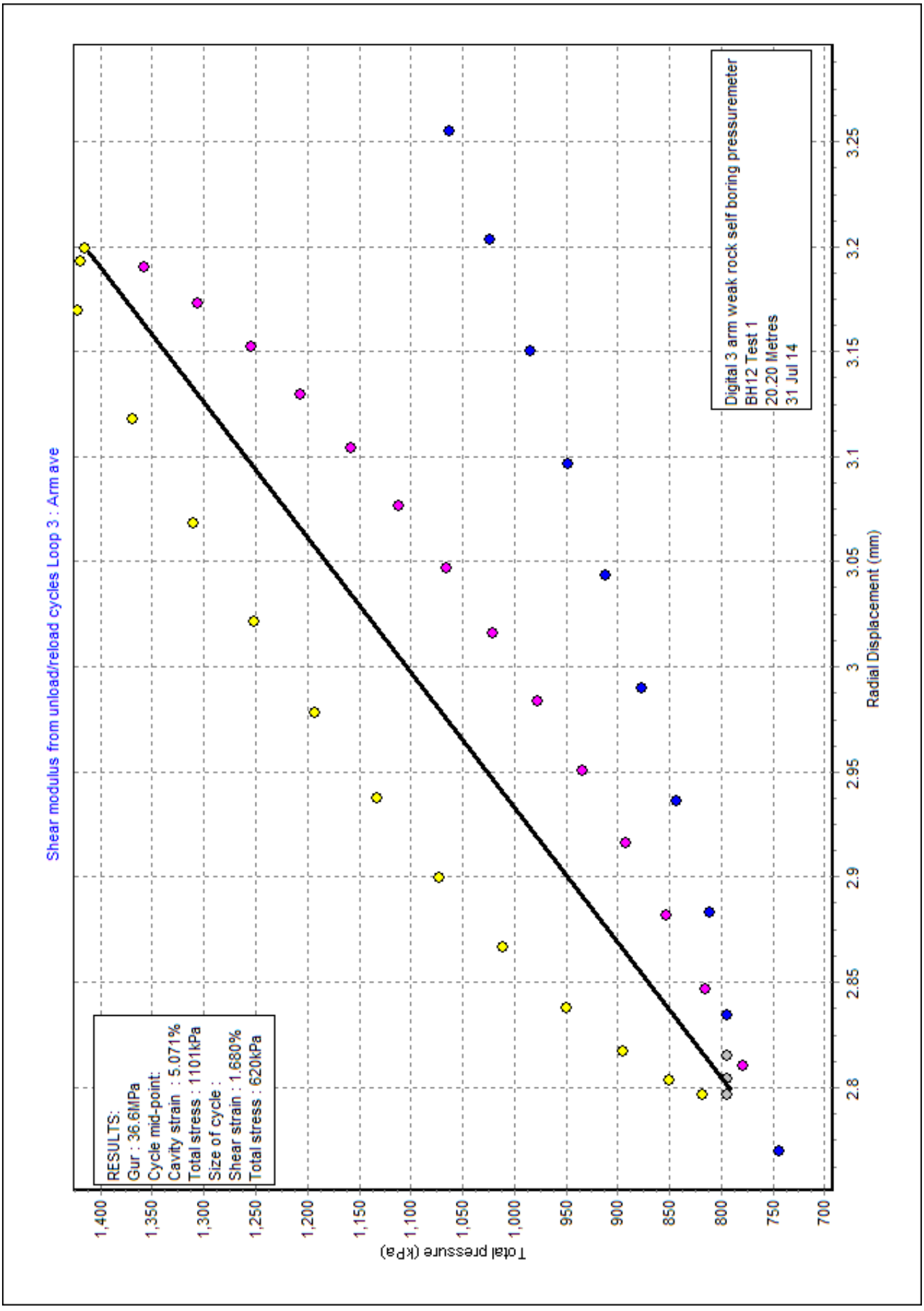

RESULTS:
Cu : 410.4kPa
Jefferies (1988) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Ln[shear strain]
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
-3
-4
-5
-6
-7

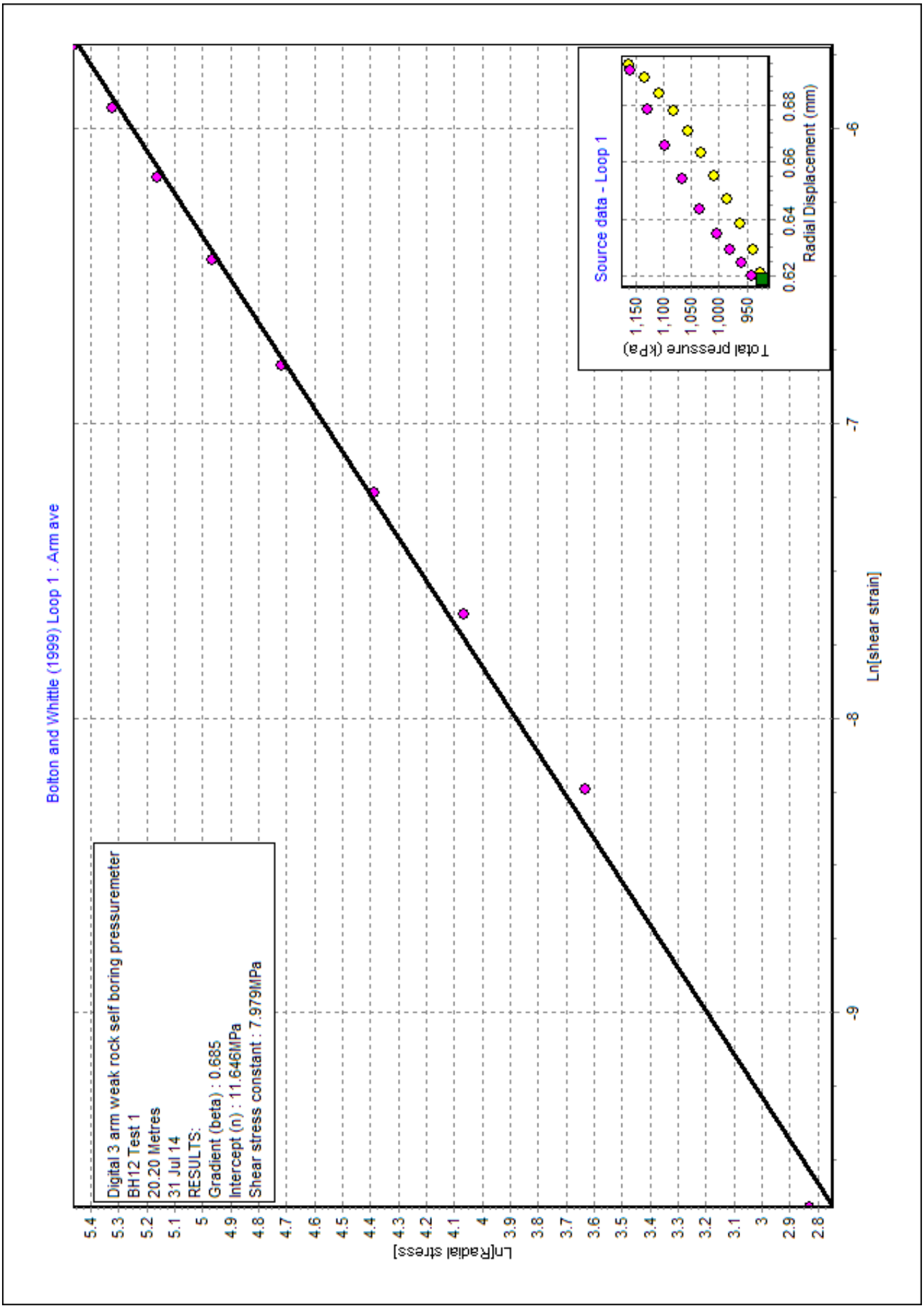

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 408.9kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Shear stress (kPa)
Shear strain (%)
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
1
2
3
4
5
6
7
8
9
10
11

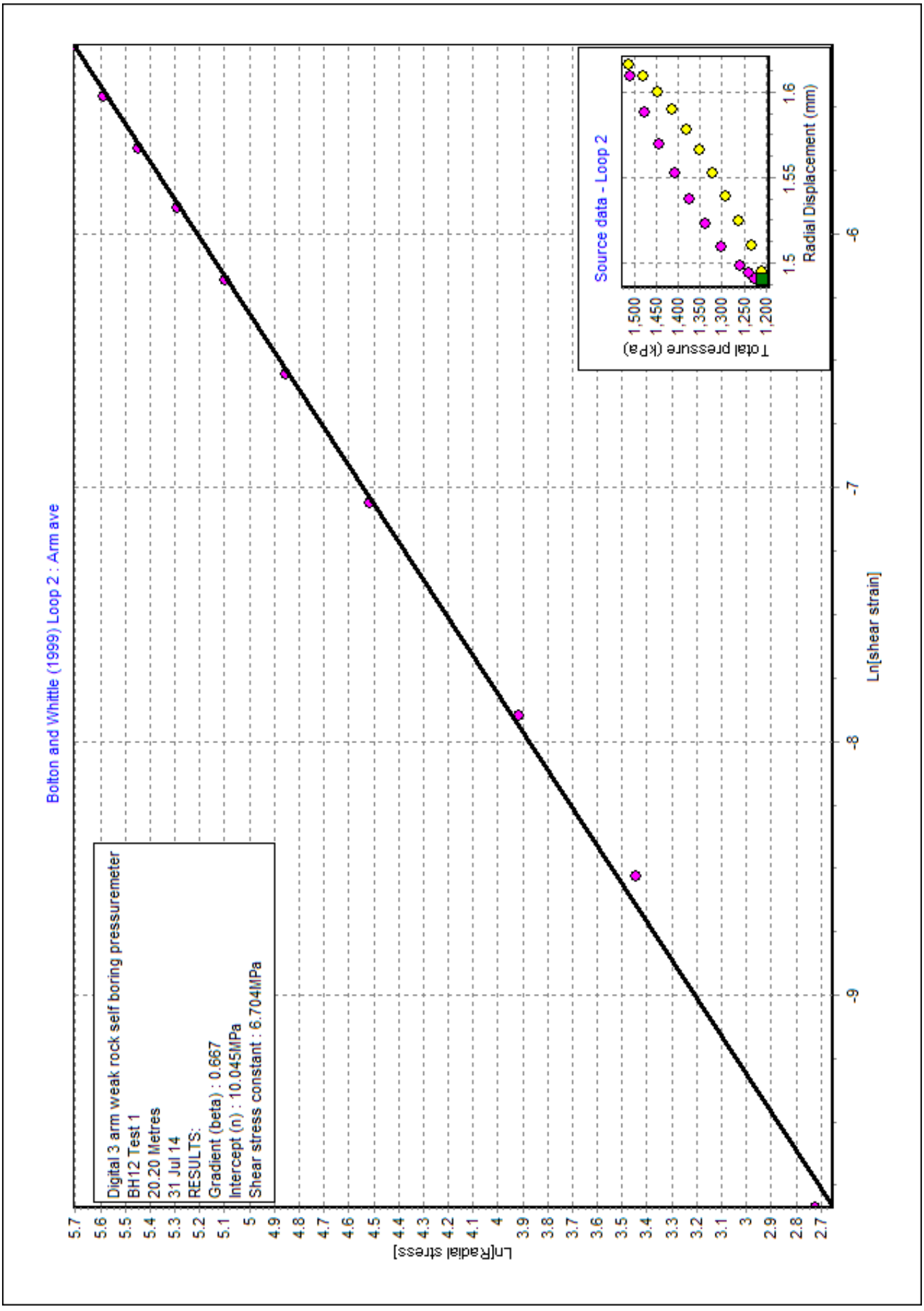

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 820.7kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Shear stress (kPa)
Shear strain (%)
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
1
2
3
4
5
6
7
8
9
10
11

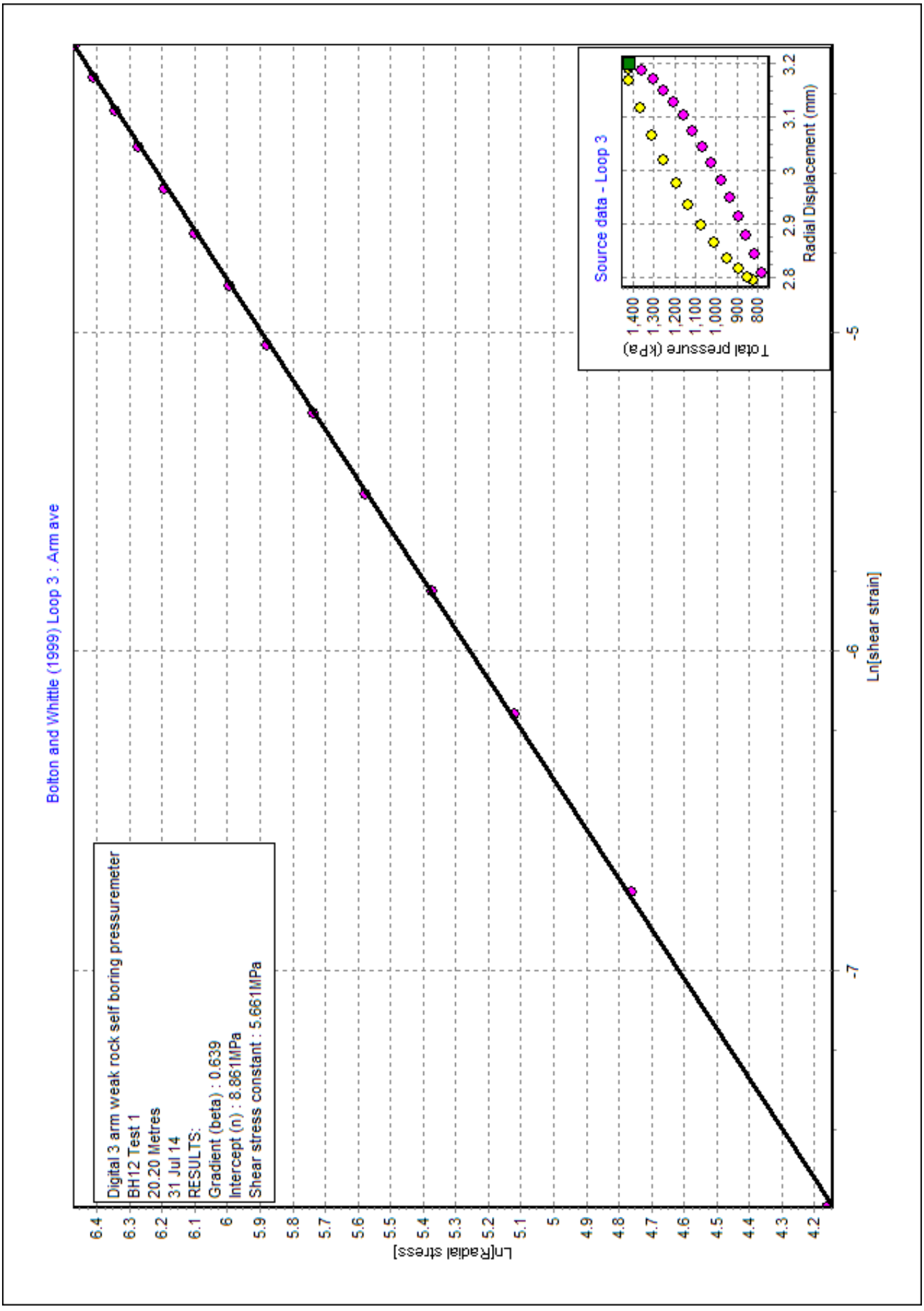

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 70.7MPa
Cycle mid-point:
Cavity strain : -0.163%
Total stress : 1041kPa
Size of cycle :
Shear strain : 0.337%
Total stress : 238kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)

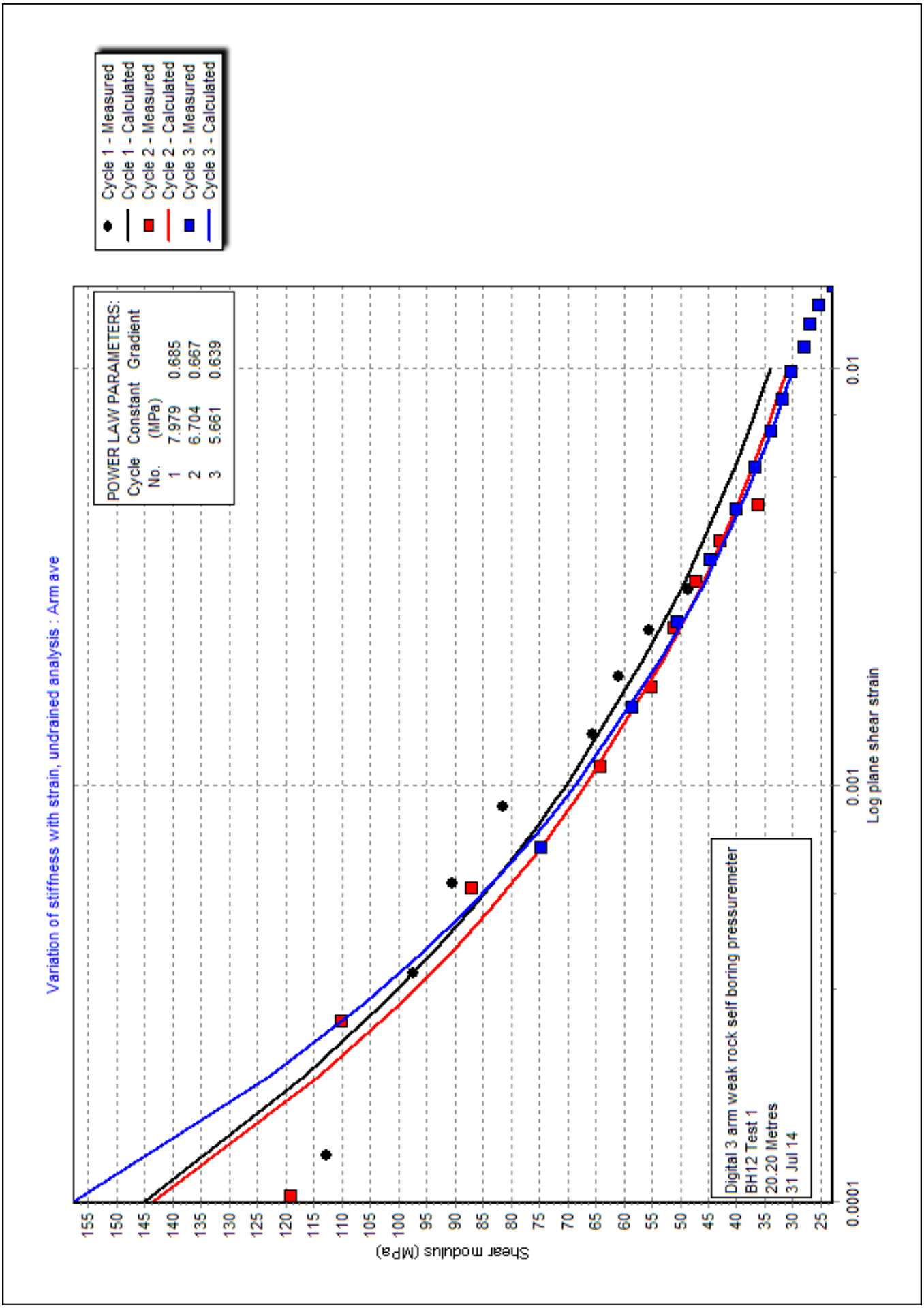

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 55.5MPa
Cycle mid-point:
Cavity strain : 1.843%
Total stress : 1360kPa
Size of cycle :
Shear strain : 0.541%
Total stress : 301kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)

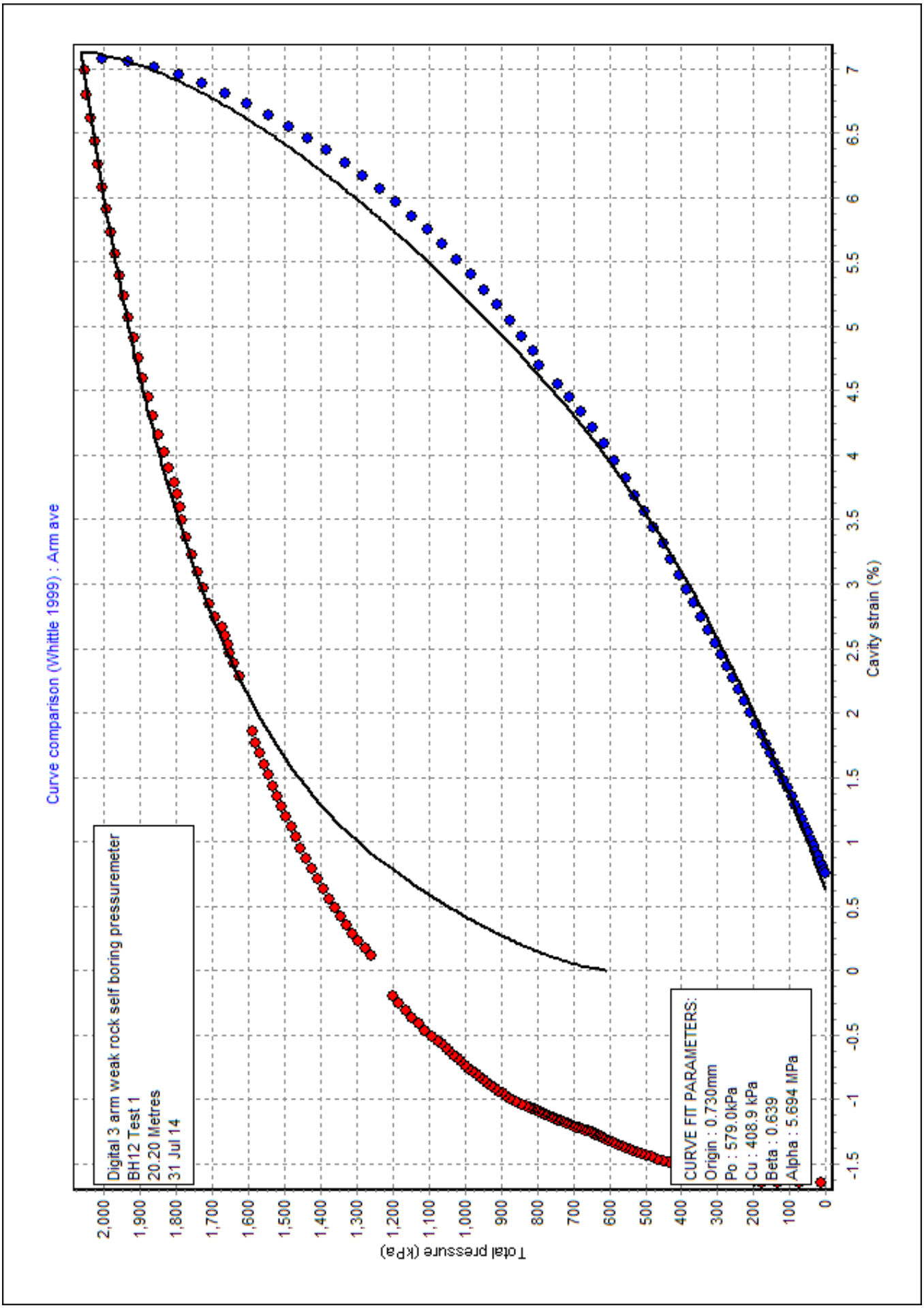

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 36.6MPa
Cycle mid-point:
Cavity strain : 5.071%
Total stress : 1101kPa
Size of cycle :
Shear strain : 1.680%
Total stress : 620kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)
700
750
800
850
900
950
1,000
1,050
1,100
1,150
1,200
1,250
1,300
1,350
1,400
2.8
2.85
2.9
2.95
3
3.05
3.1
3.15
3.2
3.25

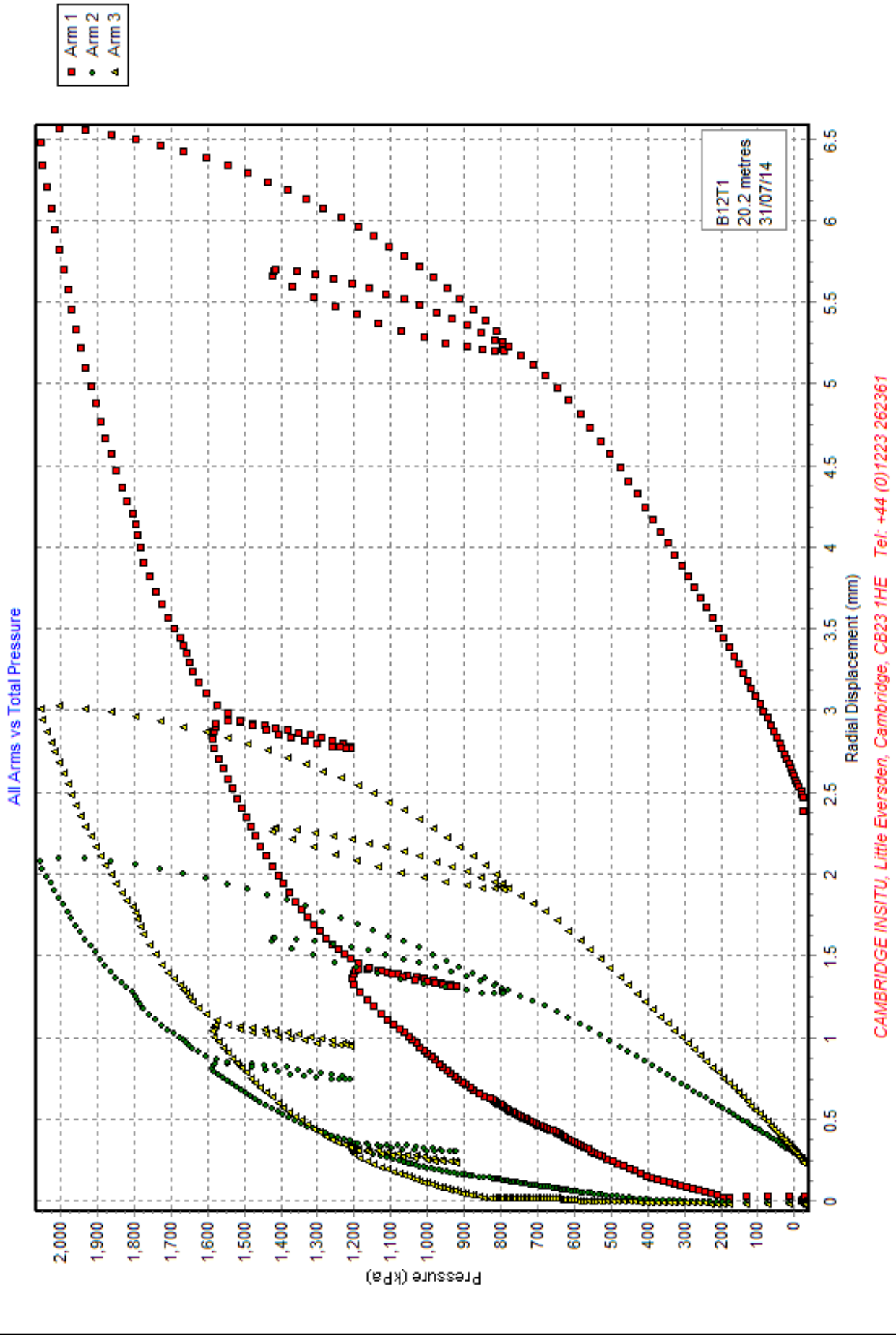

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.685
Intercept (n) : 11.646MPa
Shear stress constant : 7.979MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

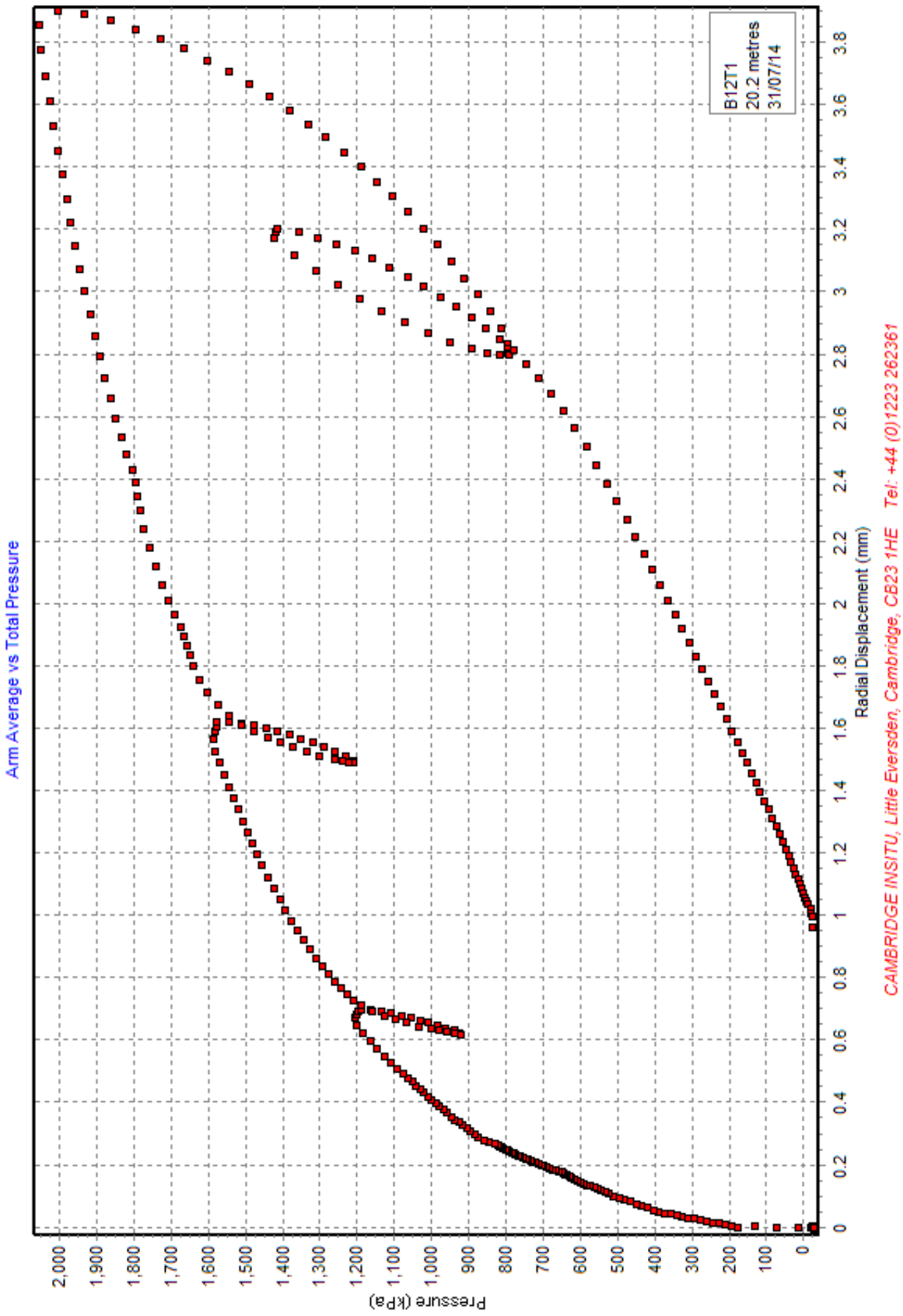

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.667
Intercept (n) : 10.045MPa
Shear stress constant : 6.704MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

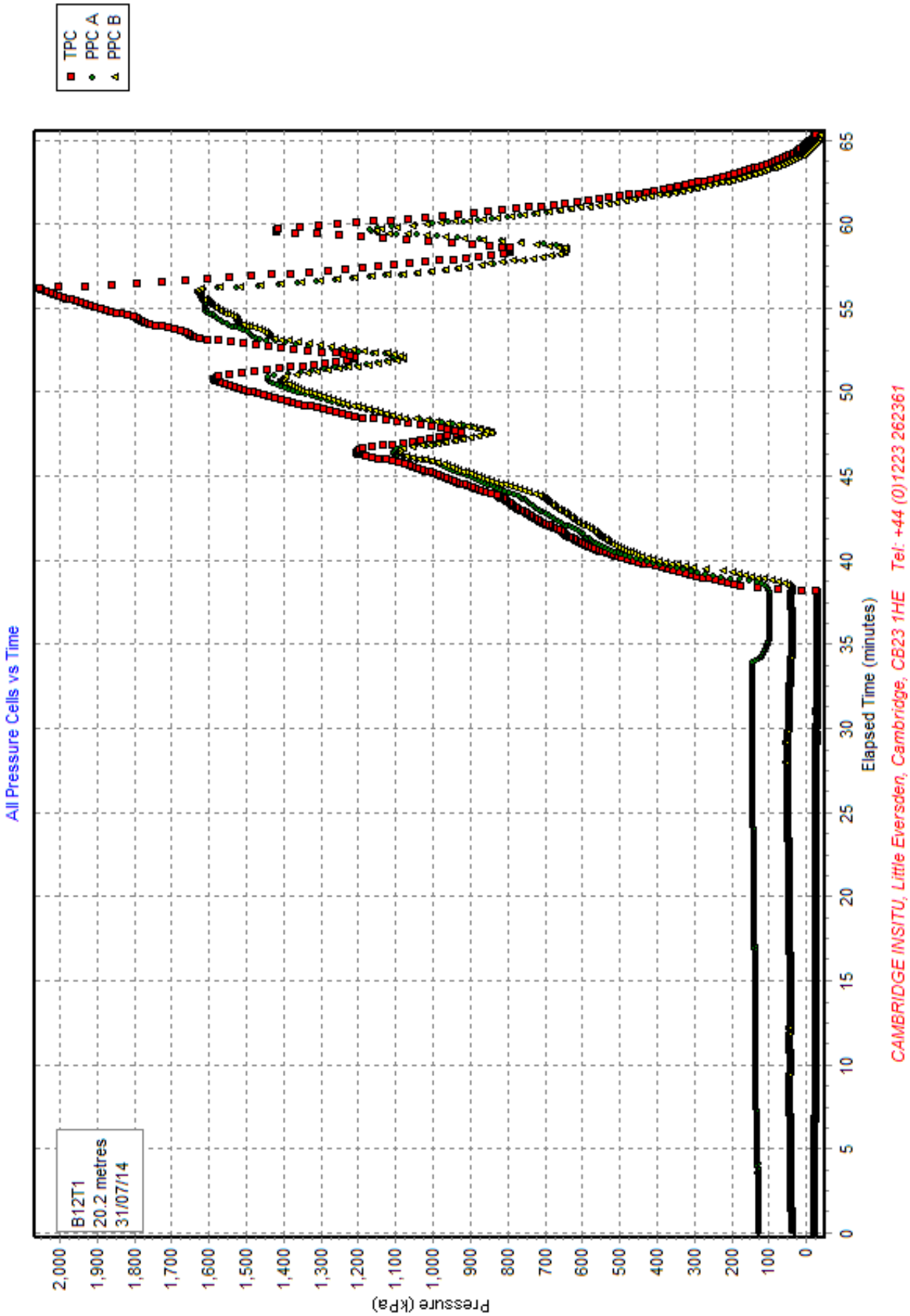

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.639
Intercept (n) : 8.861MPa
Shear stress constant : 5.661MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 7.979 0.685
2 6.704 0.667
3 5.661 0.639
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 1
20.20 Metres
31 Jul 14
CURVE FIT PARAMETERS:
Origin : 0.730mm
Po : 579.0kPa
Cu : 408.9 kPa
Beta : 0.639
Alpha : 5.694 MPa
Total pressure (kPa)
Cavity strain (%)
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7


Arm 1
Arm 2
Arm 3
B12T1
20.2 metres
31/07/14
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B12T1
20.2 metres
31/07/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B12T1
20.2 metres
31/07/14
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

BH12 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]

Project	:	C4237
Site	:	Rivenhall Airfield
Borehole	:	BH12
Test name	:	BH12 Test 2
Test date	:	1 Aug 14
Test depth	:	30.00 Metres
Water table	:	8 Metres
Ambient PWP	:	215.8 kPa
Material	:	London Clay
Probe	:	Digital 3 arm weak rock self boring pressuremeter
Diameter	:	88.0 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 1 Aug 14

Remarks: Start drill 29.4m at 09:27. Ends 10:07. 1.1m bored.

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.680"
Po from Marsland & Randolph (kPa)	:	"Arm ave=799.7"
Po from Lift off (kPa)	:	"Arm ave=893.1"
Best estimate of Po (kPa)	:	"Arm ave=896.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=468.1"
Limit pressure (kPa)	:	"Arm ave=3586"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=464.6"
Undrained yield stress (kPa)	:	"Arm ave=1545.1"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=31.3"

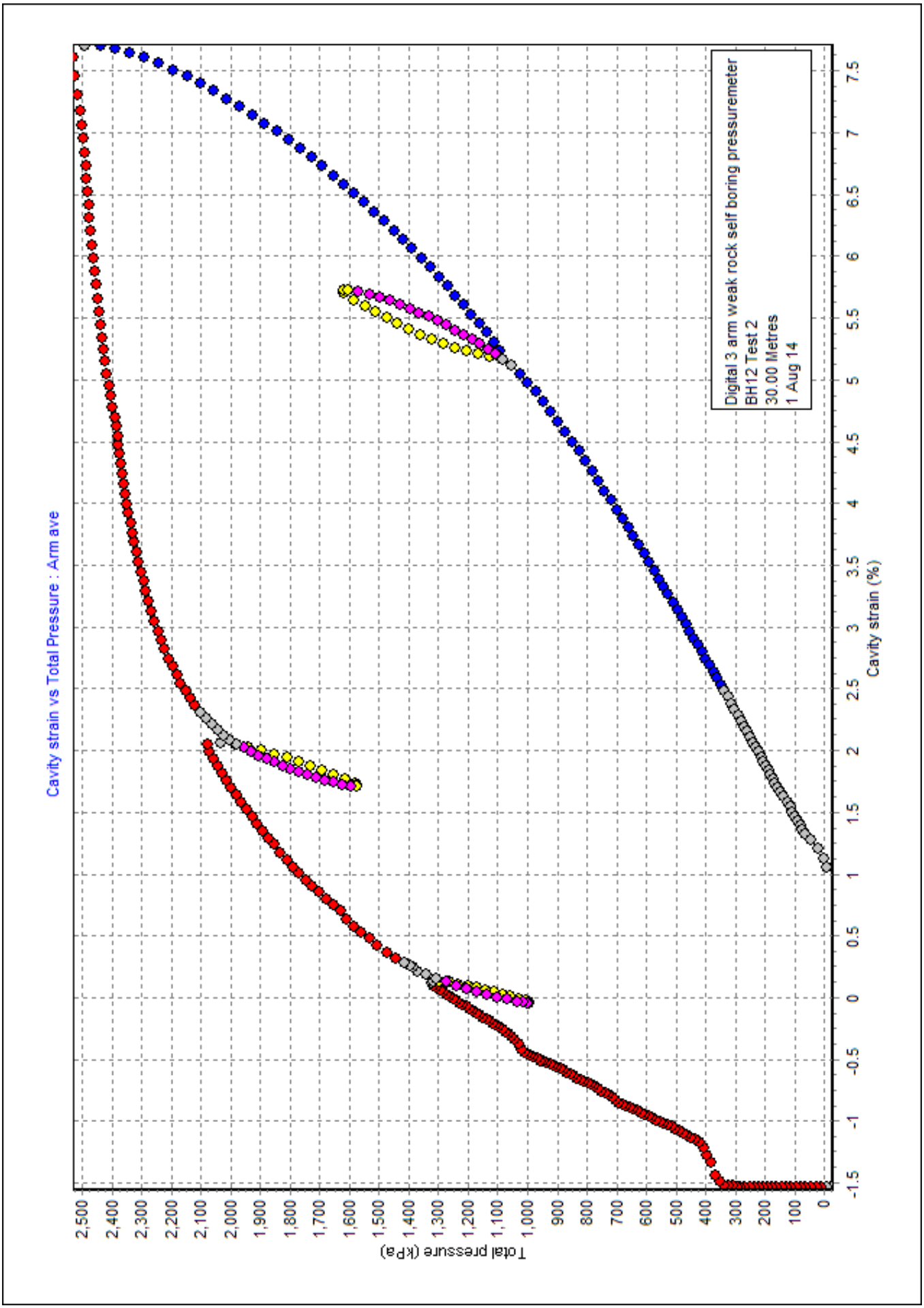
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	81.1	0.055	1138	0.354	288
Arm ave	2	60.4	1.888	1775	0.660	400
Arm ave	3	50.6	5.468	1361	0.989	503

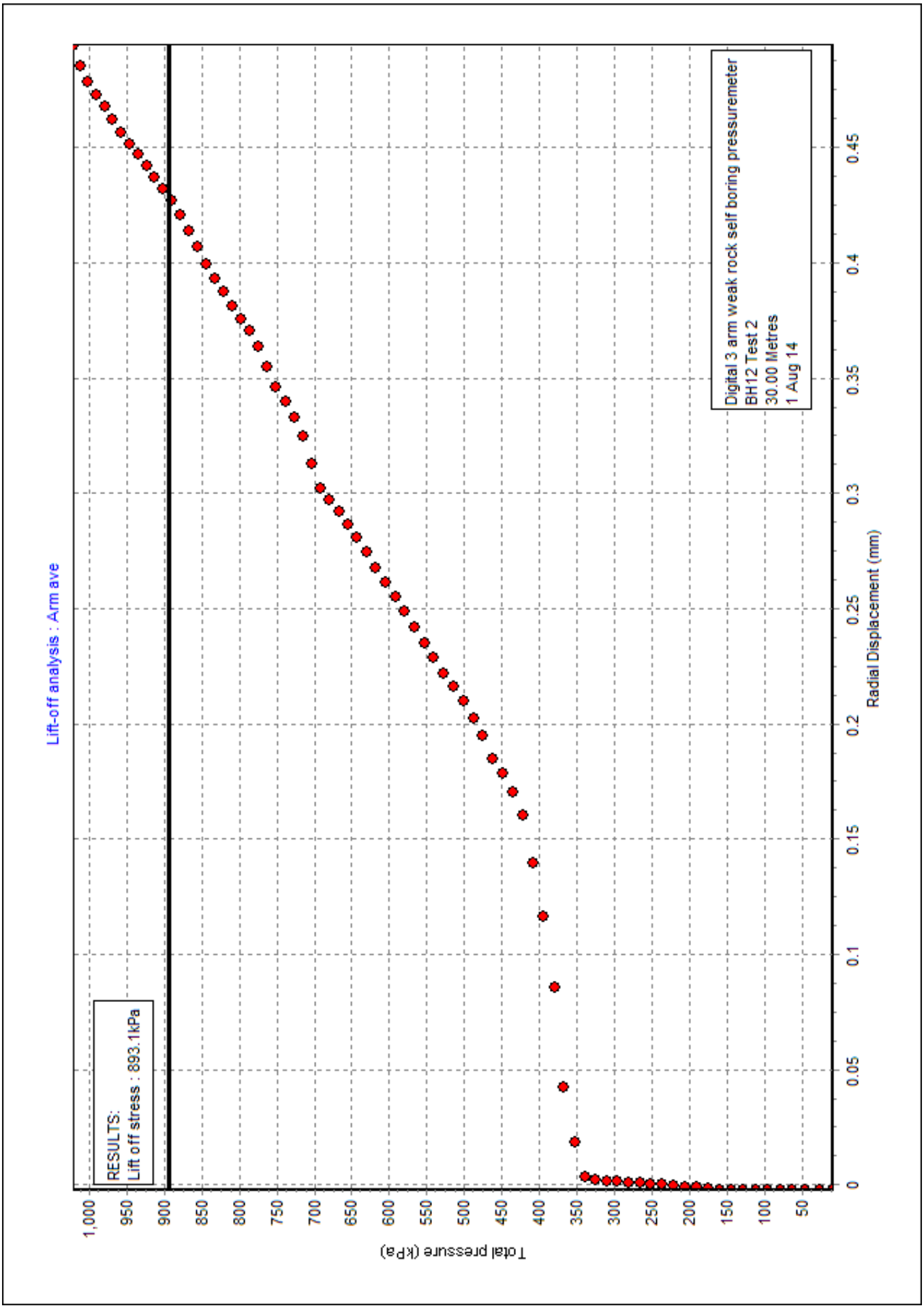
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

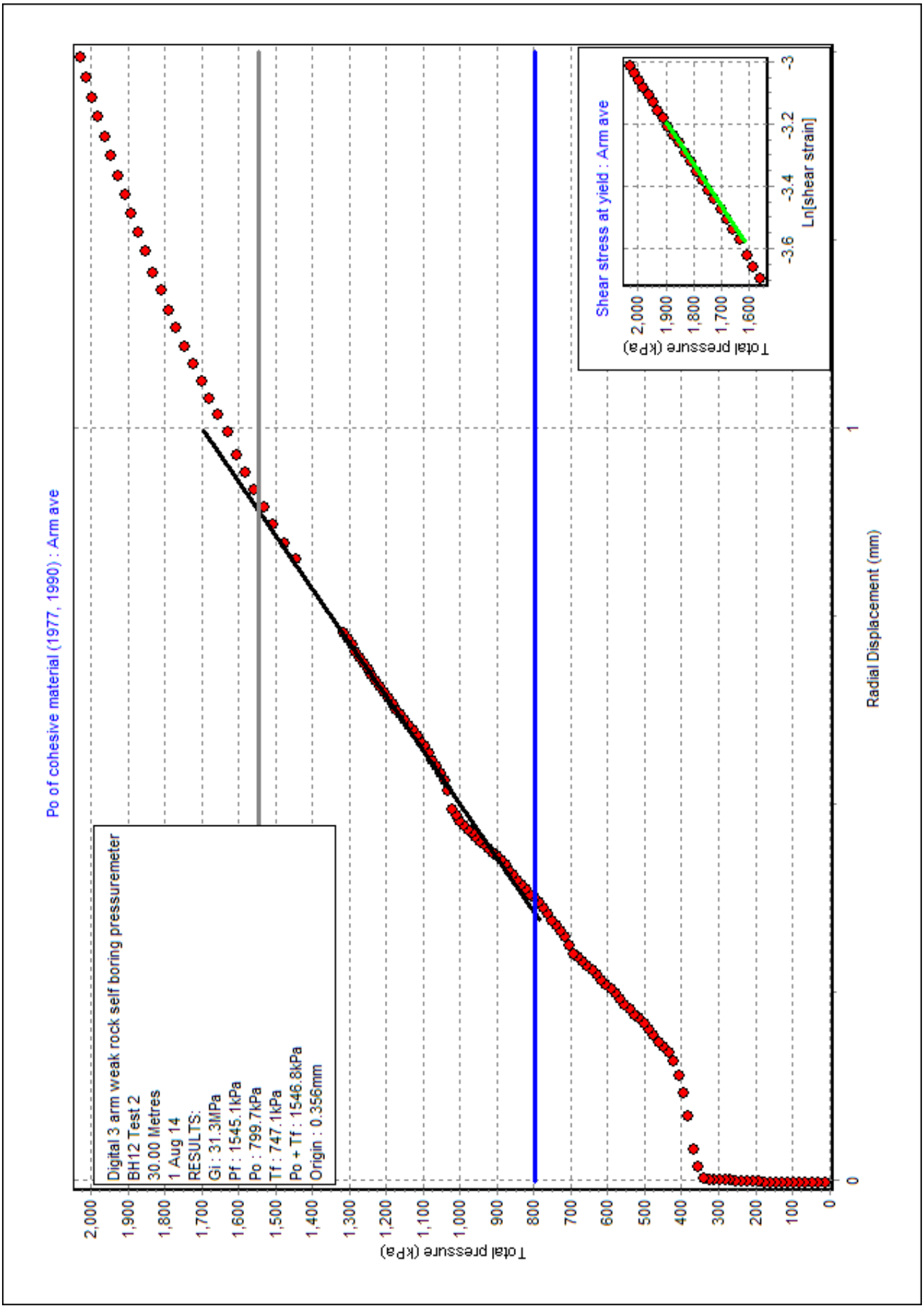
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	21.501	16.449	0.765
Arm ave	2	14.768	10.596	0.717
Arm ave	3	12.976	9.067	0.699

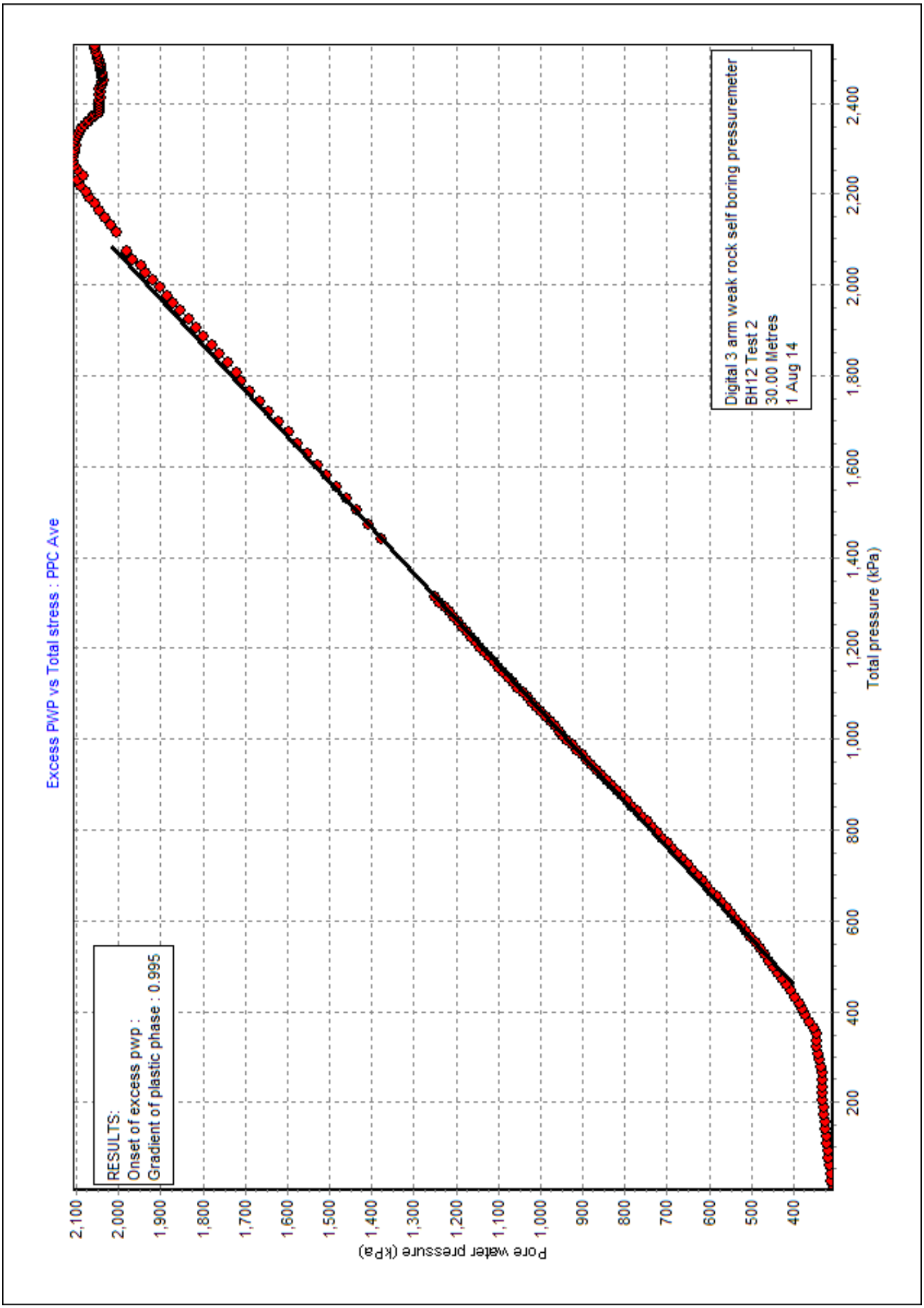
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}

Strain Origin (mm)	:	0.68
Po (kPa)	:	896
Cu (kPa)	:	468.1
Limit pressure (kPa)	:	3586
Non-linear exponent	:	0.699
Calculated alpha (MPa)	:	9.559
G at yield (MPa)	:	35.0


Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Cavity strain (%)
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5


Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 893.1kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45


Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
RESULTS:
Gi : 31.3MPa
Pf : 1545.1kPa
Po : 799.7kPa
Tf : 747.1kPa
Po + Tf : 1546.8kPa
Origin : 0.356mm
Po of cohesive material (1977, 1990) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]


Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp :
Gradient of plastic phase : 0.995
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Pore water pressure (kPa)
Total pressure (kPa)
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
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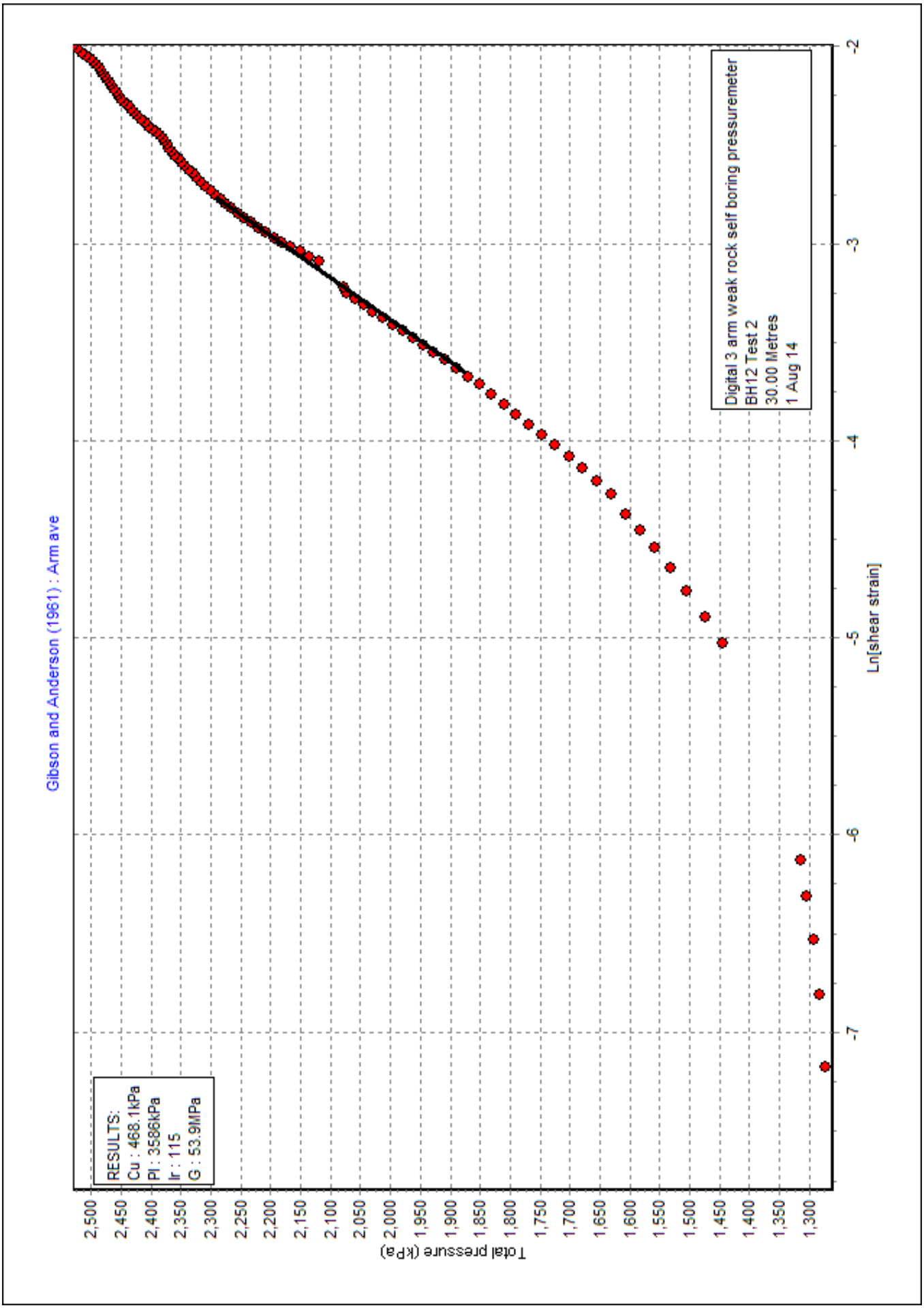
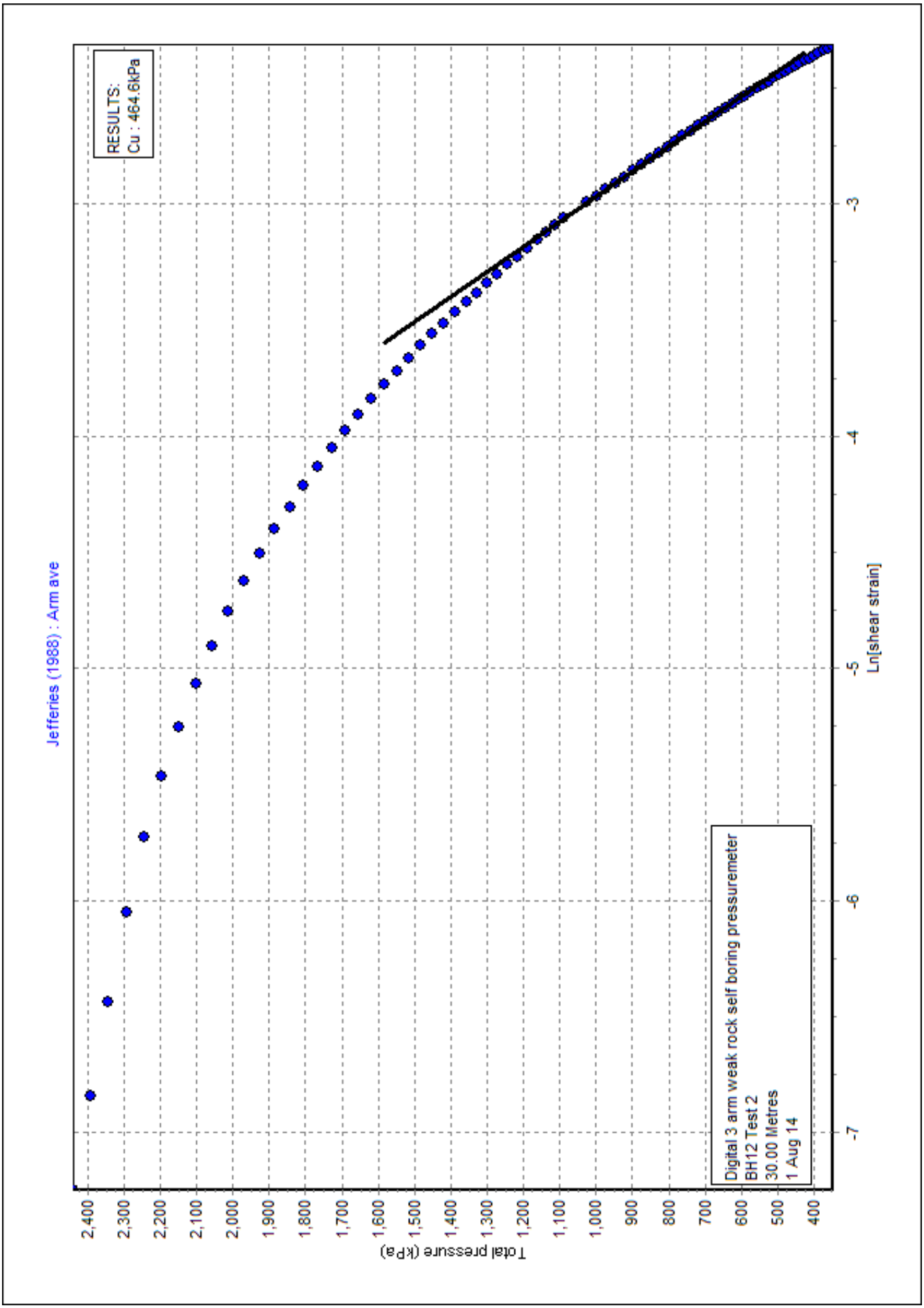
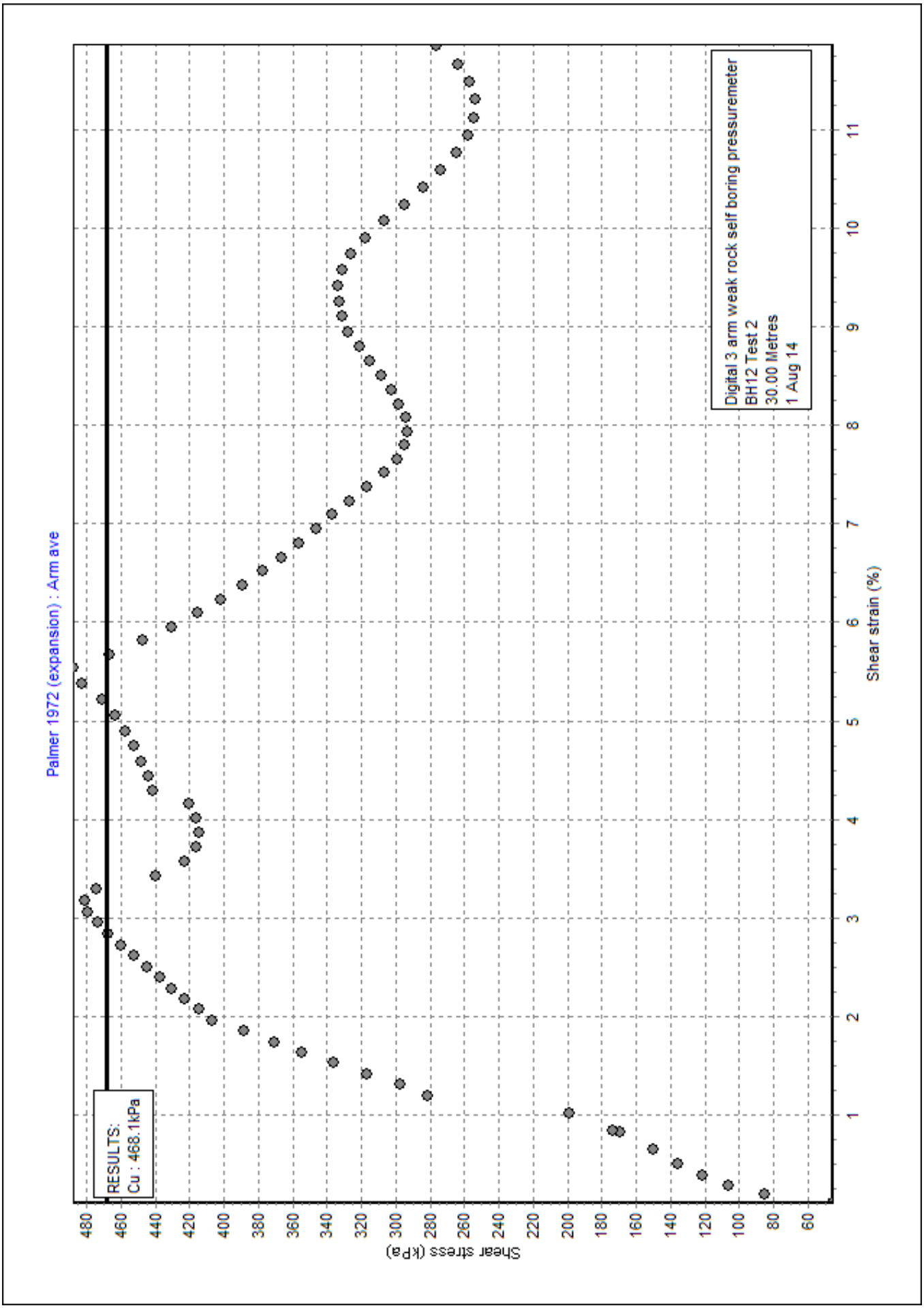
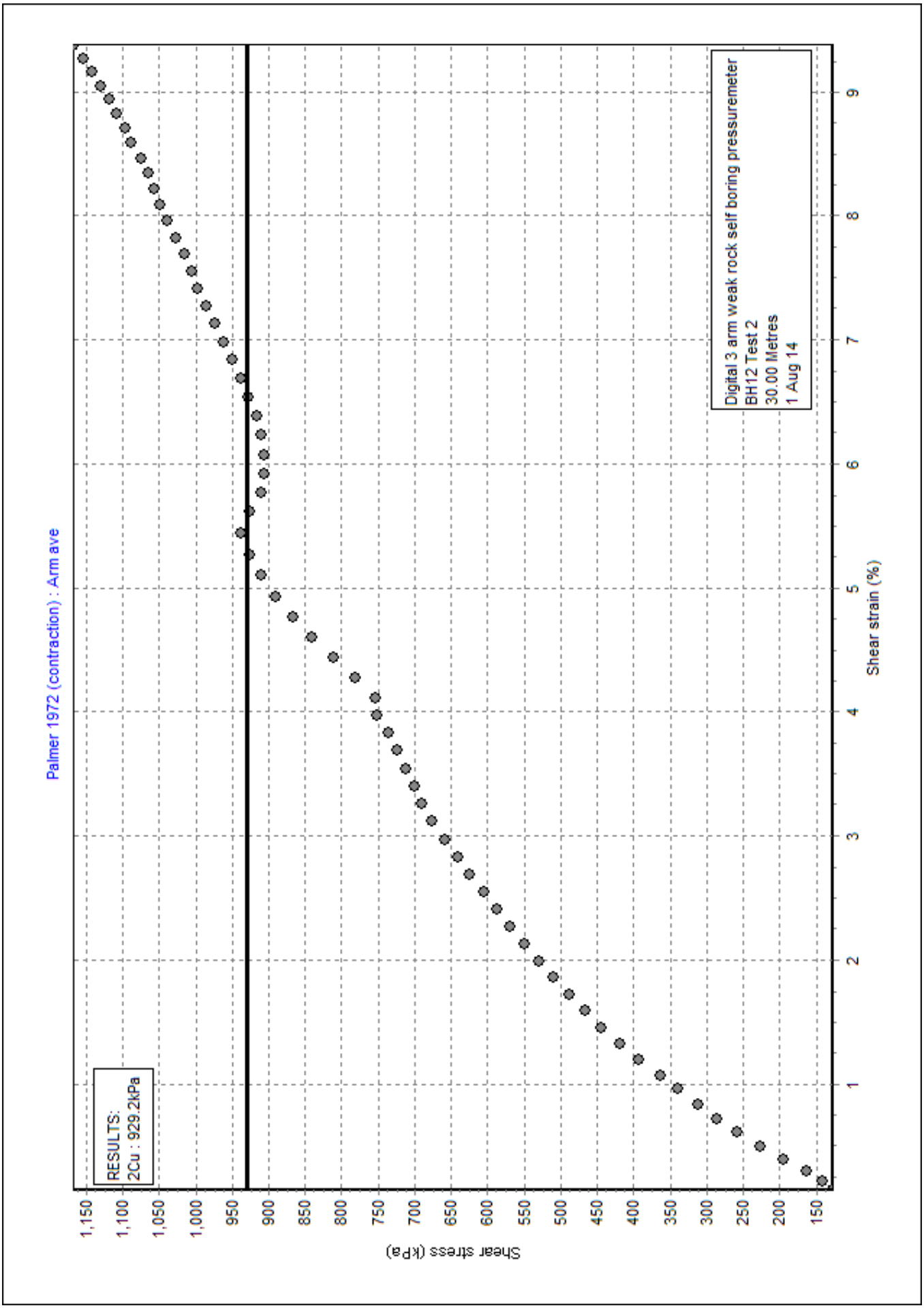
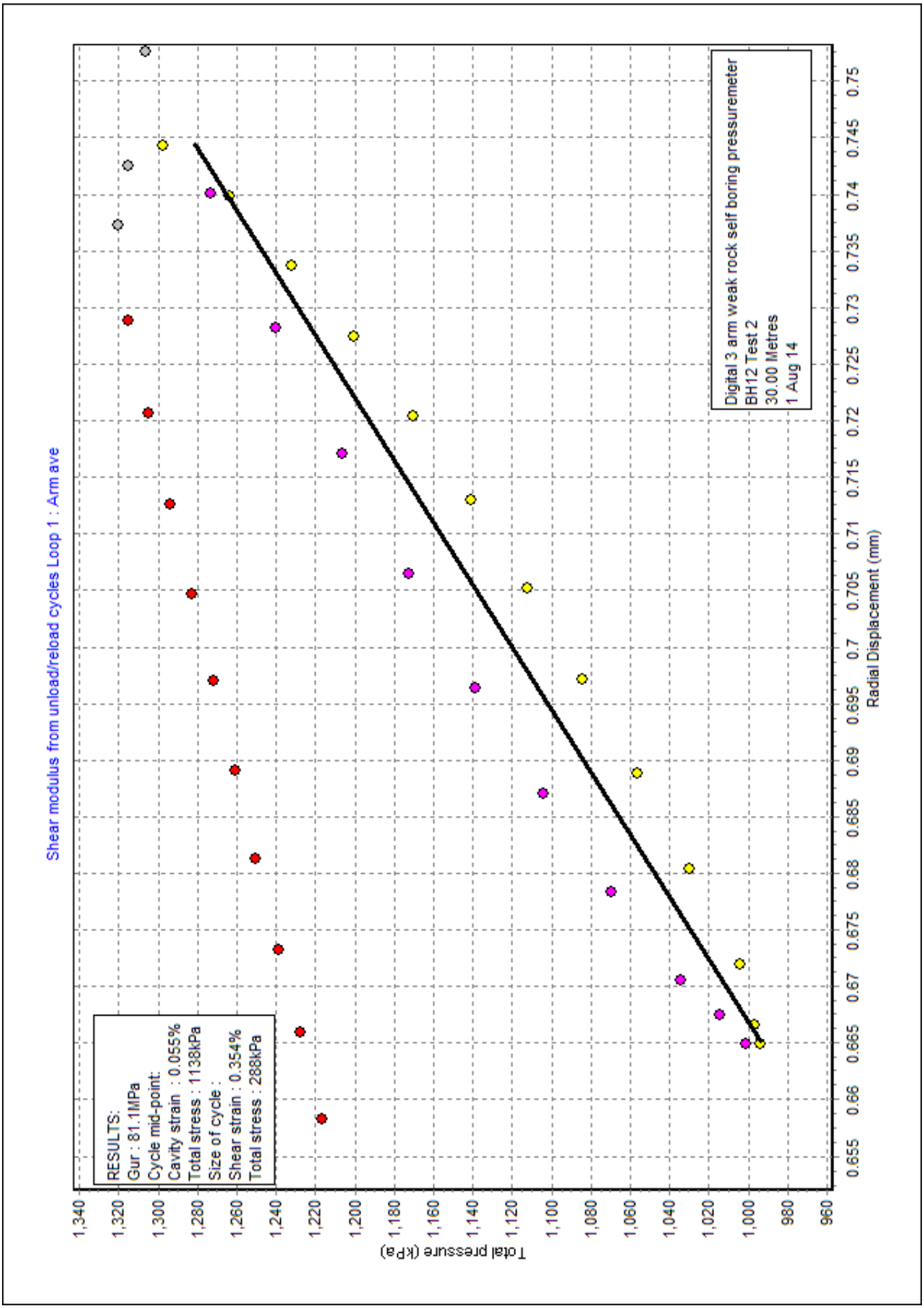
1,200
1,400
1,600
1,800
2,000
2,200
2,400

