ST/0970/15/FUL

Site Investigation Report

Proposed Housing Development
Waterside Park, Hebburn

Hebburn Properties Ltd

Report Number S60330/SI

May 2006

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SECTION

TABLES

APPENDICES

Status	Prepared by	Checked	Date
Final	A Cutts	D Simpson	May 2006

Site Investigation Report

Waterside Park, Hebburn

1 INTRODUCTION

1.1 This report describes phase two of the ground investigation carried out by Solmek on land located at Waterside Park, Hebburn near Newcastle Upon Tyne. The work was carried out for Hebburn Properties Ltd for a proposed housing development.

1.2 The objectives of the investigation were to investigate the ground conditions at the site and specifically undertake a series of boreholes and shallow hand excavated CBR trial pits with a view to providing information on near surface geotechnical and contamination conditions. A desk study was carried out by Solmek in April 2006 (Report Number S60330) and should be read in conjunction with this report. However a brief summary is included in Section 2.

1.3 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. Samples obtained from the boreholes were subjected to a programme of laboratory geotechnical and contamination testing. Testing in the geotechnical laboratory was carried out to BS1377:1990 "Methods of Test for Soils for Civil Engineering Purposes". The results and interpretation provided in this report are based on the investigation fieldwork and laboratory testing; they are subject to the comments and approval of the various regulatory authorities and utilities.

1.4 The comments and opinions presented in this report are based on the findings of a review of available information, ground conditions encountered during the intrusive investigation work and on the results of tests carried out in the laboratory. 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. Responsibility cannot be accepted for conditions not revealed by the investigation. 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.

2 DESK STUDY SUMMARY

Site Description

2.1 The preliminary site inspection, as recommended in BS5930 and BS10175, was undertaken on 29th March 2006. A site location map is presented in Figure 1, Appendix 1. The site is centred at Ordnance Survey Co-ordinates 430340E, 564570N.

2.2 The site is located to the north west of Hebburn, South Tyneside and currently comprises an area of undeveloped land to the south of a new housing estate (Waterside Park). The site covers an area of approximately 0.2ha.

2.3 The entrance to the site is accessed from the main road running through the housing estate. The entrance is generally flat and leads to one side of, and behind, an existing bungalow where the site opens out to reveal a moderate slope trending to the north west. There are a number of plateaus along the south eastern third of the site and the slope gradient increases further to the east beyond this. The ground surface is covered in scrub grass vegetation including thorn bushes. A number of areas in the north and east are boggy and moss has grown within the grass. A channel (running south east to north west) had been excavated down the slope near the northern boundary and this was gently issuing water indicating a possible spring further up the slope. Trees are located at the top of the slope to the east and along the bottom of the slope to the west.

2.4 The site is bound to the north by the rear gardens of the housing estate. Trees mark the western boundary along with a broken concrete post and wire fence. The ground slopes down to the west to an open grassed area including a playing field and a series of footpaths. A footpath circles the southern boundary beyond some trees and continues along the eastern boundary. A large factory or works is located to the east and part of the building consists of three tall chimneys.

2.5 No significant sources of contamination were observed during the site walkover. Some general litter was located around the periphery of the site.

History

2.6 The site has been directly associated with heavy industrial activity in the past. Industry on the site included an alkali works (from at least 1897 up to 1941) with railway lines.

Industry in the close vicinity included a rifle range, colour works, electrical engineering works, bauxite works, further railway lines and tanks. The site was also shown to contain an earth embankment in the 1970's. Due to the lack of definition of some of the map extracts however, not all previous land uses may have been identified.

Regulatory Search Summary

2.7 The regulatory search from the previous investigation indicated that within 500m of the site there was one landfill (A British Geological Survey landfill 294m south west; however no information is available as to the type and age of waste). There are no sites under Integrated Pollution Control (IPC), or sites with hazardous, radioactive or dangerous substance consents in the area.

2.8 The site falls within a 5km square area in which less than 1% of homes are above the radon action level. No radon protection measures are required under the building regulations BR211. However consultation with the local council regarding radon specific protection measures is recommended.

2.9 A number of other environmental elements collated from local authority and Environment Agency sources are presented in the previous report.

Geology

2.10 Inspection of the published geological data (Sheet 21, Sunderland) indicates that the site lies on made ground over drift deposits of Upper or Pelaw Clay. The solid geology comprises Westphalian C Middle Coal Measures of the Carboniferous Age.

2.11 Two parallel aligned geological faults (trending east to west) are shown in close vicinity to the south of the site. The Bottom and Top Hebburn Fel coal seams are shown to sub crop just to the south of the site and are bound by the two faults.

Mining

2.12 The Envirocheck report states that the site is in an area affected by coal mining. As a result, a mining report was requested on 28th March 2006. The mining report, dated 10th April 2006, indicates that there are three worked seams at depths ranging from 292 to 327mbgl. The shallowest seam is the High Main and has a section of 180cm. There are no opencast workings, tips, lagoons, shafts or adits in the vicinity of site. No further workings are likely.

Subsidence

2.13 The Envirocheck report states that no hazard is posed by ground dissolution and collapsible ground subsidence on site. A moderate hazard exists for compressible ground. There is a very low risk of running sand, shrinking/swelling clay and landslide subsidence.

Environmental Issues, Surface and Groundwater

2.14 The underlying solid geology beneath the site is a minor aquifer with soils of a high leaching potential.

2.15 The site is not situated within a Source Protection Zone for a protected water source as designated by the Environment Agency. The nearest surface water feature is the River Tyne, which lies approximately 300m to the west of the site centre.

2.16 The site does not lie in an area previously affected by flooding or extreme flooding from any type of water source.

2.17 There have been five pollution incidents to controlled waters, the nearest of which took place 185m north west on 5th Nov 1993. The pollutant was unknown, released into a saline estuary and was categorised as a minor incident.

2.18 The site does not lie in a nitrate vulnerable zone.

Abstraction Licences and Discharge Consents

2.19 There are no records of abstraction licences however there are seventy-three discharge consents within 1km of the site, generally relating to industrial, storm sewage overflow and sewage discharges into the River Tyne. The nearest current licence is located 308m west of the site and licenced to Northumbrian Water Ltd for sewage discharge due to storm overflow into the Tyne Estuary.

3 FIELDWORK

3.1 Seven small percussion boreholes (BH1 to BH6 inclusive and BH4a) were drilled on 3rd April 2006 to between 2.0 and 5.0m below ground level (bgl). Borehole 4 was attempted again after abandonment at 2.0mbgl (BH4A). An engineering geologist carried out logging of the boreholes and samples were taken for geotechnical and contamination analysis. The boreholes were positioned across the site generally corresponding with the proposed locations of the proposed house plots.

