SOLMEK



Lidget Lane, Thurnscoe
Phase 2 Site Investigation Report
S130816
Chevin Housing Association and Synergy Housing Solutions

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PHASE 2 SITE INVESTIGATION REPORT

Lidget Lane, Thurnscoe

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Revision	Date	Prepared By	Checked By
Final	September 2013	D SIMPSON	P FINNIMORE

1 EXECUTIVE SUMMARY

Site Address	Lidget Lane, Thurnscoe
Site Description	The site comprises two parcels of land which are divided by Lidget Lane, Thurnscoe, Rotherham. The northern proportion of the site is divided with a road which runs from north to south down the centre of the site, this area is surrounded with low wooden posts and metal rail fencing with an end of terrace house along the eastern boundary. The southern parcel has recently been subject to demolition. The sites are divided by Lidget Lane and are both level in topography
Fieldwork	• 6no small percussive boreholes to a maximum depth of 2.45mbgl
Ground Conditions	• Made ground was encountered in all of the boreholes to a maximum depth of 0.9mbgl (BH2). Over the smaller area (southwest) the made ground comprised a layer of granular fill (probably resultant demolition waste) to depths of 0.4 and 0.5mbgl over clay fill with brick inclusions. The larger (northeast) area had a layer of sandy topsoil of thickness between 0.2 and 0.4m thick overlying clay fill with brick • Natural deposits underlying the made ground in both areas comprised stiff laminated clay (weathered mudstone) to depths of between 1.85 and 2.0mbgl where very dense highly weathered sandstone and mudstone was encountered. • Groundwater not encountered during fieldwork.
Contamination Testing Results	• From the four samples tested, there was no raised metals or metalloids exceeding the thresholds values for long term risk to human health • 2no samples subject to organic testing for speciated PAH and aliphatic/aromatic TPH determinands are low and below the relevant threshold values for long term harm to human health apart from the level of benzo(a)pyrene from BH6 (0.3-0.4m) which comprised ashy clay fill.
Contamination Analysis	• Remediation not required beneath hard cover areas and building footprints. • Made ground should be classed as slightly contaminated locally contaminated with respect to construction workers. Correct PPE required. • Given the low contamination profile of the ground (both soil results) the risk to controlled waters is considered low. • If garden areas are proposed on the site, during the initial site strip, these areas should be excavated to 0.5mbgl. The made ground across the larger area of the site can be reused. This material should be screened for any deleterious materials. Any deleterious materials encountered (i.e. brick rubble and concrete) should be placed beneath areas of permanent hardcover. The screened topsoil from the larger area can then be separately stockpiled and validated prior to use within garden areas. Should insufficient clean topsoil from the site be available then this will have to be imported from a clean reputable source. It is envisaged that clean subsoil will have to be imported. As a minimum all garden areas should contain 300mm subsoil and 200mm topsoil. • 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 majority of the pH and sulphate tests fall into Class DS-1, ACEC (Class AC-1) requirements for concrete protection. This assumes mobile 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 pH and arsenic were present in levels exceeding the threshold values. Consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.
Ground Gas Results & Analysis	• Gas monitoring currently on going on site.
Contamination Risk Assessment	Based on the information contained in this report, it is the opinion of Solmek that the site represents a **low** environmental risk.
Geotechnical Testing Results	• Shallow cohesive deposits stiff (100-135kPa). • Cohesive materials on site have a medium volume change potential. • No elevated levels of water soluble sulphates and slightly acidic conditions.
Geotechnical Analysis & Foundation Recommendations	Based on a shear strength of 100kN/m² a safe bearing capacity of 230kN/m² has been determined for strip foundations 0.6m wide founding on the natural clay at depths of around 0.9mbgl. Foundations will required deepening locally to allow for deep made ground. Settlements have been calculated to be less than 25mm. Should any of the footings cross differing founding strata the strip footings should be reinforced to prevent excessive differential settlement. Foundations near existing or proposed trees should be deepened and provided with appropriate heave precautions in accordance with NHBC Standards Chapter 4.2 current guidance. Stability of excavations will be poor in the made ground but should improve in the natural cohesive deposits. No groundwater was recorded within the small percussive boreholes during the site works. Therefore it is considered unlikely that dewatering of any shallow excavations will be required.

2 INTRODUCTION

2.1 Authorisation

Solmek were instructed by Chevin Housing Association Ltd and Synergy Housing Solutions to undertake a site investigation on two parcels of land which are divided by Lidget Lane, Thurnscoe. The proposed development on site is to comprise new residential housing.

Sources of information, including previous work undertaken at the site, are detailed below:

- *Solmek Phase 1 Desk Study Report (S130320, April 2013).*

Reference should be made to the above report for details of the site's history, mining and environmental setting.

2.2 Scope of Works

The proposed development is to comprise a new residential housing development. The proposals are also inferred to include the development of hardstanding areas for car parking along with soft landscaping as garden areas. A drawing showing the site is included in Appendix A (Figure 1).

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. 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 holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

3 SITE DESCRIPTION AND FIELDWORK

The centre of the site is located at OS Grid Ref 446180E, 405500N and covers an area of approximately 0.44Ha. The site is currently grass open space within the northern area and recently demolished shops to the southern area of the site.

The site comprises two parcels of land which are divided by Lidget Lane, Thurnscoe, Rotherham. The northern proportion of the site is divided with a road which runs from north to south down the centre of the site, this area is surrounded with low wooden posts and metal rail fencing with an end of terrace house along the eastern boundary. The southern parcel has recently been subject to demolition. The sites are divided by Lidget Lane and are both level in topography.

There were no visual signs of contamination noted during the site walkover, a number of service manholes were noted within the surrounding area.

3.1 Fieldwork

The fieldwork was carried out on 12th August 2013. Six small percussive boreholes (BH1 to BH6 inclusive) were drilled to depths of up to 2.45m below ground level (bgl). A plan showing the location of all the boreholes undertaken can be found in Appendix A, Figure 1.

Standard penetration tests (SPT) were undertaken at various depths within the small percussive boreholes and disturbed samples were retrieved for laboratory testing. Descriptions of the strata encountered in the boreholes together with details of testing, sampling and groundwater are presented in Appendix B of this report.

