Temple Park Leisure Centre, South Shields

Site Investigation Report

South Tyneside Council

Report Number S120505

July 2012

Solmek
12 Yarm Road
Stockton-on-Tees
TS18 3NA

Tel: 01642 607083
Fax: 01642 612355
Email: south@solmek.com

WWW.SOLMEK.COM

Temple Park Leisure Centre, South Shields

Site Investigation Report

Contract Number: S120505
Date: July 2012

SECTION		Page Nos
1.0	Introduction and Scope of Works	2
2.0	Site Description and Fieldwork	2
3.0	Desk Study Summary	4
4.0	Ground Conditions	5
5.0	Contamination Analysis and Results	6
6.0	Ground Gas Assessment	12
7.0	Conceptual Model and Risk Assessment	13
8.0	Geotechnical Testing	15
9.0	Conclusions and Summary	16

TABLES		
1	Summary of Inorganic Contamination Testing Results	7
2	Summary of Organic Contamination Testing Results	8
3	Summary of Pollution Linkages	9
4	Ciria 149 Gas Regimes	13
5	Conceptual Model and Risk Assessment	14

APPENDICES	
A	Drawings
B	Borehole Logs
C	Geotechnical Laboratory Results
D	Chemical Laboratory Results and CLEA Reports (GAC)
E	Gas Monitoring Results
F	Contamination Guidelines, Gas Protection measures and Notes on Limitations

Revision	Date	Prepared	Checked
Final	July 2012	A Cutts	D Simpson

Temple Park Leisure Centre, South Shields

Site Investigation Report

1 INTRODUCTION AND SCOPE OF WORKS

At the request of South Tyneside Council, a ground investigation involving chemical and geotechnical testing was carried out at Temple Park Leisure Centre, South Shields, Tyne and Wear. A drawing showing the site location is included in Appendix A, Figure 1.

Scope of Works

The investigation was commissioned to determine the ground conditions for the refurbishment of the existing Pool Area at the Leisure Centre. The fieldwork and testing was generally carried out according to the recommendations of BS 5930:1999 "Code of Practice for Site Investigations" and all stratum descriptions are as recommended in that publication.

The information provided in this report is based on the investigation fieldwork and subsequent geotechnical/chemical testing, and is subject to the comments and approval of the various Regulatory Authorities.

A geotechnical and environmental report was requested including a ground gas assessment. A desk study was carried out by Solmek (S111123, December 2011) and should be read in conjunction with this report. A brief summary is provided in Section 3.

There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Solmek reserve the right to alter conclusions and recommendations should further information be available or provided. Any schematic representation or opinion of the possible configuration of ground conditions between exploratory boreholes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

2 SITE DESCRIPTION AND FIELDWORK

The preliminary site inspection, as recommended in BS 5930 and BS 10175, was undertaken on Wednesday 30th November 2011. The site is centred at the approximate Ordnance Survey Co-ordinates 437180E, 563950N, within Temple Memorial Park, South Shields.

The redevelopment lies within Temple Park Leisure Centre and forms the swimming pool and changing area of the complex which is located within the southern half of the Leisure Centre. This comprises an "L" shaped building, the lower half of which is of masonry construction with masonry and glass panelling in the upper half.

A metal stairway provides emergency access to the swimming pool area on the western elevation. The access door is present at pool water level approximately 2-3m above ground level and at the base of the glass panelling. The stairway lies adjacent to a covered, elevated walkway linking the pool area to the Gymnastic Centre further to the west.

The topography of the site varies; the land on the western and eastern sides of the pool area is lower than the south. The land rises up toward the south and south west from the pool base level to approximate pool water level. A series of vent chimneys are located on the eastern elevation which is accessed down a tarmac service roadway beneath the main entrance to the leisure centre. An electrical substation and chemical store is also located in this area and forms part of the retaining structure for the land to the south of it.

The site is set wholly within Temple Memorial Park and comprises public open space over undulating grassed parkland intersected with footpaths.

There are no surface water features near the site.

There were no obvious signs of contamination noted during the site walkover.

Fieldwork

The fieldwork was carried out between 8th and 10th May 2012. Three shell and auger boreholes (BH1 to BH3) were drilled to depths of between 9.15 and 14.65m below ground level (bgl). The boreholes were positioned around the existing swimming pool area. A soil gas monitoring pipe was installed into borehole 1 and three gas/groundwater monitoring visits were carried out over June and July 2012.

Undisturbed and disturbed samples along with insitu standard penetration tests (SPT) tests were undertaken at various depths within the boreholes. Logging of the boreholes was carried out by the drilling supervisor during drilling, with part time supervision by an engineer. Samples were taken for both geotechnical and contamination analysis.

Descriptions of the strata encountered in the boreholes together with details of testing, sampling and groundwater are presented in Appendix B of this report. A plan showing the location of the boreholes can be found in Appendix A (Figure 2).

3 DESK STUDY SUMMARY

History

The site remained a field with a small stream along the eastern boundary until the 1940's when it became part of Harton Moor Golf Course. The golf course was not shown on mapping from the mid 1950's and the site became known as Temple Memorial Park in the 1970's. The stream was no longer shown around this time period. The Leisure Centre was constructed sometime between the late 1970's and the early 1980's and was extended in the 1990's.

The earliest maps show the site to lie within a series of fields. A Rifle Range was developed to the west of the site around the late 1800's but was removed by the early 1900's. A period of steady residential development occurred from the 1920's and 1930's along with new road infrastructure which continued into the 1980's. John Reid Road was constructed sometime around the late 1960's. A refuse tip was shown on mapping from the late 1960's, 250m to the south west of the site, but this was not present on subsequent maps.

Geology and Mining

The superficial geology consists of Upper or Pelaw Clay beneath an area of made ground and domestic waste. The solid geology underlying the site is expected to comprise Middle Coal Measures rocks (Mudstone and sandstone). There are no faults in the area. No risk is posed by ground dissolution or shrinking and swelling clay hazards. A very low risk is given for landslide, collapsible ground, compressible ground and running sand hazards.

The Coal Mining Report indicates that there are six worked seams beneath the site at depths of between 315 and 448mbgl, the last date of working being 1969. The shallowest seam is the Yard which has a section of 190cm in the area, this was last worked in 1938. There are no mine entries, tips or lagoons within 20m of the site. There have been no subsidence claims relating to the property over the last 10 years. The report concludes that old workings are present but all settlement is likely to have completed long ago.

The Hebburn Fell coal seam is conjectured to outcrop to the north and east of the site and potentially dip beneath it towards the south and west. The nearby Harton Colliery shaft encountered three very thin (<0.1m thick) seams of coal from depths of between 30.0mbgl and 36.5mbgl. The shallowest potentially workable seam (0.8m in thickness) lies over 80.0mbgl. It is possible therefore that the Hebburn Fell seam may be too thin to have been worked. The overall risk of the development being affected by mining issues therefore appears to be low. However the Local Authority may require further information in terms of rotary drilling to confirm this.

Environmental Setting

There are three historical landfills on the site. Details from the Environment Agency website indicate that the three sites are Temple Memorial Park No1, Temple Park No2 and Temple Park No3. The first waste received was in January 1957 for the Temple Memorial Park No1 site and the last input date is given as January 1994. Temple Park No2 first received waste in January 1950 but no details of the last waste input is given. No details are given for Temple Park No3.

There are two open Fuel Stations sites within the Envirocheck Report. These are located 668m south east on King George Road (Murco) and Moor Lane (Jet) 924m north of the site.

The HPA-RPD-033 Indicative Atlas of Radon in England and Wales Map 19 shows the site lies in an area where between 1 and 3% of homes are at or above the radon action level. The BRE Radon – Guidance on Protective Measures for New Buildings Map 19 shows that no radon protective measures are necessary in the construction of new dwellings or extensions.

The Envirocheck Report shows that the underlying solid geology beneath the site is designated a **Secondary A Aquifer**. The drift geology is designated as **Unknown.**

The site does not lie in a Source Protection Zone (SPZ). A Zone II (Outer Protection Zone) and Zone III (Total Catchment) SPZ lies 279m to the south east of the site.

There are no Discharge Consents within 1km of the site. There are no Pollution Incidents into Controlled Waters within 900m of the site. The Envirocheck Report states that no water abstraction licences are listed within 1km of the site.

The site is not in an area affected by previous flooding events. There are no areas benefiting from flood defences or flood water storage areas within 1km of site.

There are no abstraction licences within 1km of the site.

4 GROUND CONDITIONS

Made Ground

Made Ground was encountered within all three boreholes to depths of 0.5mbgl in BH2, 1.1mbgl in BH1 and 1.35mbgl in BH3. Topsoil described as clayey and gravelly was encountered in BH1 to a depth of 0.1mbgl and 0.15mbgl in BH2. In BH1 a layer of slightly sandy gravelly clay fill was proven from 0.1 to 1.1mbgl, in BH2 clayey sandy gravel was encountered from 0.15 to 0.3mbgl onto slightly sandy gravelly clay fill to 0.5mbgl.

In BH3 a 10mm thick layer of tarmac was proven over gravel fill with slag, clinker and sandstone to 0.15mbgl. This overlies loose very clayey gravelly sand fill to 1.35mbgl.

Natural Deposits

The natural deposits immediately below the fill materials consist of firm and stiff slightly sandy, locally indistinctly thinly laminated clay. This was proven to depths of between 2.75mbgl in BH3 and 5.6mbgl in BH1. The underlying deposits comprise stiff locally very stiff sandy gravelly clay to depths of 8.75mbgl in BH3 and 14.2mbgl in BH1.

Rockhead

Completely weathered sandstone was proven at the base of all three boreholes from 8.75mbgl to 14.2mbgl. Once in these deposits SPT refusal was reached as the boreholes progressed at depths of between 9.15 and 14.65mbgl.

Groundwater

Groundwater was not encountered in the boreholes across the site, or during the later monitoring visits. It should be noted that groundwater levels can fluctuate with seasonal and climatic variations as well as in proximity to local dewatering and abstraction schemes.

5 CONTAMINATION ANALYSIS AND RESULTS

The proposals include the refurbishment of the existing pool area at the Leisure Centre.

To provide information upon the possibility of ground contamination, two clay fill samples, a sample of topsoil, a sample of sand fill and a sample of slag and clinker gravel fill were subject to chemical contamination analysis.

Given the nature of the proposed development, the test results have been compared to a series of Solmek Generic Assessment Criteria (GAC) thresholds based on a residential land use without home grown produce. Solmek GAC were derived using the EA CLEA Software Version 1.06 (May 2011) which produce Model Output Reports to compare the contamination concentrations against. In the absence of Solmek GAC values, WS Atkins Soil Screening Values (SSV) for residential land use with home grown produce have been used (which have been derived using EA CLEA Version 1.06, May 2011).

Solmek used the following input parameters within the CLEA Model to generate the GAC values:

- **Land use:** Residential without Homegrown Produce
- **Receptor:** Female
- **Building Type:** Office (Post 1970)
- **Soil Type:** Sandy Clay Loam
- **Soil pH:** 8.1 (Lowest Recorded Value)
- **Soil Organic Matter:** 0.7% (Lowest Recorded Value)

The samples were subjected to a range of tests including metals, inorganics, Speciated Polyaromatic Hydrocarbons (PAH) and Total Petroleum Hydrocarbons (TPH) Aromatic and Aliphatic splits. In addition the samples were subject to asbestos screening.

The results are provided in full in Appendix D and summarised as Tables 1 and 2 below. The CLEA UK Model Output Reports have been included in Appendix D.

Determinant	Units	Number of Samples above Level of Detection	Minimum Level	Maximum Level	Threshold Value	Number of Results Exceeding Threshold Value
Metals						
Cadmium	mg/kg	5	0.2	0.9	12	0
Chromium	mg/kg	5	5.7	30	1640	0
Chromium VI	mg/kg	0	<1.0	-	2.14	0
Copper	mg/kg	5	12	71	4040	0
Lead	mg/kg	5	6.1	130	276*	0
Mercury	mg/kg	4	<0.05	0.97	218	0
Nickel	mg/kg	5	6.9	26	64.3	0
Zinc	mg/kg	5	34	140	30700	0
Semi metals and non metals						
Arsenic	mg/kg	5	2.2	15	35	0
Boron	mg/kg	5	1.3	2.0	378	0
Selenium	mg/kg	1	<0.5	0.8	593	0
Inorganic chemicals						
Cyanide	mg/kg	3	<0.1	0.7	73.7	0
W.S. Sulphate	mg/l	5	22	1300	500#	1
Sulphide	mg/kg	4	<10	1800	250+	1
Other						
pH	pH	5	8.1	10.3	<5.5+	0
Phenol	mg/kg	3	<0.3	1.2	611	0
Asbestos	-	5	No Fibres Detected			

TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS

* SSV Residential with home grown produce
\+ EA derived thresholds
\# BRE Special Digest One

Metals, Semi Metals and Non Metals (Asbestos)

The metals, semi and non metals tested were below the GAC and SSV thresholds. No asbestos fibres were detected in the five samples.

Inorganic Chemicals

Cyanide concentrations were recorded below the threshold limits. Soluble sulphate (potentially aggressive to foundation concrete was recorded between 22 and 1300mg/l. Sulphide concentration levels were low apart from one sample of slag and clinker gravel fill within BH3 at 0.01mbgl where a concentration of 1800mg/kg was detected.

Organic Chemicals

A summary of the organic results are presented below, where the assessment criterion is all in red the soil saturation limit has been used as the GAC threshold.

Determinant	Units	Number of Samples Determinant Detected in	Minimum Level (mg/kg)	Maximum Level (mg/kg)	Threshold Value (mg/kg)	Number of Results Exceeding Threshold Value
TPH Aliphatic Fractions						
C5-6	mg/kg	0	<0.01	-	230s	0
C6-8	mg/kg	0	<0.01	-	104s	0
C8-10	mg/kg	1	<0.01	0.03	54.7s	0
C10-12	mg/kg	1	<1.5	1.7	33.3s	0
C12-16	mg/kg	1	<1.2	63	16.6	1
C16-21	mg/kg	1	<1.5	180	80400	0
C21-35	mg/kg	1	<3.4	600	80400	0
TPH Aromatic Fractions						
C5-7	mg/kg	0	<0.01	-	2.76	0
C7-8	mg/kg	0	<0.01	-	679s	0
C8-10	mg/kg	1	<0.01	0.24	302	0
C10-12	mg/kg	1	<0.9	3.3	258s	0
C12-16	mg/kg	1	<0.5	19	1730	0
C16-21	mg/kg	1	<0.6	100	1320	0
C21-35	mg/kg	1	<1.4	850	1330	0
Speciated PAH						
Acenaphthene	mg/kg	0	<0.1	-	40.4s	0
Acenaphthylene	mg/kg	0	<0.1	-	61.2s	0
Anthracene	mg/kg	0	<0.1	-	23500	0
Benz' (a)anthracene	mg/kg	0	<0.1	-	4.99	0
Benz' (a)pyrene	mg/kg	0	<0.1	-	0.772	0
Benz' (b)fluor' ene	mg/kg	0	<0.1	-	5.49	0
Benz' (k)fluor' ene	mg/kg	0	<0.1	-	7.73	0
Benz (ghi)per' ene	mg/kg	0	<0.1	-	35.3	0
Chrysene	mg/kg	0	<0.1	-	7.64	0
Dibenz(ah)anth'ene	mg/kg	0	<0.1	-	0.694	0
Fluoranthene	mg/kg	0	<0.1	-	1000	0
Fluorene	mg/kg	0	<0.1	-	2900	0
Id' (123cd)pyrene	mg/kg	0	<0.1	-	3.31	0
Napthalene	mg/kg	0	<0.1	-	14.1	0
Phenanthrene	mg/kg	0	<0.1	-	975	0
Pyrene	mg/kg	0	<0.1	-	2400	0
Other						
PAH Total	mg/kg	0	<1.6	-	50[+]	0

TABLE 2: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS

[+] EA derived thresholds s Soil Saturation Limit

None of the PAH and TPH contaminants were raised apart from one sample of slag and clinker gravel fill within BH3 at 0.01mbgl where a concentration of Aliphatic c12-16 was raised (63mg/kg) above the soils saturation limit.

Contamination Assessment

A qualitative approach using the statutory definition of Contaminated land, as defined within Section 78A (2) of Part 2A of the Environmental Protection Act (1990), has been adopted. This defines contaminated land as:

> *"Any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in or on or under the land that "Significant harm is being caused or there is a significant possibility of such harm being caused; or pollution of controlled waters is being or is likely to be, caused".*

The concept of "significant harm" is dealt with via Government guidance (DEFRE circular 01/2006 Contaminated Land). The statutory guidance uses the concept of pollutant linkages set out in the Circular. Before the local authority can make a judgment on whether "significant harm" and the significant possibility of harm is being caused they are required to identify a "significant pollution linkage". This means effectively that three elements (a source of contamination, a relevant receptor and a pathway) must be present. Without identification of all three elements together, land should not be regarded as "contaminated" in the statutory sense. See Appendix F for additional notes on contamination guidelines.

Conceptual Model and Pollution Linkages

The contamination conceptual model in Table 3 identifies the potential pollution linkages present on site based on source – pathway – receptor relationships.

SOURCES	PATHWAYS	RECEPTORS
Made ground proven up to 1.35mbgl comprising clayey and granular fill over firm and stiff clays onto sandstone. History of site indicates previous use as fields then a golf course followed by Leisure Centre. No areas of obvious contamination on ground surface. Former landfills on site. Coal mining area.	Dermal absorption	Users of site, adults and child receptors.
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	
	Ground Gas Migration	
	Dermal absorption	Construction Workers
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	
	Dermal absorption	Users of surrounding sites
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
	Taken up through roots and foliage	Vegetation, soft landscaping assumed.
	Direct contact	
	Slow seepage or leaching of contaminants	Groundwater none encountered. Secondary A Aquifer, not in Source Protection Zone.
	Slow seepage or leaching of contaminants	Surface Water none in vicinity.
	Accumulation of contaminated sediments	
	Direct contact	Construction Materials

TABLE 3: SUMMARY OF POLLUTION LINKAGES

In general terms, the users of the site, construction workers, users of the surrounding sites, vegetation and construction materials are considered to be **potentially** at risk from contamination in the soils on site as pollution linkages may be present for each of these receptors.

Users of the Site Once Development is Complete

The users of the site are likely to be exposed to contaminants present in the soils beneath the site, as soft landscaping is likely to be proposed in the final development. **Potential** exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion (or deliberate soil ingestion in the case of some children). To establish if the levels of contaminants present on site may pose a risk to the health of the future users of the site the results of the made ground contamination testing have been compared to a series of Solmek Generic Assessment Criteria (GAC) thresholds based on a residential land use without homegrown produce.

The results indicate that the levels of contamination within the made ground are generally low, with none of the samples tested exceeding threshold values for long term risk to human health. However the gravel slag fill from beneath the tarmac in BH3 contained one raised sulphide and speciated Aliphatic TPH.

It is therefore considered that the levels of contamination within the made ground on site are unlikely to pose a risk to the current and future users of the site, and remediation is not required beneath proposed hardstanding areas or the proposed building footprints. The gravel slag and clinker fill from around the area of BH3 can remain insitu provided the area remains under tarmac hardcover. Should the area be development then the fills should be removed to beneath areas of hardcover or off site to a suitable waste facility.