3.2 The small percussive drilling rig comprises a small mobile unit with the facility to carry out Standard Penetration Tests (SPTs) in the soils and obtain disturbed samples as the holes are progressed. Three 19mm diameter pipes were installed into BH's 1, 4 and 5 to allow gas and water monitoring of the underlying ground. The pipes were slotted below 1.0m with a gravel surround and a bentonite seal. Headworks were fitted to the top of the pipes with a lockable cover. The gas pipes were monitored on two occasions. In addition two insitu CBR pits were excavated across the site. The CBRs were carried out using a Farnell Probe at depths of 0.3mbgl and 0.6mbgl.

3.3 Descriptions of the strata encountered in the boreholes together with details of sampling and groundwater are presented in Appendix 2 of this report. A plan showing the approximate location of the boreholes and CBR trial pits can be found in Appendix 1.

4 GROUND ENCOUNTERED

Made Ground

4.1 Made ground was encountered in all six of the boreholes across the site. Three boreholes in the north of the site (BH3, BH4 and BH4A) were abandoned at shallow depths of between 2.0 and 3.6mbgl in the made ground. These were located over the proposed three house development and the northern corner of the four house development.

4.2 A 300mm layer of clayey sandy gravelly topsoil and slightly sandy gravelly clay was proven In these three boreholes. The gravel fraction comprised glass fragments, wood, brick, concrete and sandstone. This overlies a band of clayey ashy sandy gravel and cobbles of concrete, brick, coal, clinker and wood in BH4 to 0.6mbgl and BH4A to1.0mbgl. Soft and firm ashy slightly sandy locally sandy gravelly clay fill was proven

below the gravel in BH4, BH4A and below the topsoil in BH3 to the base of the boreholes. Borehole 3 was abandoned at 3.6mbgl due to a concrete obstruction. Borehole's 4 and 4A were abandoned at 2.0mbgl where rising groundwater led to the instability of the borehole side walls.

4.3 The remaining four boreholes proved made ground to between 2.8mbgl in BH2 and 4.1mbgl in BH5, these were located over the central area of the four house development and the smaller two house development in the south of the site. The made ground soil profile comprised very soft to firm ashy slightly sandy gravelly clay fill. The gravel fraction consisted of coal, concrete, sandstone, clinker, chalk, brick and pockets of topsoil. In BH6 a layer of clayey slightly sandy slightly gravelly ash was proven between 0.25 and 1.0mbgl.

Natural Ground

4.4 The natural ground was proven in only the southern four boreholes at depths ranging from 2.8 to 4.1mbgl. The natural ground consisted of firm and stiff locally very stiff brown and grey slightly sandy slightly gravelly clay. In boreholes 5 and 6 the clay was described as thinly laminated.

Groundwater

4.5 Groundwater was encountered in all of the boreholes apart from BH1 at the southern end of the site. The groundwater was struck at depths of between 1.0mbgl in BH4 and 4.0mbgl in BH5. Rising groundwater was encountered in boreholes 2, 3, 4 and 4A. In BH4 the groundwater rose to ground level from 1.0mbgl, in BH4A it rose from 2.0mbgl to 0.3mbgl and in BH3 it rose from 2.0mbgl to 1.0mbgl. These boreholes were located up the slope from boreholes 1, 5 and 6 and possibly above the line of the inferred spring.

5 CONTAMINATION ANALYSIS & RESULTS

5.1 To provide information upon the possibility of ground contamination, five soil samples of made ground comprising ashy clay fill from ground level to 3.5mbgl across the site were submitted for contamination testing. Three samples were also submitted for leachate testing. The results are provided in full in Appendix 3 and summarised in Table 1.

5.2 The samples were tested for a range of potential contaminants, based on Contaminated Land Report 8 – *"Potential Contaminants for the Assessment of Contaminated Land"* produced by DEFRA and the Environment Agency. These give soil guideline values (SGV) at which a risk to human health may exist and are primarily intended as a guide to site development. Values are given for different land uses; these include residential gardens and commercial areas where the risks are less. EA derived lower tier threshold values for soft landscaped areas and gardens are used where no SGV are available. This report identifies the most significant risks posed by various potential contaminants, and the most likely contaminants arising from past and current land uses.

5.3 The results indicate that, with the exception of chromium, there are elevated concentrations of heavy metals throughout the made ground. Cyanide and phenol were recorded below the thresholds, the remaining inorganic and organic compounds were elevated above the threshold. The pH values are shown to be near neutral to slightly alkaline and will affect the concrete classification (see 5.26). Other threshold values for different receptors are considered in the contamination risk assessment below.

5.4 One sample was selected for asbestos presence (BH1, 0.0-0.4m). No fibres were detected.

Determinant	Units	Number of Samples above Level of Detection	Minimum Level	Maximum Level	Threshold Value (human health)	Number of Results Exceeding Threshold Value
Metals						
Cadmium	mg/kg	5	1.2	94	2**	4
Chromium	mg/kg	5	20	110	130	0
Copper	mg/kg	5	92	16000	130*	4
Lead	mg/kg	5	110	2500	450	4
Mercury	mg/kg	5	0.3	11	8	1
Nickel	mg/kg	5	28	200	50	3
Zinc	mg/kg	5	160	7500	300*	3
Semi metals and non metals						
Arsenic	mg/kg	5	21	210	20	5
Boron	mg/kg	5	0.7	7.7	3	1
Selenium	mg/kg	5	0.5	43	35	1
Inorganic chemicals						
Cyanide	mg/kg	1	<0.2	1.1	25	0
Sulphate	g/l	5	0.35	1.8	0.50	4
Sulphide	mg/kg	5	48	460	250	1
Organic compounds						
Phenols	mg/kg	2	<0.35	0.9	78	0
PAH	mg/kg	2	<5	79	50*	1
TPH	mg/kg	3	<20	930	500***	3
Other						
pH	pH units	5	7.5	8.0	<5	0

TABLE 1: SUMMARY OF CONTAMINATION TESTING RESULTS

* EA lower tier thresholds, **pH dependent, ***1/2 waste management paper concentration

Leachate Testing

5.5 Three of the samples were selected for leachate testing (BH1 0.0-0.4, BH2 0.5-1.0 and BH5 3.0-3.5mbgl) for the same suites. The results were compared with leachate quality thresholds given in The Environment Agency Report "Disposal of contaminated soils". The testing revealed three elevated concentrations of TPH and two elevated concentrations of PAH. The TPH was recorded at levels of 44 and 62µg/l with PAH at 0.23 and 0.67µg/l. The remaining leachate concentrations were below the leachate quality threshold and detection limits.