Ground gas monitoring installations were placed within three of the boreholes (BH1, BH3 and BH6) during the investigation. Three rounds of gas monitoring are currently being undertaken, the results of which will be provided as an addendum to this report.

4 GROUND CONDITIONS

A summary of the ground conditions encountered is given below.

4.1 Made Ground

Made ground was encountered in all of the boreholes to a maximum depth of 0.9mbgl (BH2). Over the smaller area (southwest), the made ground comprised a layer of granular fill (probably resultant demolition waste) to depths of 0.4 and 0.5mbgl over clay fill with brick inclusions. The larger area (northeast) had a layer of sandy topsoil of thickness between 0.2 and 0.4m thick overlying clay fill with brick inclusions.

4.2 Natural Deposits

Natural deposits underlying the made ground in both areas comprised stiff laminated clay (weathered mudstone) to depths of between 1.85 and 2.0mbgl where very dense highly weathered sandstone and mudstone was encountered.

4.3 Groundwater

No groundwater strikes were noted within the boreholes during the site works. It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities.

5 CONTAMINATION TESTING RESULTS

The proposed development of the site is to involve the construction of residential housing. The final development will also include hardstanding in the form of car parking along with areas of soft landscaping as residential gardens.

5.1 Contamination Testing

To provide information upon the possibility of ground contamination four samples of made ground deposits from 0.3m to 0.70mbgl were subject to chemical contamination analysis. A suite of metals, semi-metals, non-metals and inorganic determinants were carried out on all four samples. Speciated Polyaromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbon Aromatic/Aliphatic fractions (TPHs) were undertaken on two selected samples.

Asbestos soil screening was undertaken on three of the samples.

5.2 Test Results

Given the sites end use, 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 (Res)
- **Building Type:** Semi-detached house

- **Soil Type:** Sandy clay loam
- **Soil pH:** 7.7 (lowest recorded value)
- **Soil Organic Matter:** 1.6% (lowest recorded value)

The test results are presented in Appendix C, and a summary is provided below in Tables 1 and 2.

The CLEA UK Model Output Reports have been included in Appendix D. The CLEA Model output reports show three assessment criteria (Oral, Inhalation and Combined). Where all three boxes are shaded red the threshold values have been assumed to be the soil saturation limit.

TABLE 1: SUMMARY OF INORGANIC CONTAMINATION TESTING RESULTS

Determinand	Units	Number of Samples Tested	Number Above Detection Limit	Minimum Level	Maximum Level	Threshold Value	Number Exceeding Threshold
Metals							
Cadmium	mg/kg	4	4	0.7	0.8	5.17	0
Chromium (Total)	mg/kg	4	4	21	51	3000	0
Hexavalent Chromium	mg/kg	4	0	<1	-	4.25	0
Copper	mg/kg	4	4	15	130	2360	0
Lead	mg/kg	4	4	24	100	*276	0
Mercury (Inorganic)	mg/kg	4	4	0.06	0.08	169	0
Nickel	mg/kg	4	4	12	19	127	0
Zinc	mg/kg	4	4	73	120	2860	0
Semi-metals and non-metals							
Arsenic	mg/kg	4	4	6.9	11	32.4	0
Boron	Mg/kg	4	1	<0.2	0.2	10.3	0
Selenium	mg/kg	4	0	<0.5	-	350	0
Inorganic chemicals							
Cyanide (Total)	mg/kg	4	4	0.2	0.9	1.49	0
Sulphate (WS)	mg/l	4	4	24	480	500**	0
Sulphide	mg/kg	4	3	<10	88	250***	0
Other							
pH	pH	4	4	7.7	9.3	<5	0
Phenol	mg/kg	4	2	<0.3	0.5	262	0

** Atkins SSV (GAC), CLEA Software Version 1.04*
*** BRE Special Digest 1, 2005 (3rd Edition) 'Concrete in Aggressive Ground'*
**** EA Lower Tier Threshold Values*

5.3 Metals, Semi Metals and Non Metals

From the four samples tested, there was no raised metals or metalloids exceeding the thresholds values for long term risk to human health.

5.4 Inorganic Chemicals

Soluble sulphates (potentially aggressive to foundation concrete) were recorded between 24 and 480mg/l, therefore, none are above the BRE Special Digest One threshold value of 500mg/l.

The results of the pH testing were between 7.7 and 9.3. These pH levels are consistent with slightly alkaline to alkaline conditions

5.5 Organic Chemicals

Two samples were subjected to organic testing for speciated PAH and TPH aromatic/aliphatic splits.

TABLE 2: SUMMARY OF ORGANIC CONTAMINATION TESTING RESULTS

Determinant	Units	Number of Samples Tested	Number Above Detection Limit	Minimum Level	Maximum Level	Threshold Value	Number Exceeding Threshold
TPH Aliphatic Fractions							
C5-C6	mg/kg	2	0	<0.01	-	72.9	0
C6-C8	mg/kg	2	0	<0.01	-	207	0
C8-C10	mg/kg	2	0	<0.01	-	57.2	0
C10-C12	mg/kg	2	0	<1.5	-	75.8**	0
C12-C16	mg/kg	2	0	<1.2	-	37.8**	0
C16-C21	mg/kg	2	0	<1.5	-	13.6**	0
C21-C35	mg/kg	2	0	<3.4	-	13.6**	0
TPH Aromatic Fractions							
C5-C7	mg/kg	2	0	<0.01	-	0.134	0
C7-C8	mg/kg	2	0	<0.01	-	200	0
C8-C10	mg/kg	2	0	<0.01	-	62.4	0
C10-C12	mg/kg	2	0	<0.9	-	87.9	0
C12-C16	mg/kg	2	0	<0.5	-	212	0
C16-C21	mg/kg	2	0	<0.6	-	356	0
C21-C35	mg/kg	2	0	<1.4	-	1010	0
Speciated PAH							
Acenaphthene	mg/kg	2	1	<0.1	0.2	323	0
Acenaphthylene	mg/kg	2	1	<0.1	0.2	265	0
Anthracene	mg/kg	2	1	<0.1	0.3	3420	0
Benzo[a]anthracene	mg/kg	2	1	<0.1	2.0	4.25	0
Benzo[a]pyrene	mg/kg	2	1	<0.1	1.6	0.9	1
Benzo[b]fluoranthene	mg/kg	2	1	<0.1	1.6	6.18	0
Benzo[k]fluoranthene	mg/kg	2	1	<0.1	1.0	9.18	0
Benzo[g,h,i]perylene	mg/kg	2	1	<0.1	1.9	45.3	0
Chrysene	mg/kg	2	1	<0.1	1.8	7.31	0
Dibenzo[a,h]anthracene	mg/kg	2	1	<0.1	0.4	0.832	0
Fluoranthene	mg/kg	2	1	<0.1	3.7	356	0
Fluorene	mg/kg	2	1	<0.1	0.2	254	0
Indeno[1,2,3-cd]pyrene	mg/kg	2	1	<0.1	1.7	3.6	0
Napthalene	mg/kg	2	1	<0.1	0.2	4.17	0
Phenanthrene	mg/kg	2	1	<0.1	2.8	139	0
Pyrene	mg/kg	2	2	0.1	3.4	791	0
PAH Total	mg/kg	2	0	<1.6	23	50*	0

