

Saunderson Road, Penistone

Site Investigation Report

Yorkshire Housing

Solmek Report Number S120731/SI

September 2012

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

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

WWW.SOLMEK.COM

Saunderson Road, Penistone

Site Investigation Report

Contract Number: S120731/SI
Date: September 2012

TABLE OF CONTENTS

1	INTRODUCTION AND SCOPE OF WORKS	2
2	SITE DESCRIPTION AND FIELDWORK	2
3	GROUND CONDITIONS	4
4	GEOTECHNICAL TESTING	4
5	CONTAMINATION ANALYSIS AND RESULTS	6
6	GROUND GAS ASSESSMENT	12
7	CONCEPTUAL MODEL AND RISK ASSESSMENT	12
8	CONCLUSIONS	14

TABLE OF FIGURES

TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS	7
TABLE 2: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS	8
TABLE 3: POTENTIAL POLLUTION LINKAGES	9
TABLE 4: CONCEPTUAL MODEL AND RISK ASSESSMENT	13

LIST OF APPENDICIES

APPENDIX A: DRAWINGS

APPENDIX B: BOREHOLE & TRIAL PIT LOGS

APPENDIX C: GEOTECHNICAL LABORATORY & SOAKAWAY RESULTS

APPENDIX D: CONTAMINATION LABORATORY RESULTS AND CLEA MODEL OUTPUT REPORTS

APPENDIX E: NOTES ON LIMITATIONS AND CONTAMINATION GUIDELINES

Status	Date	Prepared by	Checked by
Final	September 2012	R Woods <i>Geotechnical Engineer</i>	D Simpson <i>Principal Geotechnical Engineer</i>

Saunderson Road, Penistone

Site Investigation Report

1 INTRODUCTION AND SCOPE OF WORKS

At the request of Billingham George and Partners on behalf of Yorkshire Housing a ground investigation involving geotechnical and chemical testing was carried out on a parcel of land to the east of Saunderson Road, Penistone, South Yorkshire. A plan showing the site location is included in Appendix A, Figure 1.

1.1 Scope of Works

The proposed development of the site involves the construction of one and two storey residential dwellings. The final development will also include hardstanding in the form of driveways and areas of soft landscaping as garden areas.

A geotechnical and environmental investigation including a ground gas risk assessment was requested. The fieldwork and testing was generally carried out according to the recommendations of BS5930:1999 "Code of Practice for Site Investigations" and all stratum descriptions are as recommended in that publication. A Phase 1 Desk Study was carried out by Solmek (S120731, August 2012) and should be read in conjunction with this report.

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

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 positions 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 7th August 2012. Location maps are presented in Appendix 1. The site is centred at the approximate Ordnance Survey Co-ordinates 424040E, 403530N and covers an area of approximately 0.6ha.

The site currently comprises a roughly rectangular shaped parcel of disused land currently filled with a combination of overgrown weeds, wild flowers, reeds and semi-mature trees. A number of short wire and post fences are present along the northern portion of the site with two dilapidated shed structures along the northern boundary. Also present on the north eastern boundary is a brick built structure, inferred to be a former mortuary. Small overhead electricity cables are present aligned north east-south west across the southern portion of the site.

An area of Japanese Knotweed, approximately 12-15m² lies towards the central east of the site.

The topography of the site shows a gentle slope inwards from north and south down towards the southern portion of the site where a series of reeds are present along with boggy ground. The topography of the slopes outside the south of the site rises much more sharply towards the cemetery beyond, perhaps by as much as 8-10m with the slope noted as heavily vegetated with mature trees. It is inferred that the southern portion of the site is a low spot collecting water hence the presence of the reeds within the boggy ground with trees around the perimeter. It is also possible that this area is a former surface water feature such as a pond.

The site is generally bounded with a stone wall. The surrounding land uses comprise open fields to the north, a telephone exchange building to the east, a cemetery to the south and residential housing to the west.

2.1 Fieldwork

The fieldwork was carried out on 8th and 9th August 2012 and comprised five small percussive boreholes (BH1 to BH5) drilled to depths of up to 2.75m below ground level (bgl). In addition to the boreholes, six machine excavated trial pits (TP1 to TP6) were dug using a mini excavator. Soakaway percolation trials were carried out within TP1, TP2 and TP3. Two hand excavated trial pits (CBR1 & CBR2) were also dug in order that insitu CBR tests could be undertaken during the Farnell probe.

Standard penetration tests (SPT) were undertaken at various depths within the boreholes. Samples were taken for both geotechnical and contamination analysis. Descriptions of the strata encountered in the boreholes and trial pits together with details of testing, sampling and groundwater are presented in Appendix B of this report. A plan showing the location of the boreholes and trial pits can be found in Appendix A (Figure 2).

Ground gas monitoring installations were placed within three of the boreholes (BH1, BH3 & BH4). The remaining boreholes and all of the trial pits were backfilled with the arisings and fully reinstated on completion of the works. A period of ground gas monitoring is currently underway and the results will be provided as an addendum to this report.

3 GROUND CONDITIONS

3.1 Made Ground

Made ground was encountered within all of the boreholes and trial pits to a maximum depth of 0.4mbgl and comprised sandy slightly gravelly to gravelly clay topsoil. The gravel fraction includes sandstone and mudstone with occasional brick rubble and wood.

3.2 Natural Deposits

The natural deposits within the boreholes were generally proven to comprise soft to firm, generally becoming stiff with depth clay. The sand and gravel content of the clay generally increases with depth and comprises sandstone, mudstone and siltstone. The clay was encountered to a maximum depth of 1.9mbgl (BH's 1, 4 and 5). A horizon of very clayey gravelly sand was found in TP4 between 1.2-1.8mbgl. All of the trial pits were terminated between 1.5 and 2.2mbgl. Underlying the clay in all the boreholes was completely to highly weathered sandstone (recovered as very gravelly clay), proven to termination depth between 2.35 and 2.75mbgl where refusal was recorded by the SPT sampler. The weathered zone of the sandstone varied in thickness from 0.65m to 1.0m.

3.3 Groundwater

The actual groundwater table was not encountered; however groundwater as seepage was encountered within all of the boreholes between 0.15 and 1.9mbgl. The shallower strikes were perched within the topsoil above the natural clay, with the deeper strikes recorded at the top of completely to highly weathered sandstone strata. Within the trial pits the shallowest water seepage was noted at 0.15mbgl. It should be noted that groundwater levels vary with rainfall, time of year and in proximity to local abstractions and dewatering activities.

4 GEOTECHNICAL TESTING

Samples taken from the boreholes underwent a series of geotechnical tests in accordance with BS 1377:1990. In addition to the geotechnical testing, insitu SPTs were undertaken during drilling. The geotechnical results are presented in Appendix C.

4.1 Strength and Density

Three disturbed samples recovered from the small percussive boreholes were subjected to quick, undrained triaxial testing. The samples ranged in depth from 0.65mbgl to 1.2mbgl. The results ranged from 11kPa to 45kPa indicating very soft to firm conditions. However, an immature shear plane failure is likely

to have occurred during testing due to the sand and gravel content of the clay. The true insitu shear strengths are likely to be much higher, the corresponding SPT N values at similar depths in all five boreholes ranged from 16 to 37. Using the rule of thumb that the N value multiplied by five gives an approximate shear strength in clay then the shear strengths of 80kPa to 185kPa (stiff to very stiff) are more indicative of the underlying material.

4.2 Atterberg Limit Determinations

Four Atterberg Limit Determination tests were out carried on samples of cohesive material to classify the fine grained soils. The results were compared to the Casagrande Chart published in BS 5930 and showed the samples to generally be clay of low to intermediate plasticity.

The Plasticity Indices ranged from 16 to 28 with moisture contents recorded at and above the corresponding plastic limits. The cohesive material can be assessed as having a **medium** shrinkage potential in relation to NHBC Guidance Chapter 4.2.

4.3 Moisture Contents

Five disturbed samples recovered from the boreholes were subjected to moisture content tests to determine the moisture profile at depths of between 0.65 and 1.2mbgl. Moisture levels were between 18% and 29%.

4.4 Particle Size Distribution Analysis

One Particle Size Distribution (PSD) test was undertaken on a sample from BH4 (1.1m) in accordance with BS 1377: Part 2: 1990: Method 9 to assist soil descriptions. The sample was tested as it was deemed too sandy and gravelly for a triaxial test. The result shows that the material can be classified as sandy gravelly clay.

4.5 pH and Sulphate Results

Two samples of natural soil from the boreholes were tested for acidity and soluble sulphate content to assess whether the material may be potentially aggressive to building fabric. The results of the testing for pH were 3.9 and 4.1 indicating very acidic conditions. Soluble sulphates were recorded at levels of 86mg/l and 185mg/l.

4.6 Insitu CBR Results

Insitu CBR testing was undertaken within CBR1 and CBR2 using the hand held Farnell Probe. The tests were carried out at depths of 0.3 and 0.6mbgl, with the results ranging from 3% to 6% within either topsoil or natural

soft to firm clay deposits. Therefore, we would recommend adopting an equilibrium CBR of 3% for the site.

4.7 Percolation Testing

Percolation testing was undertaken within TP1, TP2 and TP3 in order to derive an infiltration rate for the natural sub-strata and assess its suitability as a sustainable drainage medium. The infiltration rates were $2.2\text{m/sec}^{10^{-6}}$ (TP1), $1.34\text{m/sec}^{10^{-6}}$ (TP2) and $4.56\text{m/sec}^{10^{-6}}$ (TP3) which would be classified as 'not acceptable' to 'Poor (probably unsuitable)' based on BRE Digest 365.

5 CONTAMINATION ANALYSIS AND RESULTS

The proposed development of the site involves the construction of semi-detached homes. The final development will also include hardstanding in the form of car parking and areas of soft landscaping as garden areas.

To provide information upon the possibility of ground contamination three samples were subject to chemical contamination analysis comprising two samples of topsoil and one of natural ground.

The site's proposed end use comprises residential land use, therefore the test results have been compared to a series of Solmek Generic Assessment Criteria (GAC) thresholds based on a residential land use with 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 with home grown produce |
| ➤ Receptor: | Female |
| ➤ Building Type: | Semi-Detached House |
| ➤ Soil Type: | Clay Loam |
| ➤ Soil pH: | 5.8 (Lowest Recorded Value) |
| ➤ Soil Organic Matter: | 7.5% (Lowest Recorded Value) |

The samples were subjected to a range of tests to detect the levels of various metals, semi-metals and non-metals. Two samples were selected for organic determinants. In addition, the samples were subject to pH analysis with two selected for asbestos screening. The results are provided in full in Appendix D and summarised in Table's 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	3	0.3	1.4	5.17	0
Chromium	mg/kg	3	21	32	3000	0
Chromium VI	mg/kg	0	<1	-	4.25	0
Copper	mg/kg	3	23	48	2360	0
Lead	mg/kg	3	20	260	276*	0
Mercury	mg/kg	2	<0.05	0.1	169	0
Nickel	mg/kg	3	11	30	127	0
Zinc	mg/kg	3	52	1000	2860	0
Semi metals and non metals						
Arsenic	mg/kg	3	7.5	31	32.4	0
Boron	mg/kg	3	0.9	1.8	10.3	0
Selenium	mg/kg	0	<0.5	-	350	0
Inorganic chemicals						
Cyanide	mg/kg	2	<0.1	1.5	1.62	0
W.S. Sulphate	mg/l	3	19	24	500 [#]	0
Sulphide	mg/kg	2	<10	20	250 ⁺	0
Other						
pH	pH	3	5.8	7.4	<5.5 ⁺	0
Phenols	mg/kg	2	<0.3	0.9	471	0
TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS						
* SSV Residential with home grown produce						
+ EA derived thresholds						
# BRE Special Digest One, Lower Limit						

5.1 Metals, Semi Metals and Inorganic Chemicals

None of the three samples tested returned concentrations which exceed the thresholds for metals, semi-metals and non metals.