Contamination Assessment

5.6 A qualitative approach using the statutory definition of Contaminated Land, as defined within Section 78A (2) of Part 11A of the Environmental Protection Act, 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". "

5.7 The concept of "significant harm" is dealt with via Government guidance (DETR circular 02/2000 Contaminated Land). 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 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 4 for additional notes on contamination guidelines.

Conceptual Model and Pollution Linkages

5.8 The contamination conceptual model in Table 2 identifies the **potential** pollution linkages present on site based on source – pathway – receptor relationships.

SOURCES	PATHWAYS	RECEPTORS
Elevated levels of heavy metals, organics and inorganics in made ground.	Dermal absorption	Users of site
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	

Elevated levels of heavy metals, organics and inorganics in made ground.	Dermal absorption	Construction Workers
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
	Contact with contaminated groundwater	
Elevated levels of heavy metals, organics and inorganics in made ground.	Dermal absorption	Users of surrounding sites
	Inhalation of soil/volatised compounds	
	Ingestion of soil	
Elevated levels of heavy metals, organics and inorganics in made ground.	Taken up through roots and foliage	Vegetation - gardens and landscaping proposed.
	Direct contact	
Elevated levels of heavy metals, organics and inorganics in made ground.	Slow seepage or leaching of contaminants.	Groundwater, spring
Elevated levels of heavy metals, organics and inorganics in made ground.	Slow seepage or leaching of contaminants	No surface water in close proximity. Tyne 300m to west.
	Accumulation of contaminated sediments	
	Direct contact	Construction Materials

TABLE 2: SUMMARY OF POLLUTION LINKAGES

5.9 In general terms, the users of the site, construction workers, users of the surrounding sites, vegetation, groundwater, surface water and construction materials are considered to be **potentially** at risk from contamination in the soils on site as pollution linkages are present for each receptor. The actual risks posed are considered below.

Users of the Site Once Development is Complete

5.10 The users of the site may be exposed to contaminants present in the soils beneath the site, as private gardens and soft landscaping will form part of 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).

5.11 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 site specific threshold values (see Table 1) based on the CLEA Soil Guideline Values (SGV) for residential land use with plant uptake.

5.12 Following comparison heavy metals, inorganics and organics were elevated in the made ground including arsenic, lead, cadmium, PAH and TPH. These contaminants are regarded as having the potential to cause harm to human health.

5.13 The ground will be covered over by the new housing development, roads, driveways and new garden areas. It is understood that retaining walls are to be incorporated to the rear of the house plots to a height of 1.5m. To accommodate the house plots on the sloping

site the ground will have to be levelled and excavated. Given the elevated concentrations of potentially harmful contaminants across the site it would be prudent to remove this material to a licensed tip. The remaining material below the house footprint can remain in place. Similarly where access roads are proposed the made ground can remain under the hard cover provided no major excavation is required.

5.14 There are considerable proposed garden areas to the front and rear of the housing. Gardens and soft landscaping can provide a pathway to insitu contamination. Therefore it would be prudent to excavate the top 750mm of made ground and implement a geofabric beneath a granular contamination break layer of 200mm clean crushed stone at the excavation base. A 300mm layer of clean subsoil should then be placed over this with 250mm of clean topsoil. This should be undertaken in all garden and soft landscaped areas.

5.15 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). The material on this site may be subject to WAC by the appropriate waste disposal company. Once this material is removed off site there should not be a risk to human health with regards to contamination.

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

5.17 Brick and rubble fragments can be screened, crushed and used as engineered fill under roads or driveways

Construction Workers and Users of Surrounding Sites

5.18 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.

5.19 Using guidance published in the HSE publication *"Protection of Workers and the General Pubic during the Development of Contaminated Land"*, the made ground on site **based**

on this publication should generally be regarded as heavily contaminated. In our opinion the levels of contamination may pose a significant risk to construction workers and users of surrounding sites. It is recommended that PPE should be employed in accordance with HSE good practice in contact with the made ground including the use of gloves and overalls and employing simple hygiene precautions such as washing hands before eating or drinking. Safeguards should be taken to limit dust during ground works, and access to the public should be also limited.

Vegetation

5.20 In general terms 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.

5.21 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 *"Notes on the Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing"*. Following comparison, the levels of the phytotoxic determinants are generally above the threshold values. Given the lack of suitable subsoil and topsoil on the site a 300mm layer of clean subsoil should be placed over a geofabric and contamination break layer with 250mm of clean topsoil cover in all garden and soft landscaped areas.

Groundwater and Surface Water

5.22 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.

5.23 Three of the samples were selected for leachate testing (BH1 0.0-0.4, BH2 0.5-1.0 and BH5 3.0-3.5mbgl) for the same suites. The testing revealed three elevated concentrations of TPH and two elevated concentrations of PAH. The TPH was recorded at levels of 44 and 62µg/l with PAH at 0.23 and 0.67µg/l. The remaining leachate concentrations were below the leachate quality threshold and detection limits.

5.24 Groundwater was proven across the site with the exception of BH1. The boreholes in the north and east encountered rising water to ground level indicating a possible spring. However given the low leachate results and clayey made ground sub soil strata and surface water receptors within the close vicinity, ground and surface water are unlikely to be at risk.

5.25 Analysis of the groundwater on the site may be required by the Environment Agency.

Construction Materials

5.26 Materials at risk from potential soil contamination include inorganic matrices such as cement and concrete and also organic material such as 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.

5.27 BRE Special Digest One: *"Concrete in Aggressive Ground"* 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-3, ACEC (Class AC-3) requirements for concrete protection across the site.

5.28 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"*. The thresholds enforced by the various water authorities vary however. The levels of contaminants in the ground are relatively high and as such service fabrics are likely to require upgrading. However consultation with the utility providers is recommended. As a minimum all services should be placed in clean trenches.

6 SOIL GAS ASSESSMENT

6.1 Gas monitoring was undertaken on the 20th and 25th April 2006. The gas was monitored by measuring emissions from three monitoring points installed in boreholes 1, 4 and 5 during the phase two site investigation. The results are tabulated in Appendix 3.

6.2 The atmospheric pressure has an impact on the concentrations of gas released. Atmospheric pressure was between 1003 and 1012 millibars during the surveys. This is considered to be moderate for the time of year, so gas results during the surveys are likely to be generally representative of normal or moderate weather/atmospheric conditions.

6.3 Methane was not recorded during the surveys, carbon dioxide levels were between 0.0% and 3.1% volume with oxygen levels between 17.9% and 20.7% volume. No significant flows were recorded.