** EA derived thresholds*
*** Soil Saturation Limit*

The results for speciated PAH and aliphatic/aromatic TPH determinands are low and below the relevant threshold values for long term harm to human health apart from the level of benzo(a)pyrene from BH6 (0.3-0.4m) which comprised ashy clay fill.

5.6 Asbestos

No asbestos fibres were identified in the three samples subject to laboratory screening.

5.7 Environmental Protection Act 1990: Part 2A Revised Statutory Guidance (April 2012)

This revised document explains how the Local Authority should decide if land, based on a legal interpretation, is contaminated. The document replaces the previous guidance given in Annex 3 of DEFRA Circular 01/2006, issued in accordance with section 78YA of the 1990 Environmental Protection Act.

The main objectives of the Part 2A regime are to *"identify and remove unacceptable risks to human health and the environment" and* to *"seek to ensure that contaminated land is made suitable for its current use"*. Part 2A uses a risk based approach to defining contaminated land whereby the "risk" is interpreted as *"the likelihood that harm, or pollution of water, will occur as a result of contaminants in, on or under the land"* and by *"the scale and seriousness of such harm or pollution if it did occur"*.

For a relevant risk to exist a contaminant, pathway and receptor linkage must be present before the land can be considered to be contaminated.

The document explains that *"for a risk to exist there must be contaminants present in, on or under the land in a form and quantity that poses a hazard, and one or more pathways by which they might significantly harm people, the environment, or property; or significantly pollute controlled waters."*

A conceptual model is used to develop and communicate the risks associated with a particular site.

To determine if land is contaminated the local authority use various categories from 1 to 4. Categories 1 and 2 include *"land which is capable of being determined as contaminated land on grounds of significant possibility of significant harm to human health."*

Categories 3 and 4 *"encompass land which is not capable of being determined on such grounds"*.

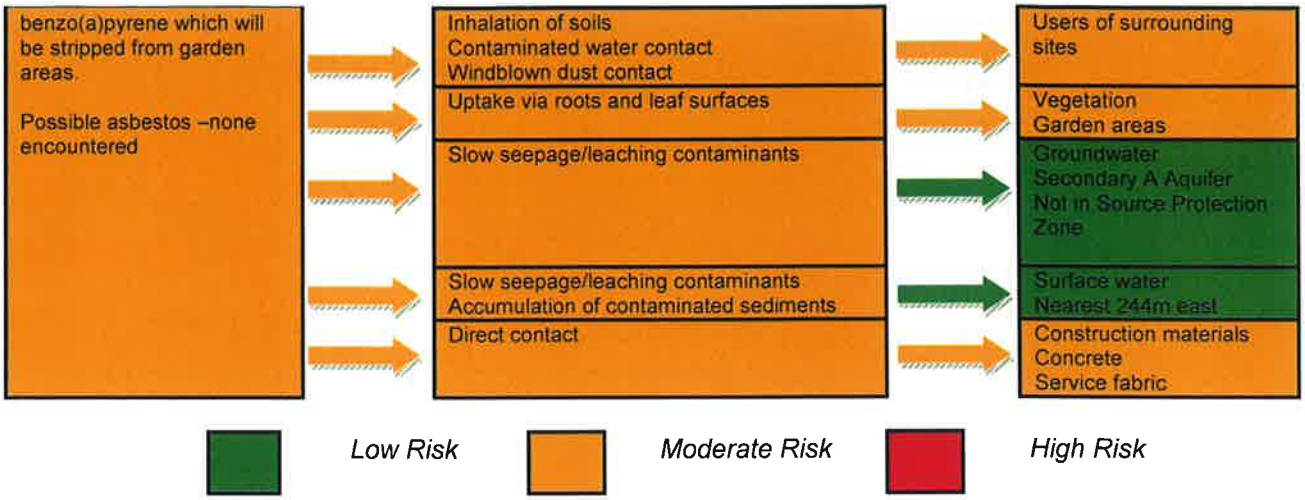
See Appendix E for additional notes on contamination guidelines.

6 CONCEPTUAL MODEL AND CONTAMINATION ANALYSIS

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

TABLE 3: CONCEPTUAL MODEL

Source	Pathway	Receptor
Potential contamination in made ground from construction materials – no raised levels apart from one raised benzo(a)pyrene which will be stripped from garden areas.	Dermal absorption Inhalation of soils Soil ingestion Contaminated water contact Soft landscaping and gardens	Users of the Site after development complete
Ground gases from near-by landfill, underlying coal working and made ground on site	Ground gas migration through underlying soils and ingress into structures	Users of the Site after development complete
Potential contamination in made ground from construction/demolition materials– no raised levels apart from one raised	Dermal absorption Inhalation of soils Soil ingestion Contaminated water contact Windblown dust contact	Construction workforce



In general terms, the users of the site, construction workers, users of the surrounding sites, vegetation, surface water, groundwater 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 receptor.