The topsoil on site has been tested and can be reused in proposed areas of soft landscaping. The cover system should include at least 300mm of clean topsoil sourced from the site over existing clay/granular fill. The topsoil and shallow fill materials should be screened of deleterious material such as brick rubble and be crushed then placed beneath areas of hardcover. The above measures act to block any pollution pathway to human receptors. If there is insufficient topsoil for the proposed design, this will have to be imported from a reputable source with certification.

If any zones of odorous, brightly coloured or suspected contaminated ground are encountered then work should cease in that area until the material has been tested. The results of the tests will determine whether or not remediation will be required.

The current legislation on waste involves the categorization of materials into inert waste, non reactive hazardous wastes and hazardous wastes. The determination of the category depends on DEFRA landfill directive waste acceptance criteria (WAC). Material taken off site may be subject to WAC by the appropriate waste disposal company.

Construction Workers and Users of Surrounding Sites

Short term human exposure to contaminants present in soils can occur via several pathways during the construction and ground works phase of the development. These include dermal absorption after contact with contaminated ground, inhalation of soil or dust (including windblown dust), inhalation of volatised compounds, inadvertent soil ingestion and contact with contaminated groundwater.

Using guidance in the HSE publication *"Protection of Workers and the General Public during the Development of Contaminated Land"*, the made ground can generally be classed as uncontaminated with only nickel falling into the slightly contaminated category, pH (highly alkaline) in the heavily contaminated and sulphide the unusually heavily contaminated categories. As a minimum PPE should be employed in accordance with HSE guidance and safeguards should be taken to limit dust during ground works, and limit access to the public.

Vegetation

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, lead, nickel, and zinc.

To establish if the levels of contaminants present on site may pose a risk to vegetation the results of the contamination testing have been compared to a series of threshold values published in "*Code of Good Agricultural Practice for the Protection of Soil*". Following comparison, the levels of the phytotoxic determinants were all low within the samples tested.

The topsoil on site has been tested and can be reused in proposed areas of soft landscaping. The cover system should include at least 300mm of clean topsoil sourced from the site over existing clay/granular fills.

Surface water and Groundwater

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology.

Groundwater was not encountered during the fieldwork or monitoring visits. It should also be noted that groundwater levels vary with rainfall, time of year and in proximity to local abstractions and dewatering activities.

The site lies over a Secondary A Aquifer and does not lie within a Source Protection Zone. There are no surface water bodies in the vicinity and no groundwater was recorded. Given the lack of surface and groundwater

receptors and presence of impermeable clay continuous across the site the risk to controlled waters from contamination is low.

Construction Materials

Materials at risk from potential soil contamination include inorganic matrices such as cement and concrete and also organic material; e.g. plastics and rubbers. Acid ground conditions and elevated levels of sulphates can accelerate the corrosion of building materials. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

BRE Special Digest One: *"Concrete in Aggressive Ground"*:2005 3rd Edition has been used to assess the risks posed to underground concrete and to establish the design measures required to mitigate the risks. The results of the pH and sulphate tests fall into Class DS-2, ACEC (Class AC-1s) requirements for concrete protection. This assumes static groundwater conditions.

The levels of potential contaminants detected have been compared to thresholds supplied in the Water Regulations Advisory Scheme Guidance Note 9-04-03 *"The Selection of materials for Water Supply Pipes to be laid in Contaminated Land"*. Based on the contamination test results, arsenic and pH were raised. Consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.

6 GROUND GAS ASSESSMENT

Ground gases such as carbon dioxide and methane can be classed as a form of contamination where there is a potential risk to human health. As a result, gas monitoring was carried out over June and July 2012.

The gas was monitored by measuring emissions from one monitoring point installed into borehole 1 during the fieldwork. The results are tabulated in Appendix E. The monitoring was generally carried out in accordance with current guidance provided within CIRIA C665:2007.

The atmospheric pressure has an impact on the concentrations of gas released. The atmospheric pressure ranged from 984 to 1012 millibars (mb) during the monitoring visits and both falling and rising atmospheric pressure regional trends were noted. Readings under atmospheric conditions of 1000mb are preferred as these are considered a worse case scenario.

Methane was not detected and carbon dioxide levels were recorded between 0.3 and 0.7%. The oxygen levels ranged from 19.6 to 20.1% by volume. No significant flows were recorded.

The results obtained have been compared with relevant guidance that includes the following:

- BRE/Environment Agency BR414 (2001) - Protective Measures for housing on gas-contaminated land
- Wilson & Card (1999) - Reliability and Risk in Gas Protection Design
- CIRIA 149 (1995) - Protecting Development from Methane
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings.

The Building Regulations set action levels for both methane and carbon dioxide from which an initial assessment can be made. The action threshold for methane is 1% while for carbon dioxide an initial consideration should be undertaken if gas concentrations exceed 1.5%. Action might be required if carbon dioxide concentrations exceed 5%. If these thresholds are exceeded, reference should be made to specific documentation to determine the nature and extent of the gas control measures required.

A Characteristic Situation ranking of between 1 and 6 is given based on the ground gas monitoring results coupled with the gas flow rate. These combined produce a Gas Screening Value (GSV). Where no flow is recorded a flow rate of 0.1l/hr is assumed. The GSV and risk classification define the characteristic situation, which are comparable to Table 4 below, taken from CIRIA C665 2007, and derived from CIRIA R149.

CHARACTERISTIC SITUATION (CS)	RISK CLASSIFICATION	GAS SCREENING VALUE CH_4 OR CO_2 (l/hr)	ADDITIONAL FACTORS
1	Very Low Risk	<0.07	*CS1 where CH_4 is <1% and/or CO_2 is <5%, Otherwise increase to CS2*
2	Low Risk	<0.7	
3	Moderate Risk	<3.5	
4	Moderate to High Risk	<15	
5	High Risk	<70	
6	Very High Risk	>70	

TABLE 4: CIRIA R149 Gas Characteristic Situation

The results of the gas monitoring show the site falls within the CS1 classification whereby no precautions are necessary. A table showing the gas protection measures required is presented in Appendix F.

7 CONCEPTUAL MODEL AND RISK ASSESSMENT

The conceptual model (Table 5) collates the salient aspects of the site to form a model. This model identifies the potential pollution linkages that may influence the proposed development and the relevant geological considerations.

SOURCES	PATHWAYS	RECEPTORS	MITIGATION	RISK RATING
Low levels of contamination present across the site within the made ground topsoil and clay/sand fill but one elevated sulphide and speciated TPH in the slag and clinker gravel fill beneath the tarmac in BH3 at 0.01mbgl. No areas of obvious contamination on ground surface. History of site indicates previous use as fields then a golf course followed by Leisure Centre. No areas of obvious contamination on ground surface. Former landfills on site. Coal mining area. CH_4 0.0% CO_2 0.3-0.7% O_2 above 19.6-20.1% Radon protection measures not required.	Dermal absorption Inhalation of soil/volatised compounds Ingestion of soil Contact with contaminated groundwater	Proposed new swimming pool. Transient children and adults within the proposed structure.	The site to be capped by the development with areas of soft landscaping. Remediation is not required beneath hardstanding or the building footprints. Clean cover system for soft landscaped areas. Alternatively import topsoil from a reputable source.	LOW
	Ground gas migration. Clay and granular fill over natural clay.		Characteristic Situation (CS) 1. No precautions necessary.	LOW
	Dermal absorption Inhalation of soil/volatised compounds (dust) Ingestion of soil Contact with contaminated groundwater	Construction workers.	Made ground on site generally classed as uncontaminated. Nickel falls into the slightly contaminated category, pH heavily contaminated and sulphide unusually heavily contaminated category. Appropriate PPE should be employed as a matter of course. Limit dust during ground works and demolition.	LOW
	Dermal absorption Inhalation of soil/volatised compounds (dust) Ingestion of soil	Surrounding areas comprise residential areas.	Damping down of site in dry/windy conditions and limit access by the public.	LOW
	Uptake via roots and leaf surfaces	Soft landscaping.	Topsoil to be reused in proposed soft landscaping areas. Screen topsoil and underlying fills of deleterious material, place this beneath hardcover. Cover to comprise topsoil 300mm onto screened fills. Alternatively import from reputable source.	LOW
	Seepage or leaching of contaminants. Accumulation of contaminated sediments in water body.	Surface Water. No surface water bodies in area.	Site to be capped by the proposed development. No groundwater encountered. Impermeable clay layer, continuous across the site.	LOW
	Seepage or leaching of contaminants Clay fill over clays.	Secondary A Aquifer. No Source Protection Zones.		LOW
	Contact with contaminated soil/deleterious material.	Construction Materials and service fabrics	Class DS-2, AC-1s Arsenic and pH elevated for service fabric. Consultation with utility providers recommended.	LOW

TABLE 5: CONCEPTUAL MODEL AND RISK ASSESSMENT

8 GEOTECHNICAL TESTING

Samples taken from the boreholes underwent a series of geotechnical tests (BS 1377:1990) to aid foundation design and soil description. In addition insitu SPT's were undertaken within the underlying materials. The geotechnical results are presented in Appendix C.

Strength and Density

Triaxial soil strength testing was undertaken on ten samples of the natural clay from depths of between 1.20 and 7.45mbgl. The results ranged from 33 to 127kN/m^2 which are indicative of soft to stiff conditions. The two lowest results 33 and 36kN/m^2 (Soft) were recorded at depths of 5.0 and 7.0mbgl respectively. SPT N values of between 8 and 41 were recorded in the boreholes, when using the rule of thumb that five times the N value equates to shear strength this gives a range of Cu values from 40 to 205kN/m^2 indicating firm to very stiff conditions.

Moisture Contents

Disturbed samples recovered from the boreholes were subjected to moisture content tests to determine the moisture profile at depth. Moisture levels were between 14% and 33%.

Atterberg Limit Determinations

Three Atterberg Limit tests were carried out to classify the fine grained soils. The results were compared to the Casagrande Chart published in BS 5930 and showed the samples to be clay of high to very high plasticity. The Plasticity Indices of the samples were between 39 and 41 with moisture contents recorded at and above the corresponding plastic limit. The cohesive material can be assessed as having a **high** shrinkage potential in relation to NHBC guidance chapter 4.2.

pH and Sulphate Results

Four samples of soil were tested for acidity and soluble sulphate content to assess whether the natural materials may be potentially aggressive to building fabric. The results of the testing for pH ranged from 7.6 to 8.0 indicating slightly alkaline conditions. The soluble sulphates were recorded between 95 and 119mg/l.

Consolidation

Eight samples were selected for one dimensional consolidation testing at depths of between 1.2 and 7.45mbgl. The highest recorded coefficient of compressibility (M_v) ranged from 0.148 to 0.632m^2/MN and the lowest recorded M_v ranged from 0.007 to 0.030m^2/MN.

9 CONCLUSIONS AND SUMMARY

The Proposed Development

The proposal are for a redevelopment of the pool area of the leisure centre. The development will also include possible soft landscaped areas; mainly planting borders or beds.

Foundations

The current ground conditions generally indicate made ground to a maximum depth of 1.35mbgl. This overlies firm and stiff clays to depths of between 8.75 and 14.2mbgl onto weathered sandstone.

The ground conditions on the site are suitable for strip footing foundations 0.6m wide or $1m^2$ pad foundations placed on undisturbed natural clay at a depth of between 1.2 and 1.35mbgl. The average shear strength from the triaxial test results around 1.2mbgl is $72kN/m^2$ and at this depth a safe bearing capacity of $174kN/m^2$ can be assumed.

Prior to placing any foundation concrete all exposed formations should be well compacted and any obvious soft spots should be removed and replaced with hardcore. Furthermore, all excavations should be inspected to ensure that they fully penetrate any areas of disturbed ground. Assuming that any new structures are founded in the natural clays and will impart a load of less than $174kN/m^2$ at the required depth, total settlements should be less than 25mm.

Atterberg Limit testing indicates the fine grained soils at foundation depths have a **high** shrinkage potential. Reference should be made to NHBC Standards, Chapter 4.2 to determine the depth of foundations in the vicinity of existing trees and proposed trees.

Excavations and Groundwater

Based on the evidence of the investigation, shallow excavations should be easily achieved by means of a normal excavator. Stability of excavations is likely to be poor in the made ground but should improve within the natural clay deposits. Shoring may be required if excavations are likely to be left open for long periods or during inclement weather conditions. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: "Trenching Practice".

Groundwater was not encountered during the fieldwork or the subsequent monitoring visits. Therefore groundwater is unlikely to be encountered in shallow excavations. It should also be noted that groundwater levels may vary with rainfall, time of year and in proximity to local abstractions and dewatering activities.

Sulphate results

No pyritic soils were noted during the fieldwork and pH values were slightly alkaline to alkaline with soluble sulphate falling within the negligible range. Based on these results, Design Sulphate Class DS-2 should be appropriate and assuming static groundwater conditions the Aggressive Chemical Environment for Concrete (ACEC) assessment for the site should be taken as AC-1s, as prescribed in current BRE Special Digest 1.

Contamination

The gravel slag fill from beneath the tarmac in BH3 contained one raised sulphide and one raised speciated Aliphatic TPH. Remediation is not required beneath proposed hardstanding areas or the proposed building footprints. The gravel slag and clinker fill from around the area of BH3 can remain insitu provided the area remains under tarmac hardcover. However, should the area be development then the fills should be removed to beneath areas of hardcover or to a suitable waste facility.

The topsoil on site has been tested and can be reused in proposed areas of soft landscaping. The cover system should include at least 300mm of clean topsoil sourced from the site over existing clay/granular fill. The topsoil and shallow fill materials should be screened of deleterious material such as brick rubble and be crushed then placed beneath areas of hardcover. If there is insufficient topsoil for the proposed design, this will have to be imported from a reputable source with certification.

If any zones of odorous, brightly coloured or suspected contaminated ground are encountered then work should cease in that area until the material has been tested. The results of the tests will determine whether or not remediation will be required. Material taken off site may be subject to WAC by the appropriate waste disposal company.

The made ground can generally be classed as uncontaminated with only nickel falling into the slightly contaminated category, highly alkaline pH in the heavily contaminated and sulphide the unusually heavily contaminated categories. As a minimum PPE should be employed in accordance with HSE guidance and safeguards should be taken to limit dust during ground works, and limit access to the public.

The site lies over a Secondary A Aquifer and does not lie within a Source Protection Zone. There are no surface water bodies in the vicinity and no groundwater was recorded. Given the lack of surface and groundwater receptors and presence of impermeable clay across the site the risk to controlled waters from contamination is low.

The levels of potential contaminants detected have been compared to thresholds supplied in the Water Regulations Advisory Scheme Guidance Note 9-04-03 *"The Selection of materials for Water Supply Pipes to be laid in Contaminated Land"*. Based on the contamination test results, arsenic and pH were raised. Consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.

Ground Gas and Radon

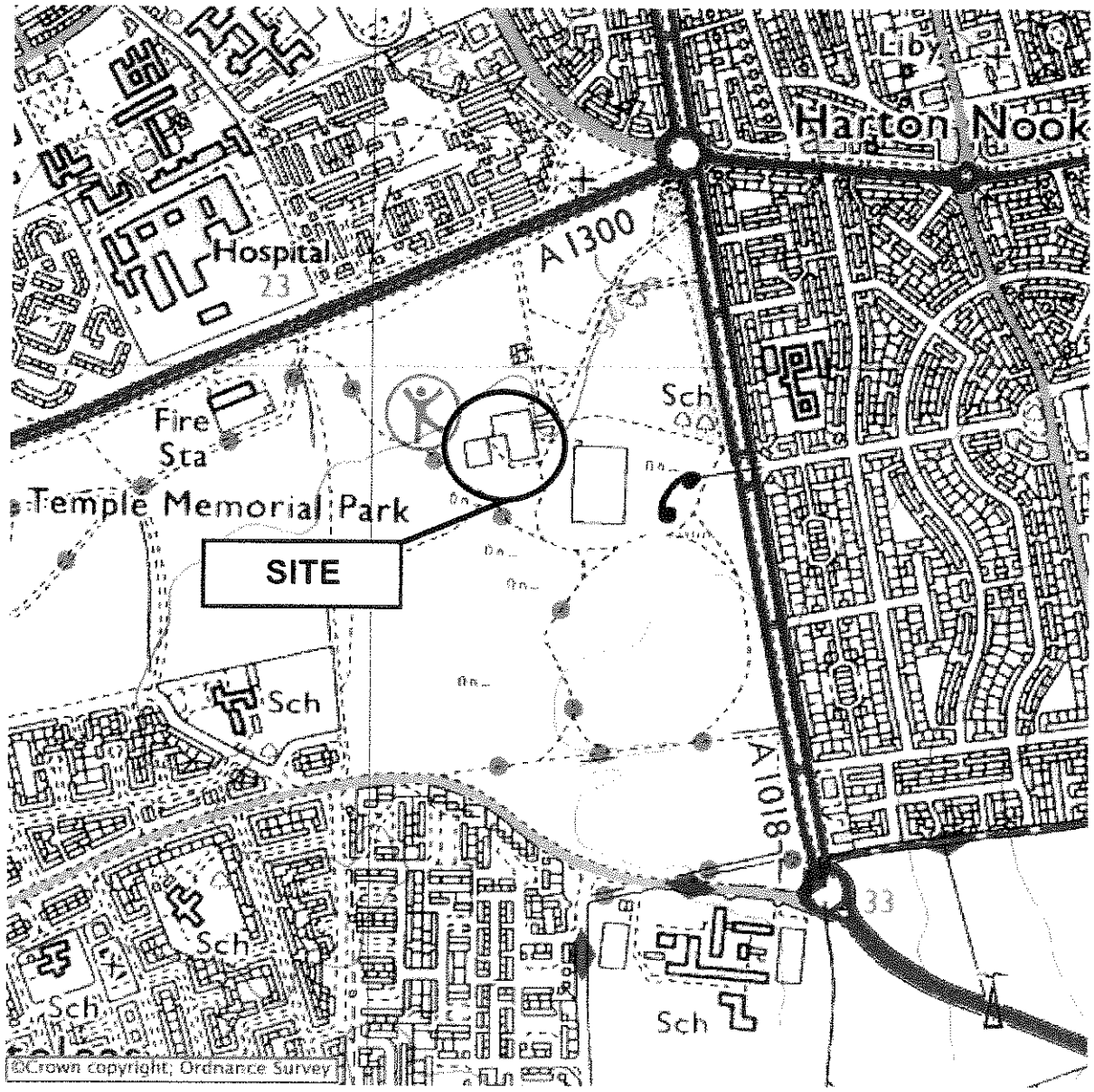
The gas was monitored by measuring emissions from one monitoring point installed into borehole 1 during the fieldwork. The atmospheric pressure ranged from 984 to 1012 millibars and both falling and rising atmospheric pressure regional trends were noted.

Methane was not detected and carbon dioxide levels were recorded between 0.3 and 0.7%. The oxygen levels ranged from 19.6 to 20.1% by volume. No significant flows were recorded. The results of the gas monitoring show the site falls within the CS1 classification whereby no precautions are necessary.

The BRE Radon – Guidance on Protective Measures for New Buildings Map 19 shows that no radon protective measures are necessary in the construction of any new dwellings or extensions.