6.4 The lower explosive limit for methane is 5%. The results obtained have been compared with relevant guidance that includes the following:

- The Building Regulations 1991, Approved Document C, Section 2;
- Protecting Development from Methane, CIRIA Report 149, 1995;
- Landfill Gas, Waste Management Paper Number 27;
- Construction of New Buildings on Gas-Contaminated Land, BRE Report, 1991.

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

Gas Regime	Methane (%v/v)	Carbon Dioxide (%v/v)	Flow (metres/ sec)	Summary of Gas Control Systems
1	<0.1	<1.5	No flow	No special precautions
2	>0.1 – 1	>1.5 – 5	No flow	Ventilation of confined spaces within the building Well constructed ground slab Low permeability gas membrane Minimum penetration of the ground slab by services
3	>1 – 5	>5	No flow	As regime 2 plus: Passive venting to building – under slab void
4	>5 – 20	<20	<0.01	As regime 2 plus: passive in ground venting active in ground venting gas monitoring of installed measures with alarms
5	>20	>20	>0.01 - 0.50	Reduce gas regime prior to development
6	>20	>20	>0.50	Reduce gas regime prior to development

TABLE 3: CIRIA 149 GAS REGIMES

6.6 Guidance within the CIRIA 149 Report entitled *"Protecting Developments from Methane"*, identifies six gas regimes based on the gas concentrations recorded during monitoring. The gas regimes and the protection measures required are summarised in Table 3. The gas levels accord with Gas Regime 2.

7 GEOTECHNICAL TESTING & ASSESSMENT

7.1 The nature of materials encountered during field work was made ground of clay fill over clay. A series of insitu hand vane tests and SPTs were carried out during fieldwork within the made ground and natural ground. The table below summarises the relative densities and strengths of materials tested:

Borehole	Depth (mbgl)	Stratum	Hand vane shear strength	SPT *N*-value	Classification in accordance with (BS: 5930)
BH1	1.0-1.45	Made Ground		3	Very Soft
BH2	1.1-1.55	Made Ground		7	Soft
BH2	2.0-2.45	Made Ground		7	Soft
BH2	2.8	Clay	150		Very Stiff
BH2	3.5	Clay	150		Very Stiff
BH4	0.6	Made Ground	30		Soft
BH4	1.0	Made Ground	42		Firm
BH5	0.6	Made Ground	72		Firm
BH5	1.5	Made Ground	59		Firm
BH5	2.5	Made Ground	49		Firm
BH5	3.5	Made Ground	55		Firm
BH5	4.5	Made Ground	150		Stiff
BH6	1.0-1.45	Made Ground		4	Soft
BH6	2.0-2.45	Made Ground		5	Soft
BH6	3.0-3.45	Clay		22	Stiff
BH6	3.5	Clay	150		Stiff

TABLE 4: SUMMARY OF INSITU TESTING

7.2 Samples taken from the boreholes underwent a series of geotechnical tests according to BS 1377:1990. The geotechnical results are presented in Appendix 3.

7.3 Triaxial soil strength testing was undertaken on four samples taken from the cohesive stratum. The results ranged from 11kN/m^2 (borehole 3, 1.0m) to 149kN/m^2 (borehole 6, 3.0m) indicating very soft to stiff conditions.

7.4 Moisture content testing was undertaken within all of the boreholes to determine a moisture profile within the strata. The results ranged from 19 to 35%. The results can be viewed within the summary in Appendix 3.

7.5 Three Atterberg Limit tests were carried out to classify the fine grained soils. The results were compared to the Plasticity Chart published in BS 5930. The results generally indicate that the cohesive deposits are clay of intermediate plasticity. Liquid Limits ranged from 36% to 49%. The Plasticity Indices of the samples ranged from

14% to 25%. The clay can be regarded as having a medium shrinkage potential in accordance with NHBC guidelines.

7.6 Two samples of made ground were subject to particle size distribution testing. The results show that the samples were sandy, gravelly clay.

7.7 Two samples of natural soil at depths of 3.0 and 4.0mbgl were tested for their acidity and soluble sulphate content to assess whether the natural soils may be potentially aggressive to building fabric. The results of the testing for pH were 7.9 and 8.7 (alkaline), with soluble sulphates recorded as 0.14 and 0.21g/l.

7.8 The results of the insitu CBR tests are presented in Table 5 below. Based on these results a conservative CBR of 2% should be assumed for roads and parking areas.

CBR Position	CBR at 0.3mbgl (%)	CBR at 0.6mbgl (%)
TP1	11.5	14.0
TP2	2.1	6.1

TABLE 5: INSITU CBR RESULTS

The Proposed Development

7.9 The development includes three blocks of housing (two, three and four houses in each one of the blocks) located to east of centre, and within the southern extent of the site. The ground conditions vary across the site and these together with contamination issues influence the foundations which should be adopted on the site.

Foundations

7.10 The proposed development is to be three storey residential buildings. A pair of semi detached houses is proposed in the southern part of the site (BH1 and BH6) where ground conditions comprise very soft and soft clay fill made ground to depths of up to 3.0mbgl. This made ground is unsuitable as a founding stratum and consideration should be given to deep trench fill footings founding onto the underlying firm and stiff natural clay. Using the results of the lower conservative shear strength of 67kN/m^2 an allowable bearing pressure of 150kN/m^2 has been calculated for 0.6m wide footings placed at a depth of 3.0mbgl.

7.11 Two proposed blocks run longitudinally east of centre of the site. Again there is deep made ground over this area some 1.5m of which will be excavated as part of the site

clearance for base and retaining wall construction. The extent of the made ground in terms of depth precludes the use of deep trench fill footings therefore it is recommended that a mini piled system is considered transferring loads through the made ground and into the very stiff underlying clay. It should be noted that an obstruction was encountered within BH3 at 3.6mbgl. The results of the drilling operations together with in-situ test results should be used by a competent piling contractor to design a suitable system to support these two blocks.

7.12 Any old foundations blocks of rubble or any services should be removed from beneath the building footprint to avoid the effects of differential settlement.

7.13 Prior to placing any foundation concrete all exposed formations at basement level should be well compacted and any obvious soft or very loose spots should be removed and replaced with compacted hardcore. Furthermore, all excavations should be inspected to ensure that they fully penetrate any areas of disturbed ground.

Retaining walls

7.14 It is understood that retaining walls will be utilised along the eastern side of the three and four house blocks due to changes in elevation of the ground in this area. The presence of springs within the strata behind these walls should be addressed and it would be prudent to provide some rear wall drainage facilities to collect the spring water and drain it into a positive system to prevent pore water pressure build up. Impermeable backing to the retaining walls will prevent egress through, and allow collection within a rear skin of porous blocks or a gravel French drain. A porous or slotted pipe system should be installed to the base of this rear wall system to collect the spring water and outfall into the positive site surface water system.