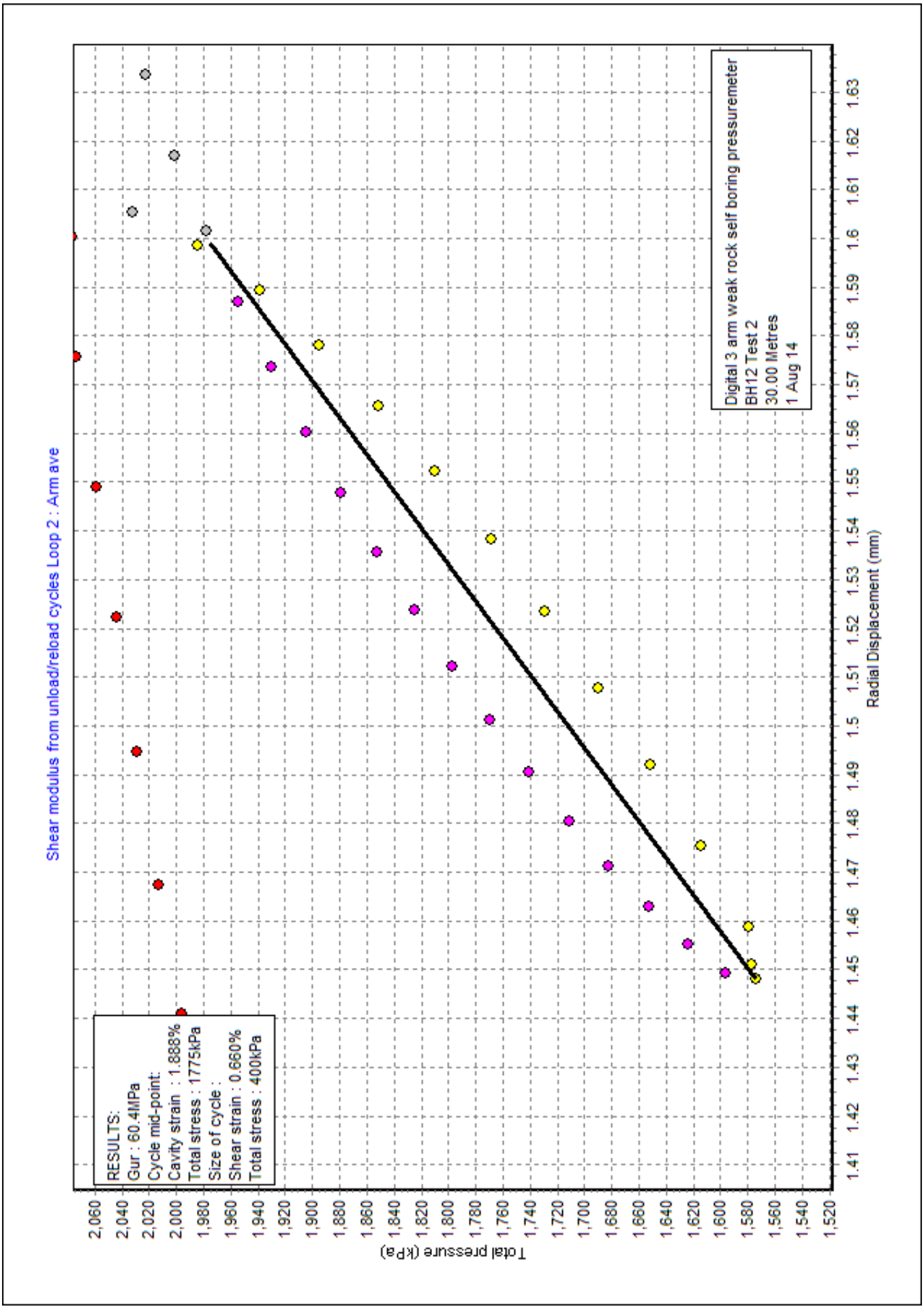

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 468.1kPa
Pl : 3586kPa
Ir : 115
G : 53.9MPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Ln[shear strain]
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1,550
1,500
1,450
1,400
1,350
1,300
-2
-3
-4
-5
-6
-7

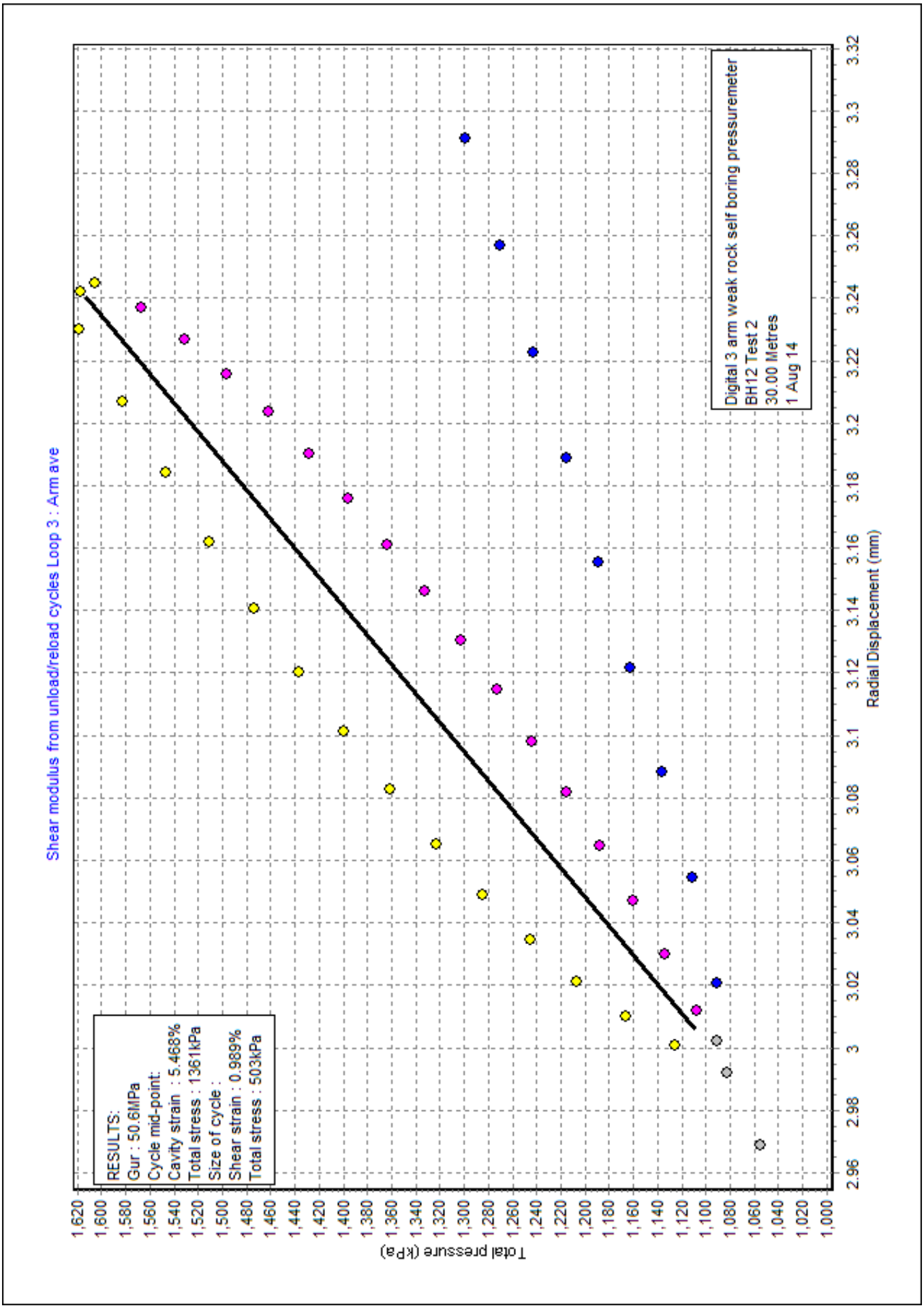

RESULTS:
Cu : 464.6kPa
Jefferies (1988) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Ln[shear strain]
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
-3
-4
-5
-6
-7

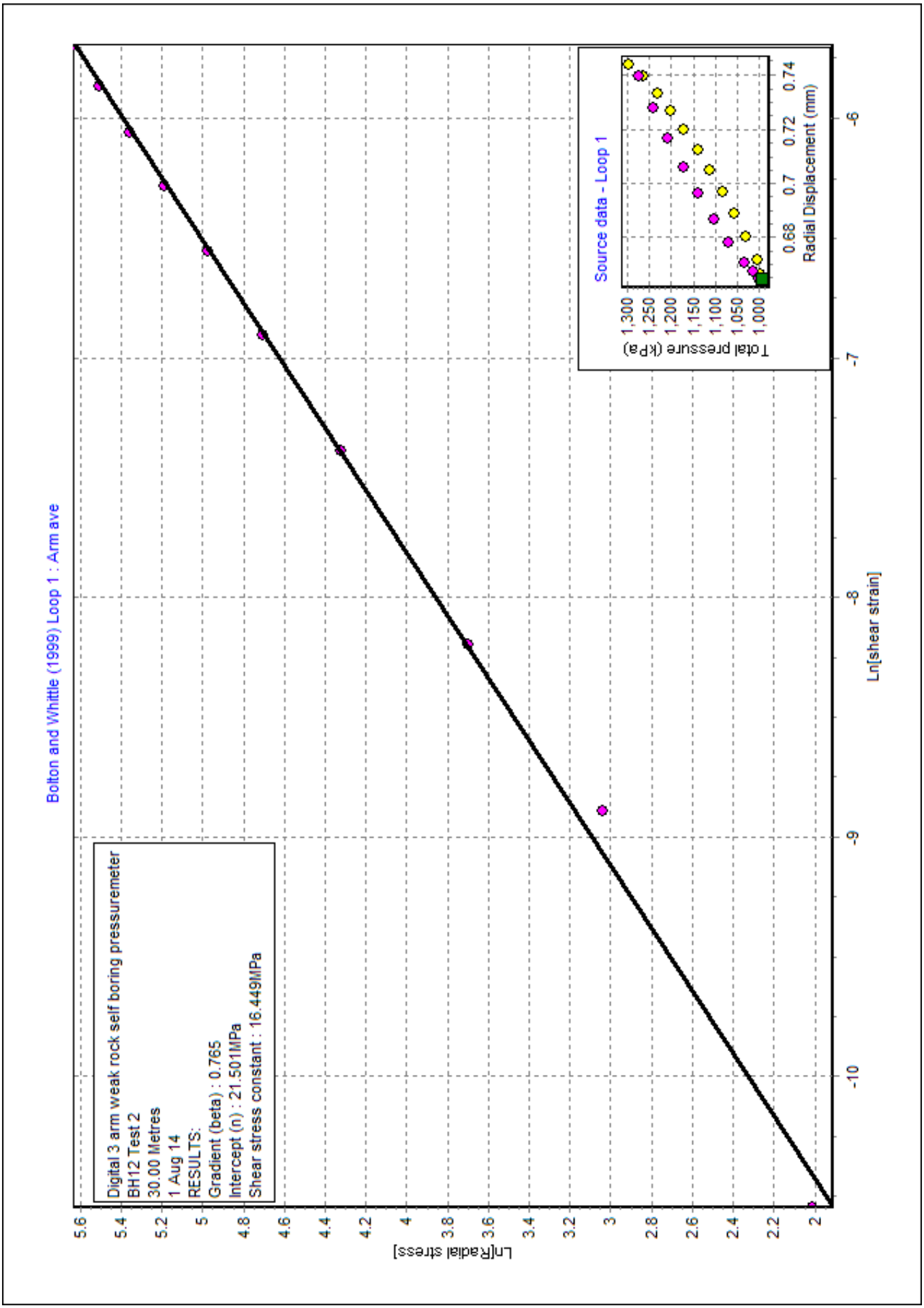

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 468.1kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Shear stress (kPa)
Shear strain (%)

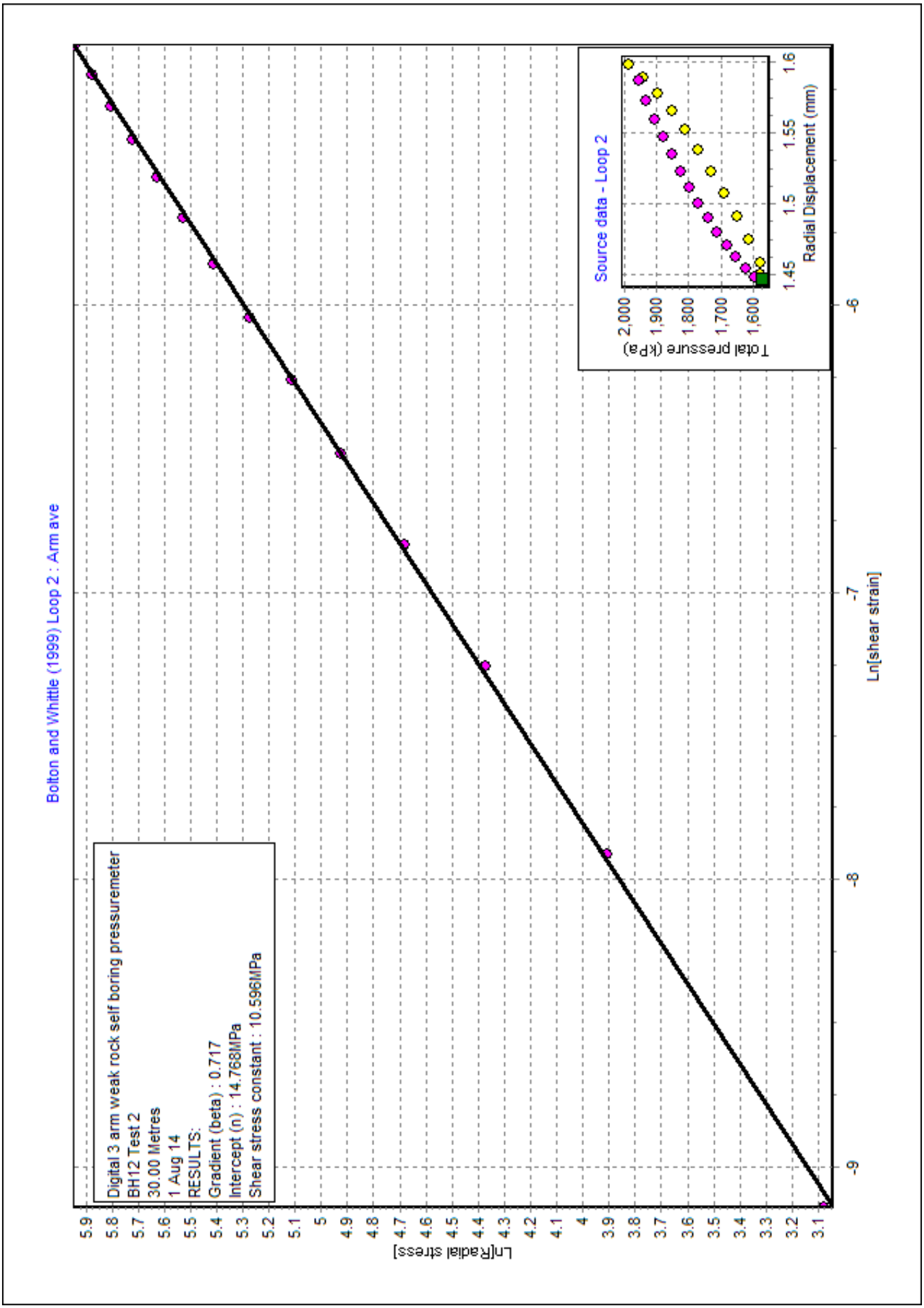

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 929.2kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Shear stress (kPa)
Shear strain (%)
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
1
2
3
4
5
6
7
8
9

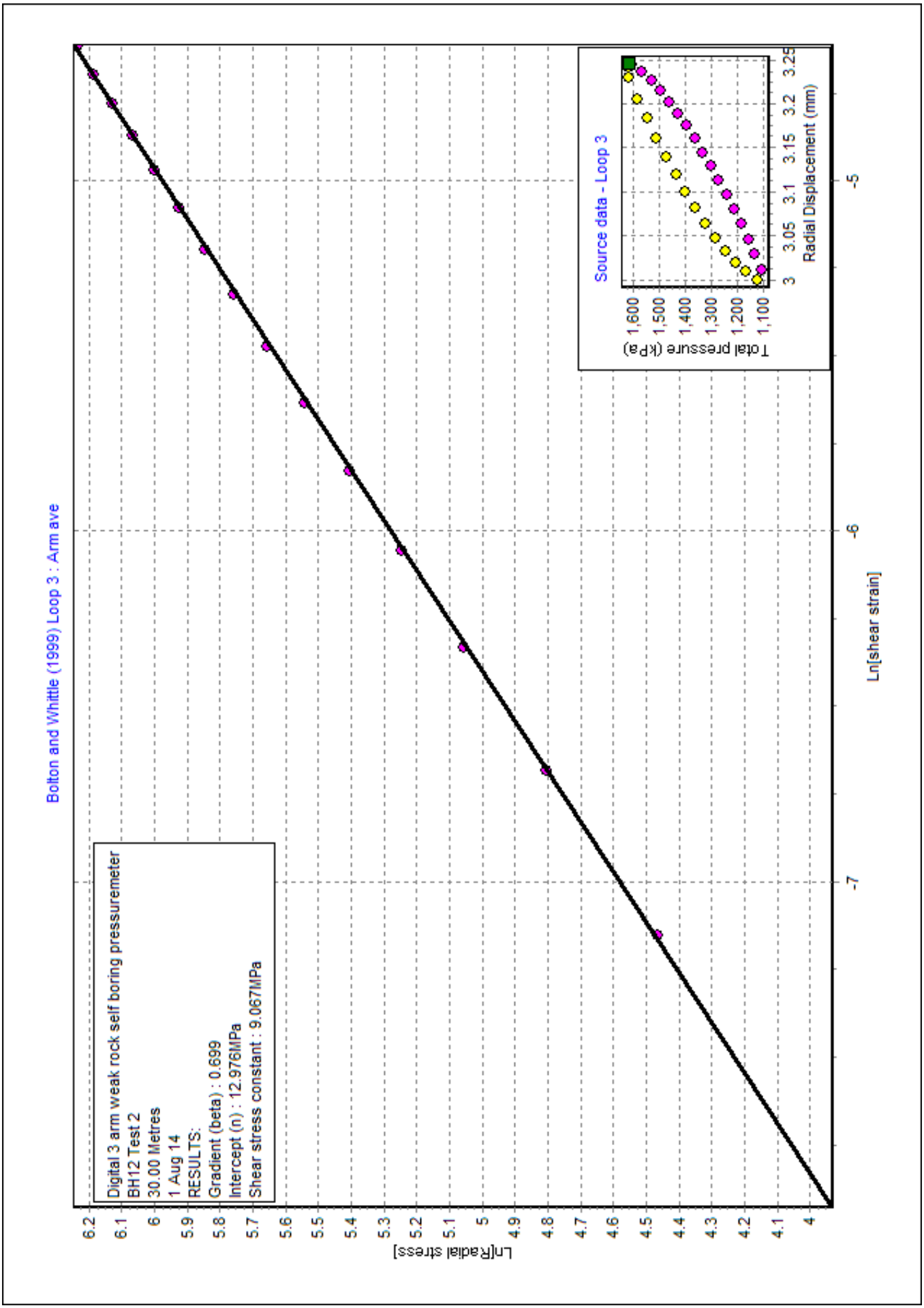

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 81.1MPa
Cycle mid-point:
Cavity strain : 0.055%
Total stress : 1138kPa
Size of cycle :
Shear strain : 0.354%
Total stress : 288kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,340
1,320
1,300
1,280
1,260
1,240
1,220
1,200
1,180
1,160
1,140
1,120
1,100
1,080
1,060
1,040
1,020
1,000
980
960
0.655
0.66
0.665
0.67
0.675
0.68
0.685
0.69
0.695
0.7
0.705
0.71
0.715
0.72
0.725
0.73
0.735
0.74
0.745
0.75

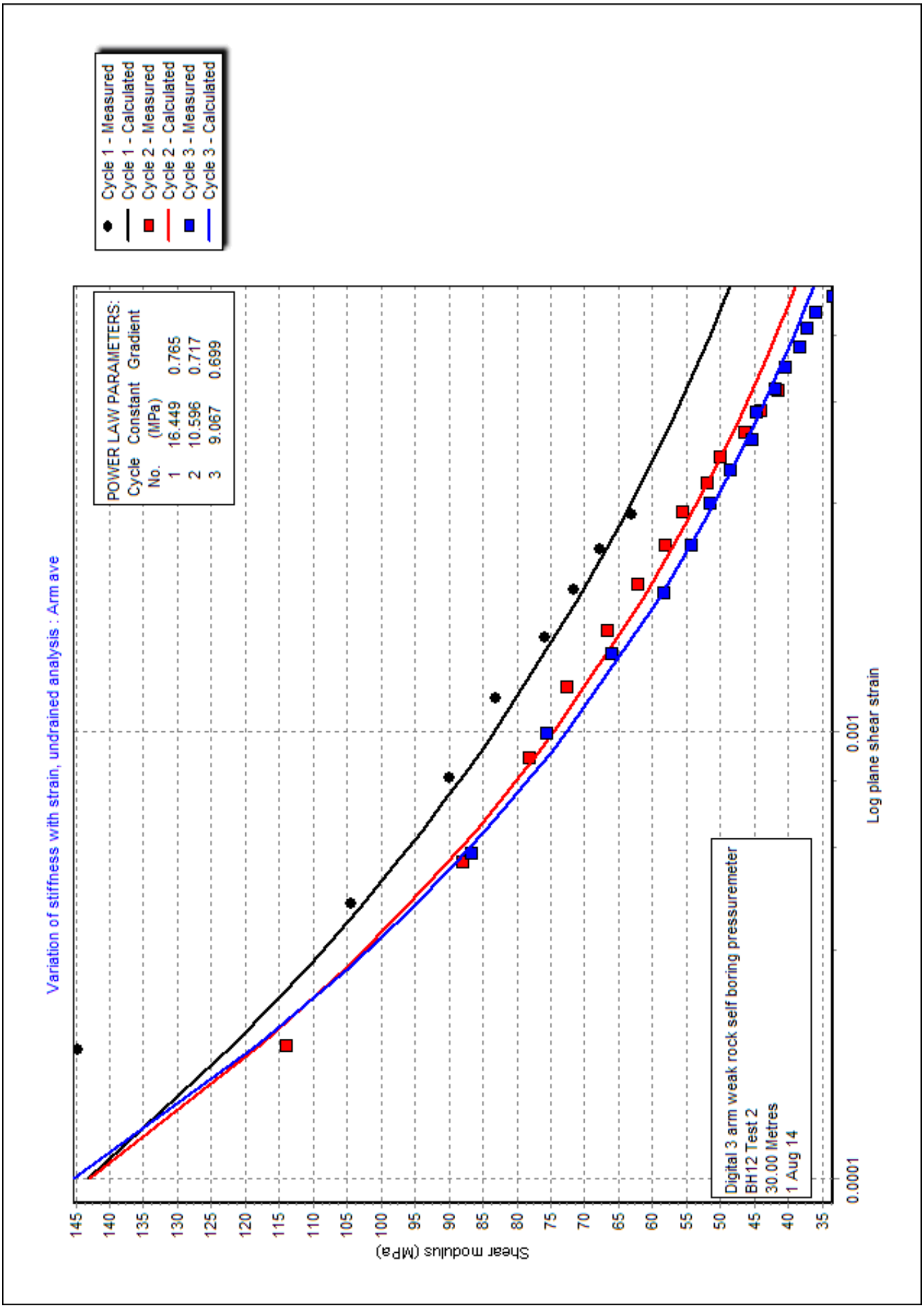

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 60.4MPa
Cycle mid-point:
Cavity strain : 1.888%
Total stress : 1775kPa
Size of cycle :
Shear strain : 0.660%
Total stress : 400kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

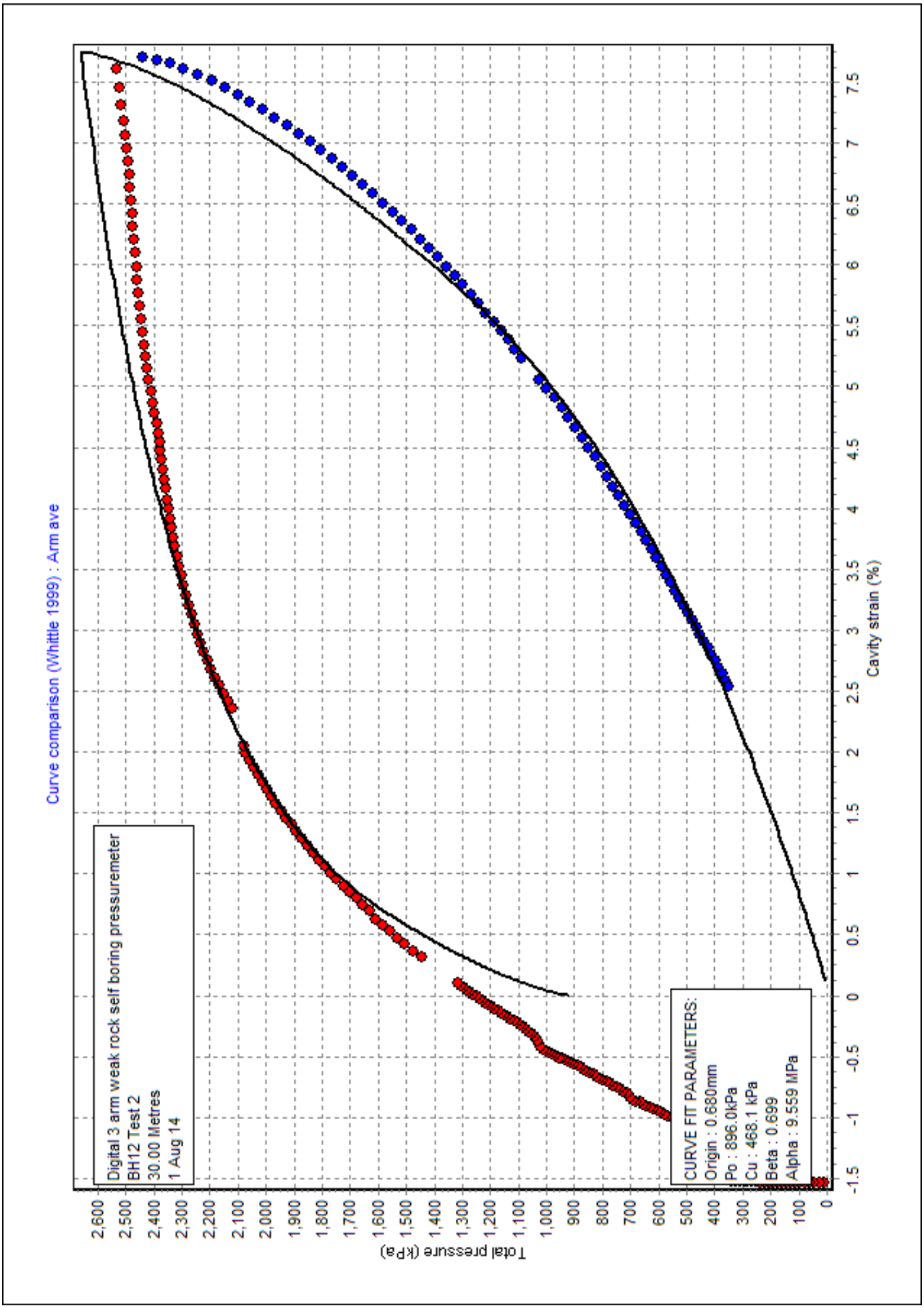

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 50.6MPa
Cycle mid-point:
Cavity strain : 5.468%
Total stress : 1361kPa
Size of cycle :
Shear strain : 0.989%
Total stress : 503kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

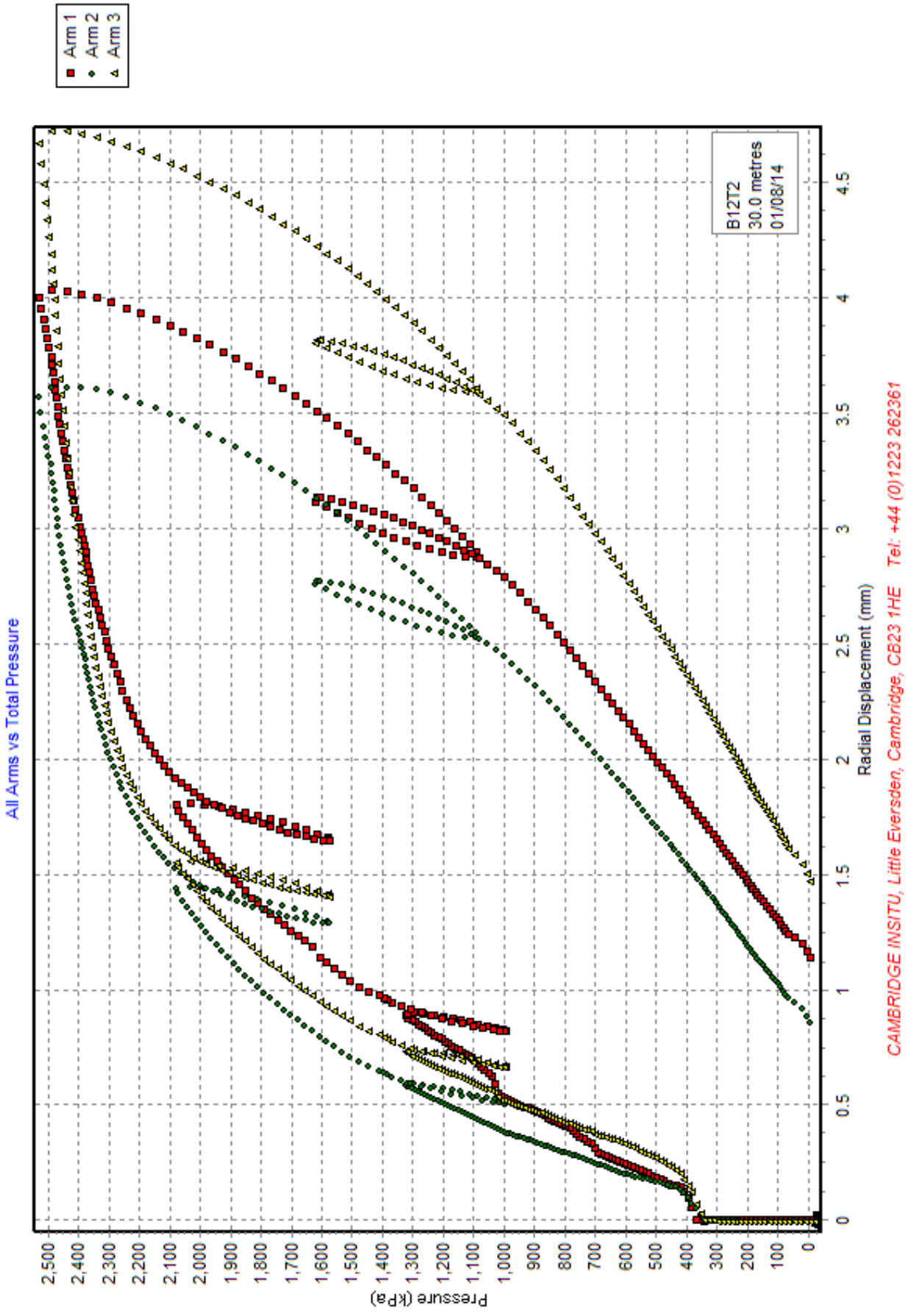

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
RESULTS:
Gradient (beta) : 0.765
Intercept (n) : 21.501MPa
Shear stress constant : 16.449MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

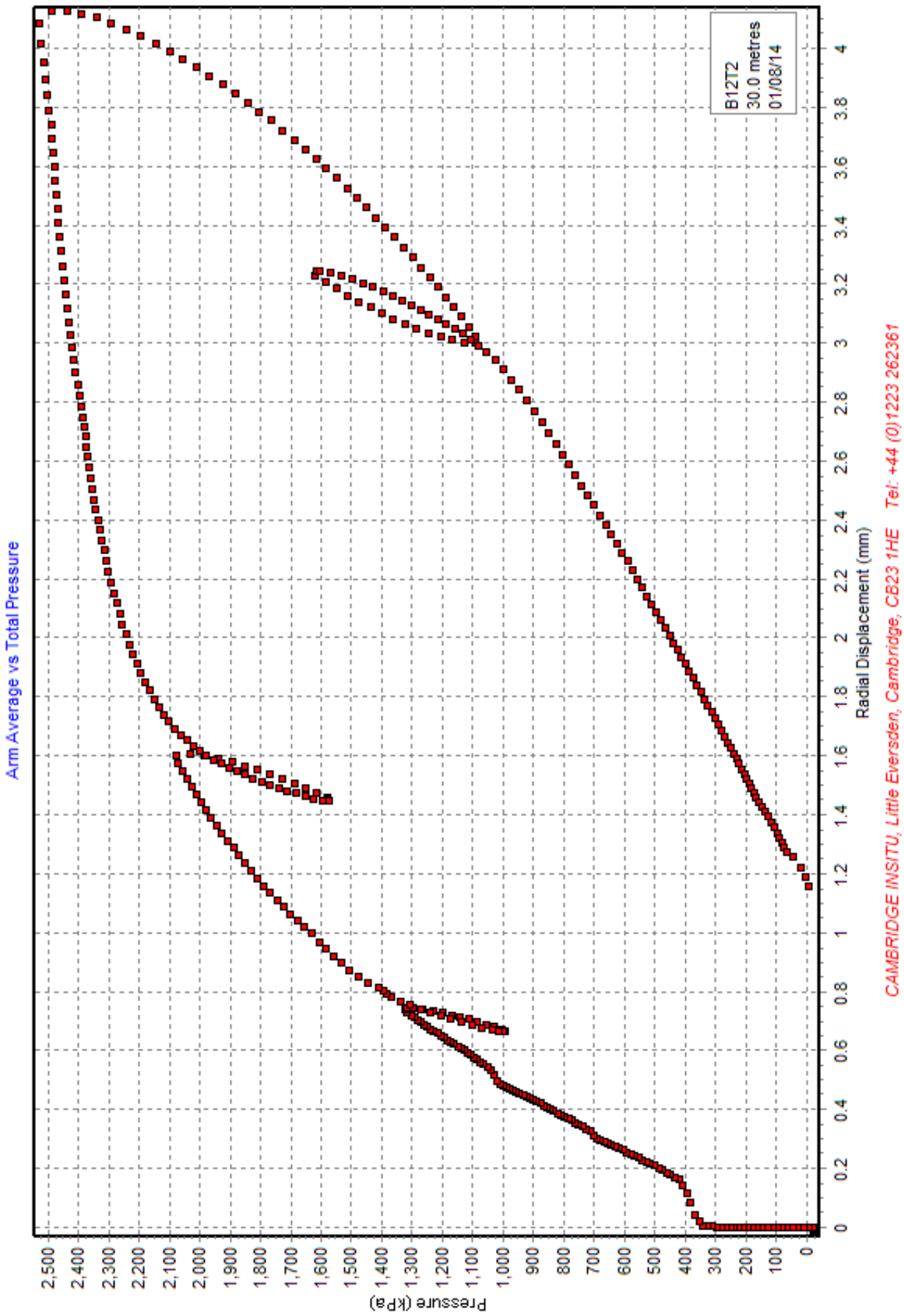

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
RESULTS:
Gradient (beta) : 0.717
Intercept (n) : 14.768MPa
Shear stress constant : 10.596MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

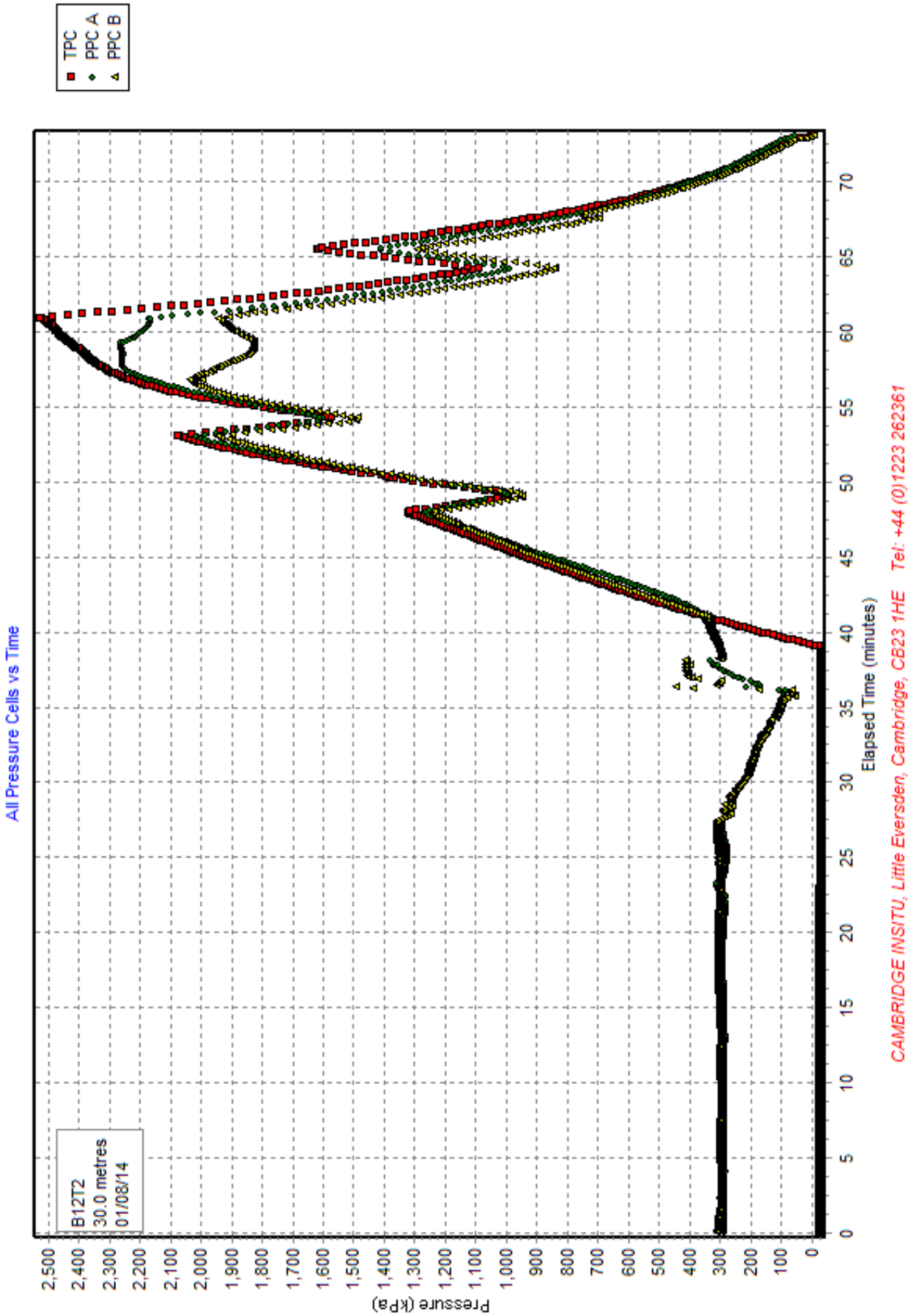

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
RESULTS:
Gradient (beta) : 0.699
Intercept (n) : 12.976MPa
Shear stress constant : 9.067MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 16.449 0.765
2 10.596 0.717
3 9.067 0.699
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 2
30.00 Metres
1 Aug 14
CURVE FIT PARAMETERS:
Origin : 0.680mm
Po : 896.0kPa
Cu : 468.1 kPa
Beta : 0.699
Alpha : 9.559 MPa
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
All Arms vs Total Pressure
B12T2
30.0 metres
01/08/14
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B12T2
30.0 metres
01/08/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B12T2
30.0 metres
01/08/14
Pressure (kPa)
Elapsed Time (minutes)
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BH12 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]

Project	:	C4237
Site	:	Rivenhall Airfield
Borehole	:	BH12
Test name	:	BH12 Test 3
Test date	:	6 Aug 14
Test depth	:	39.60 Metres
Water table	:	8 Metres
Ambient PWP	:	310.0 kPa
Material	:	London Clay
Probe	:	Digital 3 arm weak rock self boring pressuremeter
Diameter	:	88.0 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 7 Aug 14

Remarks: Starts at GL 15:22..Drill begins 15:48, 39.1m.

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.700"
Po from Marsland & Randolph (kPa)	:	"Arm ave=914.4"
Po from Lift off (kPa)	:	"Arm ave=1122.0"
Best estimate of Po (kPa)	:	"Arm ave=872.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=541.1"
Limit pressure (kPa)	:	"Arm ave=4225"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=541.6"
Undrained yield stress (kPa)	:	"Arm ave=1809.7"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=36.7"

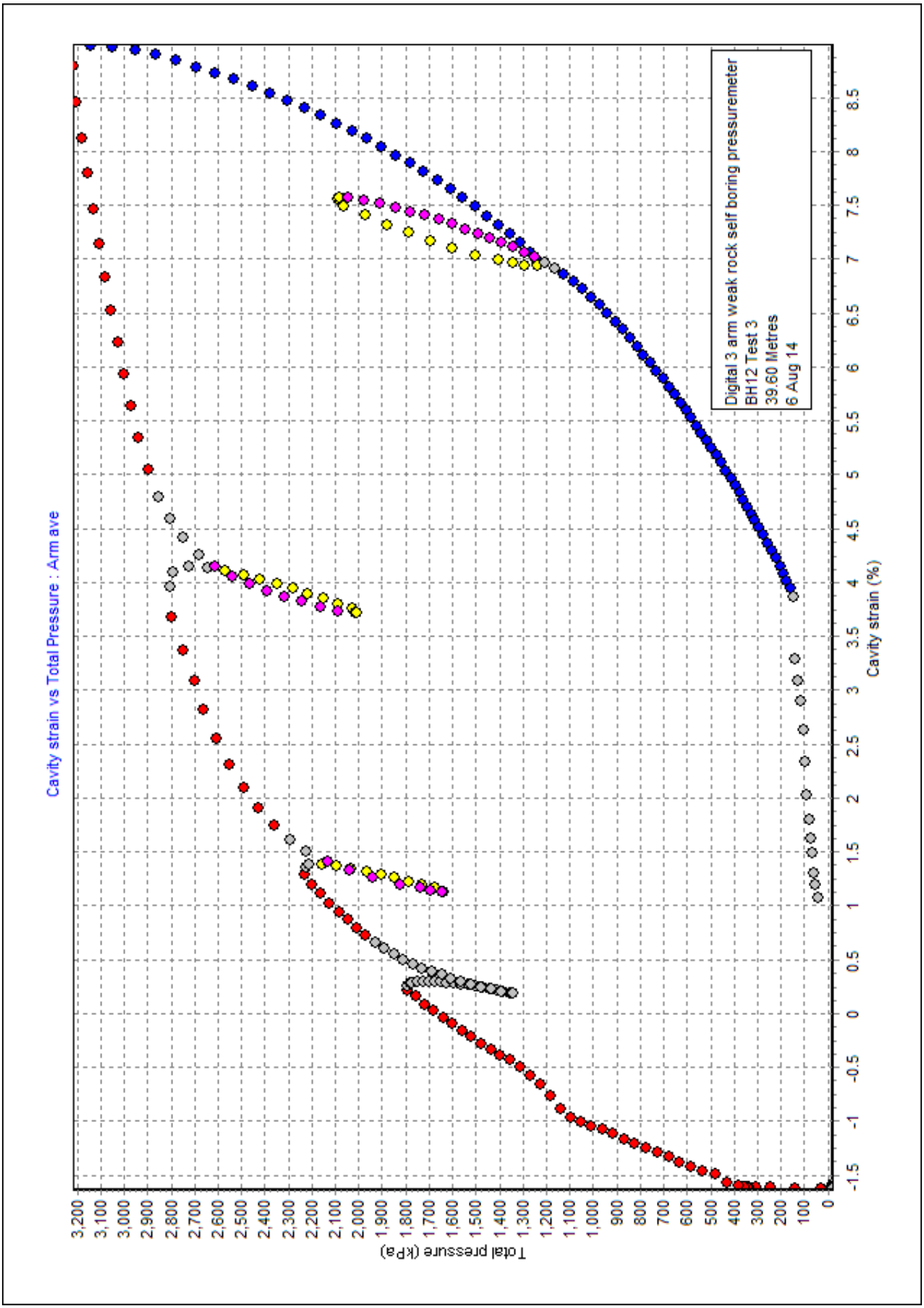
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	95.6	1.278	1903	0.549	526
Arm ave	2	76.4	3.923	2296	0.729	558
Arm ave	3	72.9	7.264	1652	1.168	857

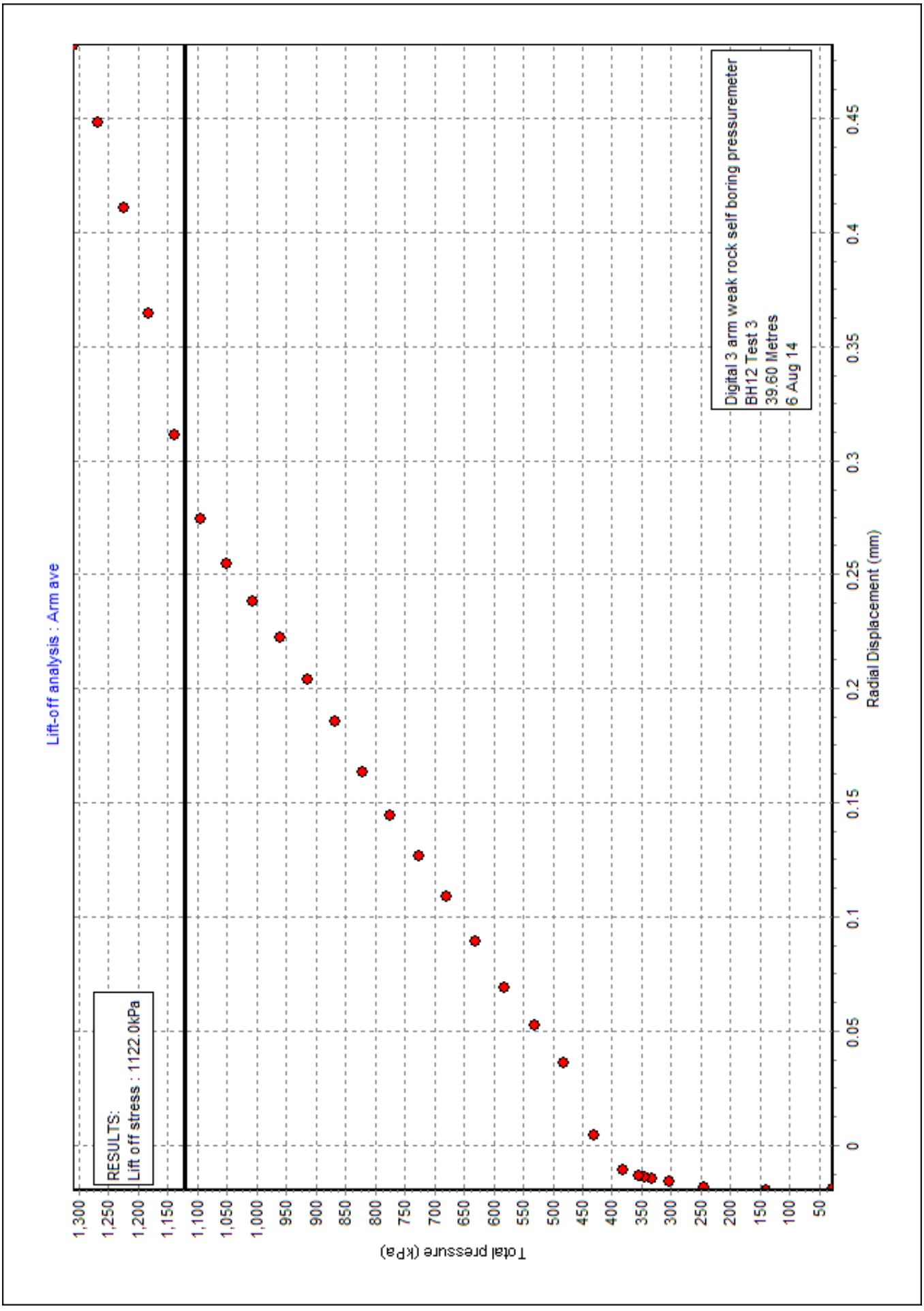
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

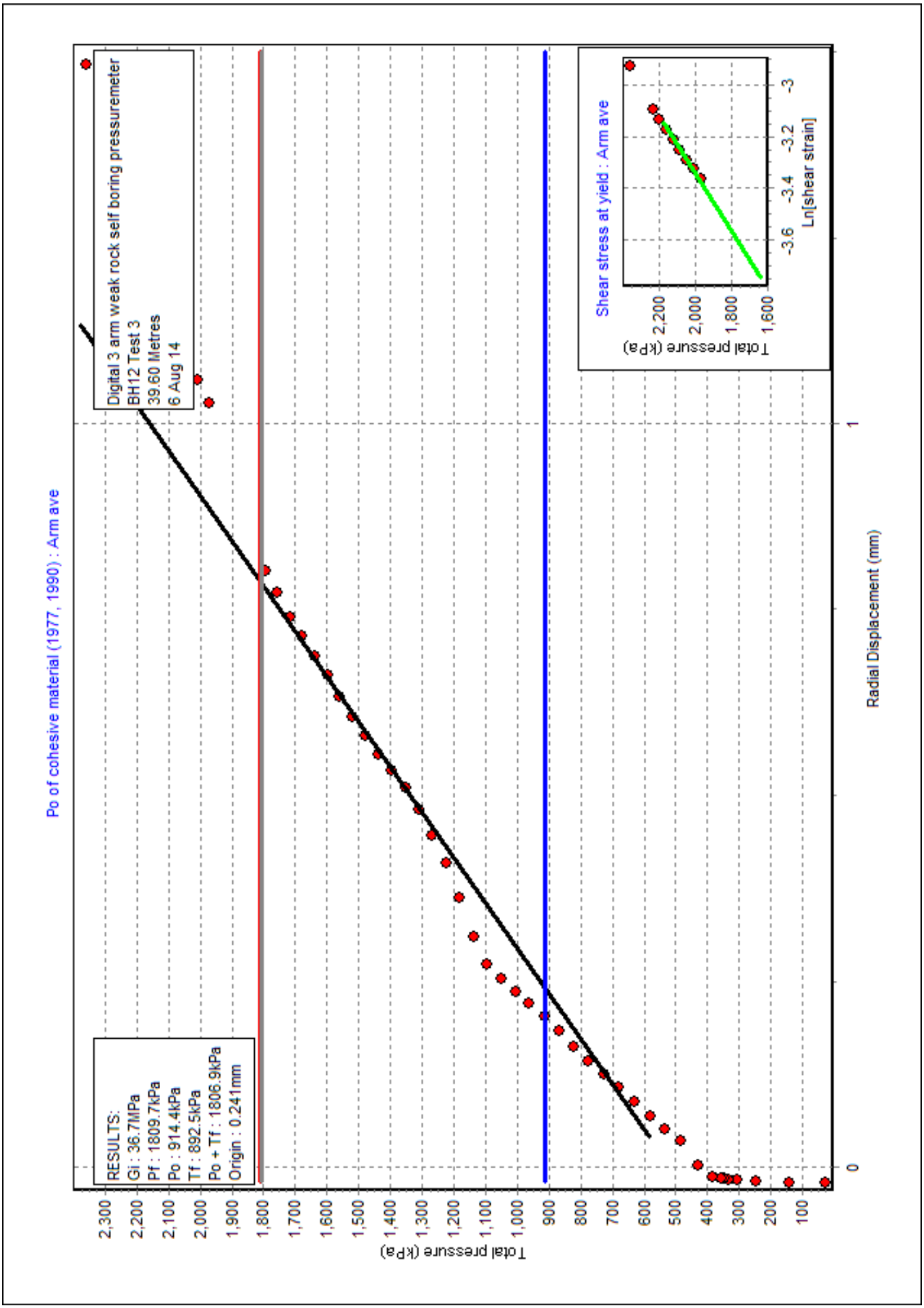
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	27.094	20.754	0.766
Arm ave	2	17.936	12.586	0.702
Arm ave	3	18.184	12.242	0.673

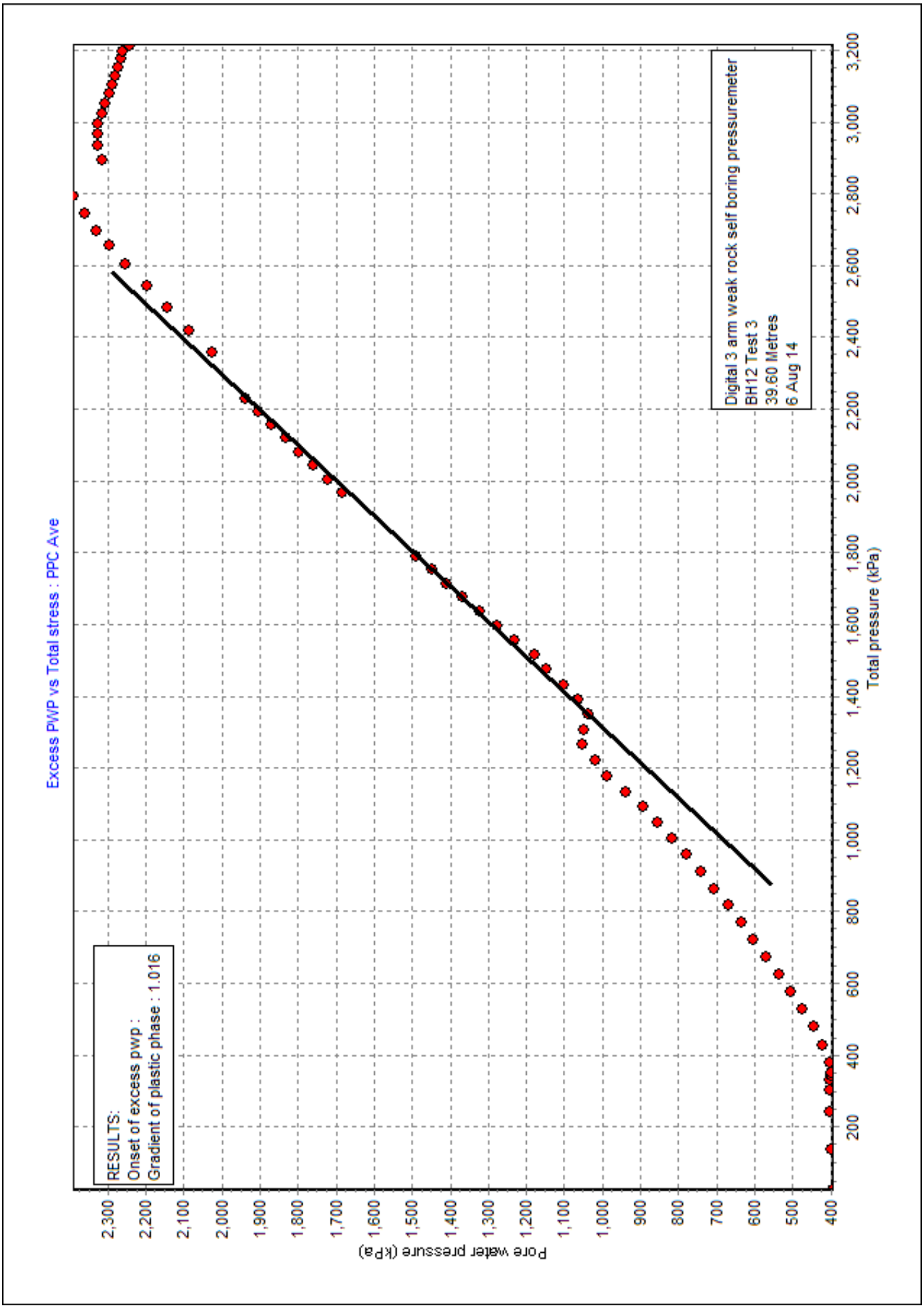
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}

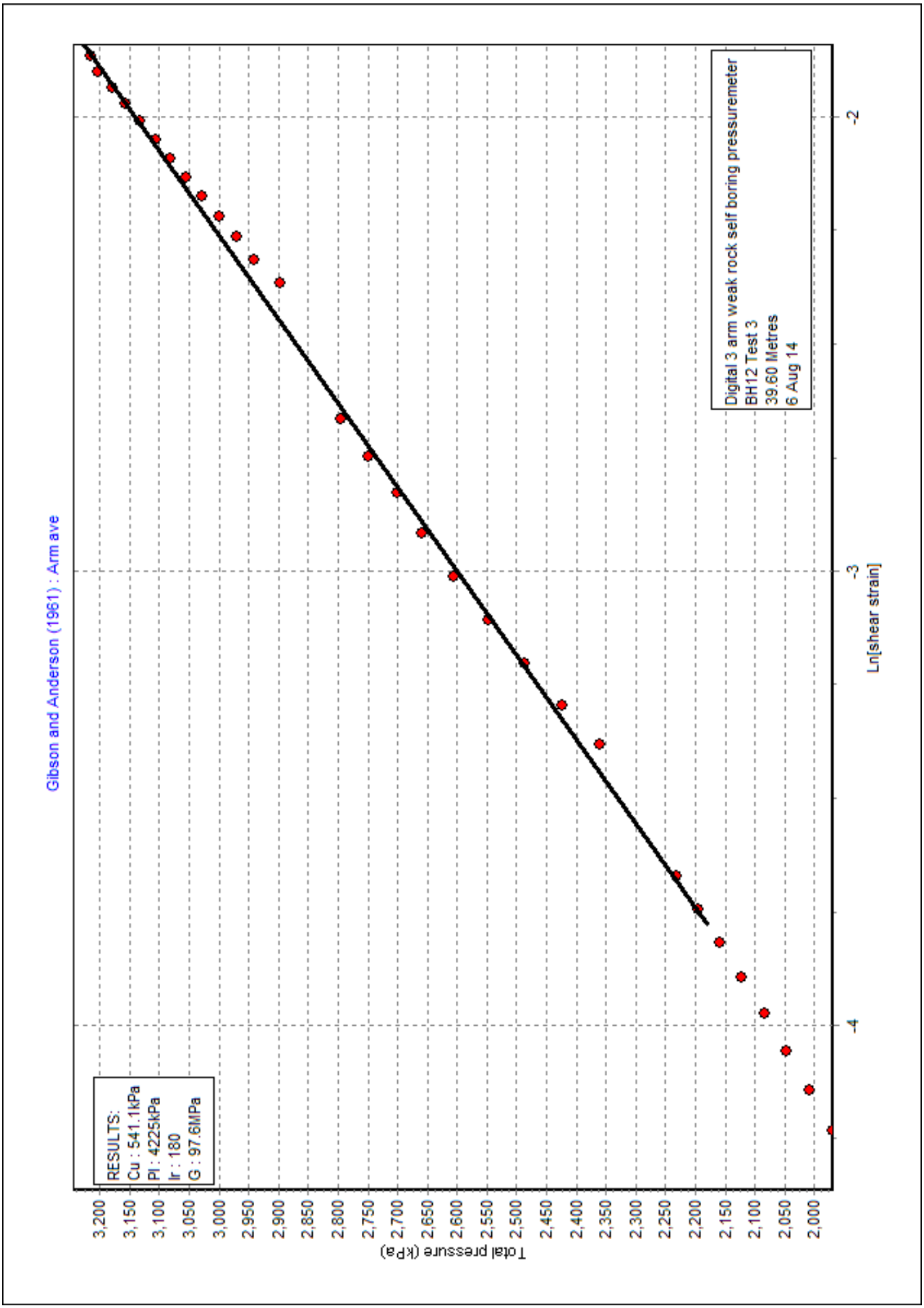
Strain Origin (mm)	:	0.70
Po (kPa)	:	872
Cu (kPa)	:	541.1
Limit pressure (kPa)	:	4225
Non-linear exponent	:	0.673
Calculated alpha (MPa)	:	12.876
G at yield (MPa)	:	60.1

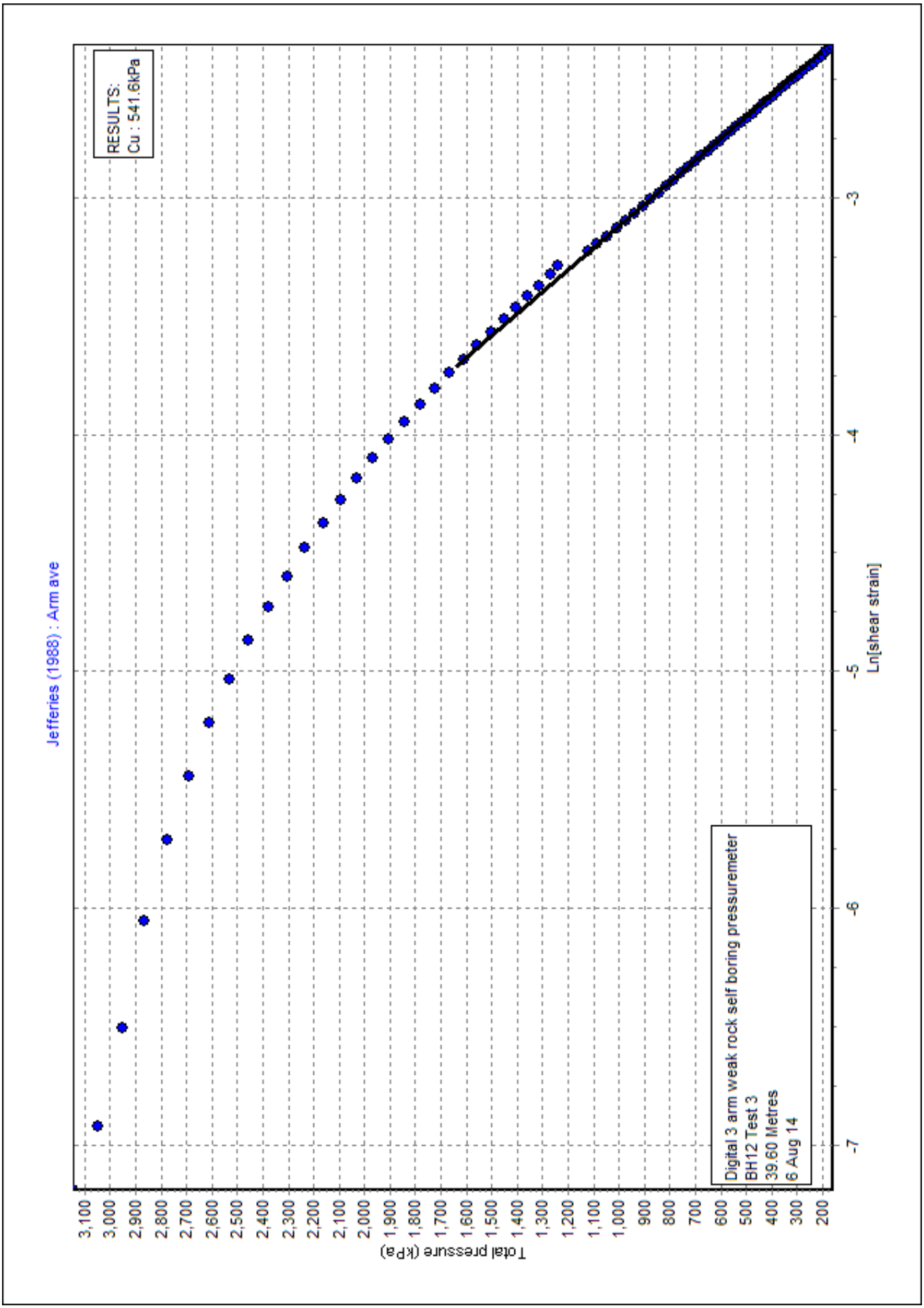

Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Cavity strain (%)

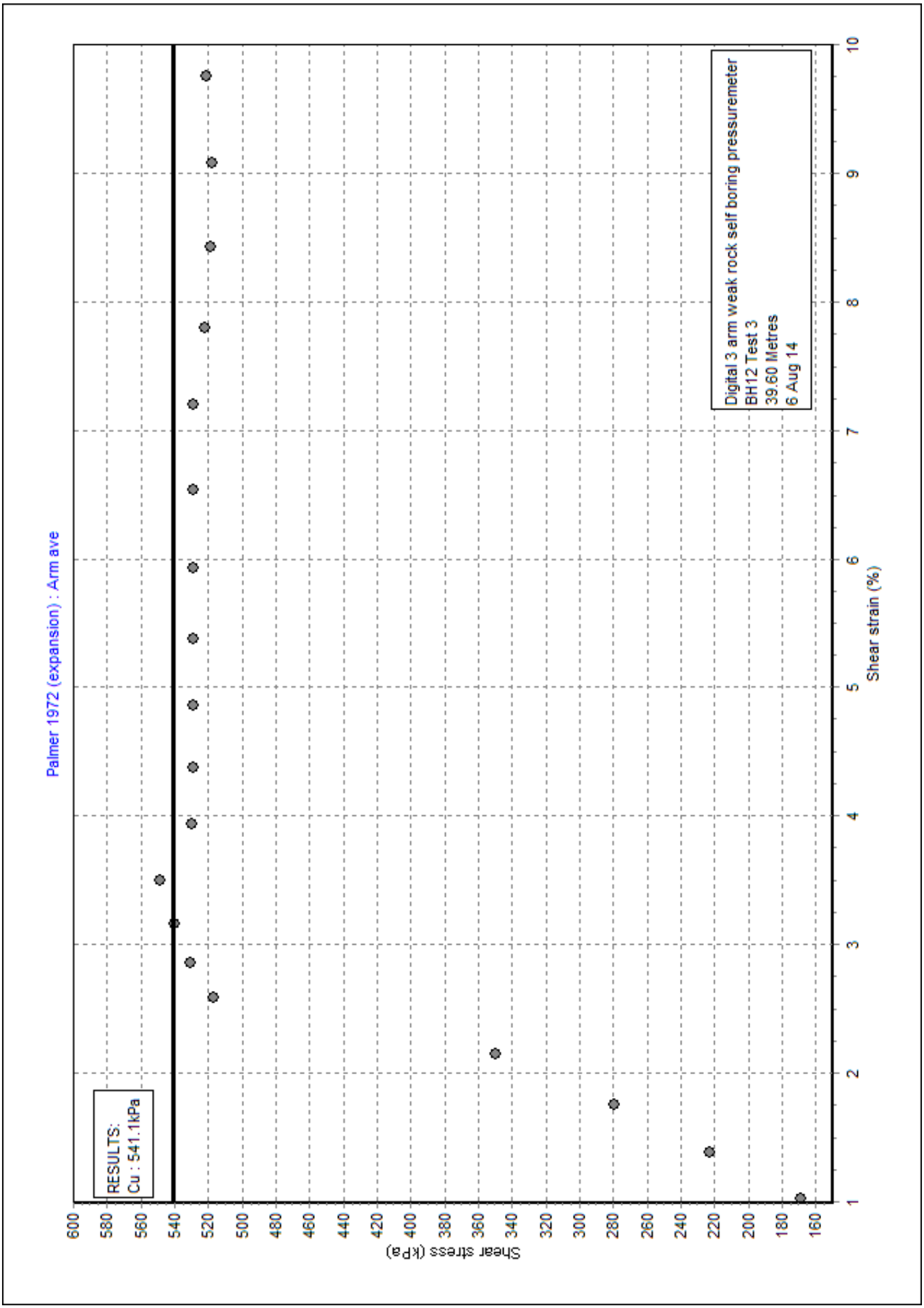

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 1122.0kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45