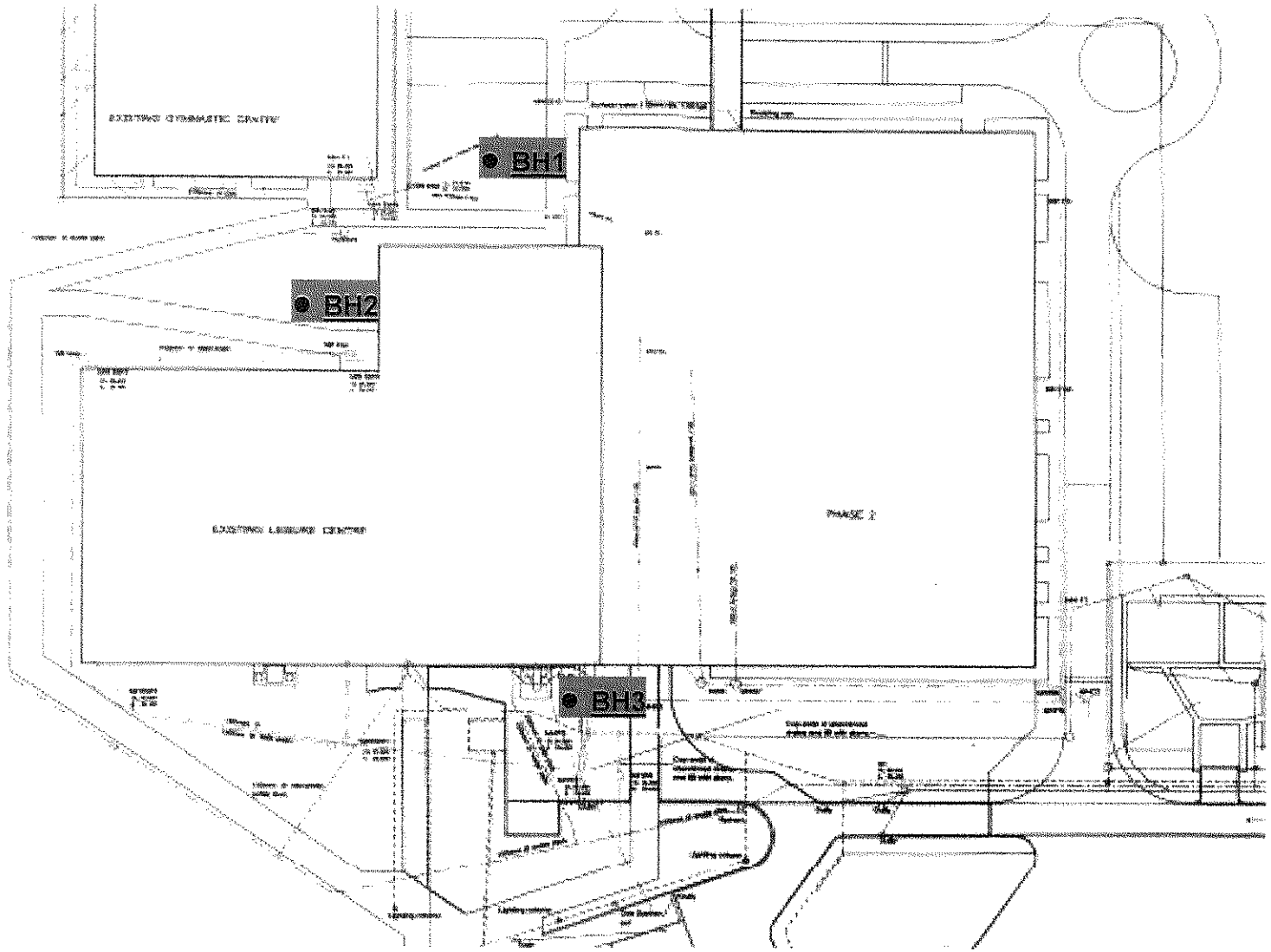
SOLMEK

APPENDIX A



Client:	South Tyneside Council	
Project:	Temple Park Leisure Centre	
Title:	Site Location Map	
Drawing No:	Figure 1	Scale: NTS
Date	July 2012	

SOLMEK



Title	Borehole Location Plan
Project	Temple Park, South Shields
Client	South Tyneside Council
Date	July 2012
DRG No	Figure 2
Scale	NTS

Solmek
12 Yarm Road
Stockton on Tees
Cleveland
TS18 3NA
Tel: +44 (0) 1642 607 083
Fax: +44 (0) 1642 612 355
Email: south@solmek.com
www.solmek.com

SOLMEK

APPENDIX B

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH1**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	08-05-12			
Contractor				Sheet 1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10-0.50	B					0.10	MADE GROUND: Grass over brown clayey gravelly topsoil. Gravel is angular to sub rounded fine to coarse sandstone, brick and limestone.		
0.10	D						MADE GROUND: Brown slightly sandy gravelly clay fill. Gravel is angular to sub angular fine to coarse sandstone, limestone and brick.		
0.50	D					(1.00)			
0.60-1.00	B								
0.80	D					1.10			
1.20-1.65	U	52 blows					Firm locally stiff brown to grey brown locally indistinctly thinly laminated slightly sandy CLAY.		
1.80	B								
2.00-2.45	B SPT	N=13							
3.00-3.45	U	39 blows				(4.50)			
4.00-4.45	B SPT	N=11							
5.00-5.45	U	31 blows				5.60			
5.70-6.00	B						Stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone.		
6.00-6.45	B SPT	N=20							
7.00-7.45	U	49 blows							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	Gas standpipe instlalled on completion. No groundwater encoutered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH1**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	08-05-12			
Contractor				Sheet
				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
8.00-8.45	B						Stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone. *(continued)*		
	SPT	N=28							
9.20-9.65	U	72 blows				(8.60)			
10.50-10.95	B								
	SPT	N=28							
11.00-11.15	SPT	N=50 for 20mm							
12.00-12.45	U	64 blows							
13.50-13.95	B								
	SPT	N=41				14.20			
14.20-14.35	SPT	N=50+				(0.45)	Very weak yellow brown completely weathered SANDSTONE. Recovered as gravelly sand.		
14.50-14.60	SPT	N=50 for 30mm				14.65			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
11.1	11.35	0020		
14.2	14.65	0040		

GENERAL REMARKS

Gas standpipe instlalled on completion.
No groundwater encoutered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH2**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	09-05-12			
Contractor				Sheet
				1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.10	B					0.15	MADE GROUND: Grass over dark brown clayey gravelly topsoil. Gravel is angular to sub rounded fine to coarse sandstone, brick and limestone.		
	D					0.30			
0.30	B					0.50	MADE GROUND: Yellow brown to dark brown clayey sandy angular to sub angular gravel of limestone.		
	D								
0.40	B						MADE GROUND: Brown slightly sandy gravelly clay fill. Gravel is angular to sub angular fine to coarse sandstone, limestone, brick and occasional glass fragments.		
1.20-1.65	U	29 blows					Firm brown to grey brown locally indistinctly thinly laminated slightly sandy CLAY.		
1.65-1.80	B								
2.00-2.45	B								
	SPT	N=8							
3.00-3.45	U	46 blows				(5.00)			
4.00-4.45	B								
	SPT	N=10							
5.00-5.45	U	51 blows							
						5.50			
5.60-5.80	B						Stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone.		
6.00-6.45	B								
	SPT	N=20							
7.00-7.45	U	75 blows							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	No groundwater encountered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH2**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	09-05-12			
Contractor				Sheet
				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
8.10-8.55	B SPT	N=26					Stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone. *(continued)*		
9.00-9.35	U	100 blows				(8.00)			
10.50-10.95	B SPT	N=28							
11.50-11.95	SPT	N=34							
12.00-12.45	B SPT	N=37							
						13.50			
13.50-13.50	SPT	N=50 for 30mm					Very weak yellow brown completely weathered SANDSTONE. Recovered as gravelly sand.		
13.90-14.10	SPT	N=50 for 50mm				(1.15)			
						14.65			

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
13.5	13.9	0045		

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	10-05-12			
Contractor				Sheet
				1 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.01	B					0.15	MADE GROUND: Tarmac over dark brown to black sandy angular to sub angular fine to coarse gravel of slag, clinker and sandstone.		
0.50	B D					(1.20)	MADE GROUND: Loose yellow brown very clayey gravelly sand fill. Gravel is angular to sub angular fine to coarse sandstone and limestone. Occasional pieces of fabric.		
1.00	D								
1.20-1.25	B					1.35			
1.20-1.65	SPT	N=9					Firm brown to grey brown locally indistinctly thinly laminated slightly sandy CLAY.		
2.00-2.45	U	24 blows				(1.40)			
2.50-2.60	B					2.75			
3.00-3.45	B SPT	N=15					Stiff becoming very stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone.		
4.00-4.45	U	47 blows							
4.50-5.00	B								
5.10-5.55	B SPT	N=22							
6.00-6.45	U	61 blows				(6.00)			
6.50-7.00	B								
7.20-7.65	B SPT	N=30							

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	No groundwater encountered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

Solmek/Hymas Geo
12 Yarm Road, Stockton on tees
TS 18 3NA

Tel 01642 607083
Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Temple Park Leisure Centre, South Shields				**BH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S120505	10-05-12			
Contractor				Sheet
				2 of 2

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
8.00-8.27	U	100 blows				8.75	Stiff becoming very stiff brown to grey brown sandy gravelly CLAY. Gravel is angular to sub rounded fine to medium limestone and sandstone. *(continued)*		
8.70-8.75	SPT	N=50 for 20mm				(0.40) 9.15	Very weak yellow brown completely weathered SANDSTONE. Recovered as gravelly sand.		
9.10-9.15	SPT	N=50 for 20m							

Boring Progress and Water Observations					
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt

Chiselling			Water Added	
From	To	Hours	From	To
8.7	9.1	0100		

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:50	Client South Tyneside Council	Method/ Plant Used	Logged By AC

GRD_BOREHOLE_LOG S120505.GPJ AGS3_ALL.GDT 04/07/12

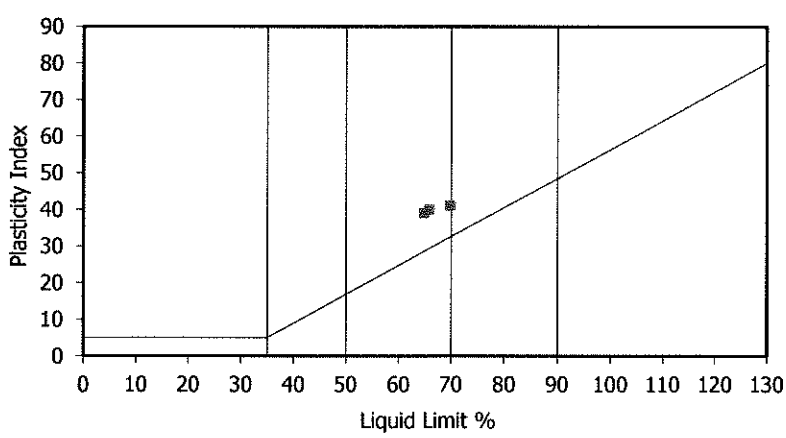
APPENDIX C

SUMMARY OF SOIL CLASSIFICATION TESTS
(BS1377-2:1990+A1:1996)

TEMPLE PARK LEISURE CENTRE, SOUTH SHIELDS
S120505

SOLMEK

Hole	Depth m	Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Plasticity	% Passing 425µm	pH	SO_4 Content mg/L	Chloride Content mg/L	Lab Shear Vane (kPa)
BH1	1.20	U100	29	66	26	40	CH	100.0	7.6	103		
BH1	3.00	U100	29									
BH1	5.00	U100	24									
BH1	7.00	U100	16									
BH2	1.20	U100	29	70	29	41	CH/CV	100.0	7.6	119		
BH2	3.00	U100	32						8.0	107		
BH2	5.00	U100	33									
BH2	7.00	U100	14									
BH3	2.00	U100	32	65	26	39	CH	100.0	7.9	95		
BH3	4.00	U100	14									
BH3	6.00	U100	20									



Liquid Limit

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

Comments

Prepared: [redacted] Date: 28/6/12

Checked: [redacted] Date: 03/07/12

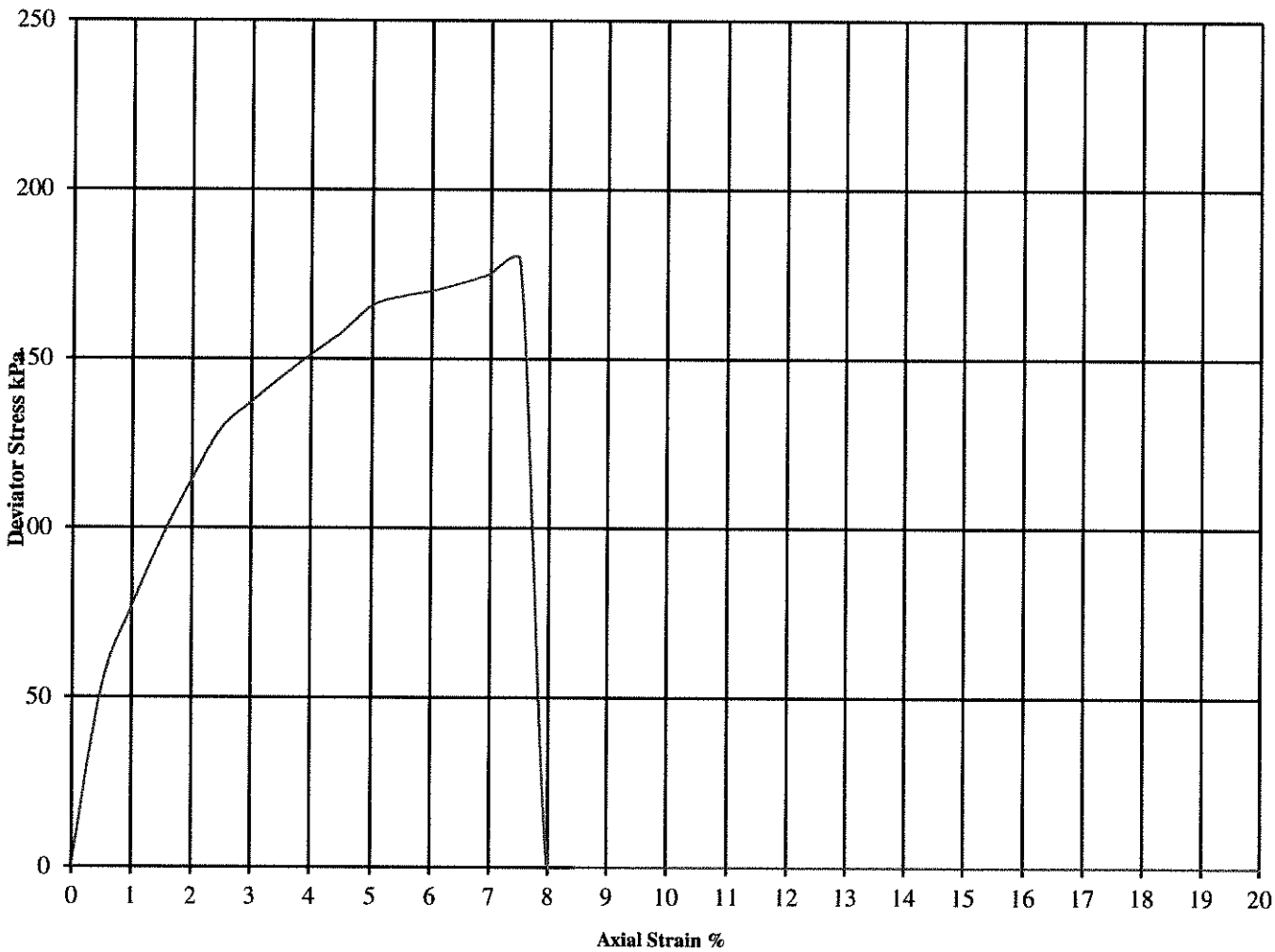
Approved: [redacted] Date: 03/07/12

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 1** **Depth (m)** **1.20 - 1.65**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	29	2.11	1.63	25	179	89	7.5	Brittle	89	
Sample Description:		Stiff grey thinly laminated CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/06/11

SOLMEK

Temple Park Leisure Centre, South Shields

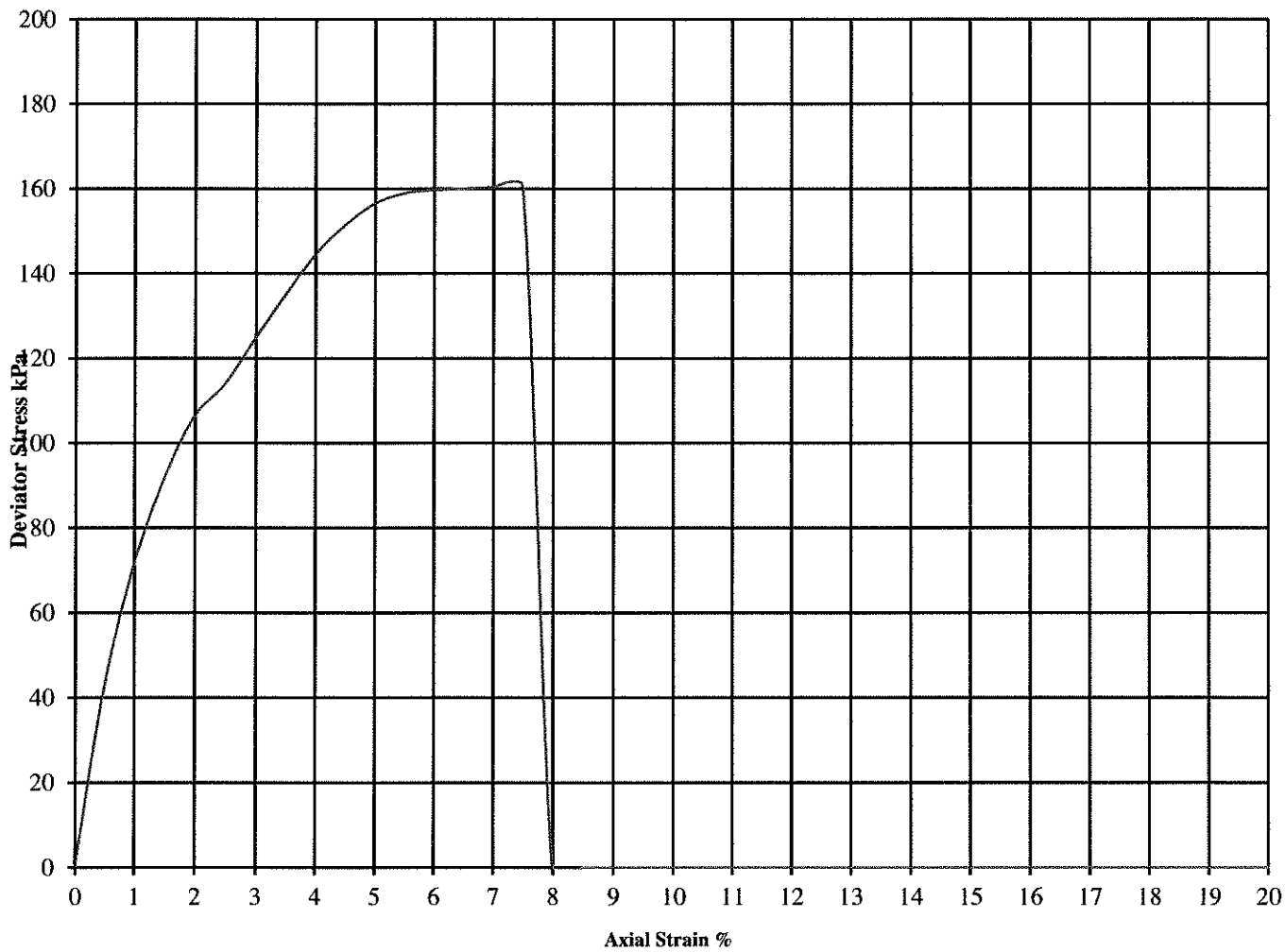
Contract No
S120505

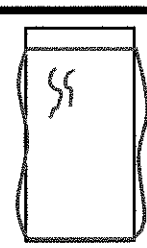
Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 1** **Depth (m)** **3.00-3.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	29	2.01	1.56	65	160	80	7.0	Compound	80	
Sample Description:		Stiff mid brown thinly laminated slightly gravelly CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	