Water soluble sulphate was recorded at a maximum concentration of 24mg/l, with levels of sulphide and cyanide below GAC threshold values.

5.2 Other

The results of the pH testing were between 5.8 and 7.4. These pH levels are consistent with acidic to slightly alkaline conditions. No asbestos fibres were detected in the two samples subject to screening.

5.3 Organic Test Results

Two samples of topsoil were subject to speciated PAH testing and TPH aromatic/aliphatic fractions analysis.

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	-	414	0
C6-8	mg/kg	1	<0.01	0.04	908s	0
C8-10	mg/kg	1	<0.01	0.01	407	0
C10-12	mg/kg	0	<1.5	-	354s	0
C12-16	mg/kg	0	<1.2	-	177s	0
C16-21	mg/kg	0	<1.5	-	84700	0
C21-35	mg/kg	0	<3.4	-	84700	0
TPH Aromatic Fractions						
C5-7	mg/kg	0	<0.01	-	0.53	0
C7-8	mg/kg	0	<0.01	-	872	0
C8-10	mg/kg	0	<0.01	-	293	0
C10-12	mg/kg	0	<0.9	-	351	0
C12-16	mg/kg	0	<0.5	-	689	0
C16-21	mg/kg	0	<0.6	-	837	0
C21-35	mg/kg	0	<1.4	-	1240	0
Speciated PAH						
Acenaphthene	mg/kg	0	<0.1	-	1210	0
Acenaphthylene	mg/kg	0	<0.1	-	1020	0
Anthracene	mg/kg	0	<0.1	-	10500	0
Benz' (a)anthracene	mg/kg	0	<0.1	-	6.23	0
Benz' (a)pyrene	mg/kg	0	<0.1	-	1.01	0
Benz' (b)fluor' ene	mg/kg	0	<0.1	-	7.1	0
Benz' (k)fluor' ene	mg/kg	0	<0.1	-	10.1	0
Benz (ghi)per' ene	mg/kg	0	<0.1	-	47	0
Chrysene	mg/kg	0	<0.1	-	9.53	0
Dibenz(ah)anth' ene	mg/kg	0	<0.1	-	0.912	0
Fluoranthene	mg/kg	0	<0.1	-	722	0
Fluorene	mg/kg	0	<0.1	-	916	0
Id' (123cd)pyrene	mg/kg	0	<0.1	-	4.25	0
Naphthalene	mg/kg	0	<0.1	-	24.2	0
Phenanthrene	mg/kg	0	<0.1	-	429	0
Pyrene	mg/kg	0	<0.1	-	1670	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						

From the two samples subject to organic contamination testing, no raised levels of the speciated PAH determinants or TPH aliphatic/aromatic fractions were present in concentrations above the assessment criteria thresholds for harm to human health. Indeed, the vast majority of the results were below the limits of detection.

5.4 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 (DEFRA 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 E for additional notes on contamination guidelines.

5.5 Conceptual Model and Pollution Linkages

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

SOURCES	PATHWAYS	RECEPTORS
Made Ground proven to depths of up to 0.4mbgl and comprised clay topsoil with occasional brick. Minimal previous development, small mortuary building and an inferred memorial pond feature. 11 no landfill sites within a 200m radius. No significant levels of contamination in made ground on the site. No radon protection measures required.	Dermal absorption	Users of site – Adult and child receptors.
	Inhalation of soil/volatilised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	
		Soft landscaping present in final development as garden areas.
	Dermal absorption	Construction Workers – Users of the site during construction phase of development.
	Inhalation of soil/volatilised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	
	Dermal absorption	Users of surrounding sites – Residential area with a cemetery to the south.
	Inhalation of soil/volatilised compounds	
	Ingestion of soil	Vegetation – Soft landscaping as garden areas.
	Taken up through roots and foliage	
	Direct contact	Groundwater – Secondary A Aquifer. Groundwater seepage between 0.15 and 1.9mbgl.
	Slow seepage or leaching of contaminants	
	Slow seepage or leaching of contaminants and accumulation of contaminated sediments	Surface water – nearest located 102m to the north west of the site.
	Direct contact	Construction Materials – Concrete and underground service pipes.
TABLE 3: POTENTIAL POLLUTION LINKAGES		

In general terms, the users of the site, construction workers, users of the surrounding sites, vegetation, controlled waters and construction materials are considered to be at risk from potential contamination in the soils on site as pollution linkages may be present for these receptors. The actual risks posed are considered below.

5.6 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 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 contamination testing have been compared to a series of Solmek GAC thresholds based on a residential land use with homegrown produce. The results indicate that the concentrations of the metals, semi-metals, non-metals and organics within the made ground are below the threshold values for long term risk to human health.

The area of Japanese Knotweed on the site will require specialist treatment/removal by an approved contractor. The developer should ensure that no unauthorised personnel at the site disturb or try to remove the affected area as the plant and roots are classified as 'hazardous waste' should they be removed from site.

It is therefore considered that the levels of contamination 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.

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) testing. Material taken off site may be subject to WAC by the appropriate waste disposal company.

5.7 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 ground can generally be classed as slightly

contaminated, due to raised arsenic, sulphide, nickel and acidic pH levels. Two samples of the natural soil tested for acidity returned results of 3.9 (BH5, 1.1m) and 4.1 (BH1, 0.9m) which would be classed as contaminated to highly contaminated. 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. Gloves should be worn when handling made ground and suitable provision for hygiene facilities should be made.

5.8 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, 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 one elevated concentration of the phytotoxic determinants zinc from BH3 (0.2-0.3m) was above the corresponding thresholds.

Garden areas are proposed around the site. The existing topsoil onsite should be suitable for re-use in garden areas despite the isolated raised level of zinc in BH3. Any proposed garden areas in the vicinity of BH3 should be excavated to a depth of 0.5mbgl and screened for deleterious made ground materials such as brick rubble. Should any deleterious materials be encountered then these can be removed and placed beneath areas of permanent hardcover. The remaining material from around BH3 after screening and the rest of the site can then be used in proposed garden areas. As a minimum all garden areas should contain 300mm of clean topsoil.

5.9 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.

The solid geology is classified as a Secondary A Aquifer. The nearest surface water feature is located 102m north west of the site. Groundwater as seepage was encountered within all of the boreholes between 0.15 and 1.9mbgl. It should be noted that groundwater levels vary with rainfall, time of year and in proximity to local abstractions and dewatering activities.

Therefore, given the low contamination profile of the ground and continuous layer of practically impermeable clay across the site the risk to controlled waters is considered low.

5.10 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-1, 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 levels of arsenic and acidic pH values exceed threshold values. Prior to laying any new services consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.

6 GROUND GAS ASSESSMENT

A period of ground gas monitoring is underway on standpipes placed within BH1, BH3 and BH4. The results and analysis of the monitoring will be published as an addendum to this report.

7 CONCEPTUAL MODEL AND RISK ASSESSMENT

The conceptual model (Table 4) 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.

The risk ratings are based on the outcome **after** mitigating action has taken place

SOURCES	PATHWAYS	RECEPTORS	MITIGATION	RISK RATING
No raised levels of inorganic or organic contaminants from the three samples subject to testing.	Dermal absorption Inhalation of soil/volatilsed compounds Ingestion of soil Contact with contaminated groundwater	Proposed housing. Adult and child users.	Levels of contamination are generally low. Remediation not required beneath buildings or hardstanding. Existing topsoil suitable for re-use. Screen topsoil around BH3 for deleterious materials prior to re-use. Japanese Knotweed requires specialist treatment/removal.	MOD
Raised values of arsenic, sulphide, nickel and acidic pH lie within the slightly contaminated category. Natural ground with acidic pH values of 3.9 and 4.1.	Dermal absorption Inhalation of soil/volatilsed compounds (dust) Ingestion of soil Contact with contaminated groundwater	Construction workers.	Made ground on site classed as slightly contaminated. Natural ground is contaminated to highly contaminated due to acidic ground conditions. Only approved personnel to tackle Japanese Knotweed treatment/removal. Appropriate PPE should be employed as a matter of course.	MOD
No raised levels of inorganic or organic contaminants from the three samples subject to testing.	Dermal absorption Inhalation of soil/volatilsed compounds (dust) Ingestion of soil	Surrounding areas contains some residential land.	Damping down of site in dry/windy conditions and limit access to the general public.	LOW
One raised concentration of the phytotoxic determinant zinc.	Uptake via roots and leaf surfaces	Vegetation.	Garden areas are included within the final development. Existing topsoil suitable for re-use. Screen topsoil around BH3 for deleterious materials prior to re-use.	LOW
No raised levels of inorganic or organic contaminants from the three samples subject to testing.	Seepage or leaching of contaminants. Accumulation of contaminated sediments in water body.	Surface Water The nearest surface water feature 102m north west of site.	Site to be capped by the proposed development. Low soil contamination profile. Continuous natural clay layer beneath site.	LOW
	Seepage or leaching of contaminants.	Ground Water Secondary A Aquifer.		LOW
Concentrations of arsenic and acidic pH levels are above utility suppliers threshold values.	Contact with contaminated soil/deleterious material.	Construction Materials and service fabrics	Class DS-1, AC-1s assuming static ground water. Services should be laid in clean trenches as a minimum . Consultation with utility providers is recommended.	LOW

TABLE 4: CONCEPTUAL MODEL AND RISK ASSESSMENT

8 CONCLUSIONS

A site investigation was required for a site on Saunderson Road, Penistone where new residential properties are to be developed.

8.1 Summary of Ground Conditions

Made ground was encountered within all of the boreholes and trial pits to a maximum depth of 0.4mbgl and comprised sandy slightly gravelly to gravelly clay topsoil. The gravel fraction includes sandstone and mudstone with occasional brick rubble and wood.

The natural deposits within the boreholes and trial pits were generally proven to comprise soft to firm, generally becoming stiff with depth clay. The sand and gravel content of the clay generally increase with depth and comprises sandstone, mudstone and siltstone. The clay was encountered to a maximum depth of 1.9mbgl. All of the trial pits were terminated between 1.5 and 2.2mbgl. Underlying the clay in all the boreholes was completely to highly weathered sandstone proven to termination depth between 2.35 and 2.75mbgl.

8.2 Foundations

Foundations for the proposed new housing are likely to be traditional strip footings. Plasticity index values indicated that the clay tested and located at foundation depth has a medium shrinkage potential.

The foundations should be placed on natural clay at a minimum depth of 0.9mbgl. Taking the lowest shear strength from converted SPT N values (80kPa) a bearing capacity of around 184kN/m² has been calculated for a 0.6m wide strip footing. Providing the imposed load of the structures do not exceed the bearing capacity then settlement should be within normal tolerances.

Prior to placing any foundation concrete all exposed formations should be well compacted and any obvious soft or loose 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.

8.3 Insitu CBR Results

Insitu CBR testing carried out at depths of 0.3 and 0.6mbgl, produced results ranging from 3% to 6%. Therefore, we would recommend adopting an equilibrium CBR of 3% for the site.

8.4 Percolation Testing

Percolation testing was undertaken and the infiltration rates were $2.2\text{m/sec}^{*10^{-6}}$ (TP1), $1.34\text{m/sec}^{*10^{-6}}$ (TP2) and $4.56\text{m/sec}^{*10^{-6}}$ (TP3) which would be classified as 'not acceptable' to 'Poor (probably unsuitable)' based on BRE Digest 365.

8.5 Excavation

From the evidence of the investigation, excavations in the made ground should be easily achieved by means of a normal excavator. A breaker may be required if any relict foundations from the previous structures are still present, however none were encountered during the investigation. Stability of excavations will be poor in the made ground but should improve in the natural clay. The stability of any excavations will deteriorate over time and with the ingress of any water. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: "Trenching Practice".

8.6 Groundwater

The actual groundwater table was not encountered; however groundwater as seepage was encountered within all of the boreholes between 0.15 and 1.9mbgl. The shallower strikes were perched within the topsoil above the natural clay, with the deeper recorded at completely to highly weathered sandstone. Within the trial pits the shallowest water seepage was noted at 0.15mbgl. Therefore, it is likely that water ingress will occur in foundation excavations and allowance for dewatering should be made. It should be noted that groundwater levels vary with rainfall, time of year and in proximity to local abstractions and dewatering activities.