6.1 Users of the Site Once Development is Complete

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 home grown produce. The results indicate that the concentrations of the metals, semi-metals and non-metals within the made ground are below the threshold values for long term risk to human health with the exception of one raised level of sulphate.

In terms of organic determinants the majority were below the detection level and were all below the relevant thresholds for long term harm to human health.

Given the levels of contaminants recorded on site it is considered that the levels on site are unlikely to pose a risk to the current and future users of the site, and remediation is not required for the building footprints and other areas of hardstanding.

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.

6.2 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 slightly contaminated due to an elevated concentration of copper. Locally contaminated levels of pH and sulphide were noted. It is considered that levels of contamination may pose a risk to construction workers and users of surrounding sites. It is recommended that appropriate PPE in accordance with HSE and Environment Agency guidance is adopted for the duration of the contractor works and good practice is adopted to minimise the release of potential contaminants during ground works.

During dry weather, any excavations may require clean water to be sprinkled at shallow depth to prevent excess dust escaping to off-site receptors.

6.3 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*". No raised concentrations of the phytotoxic determinands were noted within the samples tested.

Garden areas are presumed to be proposed on the site, during the initial site strip, these areas should be excavated to 0.5mbgl. The topsoil made ground across the larger (northeast) area of the site can be reused as topsoil. This material should be screened for any deleterious materials. Any deleterious materials encountered (i.e. brick rubble and concrete) should be placed beneath areas of permanent hardcover. The screened topsoil from the larger area can then be separately stockpiled and validated prior to use within garden areas. Should insufficient clean topsoil from the site be available after screening etc then it will have to be imported from a clean reputable source. It is envisaged that clean subsoil will have to be imported. As a minimum all garden areas should contain 300mm subsoil and 200mm topsoil.

6.4 Ground and Surface Water

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 site does not lie within a Source Protection Zone and the solid geology is classified as a Secondary A Aquifer. The nearest surface water feature lies 244m east. No groundwater was encountered within the boreholes during the fieldwork. It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities.

6.5 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 majority of the pH and sulphate tests fall into Class DS-1, ACEC (Class AC-1) requirements for concrete protection. This assumes mobile 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 pH and arsenic were present in levels exceeding the threshold values. Consultation with the utility providers is recommended. As a minimum services should be placed within clean service trenches.

7 GROUND GAS ASSESSMENT

A period of three ground gas monitoring visits is currently underway and the results will be provided as an

addendum to this report.

8 GEOTECHNICAL TESTING AND ANALYSIS

Samples taken from the boreholes underwent a series of geotechnical tests (BS 1377:1990) to aid foundation design and soil description. In addition, insitu Standard Penetration Tests (SPTs) were undertaken at regular intervals during drilling. The geotechnical results are presented in Appendix D.

8.1 Strength and Density

SPT N values within the clay and mudstone across the site ranged from 20 to 27, when multiplied by five the SPT N values roughly equate to shear strength in cohesive deposits. Therefore, shear strengths ranging from 100kPa (stiff) to 135kPa (very stiff) can be assumed.

8.2 Moisture Contents

Samples were recovered from the boreholes which have been subject to moisture content tests at depths of 1.2mbgl. Moisture levels were between 17% and 27%.

8.3 Atterberg Limit Determinations

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 intermediate to high plasticity.

The Plasticity Indices ranged from 28 to 30 with moisture contents recorded above and below the corresponding plastic limits. The cohesive material can be assessed as having a **medium** shrinkage potential in relation to NHBC Guidance Chapter 4.2.

8.4 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 6.4 and 6.5 indicating slightly acidic conditions. Soluble sulphates were recorded at levels of 95 and 99mg/l.

8.5 Foundations

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

Based on a shear strength of 100kN/m² (lowest of the SPT values around 1.2mbgl) a safe bearing capacity of 230kN/m² has been determined for strip foundations 0.6m wide founding on the natural clay at depths of around 0.9mbgl. Providing the safe bearing capacity is not exceed settlements have been calculated to be less than 25mm. Foundations may require deepening locally around areas of deep made ground. Should any of the footings cross differing founding strata the strip footings should be reinforced to prevent excessive differential settlement.

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

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

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

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 majority of the pH and sulphate tests fall into Class DS-1, ACEC (Class AC-1s) requirements for concrete protection assuming static groundwater conditions.

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

8.6 Excavation

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant although breaking out of demolition waste and other obstructions should be anticipated. Stability of excavations will be poor in the made ground but should improve slightly in the stiff cohesive deposits on the site. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97: "Trenching Practice".