Remarks:

Operator	Checked by	Date
[redacted]		28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

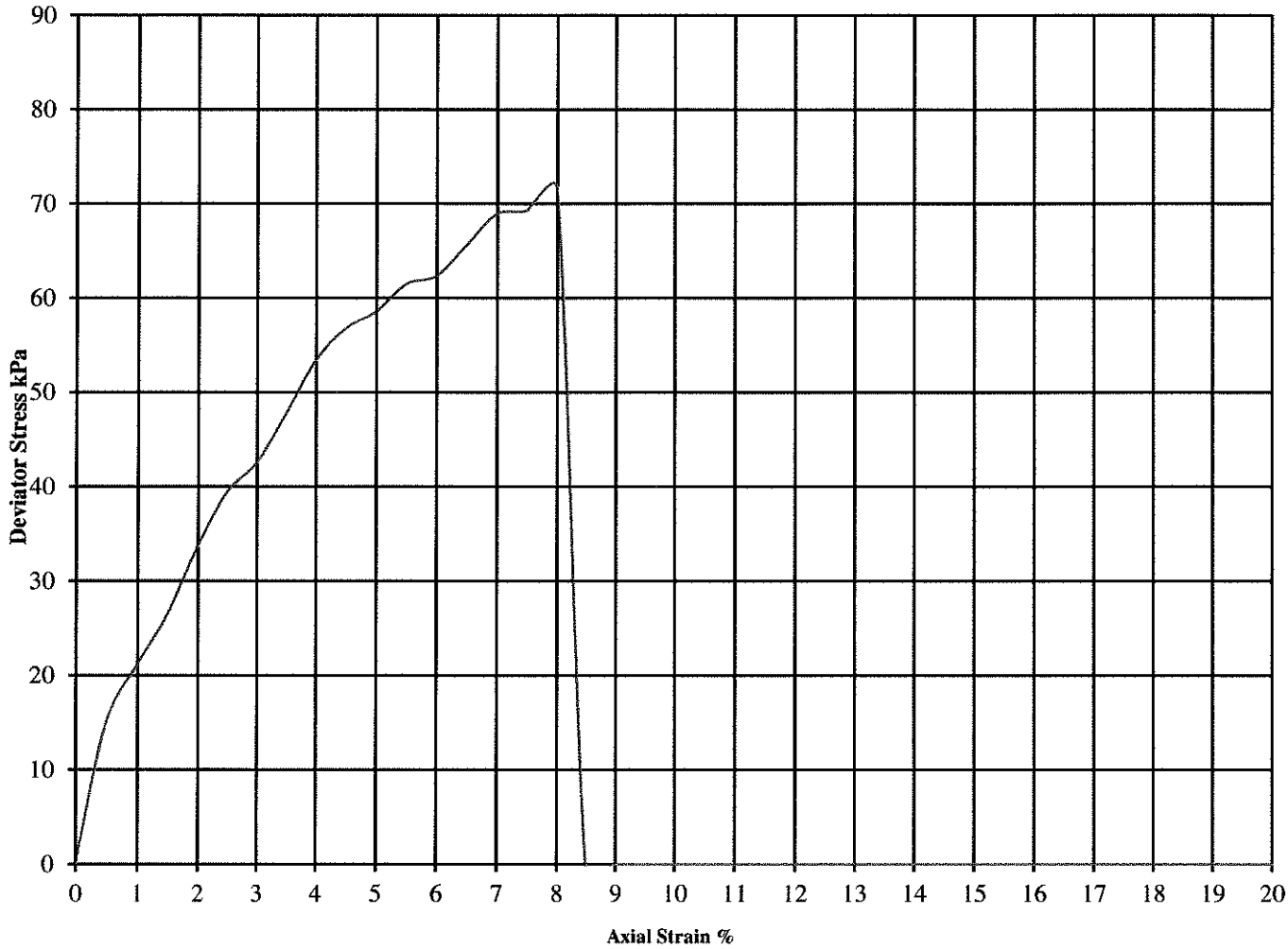
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 1** **Depth (m)** **7.00-7.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	16	2.29	1.97	150	72	36	8.0	Plastic	36	
Sample Description:		Firm mid brown gravelly CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

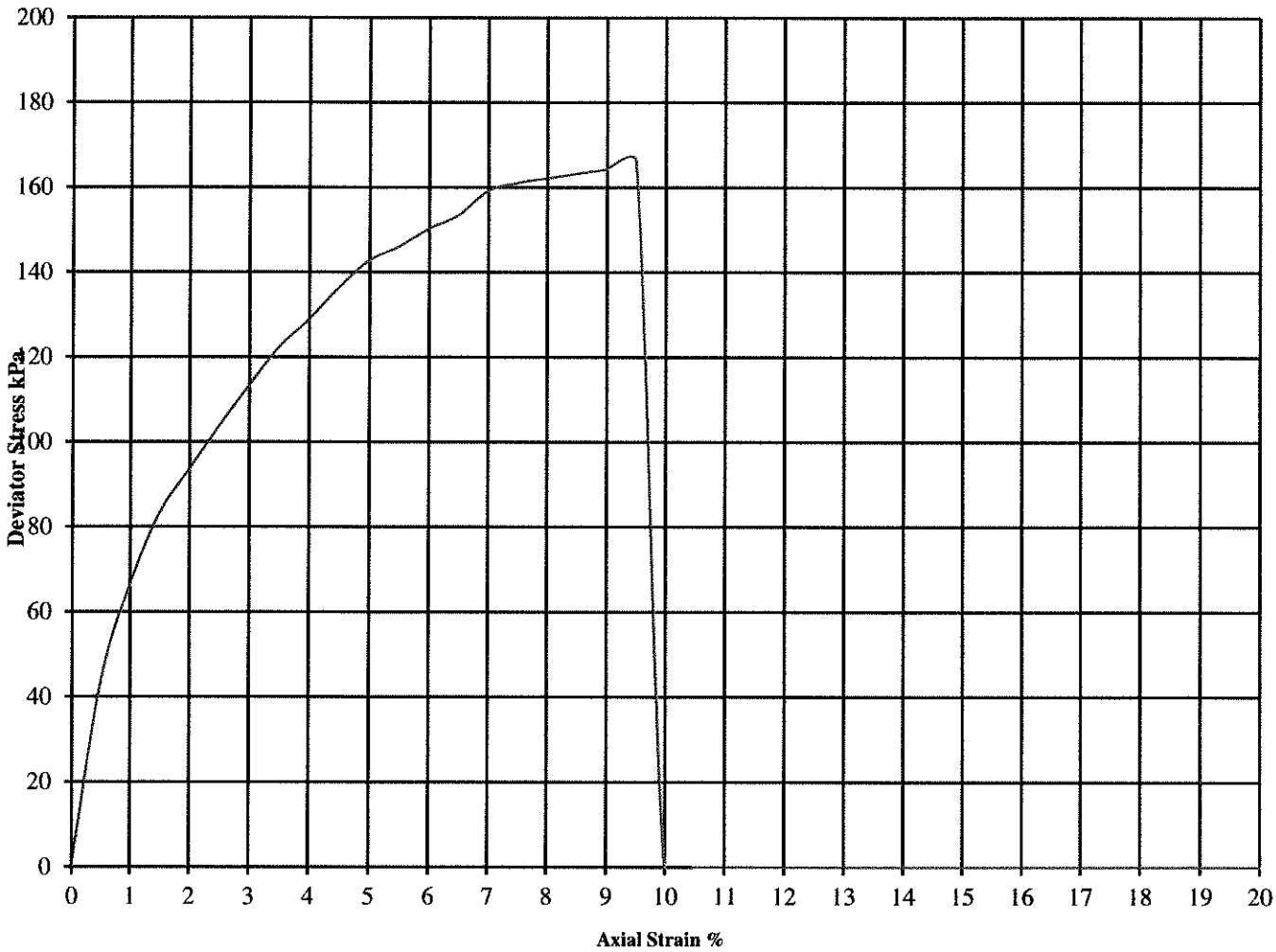
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 2** **Depth (m)** **1.20 - 1.65**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	29	2.14	1.66	25	166	83	9.5	Brittle	83	
Sample Description:		Stiff grey thinly laminated CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

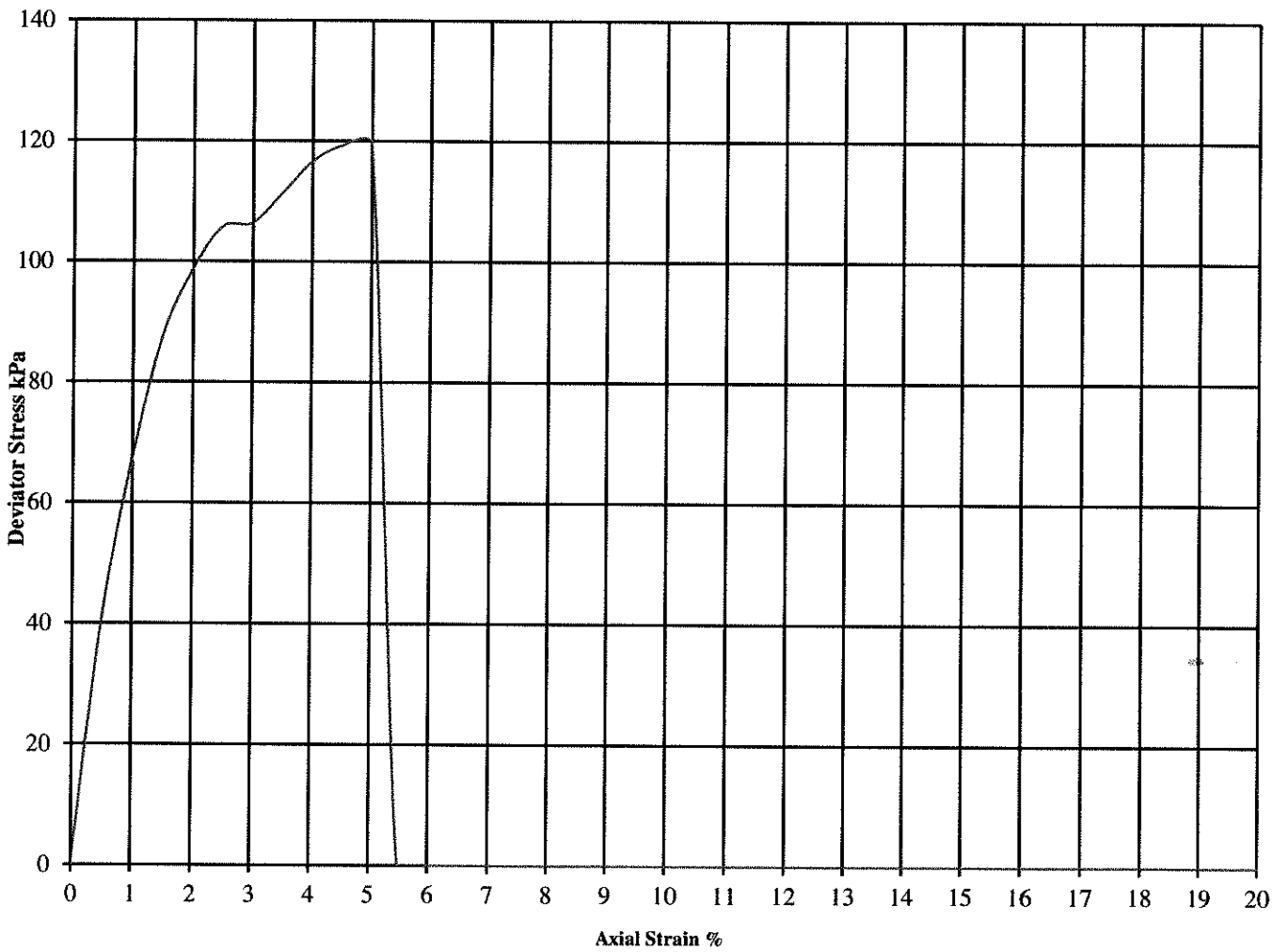
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 2** **Depth (m)** **3.00 - 3.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	32	1.91	1.45	60	119	60	5.0	Brittle	60	
Sample Description:		Firm brown thinly laminated CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

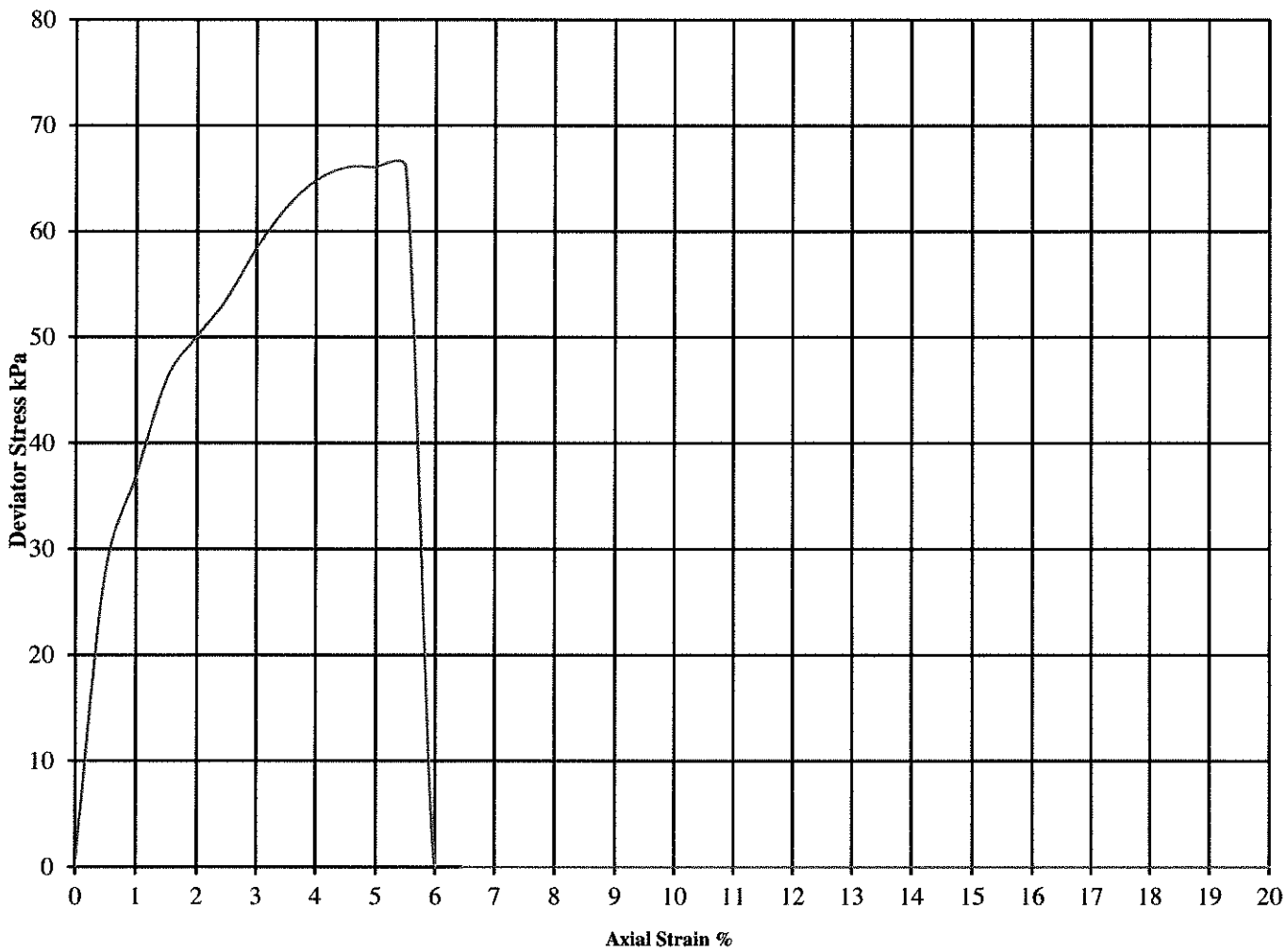
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 2** **Depth (m)** **5.00 - 5.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	33	1.85	1.39	100	66	33	5.5	Plastic	33	
Sample Description:		Soft brown CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		26/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

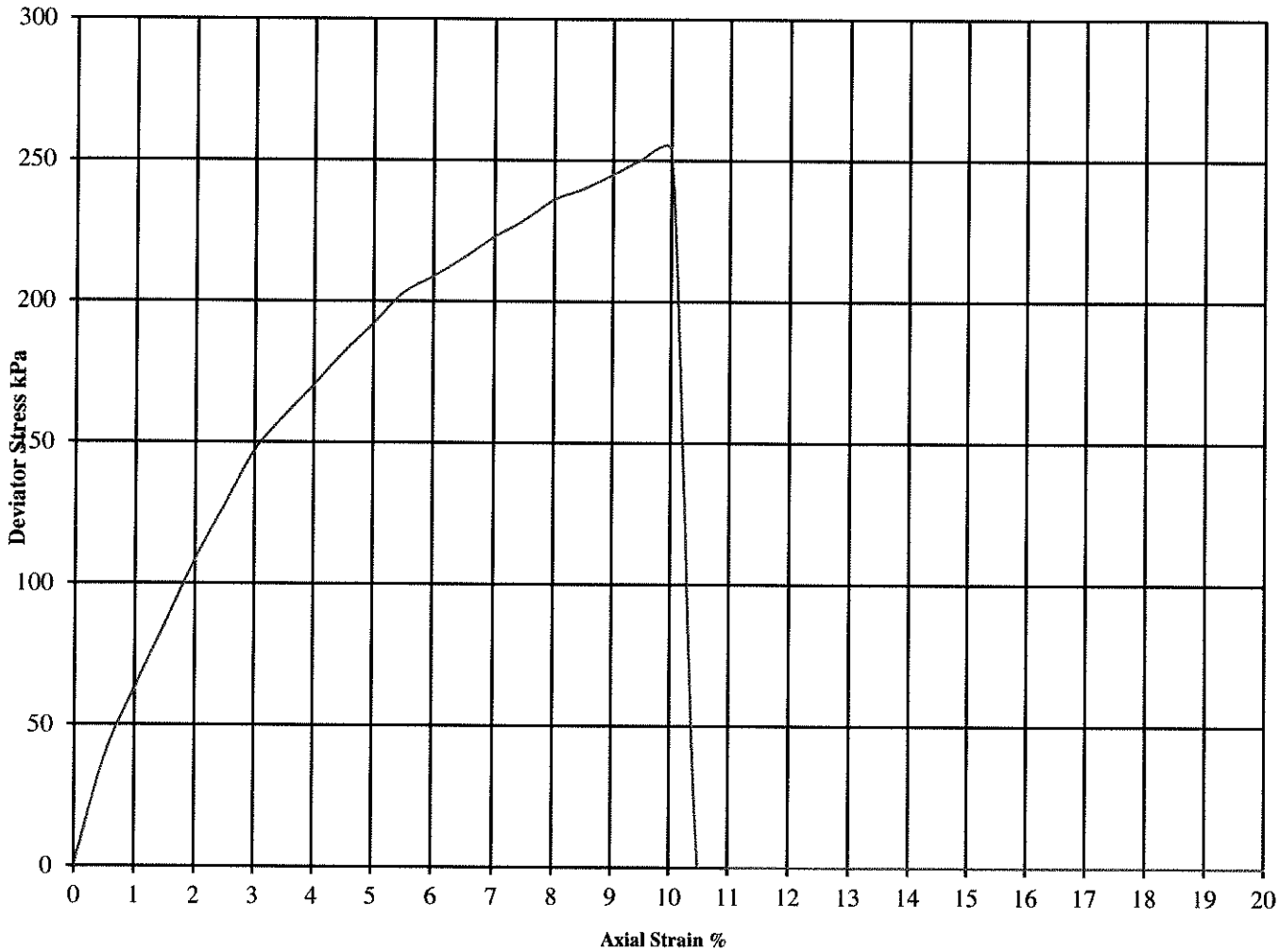
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 2** **Depth (m)** **7.00 - 7.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	14	2.41	2.11	140	254	127	10.0	Ring Limit	127	
Sample Description:		Stiff brown slightly gravelly CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/08/12