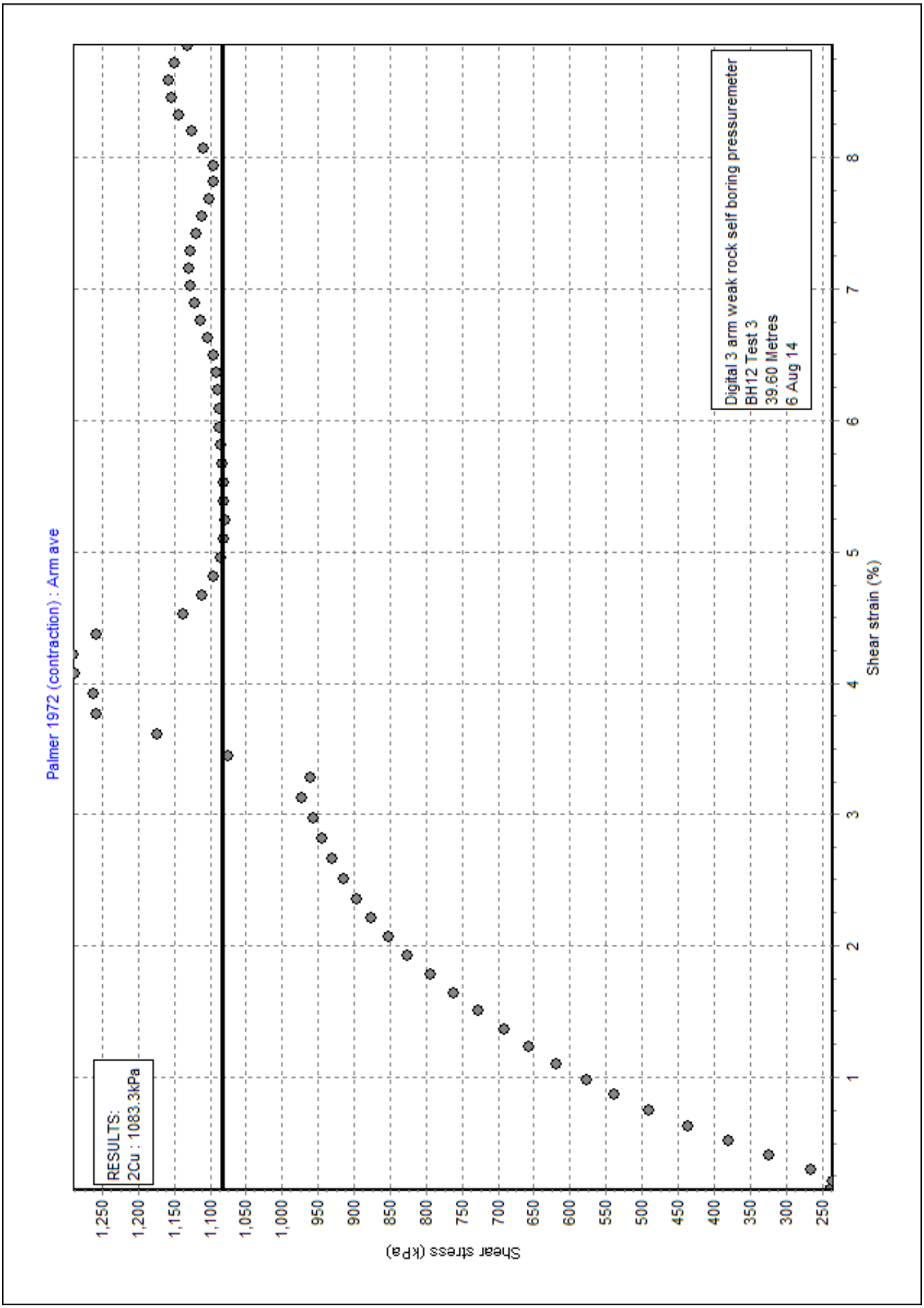

Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
RESULTS:
Gi : 36.7MPa
Pf : 1809.7kPa
Po : 914.4kPa
Tf : 892.5kPa
Po + Tf : 1806.9kPa
Origin : 0.241mm
Po of cohesive material (1977, 1990) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

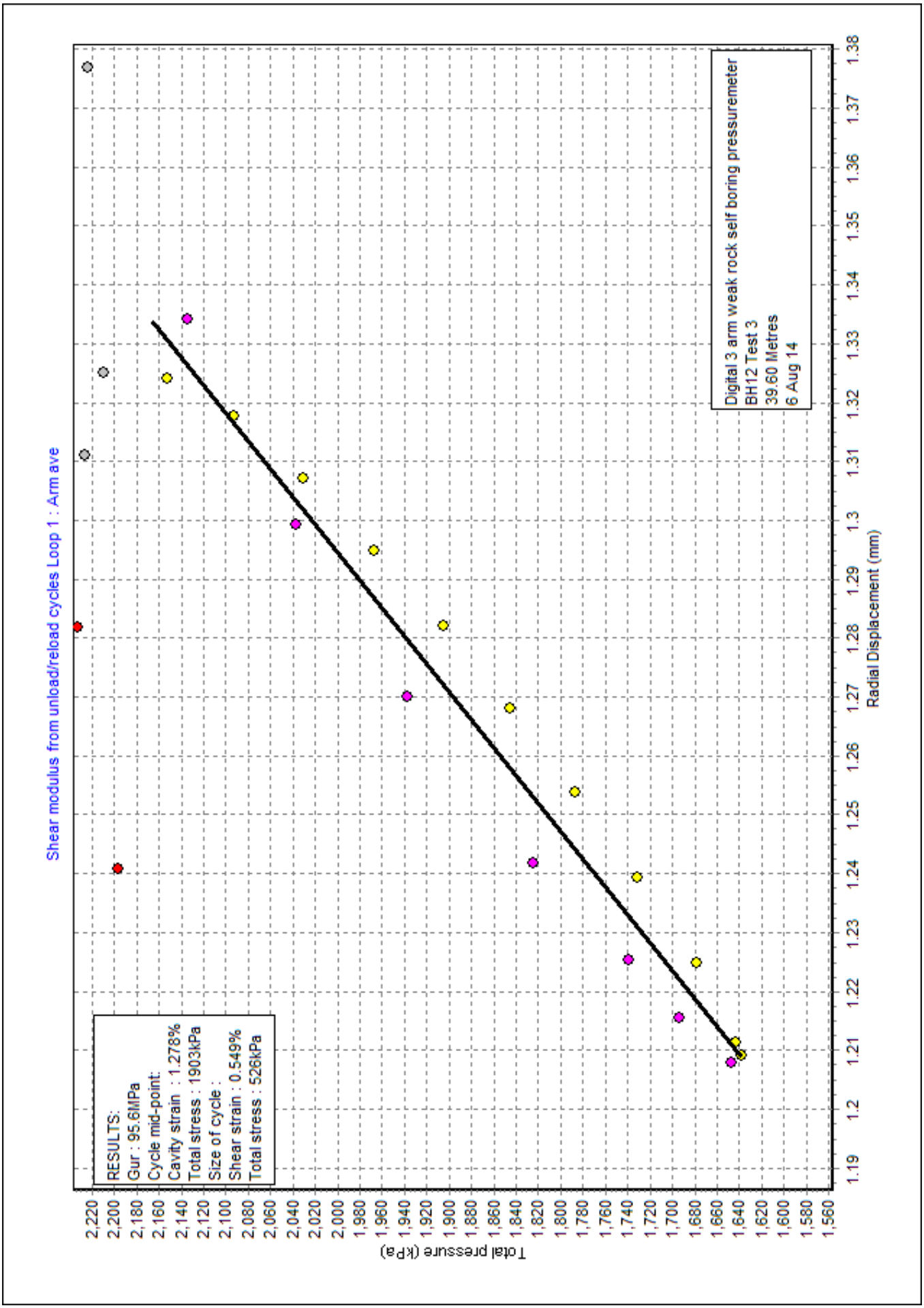

Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp :
Gradient of plastic phase : 1.016
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Pore water pressure (kPa)
Total pressure (kPa)
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
2,600
2,800
3,000
3,200

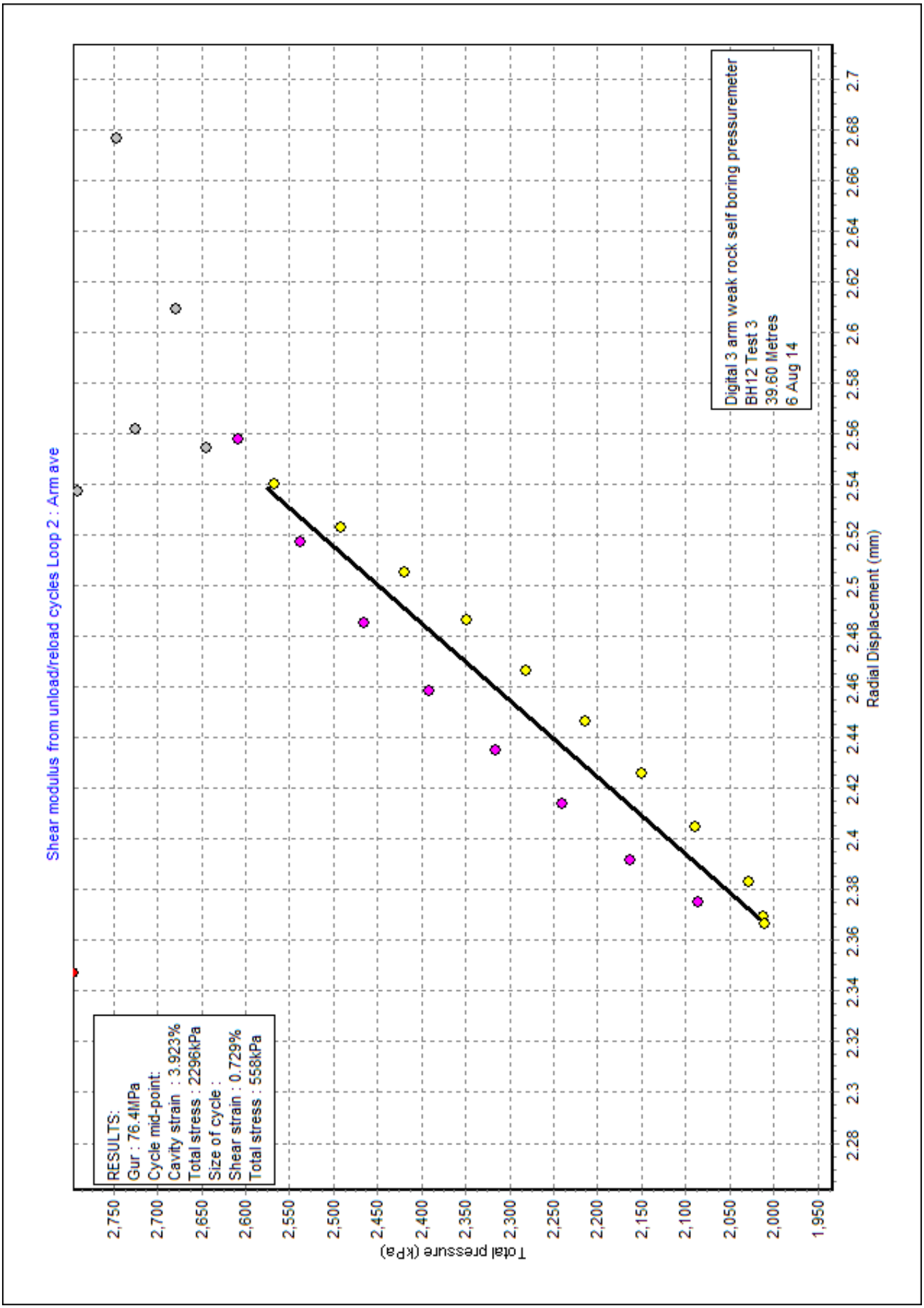

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 541.1kPa
Pl : 4225kPa
Ir : 180
G : 97.6MPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Ln[shear strain]
3,200
3,150
3,100
3,050
3,000
2,950
2,900
2,850
2,800
2,750
2,700
2,650
2,600
2,550
2,500
2,450
2,400
2,350
2,300
2,250
2,200
2,150
2,100
2,050
2,000
-2
-3
-4

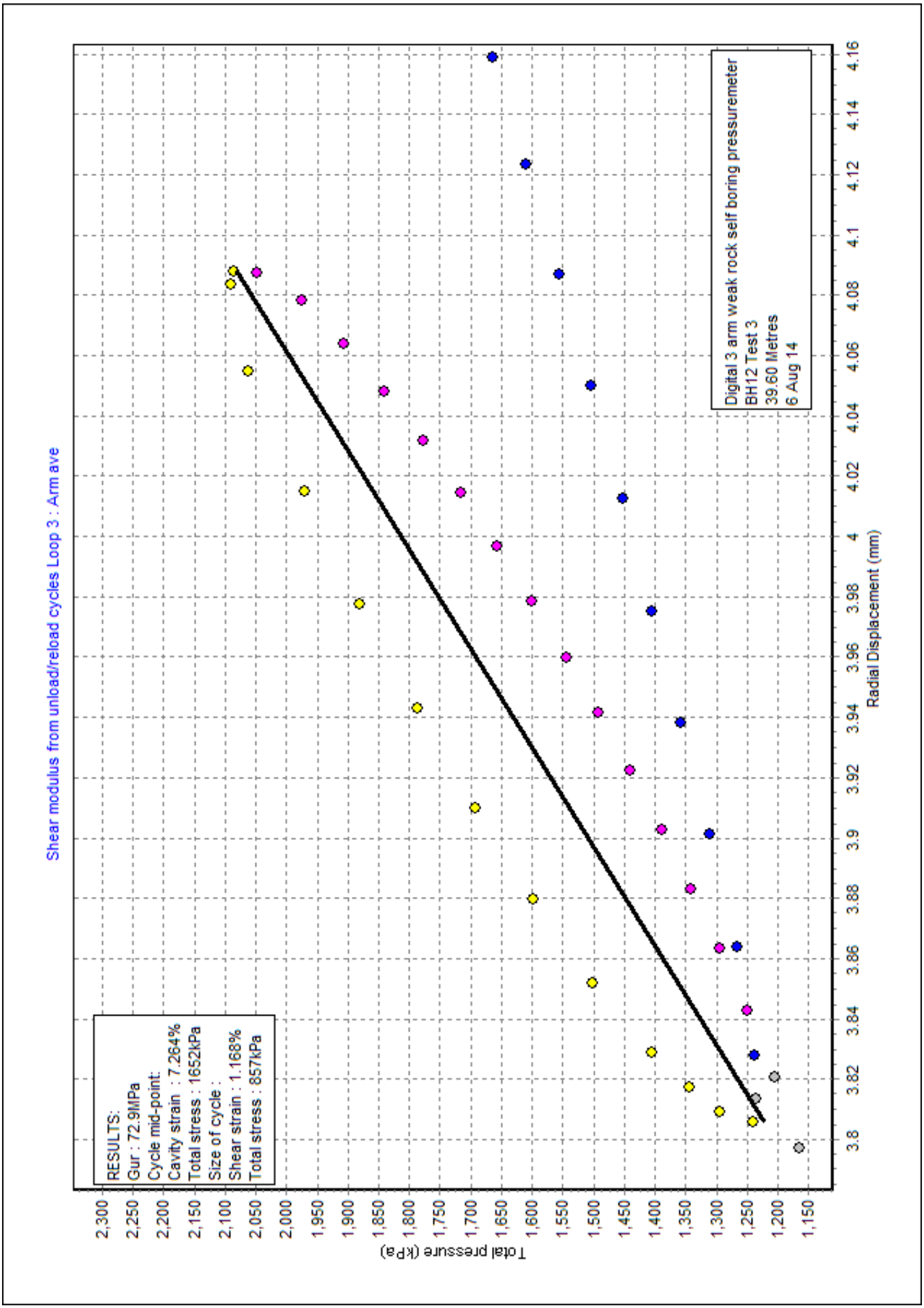

RESULTS:
Cu : 541.6kPa
Jefferies (1988) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Ln[shear strain]
3,100
3,000
2,900
2,800
2,700
2,600
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
-3
-4
-5
-6
-7

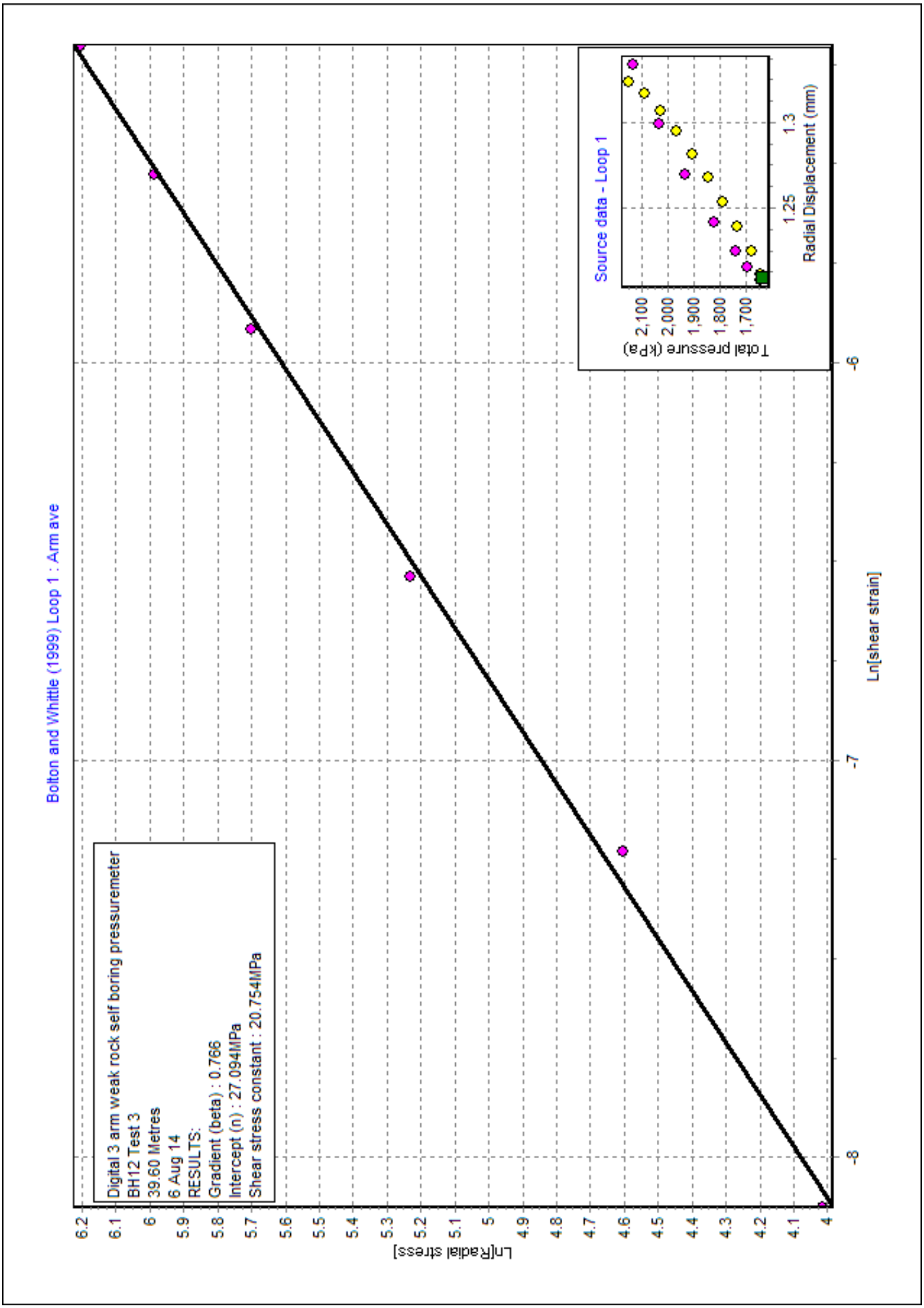

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 541.1kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Shear stress (kPa)
Shear strain (%)

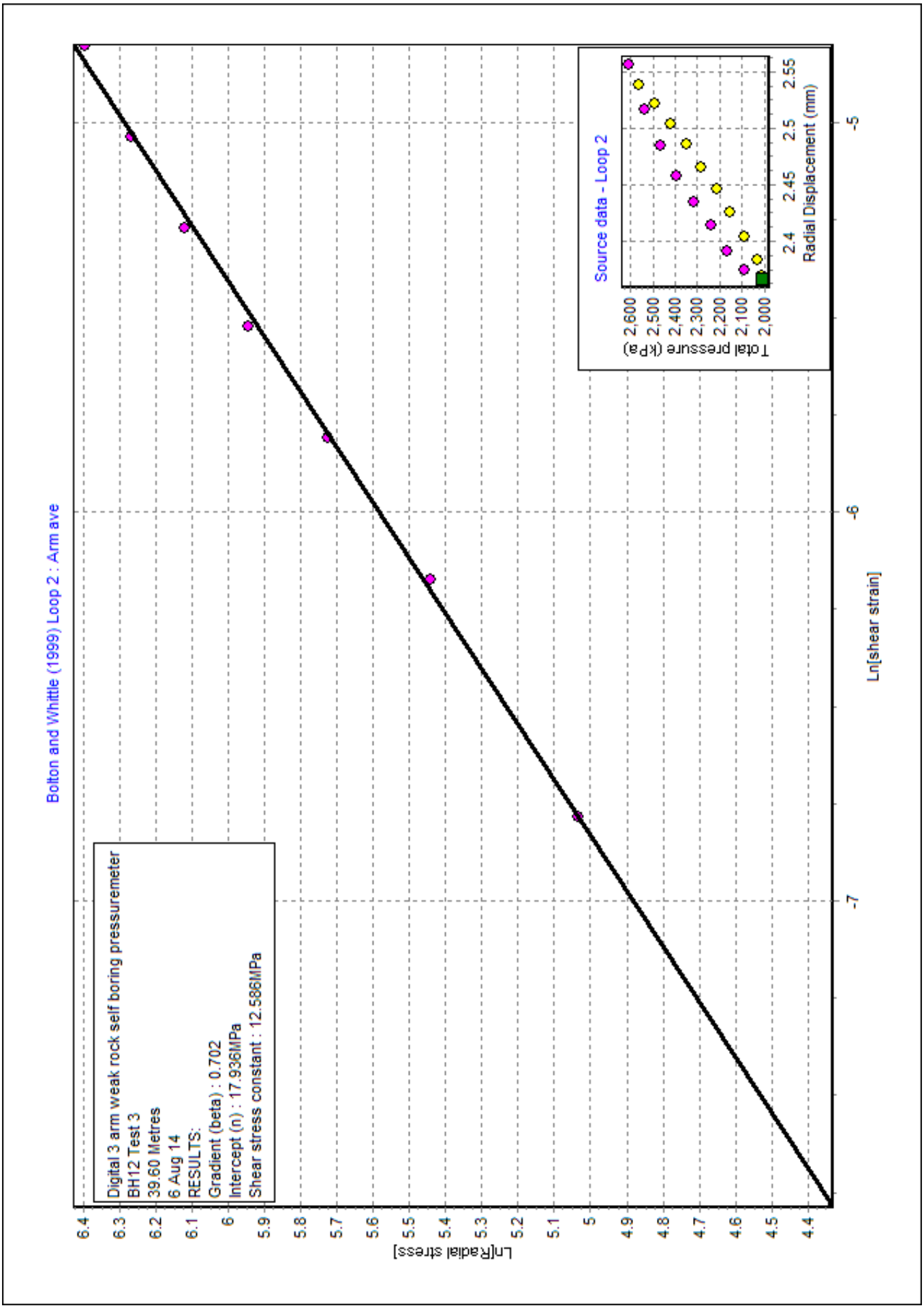

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 1083.3kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Shear stress (kPa)
Shear strain (%)
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
1
2
3
4
5
6
7
8

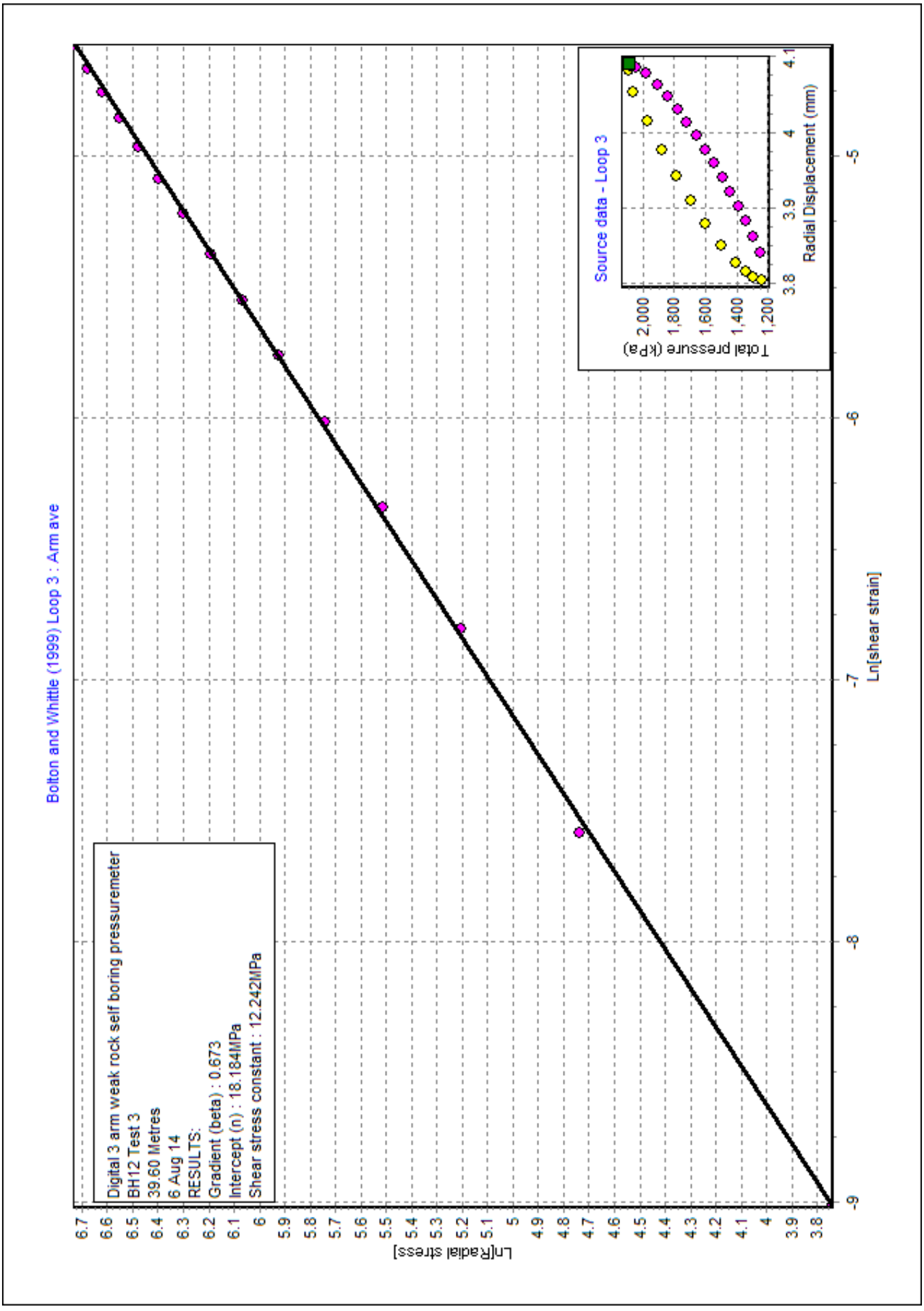

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 95.6MPa
Cycle mid-point:
Cavity strain : 1.278%
Total stress : 1903kPa
Size of cycle :
Shear strain : 0.549%
Total stress : 526kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

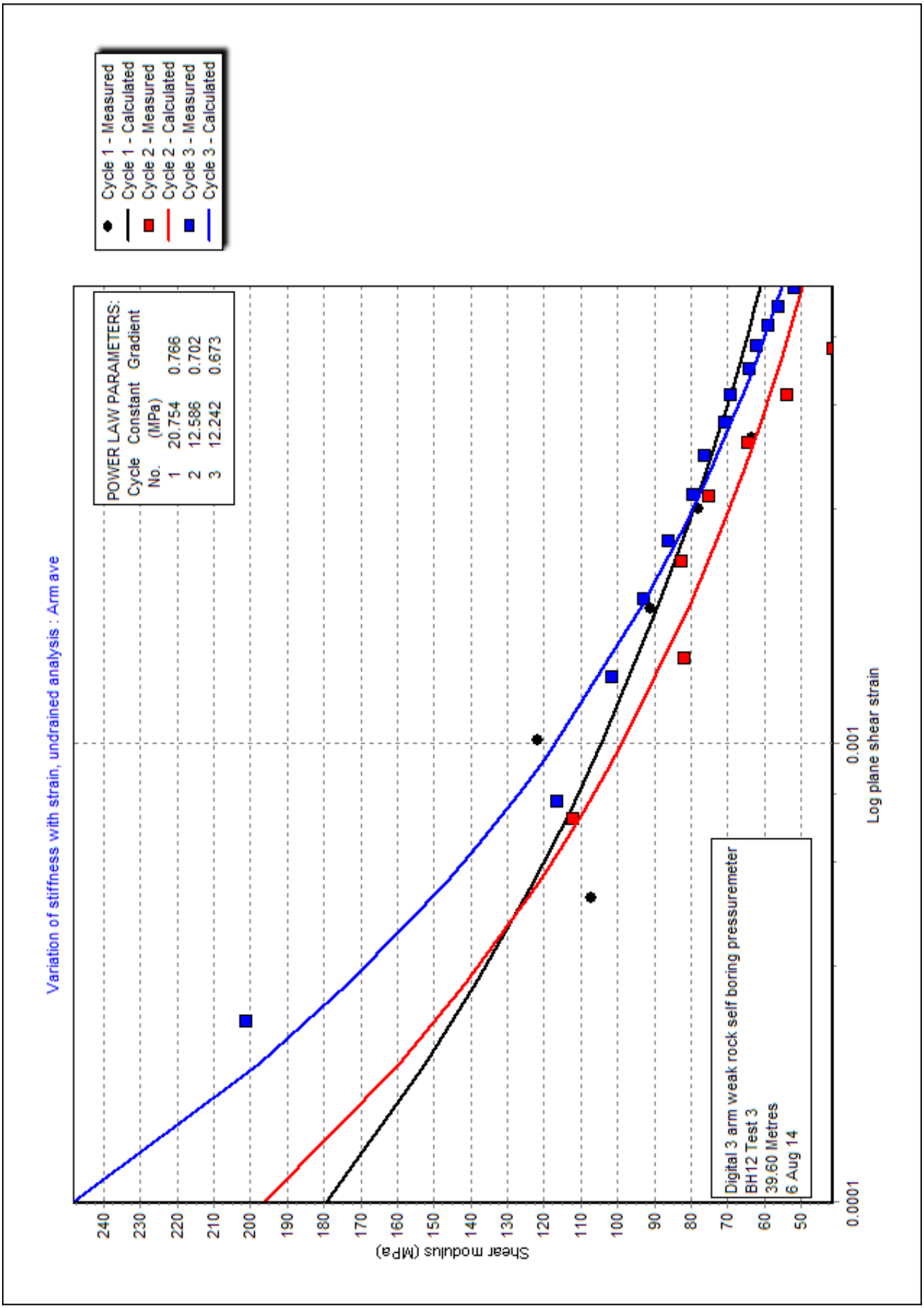

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 76.4MPa
Cycle mid-point:
Cavity strain : 3.923%
Total stress : 2296kPa
Size of cycle :
Shear strain : 0.729%
Total stress : 558kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

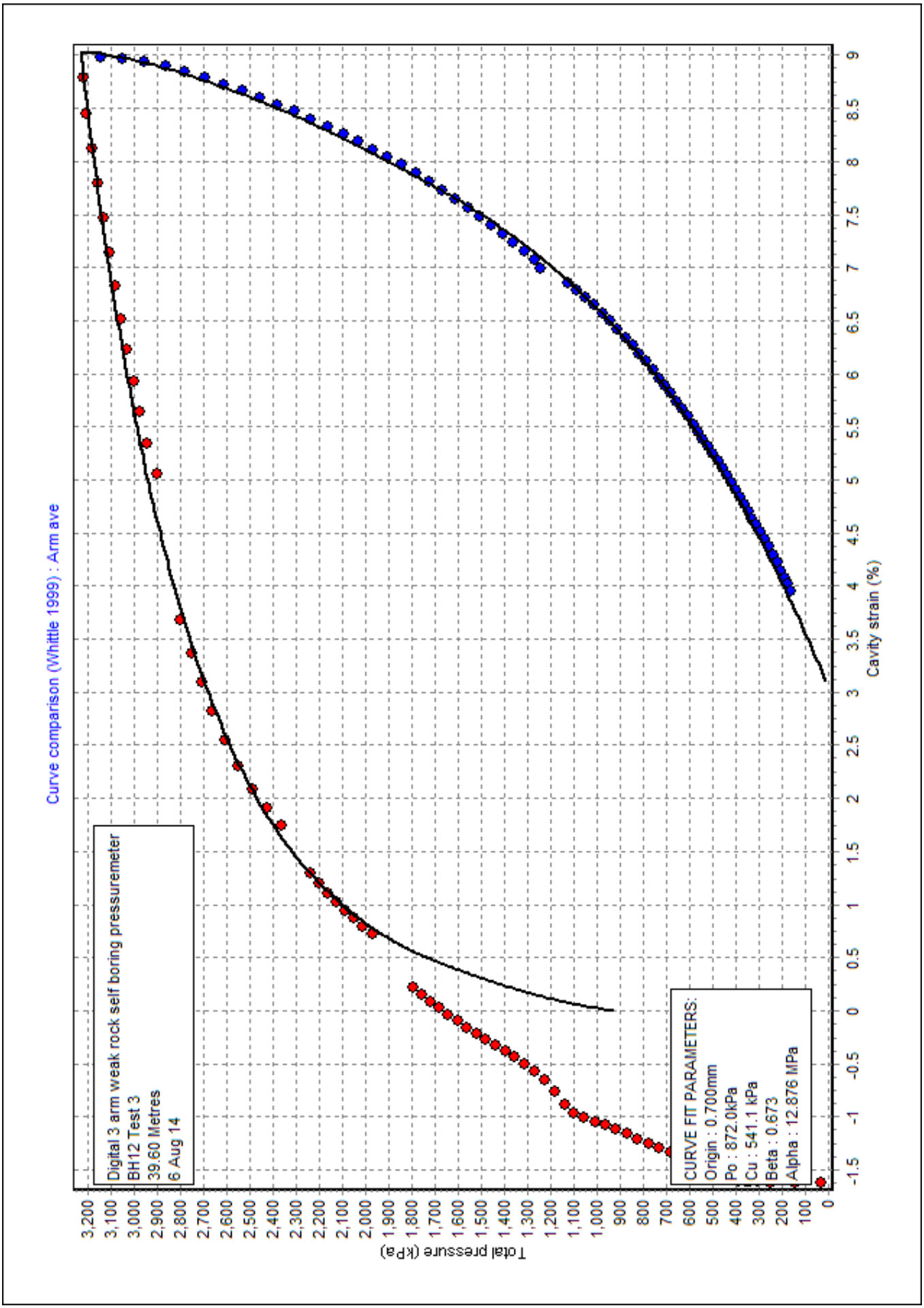

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 72.9MPa
Cycle mid-point:
Cavity strain : 7.264%
Total stress : 1652kPa
Size of cycle :
Shear strain : 1.168%
Total stress : 857kPa
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

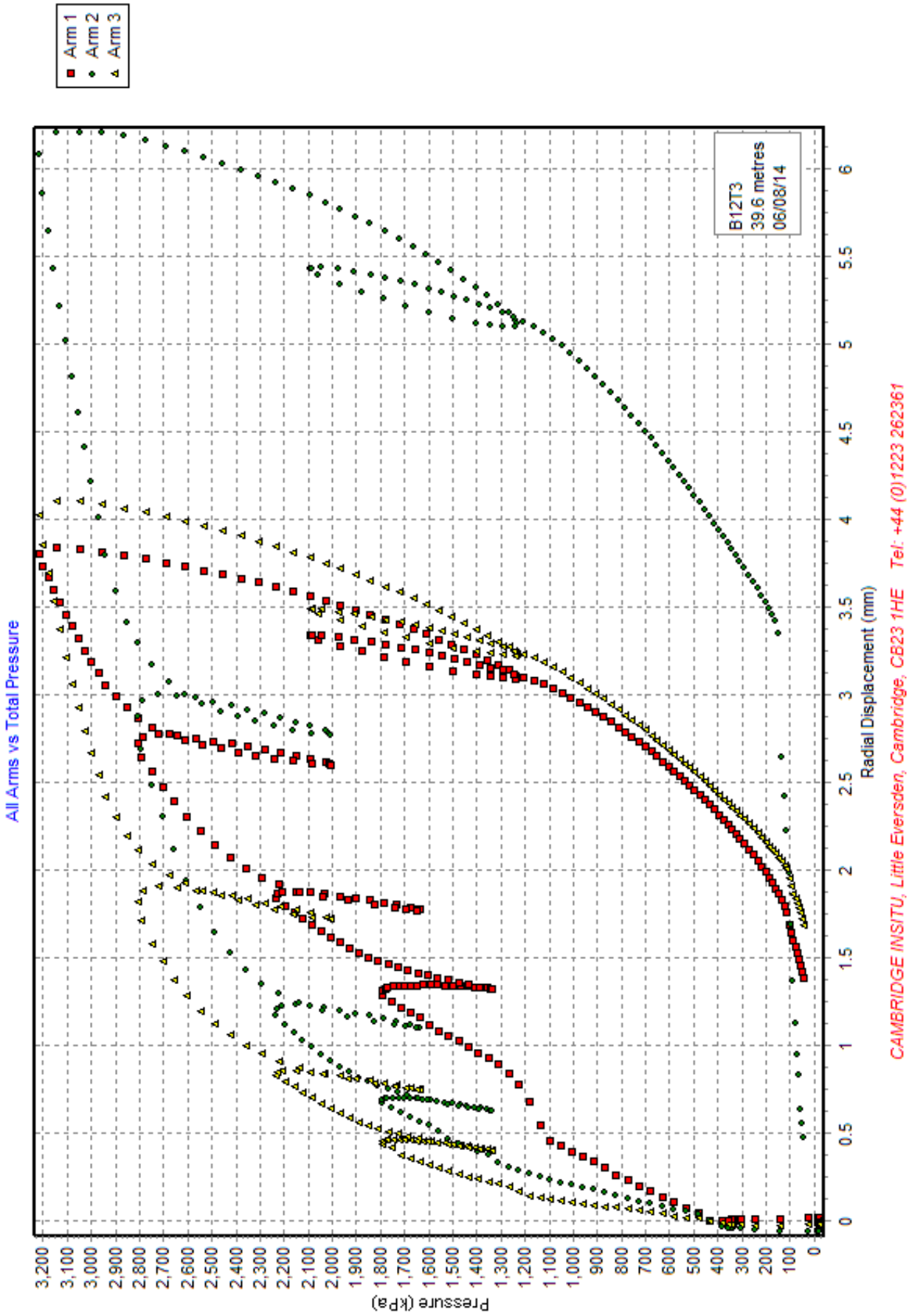

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
RESULTS:
Gradient (beta) : 0.766
Intercept (n) : 27.094MPa
Shear stress constant : 20.754MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

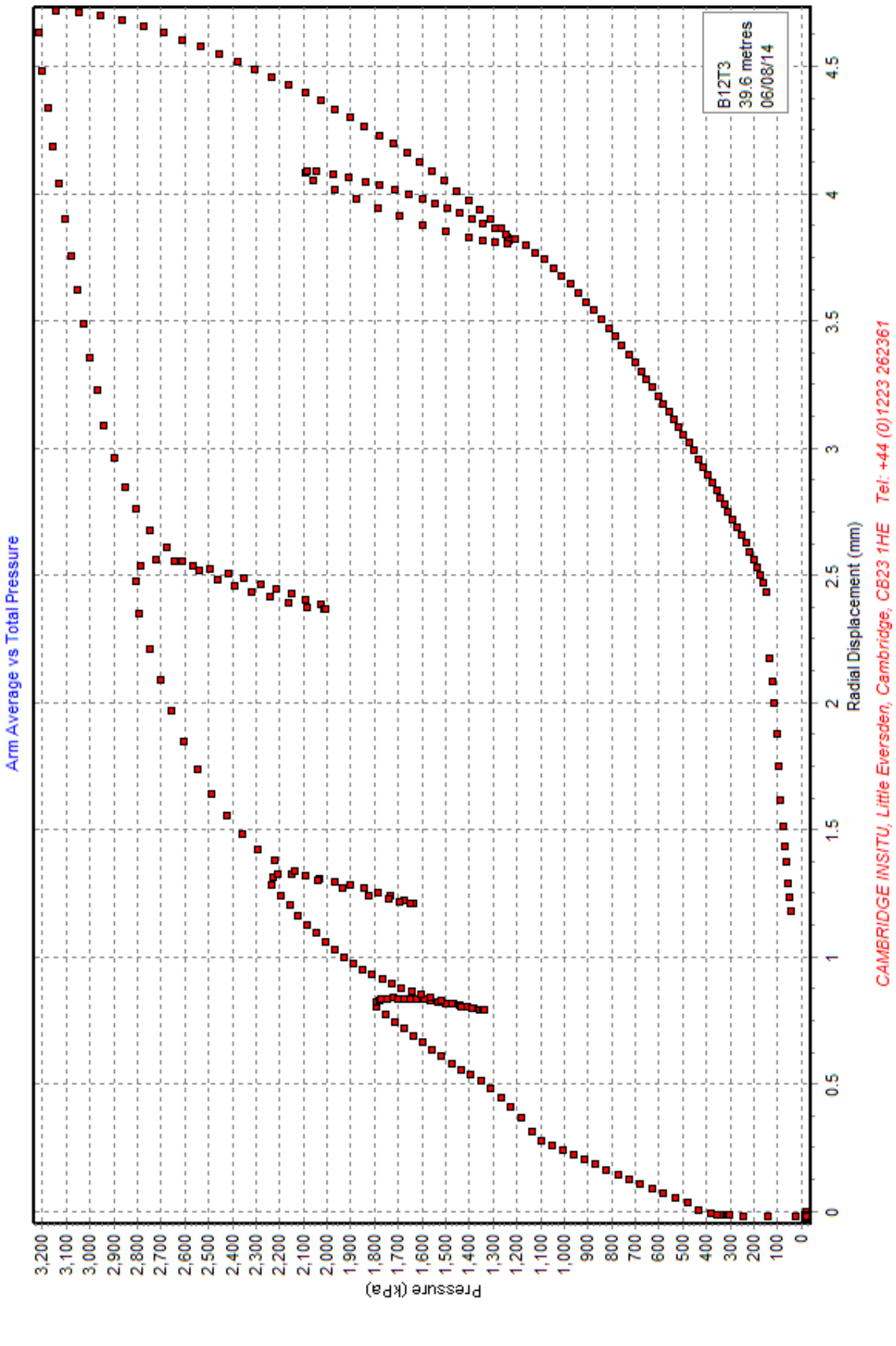

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
RESULTS:
Gradient (beta) : 0.702
Intercept (n) : 17.936MPa
Shear stress constant : 12.586MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

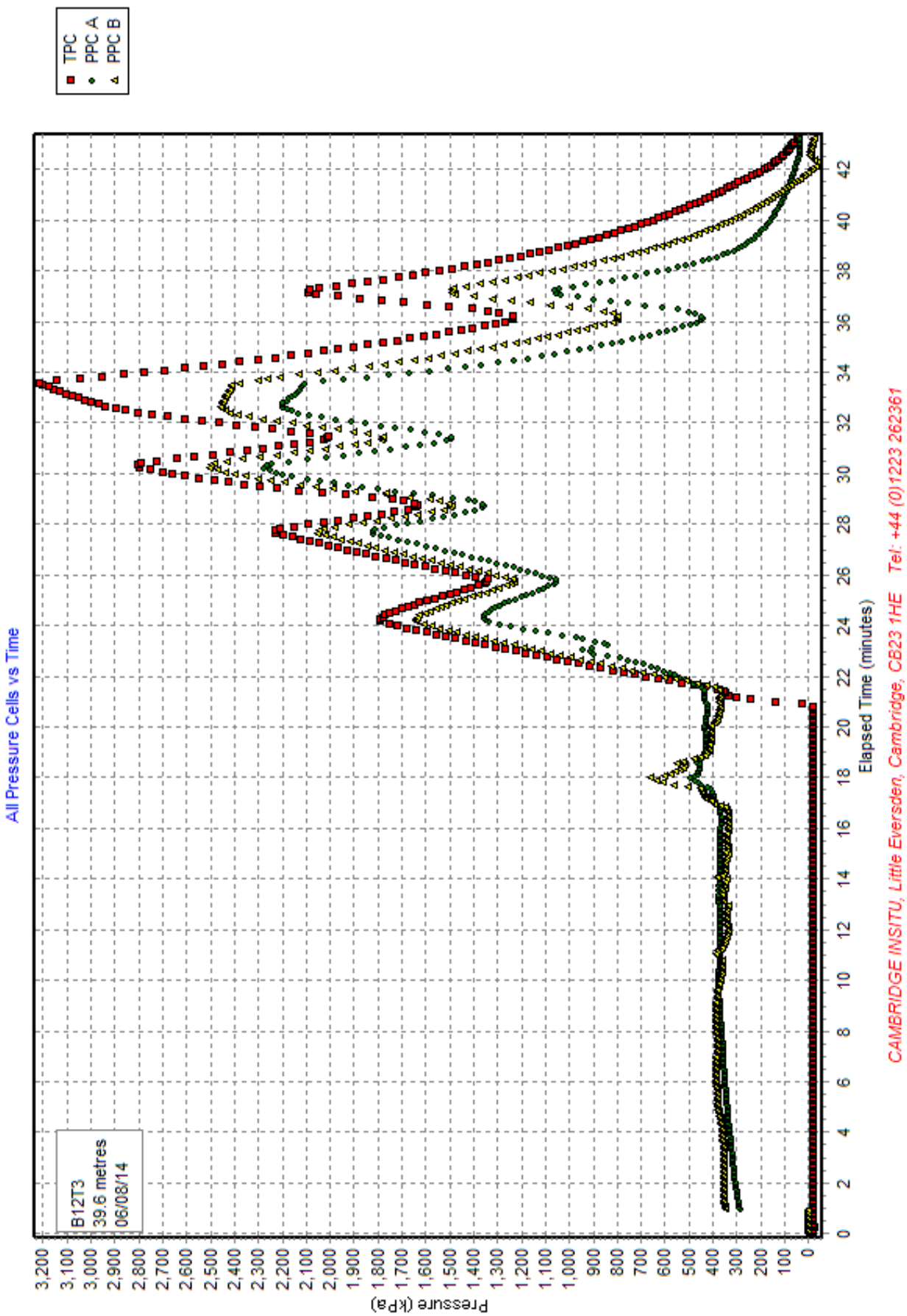

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
RESULTS:
Gradient (beta) : 0.673
Intercept (n) : 18.184MPa
Shear stress constant : 12.242MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 20.754 0.766
2 12.586 0.702
3 12.242 0.673
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
0.0001
0.001
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH12 Test 3
39.60 Metres
6 Aug 14
CURVE FIT PARAMETERS:
Origin : 0.700mm
Po : 872.0kPa
Cu : 541.1 kPa
Beta : 0.673
Alpha : 12.876 MPa
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
B12T3
39.6 metres
06/08/14
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B12T3
39.6 metres
06/08/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


All Pressure Cells vs Time
TPC
PPC A
PPC B
B12T3
39.6 metres
06/08/14
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

TEST DATA FOR INDIVIDUAL TESTS

(TAKEN FROM WINSITU and WINLOG FILES)

BH14

BH14 Test 1 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]
Project : C4237
Site : Rivenhall Airfield
Borehole : BH14
Test name : BH14 Test 1
Test date : 31 Jul 14
Test depth : 20.40 Metres
Water table : 8 Metres
Ambient PWP : 121.6 kPa
Material : London Clay
Probe : Digital 3 arm weak rock self boring pressuremeter
Diameter : 88.0 mm
Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 1 Aug 14

Remarks: Drill starts 15:30 at 19.9m. Ends 16:05

[RESULTS FOR CAVITY REFERENCE PRESSURE]
Strain Origin (mm) : "Arm ave=0.660"
Po from Marsland & Randolph (kPa) : "Arm ave=414.5"
Po from Lift off (kPa) : "Arm ave=499.9"
Best estimate of Po (kPa) : "Arm ave=482.0"

[UNDRAINED STRENGTH PARAMETERS]
Gibson & Anderson 1961 - Cu (kPa) : "Arm ave=268.9"
Limit pressure (kPa) : "Arm ave=2164"
Jefferies 1988 - Cu (kPa) : "Arm ave=269.5"
Undrained yield stress (kPa) : "Arm ave=735.6"

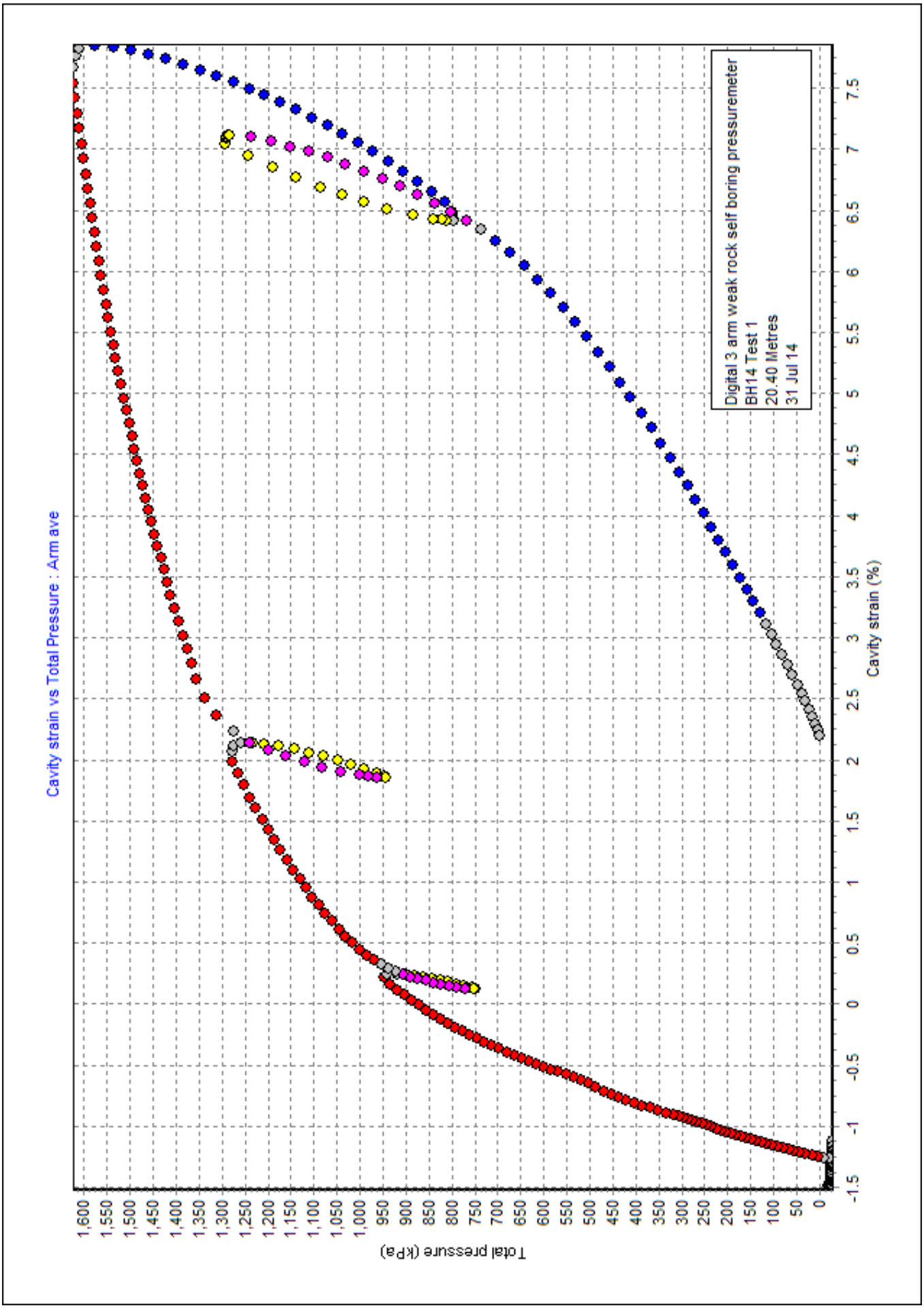
[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=34.7"

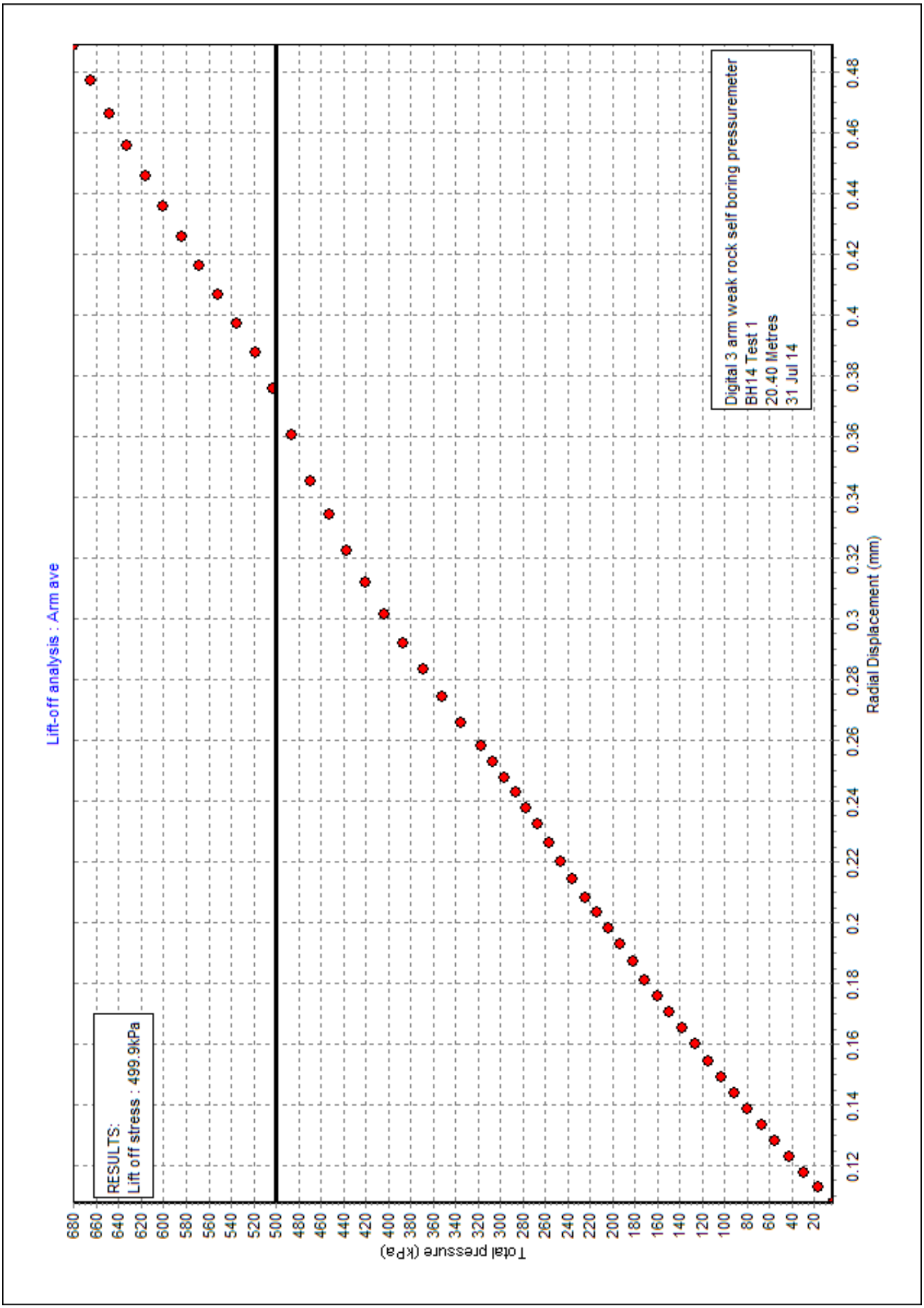
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	64.6	0.189	825	0.231	149
Arm ave	2	50.8	2.005	1089	0.554	282
Arm ave	3	37.6	6.777	1042	1.301	493

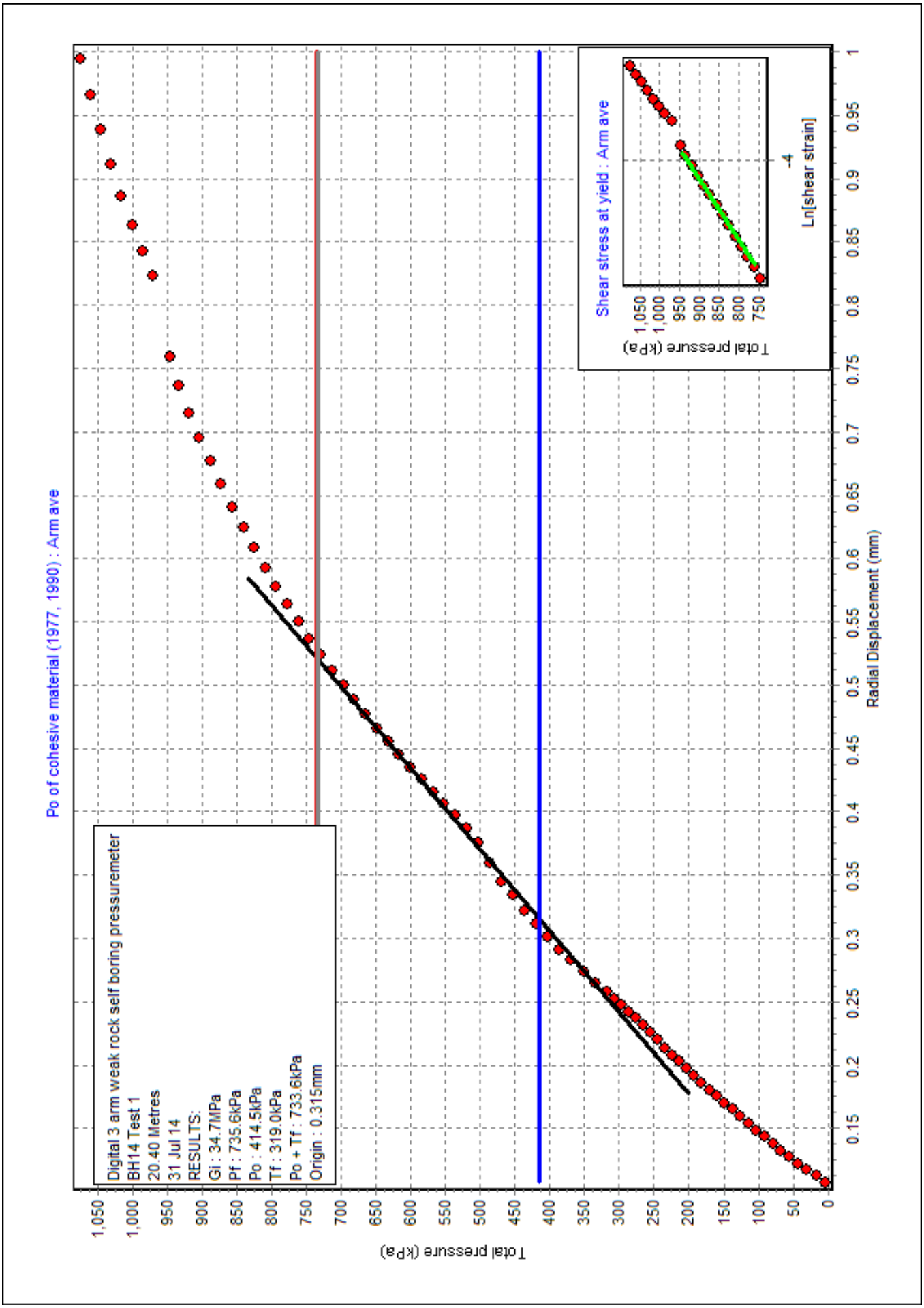
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

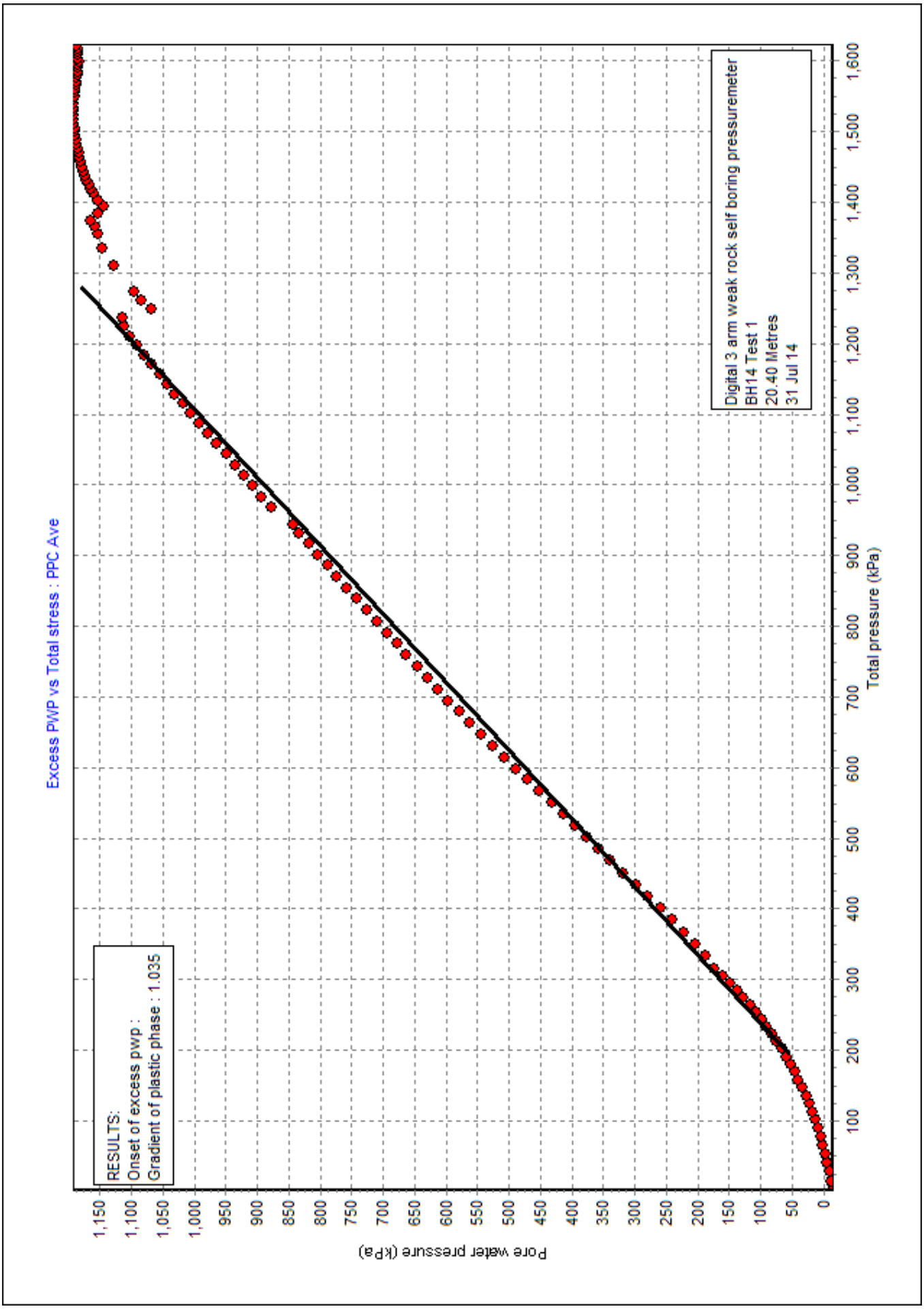
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	16.028	12.305	0.768
Arm ave	2	11.573	8.146	0.704
Arm ave	3	9.102	5.981	0.657

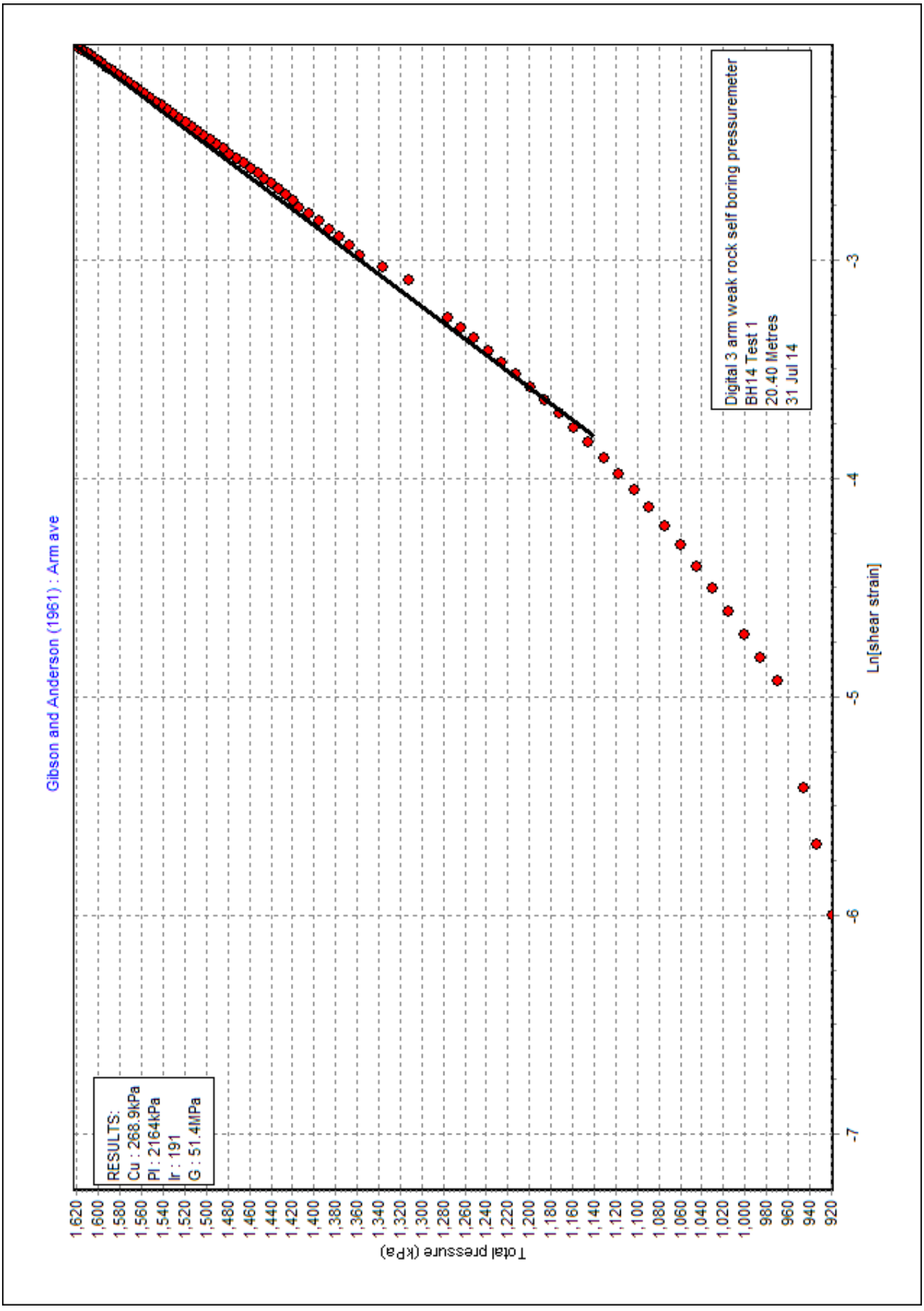
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}
Strain Origin (mm) : 0.66
Po (kPa) : 482
Cu (kPa) : 268.9
Limit pressure (kPa) : 2164
Non-linear exponent : 0.657
Calculated alpha (MPa) : 6.019
G at yield (MPa) : 30.5