8.7 Chemical Contamination Results

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 contamination testing have been compared to a series of Solmek GAC thresholds based on a residential land use with homegrown produce. The results indicate that the concentrations of the metals, semi-metals, non-metals and organics within the made ground are below the threshold values for long term risk to human health.

The area of Japanese Knotweed on the site will require specialist treatment/removal by an approved contractor. The developer should ensure that no unauthorised personnel at the site disturb or try to remove the affected area as the plant and roots are classified as 'hazardous waste' should they be removed from site.

The existing topsoil onsite should be suitable for re-use in garden areas despite the isolated raised level of the phytotoxic determinant zinc in BH3. Any proposed garden areas in the vicinity of BH3 should be

excavated to a depth of 0.5mbgl and screened for deleterious made ground materials such as brick rubble. Should any deleterious materials be encountered then these can be removed and placed beneath areas of permanent hardcover. The remaining material from around BH3 after screening and the rest of the site can then be used in proposed garden areas. As a minimum all garden areas should contain 300mm of clean topsoil.

Due to elevated concentrations of arsenic, sulphide, nickel and acidic pH levels the made ground on site should be classified as "slightly contaminated". Two samples of the natural soil tested for acidity returned results of 3.9 (BH5, 1.1m) and 4.1 (BH1, 0.9m) which would be classed as contaminated to highly contaminated with regards to construction workers and it is recommended that gloves are always worn when handling made ground.

The risk to controlled waters is considered low given the low contamination profile of the ground and continuous layer of practically impermeable clay across the site.

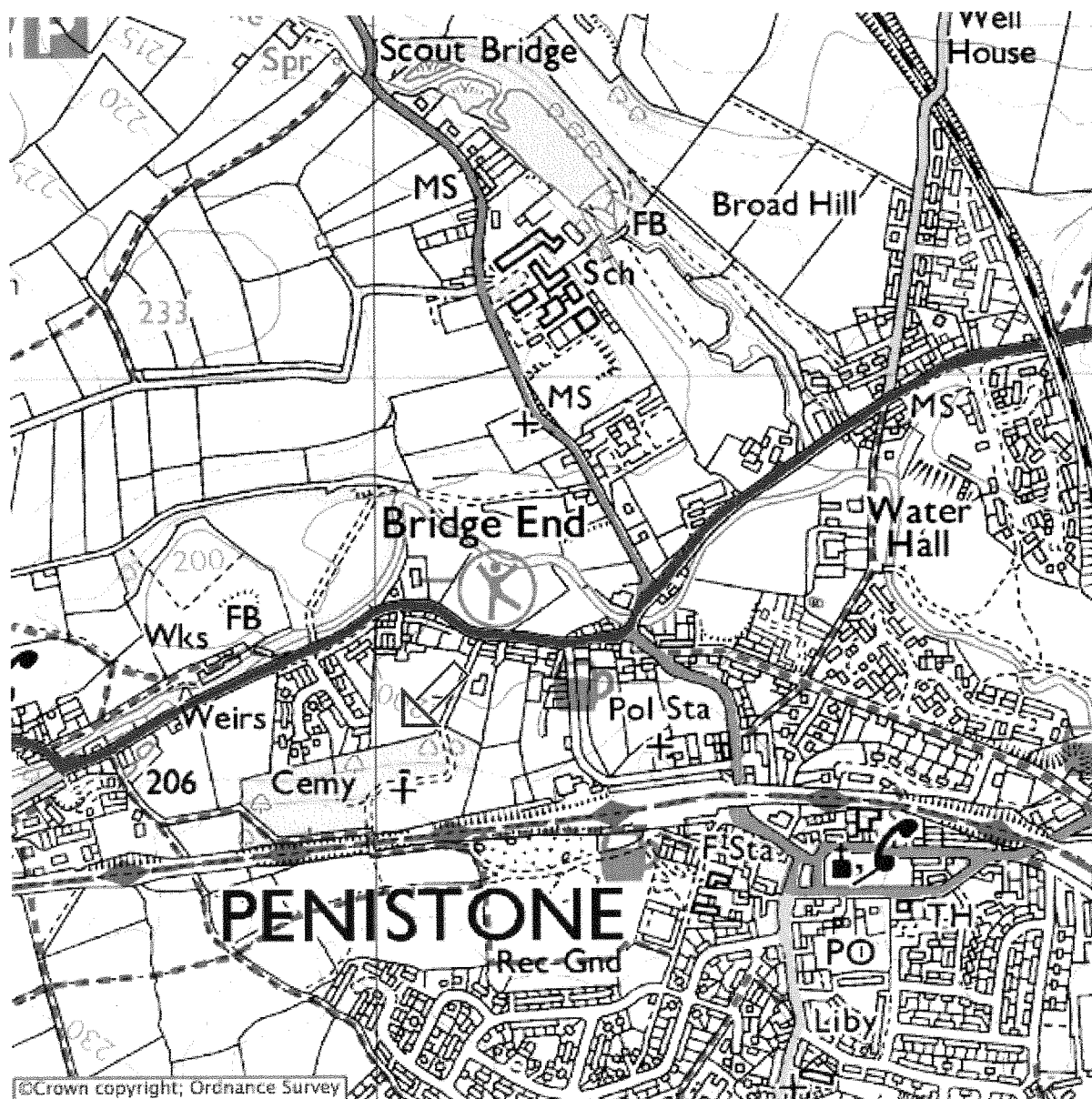
In terms of utility suppliers, levels of arsenic and acidic pH values exceed relevant threshold values. Prior to laying any new services consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.

8.8 Sulphate results

The results of the pH and sulphate tests on the made ground and natural ground, from the geotechnical analysis results fall into Class DS-1, ACEC (Class AC-1s) requirements for concrete protection assuming static groundwater conditions.

SOLMEK

APPENDIX A: Drawings



Client:	Yorkshire Housing
Project:	Saunderson Road, Penistone
Title:	Site Location Map
Drawing No:	Figure 1
Date	September 2012

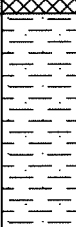
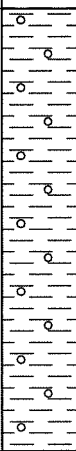
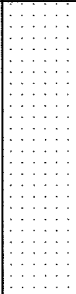


Client:	Yorkshire Housing
Project:	Saunderson Road, Penistone
Title:	Borehole & Trial Pit Location Map
Drawing No:	Figure 2
Date	September 2012

APPENDIX B:
Borehole & Trial Pit Logs

BOREHOLE LOG

Project Saunderson Road, Penistone				BOREHOLE No BH1	
Job No S120731	Date 09-08-12	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 1	
Contractor					

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.15-0.25	B	N=33				(0.25) 0.25	MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is angular to sub rounded fine to medium of sandstone, brick fragments and mudstone.	
0.50-0.60	B					(0.55) 0.80	Soft to firm light orangey-brown-grey slightly sandy CLAY.	
0.90-1.10	B					(1.10) 1.90	Firm to stiff dark brown-grey sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of sandstone, mudstone and siltstone.	
1.20-1.40 1.20	B SPT	N=50+				(0.75) 2.65	Completely to highly weathered grey SANDSTONE, recovered as slightly sandy very gravelly clay.	
1.90-2.00	B						Refusal.	
2.20-2.40 2.20	B SPT							

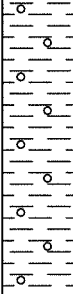
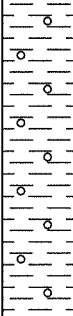
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Perched seepage from 0.5m

All dimensions in metres Scale 1:18.75	Client Yorkshire Housing	Method/ Plant Used Mini Rig	Logged By RW
---	---------------------------------	---------------------------------------	---------------------

GRD_BOREHOLE_LOG S120731.GPJ AGS3 ALL GDT 03/09/12

BOREHOLE LOG

Project Saunderson Road, Penistone				BOREHOLE No BH2	
Job No S120731	Date 09-08-12	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 1	
Contractor					

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)		
0.10-0.15	B	N=29			(0.15) 0.15	MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is angular to sub rounded fine to medium of sandstone, brick fragments and mudstone. Firm becoming stiff orangey-brown-grey slightly sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of sandstone and mudstone. (Turning sandy gravelly from 0.75m).		
0.65-0.75	B				(1.55)			
1.20-1.40 1.20	B SPT				1.70			
1.70-1.80 1.85-1.90 1.85	B SPT	N=50+			(0.65) 2.35	Completely to highly weathered brownish grey SANDSTONE, recovered as very gravelly clay.		
						Refusal.		

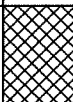
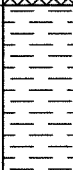
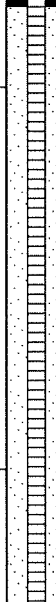
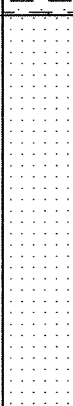
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Water seepage from 1.7m.

All dimensions in metres Scale 1:18.75	Client Yorkshire Housing	Method/ Plant Used Mini Rig	Logged By RW
---	---------------------------------	---------------------------------------	------------------------

GRD_BOREHOLE_LOG_S120731.GPJ AGS3 ALL GDT 03/09/12

BOREHOLE LOG

Project Saunderson Road, Penistone				BOREHOLE No BH3	
Job No S120731	Date 09-08-12	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 1	
Contractor					

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
0.20-0.30	TUB	N=16			(0.25) 0.25	MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is angular to sub rounded fine to medium of sandstone, brick fragments and mudstone.			
					(0.45) 0.70	Soft orangey-brown-grey CLAY.			
0.70-0.80	TUB				(0.95) 1.65	Soft to firm dark orangey-brown sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to medium of sandstone and mudstone.			
1.20-1.65 1.20	B SPT								
2.00-2.10	B					(1.00) 2.65	Completely to highly weathered brownish-grey SANDSTONE, recovered as very gravelly clay.		
2.20-2.65 2.20	B SPT	N=50+				Refusal.			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Water seepage from 1.65m.

All dimensions in metres Scale 1:18.75	Client Yorkshire Housing	Method/ Plant Used Mini Rig	Logged By RW
---	---------------------------------	---------------------------------------	------------------------

GRD_BOREHOLE_LOG S120731.GPJ AGS3 ALL GDT 03/09/12

BOREHOLE LOG

Project Saunderson Road, Penistone				BOREHOLE No BH4	
Job No S120731	Date 09-08-12	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.05-0.10	TUB					(0.15) 0.15	MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is sub rounded fine of sandstone (Organic smell noted).		
0.60-0.70	TUB						Firm to stiff dark orangey-brown-grey sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to medium of sandstone and mudstone.		
1.10-1.20 1.10	B SPT	N=37				(1.75)			
1.90-2.10	B					1.90			
2.10-2.65 2.10	B SPT	N=50+				(0.75)	Completely to highly weathered grey SANDSTONE, recovered as very gravelly clay.		
						2.65			
							Refusal.		

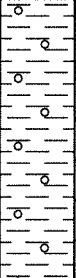
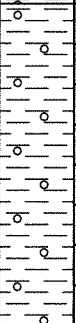
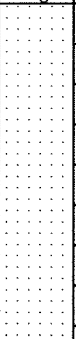
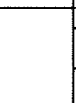
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Water seepage from 0.15m perched above natural clay.