7.15 The plot in the south of the site has a retaining wall to the rear and should also include a drainage system as groundwater was recorded at 1.6mbgl in that area.

7.16 The ground conditions are suitable for use of a reinforced ground slab.

7.17 From the evidence of the investigation, shallow excavations should be easily achieved by means of a normal excavator. Stability of excavations is considered to be poor to moderate and shoring may be required if foundations are required to be left open for long periods or during inclement weather conditions. Excavation sides should be

designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97.

Excavations

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

Concrete Design

7.19 Concrete should be designed to Class DS-3, ACEC (Class AC-3).

Groundwater

7.20 Groundwater was encountered in all the boreholes apart from BH1 at the southern end of the site. The groundwater was struck at depths of between 1.0mbgl in BH4 and 4.0mbgl in BH5. Rising groundwater was encountered in boreholes 2, 3, 4 and 4A. In BH4 the groundwater rose to ground level from 1.0mbgl, in BH4A it rose from 2.0mbgl to 0.3mbgl and in BH3 it rose from 2.0mbgl to 1.0mbgl. These boreholes were located up the slope from boreholes 1, 5 and 6 and possibly above the line of the inferred spring.

7.21 It is likely that dewatering is required for excavations. However, it should be noted that groundwater conditions vary with season, weather conditions and in proximity to local dewatering schemes and abstractions. During the monitoring visits boreholes 4 and 5 were dry and BH1 recorded water at 1.60 and 1.61mbgl in both the visits.

8 CONCEPTUAL MODEL AND RISK ASSESSMENT

8.1 The conceptual model (Table 6) 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 geotechnical considerations.

8.2 The proposed development of the site is housing with associated roads, private gardens, driveways, soft landscaping and hardstanding.

CONTAMINATION ASSESSMENT					
SOURCES	**DETAILS**	**RECEPTORS**	**PATHWAYS**	**Remediation**	**RISK RATING**
Contamination in the clay rich made ground across the site at depths of up to 4.1mbgl.	All contaminants above relevant threshold values, except for chromium, phenol and cyanide. Some heavy metals at extremely high levels e.g. lead 630 to 2500mg/kg, copper 390 to 16000mg/kg and zinc 1300 to 7500mg/kg. Hydrocarbons elevated at shallower depth. Leachate results low apart from hydrocarbons.	Users of site (once development is complete0 – children and adult receptors in exposed garden areas.	Dermal absorption Inhalation of soil/volatised compounds Ingestion of soil Contact with contaminated groundwater	Removal of upper 750mmm in exposed soft landscaping and garden areas. Geofabric under contamination break layer and clean subsoil/topsoil. Removal of any made ground excavated for the house plots and roads to licensed tip. Other areas beneath proposed hardstanding can be left if no excavation required	**LOW**
		Construction workers and users of site during construction	Dermal absorption Inhalation of soil/volatised compounds Ingestion of soil Contact with contaminated groundwater	Made ground on site classed as heavily contaminated, appropriate PPE should be employed as a matter of course and limit dust in dry conditions.	**LOW**
		Users of surrounding sites	Dermal absorption Inhalation of soil/volatised compounds Ingestion of soil	Made ground on site classed as heavily contaminated, dust minimisation measures to be employed	**LOW**
		Vegetation	Uptake via roots and leaf surfaces	Removal of upper 750mmm in exposed soft landscaping and garden areas. Geofabric under contamination break layer and clean subsoil/topsoil.	**LOW**
		Groundwater – non encountered.	Slow seepage or leaching of contaminants. Leachate low except PAH and TPH	Minor aquifer Clays present across much of the site. Groundwater encountered along with springs in north and east.	**LOW**
		Surface Water – small drain/stream approx 100m to south of the site	Leachate elevated for arsenic, mercury and zinc. Accumulation of contaminated sediments	No major water course within close vicinity.	**LOW**
		Construction Materials	Direct contact	Concrete Class DS-3, ACEC (Class AC-3),	**LOW**

GEOTECHNICAL ASSESSMENT		
FACTOR	**ON SITE DESCRIPTION**	**RISK RATING**
MADE GROUND	Made ground up to 4.1mbgl comprising generally ashy gravelly clay fill	**LOW**
NATURAL SOILS	Firm to stiff locally very stiff clays.	**LOW**
MINING	Shallowest seam at 292mbgl	**LOW**
SOIL GAS	The gas levels accord with Gas Regime 2 No radon protection measures required	**LOW**
SUBSIDENCE /GROUND STABILITY	Long term Instability not expected, however Envirocheck highlights moderate potential for compressible ground subsidence.	**LOW**

TABLE 6: CONCEPTUAL MODEL AND RISK ASSESSMENT

9 CONCLUSIONS & SUMMARY

9.1 The results of the environmental ground investigation are presented in this report and Solmek can comment as follows:

- The site is to be developed with three housing blocks comprising two, three and four new houses along with gardens, 1.5m high retaining walls to rear, roads, and driveways. The site currently comprises an area of undeveloped, partly sloping land to the south of a new housing estate (Waterside Park). The site covers an area of approximately 0.2ha.

- A channel (running south east to north west) had been excavated down the slope near the northern boundary and this was gently issuing water indicating a possible spring further up the slope.

- The history of the site included heavy industry involving an alkali works and railway lines. The surrounding areas were once occupied by a rifle range, colour works, bauxite works and an electrical engineering works.

- A site investigation comprising six small percussive boreholes to depths of up to 5.0m below ground level was undertaken including two trial pits for insitu CBR's. The boreholes were positioned across the site generally corresponding with the proposed locations of the house plots. The trial pits were dug to correspond with the location of the roads.

- Ground conditions comprised made ground to between 2.8mbgl in BH2 and 4.1mbgl in BH5, these were located over the central area of the four house development and the smaller two house development in the south of the site. The made ground soil profile generally comprised very soft to firm ashy slightly sandy gravelly clay. The gravel fraction consisted of coal, concrete, sandstone, clinker, chalk, brick and pockets of topsoil. In BH6 a layer of clayey slightly sandy slightly gravelly ash was proven between 0.25 and 1.0mbgl. Boreholes in the north and east (BH3, BH4 and BH4A) were abandoned at shall depths in the made ground.

- The natural ground was proven in only the southern four boreholes at depths ranging from 2.8 to 4.1mbgl. The natural ground consisted of firm and stiff locally very stiff brown and grey slightly sandy slightly gravelly clay. In boreholes 5 and 6 the clay was described as thinly laminated.