SOLMEK

Temple Park Leisure Centre, South Shields

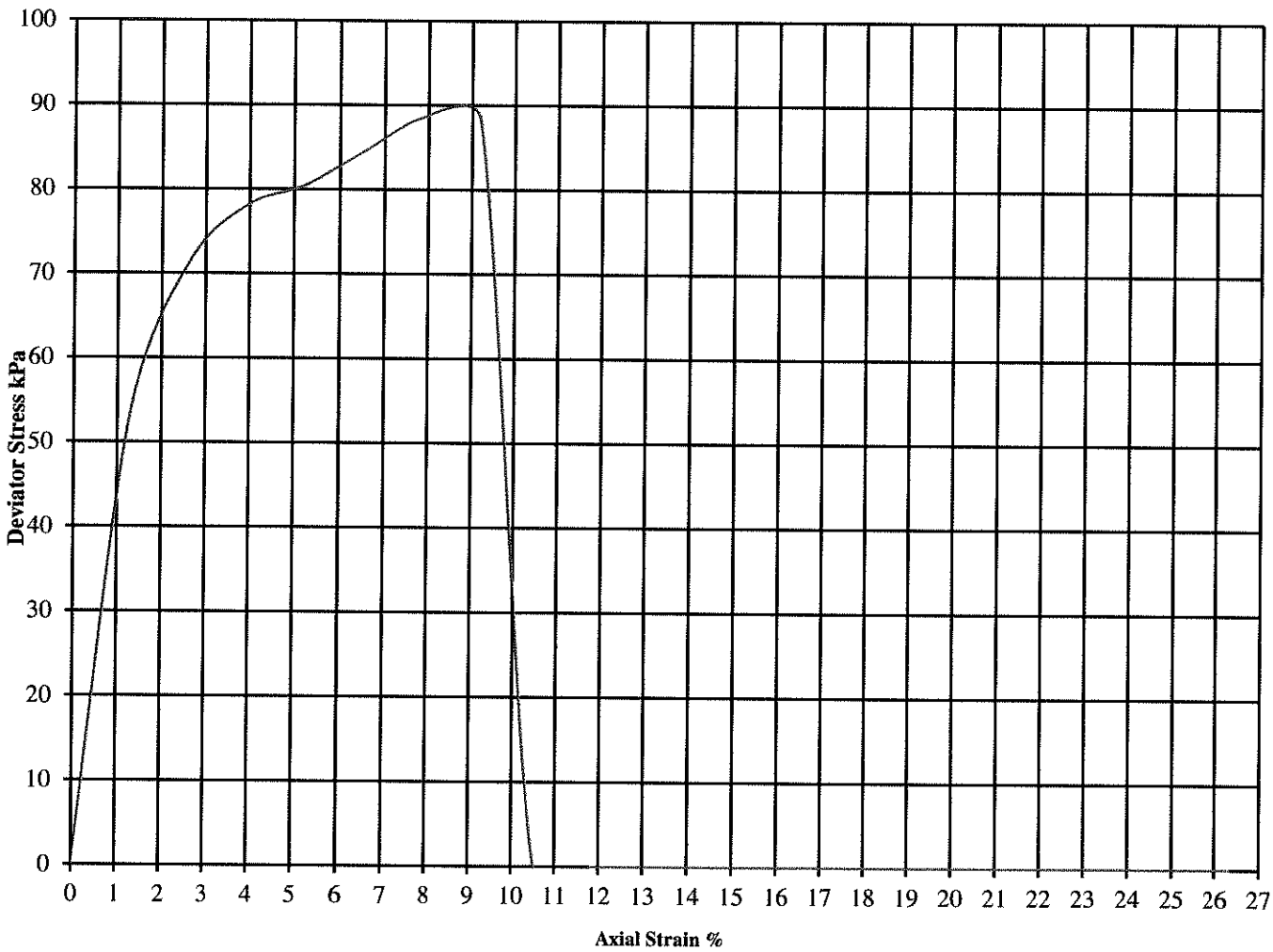
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

B.S. 1377 : Part7 : Clause 8 : 1990

Hole Reference **BH 3** **Depth (m)** **2**



Diameter (mm):		38	Height (mm):		76	Test:	38 mm Single Stage.			Diagram
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	31	1.92	1.46	40	89	44	7.9	Compound	44	
Description		Firm mid brown gravelly CLAY								

Checked and Approved	Date
[redacted]	28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

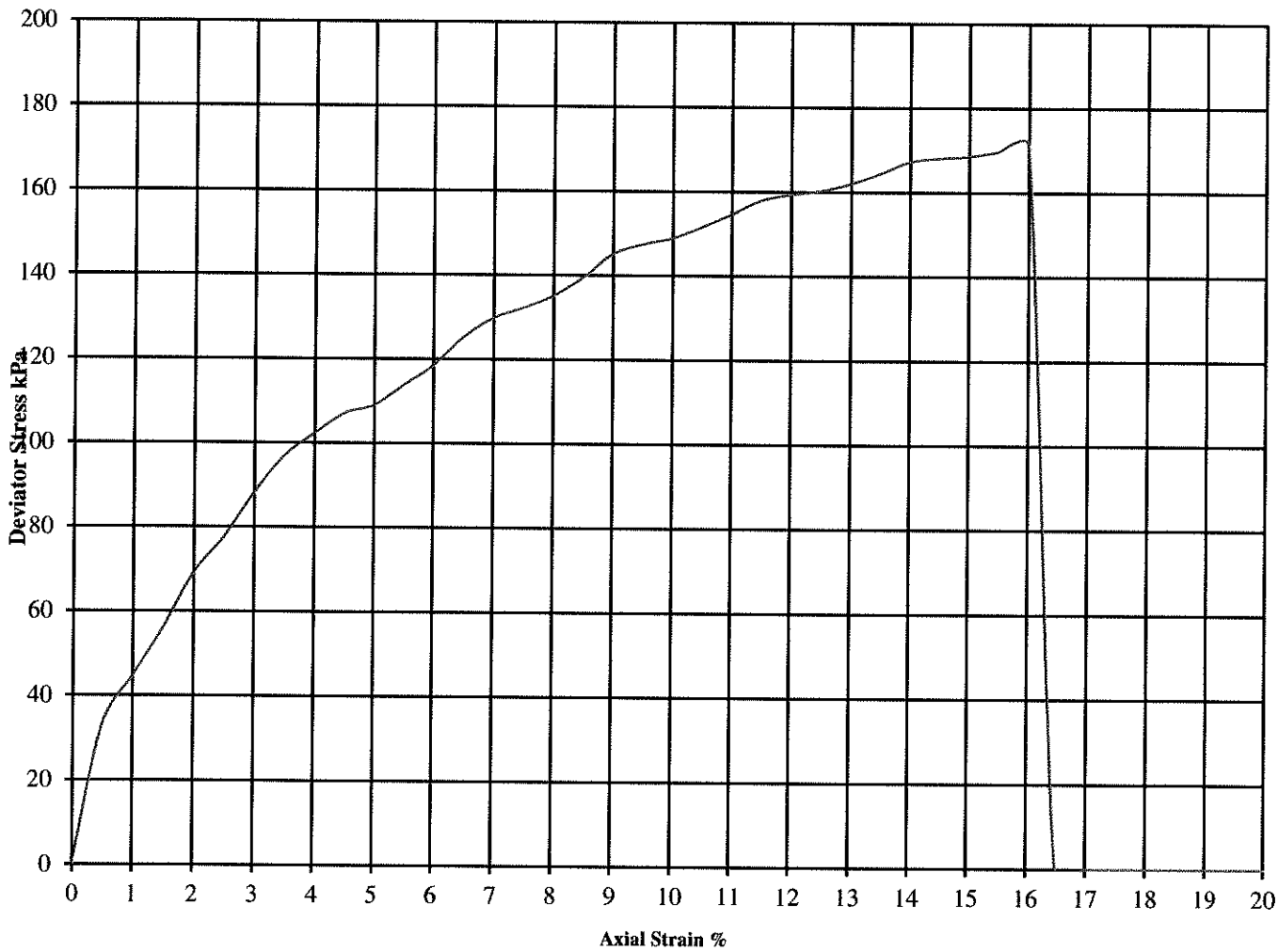
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 3** **Depth (m)** **4.00 - 4.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	14	2.34	2.05	80	171	86	16.0	Compound	86	
Sample Description:		Stiff brown gravelly CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		26/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

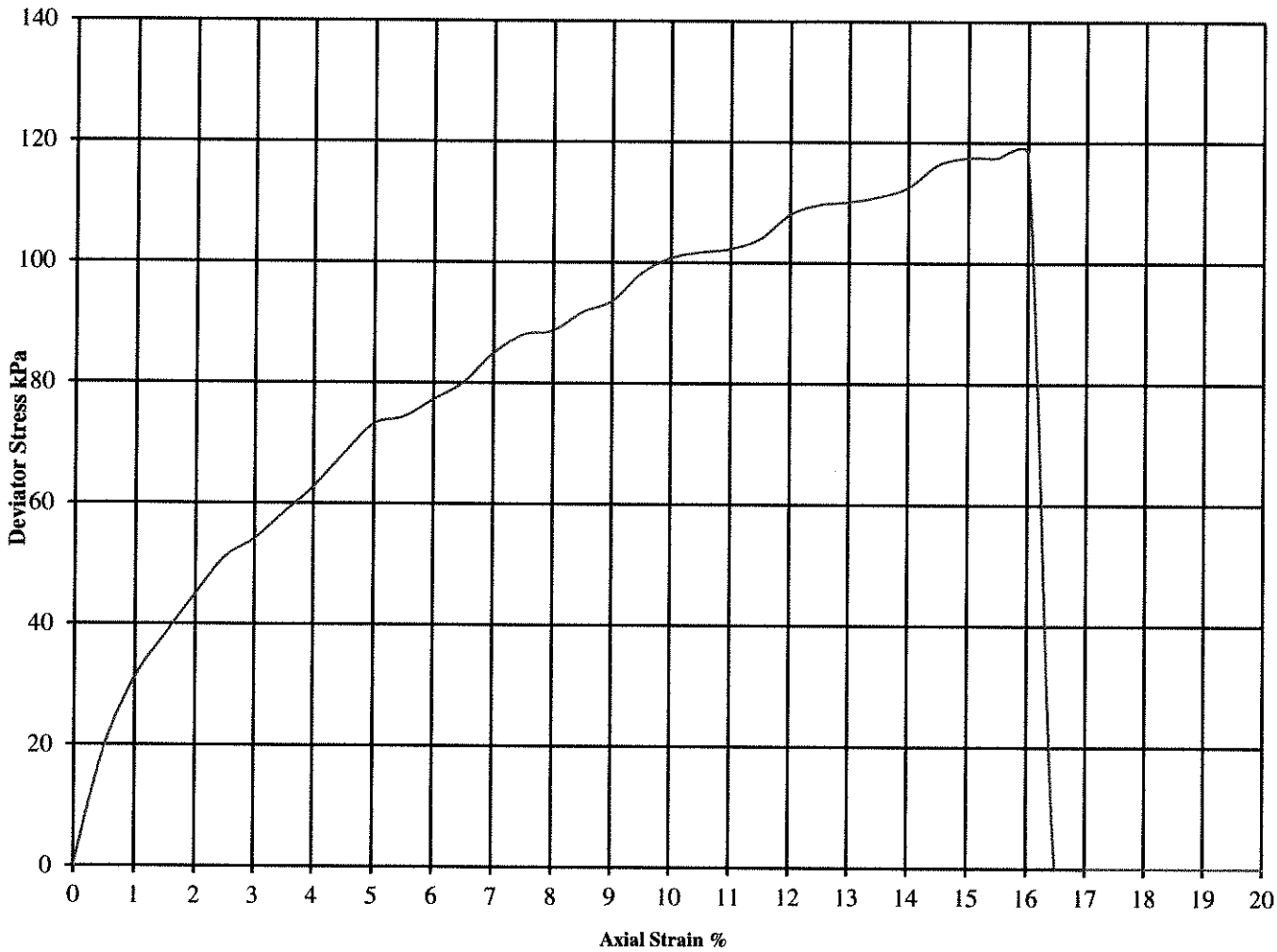
Contract No
S120505

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

BS1377-7:1990+A1:1994 [Preparation Method BS1377-1:1990:Clause 8.3]

Hole Reference **BH 3** **Depth (m)** **6.00 - 6.45**



Diameter (mm):		100	Height (mm):		200	Test:	100 mm Single Stage.			Sketch of Failure Conditions:
Stage	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Deviator Stress (kPa)	Cohesion (kPa)	Failure Strain (%)	Mode of Failure	Shear Strength (kPa)	
1	14	2.41	2.11	140	118	59	16.0	Ring Limit	59	
Sample Description:		Stiff brown slightly gravelly CLAY								
Sample Condition:		Undisturbed		Rate of Strain %/min		2	Membrane Thickness		0.5mm	
Remarks:										

Operator	Checked by	Date
[redacted]		28/6/12

SOLMEK

Temple Park Leisure Centre, South Shields

Contract No
S120505

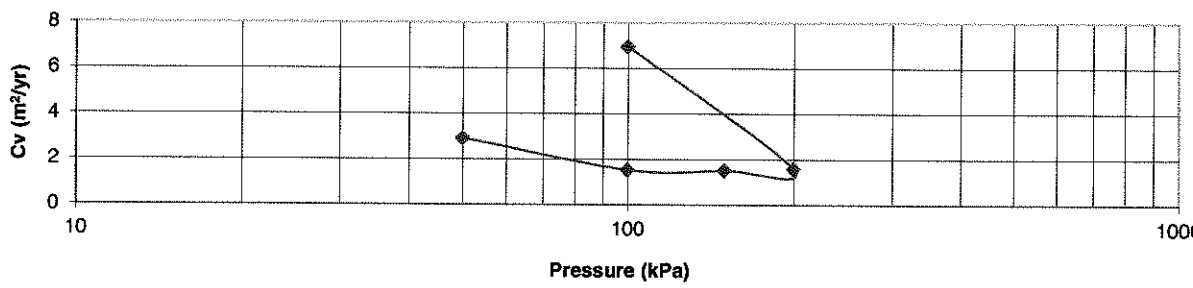
ONE-DIMENSIONAL CONSOLIDATION

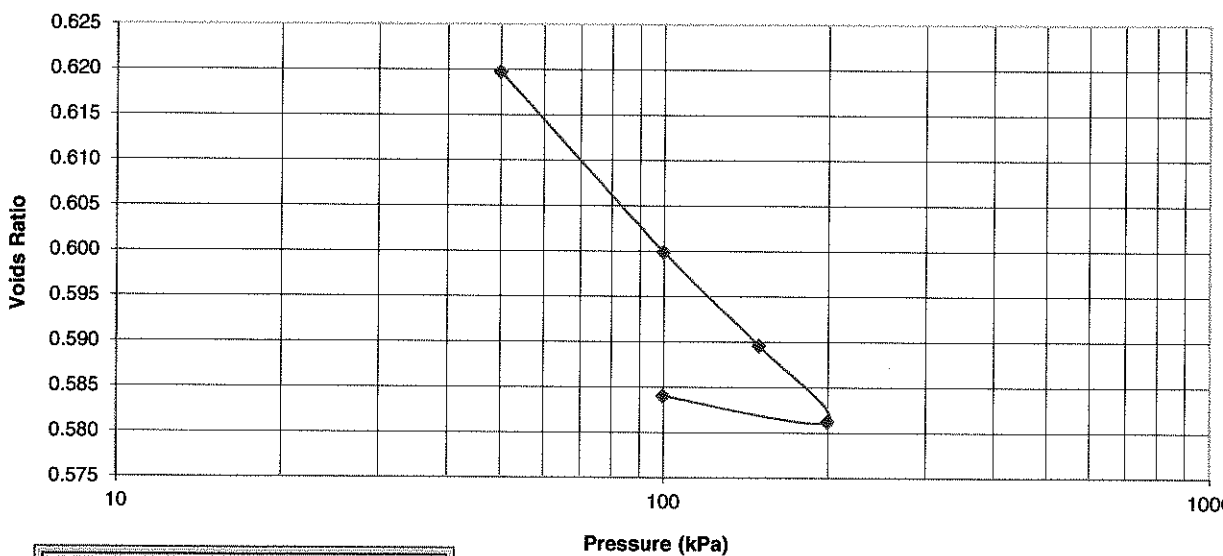
BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505

BH1 @ 1.20-1.65

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	21						Moisture Content (%) :	23
Bulk Density (Mg/m3):	1.94	0	-	50	0.487	2.919	Bulk Density (Mg/m3) :	2.04
Dry Density (Mg/m3):	1.60	50	-	100	0.245	1.534	Dry Density (Mg/m3)	1.68
Voids Ratio:	0.6602	100	-	150	0.129	1.505	Voids Ratio:	0.584
Degree of saturation:	86.2	150	-	200	0.106	1.583	Degree of Saturation: :	104.4
Height (mm):	19	200	-	100	0.018	6.959	Height (mm) :	18.13
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted]