All dimensions in metres Scale 1:18.75	Client Yorkshire Housing	Method/ Plant Used Mini Rig	Logged By RW
---	------------------------------------	--	------------------------

GRD BOREHOLE_LOG S120731.GPJ AGS3 ALL GDT 03/09/12

BOREHOLE LOG

Project Saunderson Road, Penistone				BOREHOLE No BH5	
Job No S120731	Date 09-08-12	Ground Level (m)	Co-Ordinates ()		
Contractor				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.10-0.20	B					(0.40) 0.40	MADE GROUND; Black sandy gravelly clay topsoil. Gravel is angular to sub angular fine to coarse of brick, wood and sandstone.		
0.60-0.70	B					(0.70) 1.10	Firm orangey-brown-grey sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of sandstone and mudstone.		
1.10-1.20 1.10	B SPT	N=27				(0.80) 1.90	Stiff brown-grey sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of sandstone.		
1.90-2.00	B					(0.85) 2.75	Completely to highly weathered brownish-grey SANDSTONE, recovered as very gravelly CLAY.		
2.10-2.75 2.10	B SPT	N=50+				Refusal.			

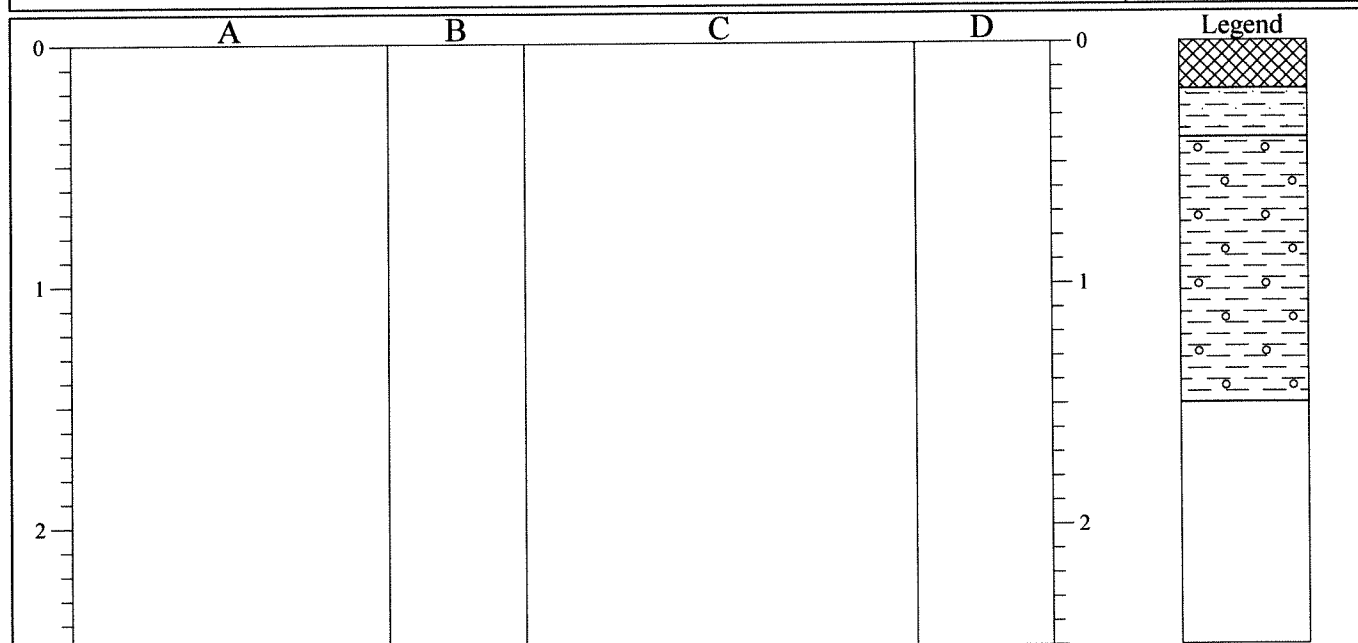
Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
											Groundwater seepage from 1.9m

All dimensions in metres Scale 1:18.75	Client Yorkshire Housing	Method/ Plant Used Mini Rig	Logged By RW
---	-----------------------------	-----------------------------------	-----------------

GRD BOREHOLE LOG S120731.GPJ AGS3 ALL GDT 03/09/12

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP1
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1

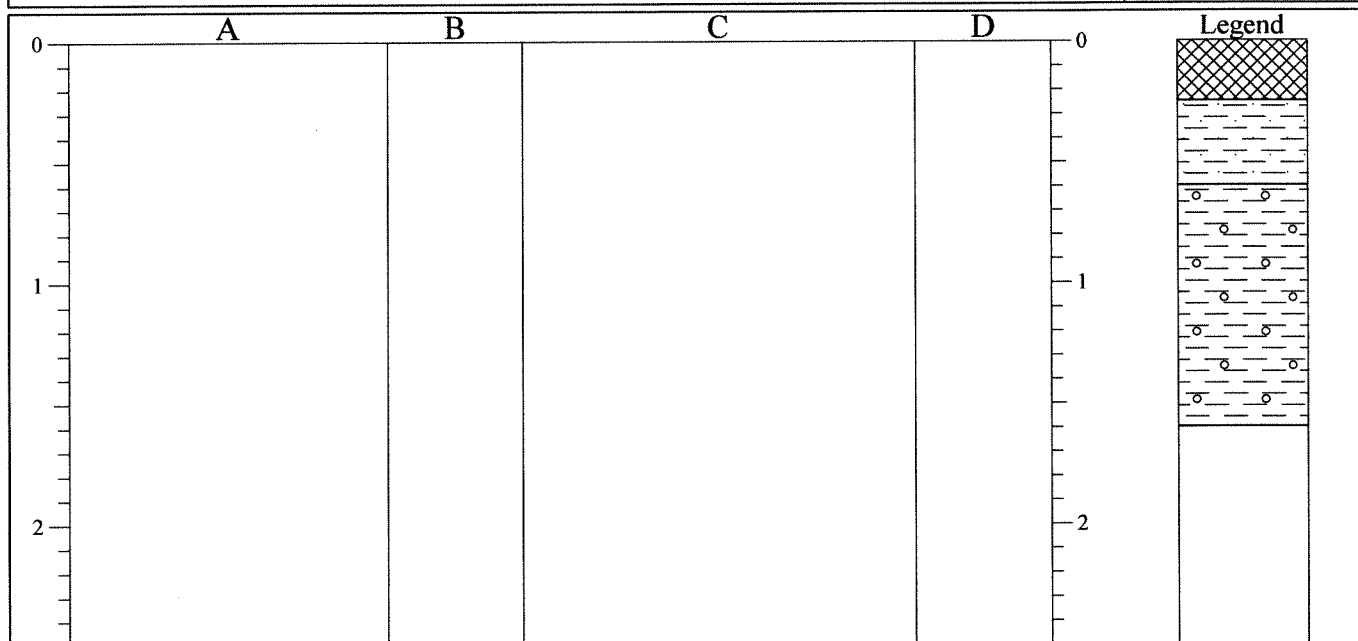


STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	Type	Remarks/Tests
0.00-0.20		MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is sub angular fine to medium of sandstone and mudstone.			
0.20-0.40		Firm orangey-brown grey slightly sandy CLAY.			
0.40-1.50		Stiff dark brown-grey slightly sandy very gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of mudstone and sandstone.			

Shoring/Support: Stability:		GENERAL REMARKS Pit walls stable. No groundwater noted.
All dimensions in metres Scale 1:31.25	Client Yorkshire Housing	Method/ Plant Used Mini Excavator
		Logged By RW

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP2
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



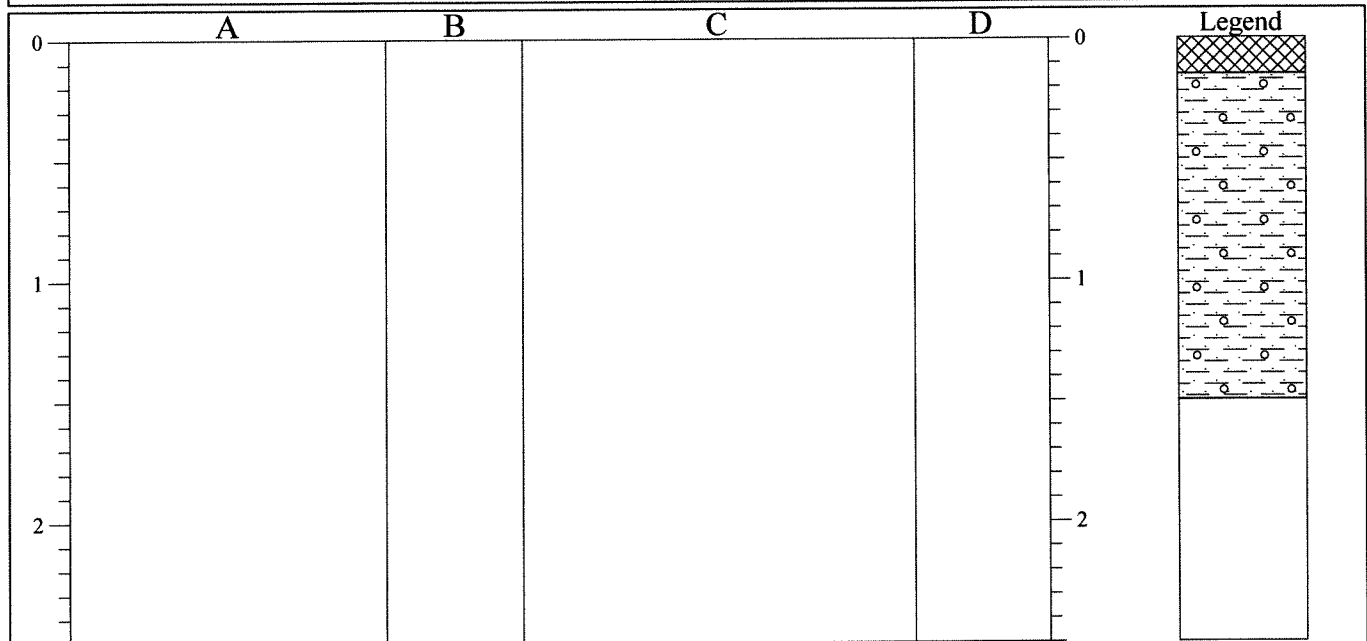
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	Type	Remarks/Tests
0.00-0.25		MADE GROUND: Dark brown and black sandy slightly gravelly clay topsoil. Gravel is sub angular fine to medium of sandstone and mudstone.			
0.25-0.60		Firm orangey-brown grey slightly sandy CLAY.			
0.60-1.60		Stiff dark brown-grey slightly sandy very gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse of mudstone and sandstone.			

Shoring/Support: Stability: 	GENERAL REMARKS Slight water seepage at base of pit. Walls stable.
--	---

All dimensions in metres Scale 1:31.25	Client Yorkshire Housing	Method/ Plant Used Mini Excavator	Logged By RW
---	---------------------------------	---	---------------------

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP3
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1

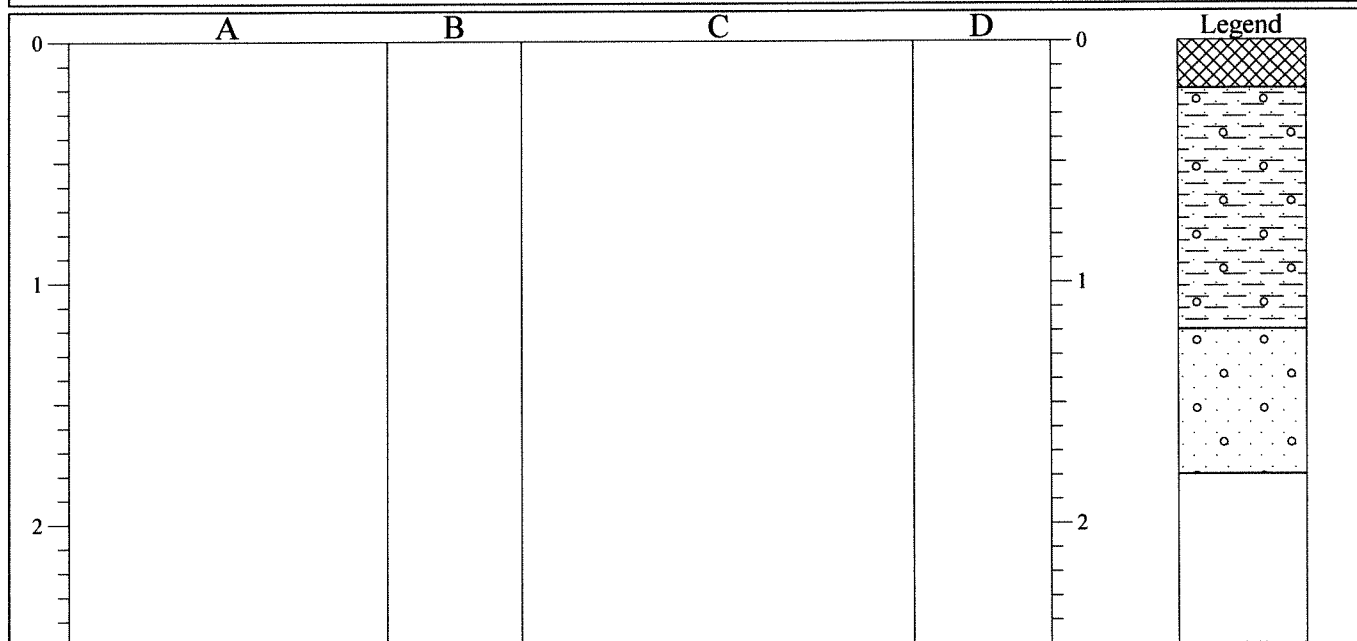


STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	Type	Remarks/Tests
0.00-0.15		MADE GROUND: Dark brown and lack sandy slightly gravelly clay topsoil. Gravel is sub rounded fine of sandstone. (Organic smell noted)			
0.15-1.50		Firm orangey-brown-grey slightly sandy very gravelly CLAY. Gravel is sub angular fine to coarse of mudstone and sandstone. (Strong organic smell from stagnant water).			