- Groundwater was encountered in all the boreholes apart from BH1 at the southern end of the site. The groundwater was struck at depths of between 1.0mbgl in BH4 and 4.0mbgl in BH5. Rising groundwater was encountered in boreholes 2, 3, 4 and 4A. In BH4 the groundwater rose to ground level from 1.0mbgl, in BH4A it rose from 2.0mbgl to 0.3mbgl and in BH3 it rose from 2.0mbgl to 1.0mbgl. These boreholes were located up the slope from boreholes 1, 5 and 6 and possibly above the line of the inferred spring.

- Contamination analysis was undertaken on five soil samples of made ground. Following comparison heavy metals, inorganics and organics were elevated in the made ground including arsenic, lead, cadmium, PAH and TPH. These contaminants are regarded as having the potential to cause harm to human health.

- The ground will be covered over by the new housing development, roads, driveways and new garden areas. It is understood that retaining walls are to be incorporated to the rear of the house plots to a height of 1.5m. To accommodate the house plots on the sloping site the ground will have to be levelled and excavated. Given the elevated concentrations of potentially harmful contaminants across the site it would be prudent to remove this material to a licensed tip. The remaining material below the house footprint can remain in place. Similarly where access roads are proposed the made ground can remain under the hard cover provided no major excavation is required.

- For garden and soft landscaped areas it would be prudent to excavate the top 750mm of made ground and implement a geofabric beneath a granular contamination break layer of 200mm clean crushed stone at the excavation base. A 300mm layer of clean subsoil should then be placed over this with 250mm of clean topsoil. This should be undertaken in all garden and soft landscaped areas.

- 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 gas levels accord with Gas Regime 2. No radon protection measures are required under the building regulations BR211.

- The mining report, dated 10th April 2006, indicates that there are three worked seams at depths ranging from 292 to 327mbgl. The shallowest seam is the High Main and has a section of 180cm. There are no opencast workings, tips, lagoons, shafts or adits in the vicinity of site. No further workings are likely. The Bottom and Top Hebburn Fell

coal seams are shown to sub crop just to the south of the site. They are bound by the two faults and are unlikely to extend below the site. The risk of shallow mining is therefore low, however the NHBC or local authority may require further evidence of this by rotary drilling methods.

- The made ground beneath the two house block in the south of the site is unsuitable as a founding stratum and consideration should be given to deep trench fill footings founding onto the underlying firm and stiff natural clay. Using the results of the lower conservative shear strength of 67kN/m^2 an allowable bearing pressure of 150kN/m^2 has been calculated for 0.6m wide footings placed at a depth of 3.0mbgl.

- Two proposed blocks run longitudinally east of centre of the site. Again there is deep made ground over this area some 1.5m of which will be excavated as part of the site clearance for base and retaining wall construction. The extent of the made ground in terms of depth precludes the use of deep trench fill footings therefore it is recommended that a mini piled system is considered transferring loads through the made ground and into the very stiff underlying clay. It should be noted that an obstruction was encountered within BH3 at 3.6mbgl. The results of the drilling operations together with in-situ test results should be used by a competent piling contractor to design a suitable system to support these two blocks.

- Where foundations are placed on natural clay reference should be made to NHBC Standards, Chapter 4.2 to determine the depth of footings in the vicinity of existing trees. However at the foundation depths proposed this should not be applicable.

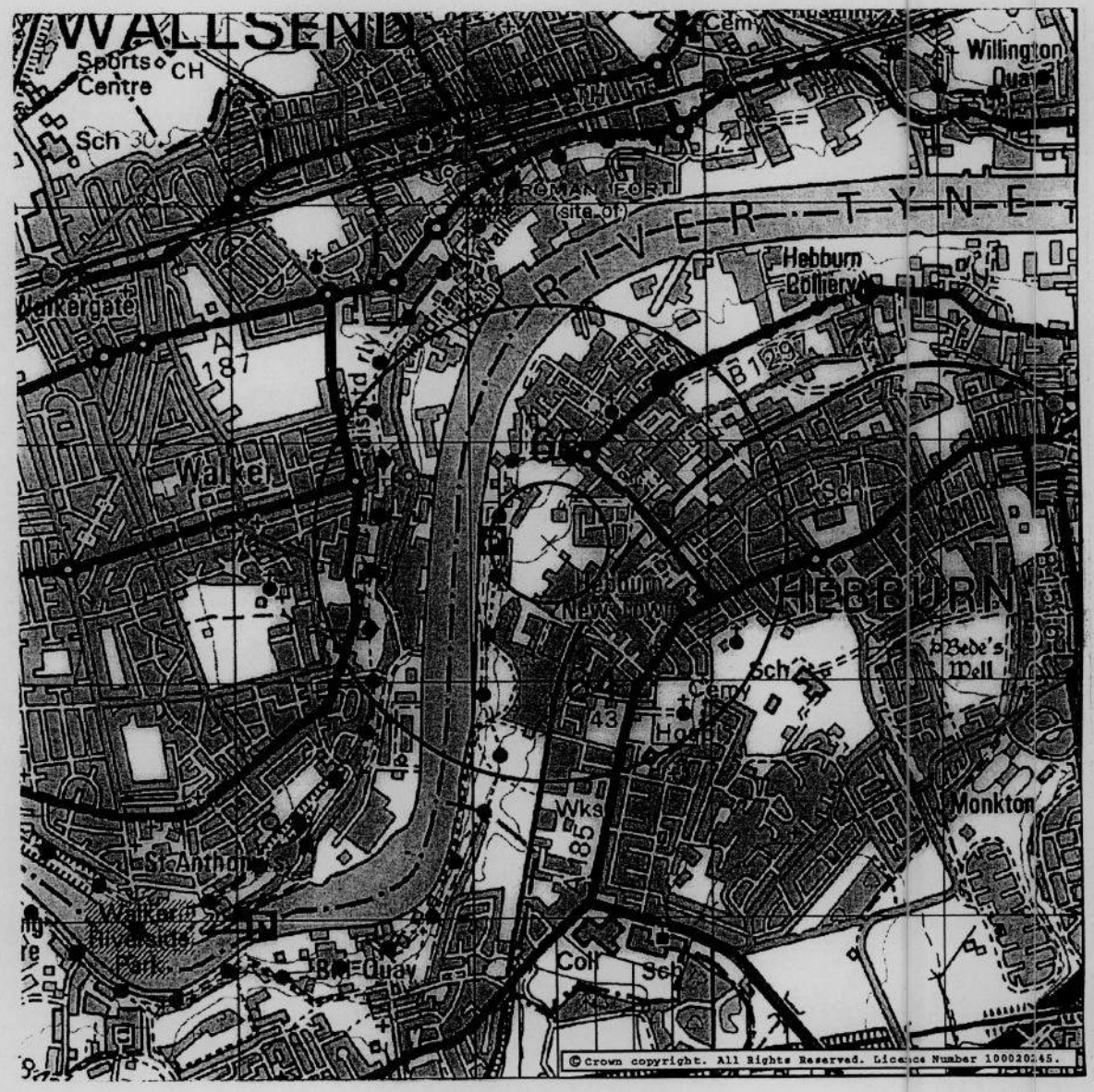
- Groundwater was encountered in the boreholes and as possible springs in the upper slope to the east. It is likely that some dewatering is required for excavations. However, it should be noted that groundwater conditions vary with season, weather conditions and in proximity to local dewatering schemes and abstractions.