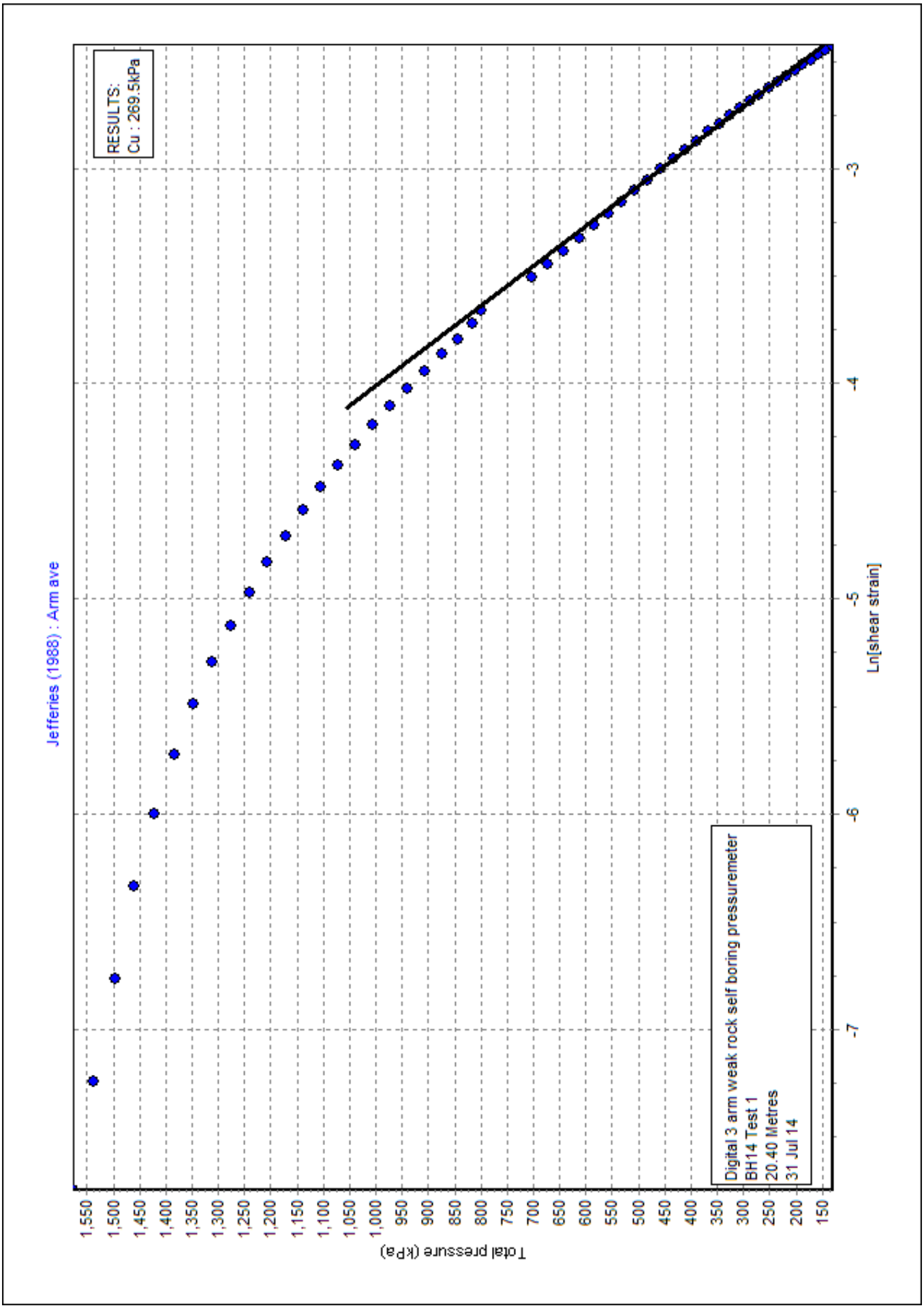

Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Cavity strain (%)

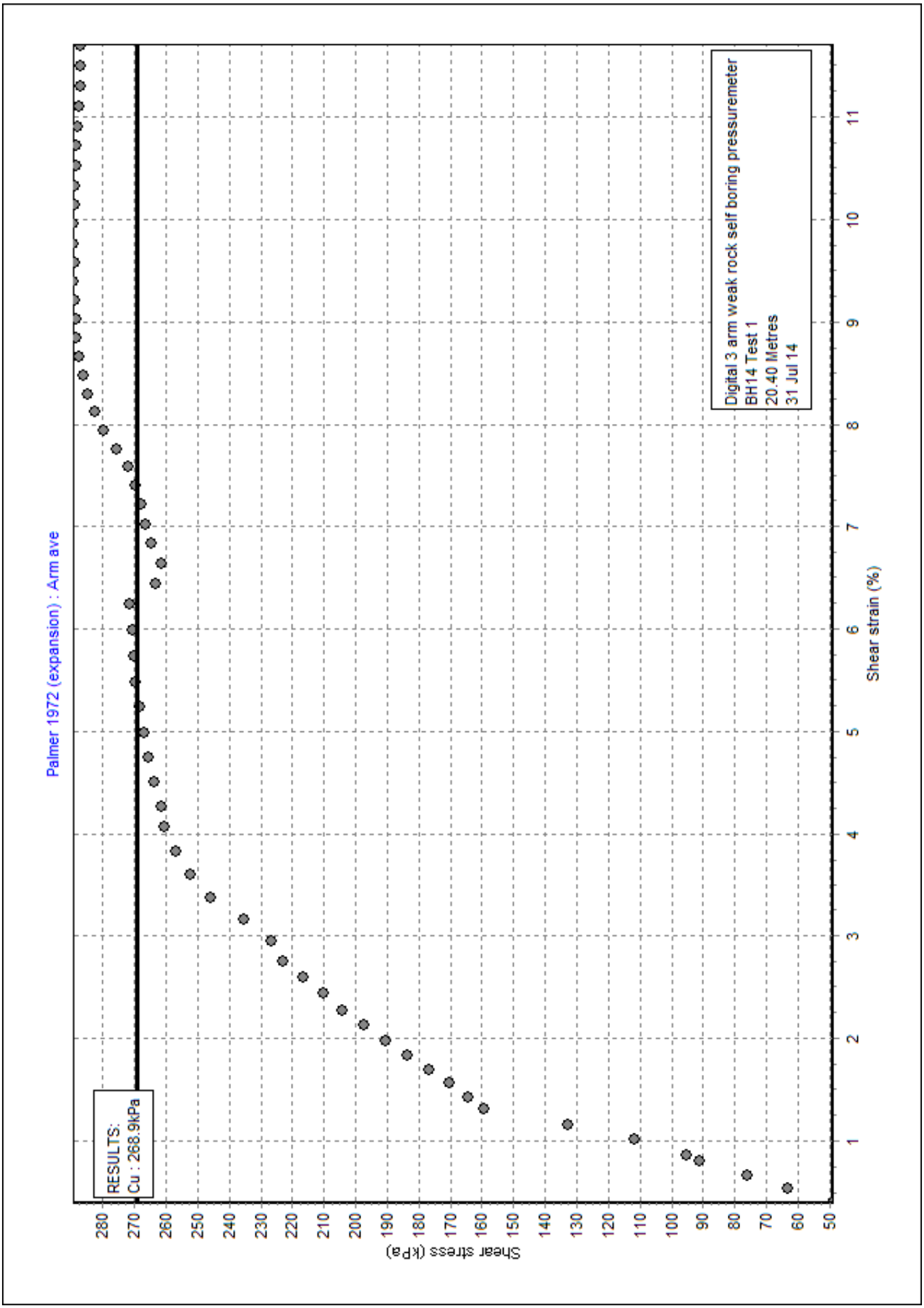

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 499.9kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)

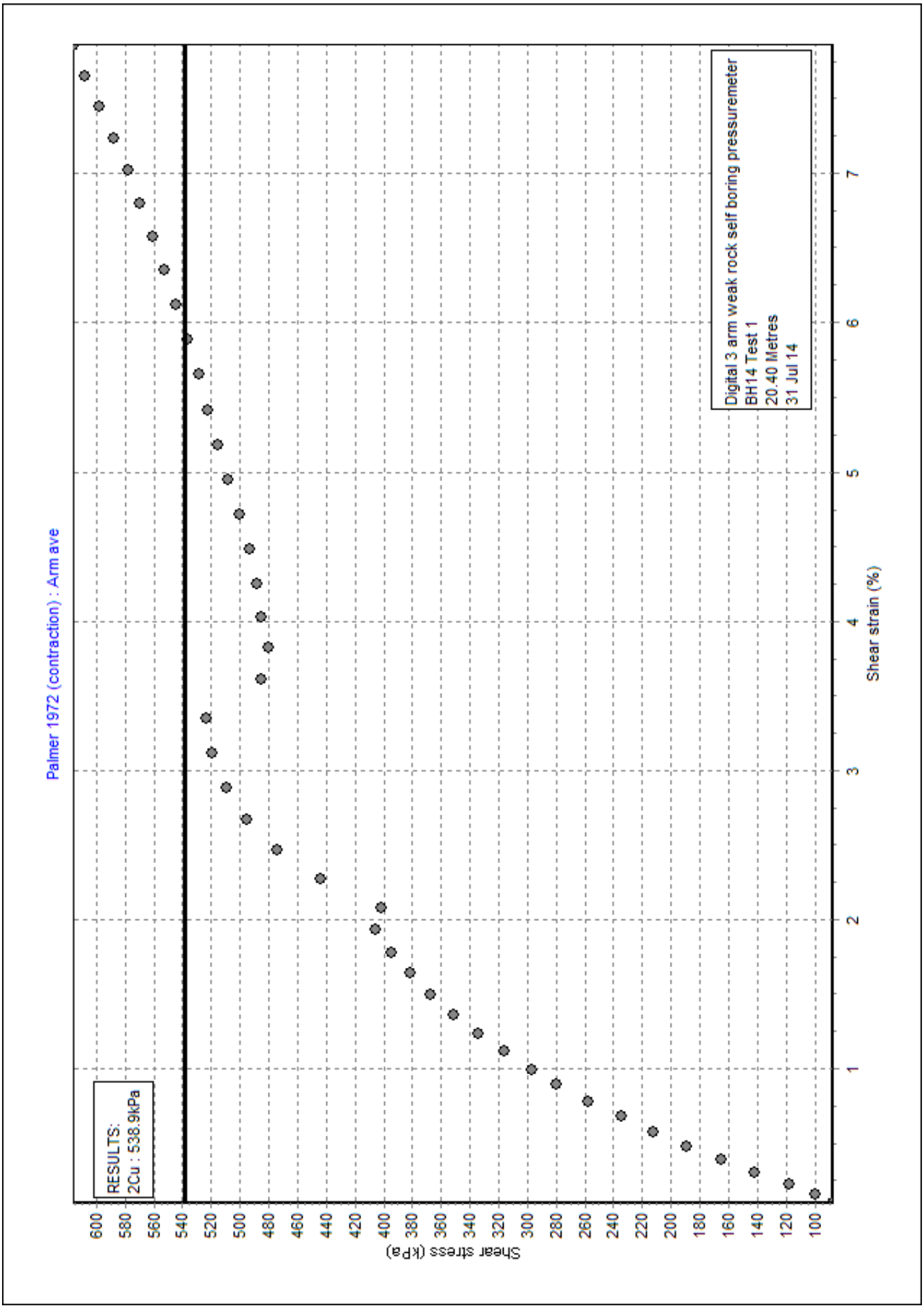

Po of cohesive material (1977, 1990) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
RESULTS:
Gi : 34.7MPa
Pf : 735.6kPa
Po : 414.5kPa
Tf : 319.0kPa
Po + Tf : 733.6kPa
Origin : 0.315mm
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

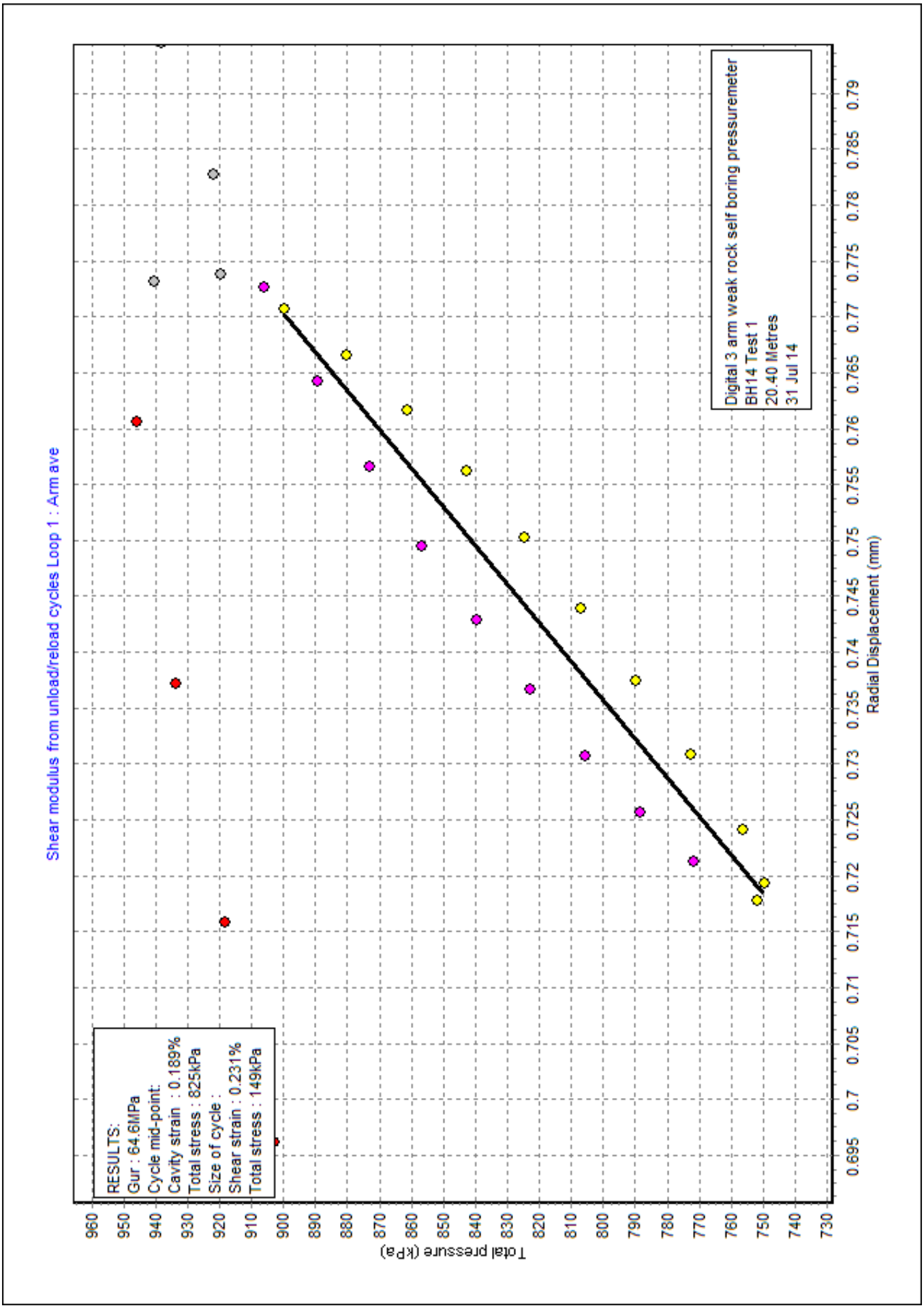

Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp :
Gradient of plastic phase : 1.035
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Pore water pressure (kPa)
Total pressure (kPa)
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
1,100
1,150
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600

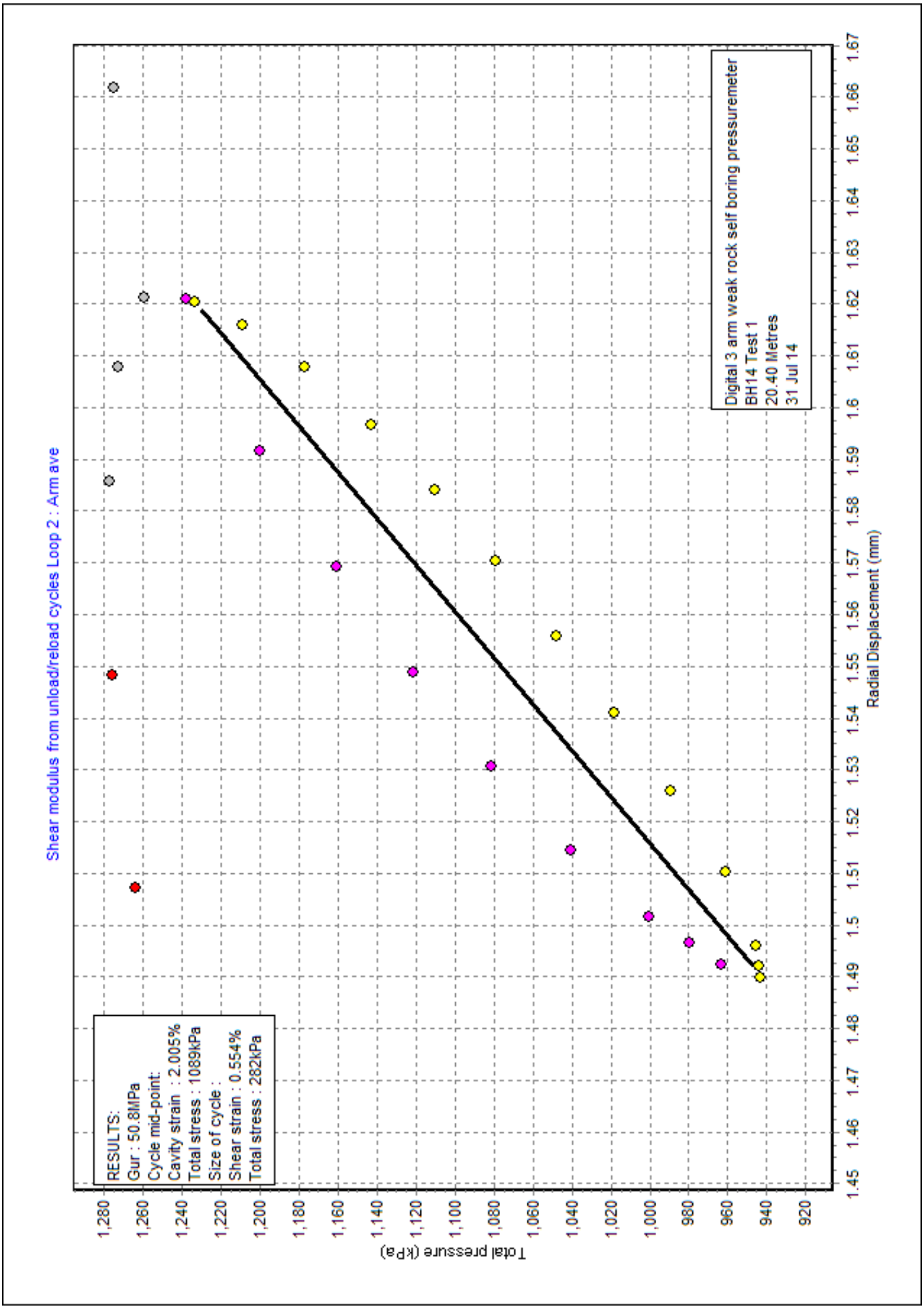

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 268.9kPa
Pl : 2164kPa
Ir : 191
G : 51.4MPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Ln[shear strain]
1,620
1,600
1,580
1,560
1,540
1,520
1,500
1,480
1,460
1,440
1,420
1,400
1,380
1,360
1,340
1,320
1,300
1,280
1,260
1,240
1,220
1,200
1,180
1,160
1,140
1,120
1,100
1,080
1,060
1,040
1,020
1,000
980
960
940
920
-3
-4
-5
-6
-7

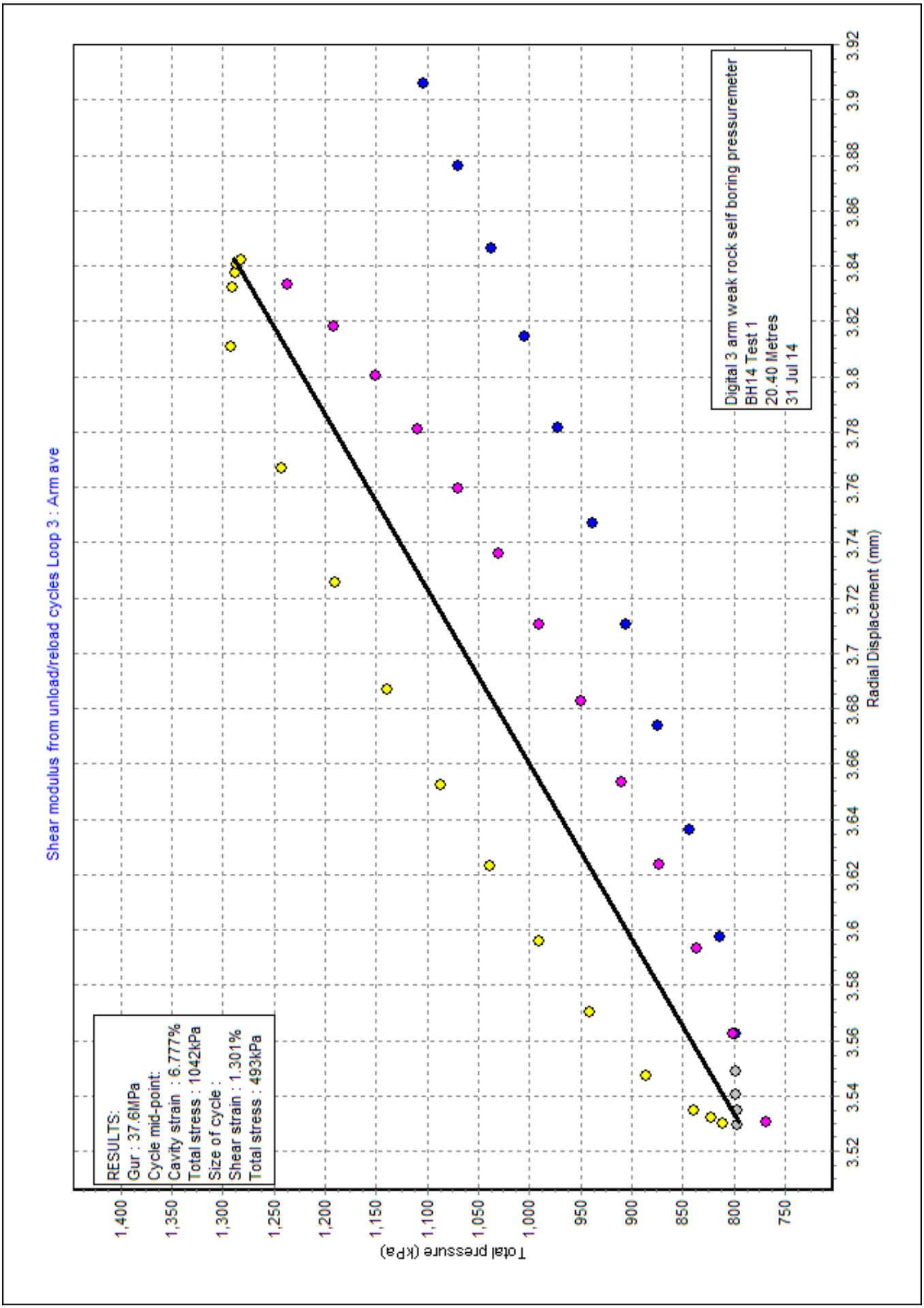

RESULTS:
Cu : 269.5kPa
Jefferies (1988) : Arm ave
Total pressure (kPa)
Ln[shear strain]
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14

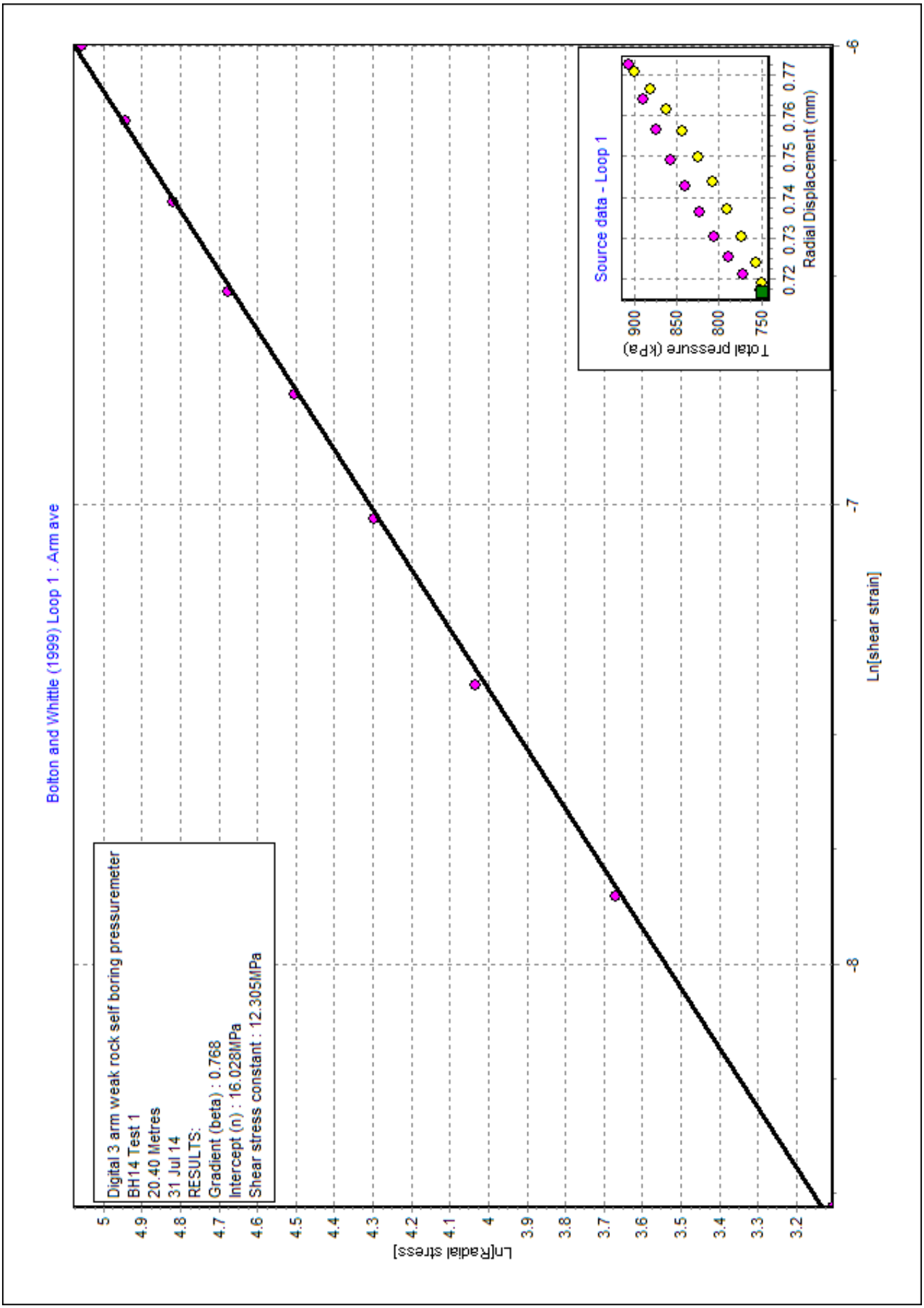

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 268.9kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Shear stress (kPa)
Shear strain (%)

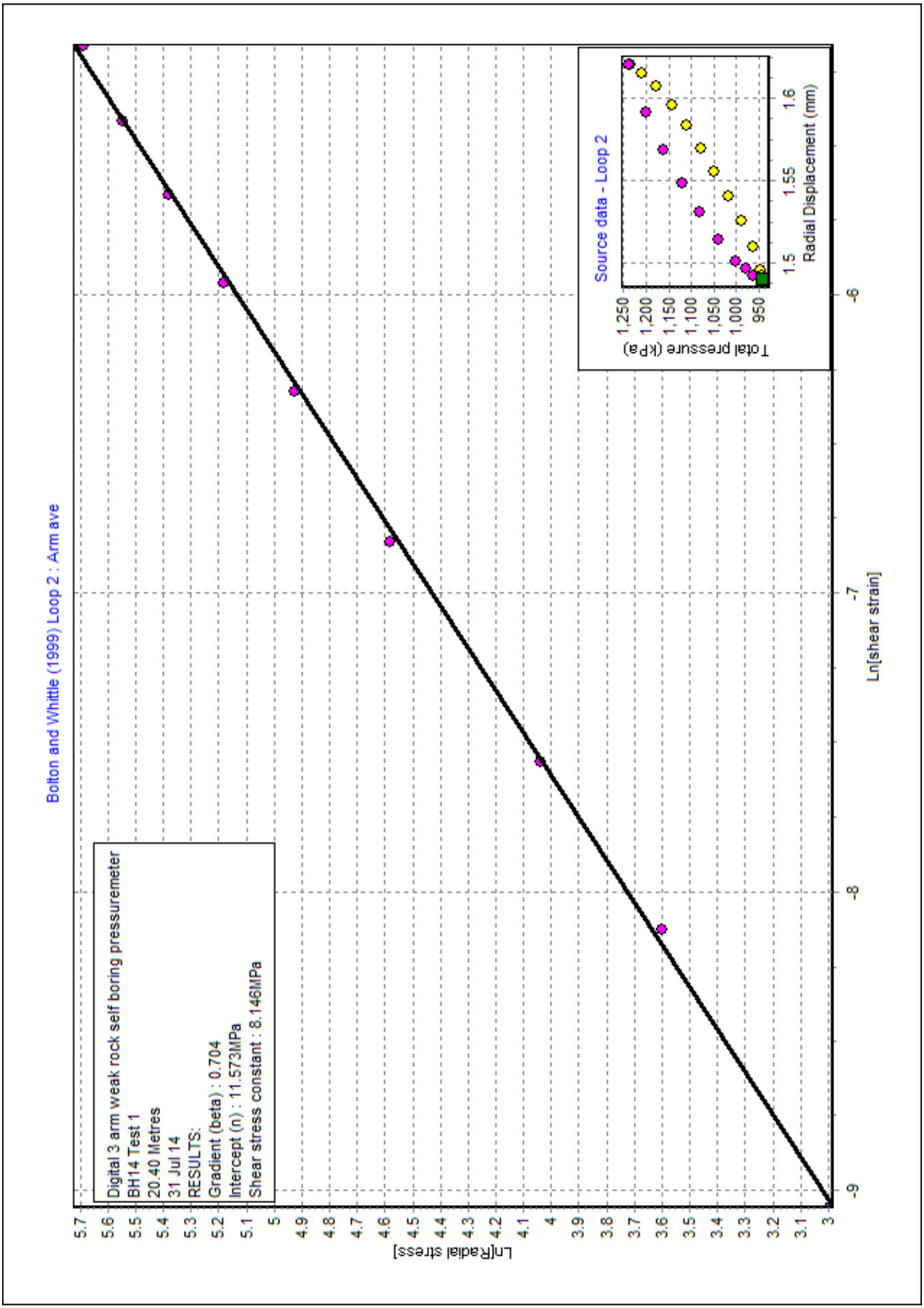

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 538.9kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Shear stress (kPa)
Shear strain (%)
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
1
2
3
4
5
6
7

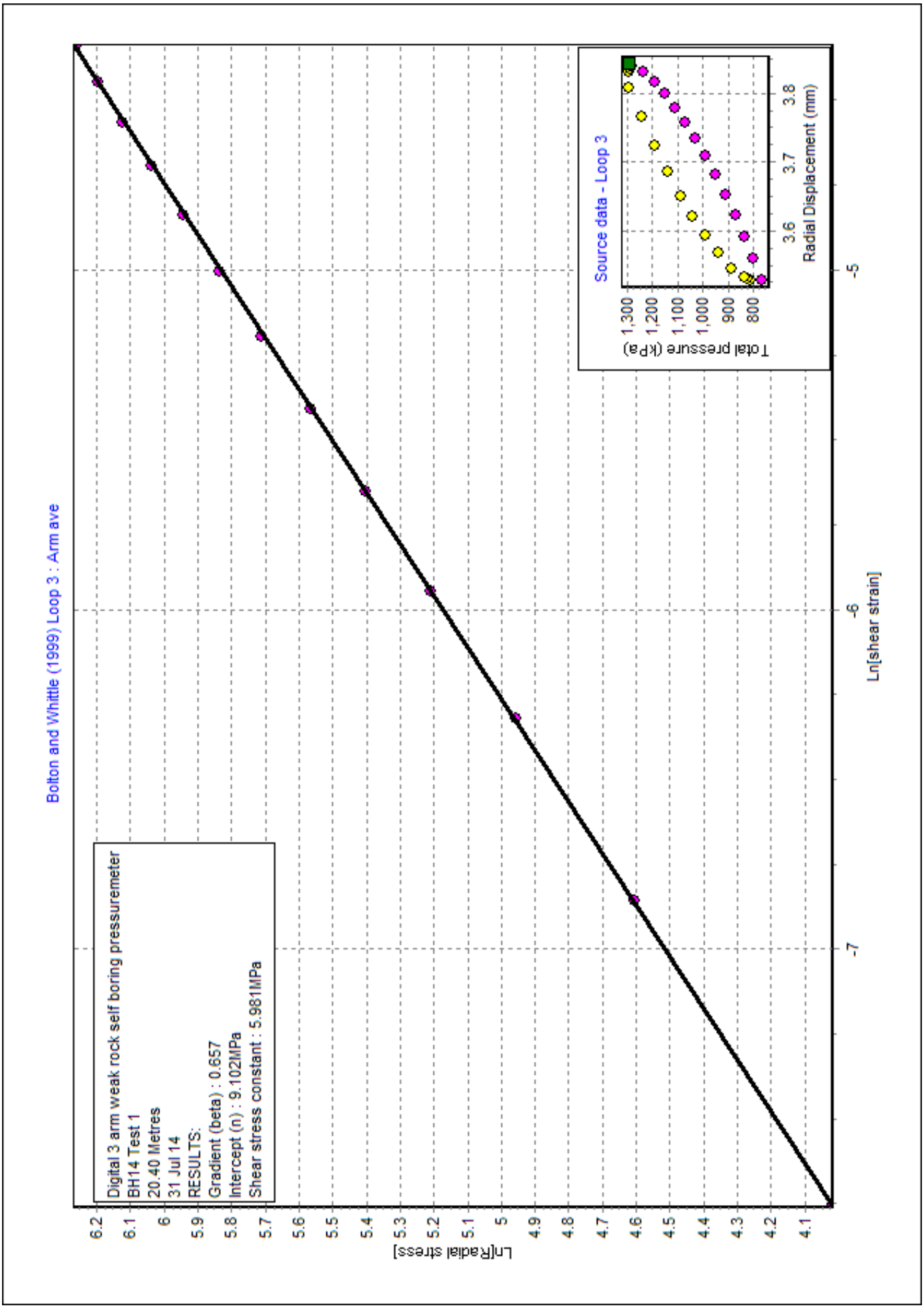

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 64.6MPa
Cycle mid-point:
Cavity strain : 0.189%
Total stress : 825kPa
Size of cycle :
Shear strain : 0.231%
Total stress : 149kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)

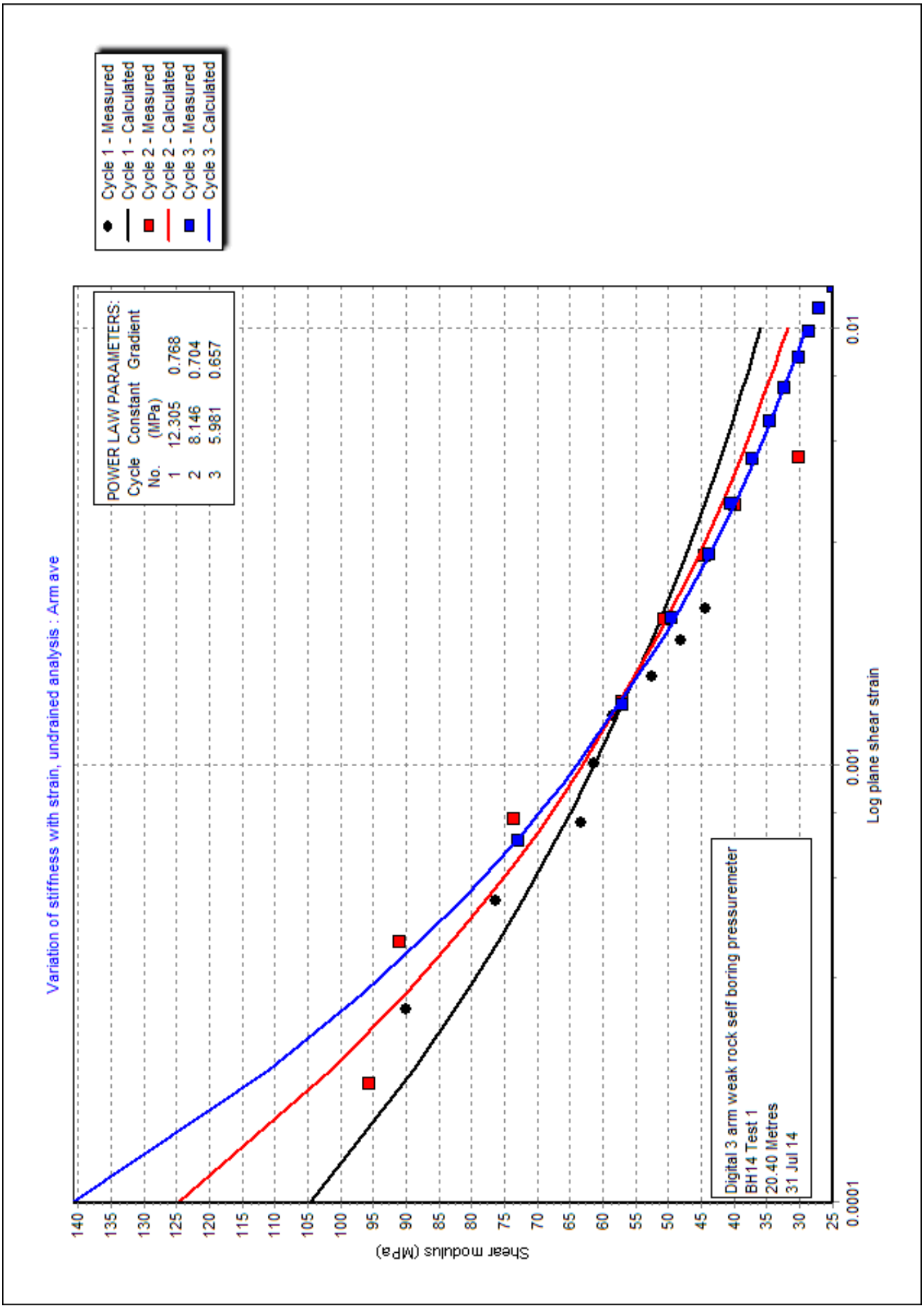

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 50.8MPa
Cycle mid-point:
Cavity strain : 2.005%
Total stress : 1089kPa
Size of cycle :
Shear strain : 0.554%
Total stress : 282kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)

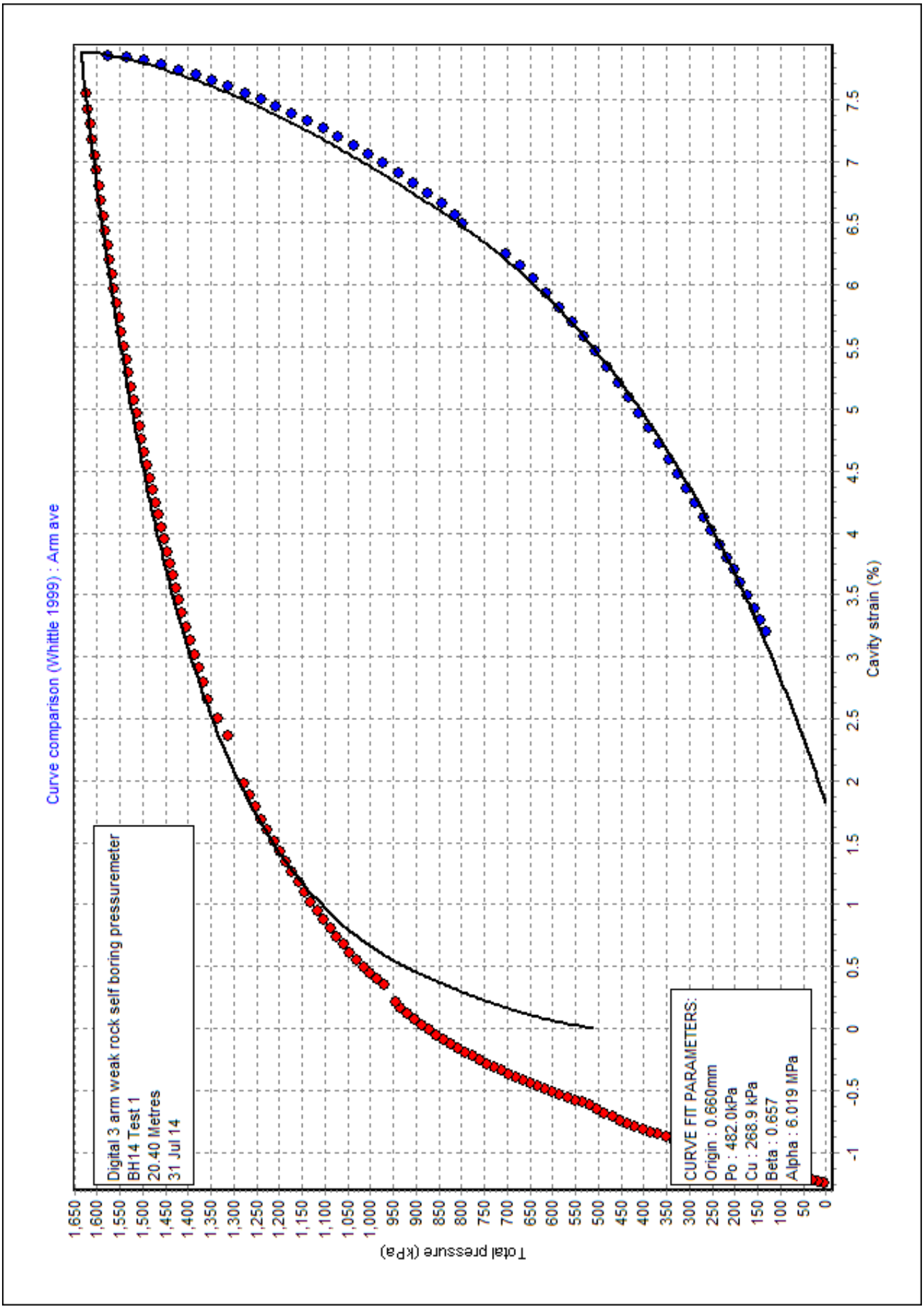

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 37.6MPa
Cycle mid-point:
Cavity strain : 6.777%
Total stress : 1042kPa
Size of cycle :
Shear strain : 1.301%
Total stress : 493kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
Total pressure (kPa)
Radial Displacement (mm)
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
3.52
3.54
3.56
3.58
3.6
3.62
3.64
3.66
3.68
3.7
3.72
3.74
3.76
3.78
3.8
3.82
3.84
3.86
3.88
3.9
3.92

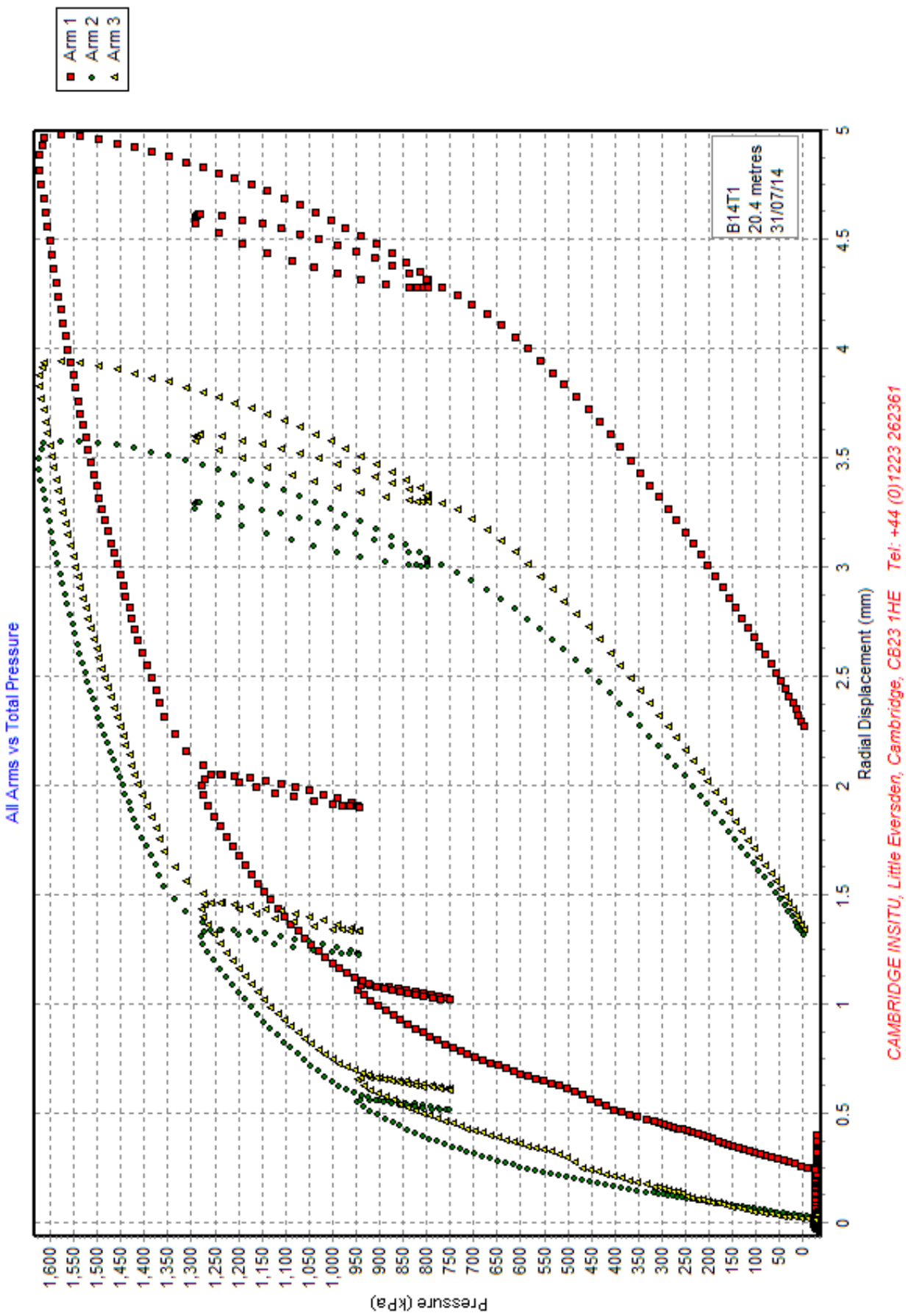

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.768
Intercept (n) : 16.028MPa
Shear stress constant : 12.305MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

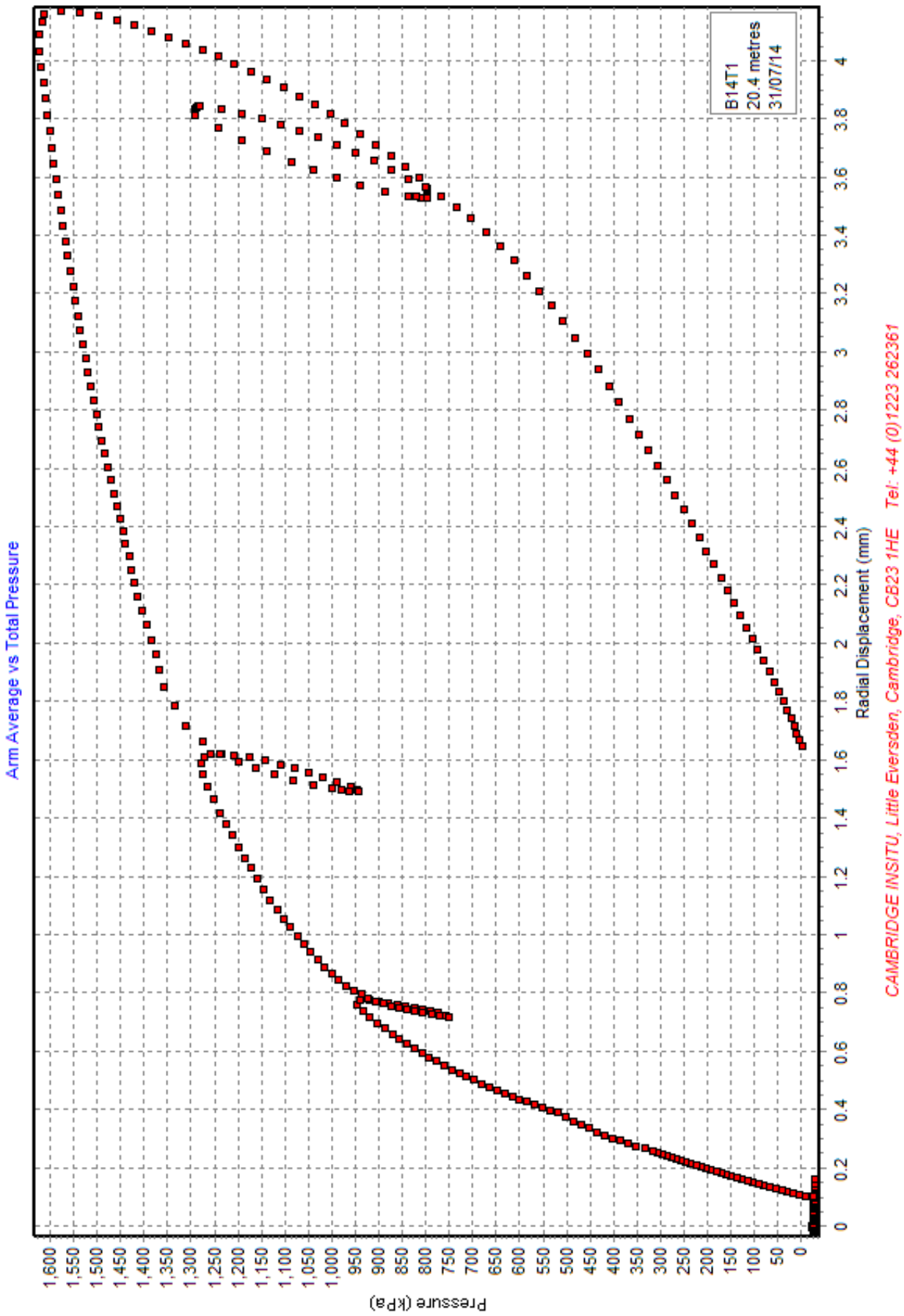

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.704
Intercept (n) : 11.573MPa
Shear stress constant : 8.146MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

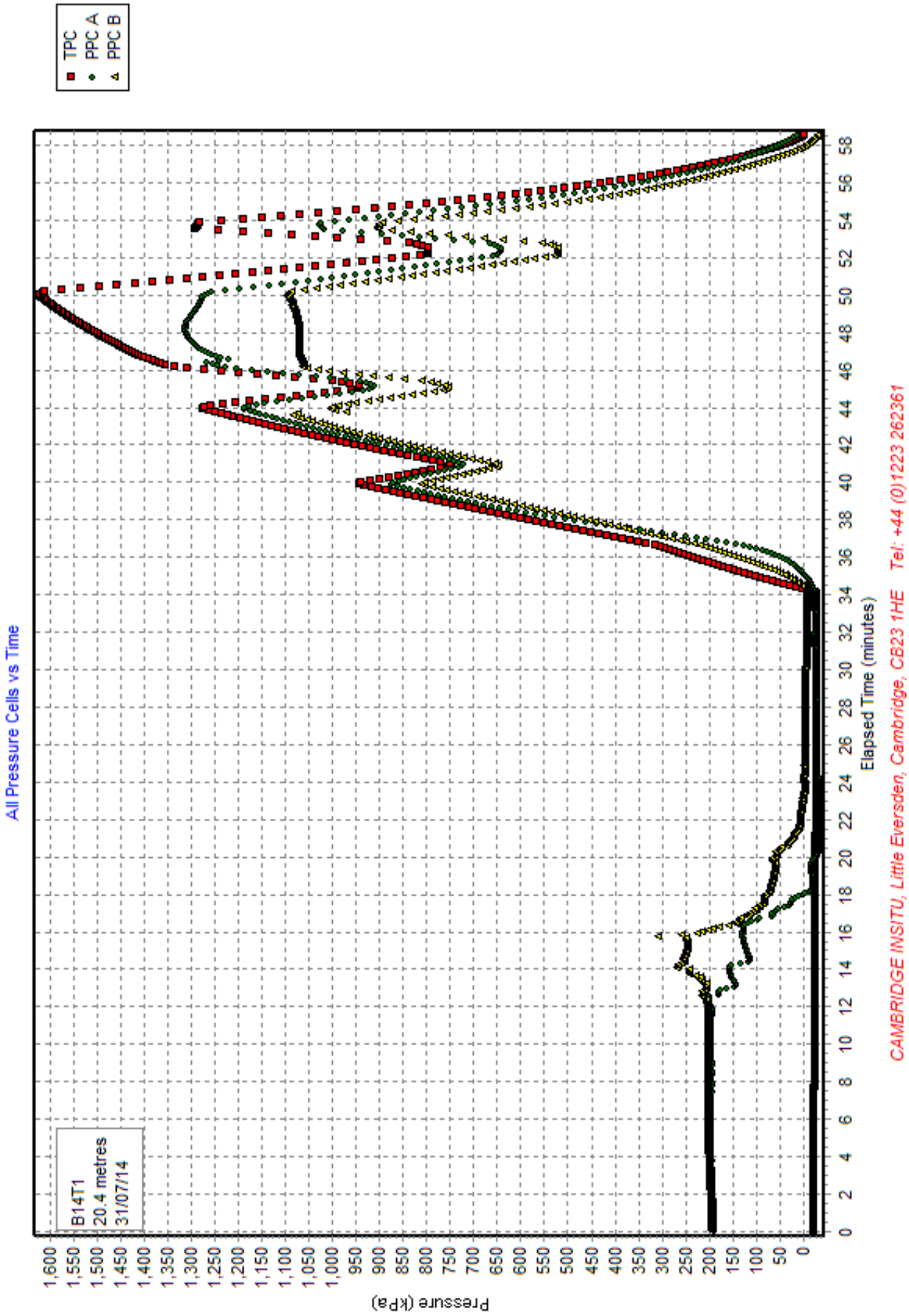

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
RESULTS:
Gradient (beta) : 0.657
Intercept (n) : 9.102MPa
Shear stress constant : 5.981MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 12.305 0.768
2 8.146 0.704
3 5.981 0.657
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 1
20.40 Metres
31 Jul 14
CURVE FIT PARAMETERS:
Origin : 0.660mm
Po : 482.0kPa
Cu : 268.9 kPa
Beta : 0.657
Alpha : 6.019 MPa
Total pressure (kPa)
Cavity strain (%)


All Arms vs Total Pressure
Arm 1
Arm 2
Arm 3
B14T1
20.4 metres
31/07/14
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B14T1
20.4 metres
31/07/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B14T1
20.4 metres
31/07/14
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

BH14 Test 2 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]

Project	:	C4237
Site	:	Rivenhall Airfield
Borehole	:	BH14
Test name	:	BH14 Test 2
Test date	:	5 Aug 14
Test depth	:	30.20 Metres
Water table	:	8 Metres
Ambient PWP	:	217.8 kPa
Material	:	London Clay
Probe	:	Digital 3 arm weak rock self boring pressuremeter
Diameter	:	88.0 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 5 Aug 14

Remarks: Start drill 11:19 at 29.7m. Ends 11:53.

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.210"
Po from Marsland & Randolph (kPa)	:	"Arm ave=585.8"
Po from Lift off (kPa)	:	"Arm ave=642.7"
PWP versus Total Stress (kPa)	:	"PPC Ave=535.2"
Best estimate of Po (kPa)	:	"Arm ave=571.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=407.0"
Limit pressure (kPa)	:	"Arm ave=2821"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=405.8"
Undrained yield stress (kPa)	:	"Arm ave=748.5"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=40.8"

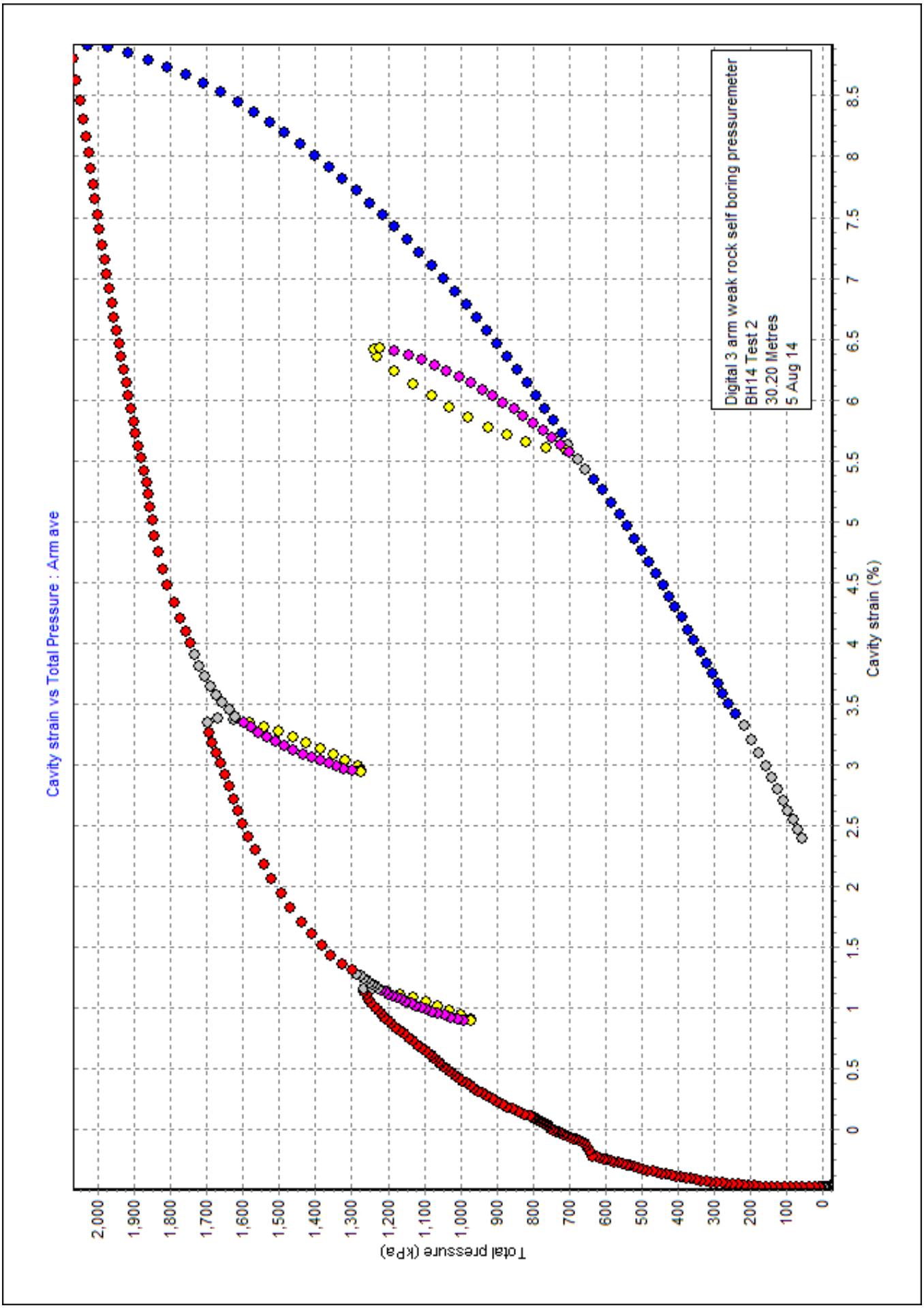
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	51.5	1.027	1091	0.478	247
Arm ave	2	40.7	3.151	1432	0.756	309
Arm ave	3	33.2	6.015	965	1.582	529

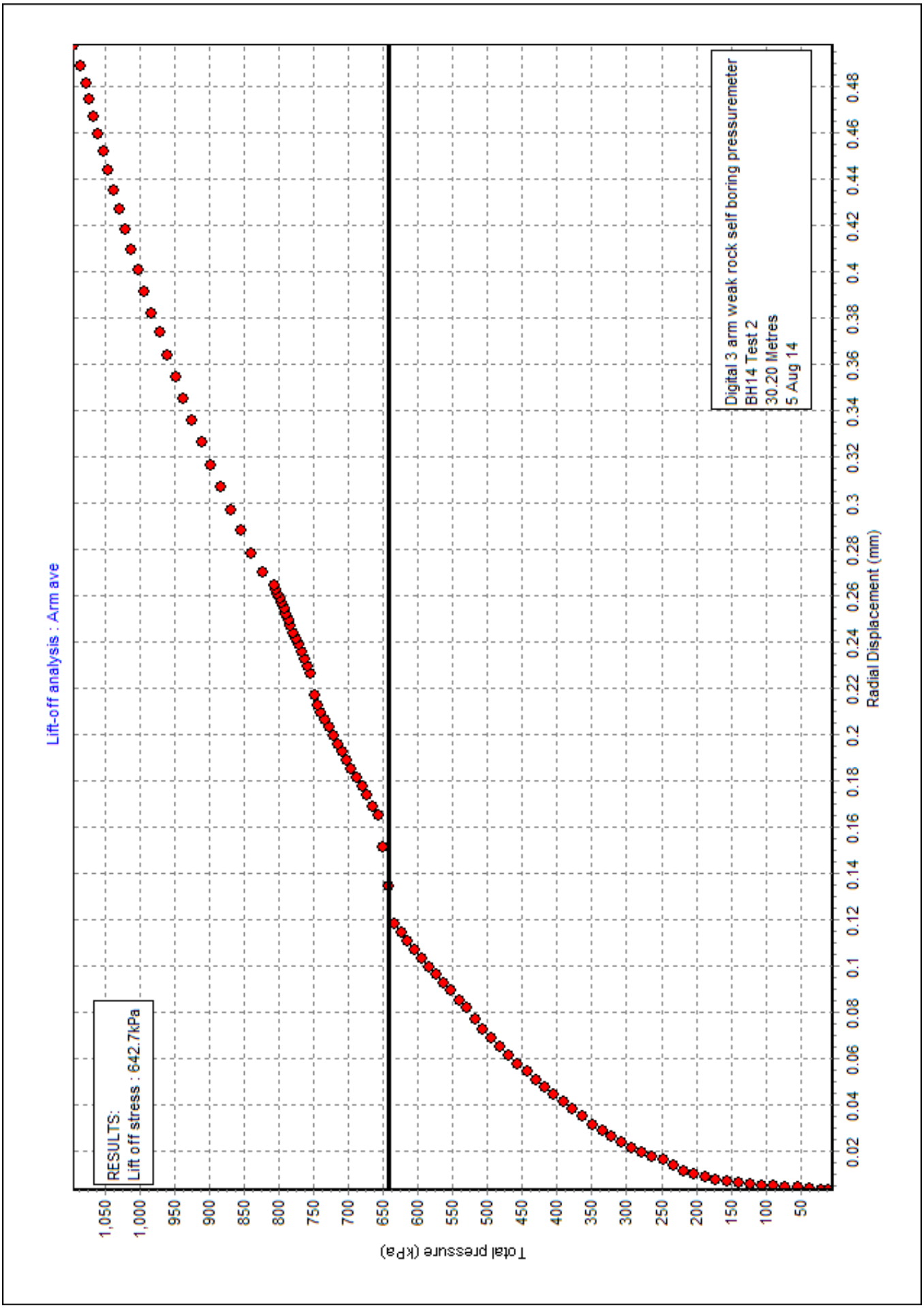
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

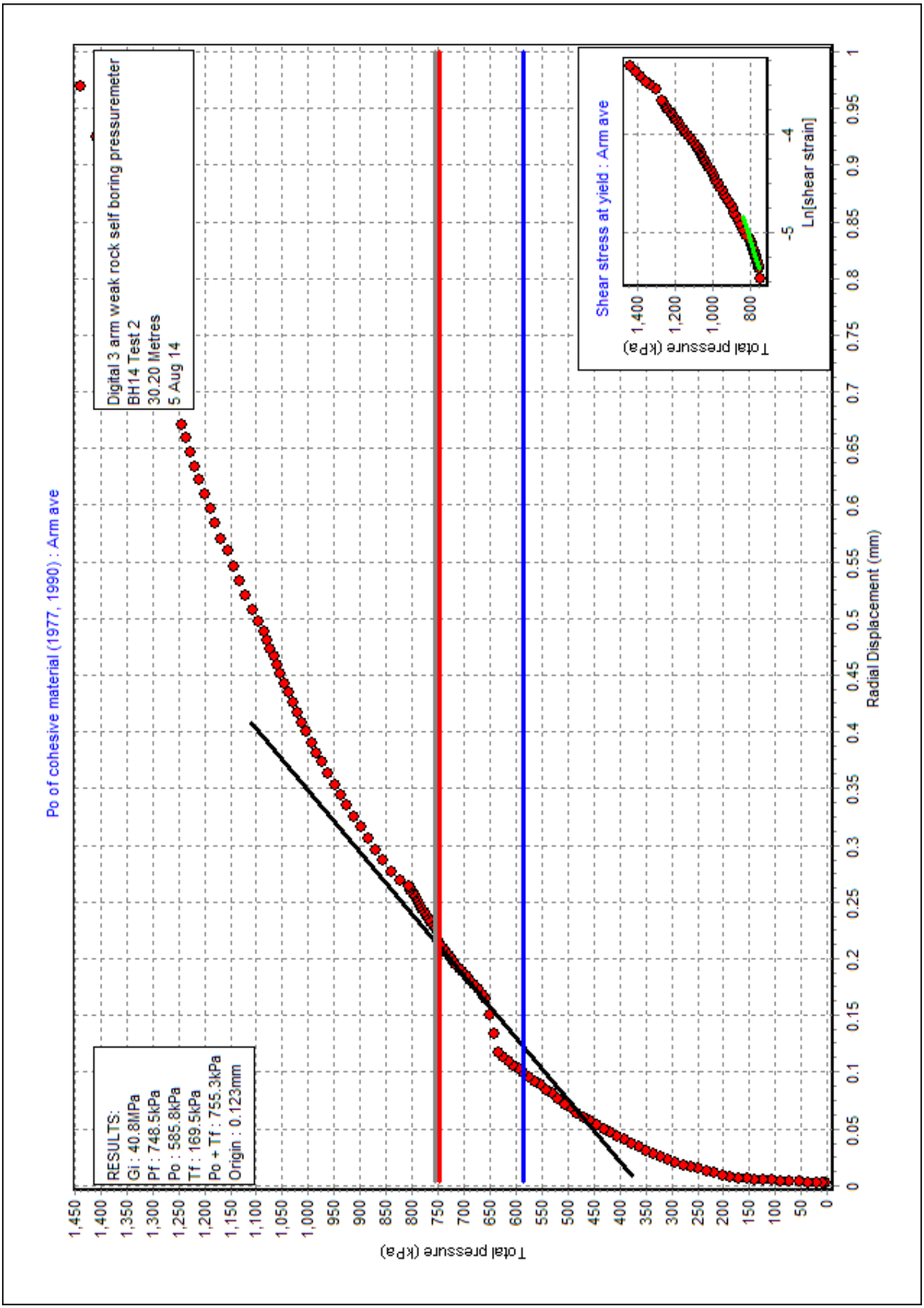
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	11.172	8.009	0.717
Arm ave	2	12.507	9.345	0.747
Arm ave	3	8.286	5.478	0.661

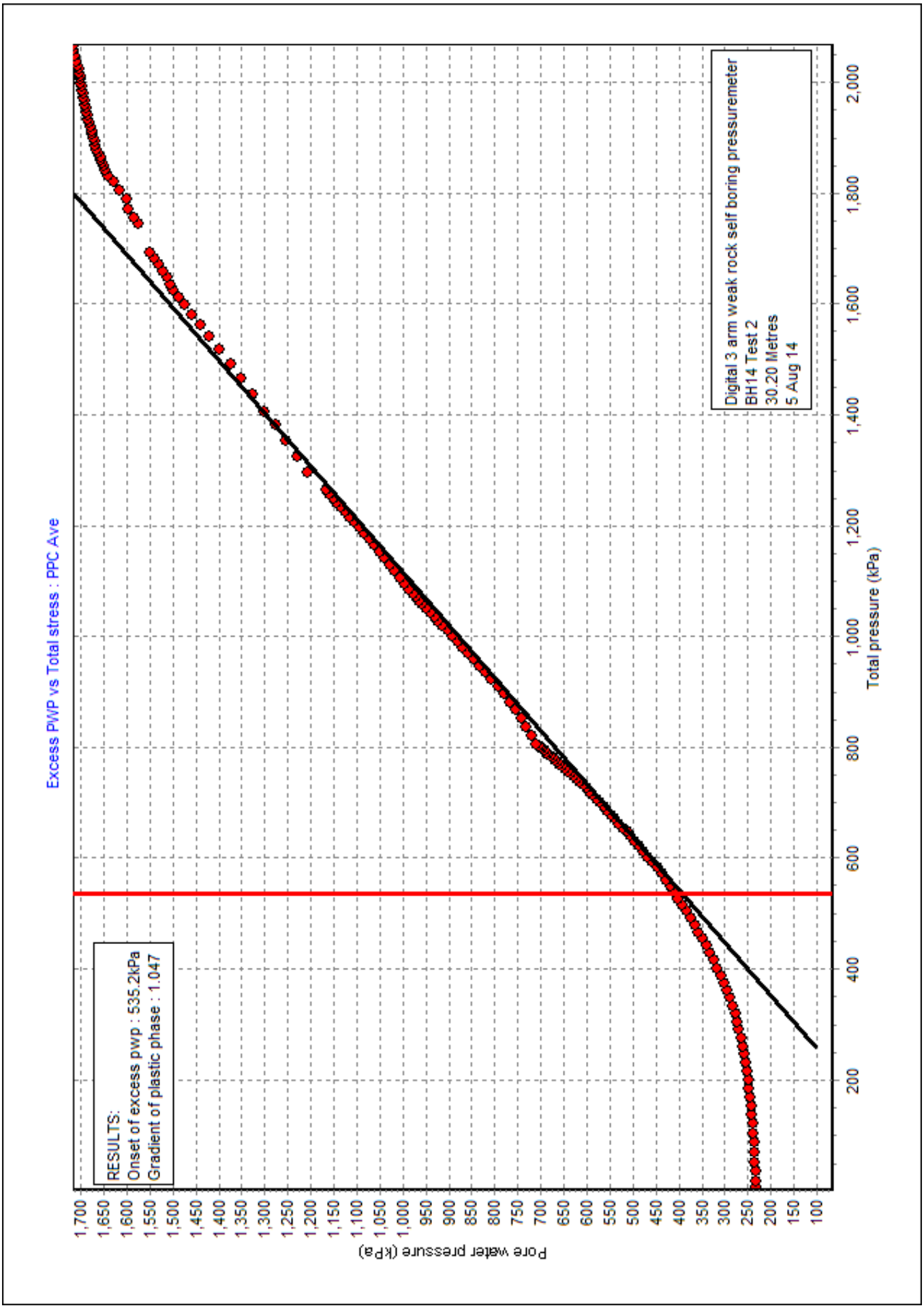
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}