Shoring/Support: Stability:		GENERAL REMARKS Water seepage from 0.15m Walls stable.
All dimensions in metres Scale 1:31.25	Client Yorkshire Housing Method/ Plant Used Mini Excavator Logged By RW	

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP4
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



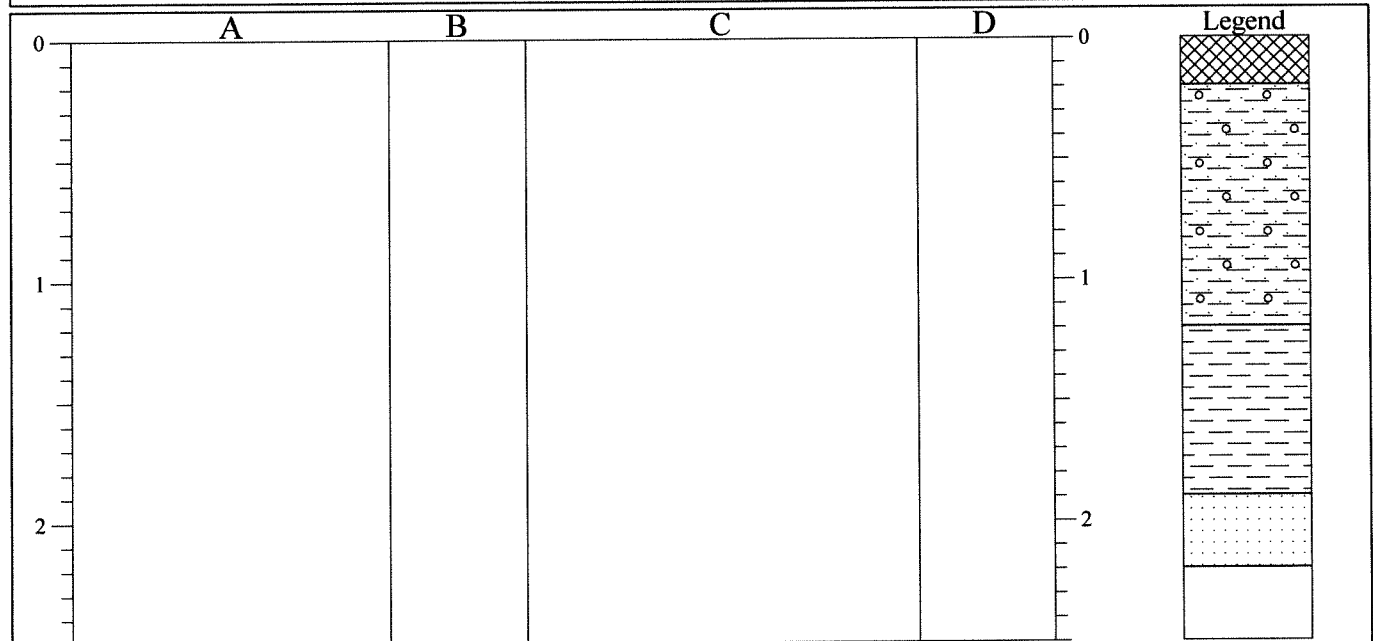
STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	Type	Remarks/Tests
0.00-0.20		MADE GROUND: Reeds over black wet sandy clay topsoil.			
0.20-1.20		Firm orangey-brown-grey sandy slightly gravelly CLAY. Gravel is sub angular to sub rounded fine to medium of sandstone and mudstone.			
1.20-1.80		Grey very clayey gravelly SAND. Gravel is sub angular fine to coarse of sandstone and mudstone.			

GRD_TRIAL_PIT_LOG S120731.GPJ AGS3 ALL.GDT 03/09/12

Shoring/Support: Stability: 		GENERAL REMARKS Water entering pit rapidly from 0.2m due to standing water in reeds. Slight collapse below 1.2m.
All dimensions in metres Scale 1:31.25	Client Yorkshire Housing Method/ Plant Used Mini Excavator Logged By RW	

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP5
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



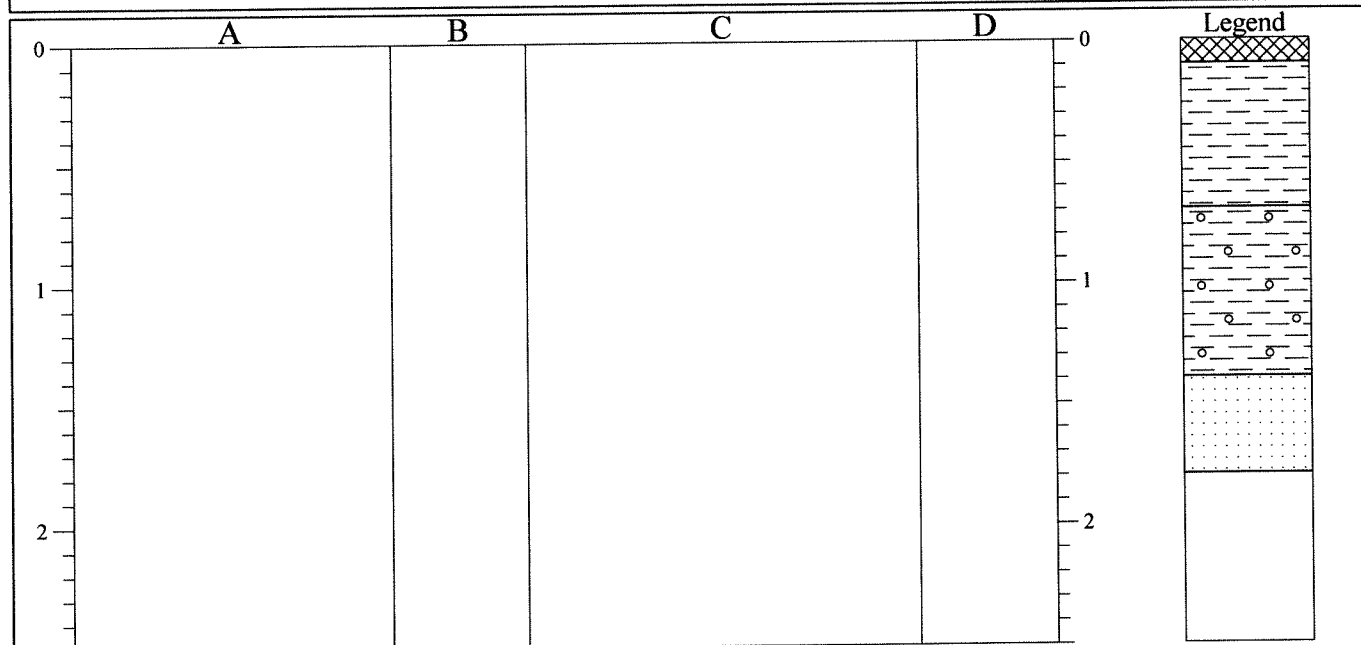
STRATA				SAMPLES & TESTS		
Depth	No	DESCRIPTION		Depth	Type	Remarks/Tests
0.00-0.20		MADE GROUND: Dark brown slightly sandy very gravelly clay topsoil. Gravel is angular to sub angular fine to coarse including cobbles of sandstone.				
0.20-1.20		Firm orangey-brown-grey sandy gravelly CLAY. Gravel is sub angular fine to coarse of sandstone and mudstone.				
1.20-1.90		Soft greenish-grey and black sandy alluvial CLAY.				
1.90-2.20		Completely weathered grey SANDSTONE, recovered as very gravelly clay.				

Shoring/Support: Stability:			GENERAL REMARKS Groundwater as seepage from 0.8m Walls stable.
All dimensions in metres Scale 1:31.25	Client Yorkshire Housing	Method/ Plant Used Mini Excavator	

GRD_TRIAL_PIT_LOG_S120731.GPJ AGS3_ALL_GDT_03/09/12

TRIAL PIT LOG

Project Saunderson Road, Penistone				TRIAL PIT No TP6
Job No S120731	Date 08-08-12	Ground Level (m)	Co-Ordinates ()	
Contractor				Sheet 1 of 1



STRATA			SAMPLES & TESTS		
Depth	No	DESCRIPTION	Depth	Type	Remarks/Tests
0.00-0.10		MADE GROUND: Dark brown and black slightly sandy slightly gravelly clay topsoil. Gravel is sub angular fine to medium of brick fragments and sandstone. Soft light orangey-brown-grey CLAY.			
0.10-0.70					
0.70-1.40		Firm dark orangey-brown-grey sandy gravelly CLAY. Gravel is sub angular to sub rounded fine to coarse including cobbles of sandstone, mudstone and siltstone.			
1.40-1.80		Completely weathered grey SANSTONE, recovered as very gravelly clay including cobbles and boulders.			

Shoring/Support: Stability:	GENERAL REMARKS Water seepage from 0.1m Walls stable.