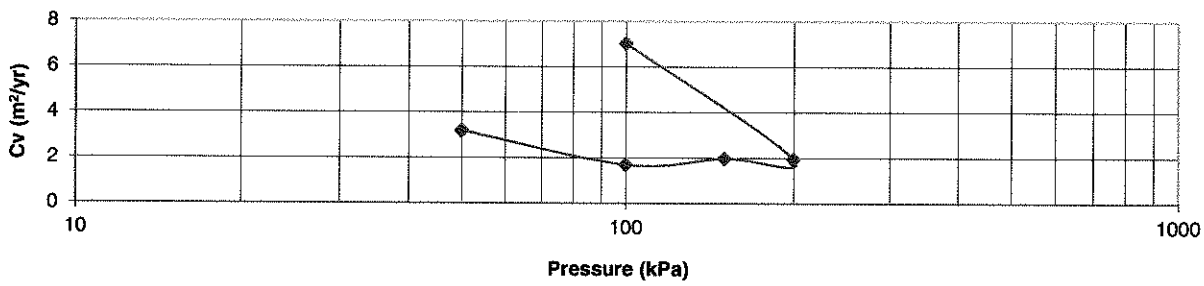
Date 20/6/12

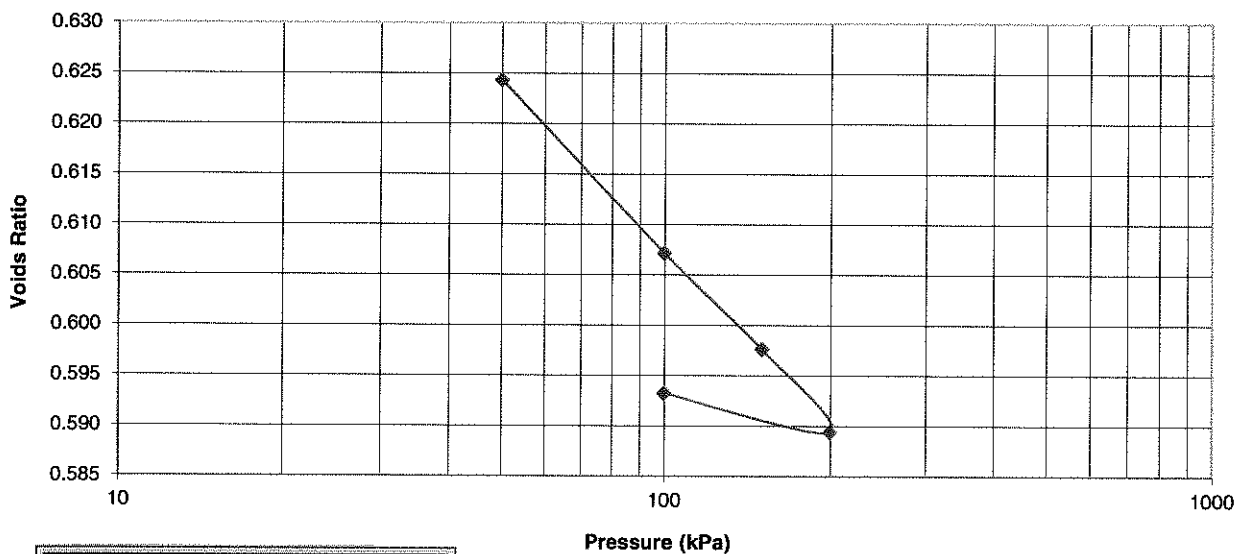
ONE-DIMENSIONAL CONSOLIDATION

BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505 BH1 @ 3.0-3.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	20						Moisture Content (%) :	21
Bulk Density (Mg/m3):	1.91	0	-	50	0.454	3.184	Bulk Density (Mg/m3) :	2.00
Dry Density (Mg/m3):	1.59	50	-	100	0.211	1.694	Dry Density (Mg/m3)	1.67
Voids Ratio:	0.6620	100	-	150	0.119	1.972	Voids Ratio:	0.593
Degree of saturation:	80.1	150	-	200	0.103	1.950	Degree of Saturation: :	95.7
Height (mm):	19	200	-	100	0.024	7.020	Height (mm) :	18.21
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted] Date 28/6/12

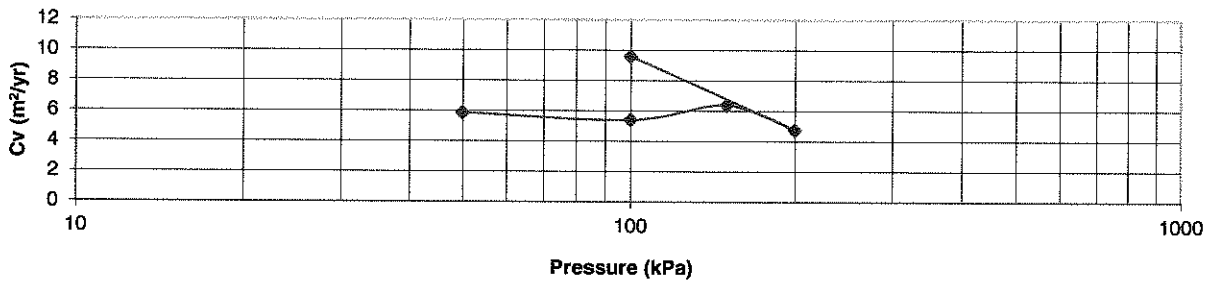
ONE-DIMENSIONAL CONSOLIDATION

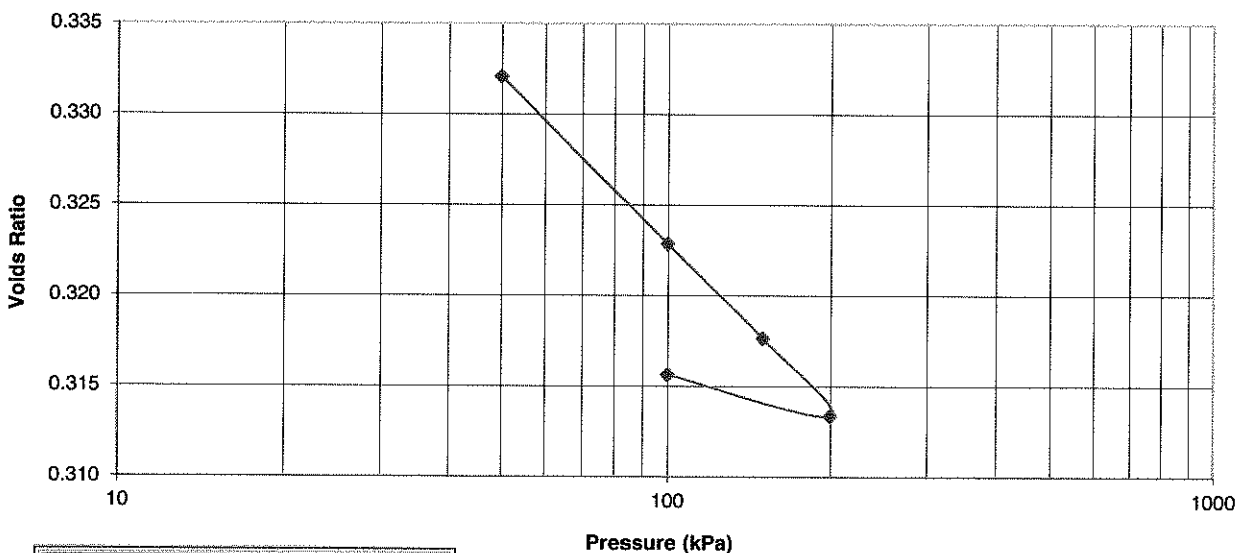
BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505

BH1 @ 7.0-7.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	14						Moisture Content (%) :	13
Bulk Density (Mg/m3):	2.23	0	-	50	0.336	5.862	Bulk Density (Mg/m3) :	2.30
Dry Density (Mg/m3):	1.96	50	-	100	0.139	5.401	Dry Density (Mg/m3)	2.02
Voids Ratio:	0.3548	100	-	150	0.079	6.391	Voids Ratio:	0.316
Degree of saturation:	103.3	150	-	200	0.065	4.746	Degree of Saturation: :	112.3
Height (mm):	19	200	-	100	0.017	9.597	Height (mm) :	18.45
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted]

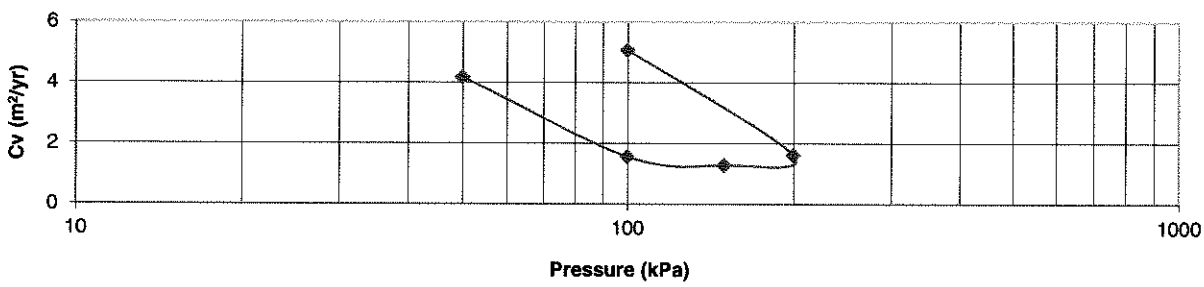
Date 28/6/12

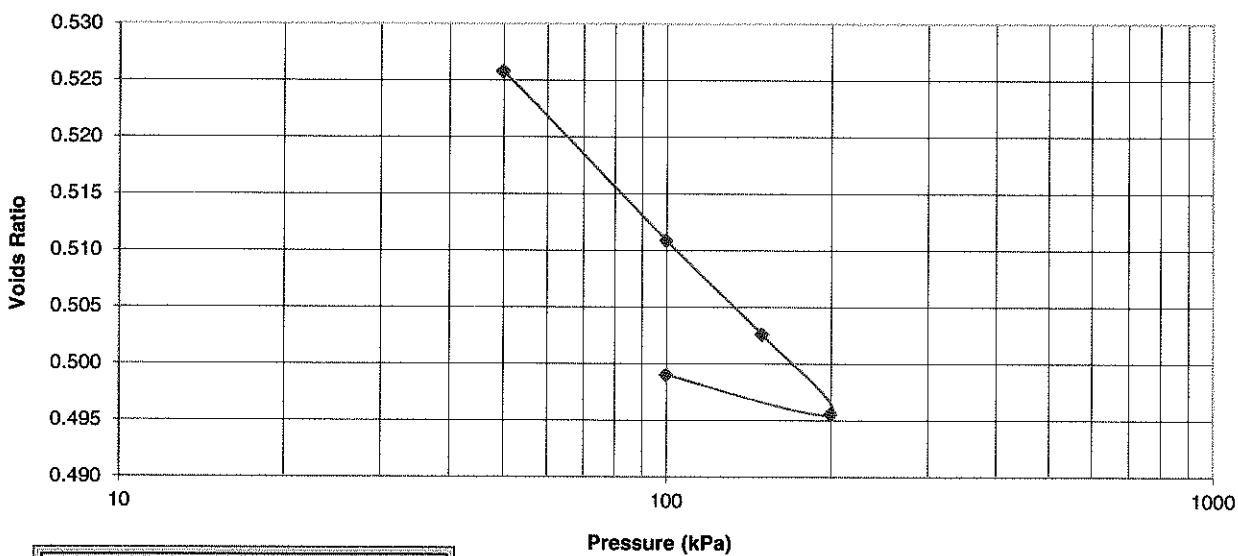
ONE-DIMENSIONAL CONSOLIDATION

BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505 BH2 @ 1.20-1.65

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	20						Moisture Content (%) :	22
Bulk Density (Mg/m3):	2.02	0	-	50	0.632	4.172	Bulk Density (Mg/m3) :	2.13
Dry Density (Mg/m3):	1.68	50	-	100	0.196	1.563	Dry Density (Mg/m3)	1.77
Voids Ratio:	0.5756	100	-	150	0.110	1.286	Voids Ratio:	0.499
Degree of saturation:	92.0	150	-	200	0.094	1.623	Degree of Saturation: :	116.9
Height (mm):	19	200	-	100	0.023	5.081	Height (mm) :	18.08
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted] Date 28/6/12

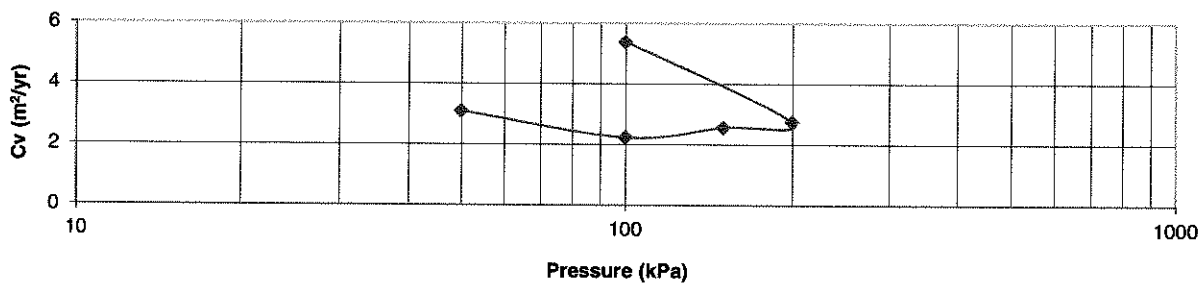
ONE-DIMENSIONAL CONSOLIDATION

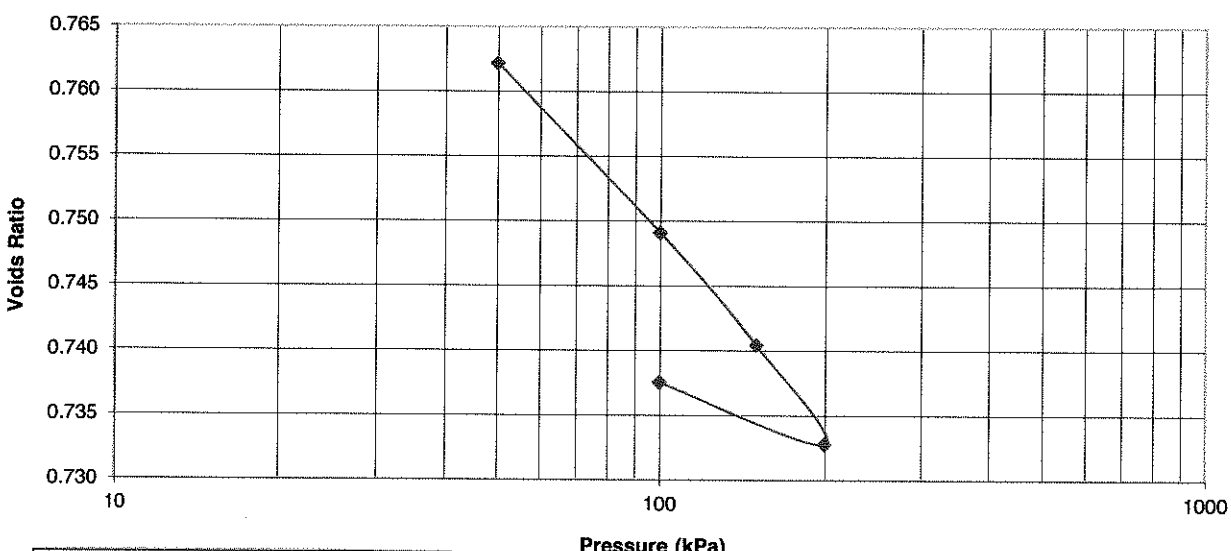
BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505

BH2 @ 3.00-3.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	28						Moisture Content (%) :	29
Bulk Density (Mg/m3):	1.91	0	-	50	0.123	3.101	Bulk Density (Mg/m3) :	1.96
Dry Density (Mg/m3):	1.49	50	-	100	0.148	2.234	Dry Density (Mg/m3)	1.53
Voids Ratio:	0.7731	100	-	150	0.099	2.566	Voids Ratio:	0.738
Degree of saturation:	96.4	150	-	200	0.088	2.753	Degree of Saturation: :	103.5
Height (mm):	19	200	-	100	0.027	5.388	Height (mm) :	18.62
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3): Assumed	2.65							





SOLMEK

Checked and Approved By [redacted]

Date 28/6/12

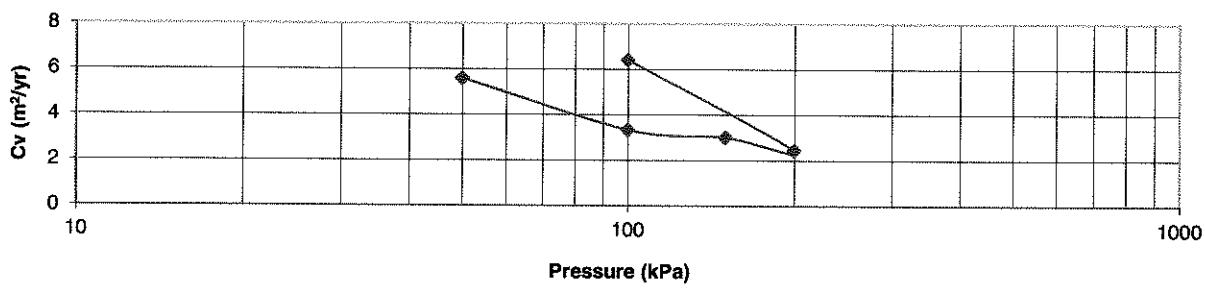
ONE-DIMENSIONAL CONSOLIDATION

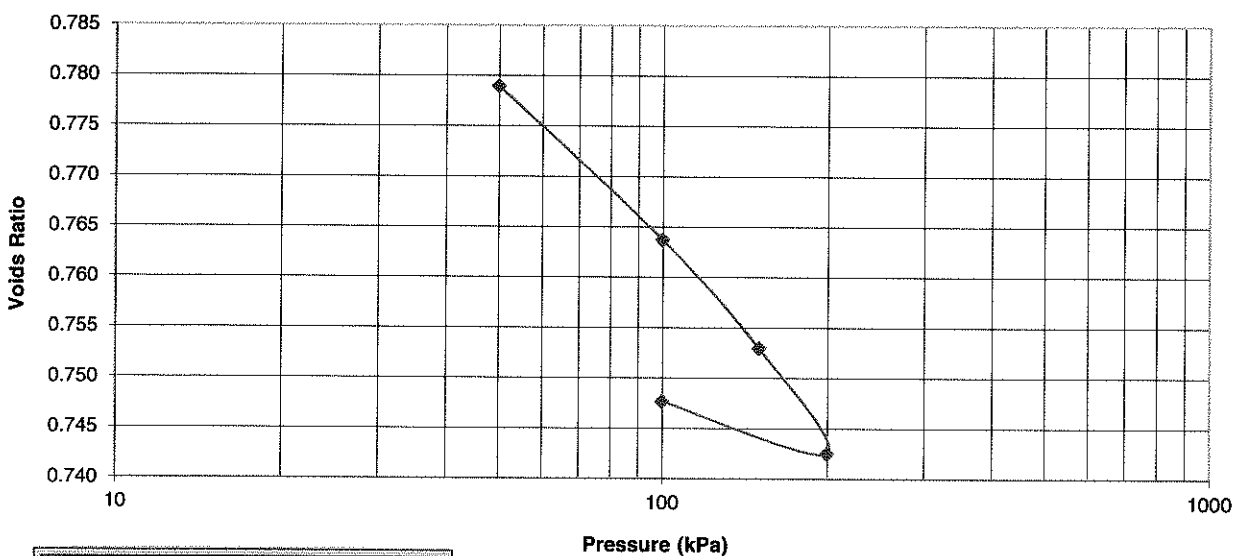
BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505

BH2 @ 5.00-5.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	29						Moisture Content (%) :	29
Bulk Density (Mg/m3):	1.91	0	-	50	0.112	5.595	Bulk Density (Mg/m3) :	1.96
Dry Density (Mg/m3):	1.48	50	-	100	0.171	3.337	Dry Density (Mg/m3)	1.52
Voids Ratio:	0.7889	100	-	150	0.122	3.014	Voids Ratio:	0.748
Degree of saturation:	97.4	150	-	200	0.119	2.433	Degree of Saturation: :	101.9
Height (mm):	19	200	-	100	0.030	6.405	Height (mm) :	18.56
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted]