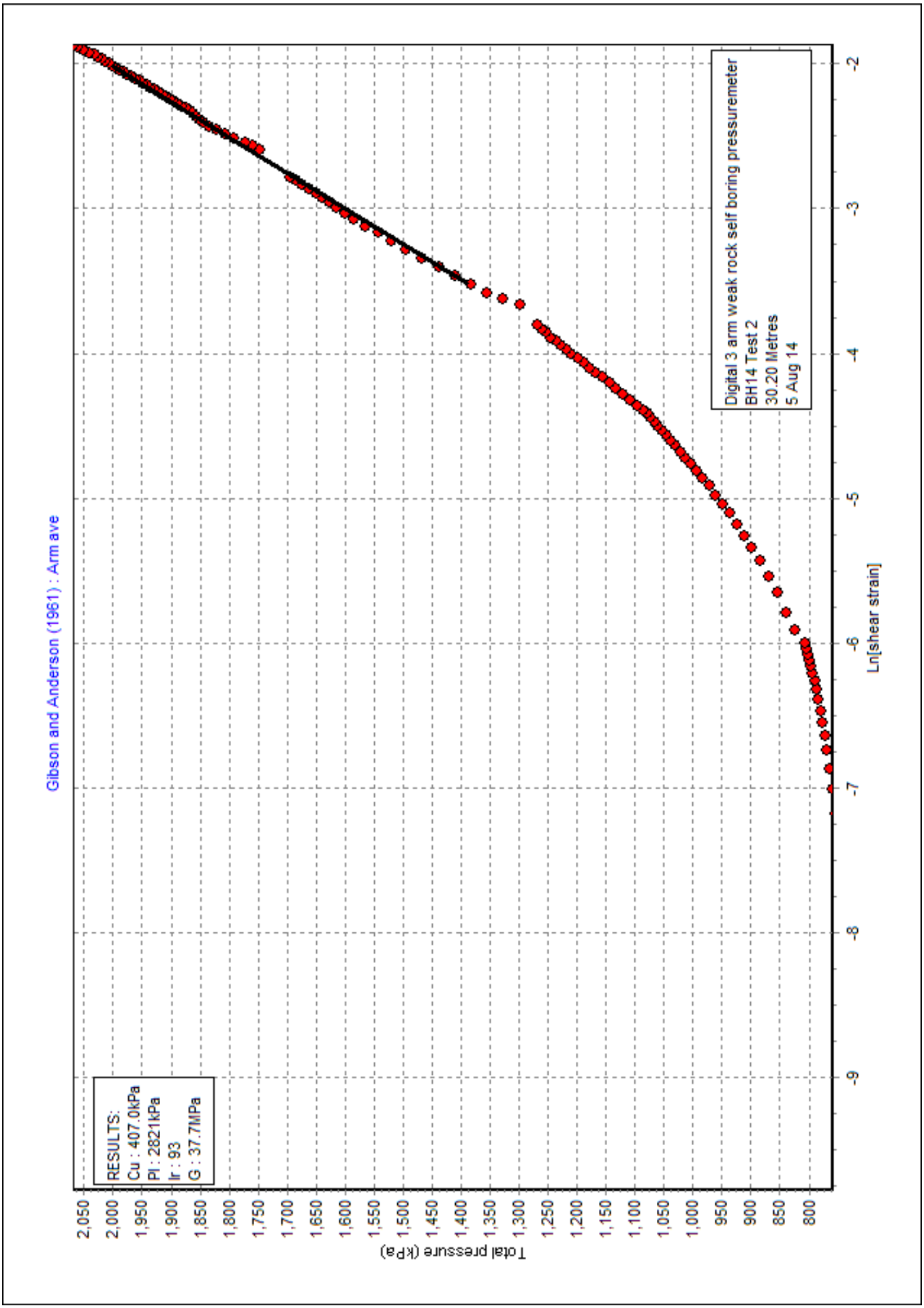
Strain Origin (mm)	:	0.21
Po (kPa)	:	571
Cu (kPa)	:	407.0
Limit pressure (kPa)	:	2821
Non-linear exponent	:	0.661
Calculated alpha (MPa)	:	5.787
G at yield (MPa)	:	22.6

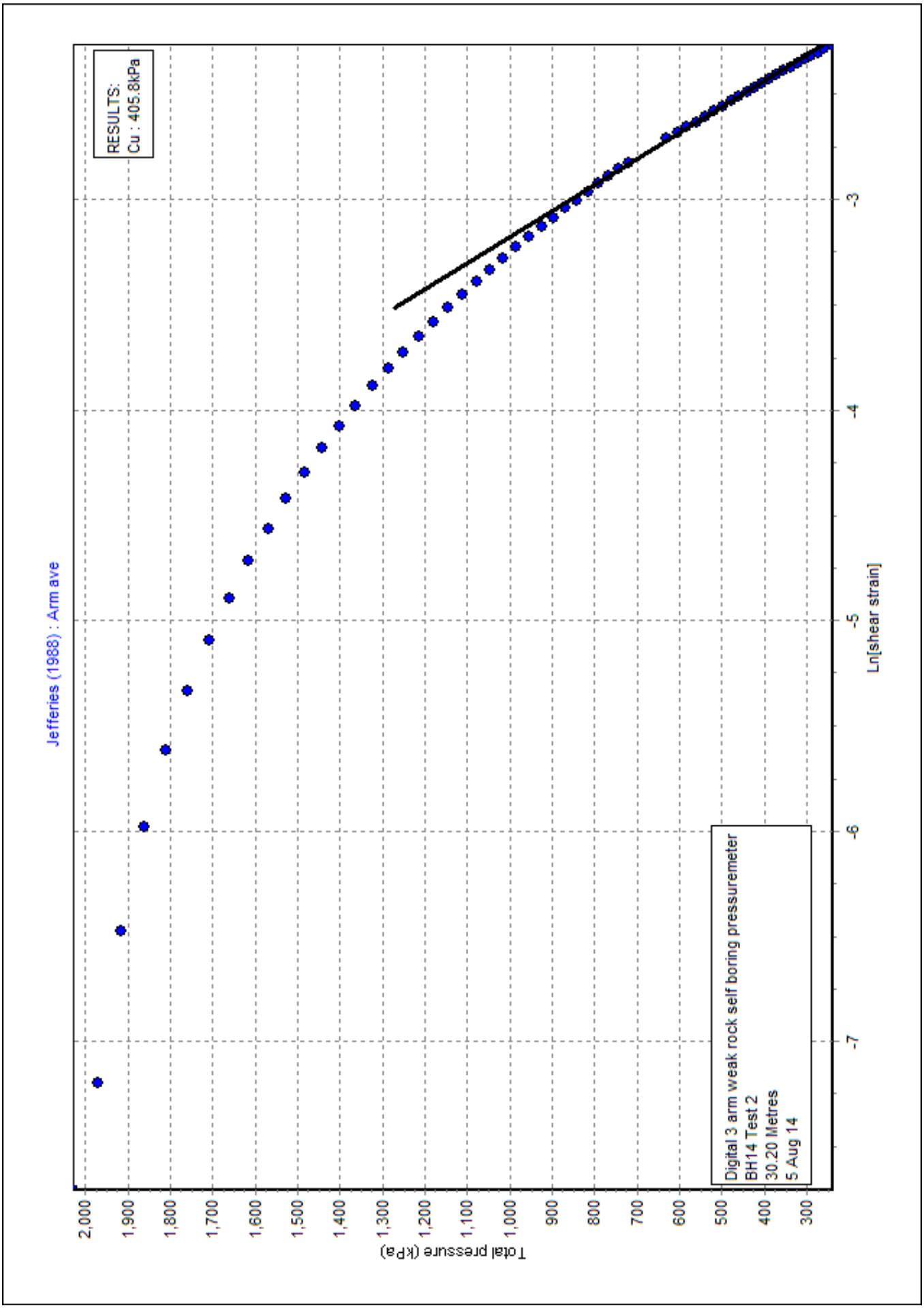

Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Cavity strain (%)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5

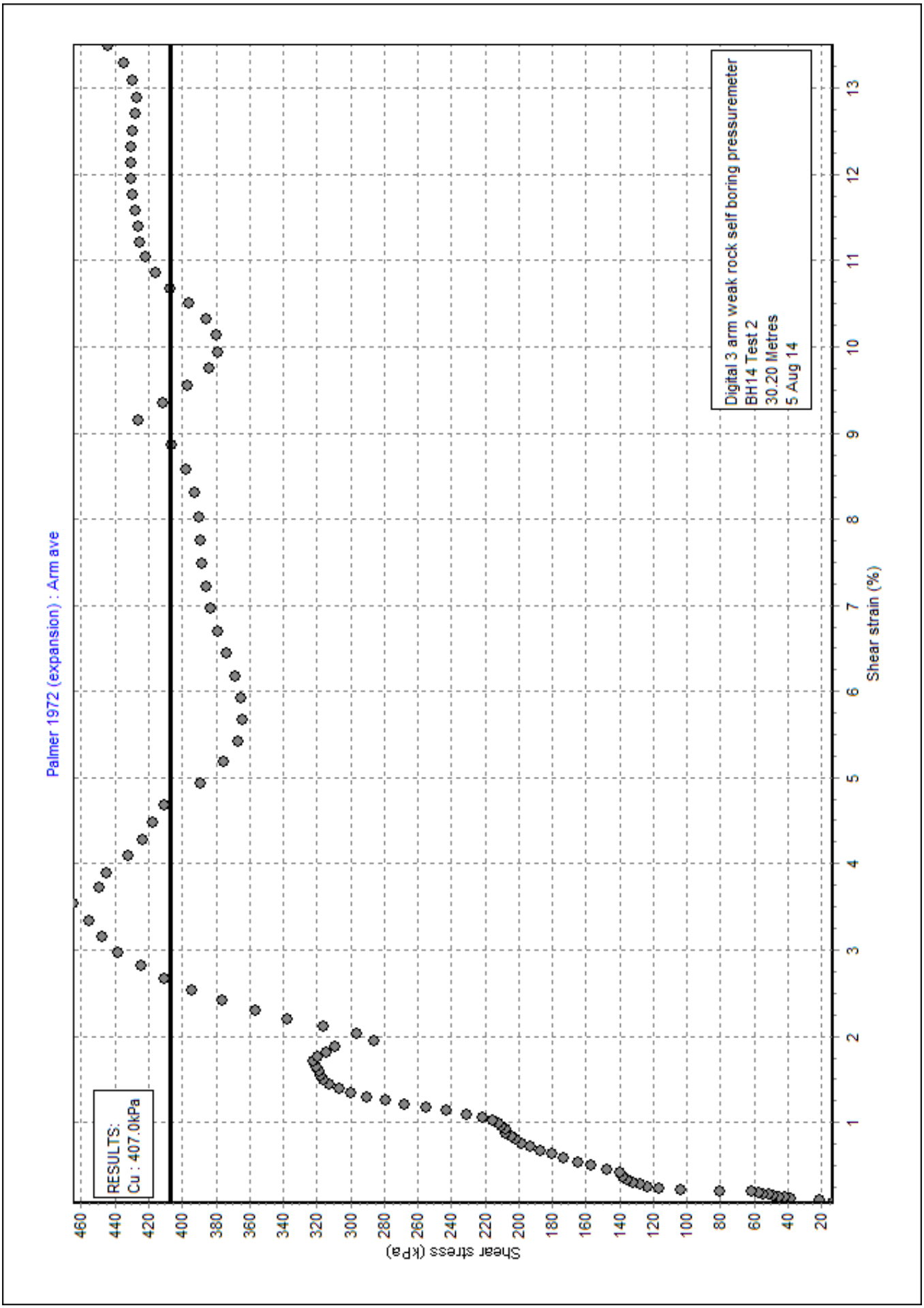

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 642.7kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4
0.42
0.44
0.46
0.48

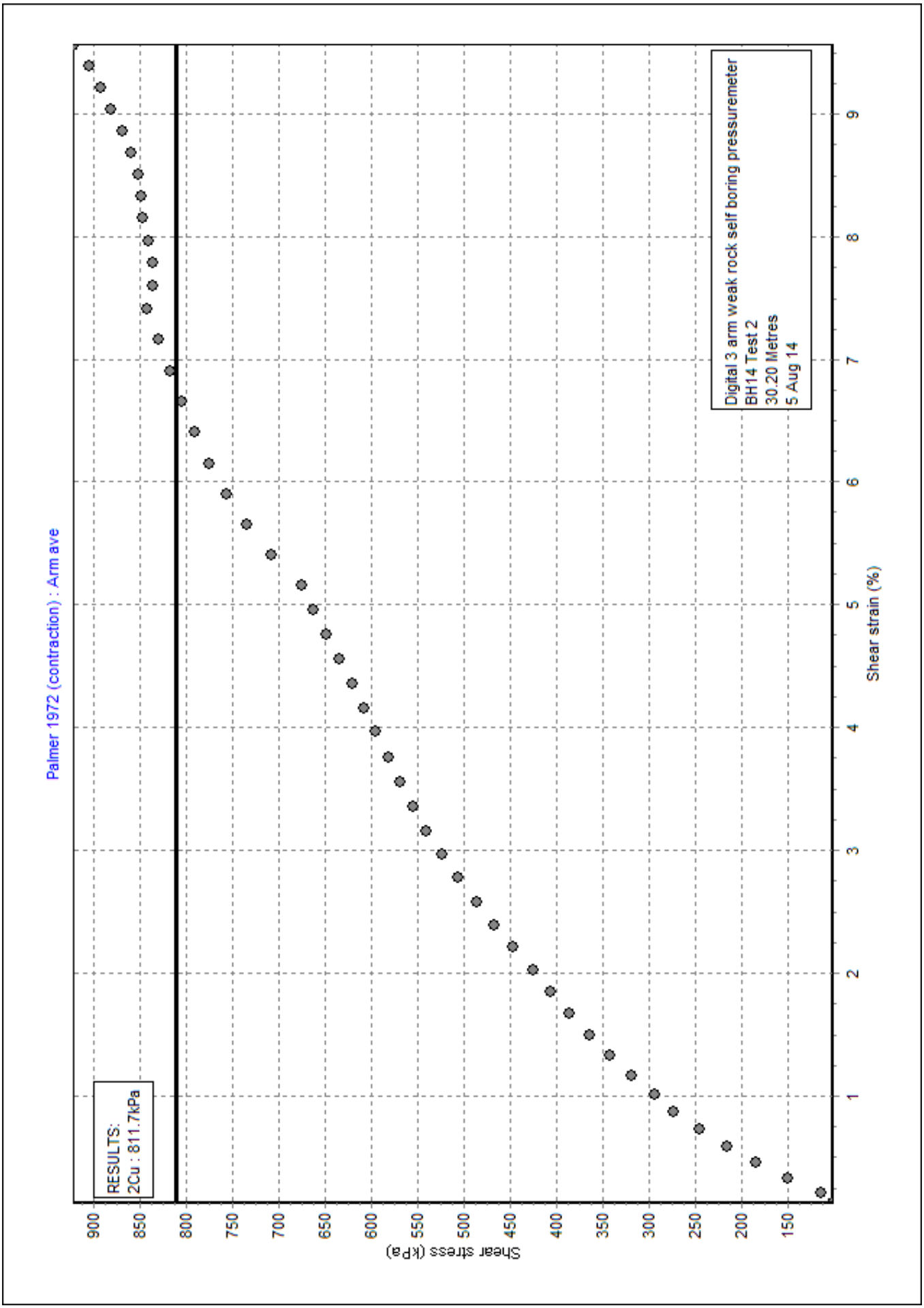

Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
RESULTS:
Gi : 40.8MPa
Pf : 748.5kPa
Po : 585.8kPa
Tf : 169.5kPa
Po + Tf : 755.3kPa
Origin : 0.123mm
Po of cohesive material (1977, 1990) : Arm ave
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

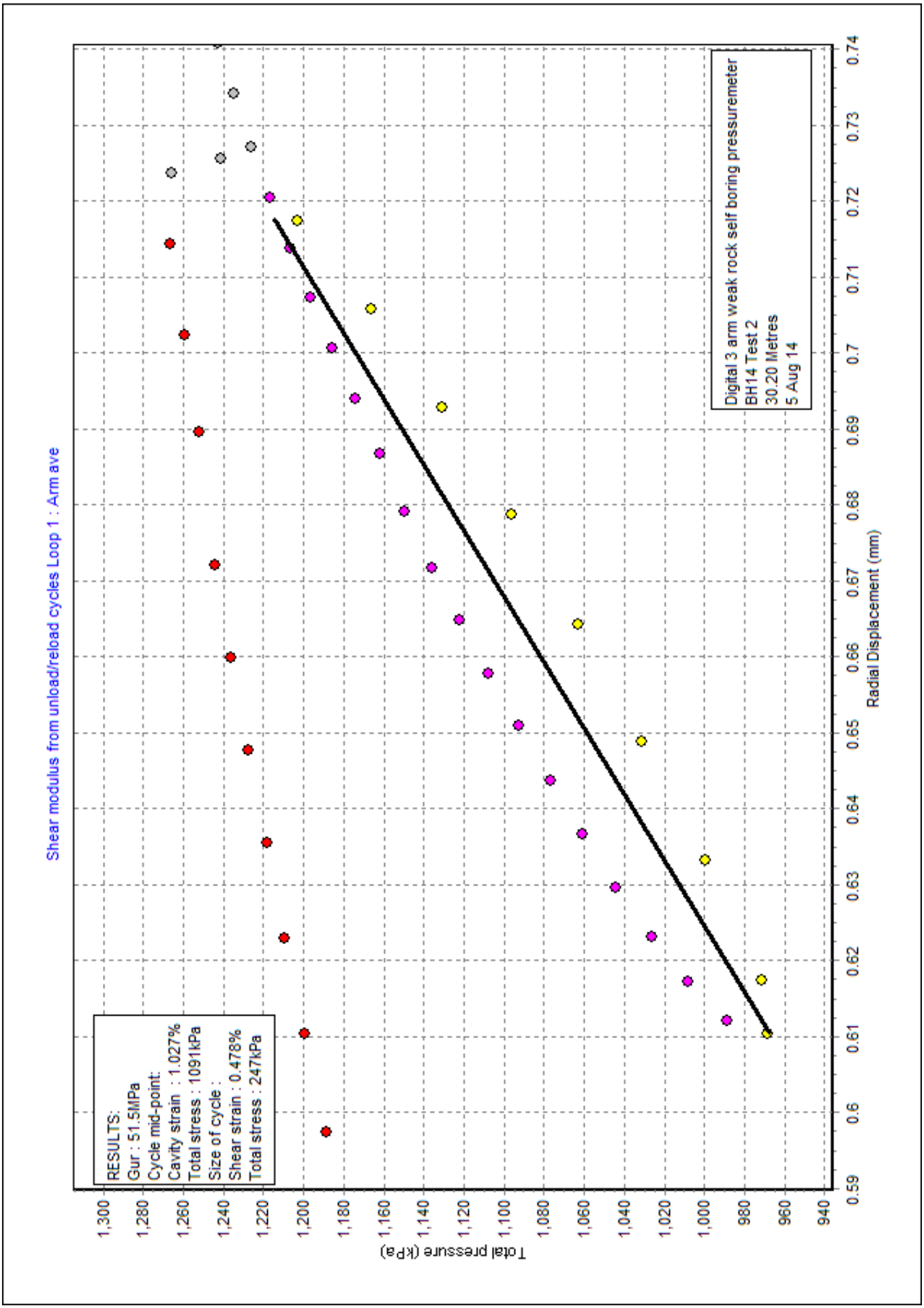

Excess PWP vs Total stress : PPC Ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
RESULTS:
Onset of excess pwp : 535.2kPa
Gradient of plastic phase : 1.047
Pore water pressure (kPa)
Total pressure (kPa)

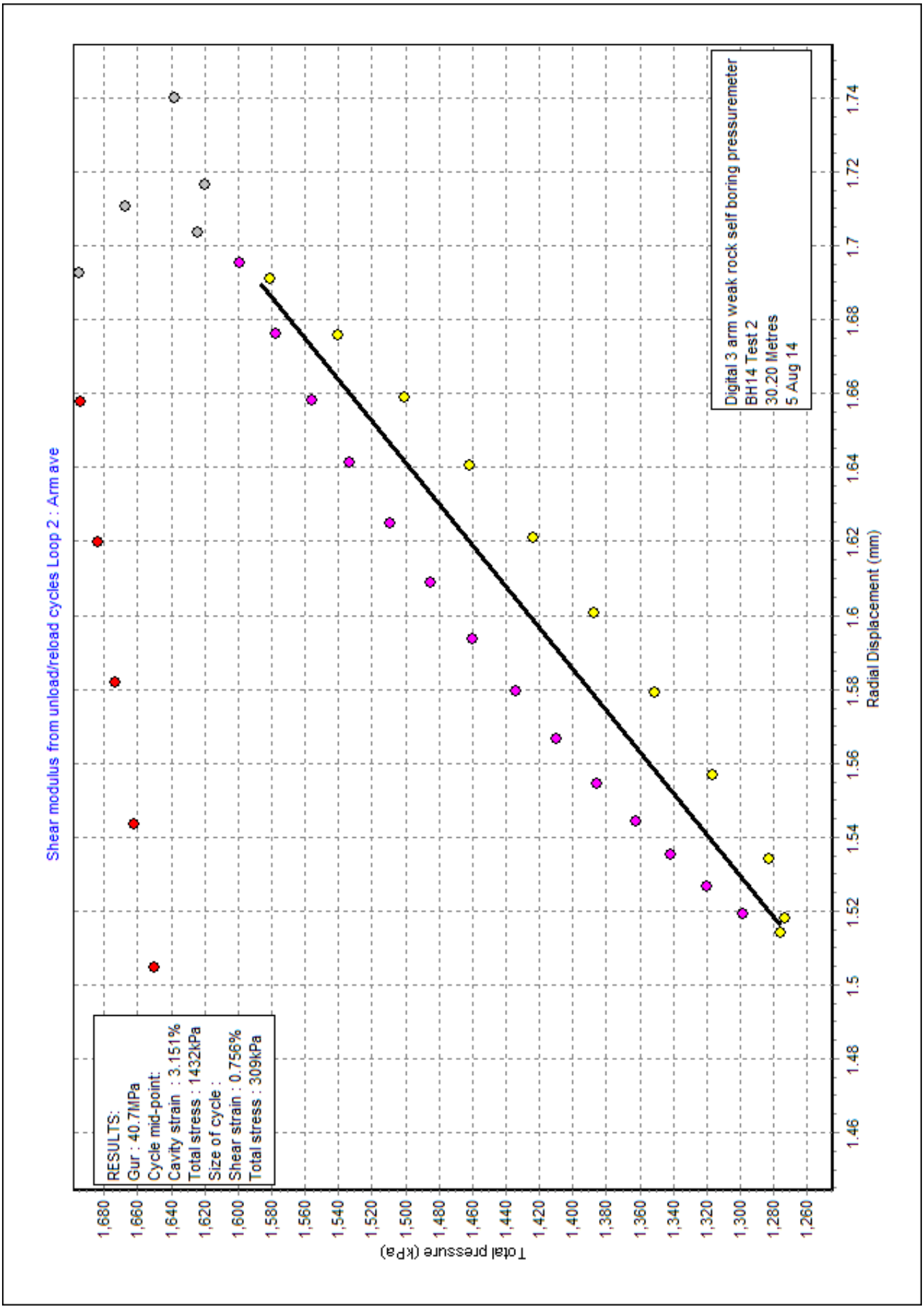

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 407.0kPa
PI : 2821kPa
Ir : 93
G : 37.7MPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Ln[shear strain]
2,050
2,000
1,950
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1,550
1,500
1,450
1,400
1,350
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
-2
-3
-4
-5
-6
-7
-8
-9

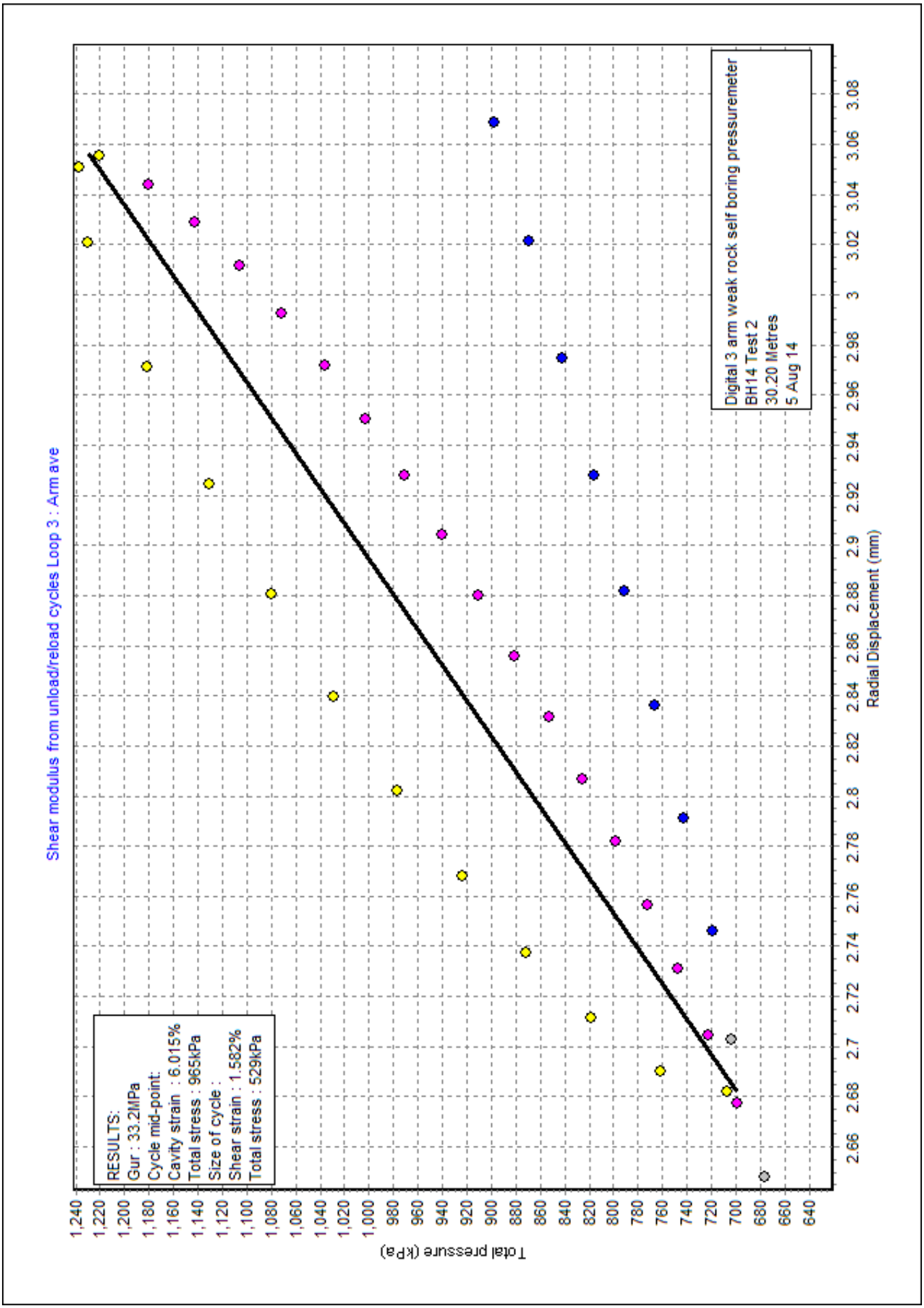

RESULTS:
Cu : 405.8kPa
Jefferies (1988) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Ln[shear strain]
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
-3
-4
-5
-6
-7

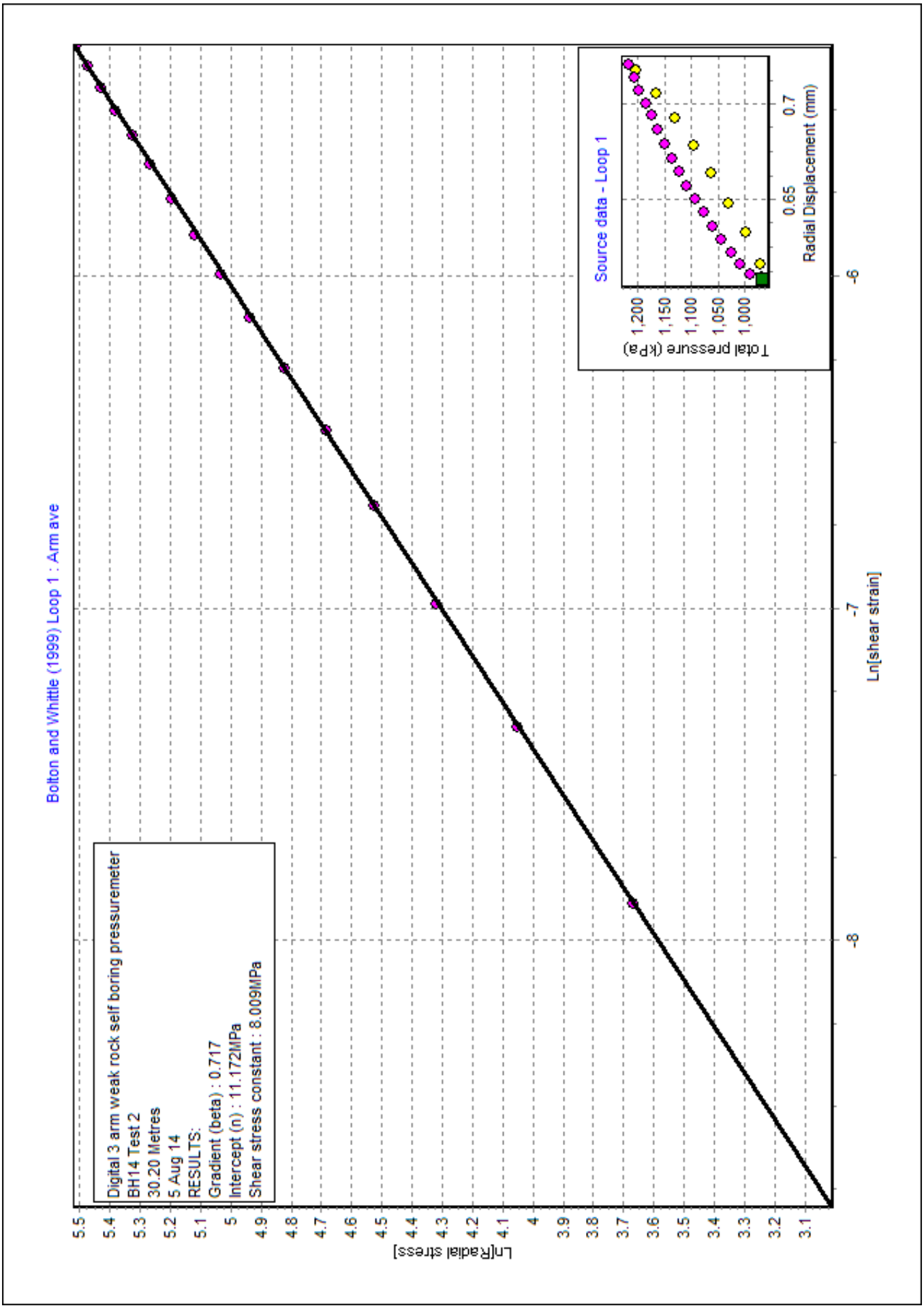

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 407.0kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Shear stress (kPa)
Shear strain (%)

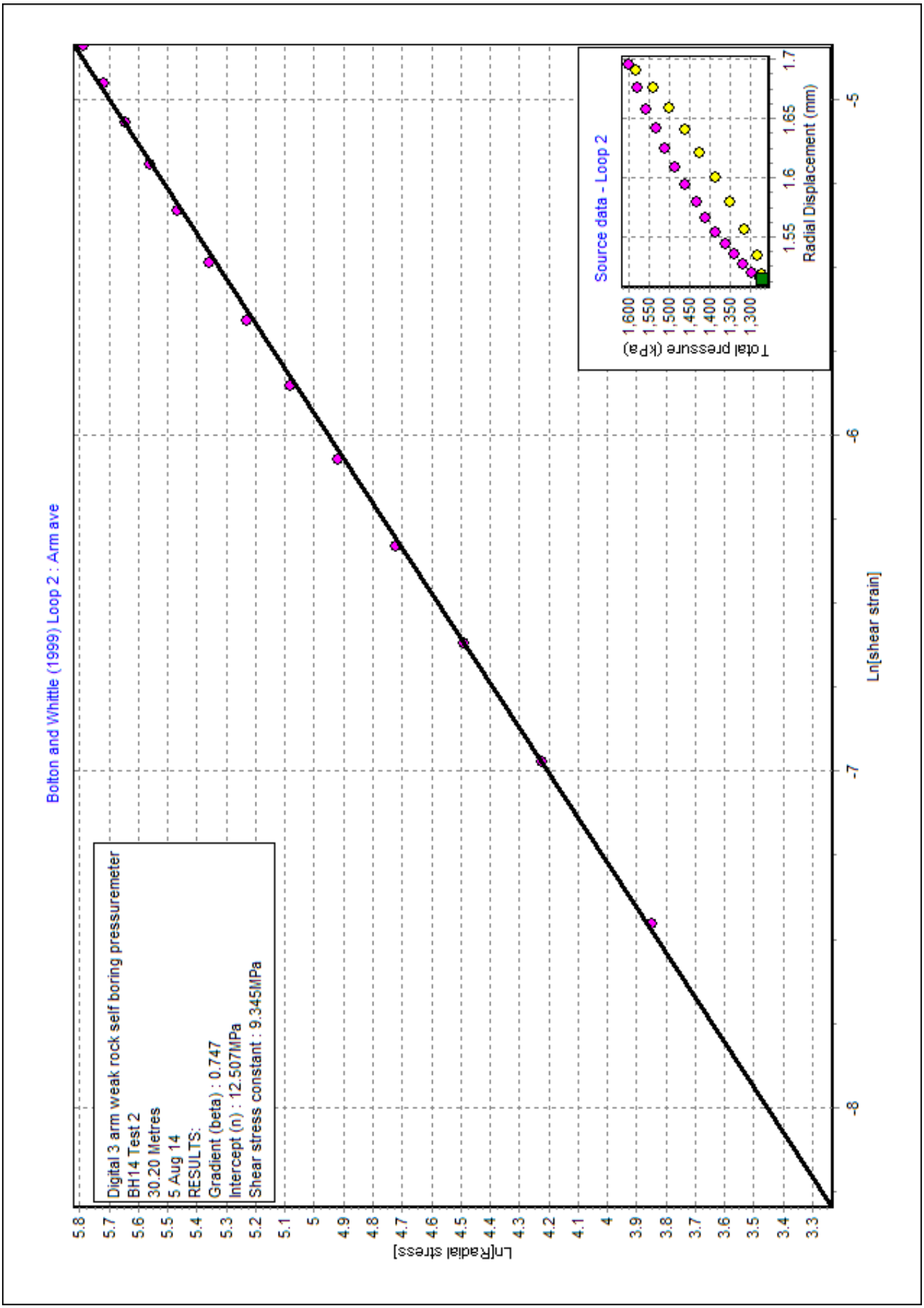

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 811.7kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Shear stress (kPa)
Shear strain (%)
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
1
2
3
4
5
6
7
8
9

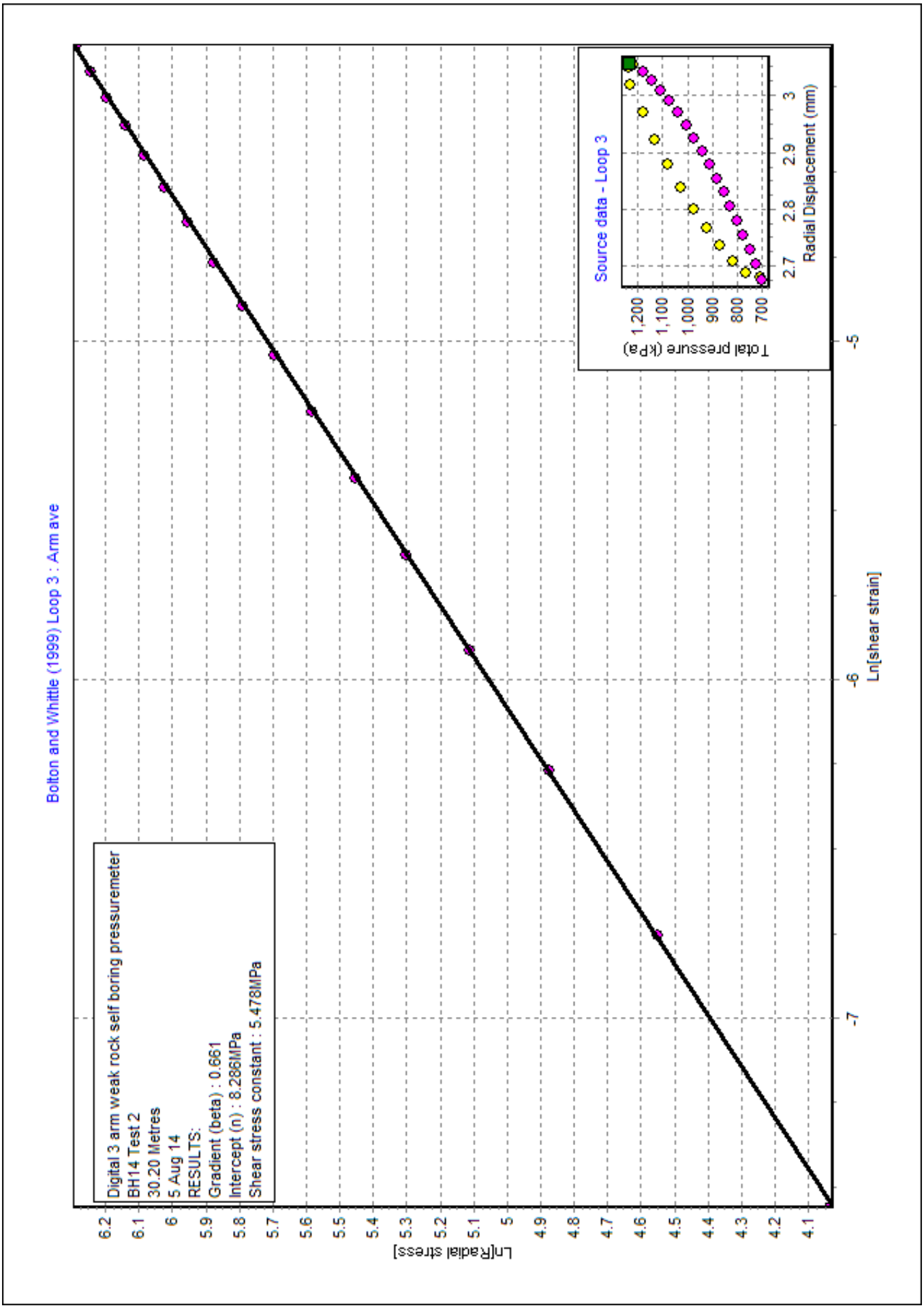

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 51.5MPa
Cycle mid-point:
Cavity strain : 1.027%
Total stress : 1091kPa
Size of cycle :
Shear strain : 0.478%
Total stress : 247kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,300
1,280
1,260
1,240
1,220
1,200
1,180
1,160
1,140
1,120
1,100
1,080
1,060
1,040
1,020
1,000
980
960
940
0.59
0.6
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.7
0.71
0.72
0.73
0.74

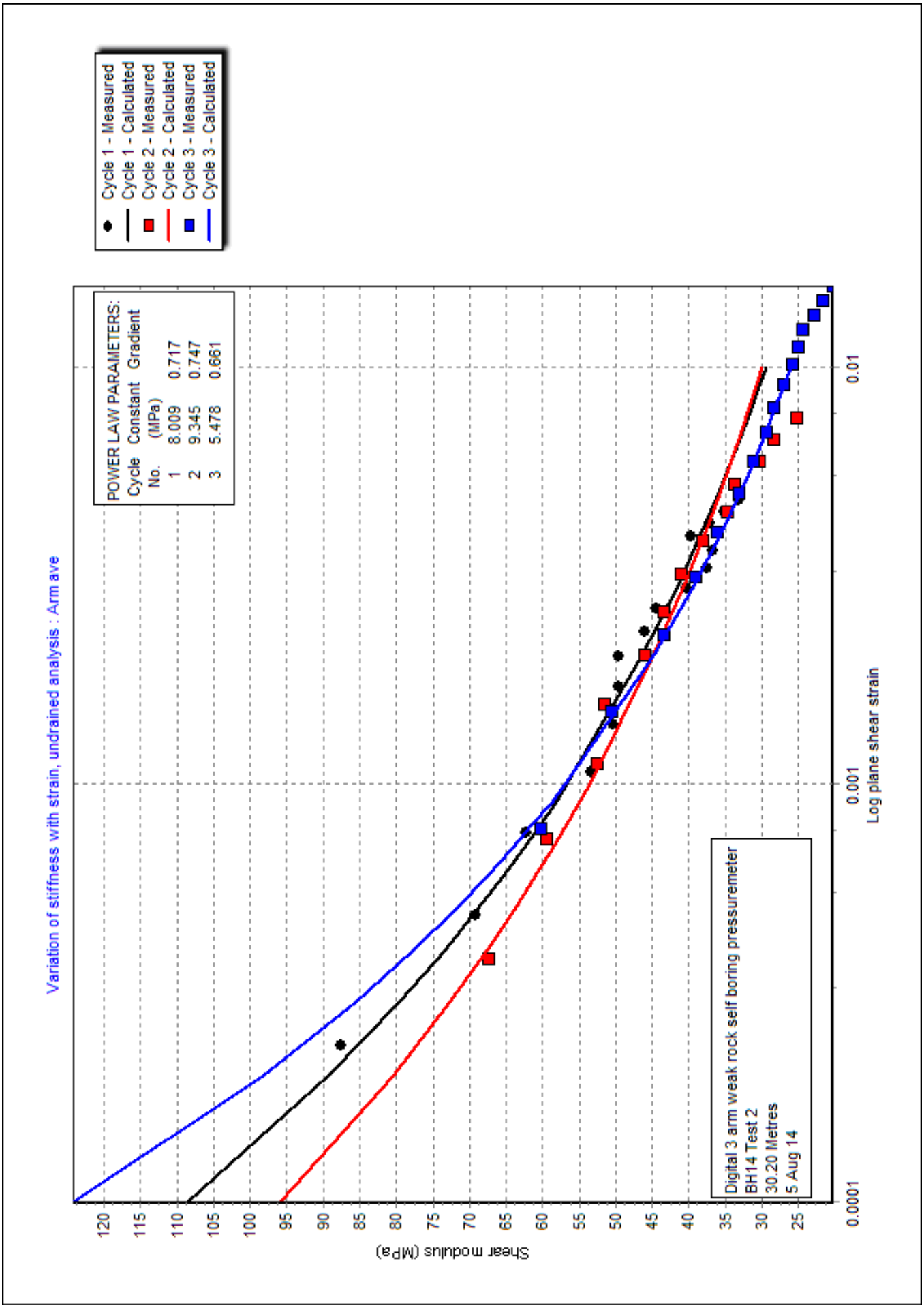

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 40.7MPa
Cycle mid-point:
Cavity strain : 3.151%
Total stress : 1432kPa
Size of cycle :
Shear strain : 0.756%
Total stress : 309kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

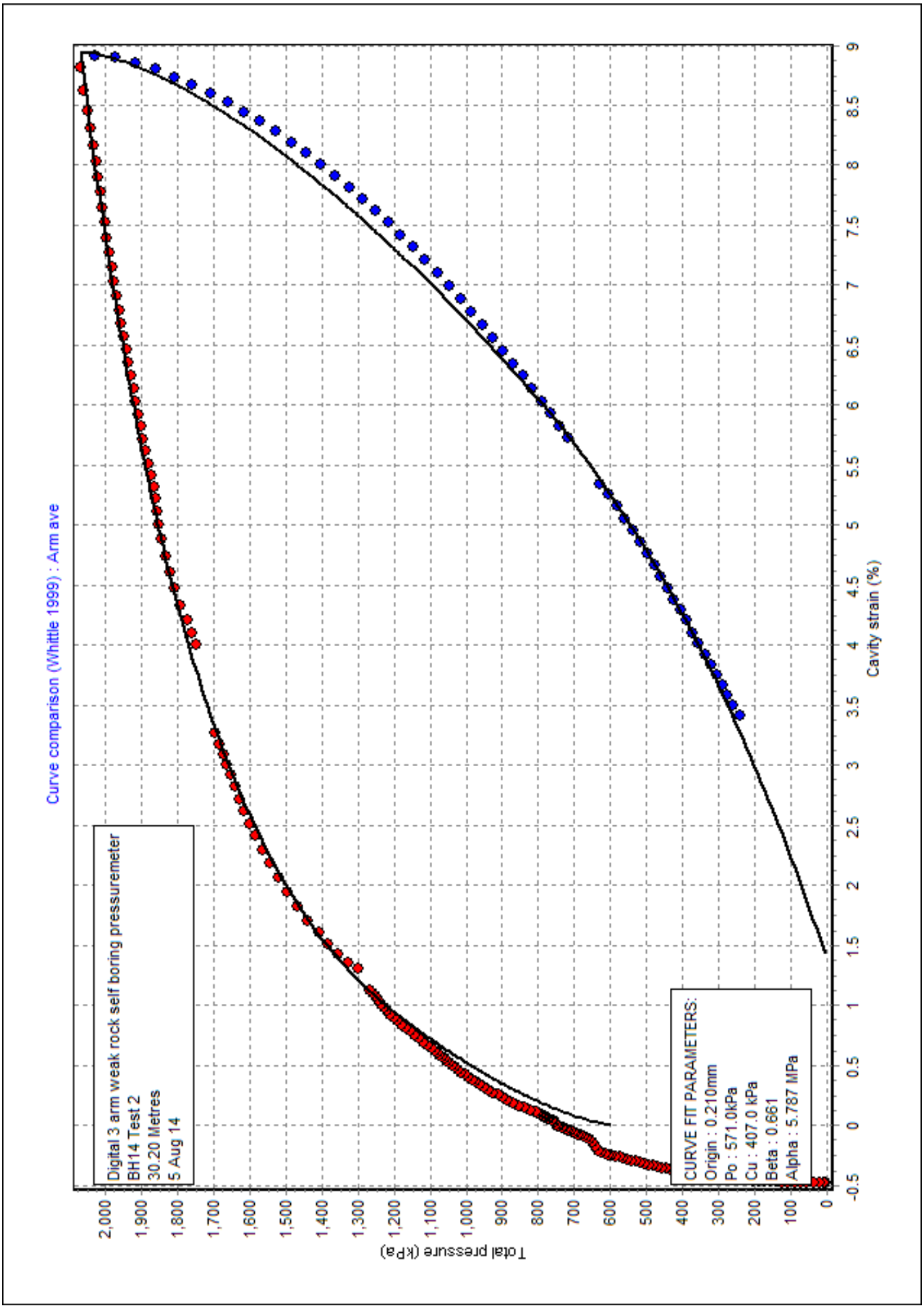

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 33.2MPa
Cycle mid-point:
Cavity strain : 6.015%
Total stress : 965kPa
Size of cycle :
Shear strain : 1.582%
Total stress : 529kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

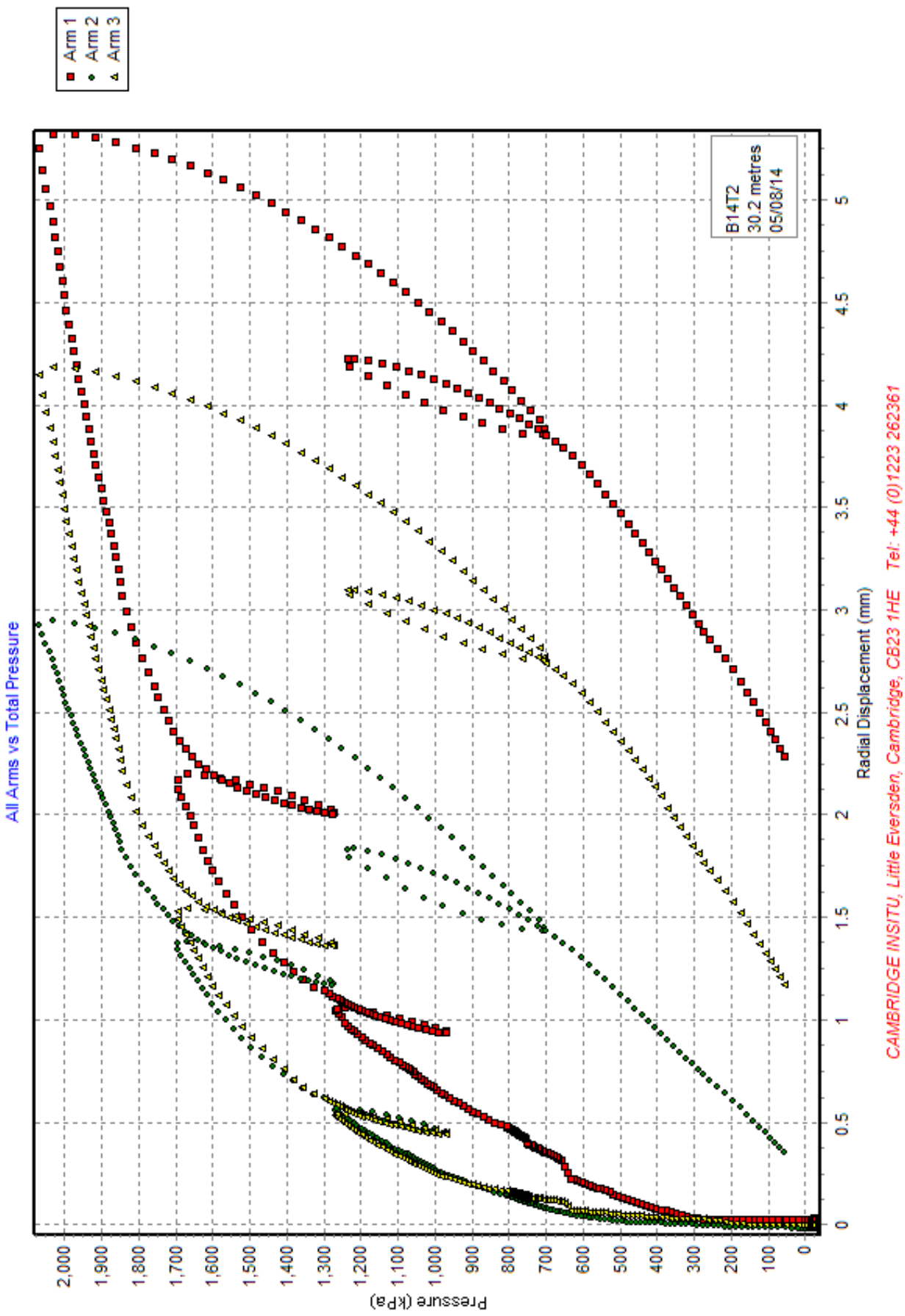

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
RESULTS:
Gradient (beta) : 0.717
Intercept (n) : 11.172MPa
Shear stress constant : 8.009MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

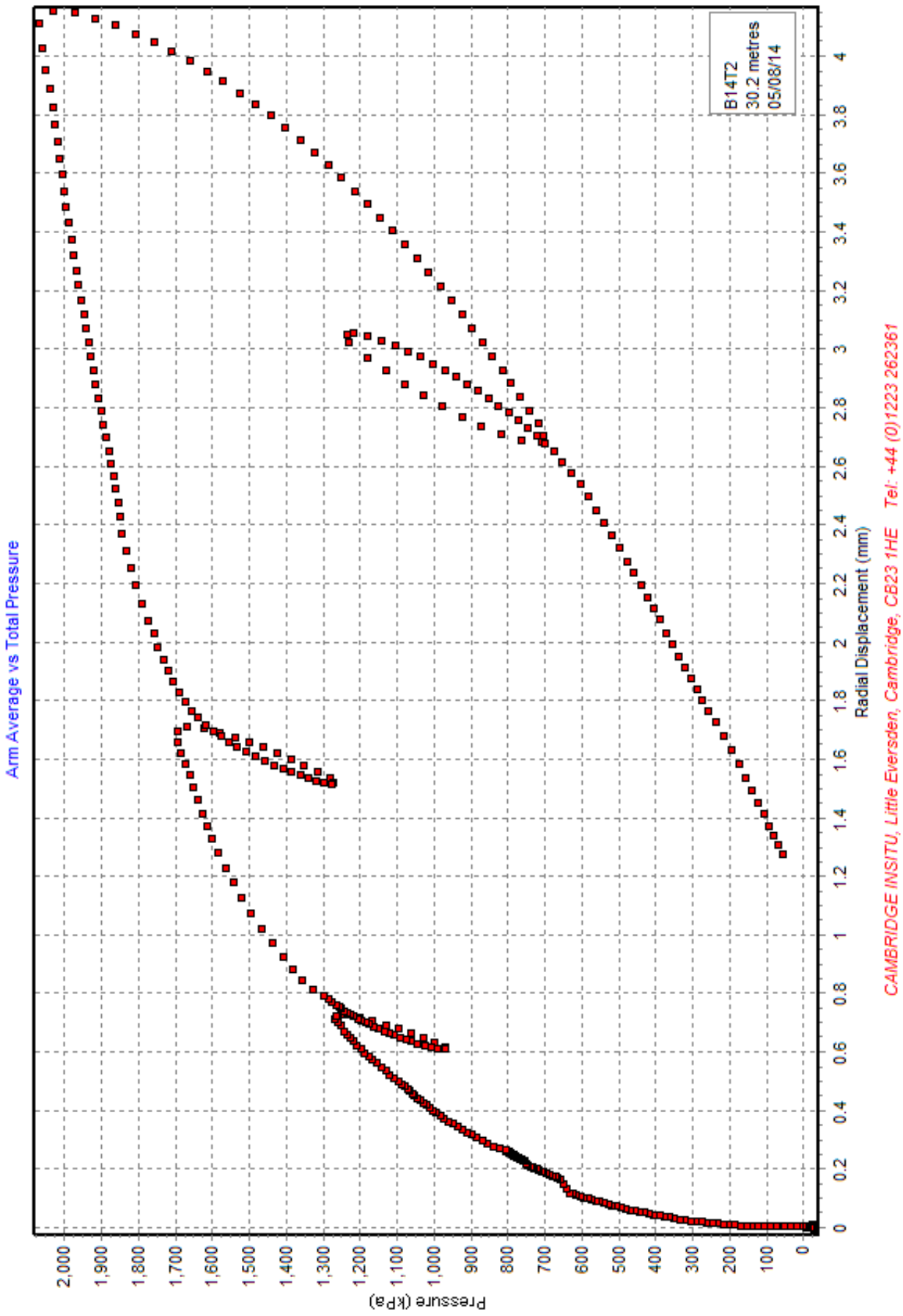

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
RESULTS:
Gradient (beta) : 0.747
Intercept (n) : 12.507MPa
Shear stress constant : 9.345MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

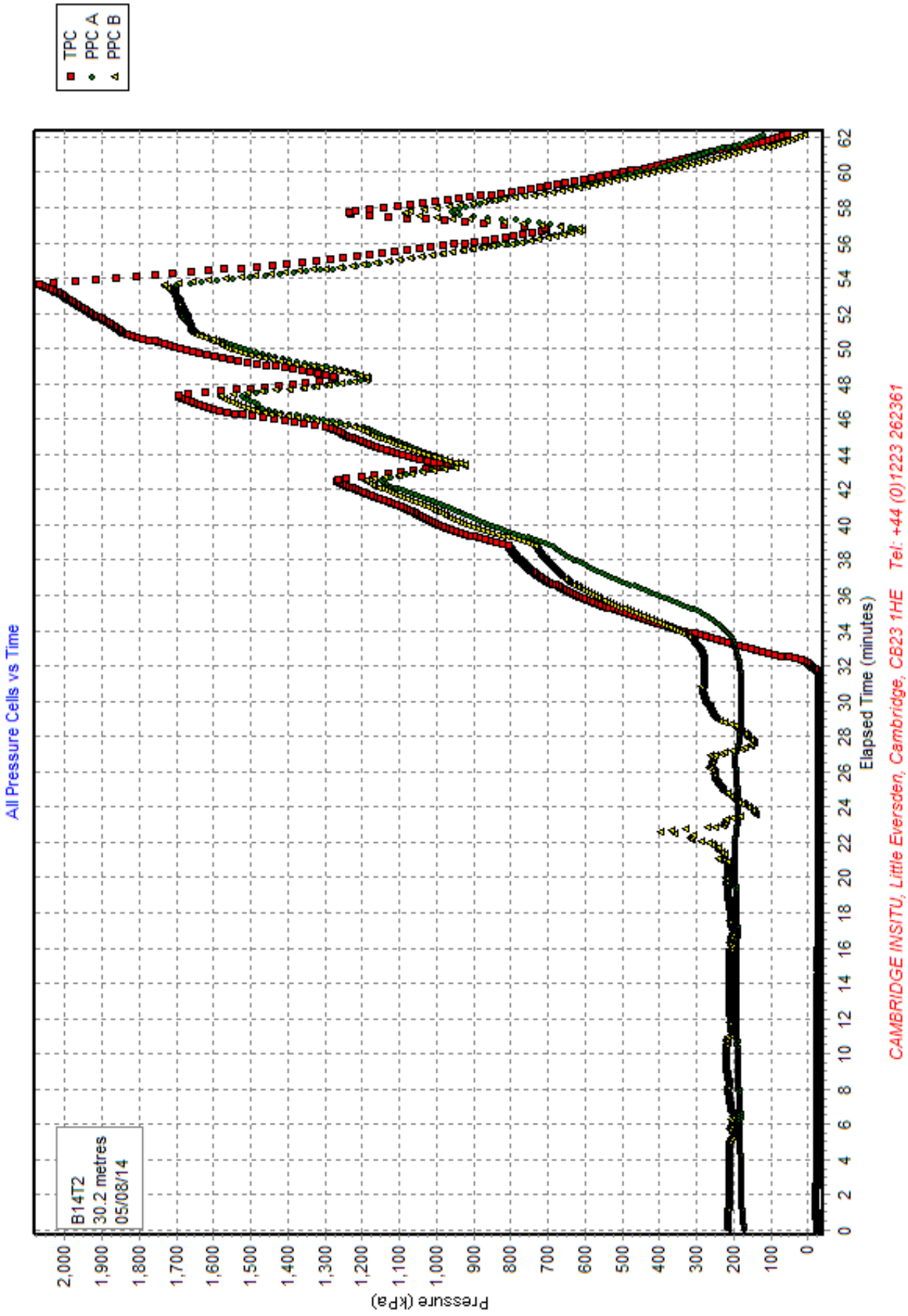

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
RESULTS:
Gradient (beta) : 0.661
Intercept (n) : 8.286MPa
Shear stress constant : 5.478MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 8.009 0.717
2 9.345 0.747
3 5.478 0.661
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 2
30.20 Metres
5 Aug 14
CURVE FIT PARAMETERS:
Origin : 0.210mm
Po : 571.0kPa
Cu : 407.0 kPa
Beta : 0.661
Alpha : 5.787 MPa
Total pressure (kPa)
Cavity strain (%)
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9


Arm 1
Arm 2
Arm 3
All Arms vs Total Pressure
B14T2
30.2 metres
05/08/14
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B14T2
30.2 metres
05/08/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B14T2
30.2 metres
05/08/14
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

BH14 Test 3 - SUMMARY OF RESULTS
[File made with WinSitu Version 3.6.1.1]

[DETAILS OF TEST]

Project	:	C4237
Site	:	Rivenhall Airfield
Borehole	:	BH14
Test name	:	BH14 Test 3
Test date	:	7 Aug 14
Test depth	:	40.50 Metres
Water table	:	8 Metres
Ambient PWP	:	318.8 kPa
Material	:	London Clay
Probe	:	Digital 3 arm weak rock self boring pressuremeter
Diameter	:	88.0 mm

Data analysed using average arm displacement curve
A non-linear analysis of the rebound cycles has been carried out
The file includes results from a curve fitting analysis

Analysed by RWW on 7 Aug 14

Remarks: Starts at GL 09:44. Ends 11:02 at 41m.