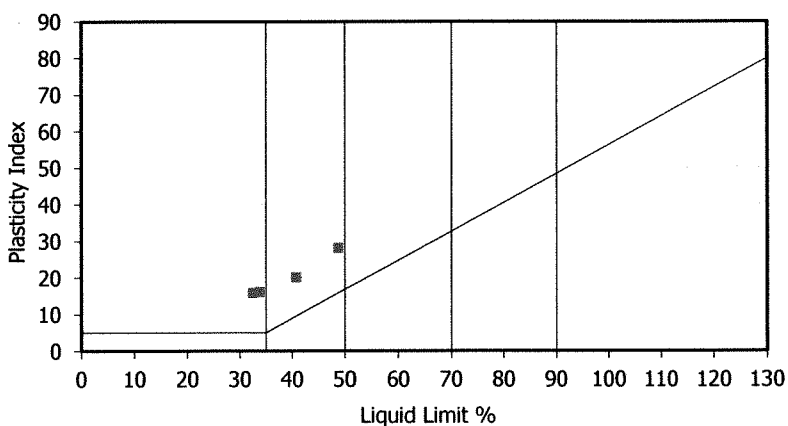
All dimensions in metres Scale 1:31.25	Client Yorkshire Housing	Method/ Plant Used Mini Excavator	Logged By RW
---	------------------------------------	--	------------------------

APPENDIX C:
Geotechnical Laboratory & Soakaway Results

SAUNDERSON ROAD, PENISTONE
S120731



Page 1 of 1

[illegible]

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

Prepared: _____

Date: 3/9/12

Checked: _____

Date: 3/9/12

Approved:

Date: 03/09/12

Comments

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

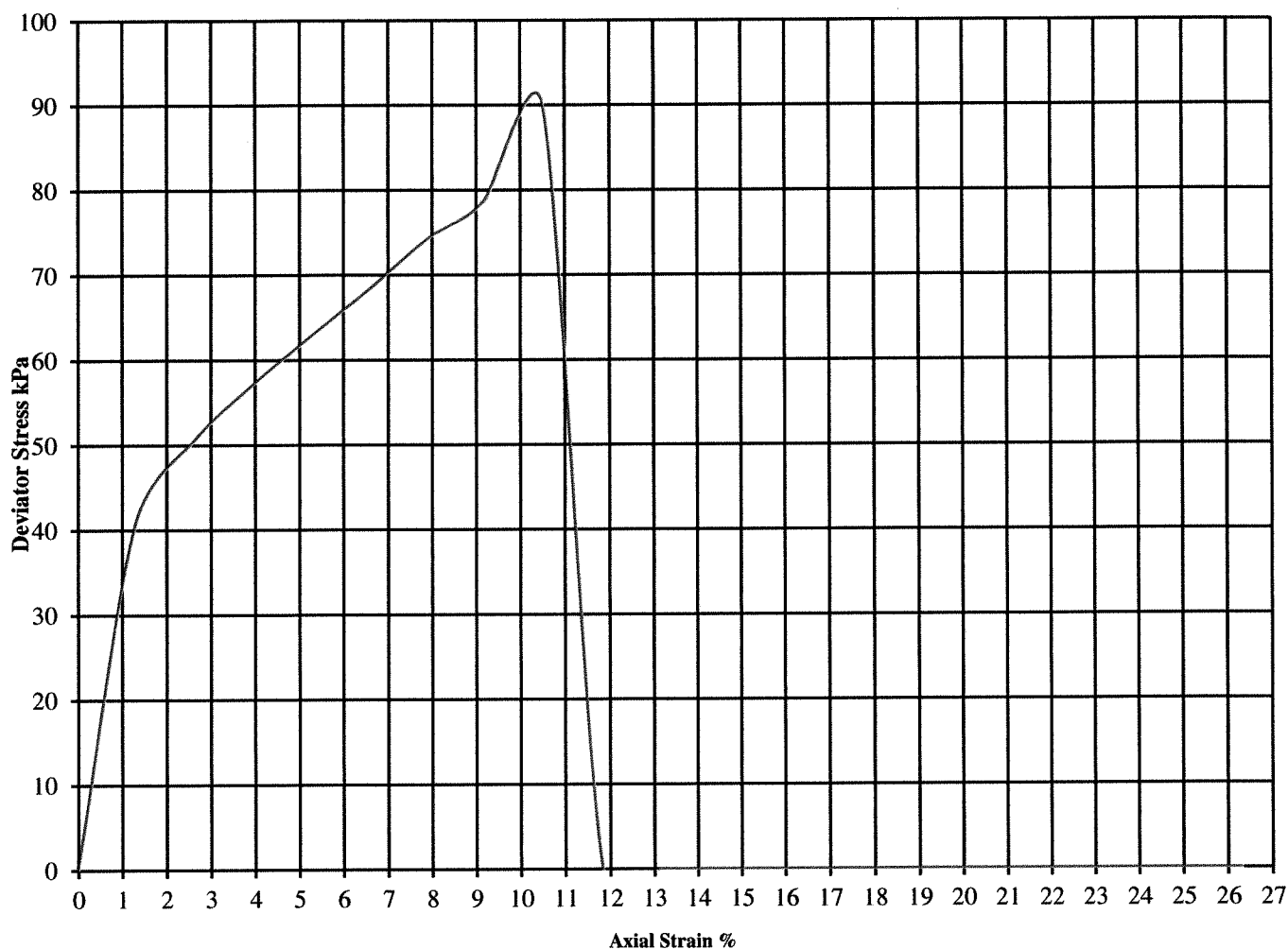
B.S. 1377 : Part 7 : Clause 8 : 1990

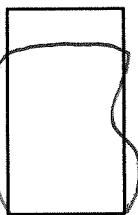
Hole Reference

BH 2

Depth (m)

0.65



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	21	2.08	1.73	20	90	45	10.5	Plastic	45	
Description		Firm brown sandy gravelly CLAY								

Checked and Approved	Date
	3/9/12



Saunderson Road, Penistone

Contract No
S120731

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

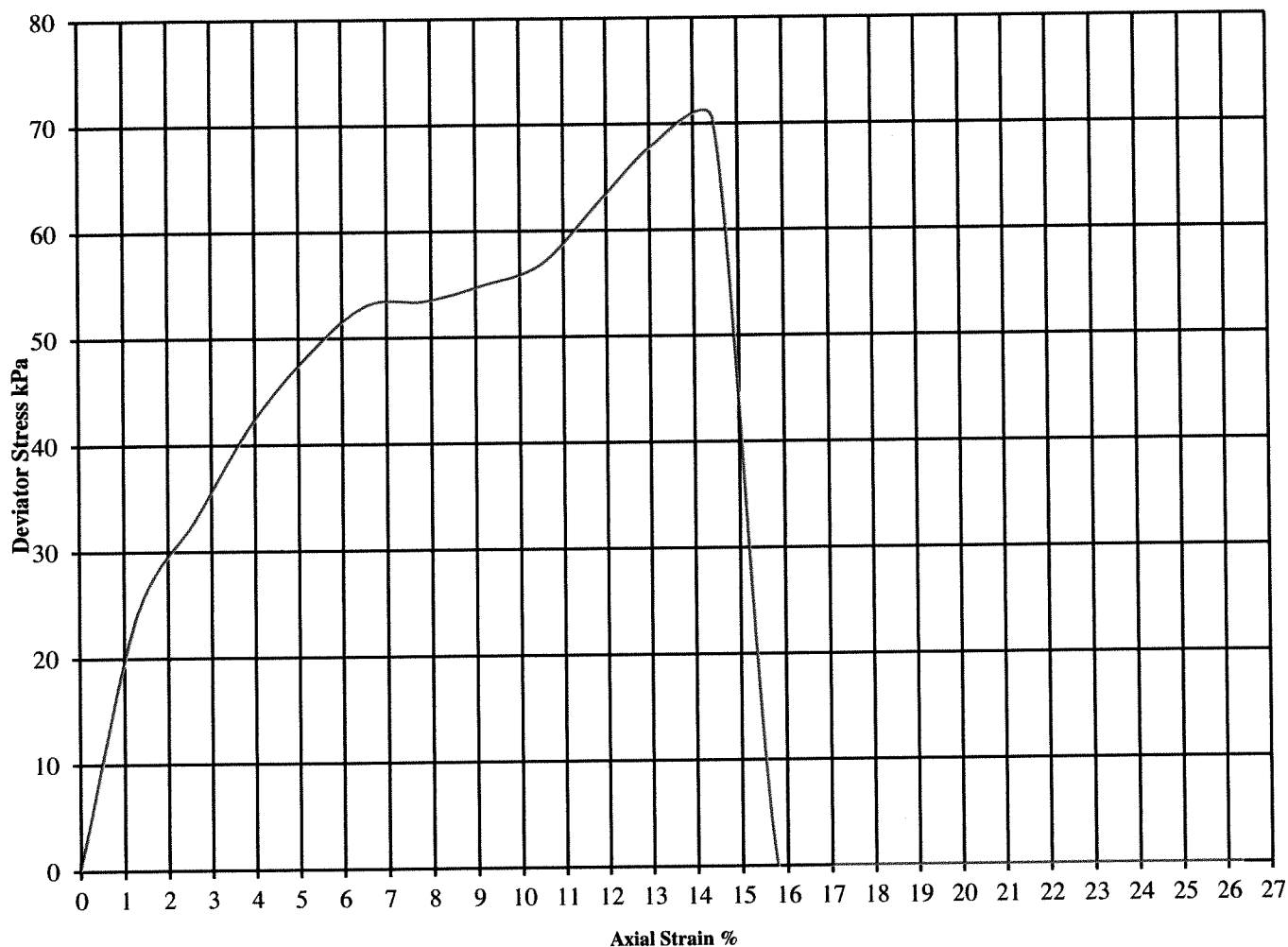
B.S. 1377 : Part 7 : Clause 8 : 1990

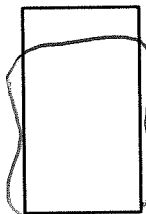
Hole Reference

BH 3

Depth (m)

1.2



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	24	2.03	1.64	20	70	35	14.5	Plastic	35	
Description		Soft brown slightly sandy gravelly CLAY								

Checked and Approved

Date

[Signature]

3/9/12

SOLMEK 

Saunderson Road, Penistone

Contract No
S120731

Undrained Shear Strength in Triaxial Compression

without measurement of Pore Pressure

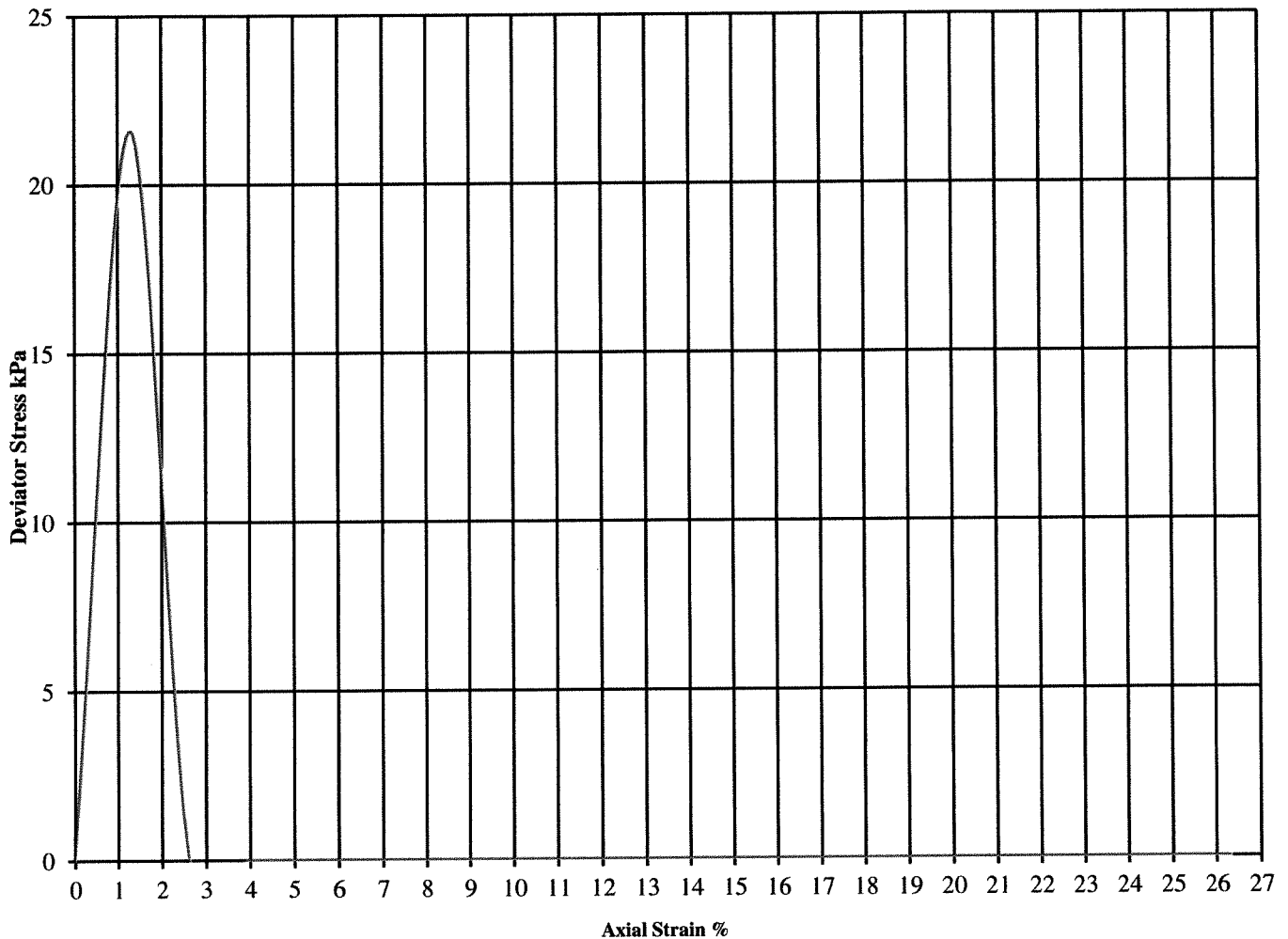
B.S. 1377 : Part7 : Clause 8 : 1990

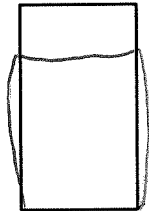
Hole Reference

BH 5

Depth (m)