Date 28/6/12

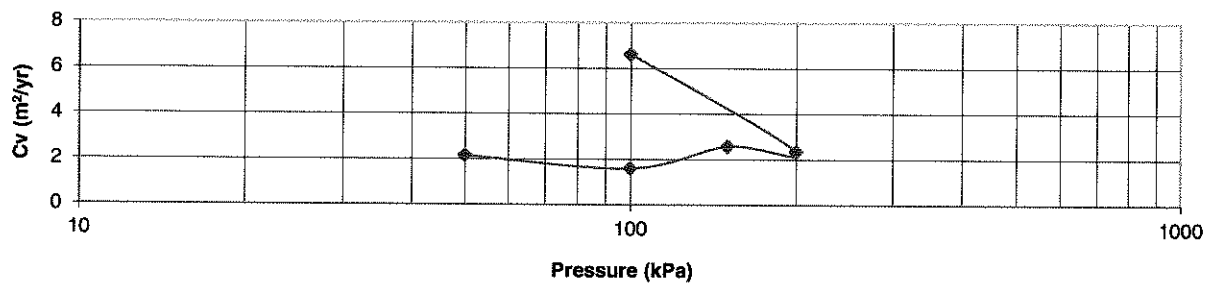
ONE-DIMENSIONAL CONSOLIDATION

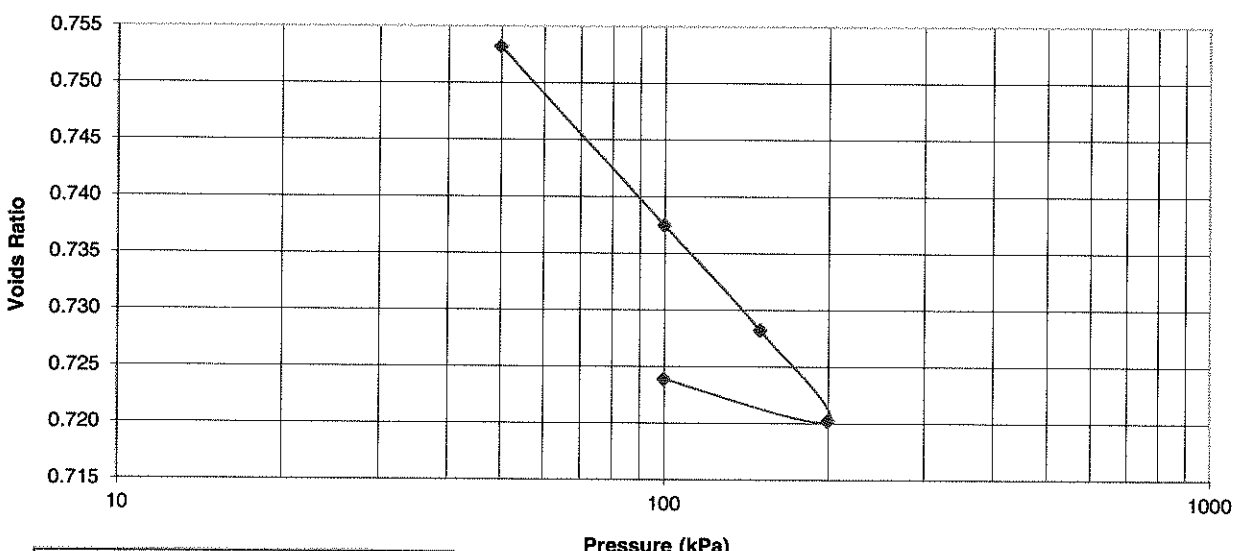
BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505

BH3 @ 2.0-2.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	27						Moisture Content (%) :	28
Bulk Density (Mg/m3):	1.88	0	-	50	0.432	2.150	Bulk Density (Mg/m3) :	1.96
Dry Density (Mg/m3):	1.48	50	-	100	0.180	1.596	Dry Density (Mg/m3)	1.54
Voids Ratio:	0.7919	100	-	150	0.106	2.578	Voids Ratio:	0.724
Degree of saturation:	90.9	150	-	200	0.093	2.360	Degree of Saturation: :	101.9
Height (mm):	19	200	-	100	0.021	6.623	Height (mm) :	18.28
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted]

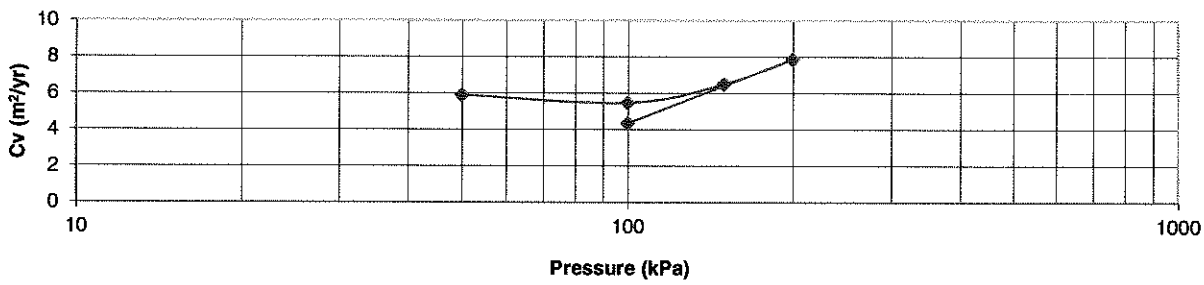
Date 28/6/12

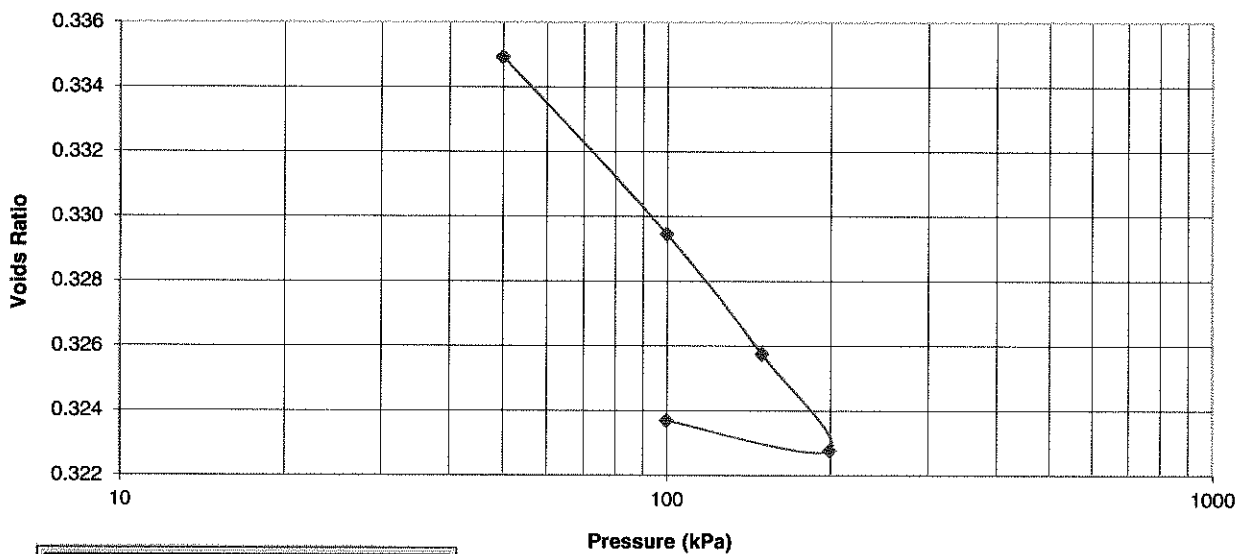
ONE-DIMENSIONAL CONSOLIDATION

BS 1377 : PART 5 : 1900 : CLAUSE 3

Temple Park Leisure (S120505 BH3 @ 4.00-4.45

Initial Conditions		Pressure Range kPa			Mv m2/MN	Cv m2/yr	Final Conditions	
Moisture Content (%):	12						Moisture Content (%) :	13
Bulk Density (Mg/m3):	2.20	0	-	50	0.240	5.890	Bulk Density (Mg/m3) :	2.25
Dry Density (Mg/m3):	1.96	50	-	100	0.082	5.469	Dry Density (Mg/m3)	2.00
Voids Ratio:	0.3511	100	-	150	0.056	6.498	Voids Ratio:	0.324
Degree of saturation:	93.3	150	-	200	0.045	7.872	Degree of Saturation: :	107.6
Height (mm):	19	200	-	100	0.007	4.346	Height (mm) :	18.61
Diameter (mm)	76						Remarks:	
Particle Density (Mg/m3):	2.65							
Assumed								





SOLMEK

Checked and Approved By [redacted] Date 28/6/12

APPENDIX D

Derwentside Environmental Testing Services

2139

Certificate of Analysis

Date: 07/06/2012

Certificate Number: 12-63570

Client:	SOLMEK 12 Yarm Road Stockton On Tees Cleveland TS18 3NA
Our Reference:	12-63570
Client Reference:	S120505
Contract Title:	Temple Park Leisure Centre, South Shields
Description:	5 soil samples, 2 leachate samples
Date Received:	28 May 2012
Date Started:	28 May 2012
Date Completed:	07 June 2012
Test Procedures:	Identified by prefix DETSn (details on request), Asbestos Analysis (DETS 082).
Notes:	Observations and interpretations are outside the scope of UKAS accreditation
Approved By:	[redacted] Paul Woodbridge, Senior Operations Manager

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

Derwentside Environmental Testing Services Limited
Unit 2, Park Road Industrial Estate South, Consett, Co Durham, DH8 5PY
Tel: 01207 582333 • Fax 01207 582444 • email: info@dets.co.uk • www.dets.co.uk

Information in Support of the Analytical Results

Analysis

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425um sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample.

Key

*	Denotes test not included in laboratory scope of accreditation
#	Denotes test that holds MCERTS accreditation, however, MCERTS accreditation is only implied if the report carries the MCERTS logo
$	Denotes tests completed by an approved subcontractor
I/S	Denotes insufficient sample to carry out test
U/S	Denotes that the sample is not suitable for testing

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

Summary of Chemical Analysis
Soil Samples

Our Ref: 12-63570
Client Ref: S120505
Contract Title: Temple Park Leisure Centre, South Shields

			Lab No.	414028	414029	414030	414031	414032
			Sample ID	BH1	BH2	BH2	BH3	BH3
			Depth	0.10-0.50	0.10	0.30	0.01	1.20-1.35
			Sample Ref					
			Sample Type	B	B	B	B	B
			Sampling Date	/ /	/ /	/ /	/ /	/ /
			Sampling Time					
Test	**Units**	**DETSxx**	**LOD**					
Arsenic	mg/kg	DETS 042#	0.2	12	15	15	2.2	3.5
Cadmium	mg/kg	DETS 042#	0.1	0.8	0.8	0.9	0.3	0.2
Chromium	mg/kg	DETS 042#	0.15	30	25	26	5.7	6.7
Hexavalent Chromium	mg/kg	DETSC2204*	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	mg/kg	DETS 042#	0.2	40	69	71	18	12
Lead	mg/kg	DETS 042#	0.3	90	130	120	6.1	19
Mercury	mg/kg	DETSC2325#	0.05	0.21	0.41	0.31	0.97	< 0.05
Nickel	mg/kg	DETS 042#	1	22	26	23	7.5	6.9
Selenium	mg/kg	DETS 042#	0.5	< 0.5	< 0.5	< 0.5	0.8	< 0.5
Zinc	mg/kg	DETS 042#	1	110	140	140	34	51
Boron (water soluble)	mg/kg	DETS 020#	0.2	1.9	1.4	1.3	2.0	1.3
Cyanide total	mg/kg	DETSC 2130#	0.1	0.7	0.4	0.4	< 0.1	< 0.1
Organic matter	%	DETSC2002#	0.1	6.0	11	9.4		0.7
Sulphide	mg/kg	DETSC2024#	10	16	< 10.0	20	1800	39
Sulphate Aqueous Extract as SO4	mg/l	DETSC 2076#	10	37	22	24	1300	67
pH		DETSC2008#		8.2	8.1	8.2	10.3	9.3
Aliphatic C5-C6	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01
Aliphatic C10-C12	mg/kg	DETSC 3072#	1.5	< 1.5	< 1.5	< 1.5	1.7	< 1.5
Aliphatic C12-C16	mg/kg	DETSC 3072#	1.2	< 1.2	< 1.2	< 1.2	63	< 1.2
Aliphatic C16-C21	mg/kg	DETSC 3072#	1.5	< 1.5	< 1.5	< 1.5	180	< 1.5
Aliphatic C21-C35	mg/kg	DETSC 3072#	3.4	< 3.4	< 3.4	< 3.4	600	< 3.4
Aromatic C5-C7	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	mg/kg	DETSC 3321*	0.01	< 0.01	< 0.01	< 0.01	0.24	< 0.01
Aromatic C10-C12	mg/kg	DETSC 3072#	0.9	< 0.9	< 0.9	< 0.9	3.3	< 0.9
Aromatic C12-C16	mg/kg	DETSC 3072#	0.5	< 0.5	< 0.5	< 0.5	19	< 0.5
Aromatic C16-C21	mg/kg	DETSC 3072#	0.6	< 0.6	< 0.6	< 0.6	100	< 0.6
Aromatic C21-C35	mg/kg	DETSC 3072#	1.4	< 1.4	< 1.4	< 1.4	850	< 1.4
Aliphatic C5-C35	mg/kg	DETSC 3072*	10	< 10	< 10	< 10	850	< 10
Aromatic C5-C35	mg/kg	DETSC 3072*	10	< 10	< 10	< 10	980	< 10
TPH Ali/Aro	mg/kg	DETSC3072*	10	< 10	< 10	< 10	1800	< 10

Summary of Chemical Analysis
Soil Samples

Our Ref: 12-63570
Client Ref: S120505
Contract Title: Temple Park Leisure Centre, South Shields

			Lab No.	414028	414029	414030	414031	414032
			Sample ID	BH1	BH2	BH2	BH3	BH3
			Depth	0.10-0.50	0.10	0.30	0.01	1.20-1.35
			Sample Ref					
			Sample Type	B	B	B	B	B
			Sampling Date	/ /	/ /	/ /	/ /	/ /
			Sampling Time					
Test	**Units**	**DETSxx**	**LOD**					
Acenaphthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	mg/kg	DESTC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Naphthalene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH	mg/kg	DETSC 3301	1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenol - Monohydric	mg/kg	DETSC2130#	0.3	1.2	1.0	0.6	< 0.3	< 0.3

Summary of Asbestos Analysis
Soil Samples

Our Ref: 12-63570
Client Ref: S120505
Contract Title: Temple Park Leisure Centre, South Shields

Lab No	Sample Ref	Material Type*	Result	Comment	Analyst
414028	BH1 0.10-0.50	Soil	NAD	None	Emrhys Sheldon
414029	BH2 0.10	Soil	NAD	None	Emrhys Sheldon
414030	BH2 0.30	Soil	NAD	None	Emrhys Sheldon
414031	BH3 0.01	Soil	NAD	None	Emrhys Sheldon
414032	BH3 1.20-1.35	Soil	NAD	None	Emrhys Sheldon

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. NAD = No Asbestos Detected. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETS 082 using polarised light microscopy in accordance with HSG248 and documented in-house methods. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'.

CLEA Software Version 1.06

Report generated 02-Jul-12

Report title Temple Park, South Shields

Created by A Cutts at Solmek

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?	
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal
1	Cadmium	2.41E+01	1.50E+01	1.20E+01	0.33	0.67	1.00	NR	Yes	Yes
2	Chromium III	1.98E+04	1.79E+03	1.64E+03	0.08	0.92	1.00	NR	No	No
3	Chromium VI	NR	2.14E+00	NR	0.00	1.00	NR	NR	Yes	No
4	Copper	1.08E+04	5.25E+03	4.04E+03	0.23	0.77	1.00	NR	Yes	No
5	Mercury, inorganic	2.62E+02	1.29E+03	2.18E+02	0.83	0.17	1.00	NR	No	No
6	Nickel	7.84E+02	6.43E+01	NR	0.04	1.00	NR	NR	Yes	Yes
7	Zinc	4.02E+04	8.04E+04	3.07E+04	0.62	0.38	1.00	NR	Yes	No
8	Arsenic	3.50E+01	4.29E+01	NR	1.00	0.82	NR	NR	No	No
9	Boron	1.07E+04	3.85E+02	3.78E+02	0.02	0.98	1.00	NR	Yes	No
10	Selenium	5.93E+02	NR	NR	1.00	NR	NR	NR	Yes	No
11	Cyanide	5.32E+02	7.95E+01	7.37E+01	0.07	0.93	1.00	NR	Yes	No
12	Phenol	9.17E+04	6.15E+02	6.11E+02	0.01	0.99	1.00	3.56E+04 (vap)	No	No
13										
14										
15										
16										
17										
18										
19										
20										

CLEA Software Version 1.06

Report generated	02-Jul-12
Report title	Temple Park, South Shields
Created by	A Cutts at Solmek

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?	
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal
1	Acenaphthene	4.85E+03	2.34E+04	4.02E+03	0.83	0.17	1.00	4.04E+01 (sol)	No	No
2	Acenaphthylene	4.85E+03	2.22E+04	3.98E+03	0.82	0.18	1.00	6.12E+01 (sol)	No	No
3	Anthracene	2.43E+04	7.12E+05	2.35E+04	0.97	0.03	1.00	8.22E-01 (vap)	No	No
4	Benzo(a)anthracene	1.12E+01	9.02E+00	4.99E+00	0.45	0.55	1.00	1.20E+00 (sol)	No	No
5	Benzo(a)pyrene	1.62E+00	1.48E+00	7.72E-01	0.48	0.52	1.00	6.38E-01 (vap)	No	No
6	Benzo(b)fluoranthene	1.15E+01	1.05E+01	5.49E+00	0.48	0.52	1.00	8.51E-01 (sol)	No	No
7	Benzo(k)fluoranthene	1.62E+01	1.48E+01	7.73E+00	0.48	0.52	1.00	4.81E-01 (sol)	No	No
8	Benzo(ghi)perylene	7.35E+01	6.80E+01	3.53E+01	0.48	0.52	1.00	1.08E-02 (vap)	No	No
9	Chrysene	1.62E+01	1.45E+01	7.64E+00	0.47	0.53	1.00	3.08E-01 (vap)	No	No
10	Dibenz(ah)anthracene	1.46E+00	1.33E+00	6.94E-01	0.48	0.52	1.00	2.75E-03 (vap)	No	No
11	Fluoranthene	1.01E+03	1.31E+05	1.00E+03	0.99	0.01	1.00	1.33E+01 (vap)	No	No
12	Fluorene	3.23E+03	2.86E+04	2.90E+03	0.90	0.10	1.00	2.19E+01 (sol)	No	No
13	Indeno(123-cd)pyrene	6.95E+00	6.30E+00	3.31E+00	0.48	0.52	1.00	4.30E-02 (vap)	No	No
14	Naphthalene	1.58E+03	1.42E+01	1.41E+01	0.01	0.99	1.00	5.57E+01 (sol)	No	No
15	Phenanthrene	1.00E+03	3.42E+04	9.75E+02	0.97	0.03	1.00	2.53E+01 (sol)	No	No
16	Pyrene	2.42E+03	3.10E+05	2.40E+03	0.99	0.01	1.00	1.54E+00 (vap)	No	No
17										
18										
19										
20										