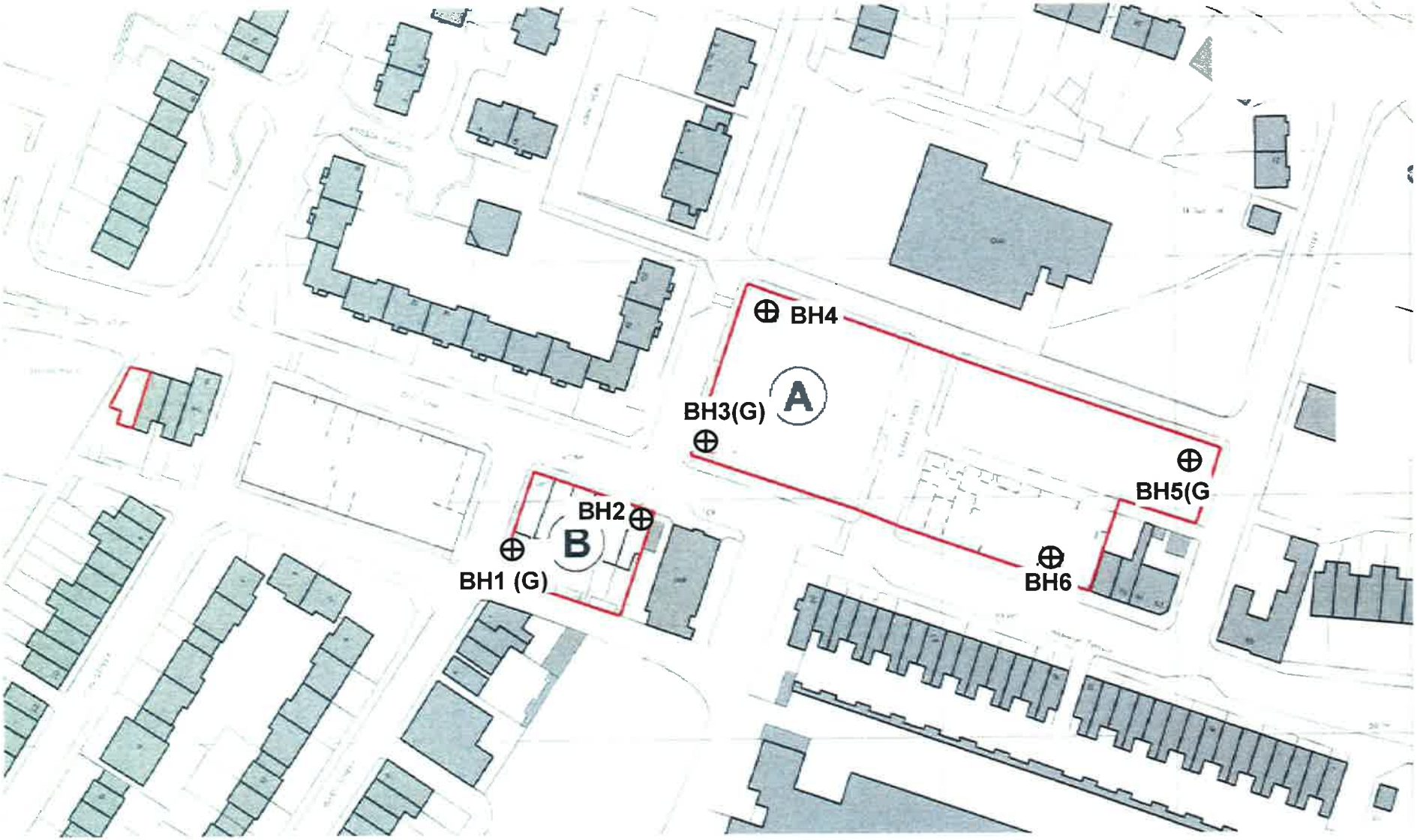
8.7 Groundwater

No groundwater was recorded within the small percussive boreholes during the site works. Therefore it is considered unlikely that dewatering of any shallow excavations will be required.

It should be noted the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities.

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APPENDIX A



CLIENT: **Chevin Housing Association and Synergy Housing Solution**	
PROJECT: **Lidget Lane, Thurnscoe**	
DRG NO: **Figure 1**	
TITLE: **Borehole Location Plan**	SCALE: **NTS**
SOLMEK	

APPENDIX B

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BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH1**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(0.40)	MADE GROUND: Compact greyish brown sandy gravel fill. Frequent brick/concrete included.		
0.30-0.40	B					0.40			
						(0.30)	MADE GROUND: Greyish brown sandy clay fill, frequent brick included.		
0.60-0.70	B					0.70			
						(1.15)	Stiff greyish brown slightly laminated sandy CLAY (weathered mudstone).		
1.20-1.65 1.20	J SPT	N=20							
						1.85			
1.85-2.20 1.85	J SPT	N=50+				(0.35)	Very dense highly weathered yellowish brown SANDSTONE.		
						2.20			
							Borehole refusal/ complete.		

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 1:18.75	Client	Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used	Mini Rig	Logged By	DS

GRD_BOREHOLE_LOG TEST S130816.GPJ AGS3_ALL.GDT 5/9/13

Solmek
12 Yarm Road
TS18 3NA

Tel 01642607083
Fax 01642612355

BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH2**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-0.40	B					(0.50) 0.50	MADE GROUND; Greyish brown sandy clay fill frequent brick/concrete included.		
0.60-0.70	B					(0.40) 0.90	MADE GROUND: Greyish brown sandy clay fill frequent brick included.		
1.20-1.65 1.20	J SPT	N=26				(1.10) 2.00	Stiff greyish brown slightly laminated sandy CLAY (weathered mudstone).		
1.95-2.20 1.95	J SPT	N=50+				(0.40) 2.40	Very dense highly weathered yellowish brown SANDSTONE.		
							Borehole refusal/complete.		

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 1:18.75	Client	Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used	Mini Rig	Logged By	DS

GRD_BOREHOLE_LOG TEST S130816.GPJ AGS3_ALL.GDT 5/9/13

Solmek
12 Yarm Road
TS18 3NA

Tel 01642607083
Fax 01642612355

BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(0.30) 0.30	MADE GROUND: Brown sandy clayey topsoil. Frequent brick/concrete included		
0.30-0.40	B					(0.30) 0.60	MADE GROUND: Greyish brown sandy clay fill frequent brick included.		
0.60-0.70	B					(1.30) 1.90	Stiff greyish brown slightly laminated sandy CLAY (weathered mudstone).		
1.20-1.65 1.20	J SPT	N=22							
1.80-2.20 1.80	J SPT	N=50+				(0.30) 2.20	Very dense highly weathered yellowish brown SANDSTONE.		
							Borehole refusal/ complete.		

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 1:18.75	Client Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used Mini Rig	Logged By DS

GRD_BOREHOLE_LOG TEST S130816 GPJ AGS3_ALL.GDT 5/9/13

Solmek
12 Yarm Road
TS18 3NA

Tel 01642607083
Fax 01642612355

BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH4**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(0.40)	MADE GROUND: Brown sandy/clayey topsoil. Frequent brick/concrete included		
0.30-0.40	B					0.40			
						(0.20)	MADE GROUND: Greyish brown sandy clay fill frequent brick included.		
						0.60			
0.60-0.70	B						Stiff yellowish brown slightly laminated sandy CLAY (weathered mudstone).		
1.20-1.65	J					(1.30)			
1.20	SPT	N=22							
1.80-2.20	J					1.90			
1.80	SPT	N=50+					Very dense highly weathered yellowish brown SANDSTONE.		
						(0.30)			
						2.20	Borehole refusal/ complete.		