[RESULTS FOR CAVITY REFERENCE PRESSURE]

Strain Origin (mm)	:	"Arm ave=0.480"
Po from Marsland & Randolph (kPa)	:	"Arm ave=1065.8"
Po from Lift off (kPa)	:	"Arm ave=923.7"
Best estimate of Po (kPa)	:	"Arm ave=900.0"

[UNDRAINED STRENGTH PARAMETERS]

Gibson & Anderson 1961 - Cu (kPa)	:	"Arm ave=476.5"
Limit pressure (kPa)	:	"Arm ave=3619"
Jefferies 1988 - Cu (kPa)	:	"Arm ave=476.8"
Undrained yield stress (kPa)	:	"Arm ave=1502.3"

[LINEAR INTERPRETATION OF SHEAR MODULUS G]
Initial slope shear modulus (MPa) :"Arm ave=36.6"

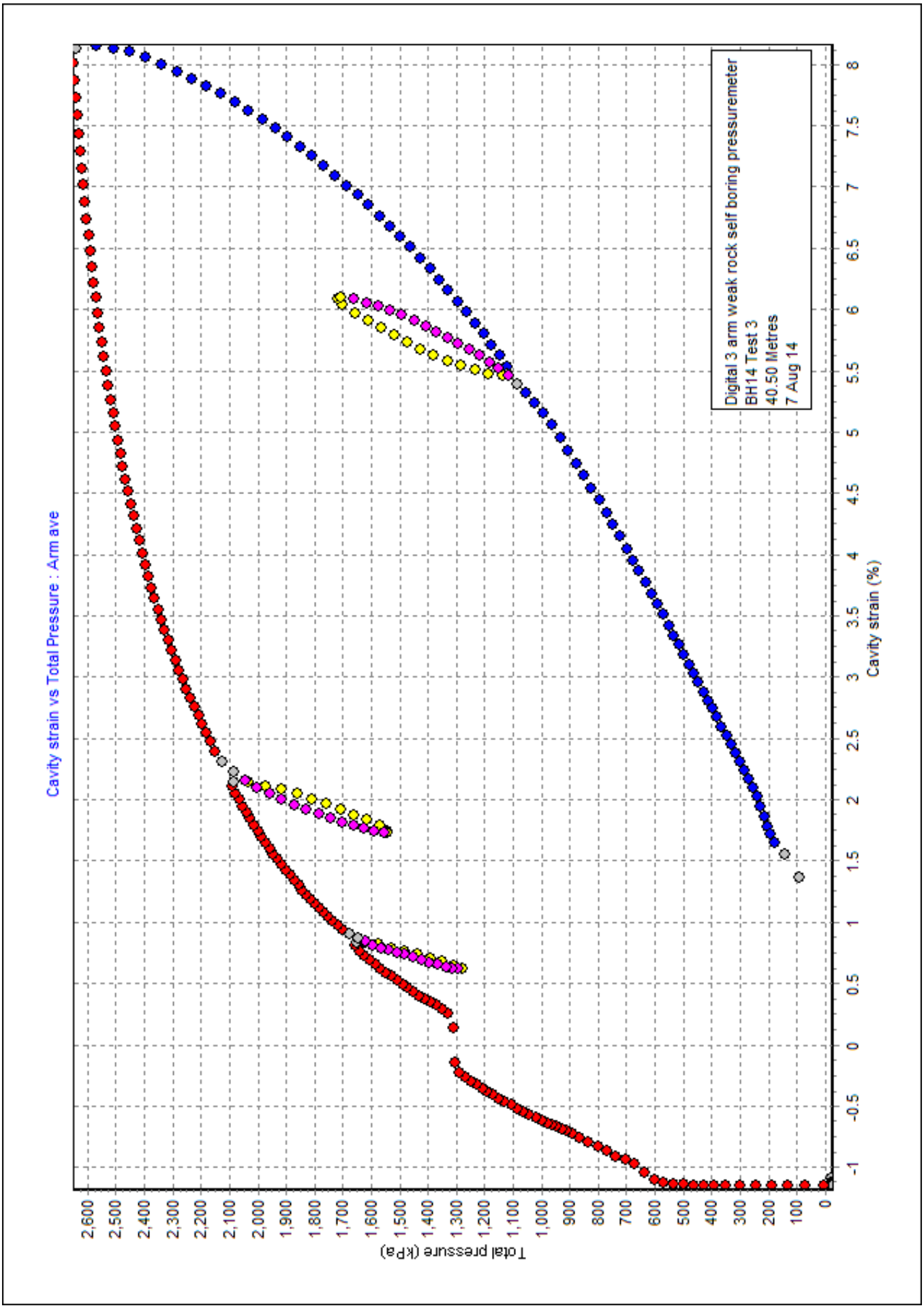
Axis	Loop No	Value (MPa)	Mean Strain (%)	Mean Pc (kPa)	dE (%)	dPc (kPa)
Arm ave	1	76.9	0.736	1448	0.469	362
Arm ave	2	60.6	1.948	1790	0.854	519
Arm ave	3	48.5	5.790	1421	1.264	617

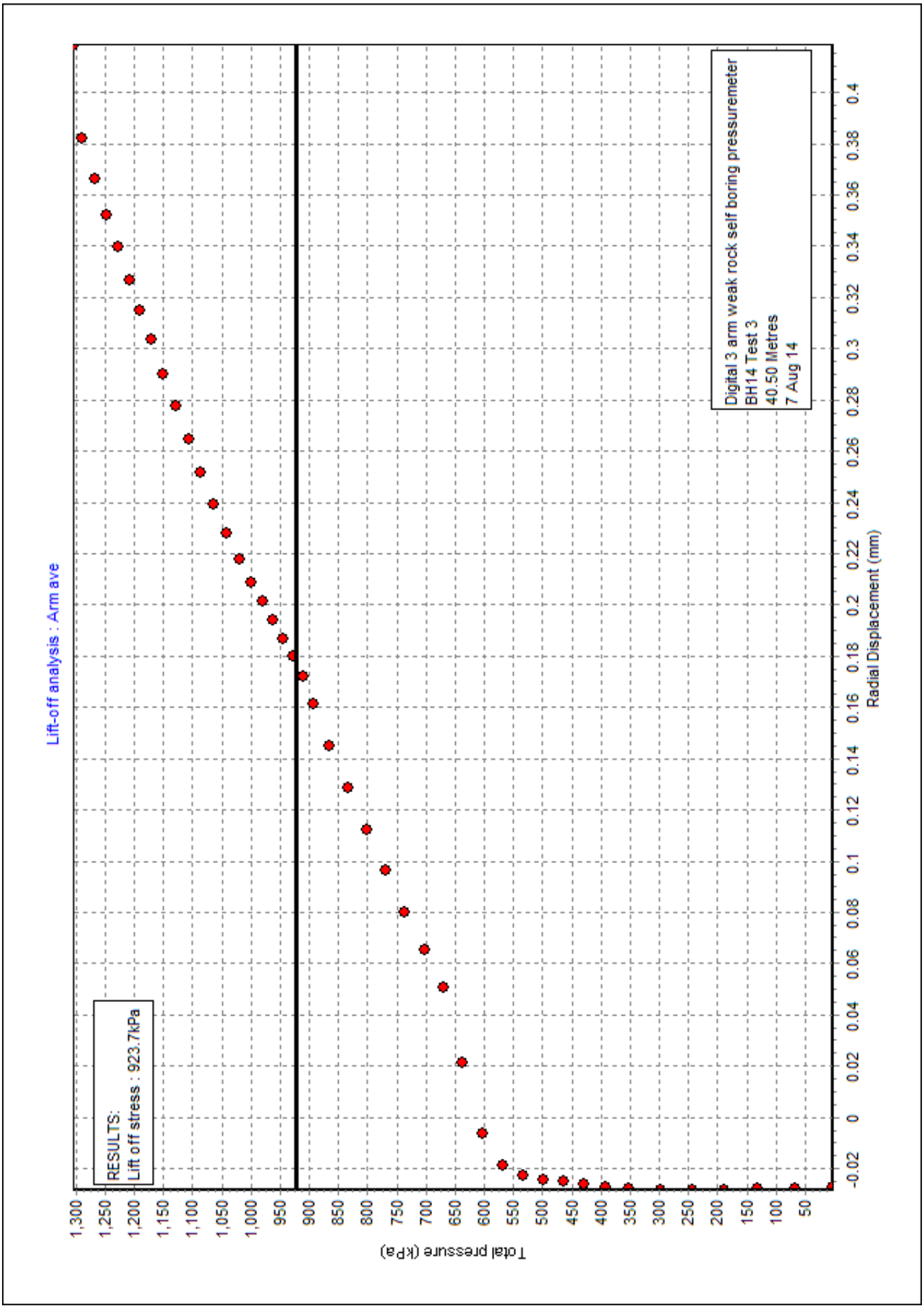
[UNDRAINED NON LINEAR INTERPRETATION OF SECANT SHEAR MODULUS]

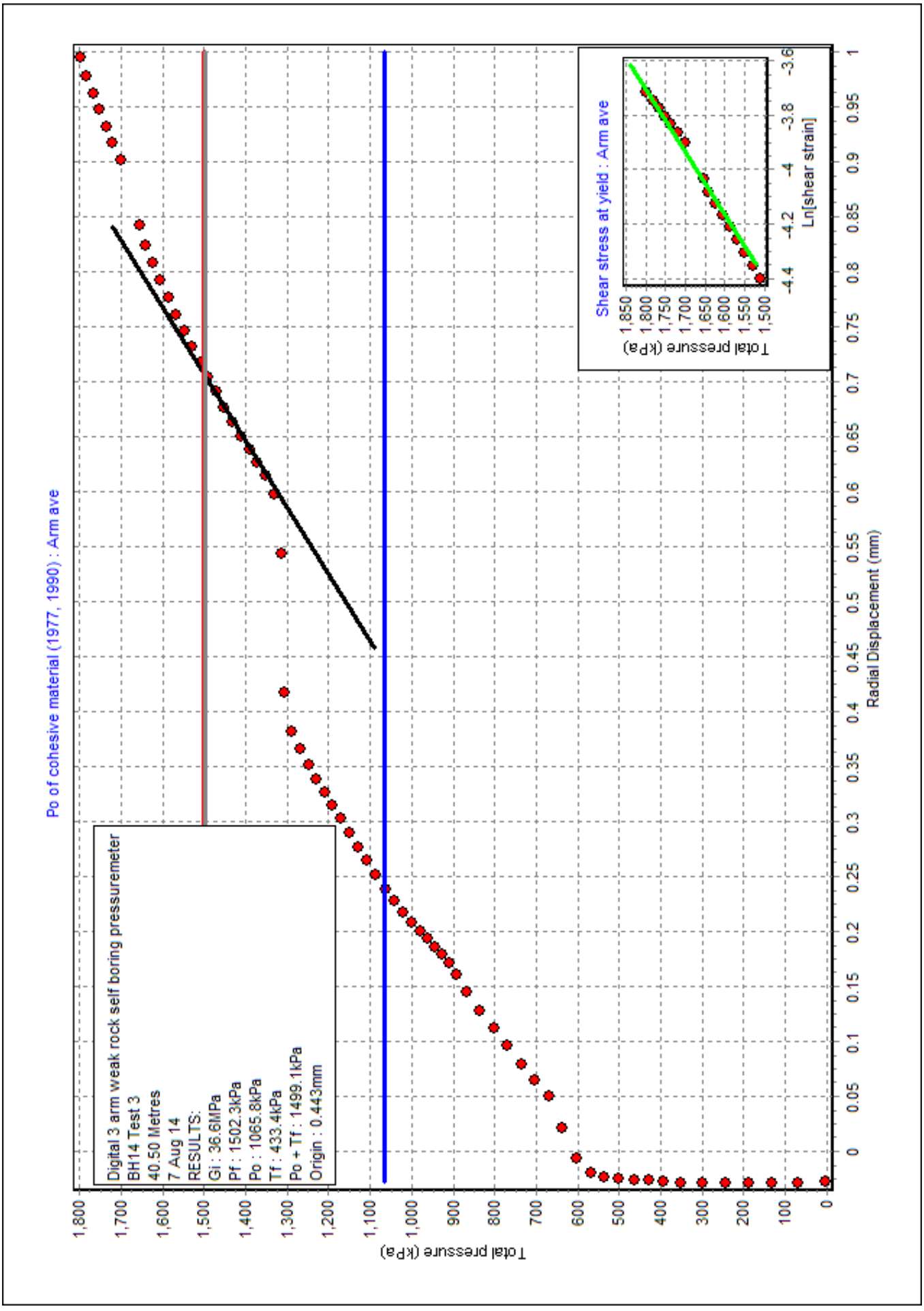
Axis	Loop No	Intercept (MPa)	Alpha (MPa)	Gradient
Arm ave	1	21.519	16.597	0.771
Arm ave	2	14.628	10.241	0.700
Arm ave	3	11.551	7.742	0.670

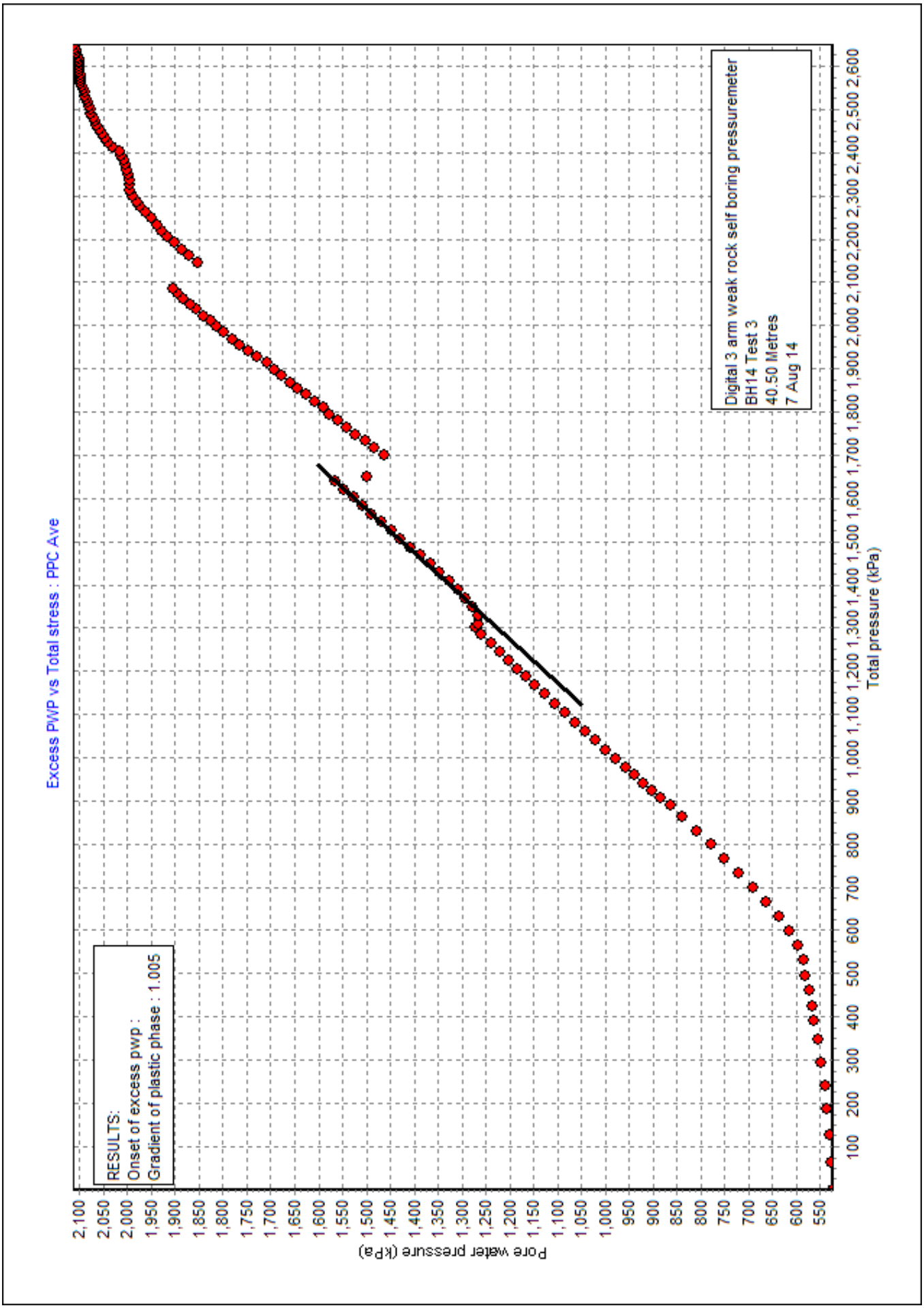
[PARAMETERS USED FOR UNDRAINED CURVE MODELLING]
{Axis is Arm ave}

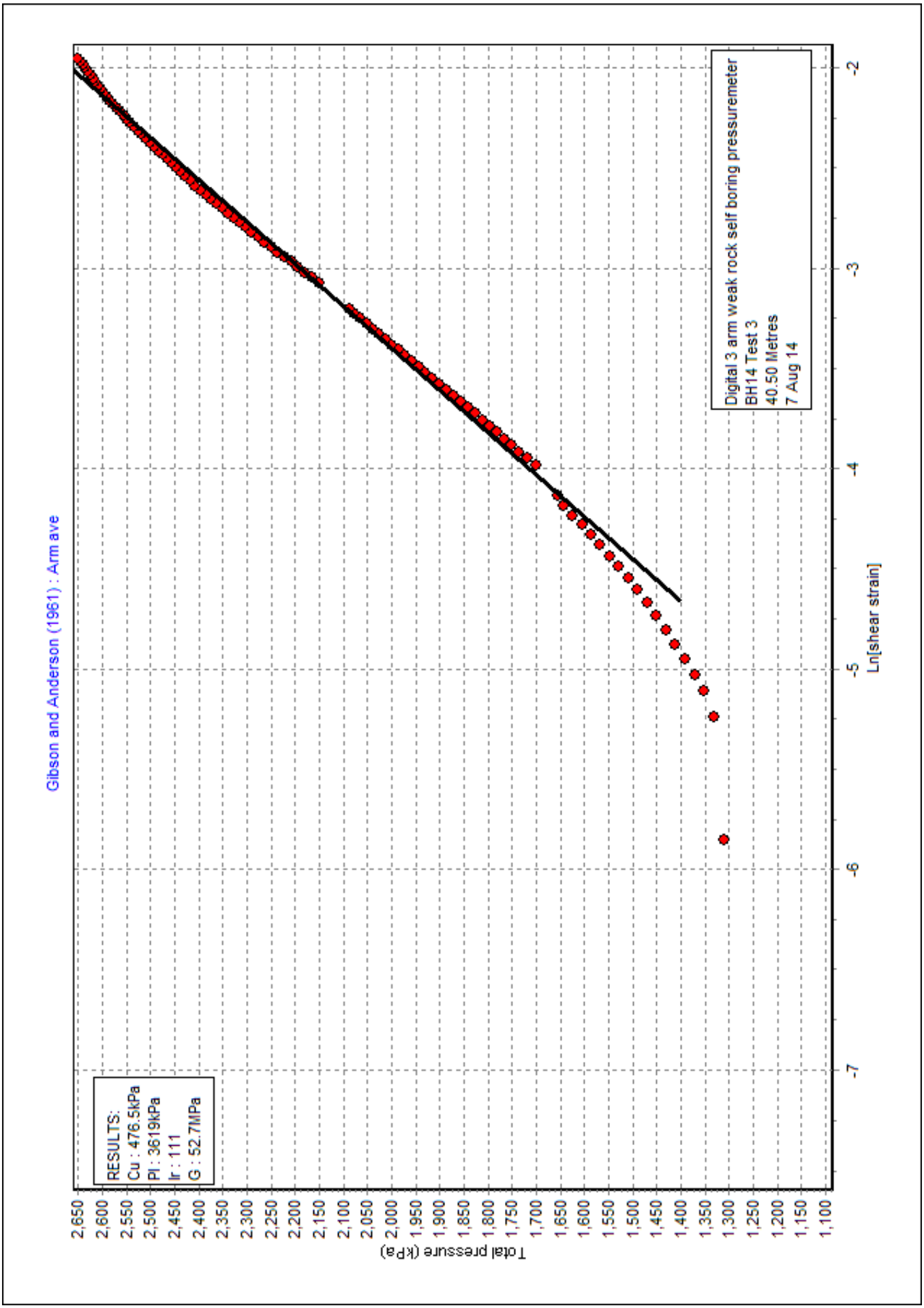
Strain Origin (mm)	:	0.48
Po (kPa)	:	900
Cu (kPa)	:	476.5
Limit pressure (kPa)	:	3619
Non-linear exponent	:	0.670
Calculated alpha (MPa)	:	8.022
G at yield (MPa)	:	32.2

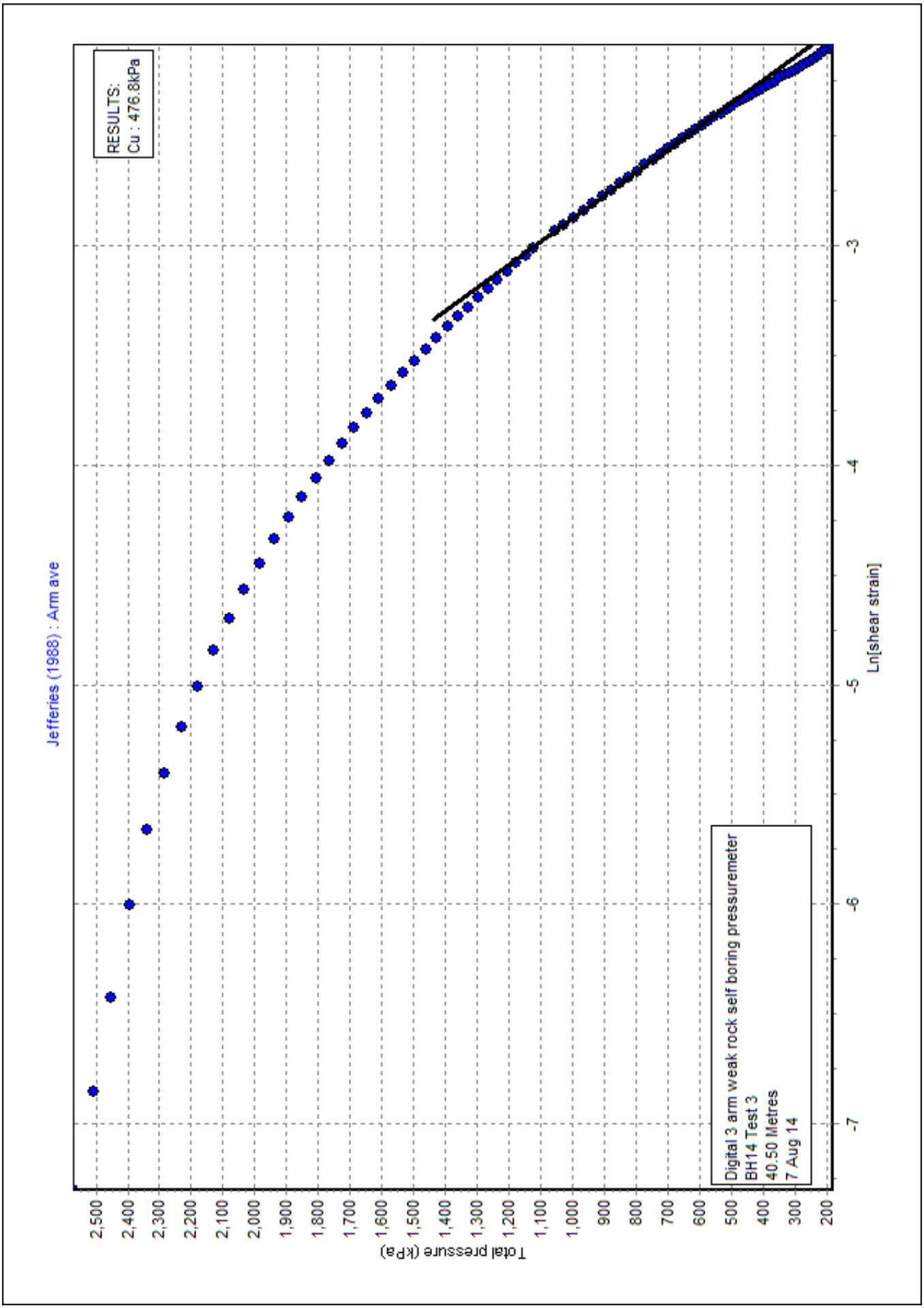

Cavity strain vs Total Pressure : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Cavity strain (%)
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
1,700
1,800
1,900
2,000
2,100
2,200
2,300
2,400
2,500
2,600
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8

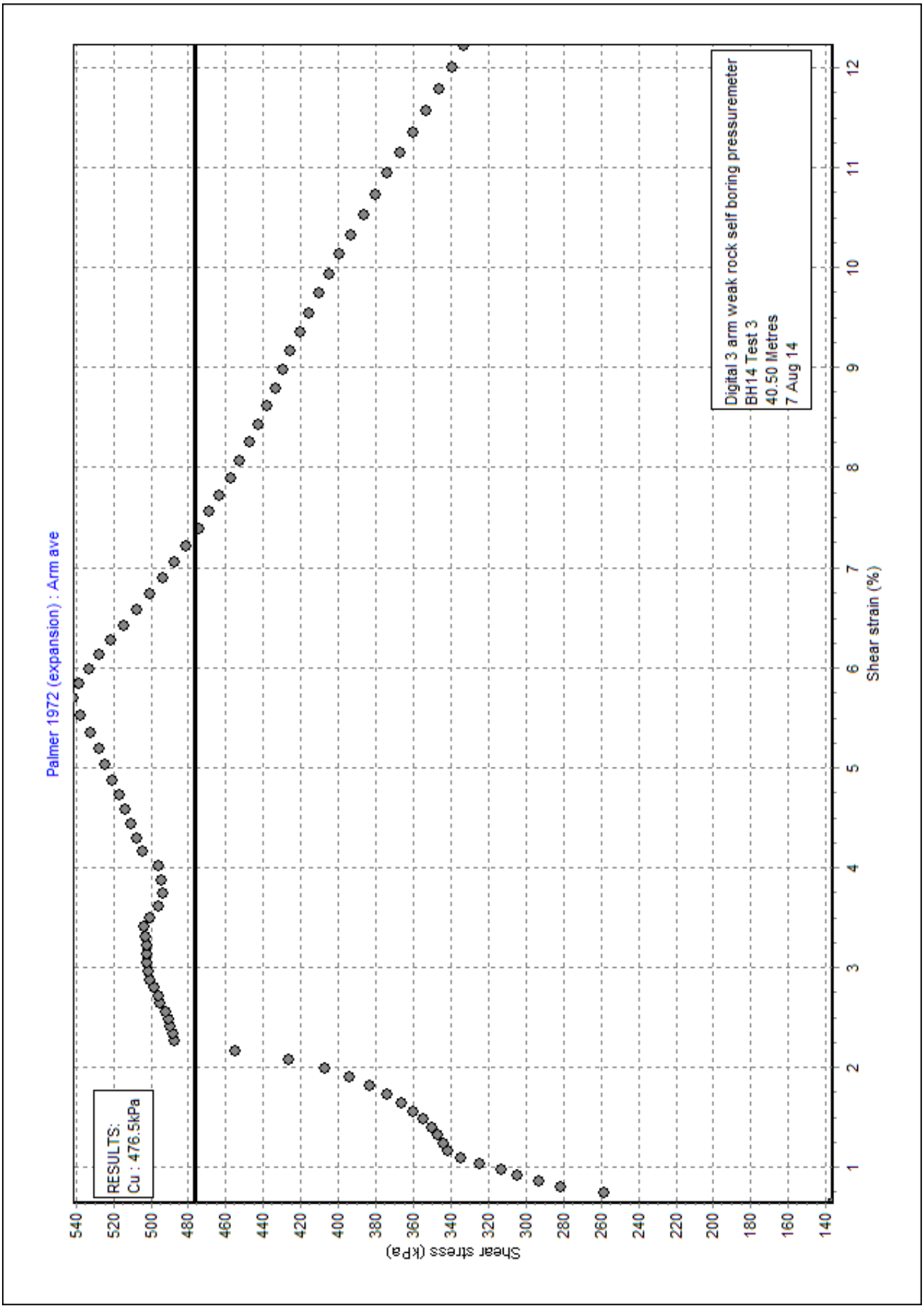

Lift-off analysis : Arm ave
RESULTS:
Lift off stress : 923.7kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Radial Displacement (mm)
1,300
1,250
1,200
1,150
1,100
1,050
1,000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
-0.02
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2
0.22
0.24
0.26
0.28
0.3
0.32
0.34
0.36
0.38
0.4

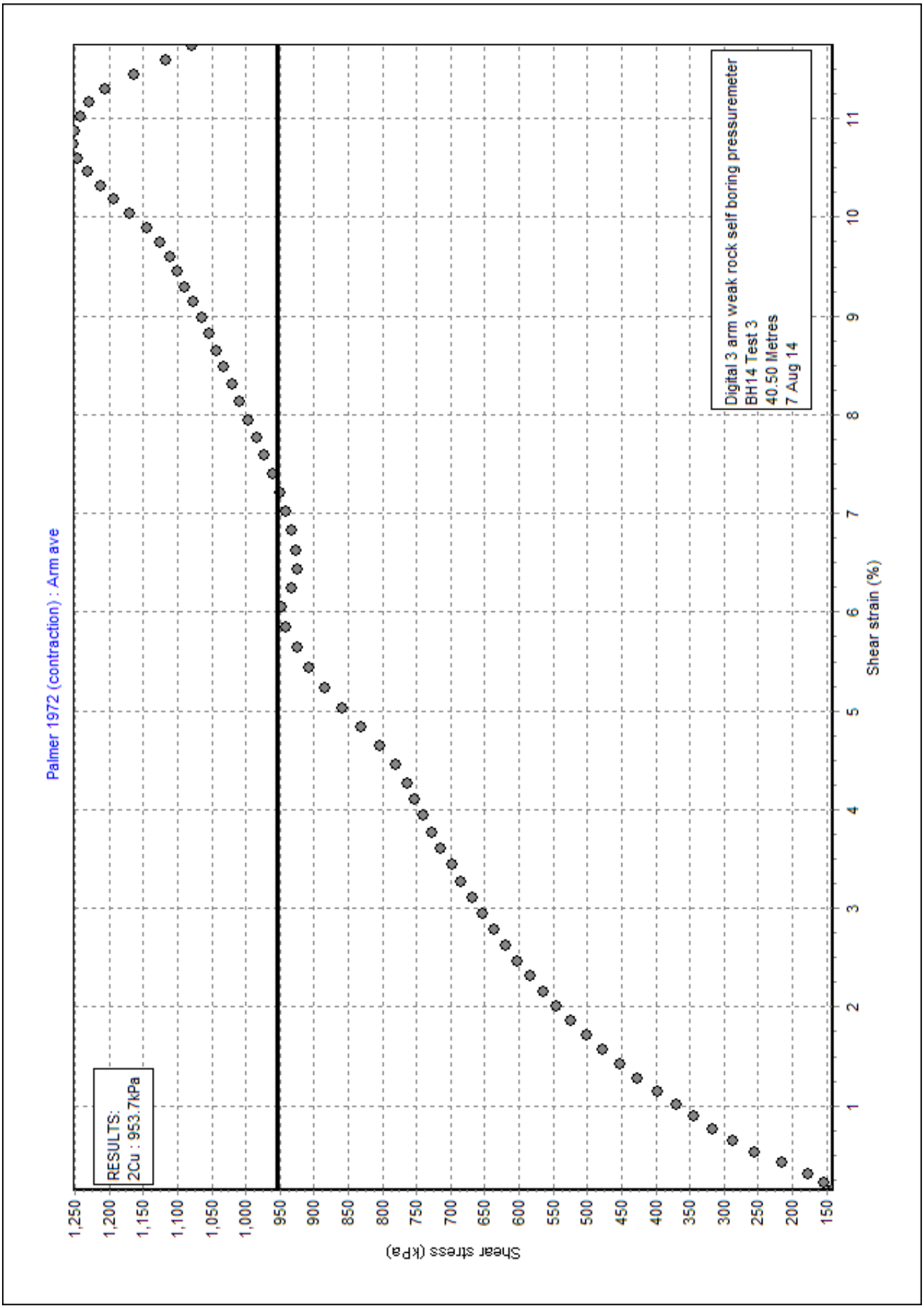

Po of cohesive material (1977, 1990) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
RESULTS:
Gi : 36.6MPa
Pf : 1502.3kPa
Po : 1065.8kPa
Tf : 433.4kPa
Po + Tf : 1499.1kPa
Origin : 0.443mm
Total pressure (kPa)
Radial Displacement (mm)
Shear stress at yield : Arm ave
Total pressure (kPa)
Ln[shear strain]

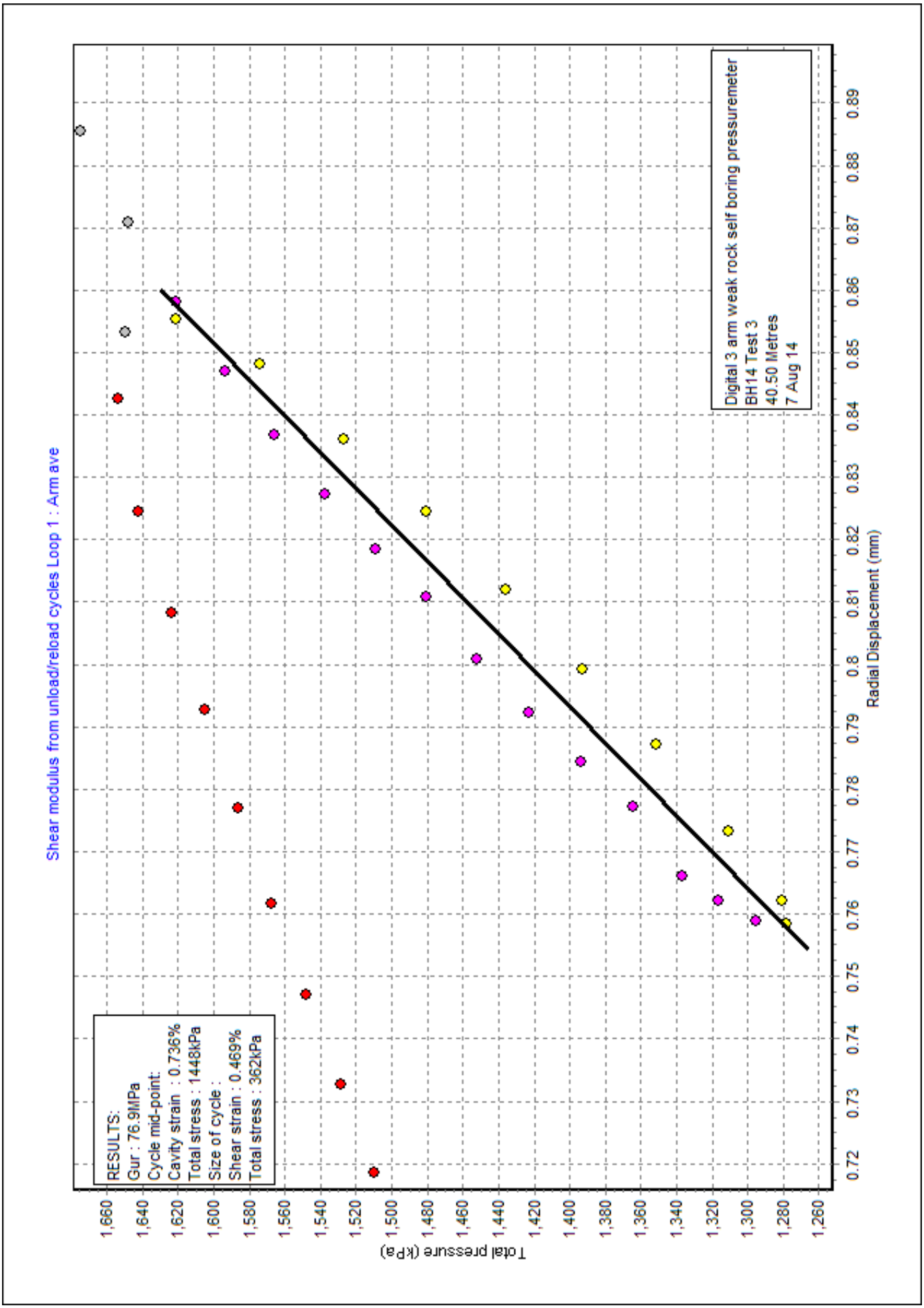

Excess PWP vs Total stress : PPC Ave
RESULTS:
Onset of excess pwp :
Gradient of plastic phase : 1.005
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Pore water pressure (kPa)
Total pressure (kPa)

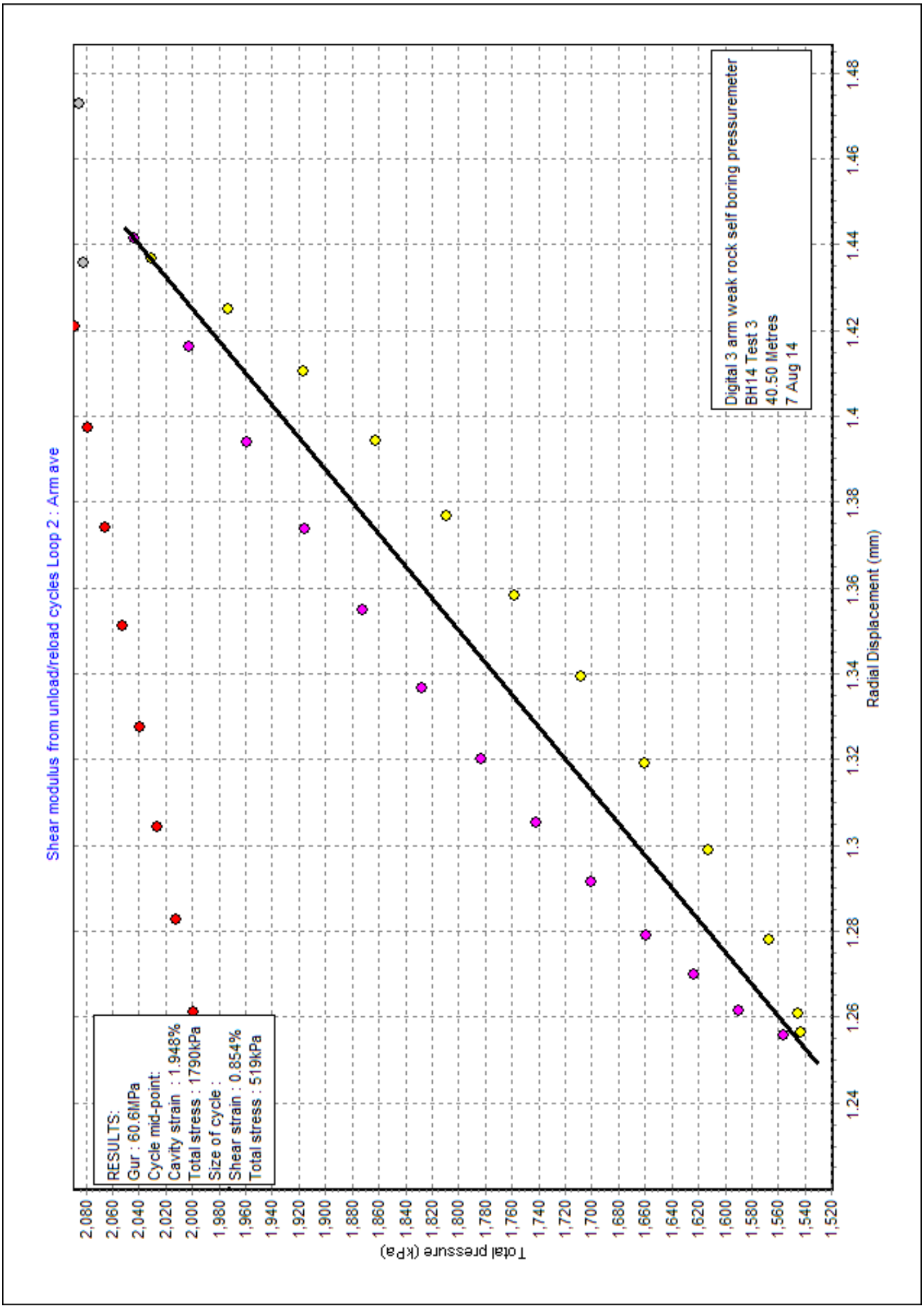

Gibson and Anderson (1961) : Arm ave
RESULTS:
Cu : 476.5kPa
Pl : 3619kPa
Ir : 111
G : 52.7MPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Ln[shear strain]

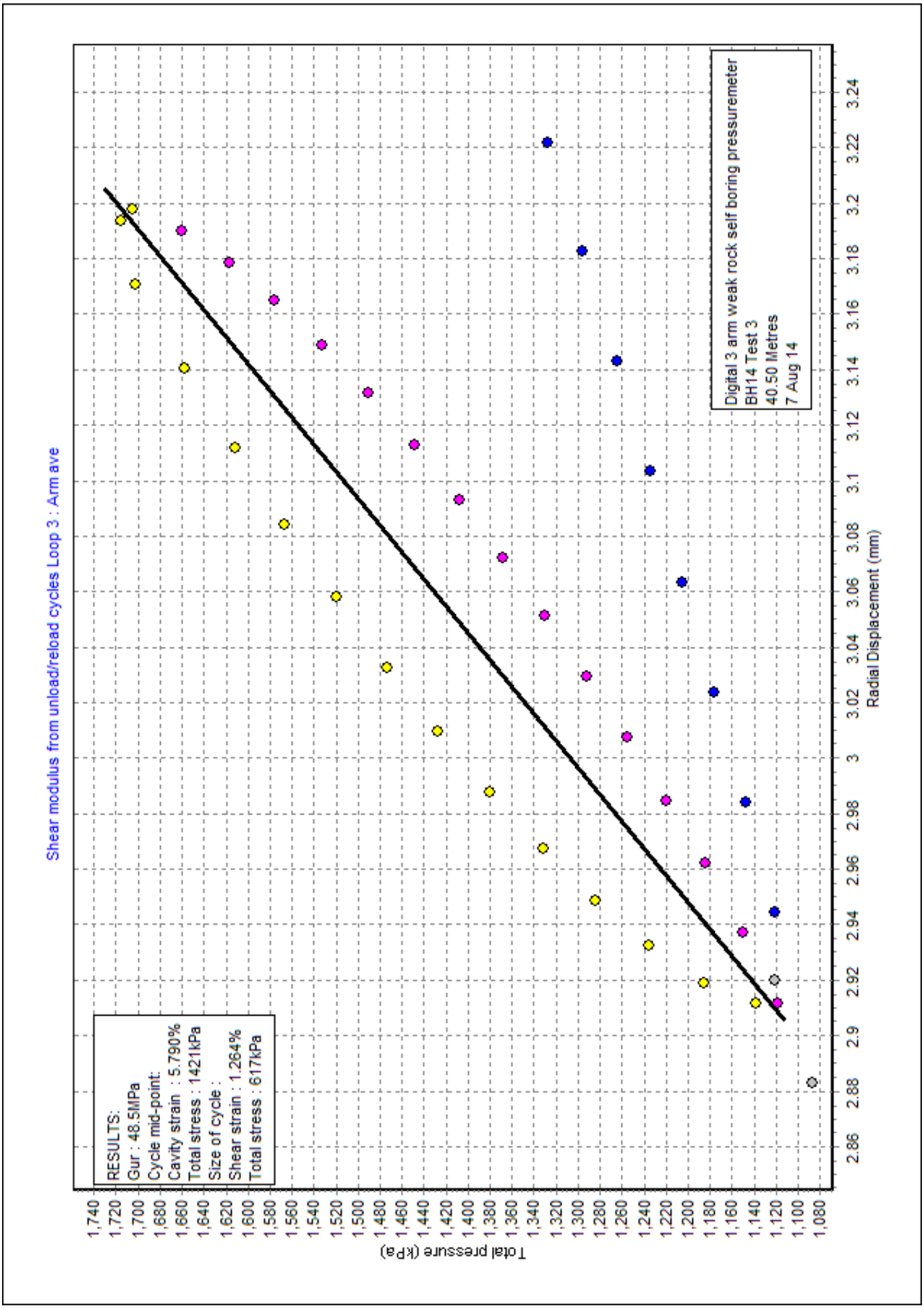

RESULTS:
Cu : 476.8kPa
Jefferies (1988) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Ln[shear strain]
2,500
2,400
2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
-3
-4
-5
-6
-7

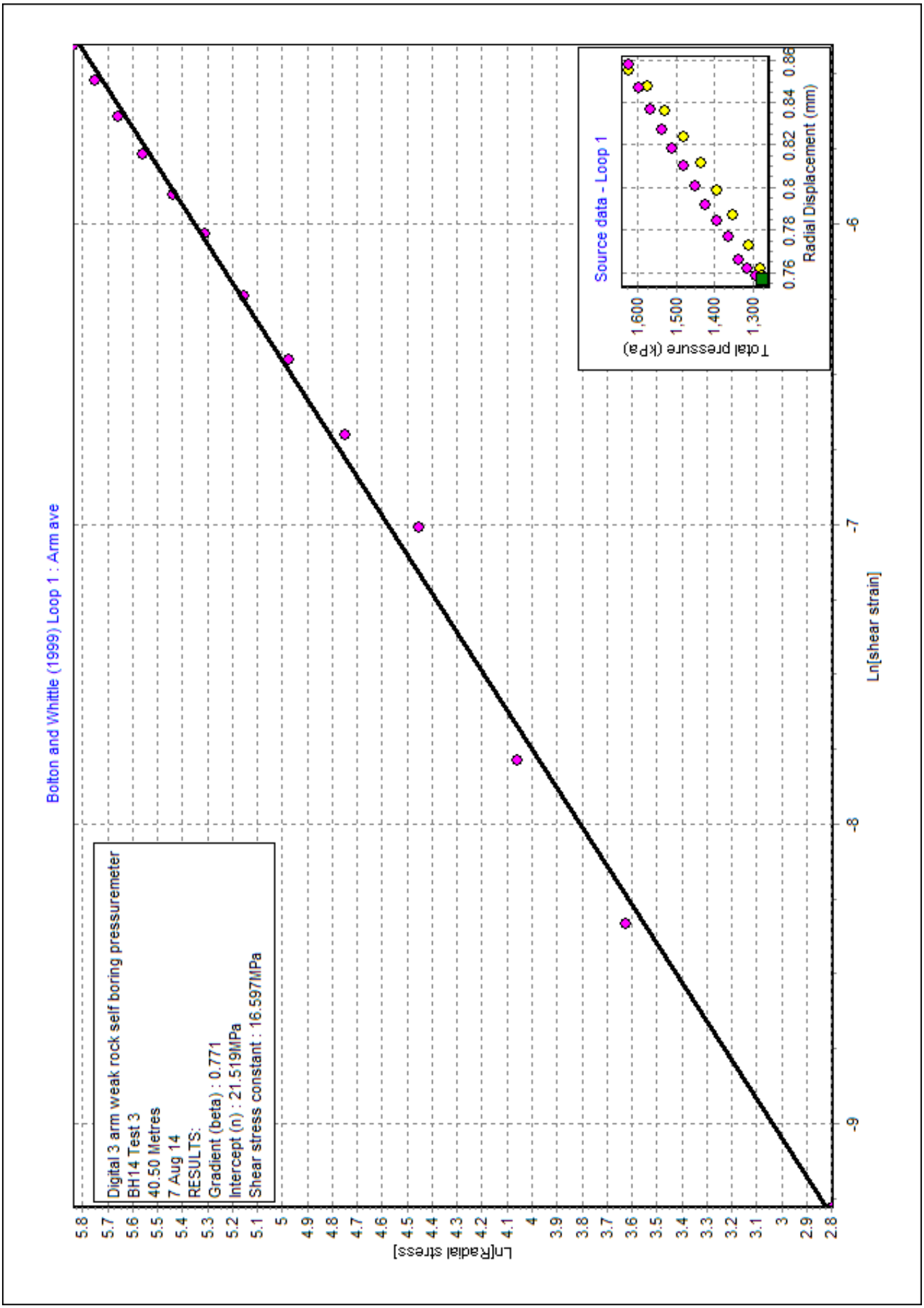

Palmer 1972 (expansion) : Arm ave
RESULTS:
Cu : 476.5kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Shear stress (kPa)
Shear strain (%)

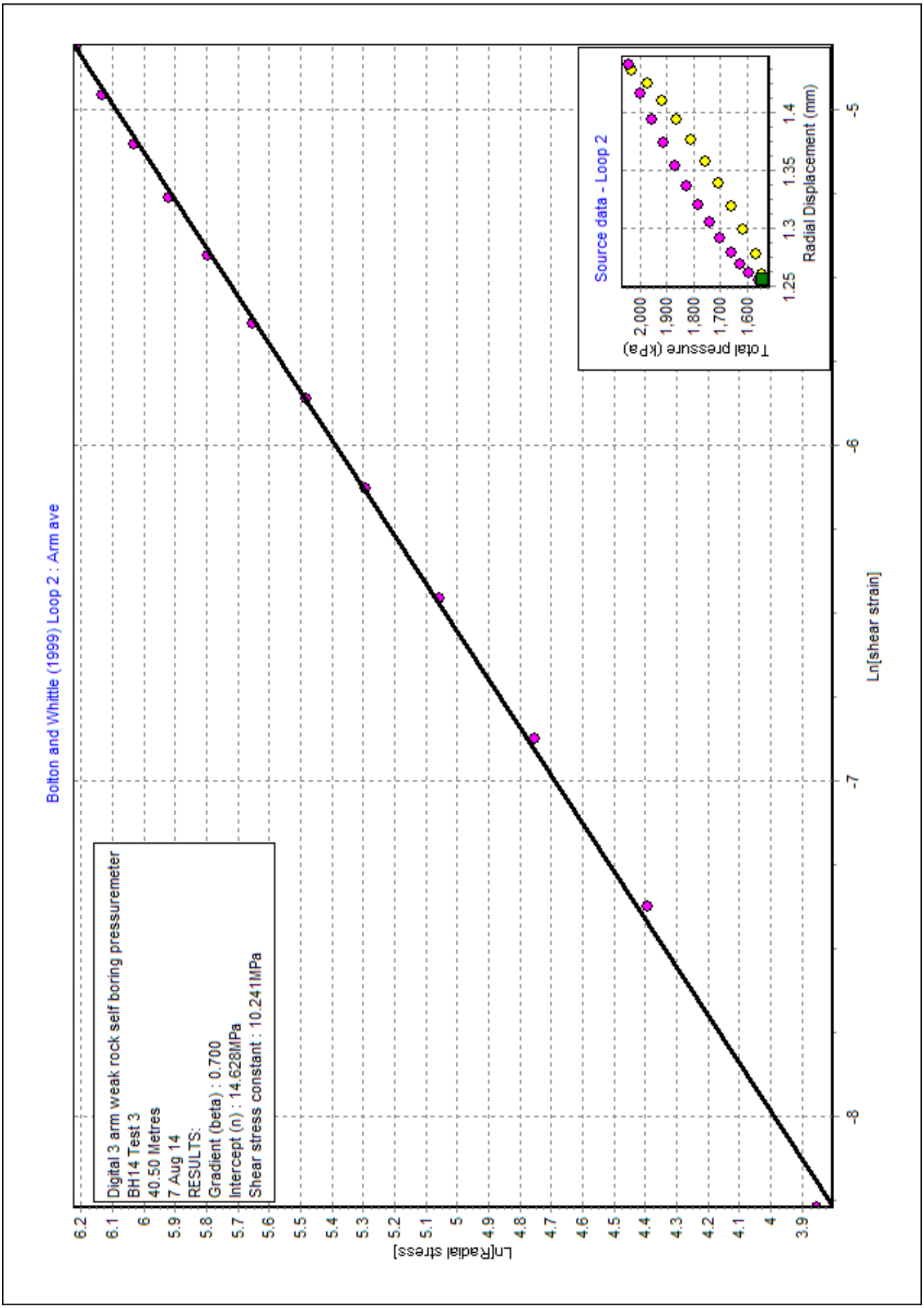

Palmer 1972 (contraction) : Arm ave
RESULTS:
2Cu : 953.7kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Shear stress (kPa)
Shear strain (%)

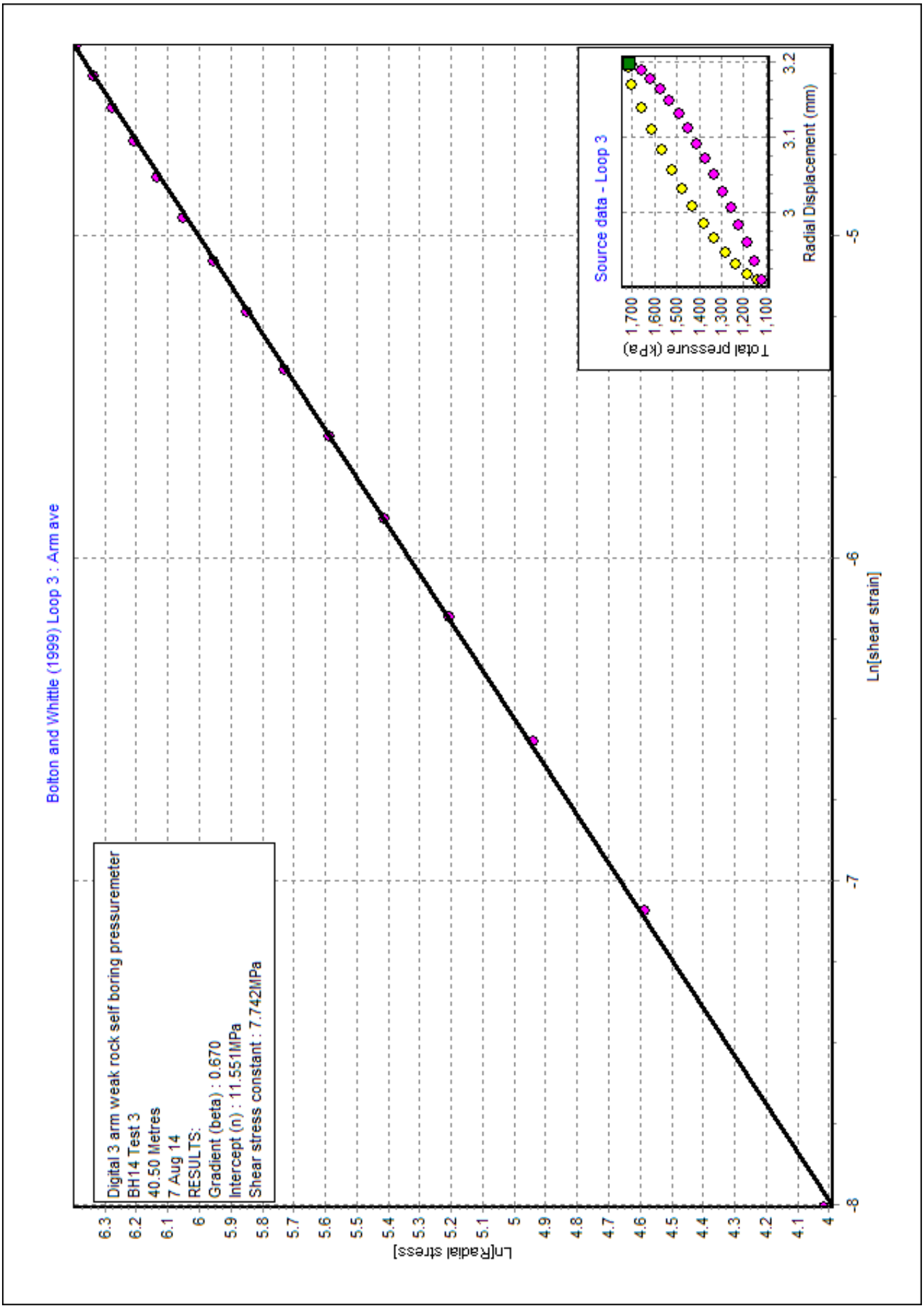

Shear modulus from unload/reload cycles Loop 1 : Arm ave
RESULTS:
Gur : 76.9MPa
Cycle mid-point:
Cavity strain : 0.736%
Total stress : 1448kPa
Size of cycle :
Shear strain : 0.469%
Total stress : 362kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

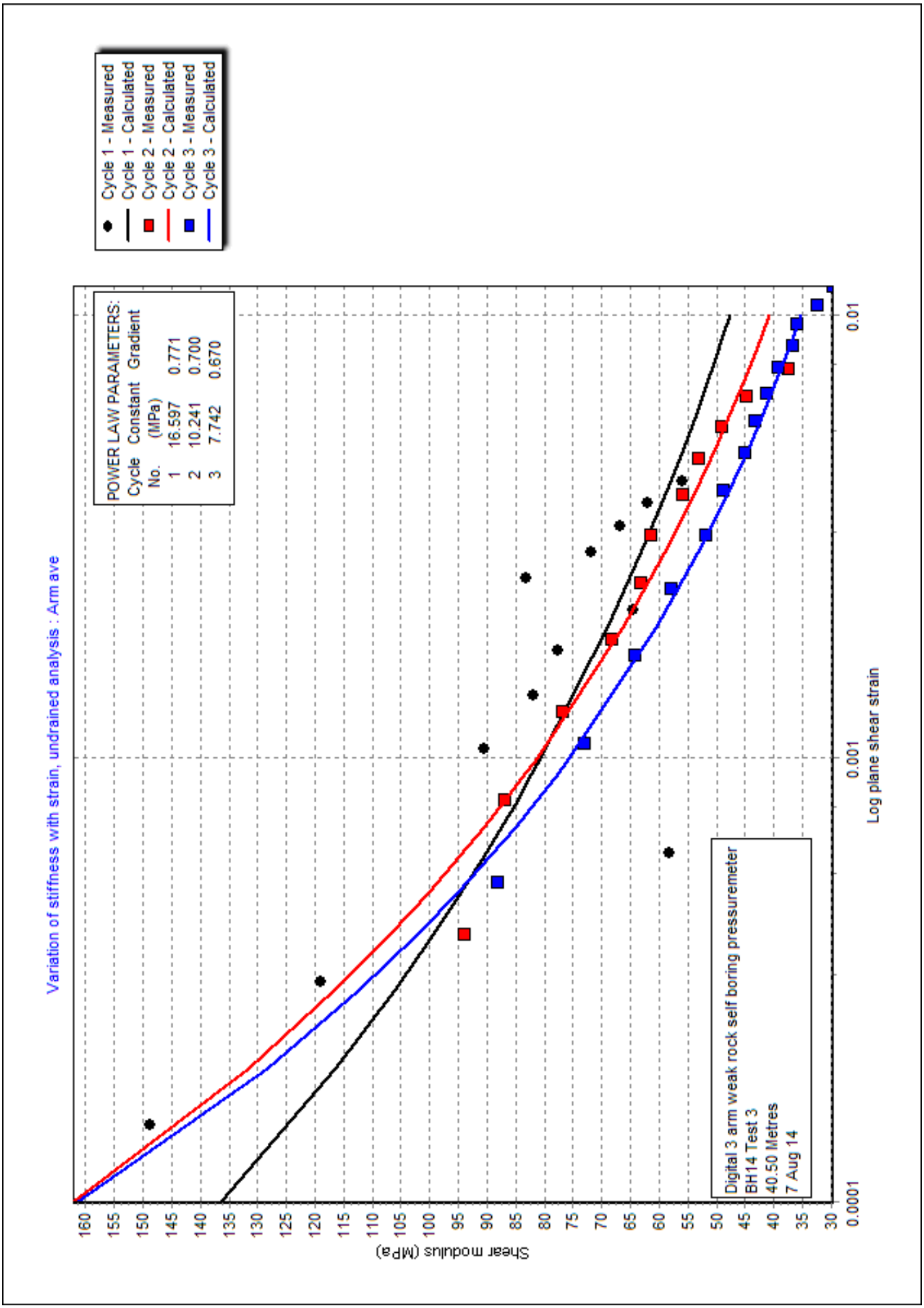

Shear modulus from unload/reload cycles Loop 2 : Arm ave
RESULTS:
Gur : 60.6MPa
Cycle mid-point:
Cavity strain : 1.948%
Total stress : 1790kPa
Size of cycle :
Shear strain : 0.854%
Total stress : 519kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

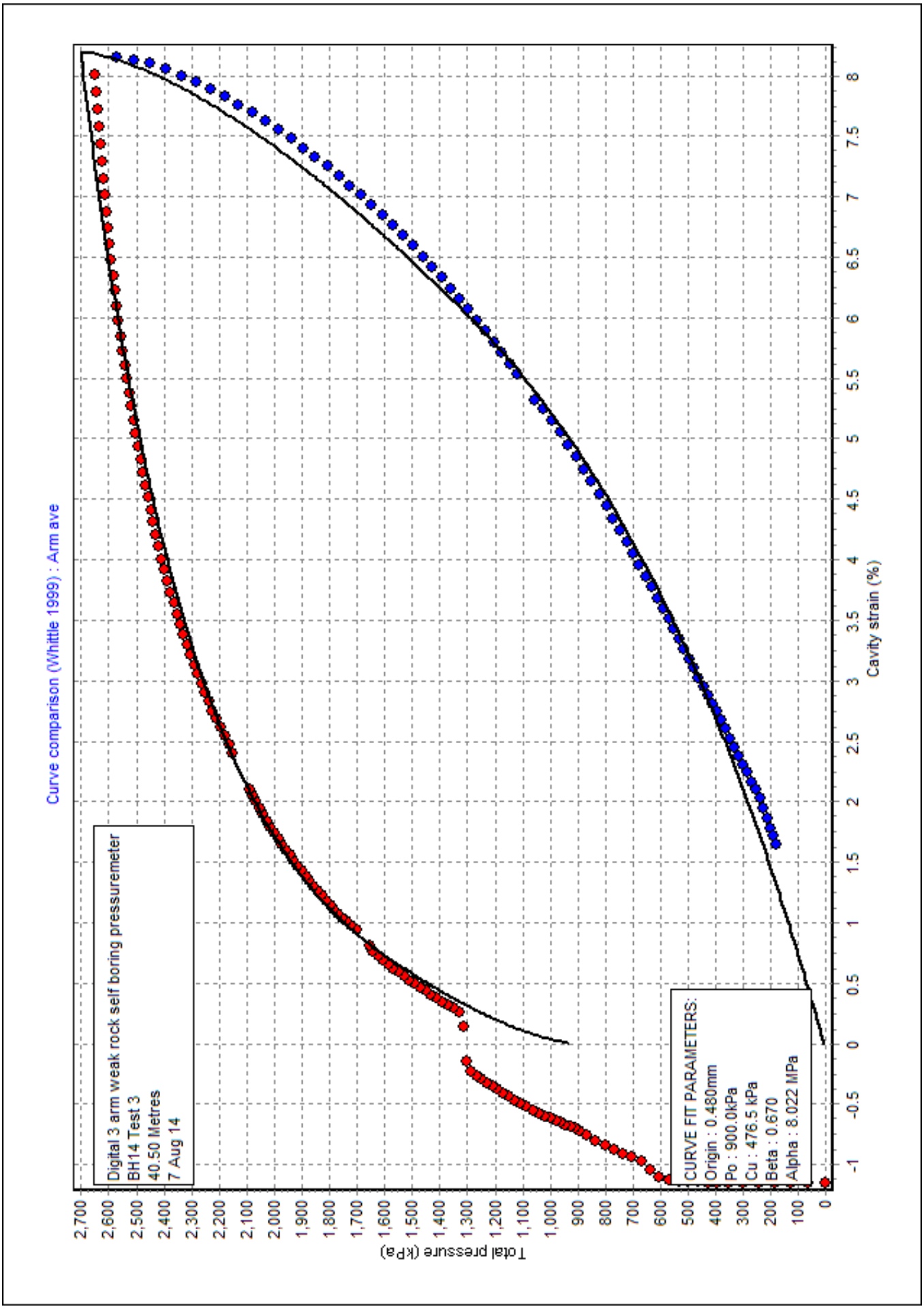

Shear modulus from unload/reload cycles Loop 3 : Arm ave
RESULTS:
Gur : 48.5MPa
Cycle mid-point:
Cavity strain : 5.790%
Total stress : 1421kPa
Size of cycle :
Shear strain : 1.264%
Total stress : 617kPa
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
Total pressure (kPa)
Radial Displacement (mm)

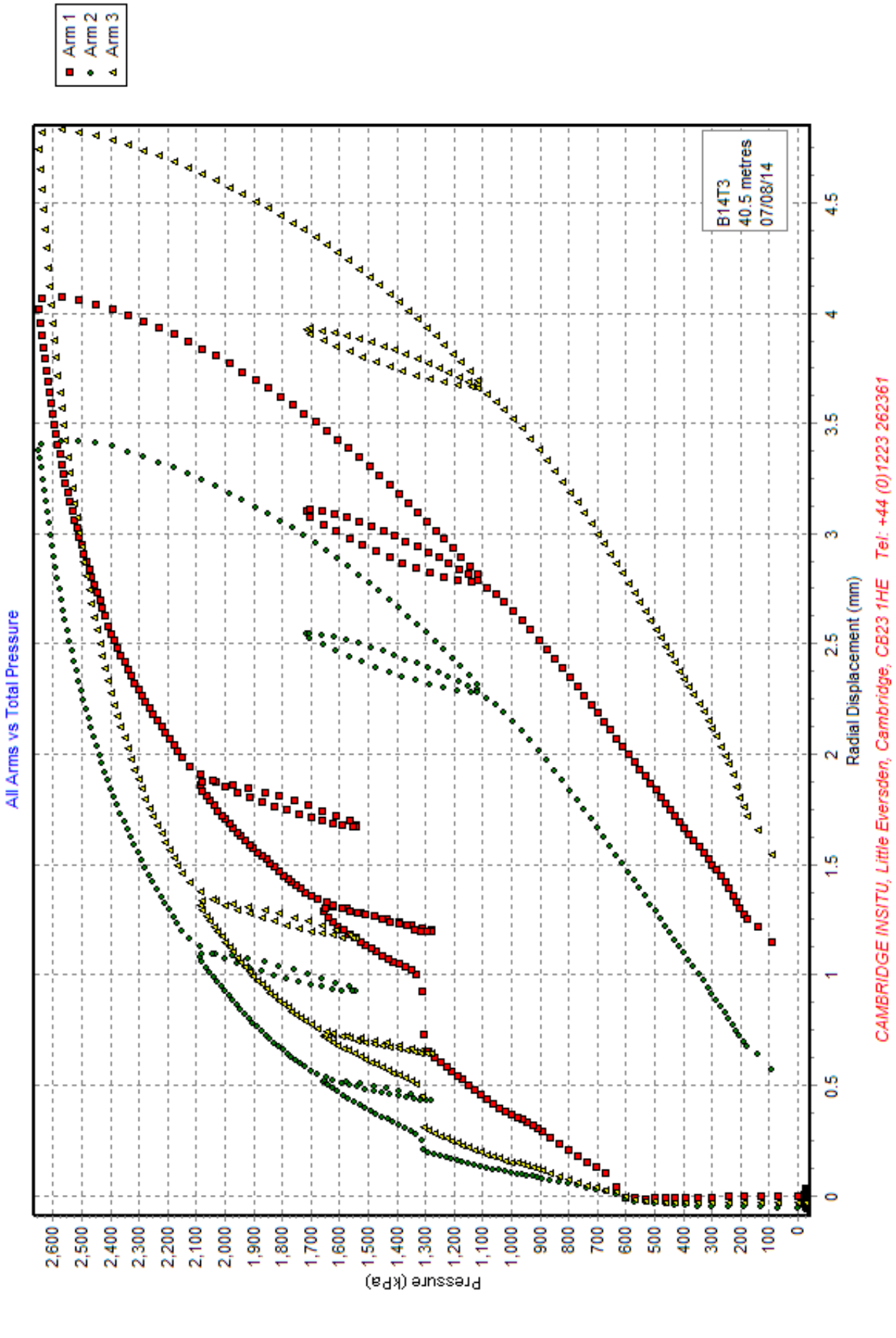

Bolton and Whittle (1999) Loop 1 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
RESULTS:
Gradient (beta) : 0.771
Intercept (n) : 21.519MPa
Shear stress constant : 16.597MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 1
Total pressure (kPa)
Radial Displacement (mm)

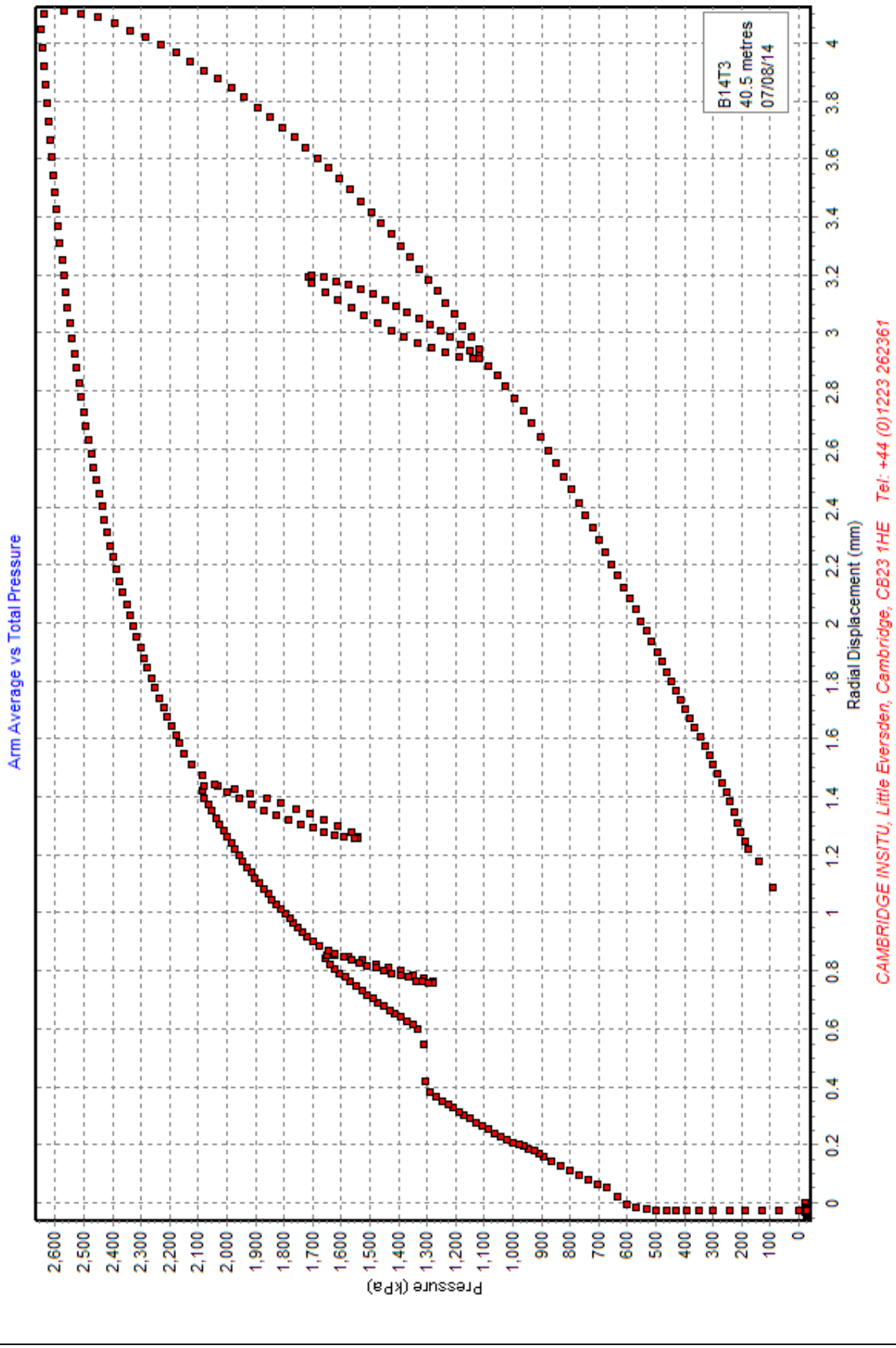

Bolton and Whittle (1999) Loop 2 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
RESULTS:
Gradient (beta) : 0.700
Intercept (n) : 14.628MPa
Shear stress constant : 10.241MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 2
Total pressure (kPa)
Radial Displacement (mm)

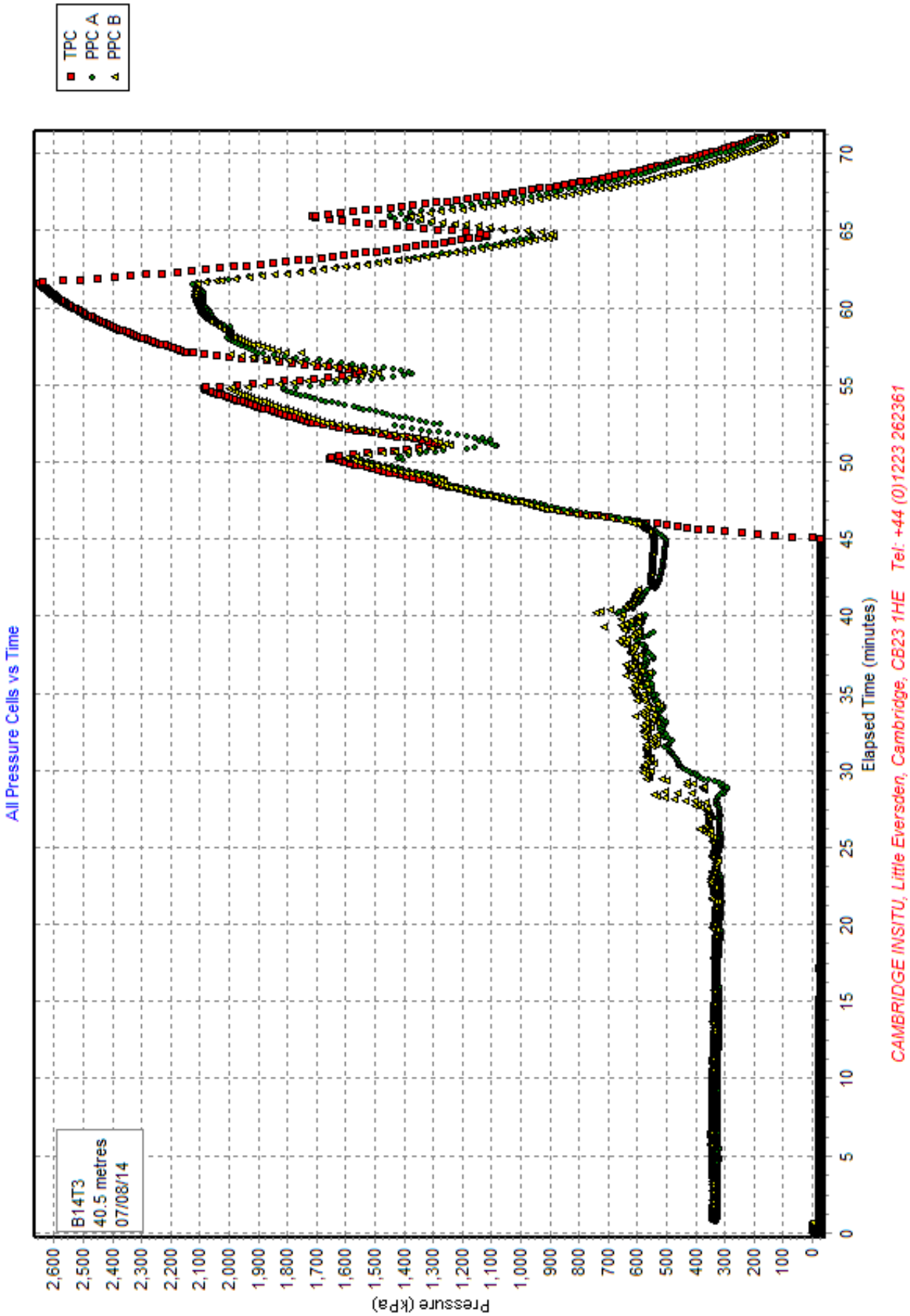

Bolton and Whittle (1999) Loop 3 : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
RESULTS:
Gradient (beta) : 0.670
Intercept (n) : 11.551MPa
Shear stress constant : 7.742MPa
Ln[Radial stress]
Ln[shear strain]
Source data - Loop 3
Total pressure (kPa)
Radial Displacement (mm)


Cycle 1 - Measured
Cycle 1 - Calculated
Cycle 2 - Measured
Cycle 2 - Calculated
Cycle 3 - Measured
Cycle 3 - Calculated
POWER LAW PARAMETERS:
Cycle No. Constant (MPa) Gradient
1 16.597 0.771
2 10.241 0.700
3 7.742 0.670
Variation of stiffness with strain, undrained analysis : Arm ave
Shear modulus (MPa)
Log plane shear strain
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14


Curve comparison (Whittle 1999) : Arm ave
Digital 3 arm weak rock self boring pressuremeter
BH14 Test 3
40.50 Metres
7 Aug 14
CURVE FIT PARAMETERS:
Origin : 0.480mm
Po : 900.0kPa
Cu : 476.5 kPa
Beta : 0.670
Alpha : 8.022 MPa
Total pressure (kPa)
Cavity strain (%)


Arm 1
Arm 2
Arm 3
B14T3
40.5 metres
07/08/14
All Arms vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


Arm Average vs Total Pressure
Pressure (kPa)
Radial Displacement (mm)
B14T3
40.5 metres
07/08/14
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361


TPC
PPC A
PPC B
All Pressure Cells vs Time
B14T3
40.5 metres
07/08/14
Pressure (kPa)
Elapsed Time (minutes)
CAMBRIDGE INSITU, Little Eversden, Cambridge, CB23 1HE Tel: +44 (0)1223 262361