- It is understood that retaining walls will be utilised along the eastern side of the three and four house blocks due to changes in elevation of the ground in this area. The presence of springs within the strata behind these walls should be addressed and it would be prudent to provide some rear wall drainage facilities to collect the spring water and drain it into a positive system to prevent pore water pressure build up. The plot in the south of the site has a retaining wall to the rear and should also include a drainage system as groundwater was recorded at 1.6mbgl in that area.

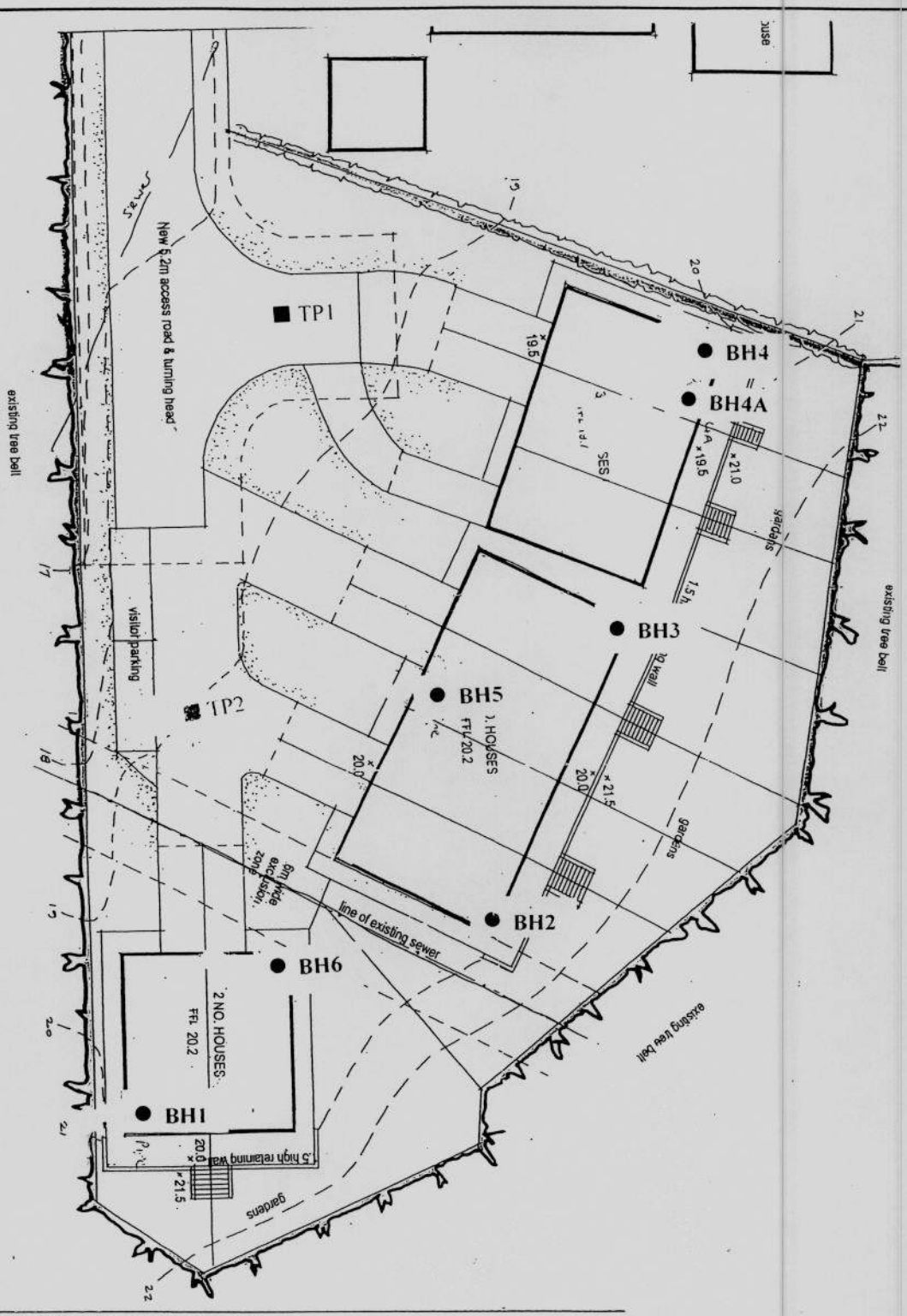
- The ground conditions are suitable for use of a reinforced ground slab.
- Given the results of the insitu testing a CBR of 2% should be assumed for road and pavement design.
- DS-3 class AC-3 should be used for concrete.

SOLMEK

APPENDIX 1



CLIENT : HEBBURN PROPERTIES LTD	
PROJECT: WATERSIDE PARK, HEBBURN	
TITLE: Site Location Plan	
DRG NO: Figure 1	SCALE: NTS
DATE: MAY 2006	
SOLMEK	



CLIENT : HEBBURN PROPERTIES LTD	
PROJECT: WATERSIDE PARK, HEBBURN	
TITLE: Borehole Location Plan	
DRG NO: Figure 2	SCALE: NTS
DATE: MAY 2006	
SOLMEK	

APPENDIX 2

Solmek/Hymas Geo
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Fax 01642 612355

BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH1**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.40	D					(1.00)	MADE GROUND. Dark brown ashy slightly sandy gravelly clay. Ash is fine to coarse. Sand is fine to coarse. Gravel is fine to coarse sub angular of sandstone, chalk, coal and clinker.		
0.40-0.80	D								
0.80-1.00	D					1.00			
1.00-1.50	D	N3				(1.60)	MADE GROUND. Very soft dark brown orange slightly ashy sandy gravelly clay. Ash is fine to coarse. Sand is fine to medium. Gravel is fine to coarse sub angular to sub rounded sandstone, coal, concrete, housebricks and chalk.		
1.50-2.00	D								
2.00-2.60	D					2.60	Sandy gravel below 2.00m.		
2.60-3.00	D					(0.30) 2.90	MADE GROUND. Dark brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, coal and chalk.		
3.00-3.50	D					(2.10)	Firm dark brown grey mottled slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub angular of sandstone and chalk.		
3.50-4.00	D								
4.00-5.00	D					5.00			