1.1



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	18	2.12	1.80	20	22	11	1.3	Plastic	11	
Description		Very soft brown slightly sandy gravelly CLAY								

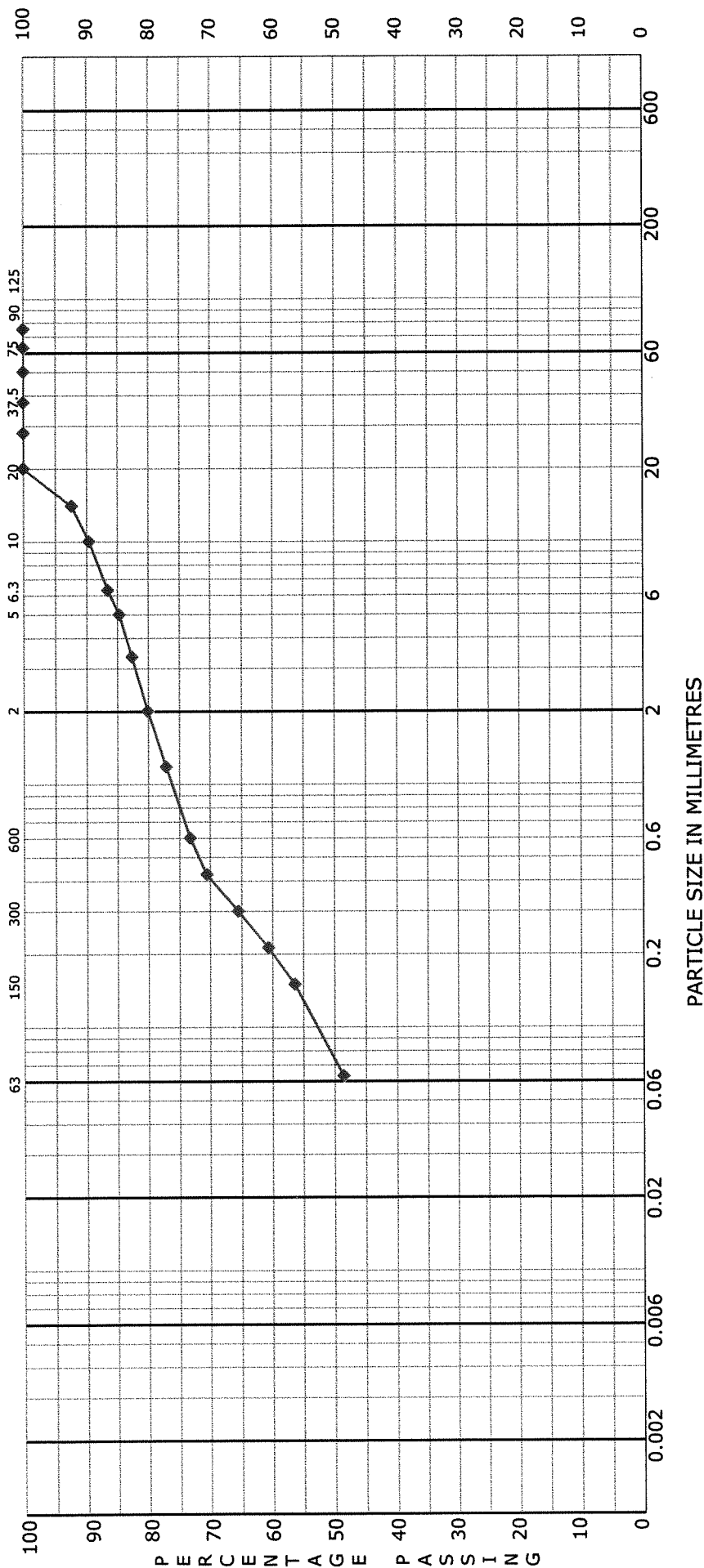
Checked and Approved	Date
	3/9/12



Saunderson Road, Penistone

Contract No
S120731

BS Test Sieves In mm and microns



	CLAY			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

[illegible]

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991
BRE Digest 365, Figure 2, Page 5

Client: Yorkshire Housing

Site: Saunderson Road, Penistone

Job No: S120731

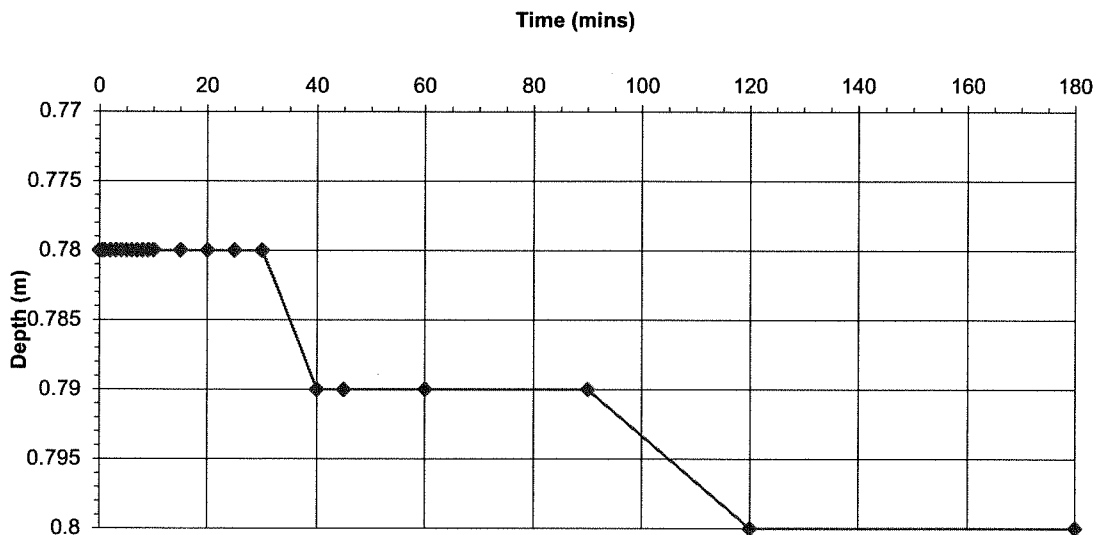
Pit No: TP1

Test No:

1

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)	Pit Dimensions	Length (m) =	1.50
0	0.78		Width (m) =	0.30
0.5	0.78		Depth (m) =	1.50
1	0.78			
2	0.78	Depth at start of test (m) = 0.780		
3	0.78	Depth at end of test (m) = 0.800		
4	0.78	75% level (m) = 0.785		
5	0.78	50% Effective Depth 0.010		
6	0.78	25% level (m) = 0.795		
7	0.78			
8	0.78	Base area of pit (m ²) = 0.450		
9	0.78	V _{p75-25} (m ³) = 0.005		
10	0.78	a _{n50} (m ²) = 0.486		
15	0.78			
20	0.78	From the graph:		
25	0.78	tp 75 (min) = 35		
30	0.78	tp 25 (min) = 105		
40	0.79			
45	0.79	Soil infiltration rate, f, (m/s) =		2.20E-06 normal test
60	0.79			
90	0.79			
120	0.8	Input by:	RW	Date: 10/08/2012
180	0.8	Checked by:		Date:



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991

BRE Digest 365, Figure 2, Page 5

Client: Yorkshire Housing

Site: Saunderson Road, Penistone

Job No: S120731

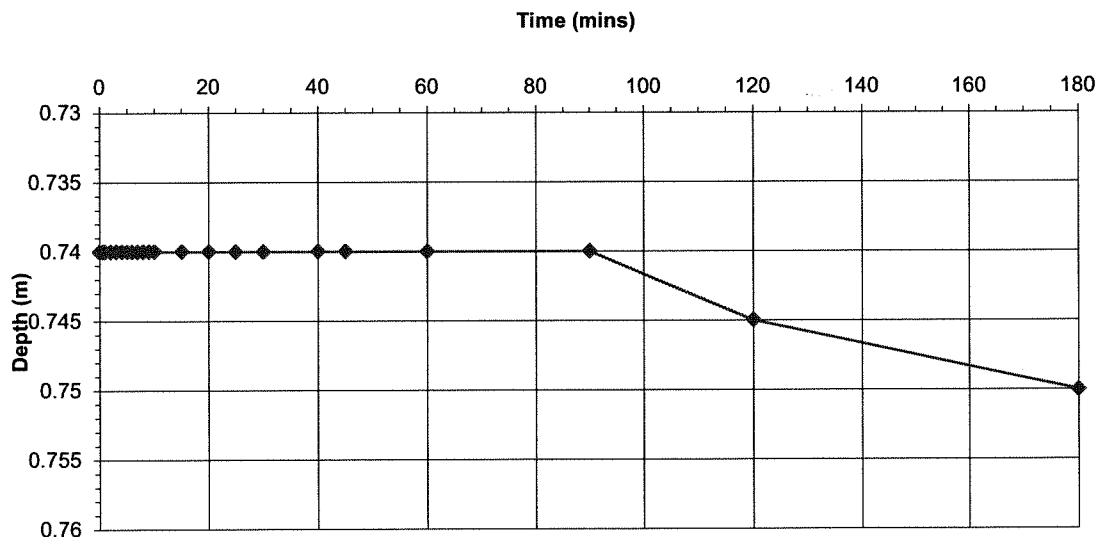
Pit No: TP2

Test No:

1

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)		Pit Dimensions	Length (m) =	1.50
0	0.74			Width (m) =	0.30
0.5	0.74			Depth (m) =	1.60
1	0.74				
2	0.74	Depth at start of test (m) = 0.740			
3	0.74	Depth at end of test (m)= 0.750			
4	0.74	75% level (m)= 0.743			
5	0.74	50% Effective Depth 0.005			
6	0.74	25% level (m)= 0.748			
7	0.74				
8	0.74	Base area of pit (m ²) = 0.450			
9	0.74	V _{p75-25} (m ³) = 0.002			
10	0.74	a _{n50} (m ²) = 0.468			
15	0.74				
20	0.74		From the graph:		
25	0.74		tp 75 (min) = 105		
30	0.74		tp 25 (min) = 165		
40	0.74				
45	0.74	Soil infiltration rate, f, (m/s) =		1.34E-06	normal test
60	0.74				
90	0.74				
120	0.745	Input by:	RW	Date:	10/08/2012
180	0.75	Checked by:		Date:	