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

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

No groundwater encountered.

All dimensions in metres Scale 1:18.75	Client Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used Mini Rig	Logged By DS

GRD_BOREHOLE_LOG TEST S130816.GPJ AGS3_ALL.GDT 5/9/13

Solmek
12 Yarm Road
TS18 3NA

Tel 01642607083
Fax 01642612355

BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH5**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.30-0.40	B					(0.40) 0.40	MADE GROUND: Brown sandy, clayey topsoil. Frequent brick/concrete included		
						(0.20) 0.60	MADE GROUND: Greyish brown ashy clay fill frequent brick included.		
0.60-0.70	B						Stiff light grey very sandy laminated CLAY (weathered mudstone).		
1.20-1.65 1.20	J SPT	N=27				(1.30) 1.90			
2.00-2.20 2.00	J SPT	N=50+				(0.55) 2.45	Very dense highly weathered clayey MUDSTONE.		
							Borehole refusal/ complete.		

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 1:18.75	Client Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used Mini Rig	Logged By DS

GRD_BOREHOLE_LOG TEST S130816 GPJ AGS3_ALL.GDT 5/9/13

Solmek
12 Yarm Road
TS18 3NA

Tel 01642607083
Fax 01642612355

BOREHOLE LOG

Project				BOREHOLE No
Lidget Lane, Thurnscoe				**BH6**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S130816	12-08-13			
Contractor				Sheet
				1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
						(0.20) 0.20	MADE GROUND: Brown sandy, clayey topsoil. Frequent brick/concrete included		
0.30-0.40	B					(0.50) 0.70	MADE GROUND: Greyish brown ashy clay fill frequent brick included.		
0.60-0.70	B								
1.20-1.65 1.20	J SPT	N=26				(1.30) 2.00	Stiff light grey very sandy laminated CLAY (weathered mudstone).		
2.00-2.20 2.00	J SPT	N=50+				(0.45) 2.45	Very dense highly weathered clayey MUDSTONE.		
							Borehole refusal/ complete.		

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 1:18.75	Client Chevin Housing Association and Synergy Housing Solution	Method/ Plant Used Mini Rig	Logged By DS

GRD_BOREHOLE_LOG TEST S130816.GPJ AGS3_ALL.GDT 5/9/13

APPENDIX C

Derwentside Environmental Testing Services

2139

Certificate of Analysis

Date: 04/09/2013

Certificate Number: 13-87865

Client:	SOLMEK 12 Yarm Road Stockton On Tees Cleveland TS18 3NA
Our Reference:	13-87865
Client Reference:	S130816
Contract Title:	Lidget Lane, Thurnscoe
Description:	4 soil samples
Date Received:	29 August 2013
Date Started:	29 August 2013
Date Completed:	04 September 2013
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:	Rob Brown, Business Manager

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

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. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28oC +/-2oC.

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: 13-87865
Client Ref: S130816
Contract Title: Lidget Lane, Thurnscoe

			Lab No.	549996	549997	549998	549999
			Sample ID	BH1	BH2	BH3	BH6
			Depth	0.30-0.40	0.60-0.70	0.30-0.40	0.30-0.40
			Sample Ref				
			Sample Type				
			Sampling Date	/ /	/ /	/ /	/ /
			Sampling Time				
Test	**Units**	**DETSxx**	**LOD**				
Mercury	mg/kg	DETSC 2325#	0.05	0.07	0.07	0.06	0.08
Arsenic	mg/kg	DETSC2301#	0.2	8.2	8.9	6.9	11
Cadmium	mg/kg	DETSC2301#	0.1	0.8	0.8	0.7	0.8
Chromium	mg/kg	DETSC2301#	0.15	27	26	21	51
Copper	mg/kg	DETSC2301#	0.2	130	29	15	26
Nickel	mg/kg	DETSC2301#	1	19	18	12	17
Lead	mg/kg	DETSC2301#	0.3	45	100	24	42
Selenium	mg/kg	DETSC2301#	0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	mg/kg	DETSC2301#	1	120	73	81	99
Boron (water soluble)	mg/kg	DETSC2123#	0.2	< 0.2	0.2	< 0.2	< 0.2
Cyanide total	mg/kg	DETSC 2130#	0.1	0.9	0.2	0.7	0.4
Organic matter	%	DETSC 2002#	0.1	3.0	1.6	7.0	4.1
Sulphide	mg/kg	DETSC 2024#	10	88	57	< 10.0	49
Sulphate Aqueous Extract as SO4	mg/l	DETSC 2076#	10	480	140	24	120
pH		DETSC 2008#		9.3	8.2	7.7	8.9
Aliphatic C5-C6	mg/kg	DETSC 3321*	0.01		< 0.01		< 0.01
Aliphatic C6-C8	mg/kg	DETSC 3321*	0.01		< 0.01		< 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: 13-87865
Client Ref: S130816
Contract Title: Lidget Lane, Thurnscoe

			Lab No.	549996	549997	549998	549999
			Sample ID	BH1	BH2	BH3	BH6
			Depth	0.30-0.40	0.60-0.70	0.30-0.40	0.30-0.40
			Sample Ref				
			Sample Type				
			Sampling Date	/ /	/ /	/ /	/ /
			Sampling Time				
Test	**Units**	**DETSxx**	**LOD**				
Acenaphthene	mg/kg	DETSC 3301	0.1		< 0.1		0.2
Acenaphthylene	mg/kg	DETSC 3301	0.1		< 0.1		0.2
Anthracene	mg/kg	DETSC 3301	0.1		< 0.1		0.3
Benzo(a)anthracene	mg/kg	DETSC 3301	0.1		< 0.1		2.0
Benzo(a)pyrene	mg/kg	DETSC 3301	0.1		< 0.1		1.6
Benzo(b)fluoranthene	mg/kg	DETSC 3301	0.1		< 0.1		1.6
Benzo(k)fluoranthene	mg/kg	DETSC 3301	0.1		< 0.1		1.0
Benzo(g,h,i)perylene	mg/kg	DETSC 3301	0.1		< 0.1		1.9
Chrysene	mg/kg	DETSC 3301	0.1		< 0.1		1.8
Dibenzo(a,h)anthracene	mg/kg	DESTC 3301	0.1		< 0.1		0.4
Fluoranthene	mg/kg	DETSC 3301	0.1		< 0.1		3.7
Fluorene	mg/kg	DETSC 3301	0.1		< 0.1		0.2
Indeno(1,2,3-c,d)pyrene	mg/kg	DETSC 3301	0.1		< 0.1		1.7
Naphthalene	mg/kg	DETSC 3301	0.1		< 0.1		0.2
Phenanthrene	mg/kg	DETSC 3301	0.1		< 0.1		2.8
Pyrene	mg/kg	DETSC 3301	0.1		0.1		3.4
PAH	mg/kg	DETSC 3301	1.6		< 1.6		23
Phenol - Monohydric	mg/kg	DETSC 2130#	0.3	0.5	< 0.3	< 0.3	0.3
Hexavalent Chromium	mg/kg	DETSC 2204*	1	< 1.0	< 1.0	< 1.0	< 1.0