APPENDIX E

Appendix E – In-Situ Testing

Project Name:	Rivenhall Airfield	**Project Started:**	13/08/2014
		Testing Started:	13/08/2014
Client Name:	CC Ground Investigation	**Date reported:**	27/08/2014
Project No:	- **Our Job / report no:** 17322	**Sample no/ type:**	-
Sample description:	Brown slightly gravelly slightly sandy CLAY (gravel is fmc and sub-angular to sub-rounded)	**TP No:**	CBR3
		Depth (m):	0.80
		Test No:	-

K4 SOILS

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

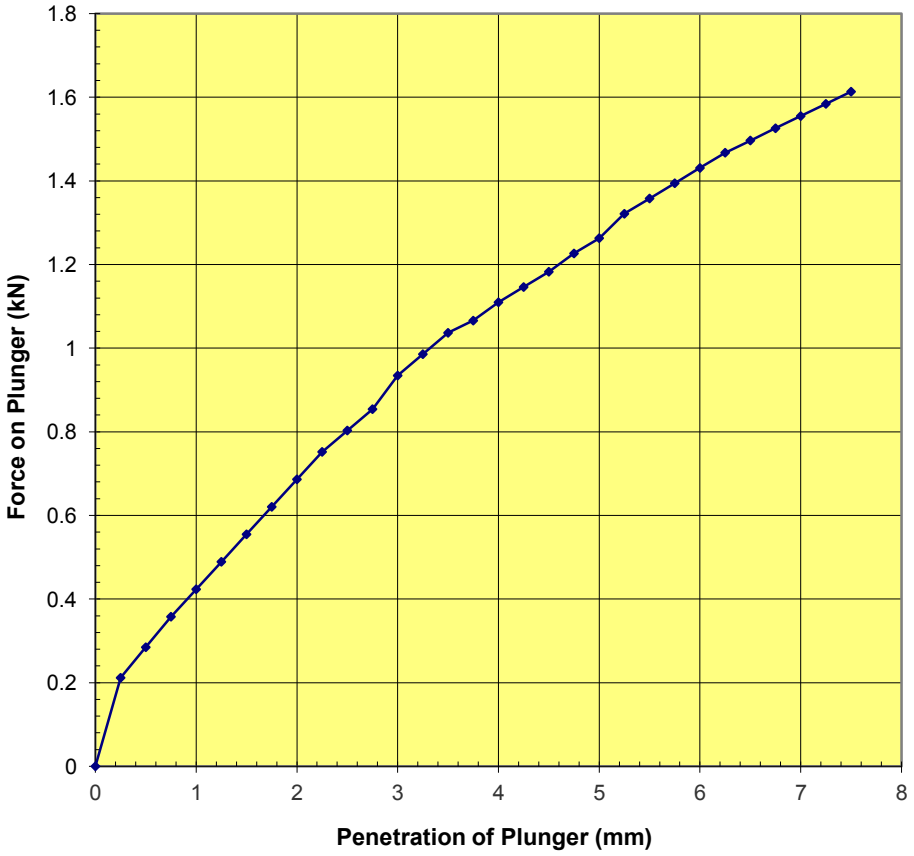
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	29	0.21
0.50	39	0.28
0.75	49	0.36
1.00	58	0.42
1.25	67	0.49
1.50	76	0.55
1.75	85	0.62
2.00	94	0.69
2.25	103	0.75
2.50	110	0.80
2.75	117	0.85
3.00	128	0.93
3.25	135	0.99
3.50	142	1.04
3.75	146	1.07
4.00	152	1.11
4.25	157	1.15
4.50	162	1.18
4.75	168	1.23
5.00	173	1.26
5.25	181	1.32
5.50	186	1.36
5.75	191	1.39
6.00	196	1.43
6.25	201	1.47
6.50	205	1.50
6.75	209	1.53
7.00	213	1.55
7.25	217	1.58
7.50	221	1.61



RESULTS:

Moisture content (%) 14

In-situ CBR value % **6.3**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	0.80	13.2	6.08
5	1.26	20	6.31

UKAS TESTING 2519

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

Remarks:

Project Name:	Rivenhall Airfield	**Project Started:**	13/08/2014
		Testing Started:	13/08/2014
Client Name:	CC Ground Investigation	**Date reported:**	27/08/2014
Project No:	- **Our Job / report no:** 17322	**Sample no/ type:**	-
Sample description:	Brown and light grey slightly sandy clayey GRAVEL (gravel is fmc and sub-angular to sub-rounded)	**TP No:**	CBR3
		Depth (m):	0.50
		Test No:	-

K4 SOILS

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

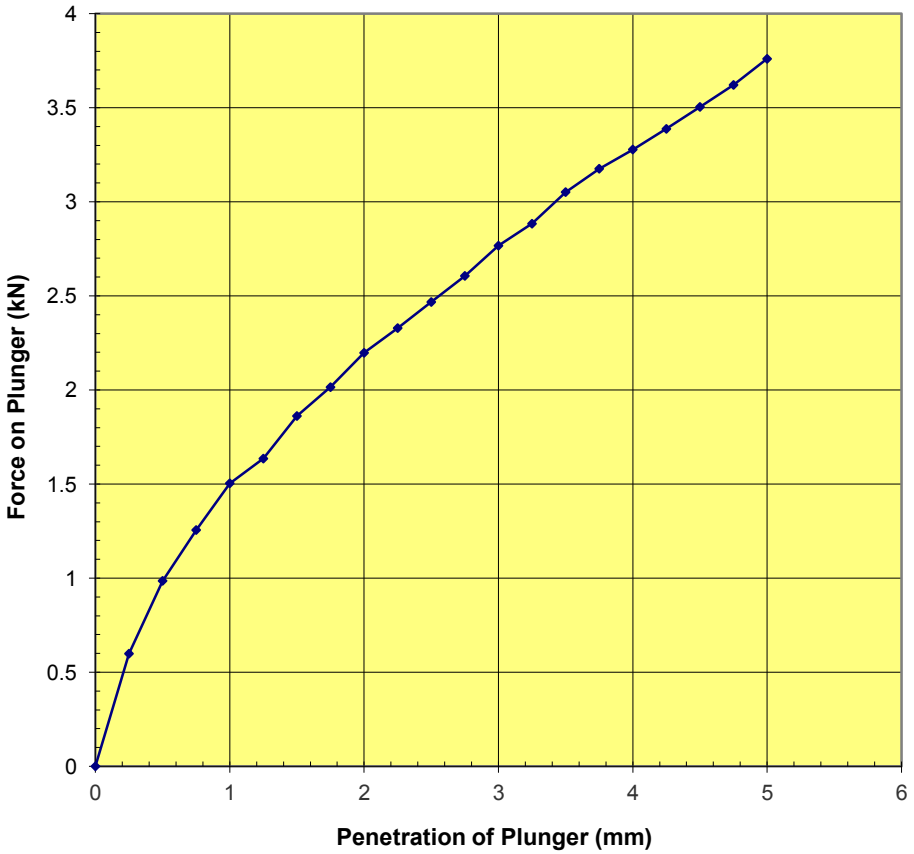
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	82	0.60
0.50	135	0.99
0.75	172	1.26
1.00	206	1.50
1.25	224	1.64
1.50	255	1.86
1.75	276	2.01
2.00	301	2.20
2.25	319	2.33
2.50	338	2.47
2.75	357	2.61
3.00	379	2.77
3.25	395	2.88
3.50	418	3.05
3.75	435	3.18
4.00	449	3.28
4.25	464	3.39
4.50	480	3.50
4.75	496	3.62
5.00	515	3.76



RESULTS:

Moisture content (%) 9.0

In-situ CBR value % **19**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	2.47	13.2	18.69
5	3.76	20	18.80

UKAS TESTING 2519

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

Remarks:

Project Name:	Rivenhall Airfield		**Project Started:**	13/08/2014	**K4 SOILS**
			Testing Started:	13/08/2014	
Client Name:	CC Ground Investigation		**Date reported:**	27/08/2014	
Project No:	-	**Our Job / report no:** 17322	**Sample no/ type:**	-	
Sample description:	Light brown gravelly SAND (gravel is fmc and sub-angular to rounded)				**TP No:** CBR2
					Depth (m): 0.80
					Test No: -

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

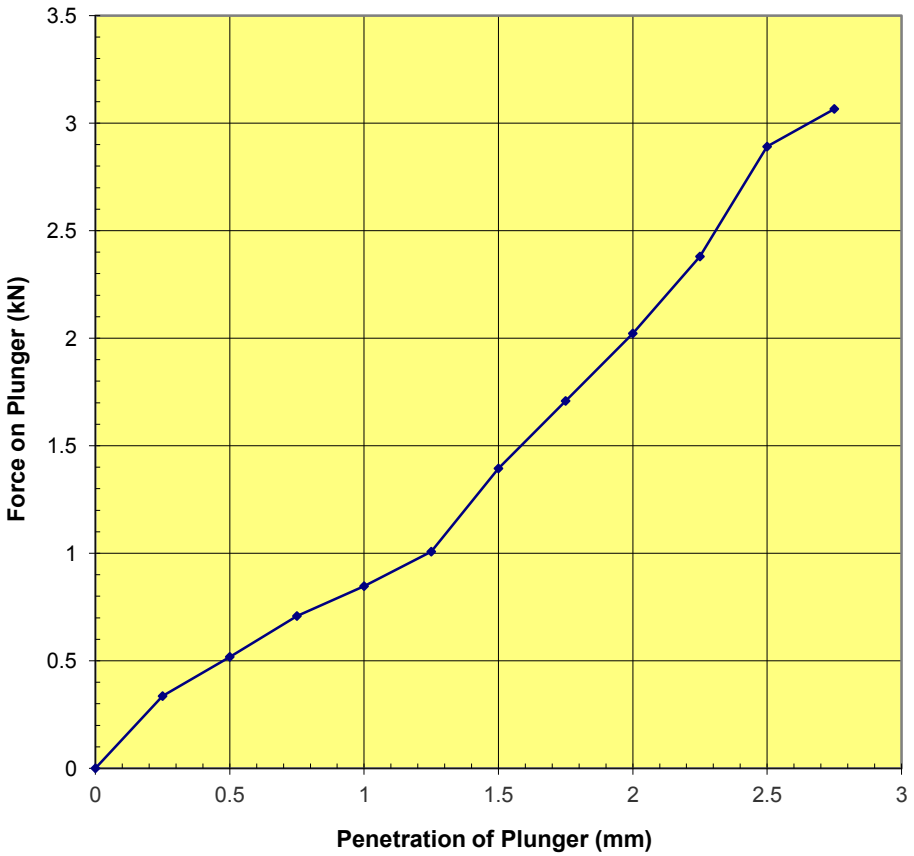
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	46	0.34
0.50	71	0.52
0.75	97	0.71
1.00	116	0.85
1.25	138	1.01
1.50	191	1.39
1.75	234	1.71
2.00	277	2.02
2.25	326	2.38
2.50	396	2.89
2.75	420	3.07



RESULTS:

Moisture content (%) 5.5

In-situ CBR value % **21.9**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	2.89	13.2	21.90
5	-	20	-

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

UKAS TESTING 2519

Remarks:

Project Name:	Rivenhall Airfield		**Project Started:**	13/08/2014	**K4 SOILS**
			Testing Started:	13/08/2014	
Client Name:	CC Ground Investigation		**Date reported:**	27/08/2014	
Project No:	-	**Our Job / report no:** 17322	**Sample no/ type:**	-	
Sample description:	Light brown gravelly SAND (gravel is fmc and sub-angular to sub-rounded)				**TP No:** CBR2
					Depth (m): 0.50
					Test No: -

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

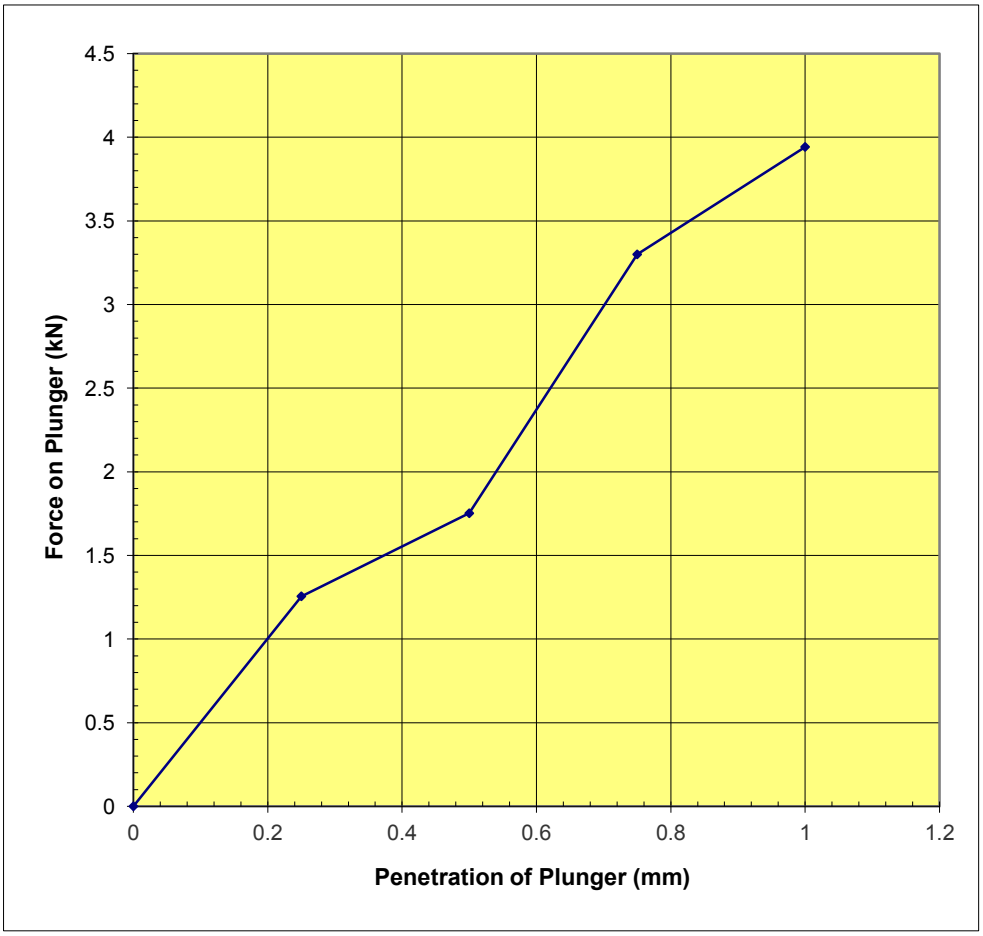
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	172	1.26
0.50	240	1.75
0.75	452	3.30
1.00	540	3.94



RESULTS:

Moisture content (%) 7.0

In-situ CBR value % **>30**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	-	13.2	-
5	-	20	-

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

UKAS TESTING 2519

Remarks: **Maximum kentledge reached**

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

Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

All samples connected with this report ,incl any on 'hold' will be stored and disposed off according to Company policy.Acopy of this policy is available on request.

Project Name:	Rivenhall Airfield		**Project Started:**	13/08/2014	**K4 SOILS**
			Testing Started:	13/08/2014	
Client Name:	CC Ground Investigation		**Date reported:**	27/08/2014	
Project No:	-	**Our Job / report no:** 17322	**Sample no/ type:**	-	
Sample description:	Light brown gravelly SAND (gravel is fmc and sub-angular to rounded)				**TP No:** CBR1
					Depth (m): 0.80
					Test No: -

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

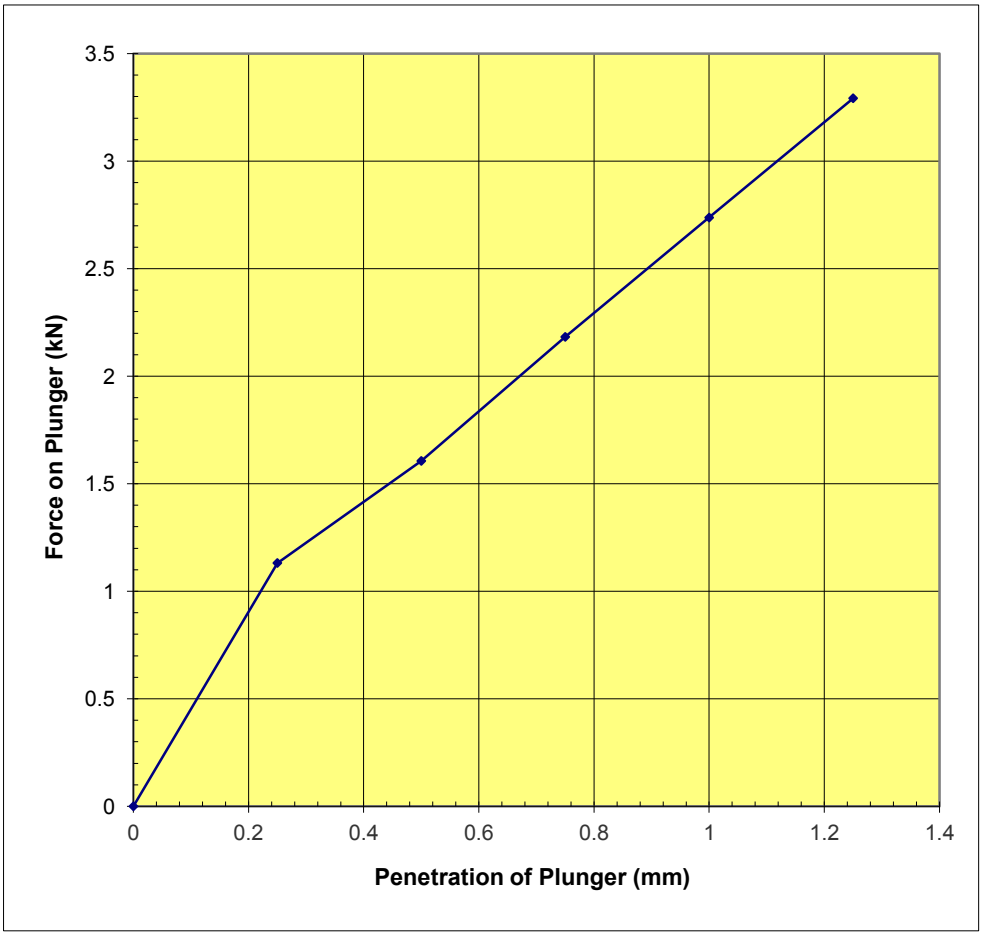
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	155	1.13
0.50	220	1.61
0.75	299	2.18
1.00	375	2.74
1.25	451	3.29



RESULTS:

Moisture content (%) 5

In-situ CBR value % **>30**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	-	13.2	-
5	-	20	-

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

UKAS TESTING 2519

Remarks: **Maximum kentledge reached**

Project Name:	Rivenhall Airfield		**Project Started:**	13/08/2014	**K4 SOILS**
			Testing Started:	13/08/2014	
Client Name:	CC Ground Investigation		**Date reported:**	27/08/2014	
Project No:	-	**Our Job / report no:** 17322	**Sample no/ type:**	-	
Sample description:	Light brown gravelly SAND (gravel is fmc and sub-angular to rounded)				**TP No:** CBR1
					Depth (m): 0.50
					Test No: -

Note: Test applicable only when maximum particle size beneath plunger does not exceed 20mm

Note: Penetration and force readings after seating load zeroed.

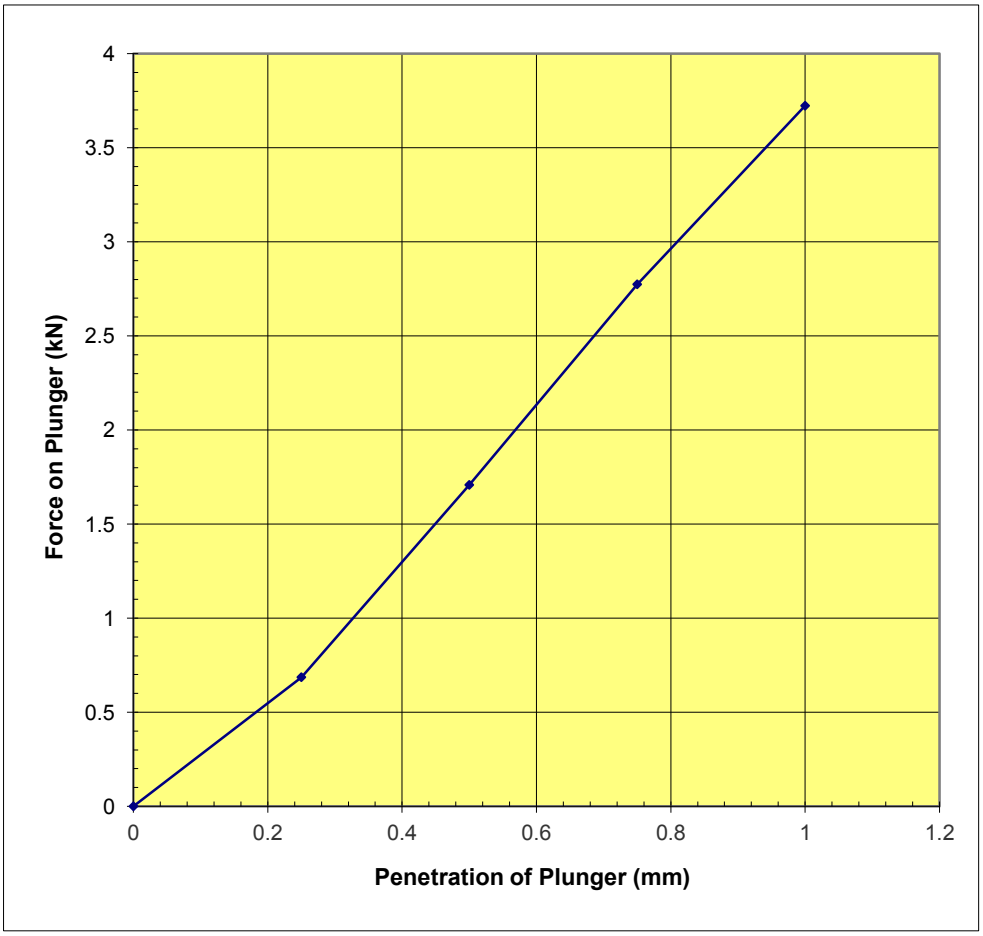
Rate of Strain :1.00mm/min

Mass of Surcharge **8.5** **kg**

Proving Ring factor: **7.3**

RECORDINGS

Penetration of Plunger	Force on Plunger	
	Dial Reading	Load
mm		kN
0	0	0
0.25	94	0.69
0.50	234	1.71
0.75	380	2.77
1.00	510	3.72



RESULTS:

Moisture content (%) 3.3

In-situ CBR value % **>30**

Penetration mm	Force kN	Standard Force kN	**CBR %**
2.5	-	13.2	-
5	-	20	-

In-situ CBR Test

BS1377 Part 9 : 1990 : 4.3

Determination of In-situ CBR values

Approved by

Initials : kp

Date : 27/08/2014

UKAS TESTING 2519

Remarks: **Maximum kentledge reached**

APPENDIX F

Appendix F – Groundwater Monitoring

Groundwater Monitoring

Borehole	Date	Installation Depth	Water Level (m)	Comments
BH05	27/08/14	19.00	Dry	
BH10	27/08/14	13.00	Dry	
BH11	27/08/14	15.00	Dry	
BH19	27/08/14	12.75	Dry	

CC Ground Investigations Ltd

Contract Name:	Rivenhall Airfield IWMF
Contract ID:	C4237
Client:	Gent Fairhead & Co Ltd
Instrument: used:	Geotechnical Instruments dip meter.

VWP Data - C4237 Rivenhall Airfield IWMF **BH02**

Installation depth (m): 25.10 Serial Number: 330222

		Hz	Temp	Period	f2
Base Reading - 14/08/2014					
Initial - 14/08/2014					
15/08/2014					
27/08/2014		2715.90	11.10	3679.30	7375.50

Note: The base reading was taken prior to install and the initial reading was taken after the piezometer was placed into the borehole.

VWP Data - C4237 Rivenhall Airfield IWMF **BH18A**

Installation depth (m): 33.00 Serial Number: 330223

		Hz	Temp	Period	f2
Base Reading - 11/08/2014		3113.00	17.70	3210.10	9691.30
Initial - 11/08/2014		3119.80	17.80	3203.10	9734.40
12/08/2014		2672.20	11.90	3739.30	7140.60
27/08/2014		2752.40	11.10	3630.50	7576.20

Note: The base reading was taken prior to install and the initial reading was taken after the piezometer was placed into the borehole.

VWP Data -

Installation depth (m): Serial Number:

		Hz	Temp	Period	f2
Base Reading -					
Initial -					

Note: The base reading was taken prior to install and the initial reading was taken after the piezometer was placed into the borehole.

VWP Data -

Installation depth (m): Serial Number:

		Hz	Temp	Period	f2
Base Reading -					
Initial -					

Note: The base reading was taken prior to install and the initial reading was taken after the piezometer was placed into the borehole.

GEOSENSE

GEOSENSE QUALITY FORM
FORM No G/QF/149
ISS. 4
DATE : JUNE 14
SIG. GC

STANDARD VW PIEZOMETER HAE CALIBRATION

Model	VWP-3001	Cal date	08-Jul-14	DPI No.	52001702
Serial	330222	Baro	1008.0	Readout No.	VR0601
Works ID	80 9 259	Temp °C	21	R/O Cal. date	15/07/2013

Applied pressure		Readings [digit]			Calculated Pressure		Error % fso	
psi	kPa	1 up	1 down	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.000	0.000	9349.3	9349.3	9349.3	-0.14	0.02	-0.04%	0.00%
10.007	69.000	8673.9	8673.9	8673.9	69.04	69.01	0.01%	0.00%
20.015	138.000	7999.9	7999.9	7999.9	138.08	137.95	0.02%	-0.01%
30.022	207.000	7326.8	7326.8	7326.8	207.02	206.90	0.01%	-0.03%
40.029	276.000	6651.0	6651.0	6651.0	276.24	276.21	0.07%	0.06%
50.036	345.000	5982.1	5982.1	5982.1	344.75	344.91	-0.07%	-0.03%

Calibration of master DPI valid from 25 February 2014. UKAS Certificate of Calibration 16499 issued by Chamois Metrology (UKAS Accredited Calibration Laboratory 0822)

CALIBRATION FACTORS

Linear factor (k)

kPa per digit	psi per digit	mH_2O per digit
-0.102426923	-0.014855	-0.010445

Polynomial factors

	kPa	psi	mH_2O
A	1.03011E-07	1.494E-08	1.0504E-08
B	-0.104006143	-0.015084	-0.010606
C	963.3978591	139.7241275	98.239242

Thermal factor (T)

kPa per °C	psi per °C	mH_2O per °C
0.077111518	0.011183686	0.007863

Note: Digits are $Hz^2 \times 10^{-3}$ units.

(please consult the User Manuals for conversion of alternative reading units)

Polynomial calculation [kPa] = A * (Reading)^2 + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

CALIBRATED TO UKAS TRACEABLE STANDARDS
GEOSENSE CERTIFIED ISO 9001 :2008

THIS CERTIFICATE IS VALID ONLY WHEN CARRYING THE OFFICIAL ORIGINAL STAMP OF GEOSENSE BELOW

Nova House, Rougham Industrial Estate, Rougham, Bury St Edmunds, Suffolk, IP30 9ND, England
t +44 (0)1359 270457 f +44 (0)1359 272860 e info@geosense.co.uk www.geosense.co.uk

GEOSENSE

GEOSENSE QUALITY FORM
FORM No G/QF/149
ISS. 4
DATE : JUNE 14
SIG. GC

STANDARD VW PIEZOMETER HAE CALIBRATION

Model	VWP-3001	Cal date	08-Jul-14	DPI No.	52001702
Serial	330223	Baro	1008.0	Readout No.	VR0601
Works ID	80 9 260	Temp °C	21	R/O Cal. date	15/07/2013

Applied pressure		Readings [digit]			Calculated Pressure		Error % fso	
psi	kPa	1 up	1 down	avg.[digit]	lin.[kPa]	polyn.[kPa]	linear	polynomial
0.000	0.000	9713.7	9713.7	9713.7	0.41	-0.04	0.12%	-0.01%
10.007	69.000	9031.8	9031.8	9031.8	68.97	69.06	-0.01%	0.02%
20.015	138.000	8348.0	8348.0	8348.0	137.71	138.07	-0.08%	0.02%
30.022	207.000	7664.3	7664.3	7664.3	206.45	206.82	-0.16%	-0.05%
40.029	276.000	6972.3	6972.3	6972.3	276.02	276.11	0.01%	0.03%
50.036	345.000	6281.9	6281.9	6281.9	345.43	344.98	0.12%	-0.01%

Calibration of master DPI valid from 25 February 2014. UKAS Certificate of Calibration 16499 issued by Chamois Metrology (UKAS Accredited Calibration Laboratory 0822)

CALIBRATION FACTORS

Linear factor (k)

kPa per digit	psi per digit	mH_2O per digit
-0.10053282	-0.014581	-0.010251

Polynomial factors

	kPa	psi	mH_2O
A	-2.87526E-07	-4.17006E-08	-2.9319E-08
B	-0.095933737	-0.013914	-0.009783
C	958.9672986	139.0815516	97.787450

Thermal factor (T)

kPa per °C	psi per °C	mH_2O per °C
0.059057071	0.008565202	0.006022

Note: Digits are $Hz^2 \times 10^{-3}$ units.

(please consult the User Manuals for conversion of alternative reading units)

Polynomial calculation [kPa] = A * (Reading)^2 + B * (Reading) + C + T * (Current Temp - Site Zero Temp)

Linear calc = k (kPa) * (Current Reading - Site Zero Reading) + T * (Current Temp - Site Zero Temp)

CALIBRATED TO UKAS TRACEABLE STANDARDS
GEOSENSE CERTIFIED ISO 9001:2008

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APPENDIX G

Appendix G – SPT Calibration Certificates

SPT Calibration Report

www.equipegroup.com

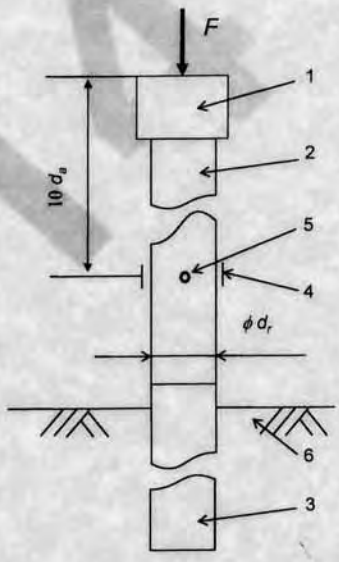
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	CC GROUND INVESTIGATIONS
Test No	EQU1091
Test Depth (m)	6.80
Date of Test	08 September 2014
Valid until	08 September 2015
Hammer ID	R01

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

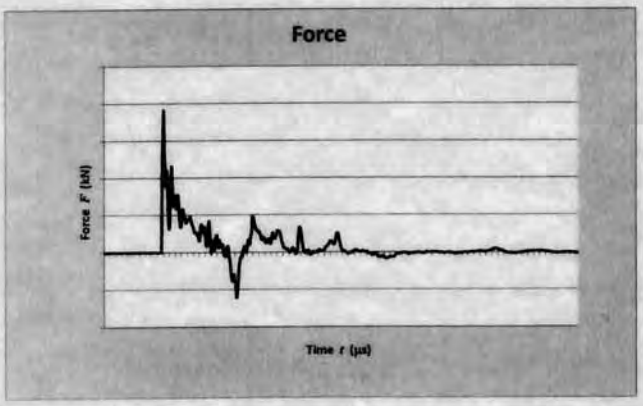


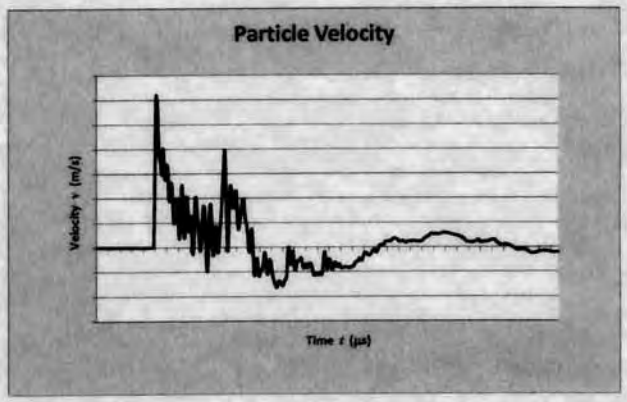
Key

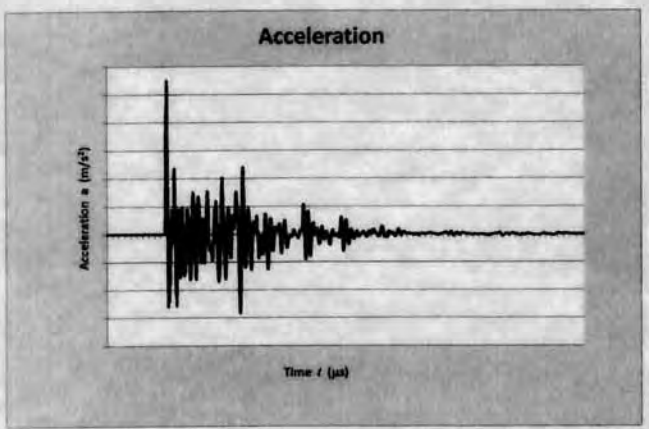
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

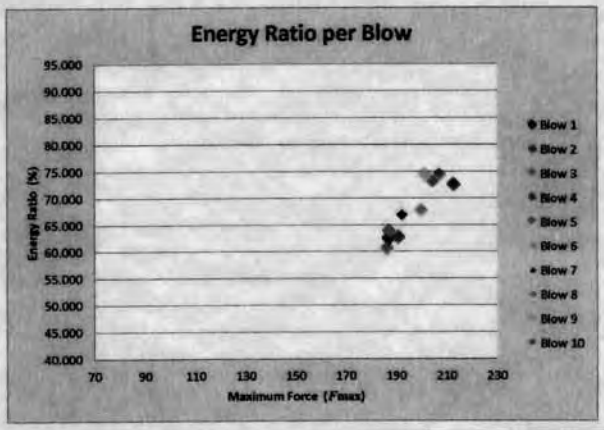
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.319** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_r) = $\frac{E_{meas}}{E_{theor}}$ = **67.44%**

Equipe SPT Analyzer Operators: JML

Prepared by: **Checked by:** **Date** 08/09/2014

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

SPT Calibration Report

www.equipegroup.com

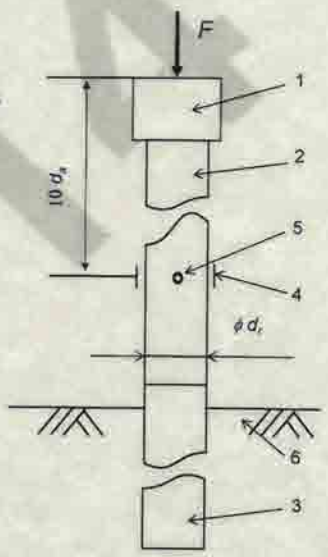
Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	CC GROUND INVESTIGATIONS
Test No	EQU1045
Test Depth (m)	11.05
Date of Test	16 May 2014
Valid until	16 May 2015
Hammer ID	R04

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

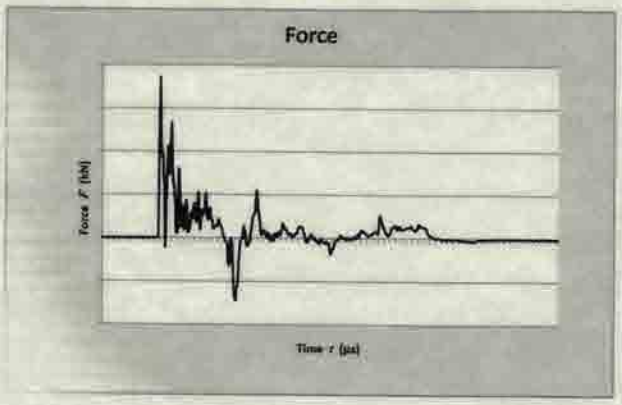


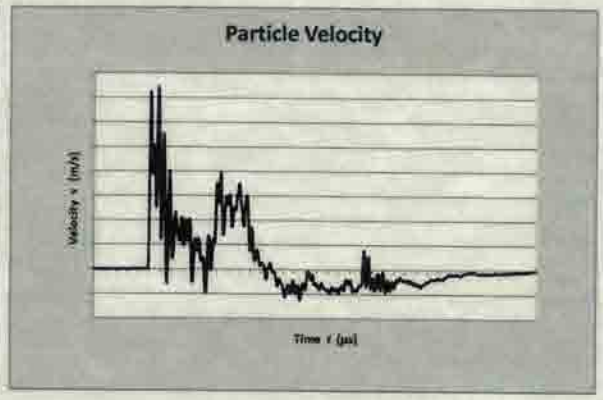
Key

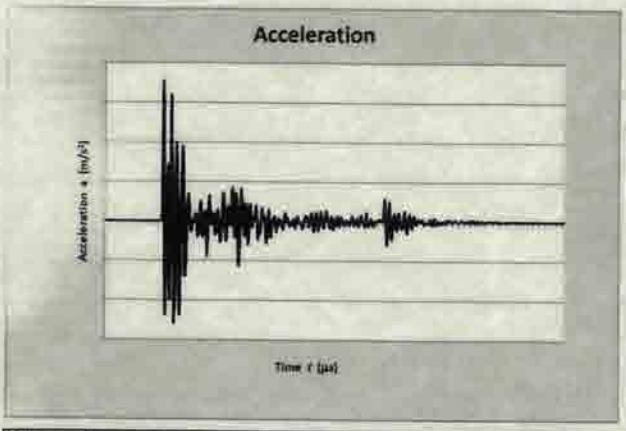
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

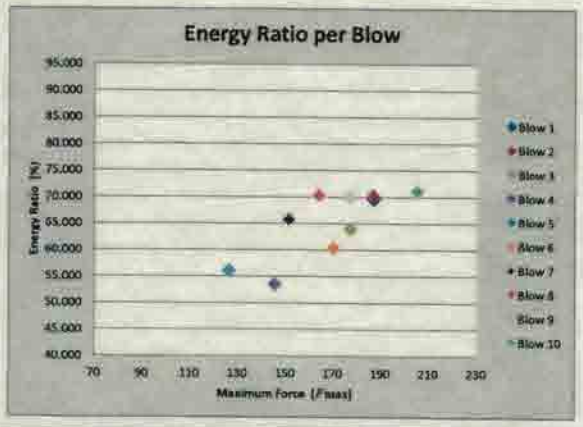
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.306** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio $(E_r) = \frac{E_{meas}}{E_{theor}} =$ **64.71%**

Equipe SPT Analyzer Operators: MH

Prepared by: Checked by: Date 20/05/2014

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

SPT Calibration Report

www.equipegroup.com

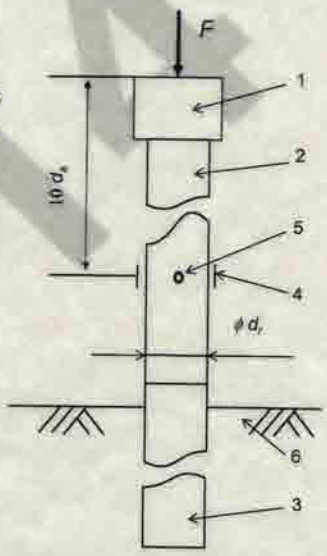
Hammer Energy Measurement Report

Type of Hammer	SPT HAMMER
Client	CC GROUND INVESTIGATIONS
Test No	EQU1046
Test Depth (m)	11.08
Date of Test	16 May 2014
Valid until	16 May 2015
Hammer ID	R05

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

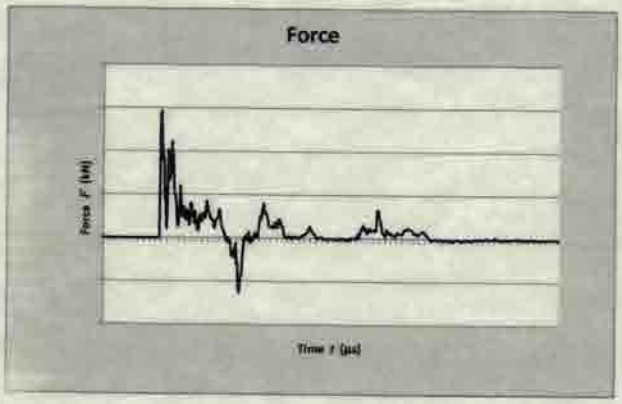


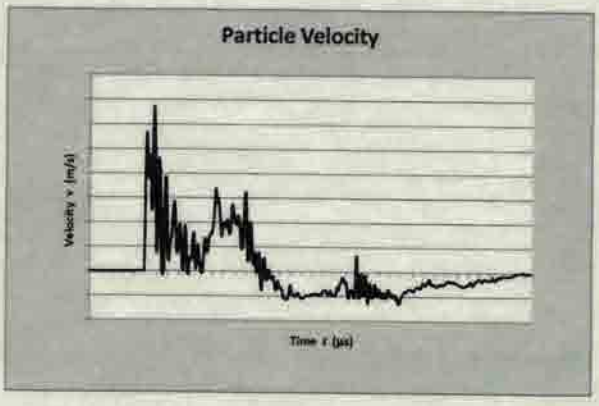
Key

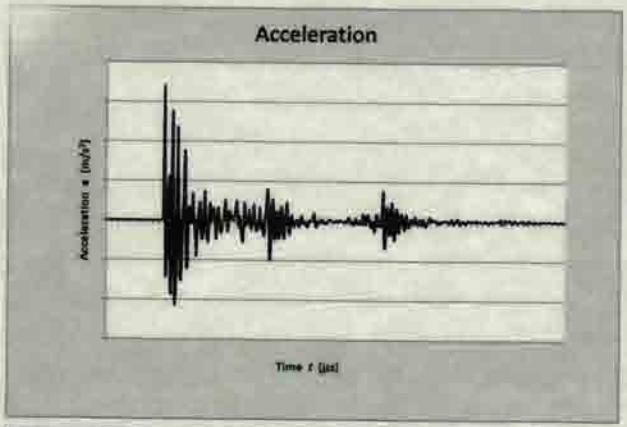
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

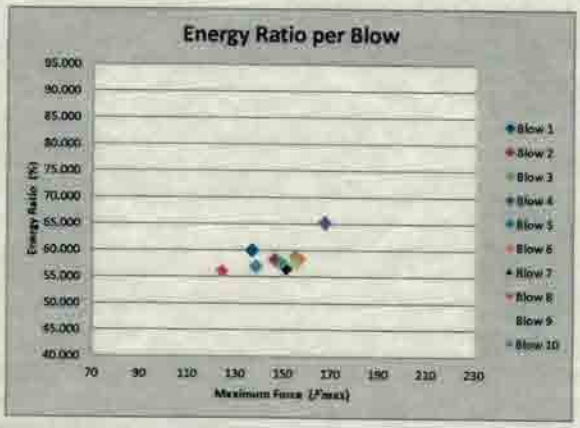
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.275** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_e) = $\frac{E_{meas}}{E_{theor}}$ = **58.19%**

Equipe SPT Analyzer Operators: MH

Prepared by: **Checked by:** **Date** 20/05/2014

Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

SPT Calibration Report

www.equipegroup.com

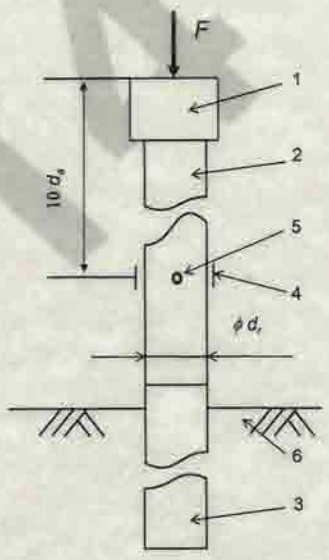
Energy Measurement Report

Type of Hammer		SPT HAMMER
Client		CC GROUND INVESTIGATIONS
Test No		EQU1044
Test Depth (m)		11.03
Date of Test		16 May 2014
Valid until		16 May 2015
Hammer ID		R07

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

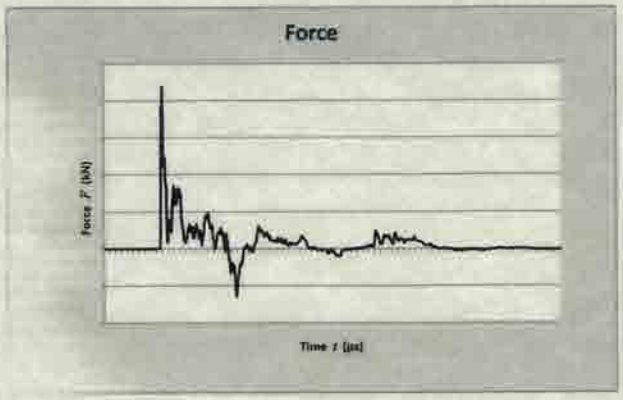


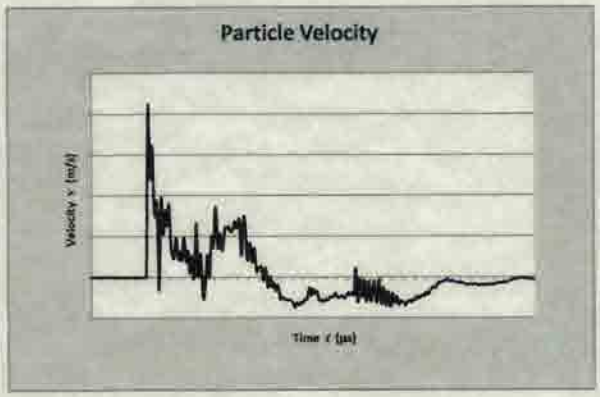
Key

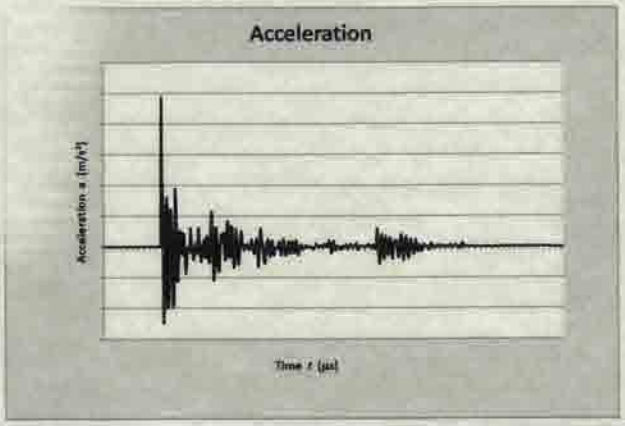
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

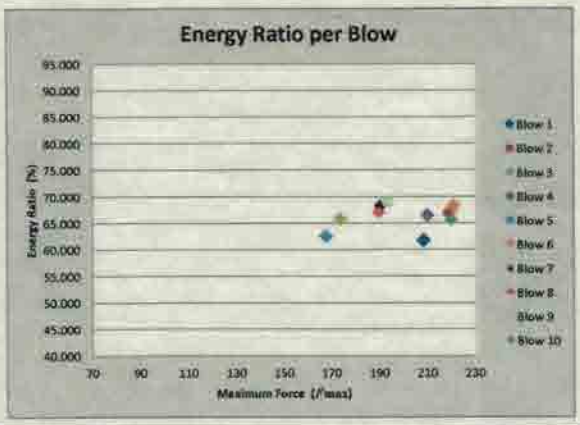
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} =	0.311 kN-m	
E_{theor} =	0.473 kN-m	

Energy Ratio $(E_r) = \frac{E_{meas}}{E_{theor}} =$ **65.77%**

Equipe SPT Analyzer Operator: MH

Prepared by:	Checked by:	Date	20/05/2014

SPT Calibration Report

www.equipegroup.com

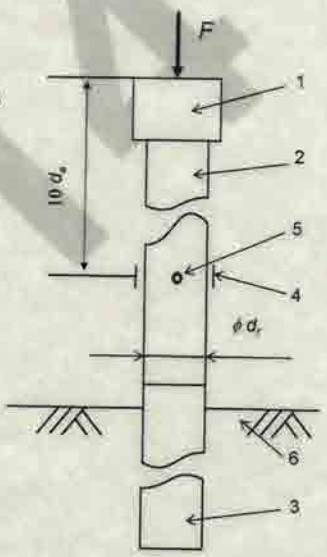
Hammer Energy Measurement Report

Type of Hammer		SPT HAMMER
Client		CC GROUND INVESTIGATIONS
Test No		EQU1048
Test Depth (m)		11.11
Date of Test		16 May 2014
Valid until		16 May 2015
Hammer ID		R08

Mass of the hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of the instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

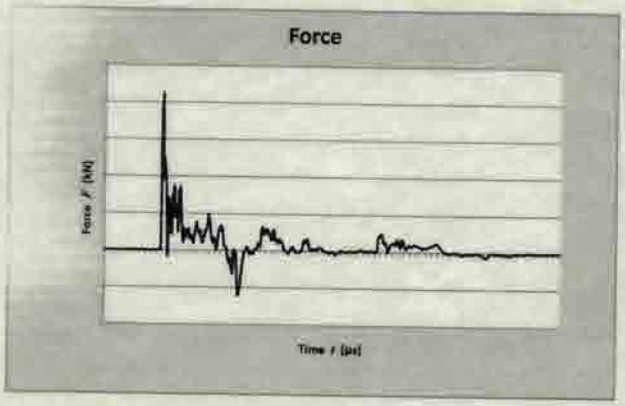


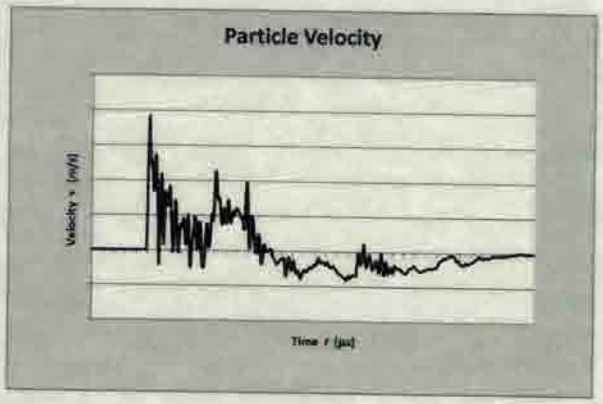
Key

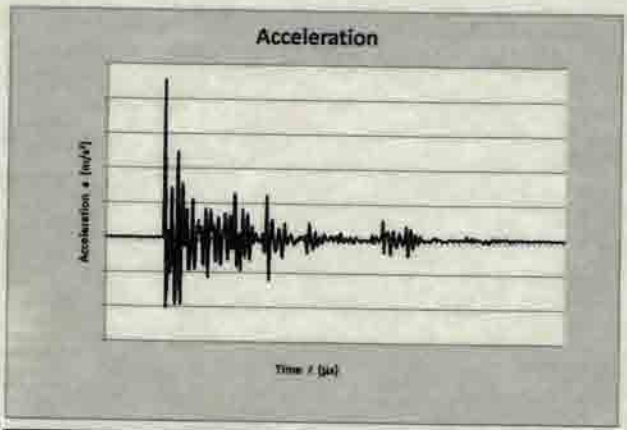
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

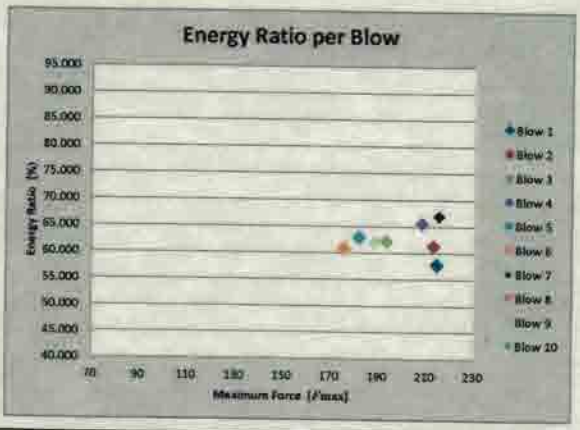
F Force
d_r Diameter of rod

Fig. B.1 and B.2 BS EN ISO 22476-3 : 2005 + A1 : 2011









Observations:
1.

E_{meas} = **0.294** kN-m

E_{theor} = **0.473** kN-m

Energy Ratio (E_r) = $\frac{E_{meas}}{E_{theor}}$ = **62.11%**

Equipe SPT Analyzer Operators: MH

Prepared by: **Checked by:** **Date** 20/05/2014

Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: 01295 670990 Fax: 01295 678232 Email: info@equipegroup.com

Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing Laboratories
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

SPT Hammer Ref:	SEDS5
Test Date:	03/05/2014
Report Date:	07/05/2014
File Name:	SEDS5.spt
Test Operator:	NPB

Instrumented Rod Data

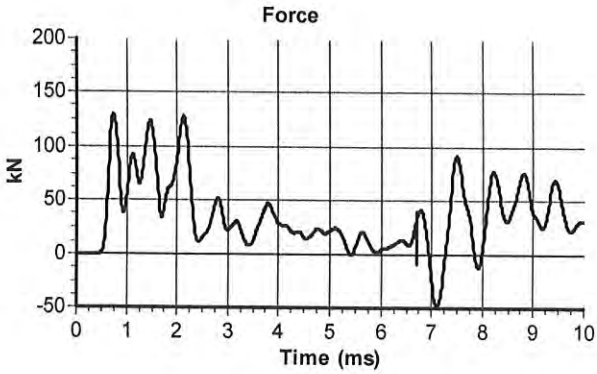
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6458
Accelerometer No.2:	6459

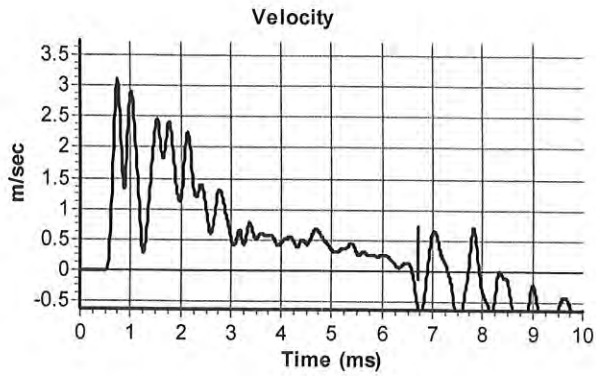
SPT Hammer Information

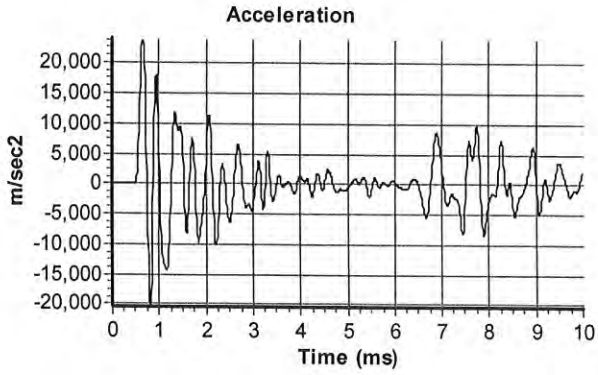
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	14.0

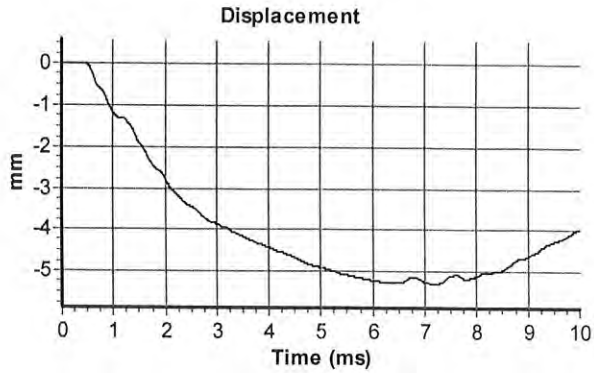
Comments / Location

CHARLWOODS









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	329

Energy Ratio E_r (%): **70**

N P Burrows

Signed: N P Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months

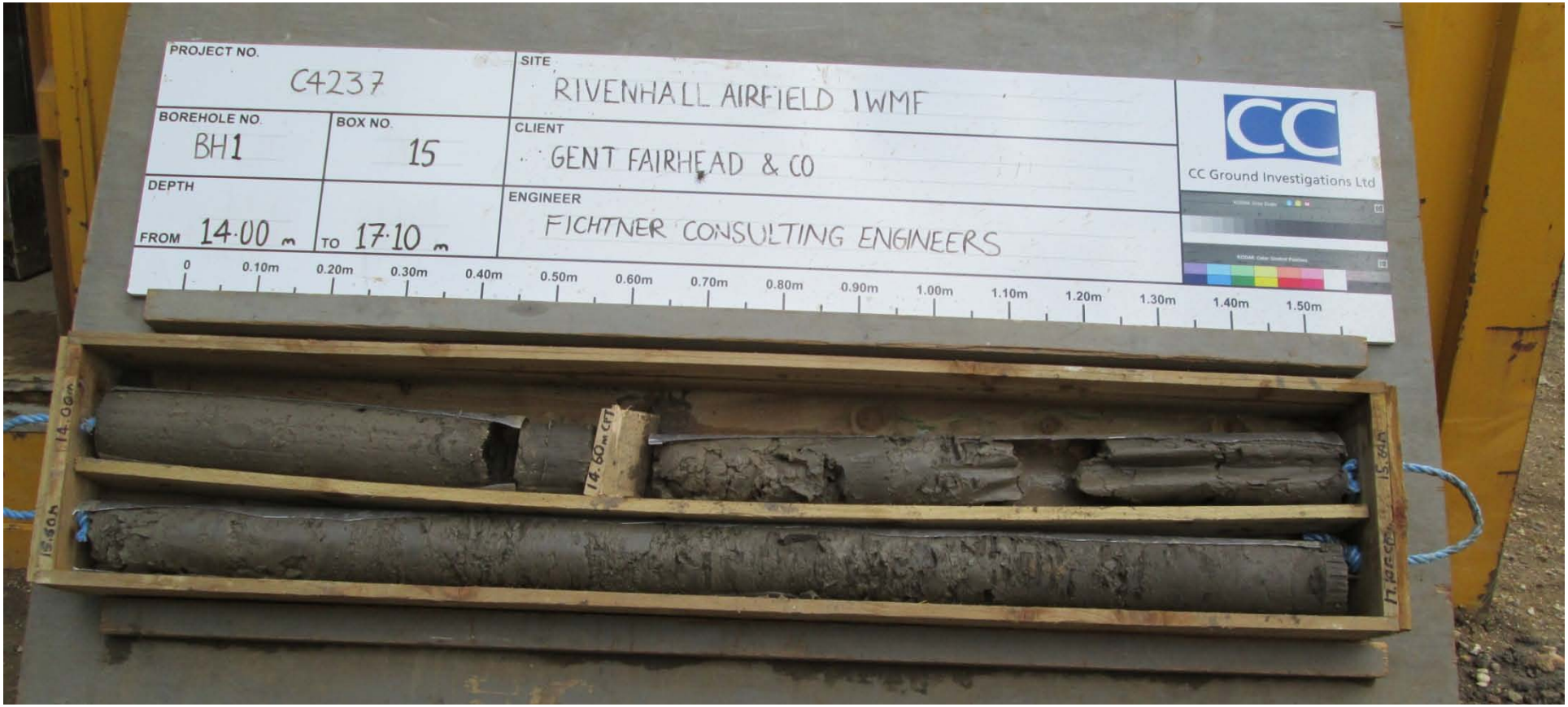
APPENDIX H

Appendix H – Photographs

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH1
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	0.20m – 0.00m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH1
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	15
	Client:	Gent Fairhead & Co.	**Depth:**	14.00m – 17.10m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 4.20m

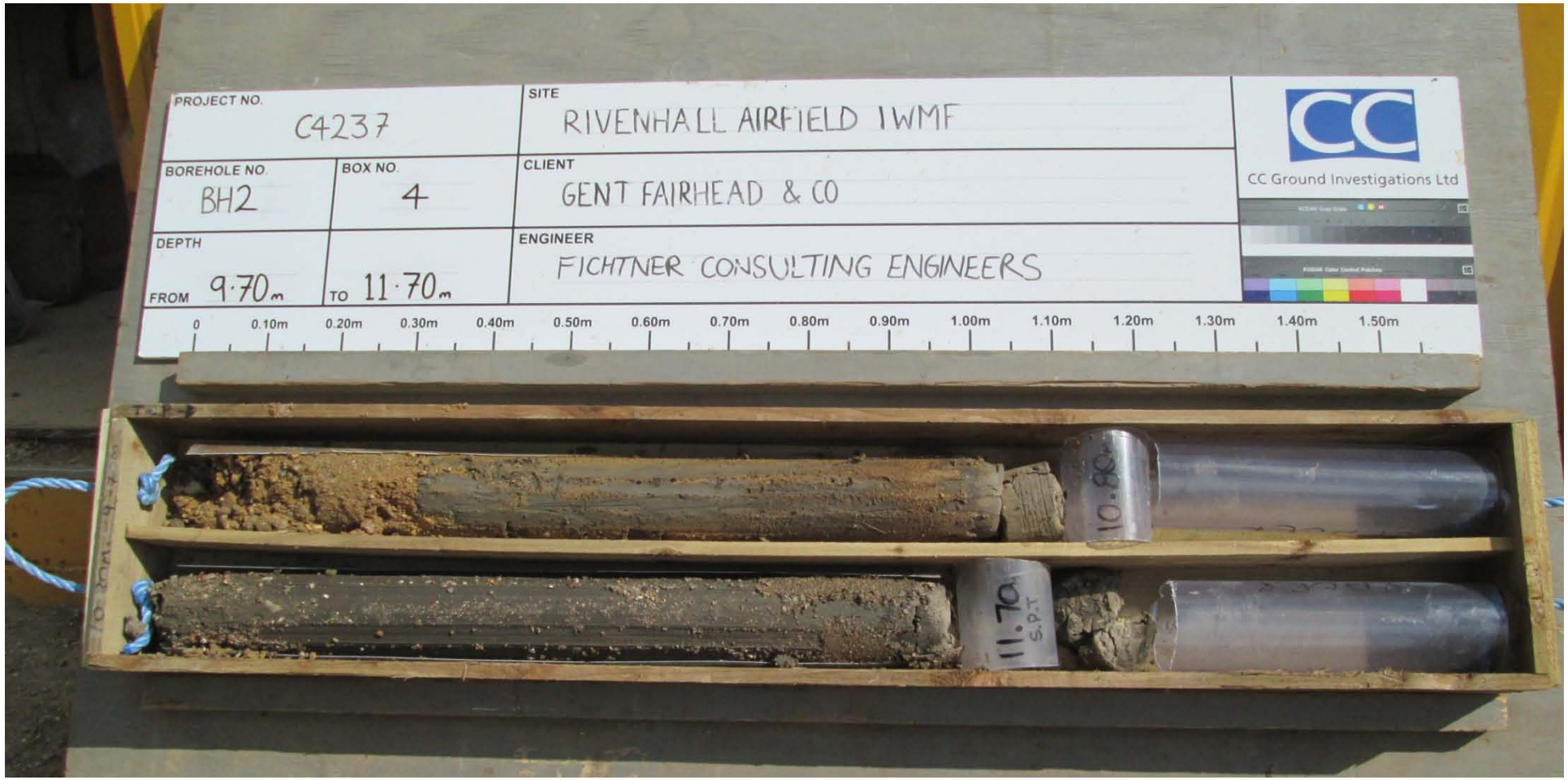
Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH2
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
	Client:	Gent Fairhead & Co.	**Depth:**	4.20m – 6.70m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH2
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	6.70m – 9.70m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	9.70m – 11.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	11.70m – 14.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	14.50m – 18.10m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	18.10m – 21.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH2
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	21.10m – 23.90m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
Client:	Gent Fairhead & Co.	**Depth:**	23.90m – 25.40m

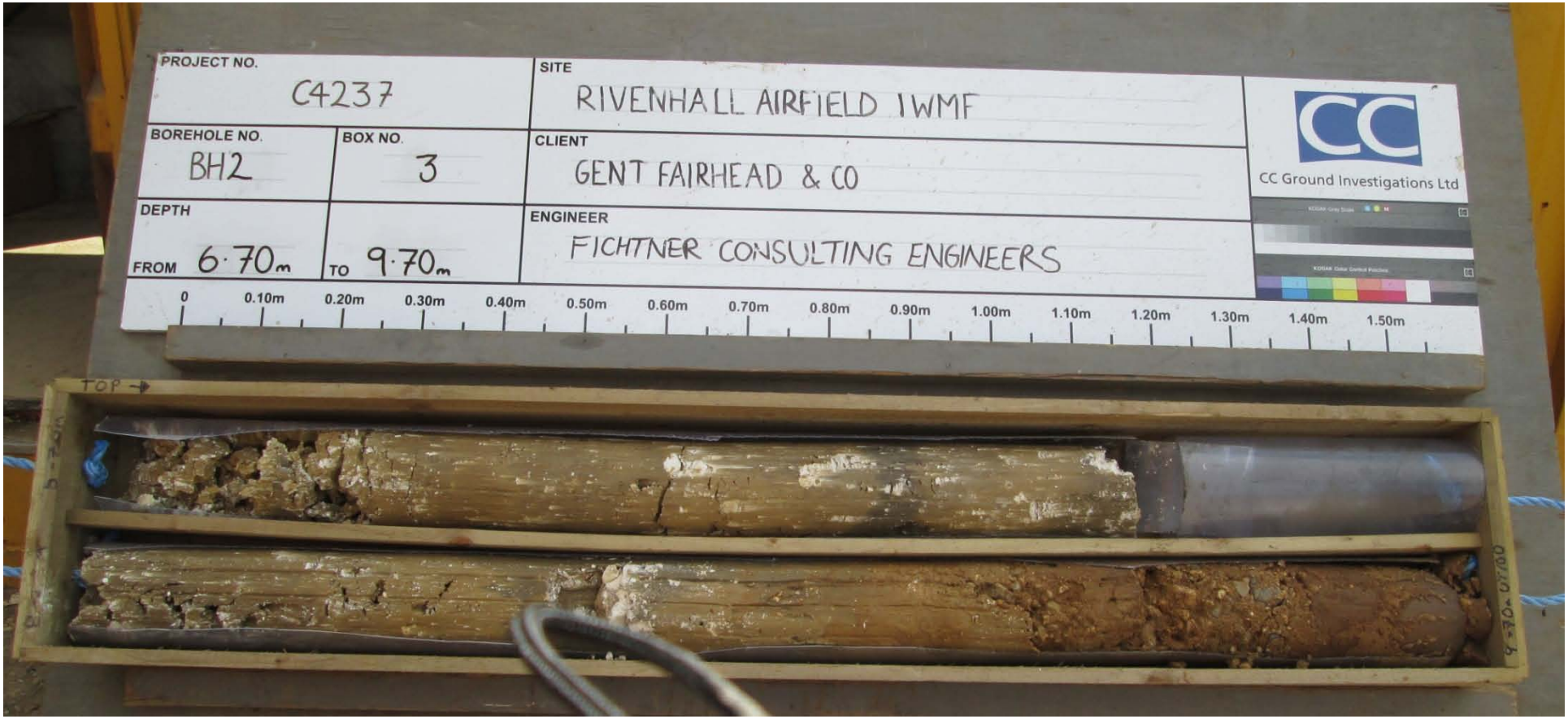
Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH7
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 4.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	4.00m – 6.50m

Core Photograph

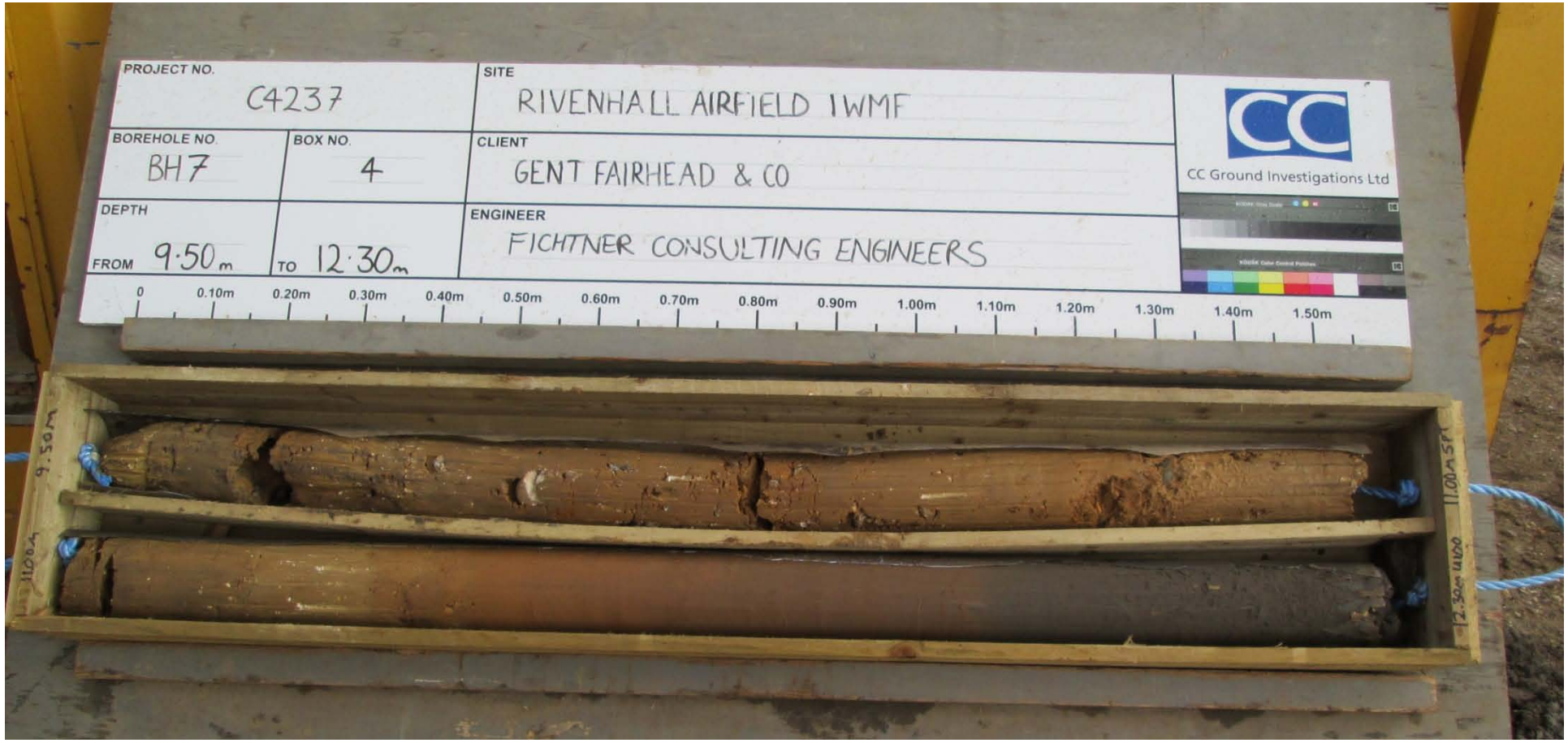


CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH2
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	6.70m – 9.70m