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 1991

BRE Digest 365, Figure 2, Page 5

Client: Yorkshire Housing

Site: Saunderson Road, Penistone

Job No: S120731

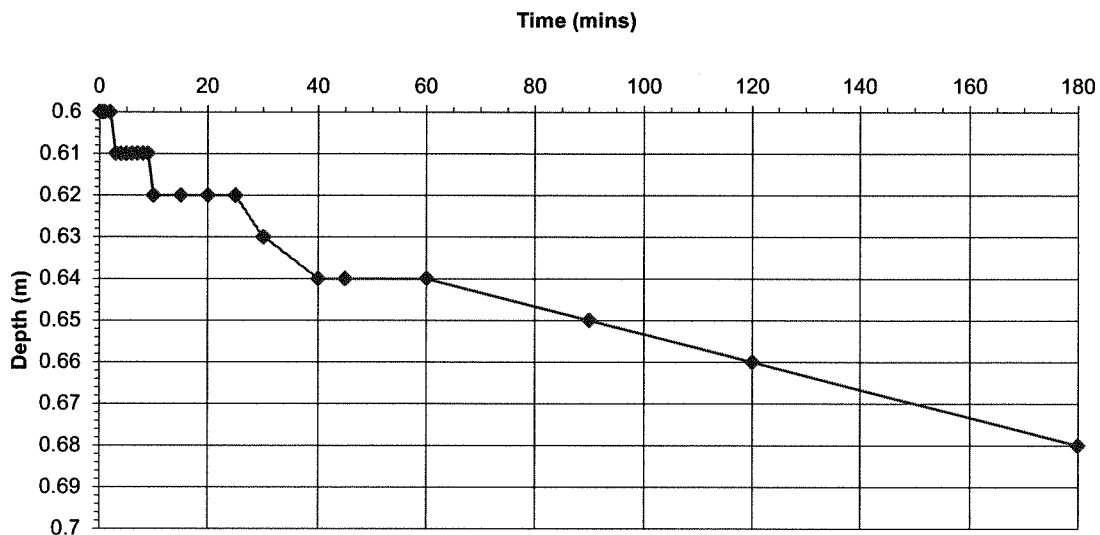
Pit No: TP3

Test No:

1

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)	Pit Dimensions	Length (m) =	1.30
0	0.6		Width (m) =	0.30
0.5	0.6		Depth (m) =	1.50
1	0.6			
2	0.6	Depth at start of test (m) = 0.600		
3	0.61	Depth at end of test (m) = 0.680		
4	0.61	75% level (m) = 0.620		
5	0.61	50% Effective Depth 0.040		
6	0.61	25% level (m) = 0.660		
7	0.61			
8	0.61	Base area of pit (m ²) = 0.390		
9	0.61	V _{p75-25} (m ³) = 0.016		
10	0.62	a _{n50} (m ²) = 0.518		
15	0.62			
20	0.62	From the graph:		
25	0.62	tp 75 (min) = 10		
30	0.63	tp 25 (min) = 120		
40	0.64			
45	0.64	Soil infiltration rate, f, (m/s) =		
60	0.64	4.56E-06 normal test		
90	0.65			
120	0.66	Input by:	RW	Date: 10/08/2012
180	0.68	Checked by:		Date:



APPENDIX D:
Contamination Laboratory Results and
CLEA Model Output Reports



Certificate of Analysis

Date: 23/08/2012

Certificate Number: 12-67238

Client:

SOLMEK
12 Yarm Road
Stockton On Tees
Cleveland
TS18 3NA

Our Reference:

12-67238

Client Reference:

S120731

Contract Title:

Saunderson Road, Penistone

Description:

3 soil samples

Date Received:

13 August 2012

Date Started:

14 August 2012

Date Completed:

23 August 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:

Mark Hughes Contracts Manager

A handwritten signature in cursive script, appearing to read 'Mark Hughes'.

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.

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: 12-67238

Client Ref: S120731

Contract Title: Saunderson Road, Penistone

				Lab No.	435782	435783	435784
				Sample ID	BH1	BH3	BH4
				Depth	0.15-0.25	0.20-0.30	0.60-0.70
				Sample Ref			
				Sample Type			
				Sampling Date	/ /	/ /	/ /
				Sampling Time			
Test	Units	DETSxx	LOD				
Arsenic	mg/kg	DETS 042#	0.2		14	31	7.5
Cadmium	mg/kg	DETS 042#	0.1		0.3	1.4	0.6
Chromium	mg/kg	DETS 042#	0.15		32	26	21
Hexavalent Chromium	mg/kg	DETSC 2204*	1		< 1.0	< 1.0	< 1.0
Copper	mg/kg	DETS 042#	0.2		36	48	23
Lead	mg/kg	DETS 042#	0.3		100	260	20
Mercury	mg/kg	DETSC 2325#	0.05		0.10	0.09	< 0.05
Nickel	mg/kg	DETS 042#	1		11	25	30
Selenium	mg/kg	DETS 042#	0.5		< 0.5	< 0.5	< 0.5
Zinc	mg/kg	DETS 042#	1		52	1000	65
Boron (water soluble)	mg/kg	DETS 020#	0.2		1.8	1.4	0.9
Cyanide total	mg/kg	DETSC 2130#	0.1		1.5	0.6	< 0.1
Organic matter	%	DETSC 2002#	0.1		8.9	7.5	
Sulphide	mg/kg	DETSC 2024#	10		< 10.0	20	12
Sulphate Aqueous Extract as SO4	mg/l	DETSC 2076#	10		19	24	21
pH		DETSC 2008#			5.8	7.4	6.1
Aliphatic C5-C6	mg/kg	DETSC 3321*	0.01		< 0.01	< 0.01	
Aliphatic C6-C8	mg/kg	DETSC 3321*	0.01		0.04	< 0.01	
Aliphatic C8-C10	mg/kg	DETSC 3321*	0.01		0.01	< 0.01	
Aliphatic C10-C12	mg/kg	DETSC 3072#	1.5		< 1.5	< 1.5	
Aliphatic C12-C16	mg/kg	DETSC 3072#	1.2		< 1.2	< 1.2	
Aliphatic C16-C21	mg/kg	DETSC 3072#	1.5		< 1.5	< 1.5	
Aliphatic C21-C35	mg/kg	DETSC 3072#	3.4		< 3.4	< 3.4	
Aromatic C5-C7	mg/kg	DETSC 3321*	0.01		< 0.01	< 0.01	
Aromatic C7-C8	mg/kg	DETSC 3321*	0.01		< 0.01	< 0.01	
Aromatic C8-C10	mg/kg	DETSC 3321*	0.01		< 0.01	< 0.01	
Aromatic C10-C12	mg/kg	DETSC 3072#	0.9		< 0.9	< 0.9	
Aromatic C12-C16	mg/kg	DETSC 3072#	0.5		< 0.5	< 0.5	
Aromatic C16-C21	mg/kg	DETSC 3072#	0.6		< 0.6	< 0.6	
Aromatic C21-C35	mg/kg	DETSC 3072#	1.4		< 1.4	< 1.4	
Aliphatic C5-C35	mg/kg	DETSC 3072*	10		< 10	< 10	
Aromatic C5-C35	mg/kg	DETSC 3072*	10		< 10	< 10	
TPH Ali/Aro	mg/kg	DETSC 3072*	10		< 10	< 10	

Summary of Chemical Analysis

Soil Samples

Our Ref: 12-67238

Client Ref: S120731

Contract Title: Saunderson Road, Penistone

				Lab No.	435782	435783	435784
				Sample ID	BH1	BH3	BH4
				Depth	0.15-0.25	0.20-0.30	0.60-0.70
				Sample Ref			
				Sample Type			
				Sampling Date	/ /	/ /	/ /
				Sampling Time			
Test	Units	DETSxx	LOD				
Acenaphthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Acenaphthylene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Anthracene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Benzo(a)anthracene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Benzo(a)pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Benzo(b)fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Benzo(k)fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Benzo(g,h,i)perylene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Chrysene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Dibenzo(a,h)anthracene	mg/kg	DESTC 3301	0.1	< 0.1	< 0.1		
Fluoranthene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Fluorene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Indeno(1,2,3-c,d)pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Naphthalene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Phenanthrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
Pyrene	mg/kg	DETSC 3301	0.1	< 0.1	< 0.1		
PAH	mg/kg	DETSC 3301	1.6	< 1.6	< 1.6		
Phenol - Monohydric	mg/kg	DETSC 2130#	0.3	0.4	0.9	< 0.3	

Summary of Asbestos Analysis

Soil Samples

Our Ref: 12-67238

Client Ref: S120731

Contract Title: Saunderson Road, Penistone

Lab No	Sample Ref	Material Type*	Result	Comment	Analyst
435782	BH1 0.15-0.25	Soil	NAD	None	Colin Patrick
435783	BH3 0.20-0.30	Soil	NAD	None	Colin Patrick

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		Page 1 of 11
Report generated	31-Aug-12	
Report title	Saunderson Road, Penistone	
Created by	RW at Solmek Ltd	
RESULTS		



[illegible]

CLEA Software Version 1.06		Page 1 of 11
Report generated	31-Aug-12	
Report title	Saunderson Road, Penistone	
Created by	RW at Solmek Ltd	
RESULTS		



CLEA Software Version 1.06		Page 1 of 11
Report generated	31-Aug-12	
Report title	Saunderson Road, Penistone	
Created by	RW at Solmek Ltd	
RESULTS		





	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	1.26E+03	3.10E+04	1.21E+03	0.96	0.04	4.21E+02 (sol)	No	No
2 Acenaphthylene	1.06E+03	2.71E+04	1.02E+03	0.96	0.04	6.32E+02 (sol)	No	No
3 Anthracene	1.06E+04	7.75E+05	1.05E+04	0.99	0.01	8.70E+00 (vap)	No	No
4 Benzo(a)anthracene	1.03E+01	1.58E+01	6.23E+00	0.61	0.39	1.28E+01 (sol)	No	No
5 Benzo(a)pyrene	1.54E+00	2.92E+00	1.01E+00	0.65	0.35	6.83E+00 (vap)	No	No
6 Benzo(b)fluoranthene	1.08E+01	2.07E+01	7.10E+00	0.66	0.34	9.11E+00 (sol)	No	No
7 Benzo(k)fluoranthene	1.55E+01	2.92E+01	1.01E+01	0.65	0.35	5.15E+00 (sol)	No	No
8 Benzo(ghi)perylene	7.21E+01	1.35E+02	4.70E+01	0.65	0.35	1.15E-01 (vap)	No	No
9 Chrysene	1.44E+01	2.81E+01	9.53E+00	0.66	0.34	3.30E+00 (vap)	No	No
10 Dibenzo(ah)anthracene	1.40E+00	2.60E+00	9.12E-01	0.65	0.35	2.95E-02 (vap)	No	No
11 Fluoranthene	7.25E+02	1.66E+05	7.22E+02	1.00	0.00	1.42E+02 (vap)	No	No
12 Fluorene	9.42E+02	3.38E+04	9.16E+02	0.97	0.03	2.29E+02 (sol)	No	No
13 Indeno(123-cd)pyrene	6.47E+00	1.24E+01	4.25E+00	0.66	0.34	4.60E-01 (vap)	No	No
14 Naphthalene	1.75E+02	2.81E+01	2.42E+01	0.14	0.86	5.41E+02 (sol)	No	No
15 Phenanthrene	4.35E+02	3.65E+04	4.29E+02	0.99	0.01	2.68E+02 (sol)	No	No
16 Pyrene	1.68E+03	3.90E+05	1.67E+03	1.00	0.00	1.65E+01 (vap)	No	No
17								
18								
19								
20								

APPENDIX E:
Notes on Limitations & Contamination Guidance

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 relevant **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 volatilised 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:

Land Use	Receptor	Building	Soil Type	pH and SOM
Residential with Homegrown Produce	Female (Age Class 1-6: Young Child)	Bungalow	Clay	pH and SOM content values as presented from testing.
Residential without Homegrown Produce	Female (Age Class 1-6: Young Child)	Small Terraced House	Silty Clay	
		Medium/large Terraced House	Silty Clay Loam	
		Semi-detached House	Clay Loam	
		Detached House	Sandy Lam Loam	
Allotments	Female (Age class 1-6: Young Child)	Assumes None	Silty Loam	
Parks			Sandy Loam	
Open spaces			Sandy Loam	
Playing fields	Female (Age class 4-11: Child)		Sand	
Commercial	Female (Age Class 17-17: Working Adult)	Warehouse (pre 1970)		
		Warehouse (post 1970)		
		Office (pre 1970)		
		Office (post 1970)		

DERIVATION OF SOLMEK GAC THRESHOLD VALUES

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.

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) dependent. 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 Practice 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.

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.