Summary of Asbestos Analysis
Soil Samples

Our Ref: 13-87865
Client Ref: S130816
Contract Title: Lidget Lane, Thurnscoe

Lab No	Sample Ref	Material Type*	Result	Comment	Analyst
549996	BH1 0.30-0.40	Soil	NAD	na	Andrew Little
549998	BH3 0.30-0.40	Soil	NAD	na	Andrew Little
549999	BH6 0.30-0.40	Soil	NAD	na	Andrew Little

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'.

Sample Comments

DETS cannot be held responsible for the integrity of sample(s) received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating.

Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note "Guidance on Deviating Samples".

All samples received are listed below. However, those samples that have additional comments in relation to hold time and/or inappropriate containers are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations.

If no sampled date (soils) or date/time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters), this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Lab No.	Sample ID	Date Sampled	Containers Received	Deviating due to holding time being exceeded for test(s)	Deviating due to inappropriate container for test(s)	Deviating due to headspace presence in container for test(s)
549996	BH1 0.30-0.40 SOIL		Plastic Bag	Sample is deviating (no sampled date supplied)		
549997	BH2 0.60-0.70 SOIL		Plastic Bag	Sample is deviating (no sampled date supplied)	Aliphatics/Aromatics Solid, BTEX Solid, Naphthalene, PAH FID Solid	
549998	BH3 0.30-0.40 SOIL		Plastic Bag	Sample is deviating (no sampled date supplied)		
549999	BH6 0.30-0.40 SOIL		Plastic Bag	Sample is deviating (no sampled date supplied)	Aliphatics/Aromatics Solid, BTEX Solid, Naphthalene, PAH FID Solid	

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Report generated 04-Sep-13

Report title LIDGET LANE

Created by DS 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	5.45E+00	2.97E+01	5.17E+00	0.91	0.10	1.00	NR	Yes	Yes
2	Chromium III	1.95E+04	3.55E+03	3.00E+03	0.15	0.85	1.00	NR	No	No
3	Chromium VI	NR	4.25E+00	NR	0.00	1.00	NR	NR	Yes	No
4	Copper	2.70E+03	1.04E+04	2.36E+03	0.77	0.23	1.00	NR	Yes	No
5	Mercury, inorganic	1.81E+02	2.55E+03	1.69E+02	0.93	0.07	1.00	NR	No	No
6	Nickel	5.31E+02	1.27E+02	NR	0.14	1.00	NR	NR	Yes	Yes
7	Zinc	3.74E+03	7.49E+03	2.86E+03	0.62	0.38	1.00	NR	Yes	No
8	Arsenic	3.24E+01	8.50E+01	NR	1.00	0.38	NR	NR	No	No
9	Boron	2.91E+02	1.05E+01	1.03E+01	0.02	0.98	1.00	NR	Yes	No
10	Selenium	3.50E+02	NR	NR	1.00	NR	NR	NR	Yes	No
11	Cyanide	1.07E+01	1.60E+00	1.49E+00	0.07	0.93	1.00	NR	Yes	No
12	Phenol	6.64E+02	4.32E+02	2.62E+02	0.39	0.61	1.00	5.95E+04 (vap)	No	No
13										
14										
15										
16										
17										
18										
19										
20										

CLEA Software Version 1.06

Report generated 04-Sep-13

Report title LIDGET LANE

Created by DS 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	7.20E+03	7.31E+01	7.29E+01	0.01	1.00	1.00	3.82E+02 (sol)	Yes	Yes
2	Aliphatic EC 6-8	2.18E+04	2.07E+02	2.07E+02	0.00	1.00	1.00	2.11E+02 (sol)	Yes	Yes
3	Aliphatic EC 8-10	1.95E+03	5.76E+01	5.72E+01	0.01	0.99	1.00	1.22E+02 (vap)	Yes	Yes
4	Aliphatic EC 10-12	3.81E+03	2.90E+02	2.84E+02	0.04	0.96	1.00	7.58E+01 (vap)	Yes	Yes
5	Aliphatic EC 12-16	4.39E+03	2.44E+03	2.01E+03	0.30	0.70	1.00	3.78E+01 (sol)	Yes	Yes
6	Aliphatic EC 16-35	6.75E+04	NR	NR	1.00	NR	NR	1.36E+01 (sol)	Yes	No
7	Aromatic EC 5-7	1.64E-01	7.28E-01	1.34E-01	0.82	0.18	1.00	1.69E+03 (sol)	No	No
8	Aromatic EC 7-8	2.25E+02	1.84E+03	2.00E+02	0.89	0.11	1.00	1.31E+03 (vap)	No	No
9	Aromatic EC 8-10	8.67E+01	1.02E+02	6.24E+01	0.56	0.44	1.00	9.71E+02 (vap)	Yes	Yes
10	Aromatic EC 10-12	1.24E+02	1.42E+02	8.79E+01	0.55	0.45	1.00	5.79E+02 (sol)	Yes	Yes
11	Aromatic EC 12-16	2.14E+02	5.81E+03	2.12E+02	0.98	0.02	1.00	2.69E+02 (sol)	Yes	Yes
12	Aromatic EC 16-21	3.56E+02	NR	NR	1.00	NR	NR	8.58E+01 (vap)	Yes	No
13	Aromatic EC 21-35	1.01E+03	NR	NR	1.00	NR	NR	7.72E+00 (sol)	Yes	No
14										
15										
16										
17										
18										
19										
20										