Core Photograph

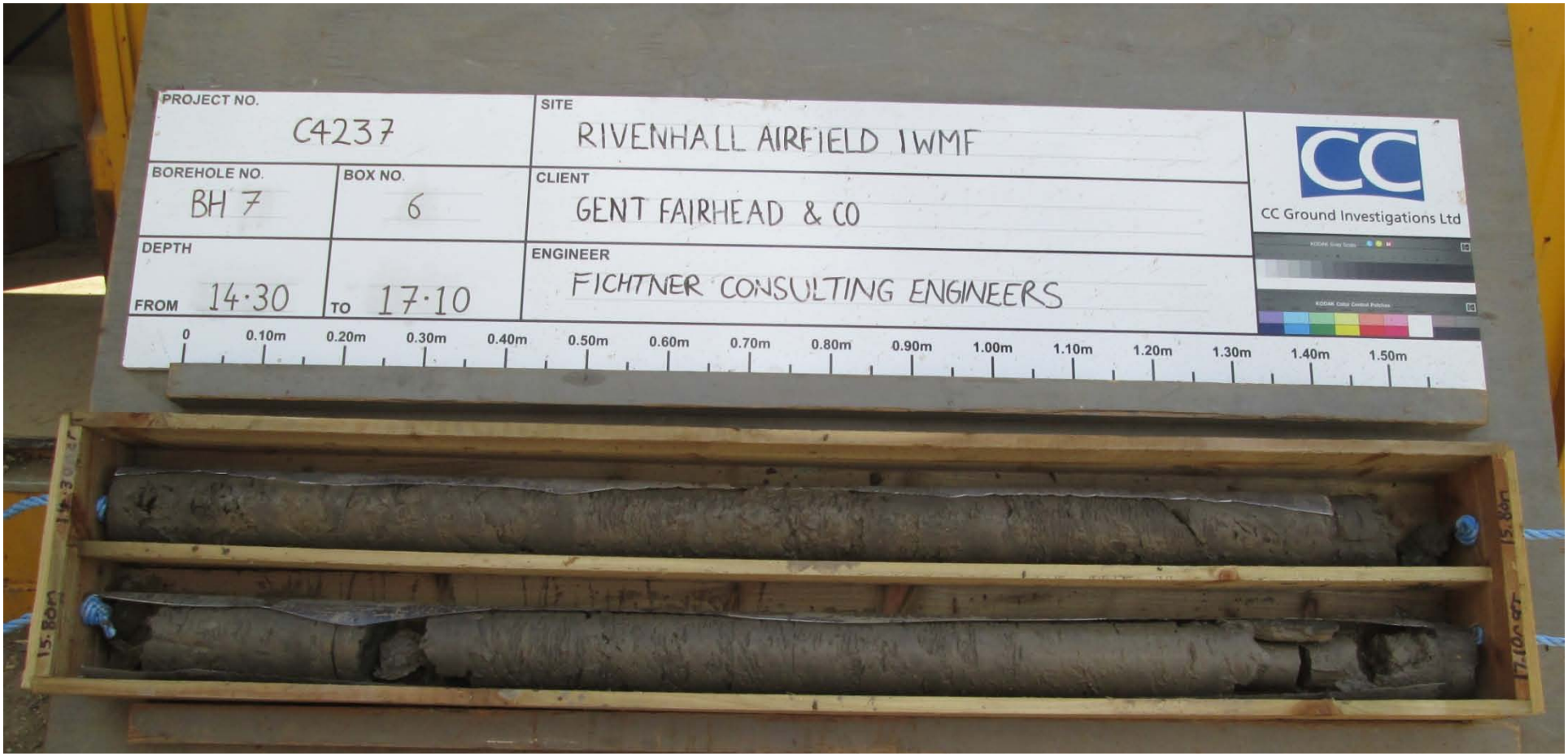
CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	6.50m – 9.50m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	9.50m – 12.30m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH7
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	14.30m – 17.10m

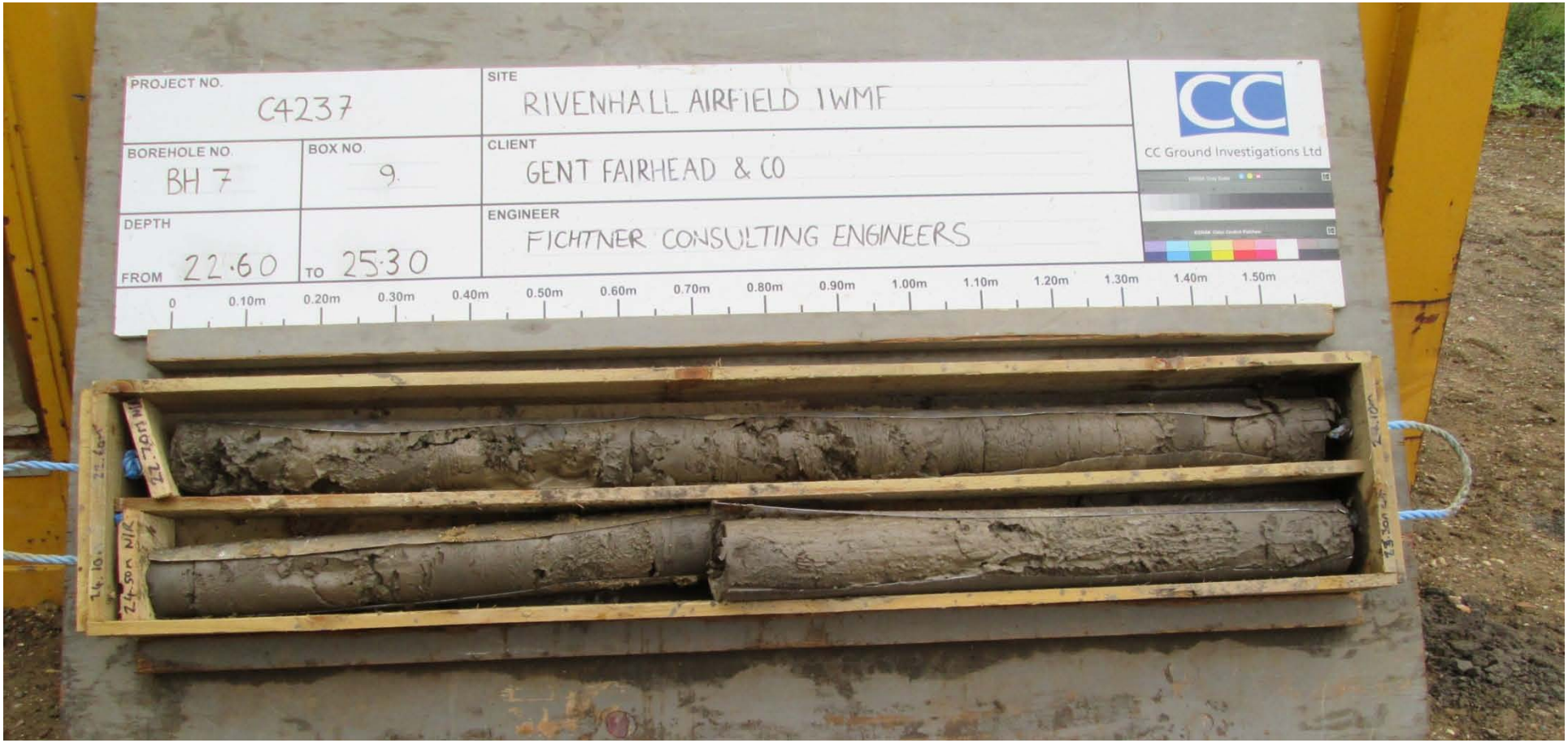
Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	17.10m – 19.80m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH7
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	19.80m – 21.10m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
Client:	Gent Fairhead & Co.	**Depth:**	22.60m – 25.30m

Core Photograph

CC Ground Investigations Ltd

Contract ID:	C4237	**Borehole ID:**	BH7
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
Client:	Gent Fairhead & Co.	**Depth:**	25.30m – 28.30m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH7
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	28.30m – 31.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH7
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
	Client:	Gent Fairhead & Co.	**Depth:**	31.00m – 32.60m

Core Photograph

CC Ground Investigations Ltd

Contract ID:	C4237	**Borehole ID:**	BH8
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	14.20m – 16.00m

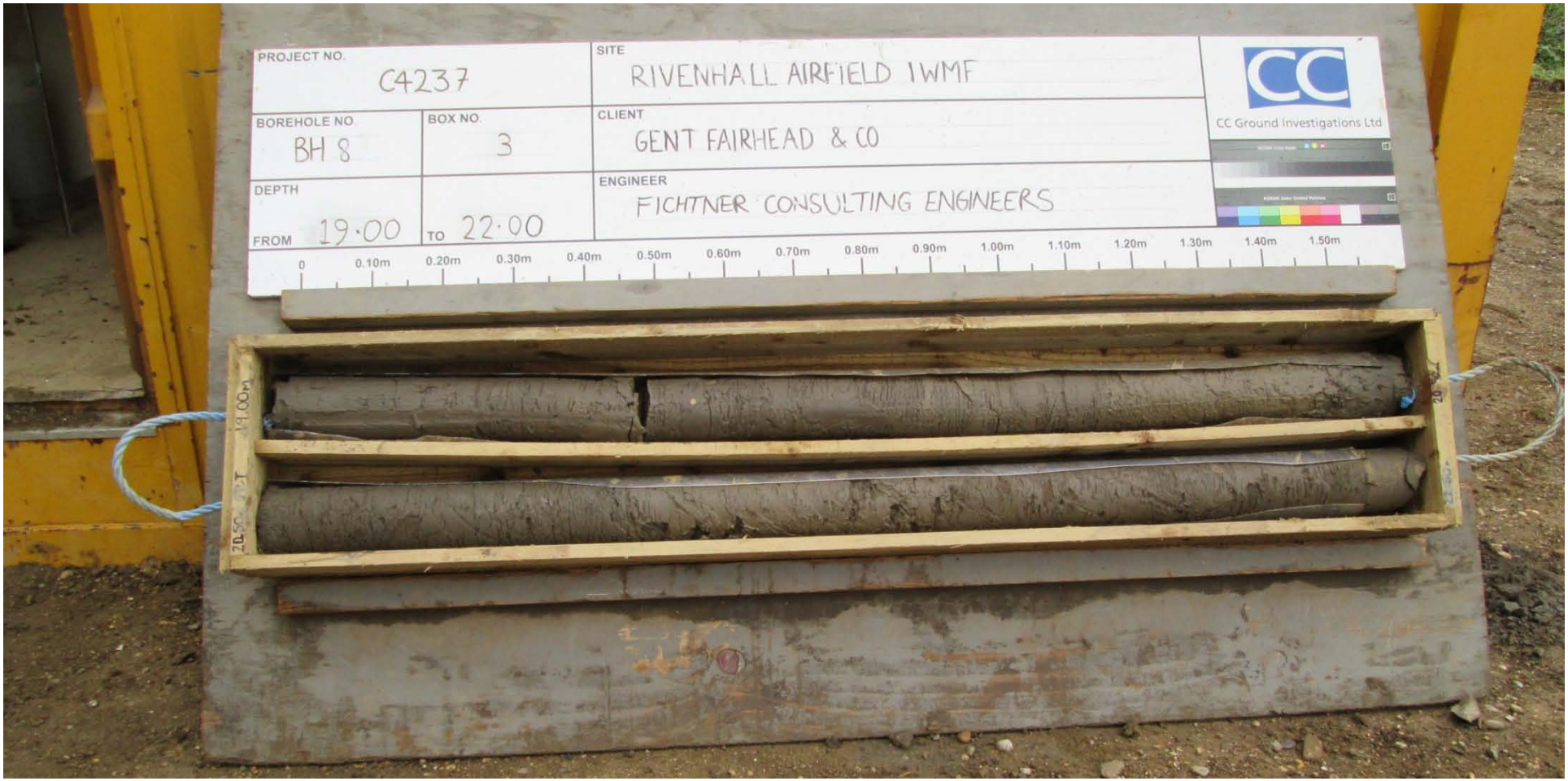
Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	16.00m – 19.00m

Core Photograph

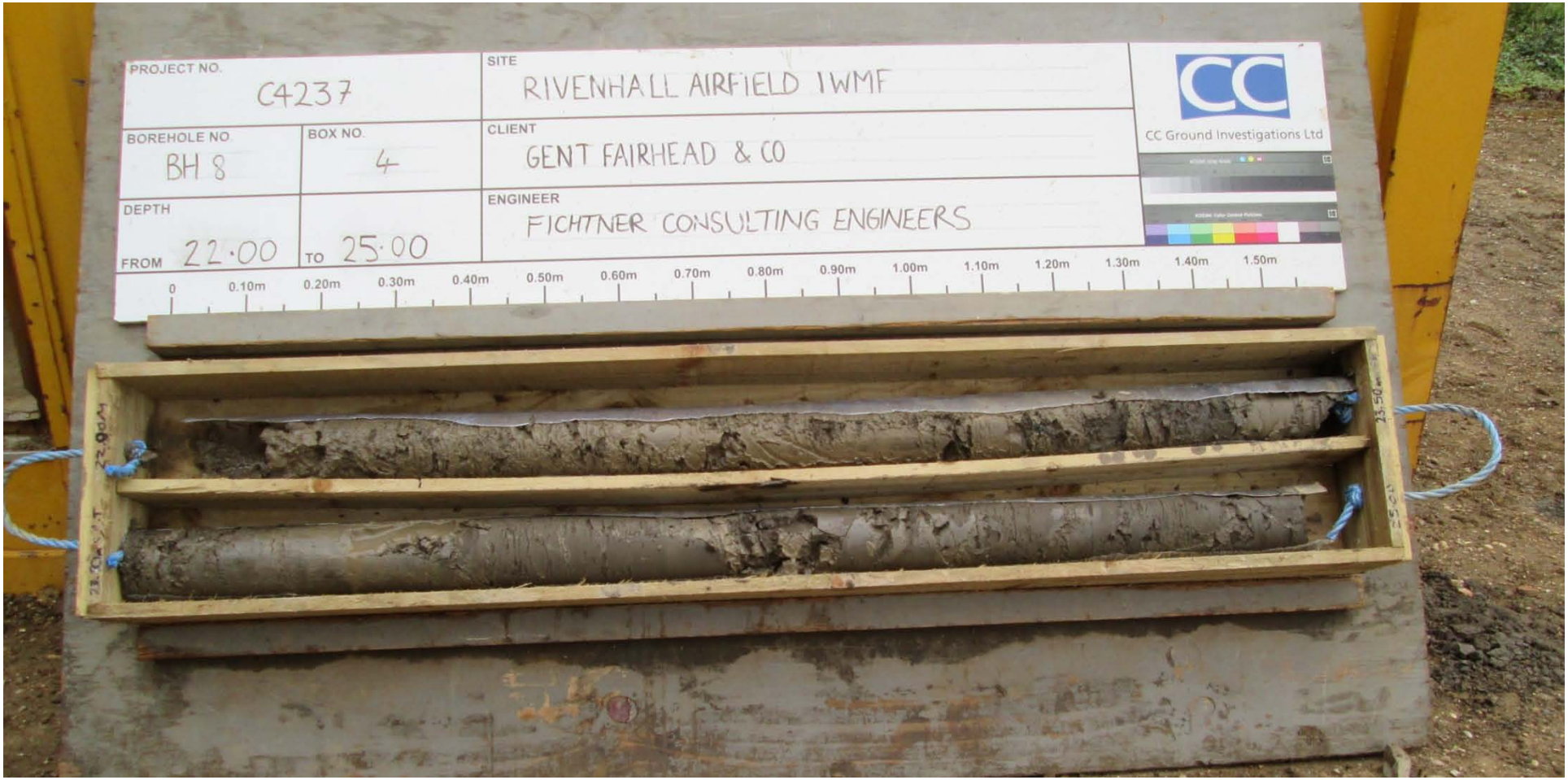
CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH8
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	19.00m – 22.60m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH8
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	19.00m – 22.00m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	22.00m – 25.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	25.00m – 28.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	29.50m – 33.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 3.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH8A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	3.20m – 5.20m

Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH8A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	5.20m – 7.80m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH10
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	4.20m – 6.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH10
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	6.70m – 9.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH10
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	9.70m – 11.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH10
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	14.10m – 16.60m

Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	16.60m – 19.60m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
	Client:	Gent Fairhead & Co.	**Depth:**	19.60m – 22.60m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	22.60m – 25.60m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	25.60m – 28.60m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
	Client:	Gent Fairhead & Co.	**Depth:**	28.60m – 31.60m

Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH10
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	31.60m – 33.90m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH10
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
Client:	Gent Fairhead & Co.	**Depth:**	33.90m – 35.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH11
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 3.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	3.20m – 5.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	5.20m – 7.85m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	12.70m – 15.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	15.70m – 16.85m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH11
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	17.85m – 20.53m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
Client:	Gent Fairhead & Co.	**Depth:**	20.53m – 23.53m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
Client:	Gent Fairhead & Co.	**Depth:**	23.55m – 26.55m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
Client:	Gent Fairhead & Co.	**Depth:**	26.55m – 28.55m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH11
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
	Client:	Gent Fairhead & Co.	**Depth:**	29.55m – 32.55m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	13
Client:	Gent Fairhead & Co.	**Depth:**	32.55m – 35.55m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	14
Client:	Gent Fairhead & Co.	**Depth:**	35.55m – 38.55m

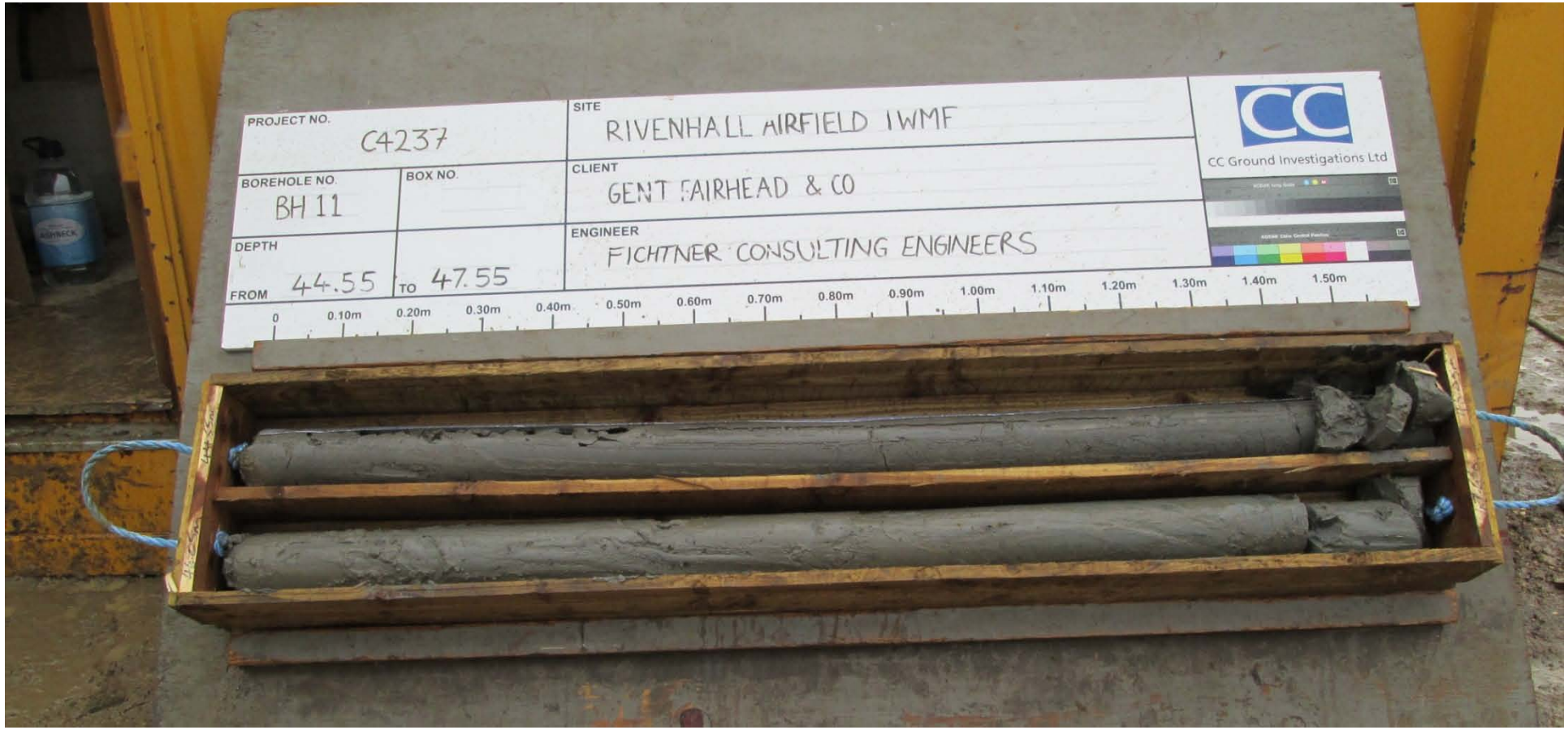
Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	15
Client:	Gent Fairhead & Co.	**Depth:**	36.55m – 39.55m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	17
Client:	Gent Fairhead & Co.	**Depth:**	41.55m – 44.55m

Core Photograph



CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH11
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	18
	Client:	Gent Fairhead & Co.	**Depth:**	44.55m – 47.55m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	19
Client:	Gent Fairhead & Co.	**Depth:**	47.55m – 50.60m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	20
Client:	Gent Fairhead & Co.	**Depth:**	50.60m – 51.60m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 3.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
	Client:	Gent Fairhead & Co.	**Depth:**	3.20m – 6.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	6.20m – 9.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	9.20m – 12.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	12.20m – 13.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	13.70m – 16.70m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
	Client:	Gent Fairhead & Co.	**Depth:**	16.70m – 19.70m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	21.70m – 24.40m

Core Photograph

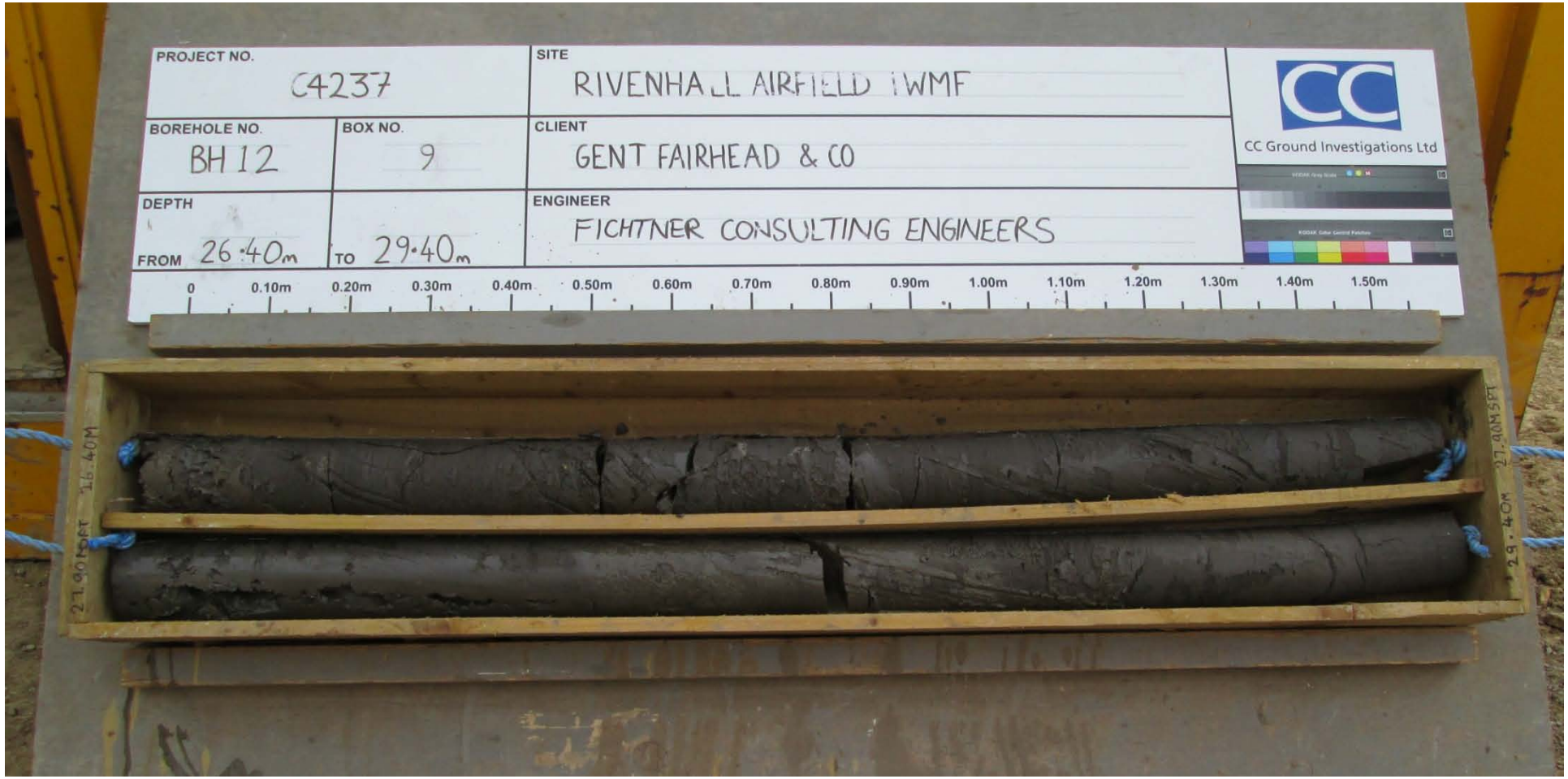
CC Ground Investigations Ltd

Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
Client:	Gent Fairhead & Co.	**Depth:**	20.70m – 23.40m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	24.90m -26.40m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	26.40m – 29.40m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
Client:	Gent Fairhead & Co.	**Depth:**	30.40m – 33.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
	Client:	Gent Fairhead & Co.	**Depth:**	33.10m – 34.60m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH12
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	13
	Client:	Gent Fairhead & Co.	**Depth:**	34.60m – 37.60m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH12
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	14
Client:	Gent Fairhead & Co.	**Depth:**	37.60m – 38.10m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH13
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 5.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH13
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
	Client:	Gent Fairhead & Co.	**Depth:**	5.20m – 8.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH11
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	7.85m – 10.85m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH13
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
	Client:	Gent Fairhead & Co.	**Depth:**	11.20m – 14.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH13
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	14.20m – 17.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH13
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	17.20m – 20.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH13
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	20.20m – 23.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH13
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
Client:	Gent Fairhead & Co.	**Depth:**	23.20m – 26.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	13.50m – 15.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	15.50m – 18.40m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	18.40m – 22.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	22.00m – 23.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	23.50m – 25.00m

Core Photograph

CC Ground Investigations Ltd

Contract ID:	C4237	**Borehole ID:**	BH13
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	26.20m – 27.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	25.00m – 28.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	28.00m – 31.30m

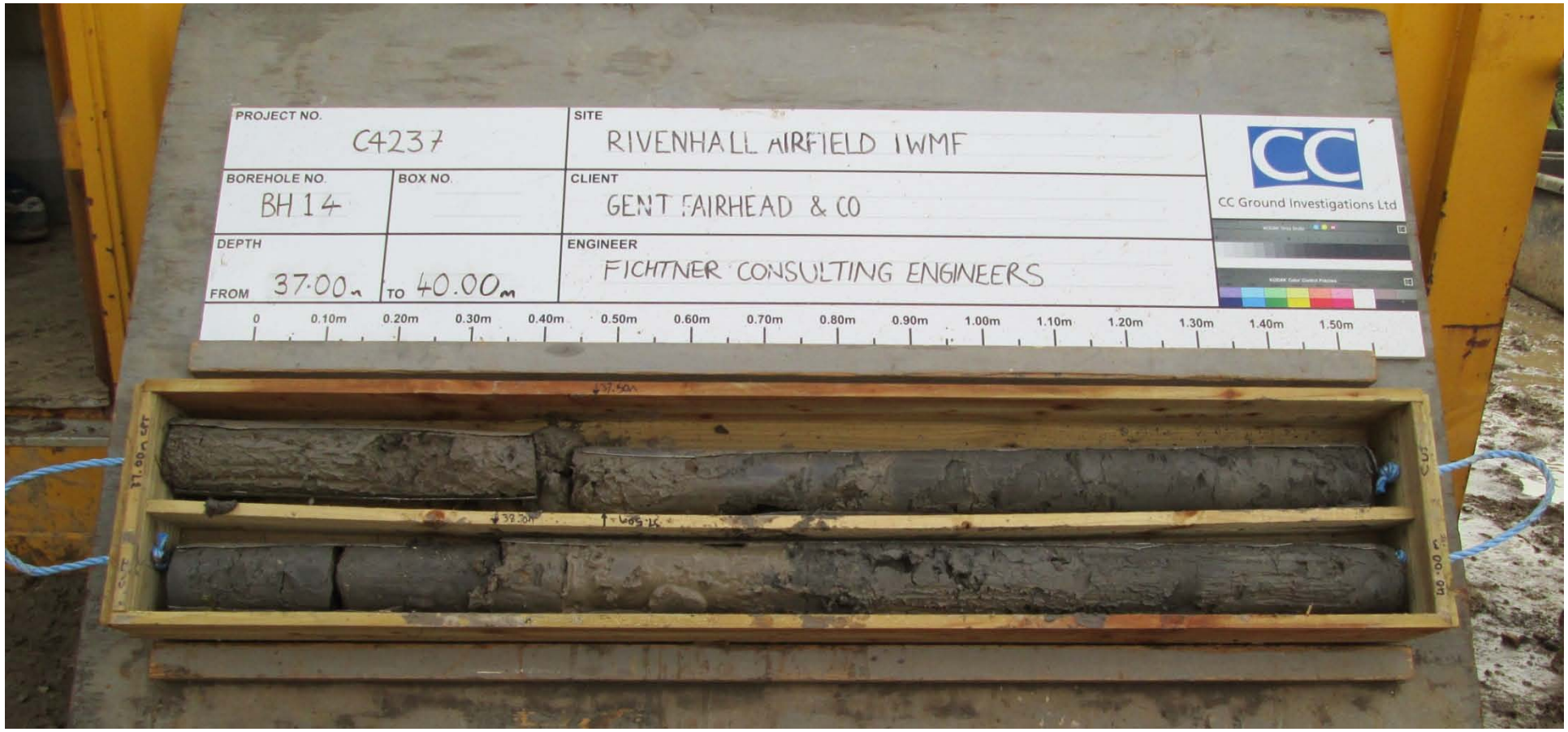
Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	31.30m – 34.30m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH14
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
	Client:	Gent Fairhead & Co.	**Depth:**	34.30m – 37.00m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH14
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	37.00m – 40.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH14
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
	Client:	Gent Fairhead & Co.	**Depth:**	40.00m – 43.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH14
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	43.10m – 46.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH14
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
	Client:	Gent Fairhead & Co.	**Depth:**	46.10m – 47.60m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH15
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	17.10m – 20.10m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH15
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	20.10m – 23.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH15
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	23.20m – 26.20m

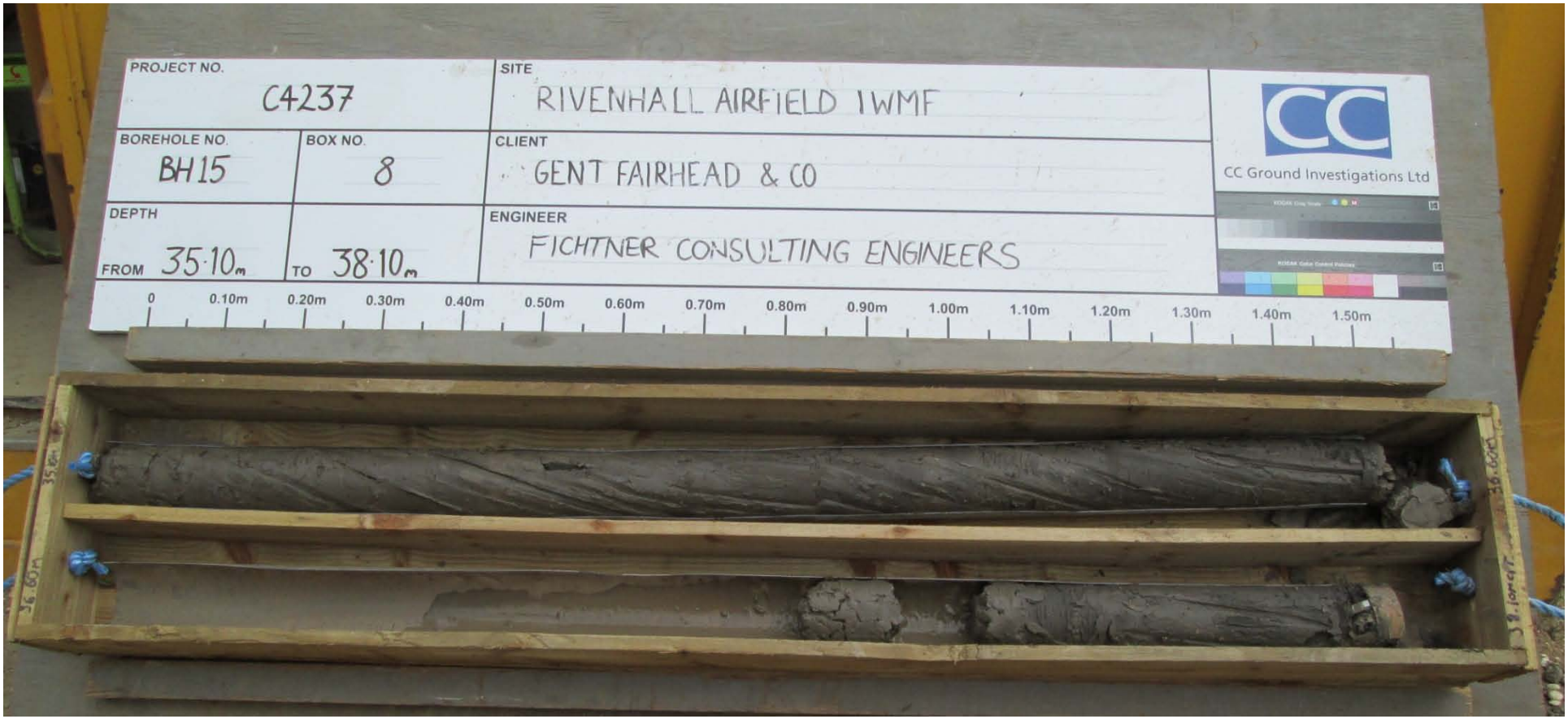
Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH15
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	26.20m – 29.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH15
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	29.20m – 31.50m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH15
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
Client:	Gent Fairhead & Co.	**Depth:**	35.10m – 38.10m

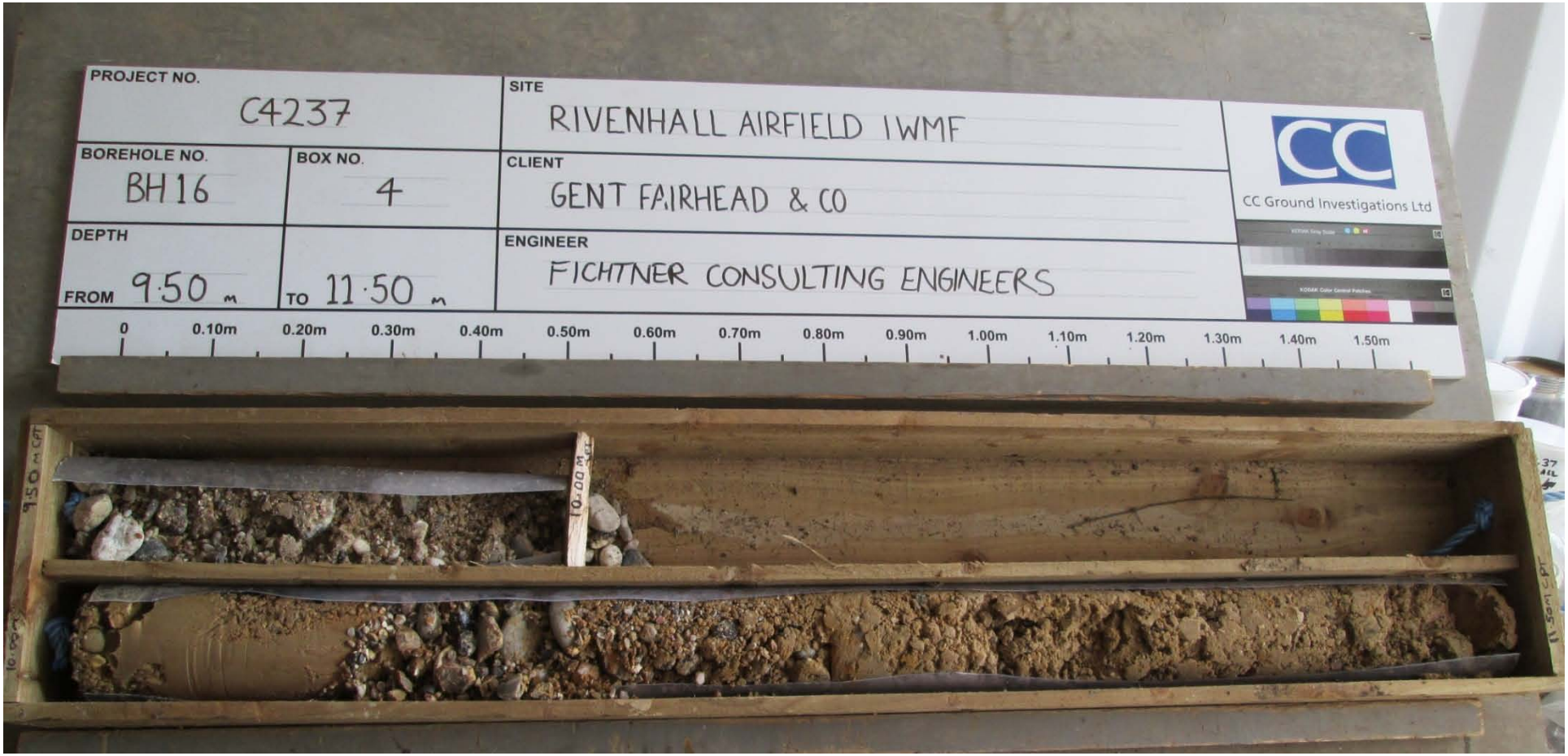
Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 4.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	4.00m – 6.50m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
	Client:	Gent Fairhead & Co.	**Depth:**	9.50m – 11.50m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	10.85m – 12.70m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	11.50m – 14.60m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	14.60m – 17.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	17.50m – 20.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	20.20m – 23.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	23.20m – 24.70m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
	Client:	Gent Fairhead & Co.	**Depth:**	26.20m – 28.80m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
Client:	Gent Fairhead & Co.	**Depth:**	28.80m – 30.90m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH16
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
Client:	Gent Fairhead & Co.	**Depth:**	30.90m – 32.40m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	13
	Client:	Gent Fairhead & Co.	**Depth:**	32.40m – 35.30m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	14
	Client:	Gent Fairhead & Co.	**Depth:**	35.30m – 38.30m

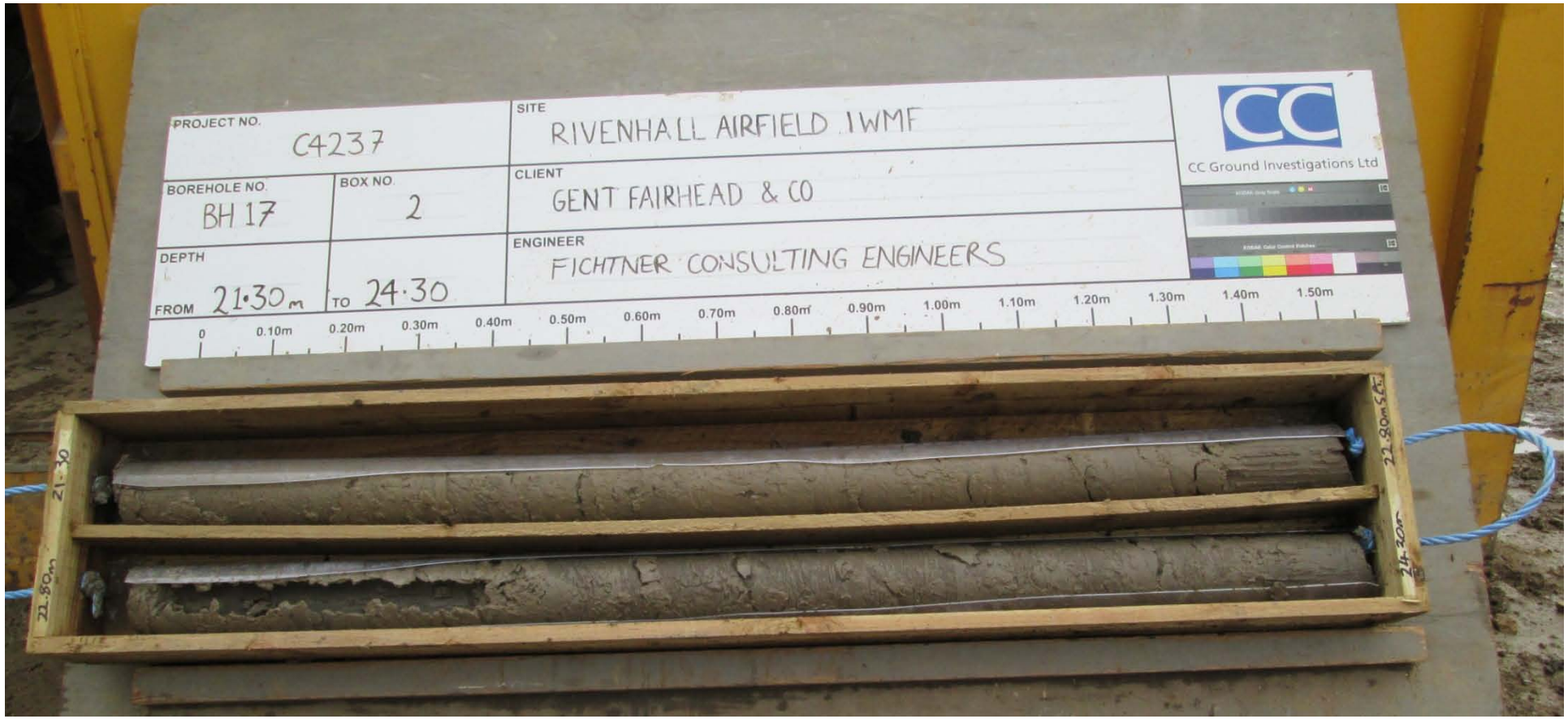
Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH16
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	15
	Client:	Gent Fairhead & Co.	**Depth:**	38.30m – 39.80m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	16.10m – 18.15m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH17
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	21.30m – 24.30m

Core Photograph

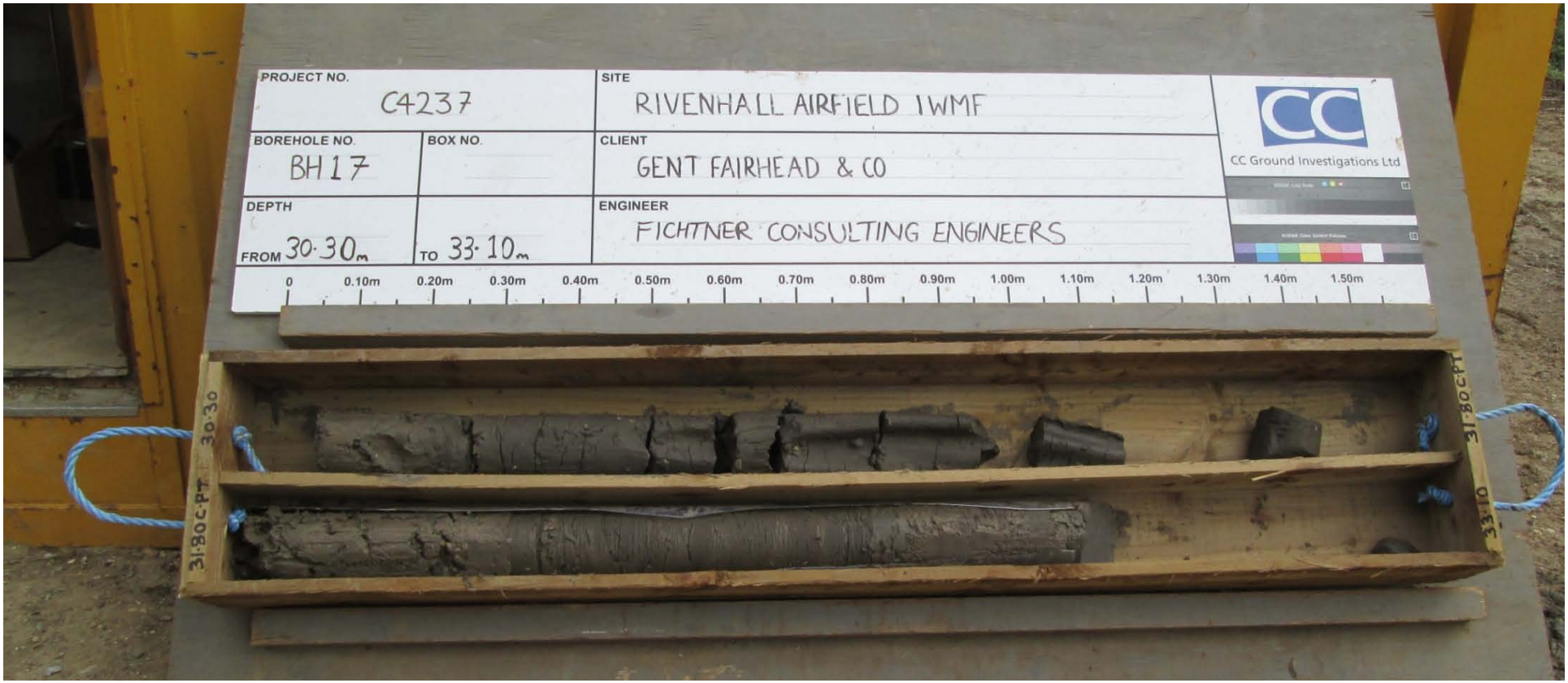
CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH17
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	24.30m – 27.30m

Core Photograph

CC Ground Investigations Ltd

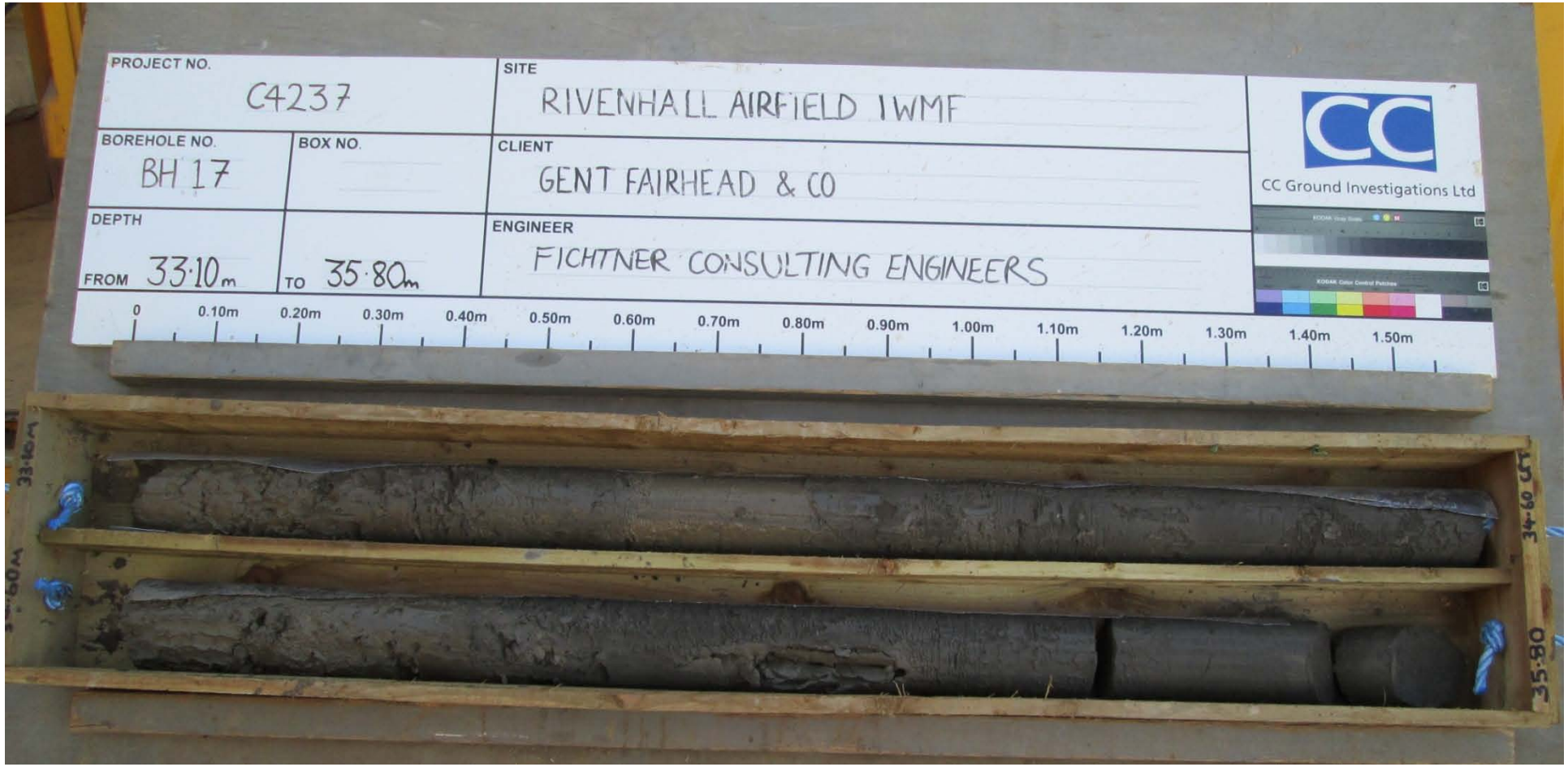
Contract ID:	C4237	**Borehole ID:**	BH17
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	27.30m – 30.30m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	30.30m – 33.10m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	33.10m – 35.80m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH17
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	35.80m – 38.80m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	38.80m – 41.80m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	41.80m – 44.90m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
	Client:	Gent Fairhead & Co.	**Depth:**	44.90m – 47.90m

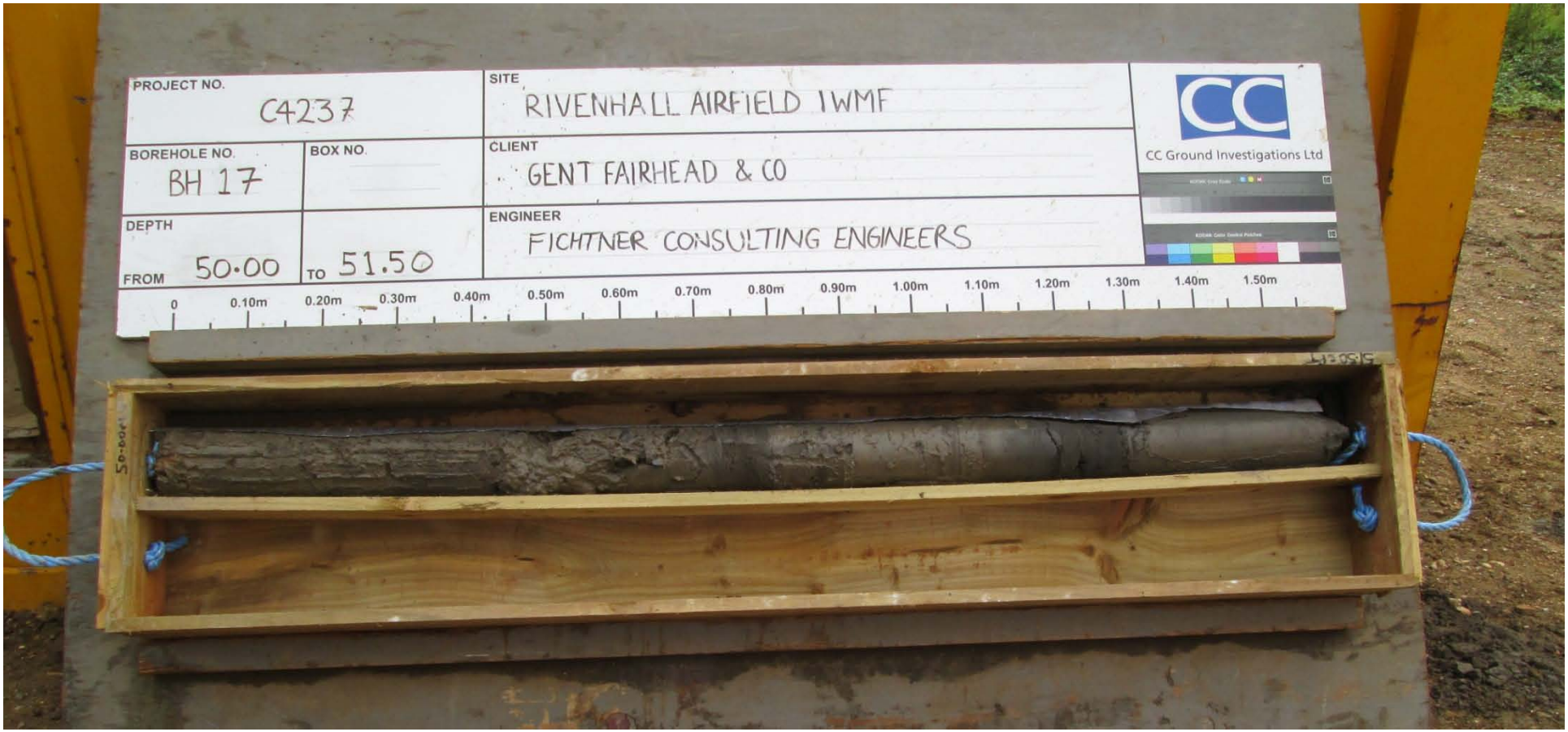
Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	47.90m – 50.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH17
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
	Client:	Gent Fairhead & Co.	**Depth:**	47.90m – 50.00m

Core Photograph

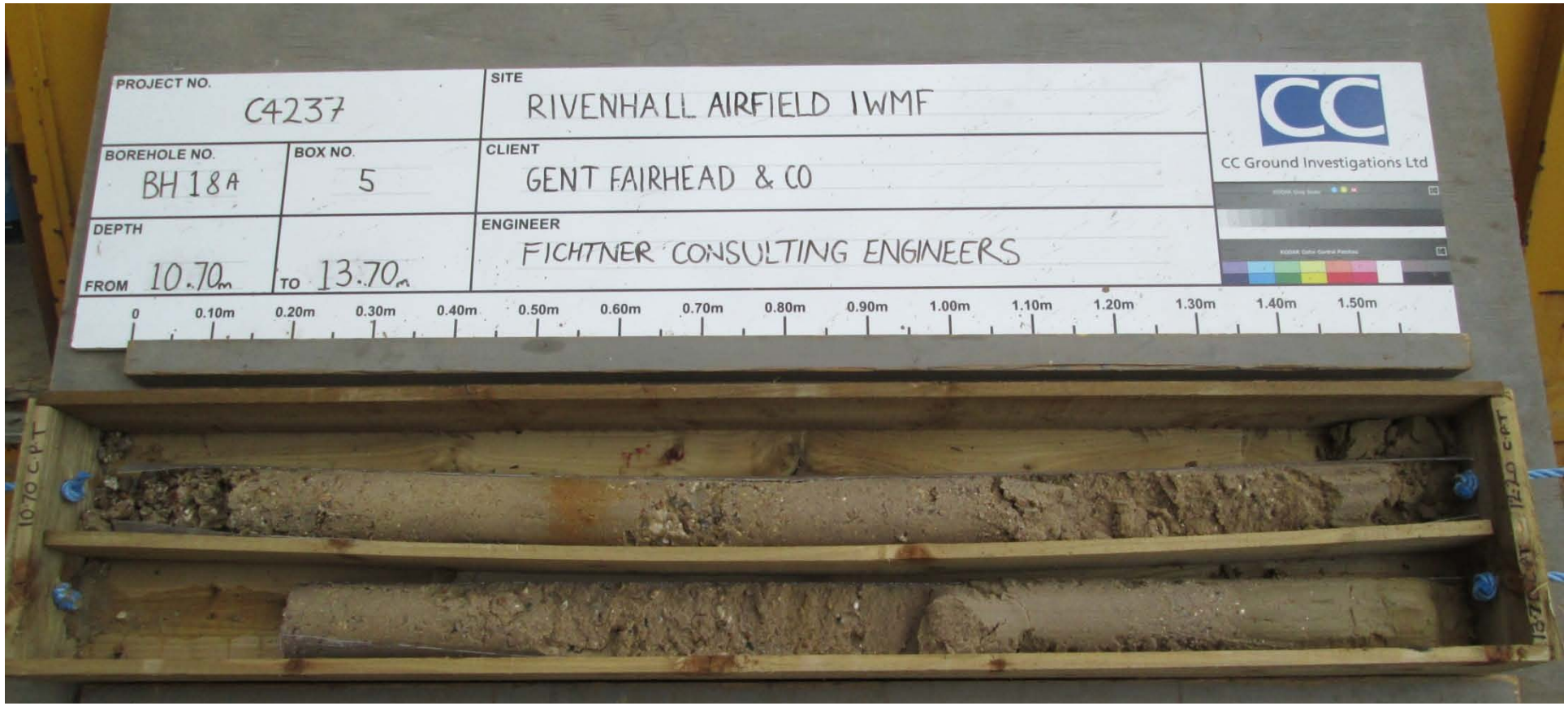


CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH17
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	13
Client:	Gent Fairhead & Co.	**Depth:**	50.00m – 51.50m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH18A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
	Client:	Gent Fairhead & Co.	**Depth:**	7.80m – 10.70m

Core Photograph



CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH18A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
	Client:	Gent Fairhead & Co.	**Depth:**	10.70m – 13.70m

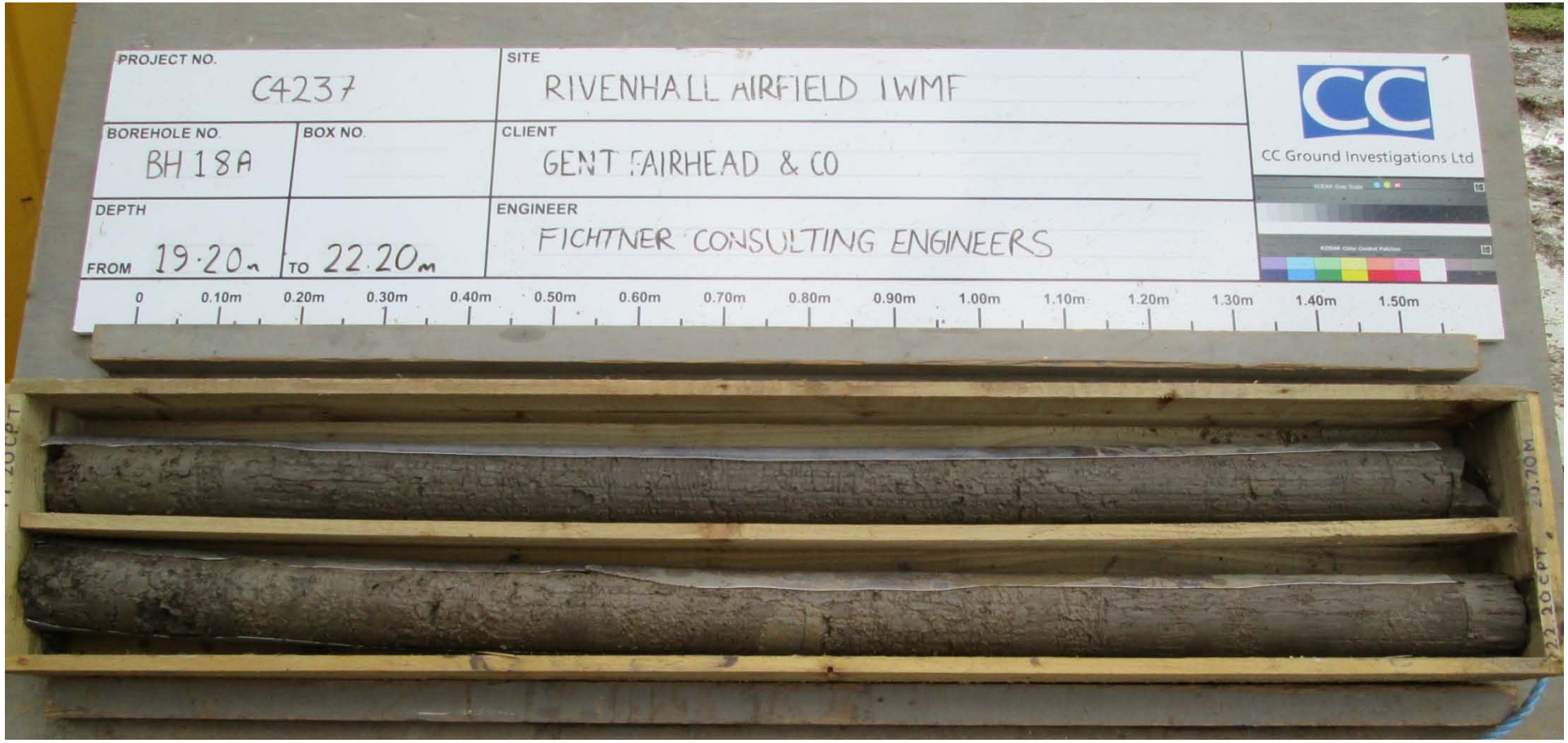
Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH18A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
Client:	Gent Fairhead & Co.	**Depth:**	13.70m – 16.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH18A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
	Client:	Gent Fairhead & Co.	**Depth:**	16.20m – 19.20m

Core Photograph

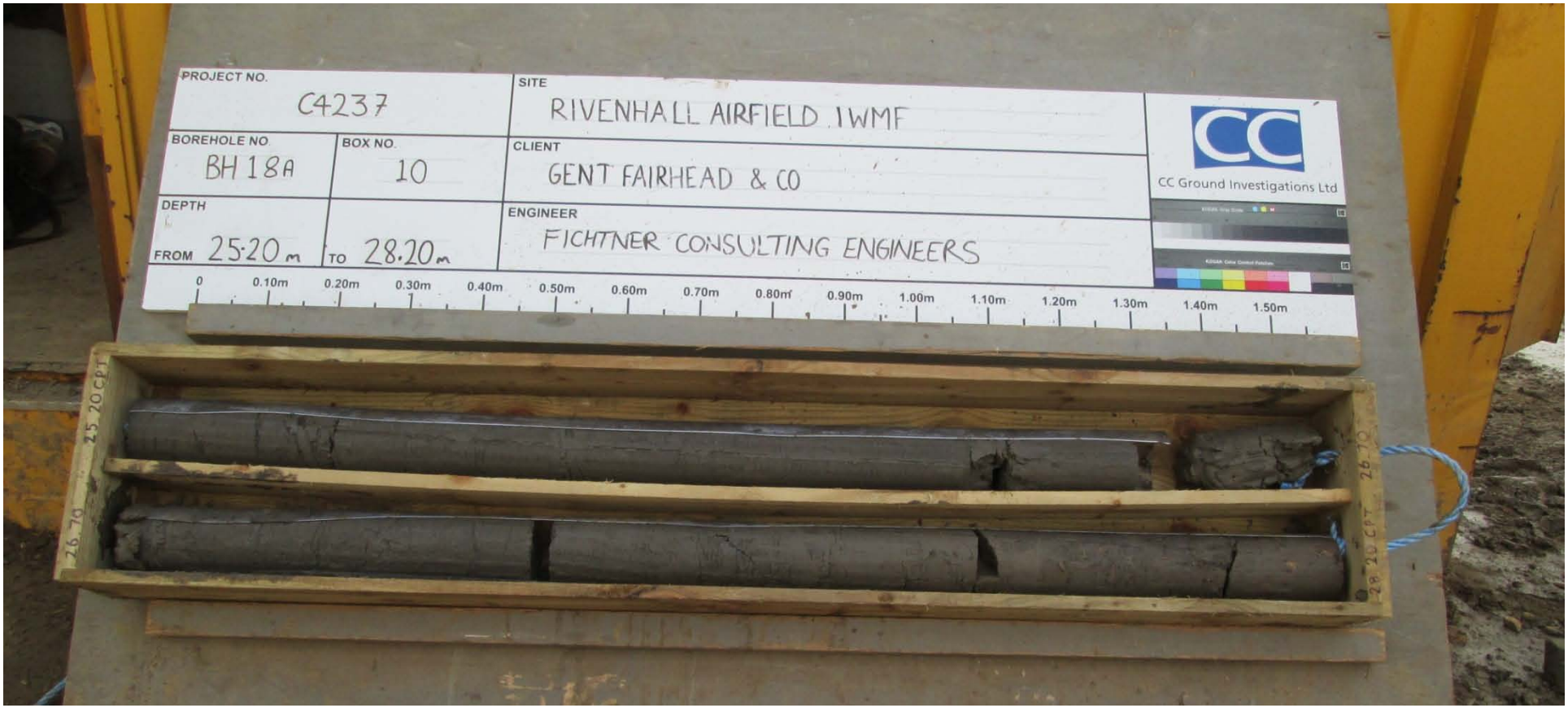


CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH18A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
Client:	Gent Fairhead & Co.	**Depth:**	19.20m – 22.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH18A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	22.20m – 25.20m

Core Photograph



CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH18A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
Client:	Gent Fairhead & Co.	**Depth:**	25.20m – 28.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH18A
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	28.20m – 31.40m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH18A
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
Client:	Gent Fairhead & Co.	**Depth:**	31.40m – 33.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH19
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
Client:	Gent Fairhead & Co.	**Depth:**	1.20m – 4.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
	Client:	Gent Fairhead & Co.	**Depth:**	4.00m – 6.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH19
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
Client:	Gent Fairhead & Co.	**Depth:**	6.50m – 8.00m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH19
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
Client:	Gent Fairhead & Co.	**Depth:**	8.50m – 11.50m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH19
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	11.50m – 14.50m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	14.50m – 17.50m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
	Client:	Gent Fairhead & Co.	**Depth:**	17.50m – 19.00m

Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	8
	Client:	Gent Fairhead & Co.	**Depth:**	19.00m – 22.00m

Core Photograph

CC Ground Investigations Ltd				
	Contract ID:	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	9
	Client:	Gent Fairhead & Co.	**Depth:**	22.00m – 25.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	10
	Client:	Gent Fairhead & Co.	**Depth:**	25.00m – 28.00m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH19
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	11
	Client:	Gent Fairhead & Co.	**Depth:**	28.00m – 32.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH19
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	12
Client:	Gent Fairhead & Co.	**Depth:**	30.80m – 33.10m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH20
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	14.00m – 16.20m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH20
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	2
Client:	Gent Fairhead & Co.	**Depth:**	16.20m – 18.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH20
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	3
	Client:	Gent Fairhead & Co.	**Depth:**	18.20m – 21.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH20
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	4
	Client:	Gent Fairhead & Co.	**Depth:**	21.20m – 24.20m

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH20
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	1
	Client:	Gent Fairhead & Co.	**Depth:**	14.00m – 16.20m

Core Photograph

Contract ID:	C4237	**Borehole ID:**	BH20
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	5
Client:	Gent Fairhead & Co.	**Depth:**	24.20m – 27.20m

CC Ground Investigations Ltd

Core Photograph

CC Ground Investigations Ltd	**Contract ID:**	C4237	**Borehole ID:**	BH20
	Contract Name:	Rivenhall Airfield IWMF	**Box No:**	6
	Client:	Gent Fairhead & Co.	**Depth:**	27.20m – 30.40m

Core Photograph

CC Ground Investigations Ltd			
Contract ID:	C4237	**Borehole ID:**	BH20
Contract Name:	Rivenhall Airfield IWMF	**Box No:**	7
Client:	Gent Fairhead & Co.	**Depth:**	30.40m – 33.60m