CLEA Software Version 1.06

Report generated 02-Jul-12

Report title Temple Park, South Shields

Created by A Cutts at Solmek

Environment Agency

RESULTS

Environment Agency

		Assessment Criterion (mg kg^{-1})			Ratio of ADE to HCV			Saturation Limit (mg kg^{-1})	50% rule?	
		oral	inhalation	combined	oral	inhalation	combined		Oral	Inhal
1	Aliphatic EC 5-6	2.23E+05	3.03E+02	3.03E+02	0.00	1.00	1.00	2.30E+02 (sol)	Yes	Yes
2	Aliphatic EC 6-8	2.23E+05	7.06E+02	7.05E+02	0.00	1.00	1.00	1.04E+02 (sol)	Yes	Yes
3	Aliphatic EC 8-10	4.45E+03	1.78E+02	1.77E+02	0.02	0.98	1.00	5.47E+01 (vap)	Yes	Yes
4	Aliphatic EC 10-12	4.45E+03	8.79E+02	8.31E+02	0.10	0.90	1.00	3.33E+01 (vap)	Yes	Yes
5	Aliphatic EC 12-16	4.45E+03	7.33E+03	3.59E+03	0.68	0.32	1.00	1.66E+01 (sol)	Yes	Yes
6	Aliphatic EC 16-35	8.04E+04	NR	NR	1.00	NR	NR	5.93E+00 (sol)	Yes	No
7	Aromatic EC 5-7	2.58E+01	3.09E+00	2.76E+00	0.11	0.89	1.00	1.06E+03 (sol)	No	No
8	Aromatic EC 7-8	1.98E+04	6.35E+03	4.81E+03	0.24	0.76	1.00	6.79E+02 (vap)	No	No
9	Aromatic EC 8-10	1.78E+03	3.18E+02	3.02E+02	0.09	0.91	1.00	4.37E+02 (vap)	Yes	Yes
10	Aromatic EC 10-12	1.78E+03	1.20E+03	9.39E+02	0.36	0.64	1.00	2.58E+02 (sol)	Yes	Yes
11	Aromatic EC 12-16	1.78E+03	1.76E+04	1.73E+03	0.95	0.05	1.00	1.19E+02 (sol)	Yes	Yes
12	Aromatic EC 16-21	1.32E+03	NR	NR	1.00	NR	NR	3.76E+01 (vap)	Yes	No
13	Aromatic EC 21-35	1.33E+03	NR	NR	1.00	NR	NR	3.38E+00 (sol)	Yes	No
14										
15										
16										
17										
18										
19										
20										

APPENDIX E

SOLMEK

GAS MONITORING RESULTS

SITE	Temple Park Leisure Centre, South Shields
JOB REF	S120505
CLIENT	South Tyneside Council
DATE	08/06/2012
VISIT NO	1 of 3
EQUIPMENT USED	GA2000 & GA5.3 Flow Pod
LAST CALIBRATED	September 2011
OPERATOR	S. J. Fisk

Weather Conditions: Rain
Ground Conditions: Wet
Ambient Atmospheric Pressure: 984mb
Regional Trend: Falling

Position	Flow (l/hr)	Atmospheric Pressure (mB)	CH_4		CO_2		O_2 (%v/v)	CO (ppm)	H_2S (ppm)	Water Level (mbgl)	Notes
			(%v/v)	GSV (l/hr)	(%v/v)	GSV (l/hr)					
Ambient	-	984	0.0	N/A	0.1	N/A	20.2	0	0	N/A	-
BH1	ND	984	0.0	0.0	0.3	0.0003	20.1	0	0	DRY	-

KEY

CH_4 = Methane, **CO_2** = Carbon Dioxide, **O_2** = Oxygen, **CO** = Carbon Monoxide, **H_2S** = Hydrogen Sulphide, **GSV** = Gas Screening Value (If no flow is recorded a value of 0.1 is assumed), **ND** = Not Detected, * = not measured, **N/A** = Not applicable, **%** = By volume, **mbgl** = m below ground level, **ppm** = parts per million

SOLMEK

GAS MONITORING RESULTS

SITE	Temple Park Leisure Centre, South Shields
JOB REF	S120505
CLIENT	South Tyneside Council
DATE	13/06/2012
VISIT NO	2 of 3
EQUIPMENT USED	GA2000 & GA5.3 Flow Pod
LAST CALIBRATED	September 2011
OPERATOR	S. J. Fisk

Weather Conditions: Slightly overcast, slight breeze
Ground Conditions: Dry
Ambient Atmospheric Pressure: 1012mb
Regional Trend: Rising

Position	Flow (l/hr)	Atmospheric Pressure (mB)	CH_4		CO_2		O_2 (%v/v)	CO (ppm)	H_2S (ppm)	Water Level (mbgl)	Notes
			(%v/v)	GSV (l/hr)	(%v/v)	GSV (l/hr)					
Ambient	-	1012	0.0	N/A	0.1	N/A	20.0	0	0	N/A	-
BH1	ND	1012	0.0	0.0	0.7	0.0007	19.6	0	0	DRY	-

KEY

CH_4 = Methane, **CO_2** = Carbon Dioxide, **O_2** = Oxygen, **CO** = Carbon Monoxide, **H_2S** = Hydrogen Sulphide, **GSV** = Gas Screening Value (If no flow is recorded a value of 0.1 is assumed), **ND** = Not Detected, * = not measured, **N/A** = Not applicable, **%** = By volume, **mbgl** = m below ground level, **ppm** = parts per million

SOLMEK

GAS MONITORING RESULTS

SITE	Temple Park Leisure Centre, South Shields
JOB REF	S120505
CLIENT	South Tyneside Council
DATE	02/07/2012
VISIT NO	3 of 3
EQUIPMENT USED	GA2000 & GA5.3 Flow Pod
LAST CALIBRATED	September 2011
OPERATOR	S. J. Fisk

Weather Conditions: Sunny and bright, slight breeze
Ground Conditions: Dry
Ambient Atmospheric Pressure: 1010mb
Regional Trend: Rising

Position	Flow (l/hr)	Atmospheric Pressure (mB)	CH_4		CO_2		O_2 (%v/v)	CO (ppm)	H_2S (ppm)	Water Level (mbgl)	Notes
			(%v/v)	GSV (l/hr)	(%v/v)	GSV (l/hr)					
Ambient	-	1010	0.0	N/A	0.2	N/A	20.2	0	0	N/A	-
BH1	ND	1010	0.0	0.0	0.3	0.0003	19.9	0	0	DRY	-

KEY

CH_4 = Methane, **CO_2** = Carbon Dioxide, **O_2** = Oxygen, **CO** = Carbon Monoxide, **H_2S** = Hydrogen Sulphide, **GSV** = Gas Screening Value (If no flow is recorded a value of 0.1 is assumed), **ND** = Not Detected, * = not measured, **N/A** = Not applicable, **%** = By volume, **mbgl** = m below ground level, **ppm** = parts per million

APPENDIX F

VEGETATION

Plants can be affected by soil contamination in a number of ways resulting in growth inhibition, nutrient deficiencies and yellowing of leaves. Contaminants are taken up by plants through the roots and through foliage. Contaminants identified as being highly phytotoxic include boron, cadmium, copper, lead, nickel, and zinc.

To establish if the levels of contaminants present on a site may pose a risk to vegetation the results of the contamination testing are compared to a series of threshold values published in 'Code of Good Agricultural Practice for the Protection of Soil'.

GROUNDWATER AND SURFACE WATER RECEPTORS

The principal pathway by which soil contamination may reach the water environment is through a slow seepage or leaching to groundwater or surface water. The potential for contaminants to migrate along such pathways is dependent on the chemical and physical characteristics of the contaminants and the local hydrogeology. Surface watercourses may also accumulate contamination as contaminated sediments are deposited within the water body.

Where the site investigated overlies major/principal aquifers (and in some cases minor/secondary aquifers depending on certain conditions), groundwater Source Protection Zones and areas in close proximity to groundwater abstractions, contamination test results have been compared with the Water Supply (Water Quality) Regulations 1989 and The Water Supply (Water Quality) Regulations 2000.

Should a surface water receptor, such as a fresh water environment (river, canal, stream, lake etc), or marine environment be considered sensitive in relation to a site, then test results are compared with DEFRA & SEPA Environmental Quality Standards (2004). Many of the Environmental Quality Standards are hardness ($CaCO_3$) depended. Where no hardness values are available, Solmek assume conservative values (of between 0 and 50mg/l).

In the absence of vulnerable ground and surface water environments, Solmek may compare any test results with the Environment Agency Leachate Quality Threshold Values.

DETAILED QUANTITATIVE RISK ASSESSMENT (DQRA)

In line with CLR 11- Model Procedures, a DQRA for groundwater/human health may be required following a Phase 2 investigation and before the preparation of a Phase 3 Remediation Strategy. For human health DQRA, a site specific assessment criteria is undertaken using CLEA Software Version 1.06. For groundwater DQRA, the Environment Agency Remedial Targets Worksheet Version 3.1 is used.

WASTE ACCEPTANCE CRITERIA

Waste Acceptance Criteria (WAC) testing accords with the Landfill (England and Wales) 2002 Regulations and the subsequent amendments set out in Schedule 1 of the Landfill (England and Wales)(Amendment) Regulations 2004. WAC testing was introduced into UK Practise to supplement the revised changes to the Hazardous Waste and Landfill regulations outlined in 2005. The WAC testing relates to materials that are to be exported from a site/development to landfill, and do not directly relate to human health specifically. The WAC test categorises materials as either inert waste, non-reactive hazardous waste, and hazardous waste. The testing results are generally presented as certificates which can be used by site owners/contractors etc, which should be presented to the accepting waste facility or waste contractor.

CONSTRUCTION MATERIALS

Materials at risk from possible soil contaminants include inorganic matrices such as cement and concrete and also organic material such as plastics and rubbers. Acid ground conditions and high levels of sulphates can accelerate the corrosion of building materials. Where pH and soluble sulphate analysis has been undertaken, Solmek compare the test results with the guidelines presented within BRE Special Digest 1, 2005 (3rd Edition) 'Concrete in Aggressive Ground'. Plastics and rubbers are generally used for piping and service ducts and are potentially attacked by a range of chemicals, most of which are organic, particularly petroleum based substances. Drinking water supplies can be tainted by substances that can penetrate piping and water companies enforce stringent threshold values.

REQUIREMENTS OF PARTIES WITHIN THE DEVELOPMENT PROCESS

Interested parties involved in the development process may use the data in different ways and there may be varying views and interpretation of the factual data. Local Authority staff may have a view on contamination and human health and the wider environment. The Environment Agency are concerned principally with the protection of Controlled waters. Building insurers, funders and purchasers may be primarily concerned with issues of potential commercial blight. Purchasers are also not always fully informed, and perceptions on issues associated with risk can affect the decision to purchase. Developers and construction organisations will focus on financial aspects of dealing with the contamination in the context of the development and construction programme.

RISKS & LIABILITIES FROM CONTAMINATION

In simple terms, risks associated with contamination may be considered in terms of 1) statutory risks and 2) development related risks. If contamination is severe or forms a potential hazard based on its potential to affect groundwater, surface water or human health, a statutory risk may be present, and as such, if the risk is not reduced, criminal proceedings may be instigated by a government body or local authority.

If the contamination is less severe or not considered to be mobile, it may be considered a commercial liability which could, in theory remain untreated, but which may at a later date affect the value of the property, or, with changing legislation, become a statutory risk. Commercial liabilities could give rise to civil proceedings by third parties if there are grounds for action.

♣Solmek conditions of offer, notes on limitations & basis for contract (ref: version1/2012)

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

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

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, ground gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Solmek cannot be held liable for any unrecorded or unforeseen obstructions between exploratory boreholes and trial pits. This includes instances where previous structures on the site (buried man made structures) or the presence of boulder clay (cobbles and/or boulder obstructions) have been anticipated. All types of piling operations should make allowance for obstructions within the construction budget to accommodate this. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

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

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

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

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

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

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

Gas Protection Measures - Commercial Development

<table>
<tr><th>Characteristic Situation</th><th>Membrane</th><th>Floor Slab</th><th>Sub-floor ventilation</th><th>External ventilation</th><th>Additional protection measures</th></tr>
<tr><td>1</td><td colspan="5">No special precautions</td></tr>
<tr><td rowspan="2">2
(equivalent to basic radon)</td><td rowspan="2">Waterproofing membrane</td><td rowspan="3">Well constructed suspended floor or raft foundation</td><td>Beam & block floors: open void min. 150mm depth (uneconomic for large structures)

Suspended in-situ concrete floors:
20mm single size gravel blanket (min. 300mm thick)
or proprietary void former:
either expanded polystyrene shuttering with equivalent clear void depth of 22mm or geocomposite drainage blanket

Rafts: granular blanket min. 300mm thick (not suitable on sites with high water table)</td><td rowspan="6">Passive venting to atmospherevia air bricks / gravel filled trenches / risers as per DETR report</td><td rowspan="2">-</td></tr>
<tr><td>Beam & block floors: open void min. 150mm depth (uneconomic for large structures)

Suspended in-situ concrete floors:
20mm single size gravel blanket with interleaved pipes at 3m centres
or proprietary void former:
either expanded polystyrene shuttering with equivalent clear void depth of 22mm or geocomposite drainage blanket

Rafts: granular blanket min. 300mm thick (not suitable on sites with high water table) with drainage pipe network</td></tr>
<tr><td>3
(equivalent to full radon)</td><td>Gas resistant membrane (basic)</td><td>-</td></tr>
<tr><td>4</td><td rowspan="3">Gas resistant membrane (with aluminium foil)</td><td rowspan="3">Reinforced concrete cast in situ ground slab or suspended floor</td><td>Beam & block floors: open void min. 150mm depth (uneconomic for large structures)

Suspended in-situ concrete floors: proprietary void former:
geocomposite drainage blanket (structures <7.5m wide only)
expanded polystyrene shuttering with equivalent clear void depth of 22mm (structures <7.5m wide only)
expanded polystyrene shuttering with equivalent clear void depth of 100mm (structures >7.5m wide)</td><td>-</td></tr>
<tr><td>5</td><td>Beam & block floors: open void min. 150mm depth (uneconomic for large structures)
Suspended in-situ concrete floors (structures <7.5m wide only): proprietary void former - expanded polystyrene shuttering with equivalent clear void depth of 22mm or geocomposite drainage blanket</td><td rowspan="2">Actively ventilated underfloor sub-space with monitoring / clean air blanket / in-ground barrier / in-ground venting layer / trenches / wells.</td></tr>
<tr><td>6</td><td>Actively ventilated underfloor sub-space with monitoring.</td></tr>
</table>

SOLMEK NOTES ON CONTAMINATION GUIDANCE(REF: VERSION 1/2012)

UK BACKGROUND

A qualitative approach using the statutory definition of Contaminated land as defined with Section 78A (2) of Part 2A of the Environmental Protection Act has been adopted. This defines contaminated land (DEFRA 'Guidance on the Legal Definition of Contaminated Land', July 2008b) as:

"any land which appears to the local authority in whose area the land is situated to be in such a condition, by reason of substances in, on or under the land, that (a) significant harm is being caused or there is a significant possibility of such harm being caused; or (b) pollution of controlled waters is being, or is likely to be, caused"

"Harm" is defined as *harm to the health of living organisms or other interference within the ecological systems of which they form part, and in the case of man, includes harm to his property.*

The concept of "significant harm" is dealt with via the Government guidance DEFRA Circular 02/2000 Contaminated Land: "*Implementation of Part IIA of the Environmental Protection Act 1990".* The statutory guidance uses the concept of pollutant linkages set out in Section 2.4 of the circular. Before the Local Authority can make a judgement on whether "*significant harm*" and the significant possibility of harm is being caused they are required to identify a "*significant pollution linkage".* This means effectively that three elements (a **source** of contamination, a relavent **receptor** and a **pathway**) must be present. In statutory terms:

- A **source** is a substance that is in, on or under the land and has the potential to cause harm.
- A **receptor** is in general terms, is something that could be adversely affected by a contaminant, such as people.
- A **pathway** is a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Without identification of all three elements together, land should not be regarded as "*Contaminated*" in the statutory sense. Solmek adopts the above measures in accordance with CLR 11 (2004) 'Model Procedures for the management of Land Contamination'.

HUMAN RECEPTORS

Human exposure to contaminants present in soils can occur via several pathways. Direct exposure pathways include dermal absorption after contact with contaminated ground, inhalation of soil or dust, inhalation of volatised compounds, and inadvertent soil ingestion (or deliberate soil ingestion in the case of some children). Other indirect pathways include human ingestion of plants grown in contaminated soil or contaminated ground or surface water. Contaminants associated with wind blown dust can affect humans on surrounding sites.

DEFRA published the discussion paper 'Soil Guideline Values: the way forward' (2006). Following consultation, DEFRA released 'Improvements to Contaminated Land Guidance and Outcome of the Way Forward exercise on Soil Guideline Values' (2008b). From this review DEFRA and the Environment Agency had withdrawn documents CLR 7 to 10 since these no longer fully reflect the new UK approach, along with the associated Soil Guidelines Values (SGV). The Environment Agency have revised and updated information presented in CLR 7 to 10 within two recently published CLEA Framework Reports: Human health toxicological assessment of contaminants in soil (Science Report Final SC050021/SR2) and updated technical background to the CLEA model (Science Report Final SC050021/SR3).

The Environment Agency released the updated CLEA Software Version 1.06 in May 2011 which accompanies the two CLEA Framework Reports and reflects the updated approach. Solmek uses the CLEA Software Version 1.06 to derive a series of Generic Assessment Criteria (GAC) threshold values based on a number of site and soil parameters. Solmek GAC values represent a level at which a risk to human health may exist and are primarily intended as a guide to site redevelopment. Various factors used within the CLEA software by Solmek are summarised below:

<table>
<tr><th>Land Use</th><th>Receptor</th><th>Building</th><th>Soil Type</th><th>pH and SOM</th></tr>
<tr><td>Residential with Homegrown Produce</td><td>Female (Age Class 1-6: Young Child)</td><td rowspan="2">Bungalow
Small Terraced House
Medium/large Terraced House
Semi-detached House
Detached House</td><td rowspan="7">Clay
Silty Clay
Silty Clay Loam
Clay Loam
Sandy Lam
Loam
Silty Loam
Sandy Loam
Sandy Loam
Sand</td><td rowspan="7">pH and SOM content values as presented from testing.</td></tr>
<tr><td>Residential without Homegrown Produce</td><td>Female (Age Class 1-6: Young Child)</td></tr>
<tr><td>Allotments</td><td rowspan="3">Female (Age class 1-6: Young Child)</td><td rowspan="3">Assumes None</td></tr>
<tr><td>Parks</td></tr>
<tr><td>Open spaces</td></tr>
<tr><td>Playing fields</td><td>Female (Age class 4-11: Child)</td></tr>
<tr><td>Commercial</td><td>Female (Age Class 17-17: Working Adult)</td><td>Warehouse (pre 1970)
Warehouse (post 1970)
Office (pre 1970)
Office (post 1970)</td></tr>
<tr><td colspan="5">DERIVATION OF SOLMEK GAC THRESHOLD VALUES</td></tr>
</table>

A number of specific exposure pathways are considered in addition to the above table when considering the generated GAC values. In some instances, the GAC generated value may be presented at the soil saturation limit if this has been exceeded. The choice of receptor may differ from the table above based on professional judgment (with justification).

Solmek adopts a pH value of 7, Soil Organic Matter (SOM) content of 1% and a sandy loam soil where this information is not available. These figures accord with the generic units presented within the CLEA Software. Where Solmek cannot generate specific GAC values, the Environment Agency's SGVs (where available), released from March 2009, and Atkins SSV's (derived using CLEA Software Version 1.04, May 2011) are adopted for comparison.