CLEA Software Version 1.06

Report generated	04-Sep-13
Report title	LIDGET LANE
Created by	DS 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	3.39E+02	7.09E+03	3.23E+02	0.95	0.05	1.00	9.07E+01 (sol)	No	No
2	Acenaphthylene	2.77E+02	6.38E+03	2.65E+02	0.96	0.04	1.00	1.37E+02 (sol)	No	No
3	Anthracene	3.48E+03	1.93E+05	3.42E+03	0.98	0.02	1.00	1.87E+00 (vap)	No	No
4	Benzo(a)anthracene	8.12E+00	8.91E+00	4.25E+00	0.52	0.48	1.00	2.74E+00 (sol)	No	No
5	Benzo(a)pyrene	1.33E+00	2.79E+00	9.00E-01	0.68	0.32	1.00	1.46E+00 (vap)	No	No
6	Benzo(b)fluoranthene	9.06E+00	1.95E+01	6.18E+00	0.68	0.32	1.00	1.94E+00 (sol)	No	No
7	Benzo(k)fluoranthene	1.36E+01	2.81E+01	9.18E+00	0.67	0.33	1.00	1.10E+00 (sol)	No	No
8	Benzo(ghi)perylene	6.90E+01	1.32E+02	4.53E+01	0.66	0.34	1.00	2.46E-02 (vap)	No	No
9	Chrysene	1.05E+01	2.41E+01	7.31E+00	0.70	0.30	1.00	7.04E-01 (vap)	No	No
10	Dibenz(ah)anthracene	1.27E+00	2.40E+00	8.32E-01	0.65	0.35	1.00	6.29E-03 (vap)	No	No
11	Fluoranthene	3.59E+02	4.99E+04	3.56E+02	0.99	0.01	1.00	3.03E+01 (vap)	No	No
12	Fluorene	2.62E+02	8.14E+03	2.54E+02	0.97	0.03	1.00	4.92E+01 (sol)	No	No
13	Indeno(123-cd)pyrene	5.25E+00	1.15E+01	3.60E+00	0.69	0.31	1.00	9.82E-02 (vap)	No	No
14	Naphthalene	4.19E+01	4.63E+00	4.17E+00	0.10	0.90	1.00	1.20E+02 (sol)	No	No
15	Phenanthrene	1.41E+02	9.08E+03	1.39E+02	0.98	0.02	1.00	5.75E+01 (sol)	No	No
16	Pyrene	7.97E+02	1.16E+05	7.91E+02	0.99	0.01	1.00	3.52E+00 (vap)	No	No
17										
18										
19										
20										

APPENDIX D

SOLMEK Laboratory Report

Contract Number: S130816 **Report Date:** 03/09/2013

Client's Reference:

Client Name: Solmek
12 Yarm Road
Stockton on Tees
TS18 3NA

For the attention of: Deryck Simpson

Contract Title: Lidget Lane, Thurnscoe

Date Received: 20/08/2013
Date Commenced: 27/08/2013
Date Complete: 03/09/2013

Notes:

Samples will be held at the laboratory for a period of 6 weeks after the report date. After the **15/10/2013** all samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Checked and Approved Signitories:

I Nicholson
(Lab Manager)

M Atkins
(Assistant Lab Manger)

D Simpson
(Office Manager)

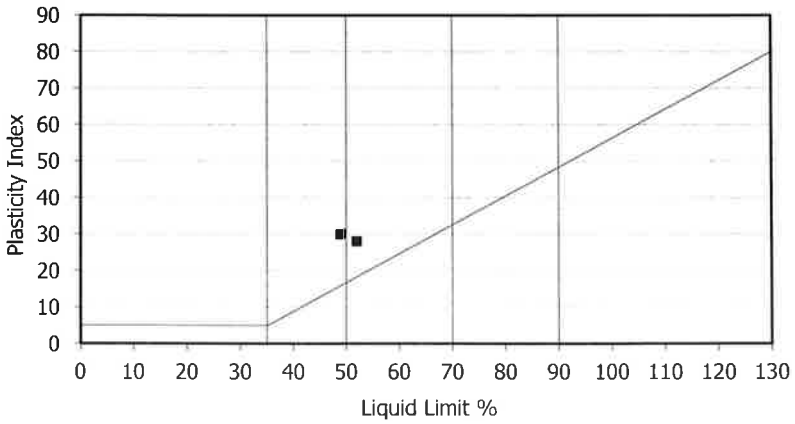
12 Yarm Road
Stockton on Tees
TS18 3NA
Tel: 01642 607083
Fax: 01642 612355
e-mail: lab@solmek.com

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

LIDGET LANE, THURNSCOE
S130816

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
BH1,2,3	1.20	D	27	52	24	28	CH	96.0	6.4	95		
BH4,5,6	1.20	D	17	49	19	30	CI	98.5	6.5	99		



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: Date: 03/09/2013

Checked: Date: 03/09/2013

Approved: Date: 03/09/2013

APPENDIX E

SOLMEK NOTES ON CONTAMINATION GUIDANCE(REF: VERSION 1/2013)

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="6">Clay
Silty Clay
Silty Clay Loam
Clay Loam
Sandy Lam
Loam
Silty Loam
Sandy Loam
Sandy Loam
Sand</td><td rowspan="6">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>
</table>

DERIVATION OF SOLMEK GAC THRESHOLD VALUES

A number of specific exposure pathways are considered in addition to the above table when considering the generated GA(values. In some instances, the GAC generated value may be presented at the soil saturation limit if this has been exceeded. Th 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 nc available. These figures accord with the generic units presented within the CLEA Software. Where Solmek cannot generat specific GAC values, the Environment Agency's SGVs (where available), released from March 2009, and Atkins SSV's (derive 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 ($CaCO_3$) 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 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: version1/2013)

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.