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. Gas standpipe installed on completion.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

GRD_BOREHOLE_LOG S60330.GPJ AGS3_ALL.GDT 19/05/06

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH2**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.25	D						MADE GROUND. Dark brown black gravelly slightly ashy clay. Gravel is fine to coarse angular to sub angular of housebrick, chalk, sandstone and coal.		
0.25-0.50	D								
0.50-1.00	D					(1.10)	Occasional topsoil pockets.		
		N7				1.10			
1.10-1.50	D						MADE GROUND. Soft black ashy slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, clinker, sandstone and coal.		
1.50-2.00	D								
2.00-2.80	D	N7				(1.70)			
						2.80			
2.80-3.00		V=150kpa					Very stiff dark brown grey mottled slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium angular to sub angular of sandstone, limestone and coal.		
3.00-3.50	D								
						(1.20)			
3.50-4.00		V=150kpa							
						4.00			

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	Groundwater encountered at 2.00m, then rising.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH3**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	D					(0.30) 0.30	MADE GROUND. Firm dark brown clayey slightly sandy gravelly topsoil. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of sandstone, housebrick, concrete and glass.		
0.30-0.50	D						MADE GROUND. Firm dark brown slightly sandy very gravelly clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, coal, sandstone and occasional cobbles and wood fragments.		
0.50-1.00	D								
1.00-1.50	D						No recovery between 2.00m and 3.00m.		
1.50-2.00	D					(2.70)	Very soft at 3.00m.		
						3.00			
3.00-3.60	D					(0.60)	MADE GROUND. Firm dark brown sandy very gravelly clay. Sand is fine to coarse. Gravel is fine to coarse of sandstone, dolomite, housebrick, clinker and coal.		
						3.60	Concrete obstruction at base of borehole.		

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	Groundwater encountered at 2.00m. Rising to 1.00m after 20 mins. Borehole abandoned on obstruction at 3.60m bgl.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

GRD_BOREHOLE_LOG S60330.GPJ AGS3_ALL.GDT 19/05/06

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH4**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	D					(0.30) 0.30	MADE GROUND. Dark brown slightly sandy slightly gravelly clayey topsoil. Sand is fine to coarse. Gravel is fine to coarse sub angular of housebrick, coal, sandstone and some rootlets.		
0.30-0.60	D					(0.30) 0.60	MADE GROUND. Dark brown ashy clayey sandy gravel. Ash is fine to coarse. Sand is fine to medium. Gravel is fine to coarse angular to sub angular of housebrick, coal, clinker, sandstone, wood fragments and rootlets.		
0.60-1.00		V=30kpa					MADE GROUND. Soft dark brown black ashy slightly sandy gravelly clay. Ash is fine to coarse. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, clinker and coal.		
1.00-2.00		V=42kpa				(1.40)	Becoming firm below 1.00m.		
						2.00			

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	Groundwater encountered at 1.00m and rose to ground level within 20 minutes. Gas standpipe installed on completion. Sides unstable, borehole abandoned.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH4A**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	D					(0.30) 0.30	MADE GROUND. Firm dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub angular of housebrick, sandstone, coal, wood fragments and rootlets.		
0.30-1.00	D					(0.70) 1.00	MADE GROUND. Grey slightly sandy gravel and cobbles. Gravel is fine to coarse of concrete.		
1.00-1.50	D					(1.00) 2.00	MADE GROUND. Firm dark brown black sandy gravelly ashy clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of sandstone, concrete and wood fragments.		
1.50-2.00	D								

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	Groundwater encountered at 2.00m then rose to 0.30m after 20 minutes.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

GRD_BOREHOLE_LOG S60330.GPJ AGS3_ALL.GDT 19/05/06

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH5**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION		
0.00-0.30	D					(1.00) 1.00	MADE GROUND. Firm dark brown black slightly sandy ashy very gravelly clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, sandstone, chalk and some rootlets.		
0.30-0.60	D								
0.60-1.00		V=72kpa							
1.00-1.50	D					(2.50) 3.50	MADE GROUND. Firm dark brown black sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of housebrick, coal and sandstone.		
1.50-2.00		V=59kpa							
2.00-2.50	D								
2.50-3.00		V=49kpa							
3.00-3.50	D								
3.50-4.00		V=55kpa				(0.60) 4.10	MADE GROUND. Firm dark brown slightly sandy very gravelly clay. Sand is fine to coarse. Gravel is fine to coarse sub angular of sandstone, housebrick and rootlets.		
4.00-4.50	D					(0.90) 5.00	Stiff dark brown thinly laminated slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of sandstone.		
4.50-5.00		V=150kpa							

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	Seepage at 4.00m. Gas standpipe installed on completion.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

GRD_BOREHOLE_LOG S60330.GPJ AGS3_ALL.GDT 22/05/06

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BOREHOLE LOG

Project				BOREHOLE No
Waterside Park, Hebburn				**BH6**
Job No	Date	Ground Level (m)	Co-Ordinates ()	
S60330	03-04-06			
Contractor				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA					
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.00-0.25	D					0.25	MADE GROUND. Dark brown clayey ashy slightly sandy gravelly topsoil. Ash is fine to coarse. Sand is fine to coarse. Gravel is fine to medium sub angular of chalk, sandstone, coal and rootlets.		
0.25-0.50	D						MADE GROUND. Black clayey slightly sandy slightly gravelly fine to coarse ash. Sand is fine to coarse. Gravel is fine to coarse angular to sub angular of clinker, coal and sandstone.		
0.50-0.75	D					(0.75)			
0.75-1.00	D					1.00			
1.00-2.00	D	N4					MADE GROUND. Soft dark brown black slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse sub angular of housebrick, chalk, coal and metal fragments.		
2.00-3.00	D	N5				(2.00)			
						3.00			
3.00-3.50	D	N22					Stiff dark brown thinly laminated sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium sub angular to sub rounded of sandstone.		
3.50-4.00		V=150kpa				(1.00)			
						4.00			

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	Seepage at 3.00m.

All dimensions in metres Scale 1:37.5	Client Hebburn Properties Ltd	Method/ Plant Used	Logged By RJH

APPENDIX 3

Solmek
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Geotechnical Test Results

Testing in accordance with BS1377 1990

May 4th 2006

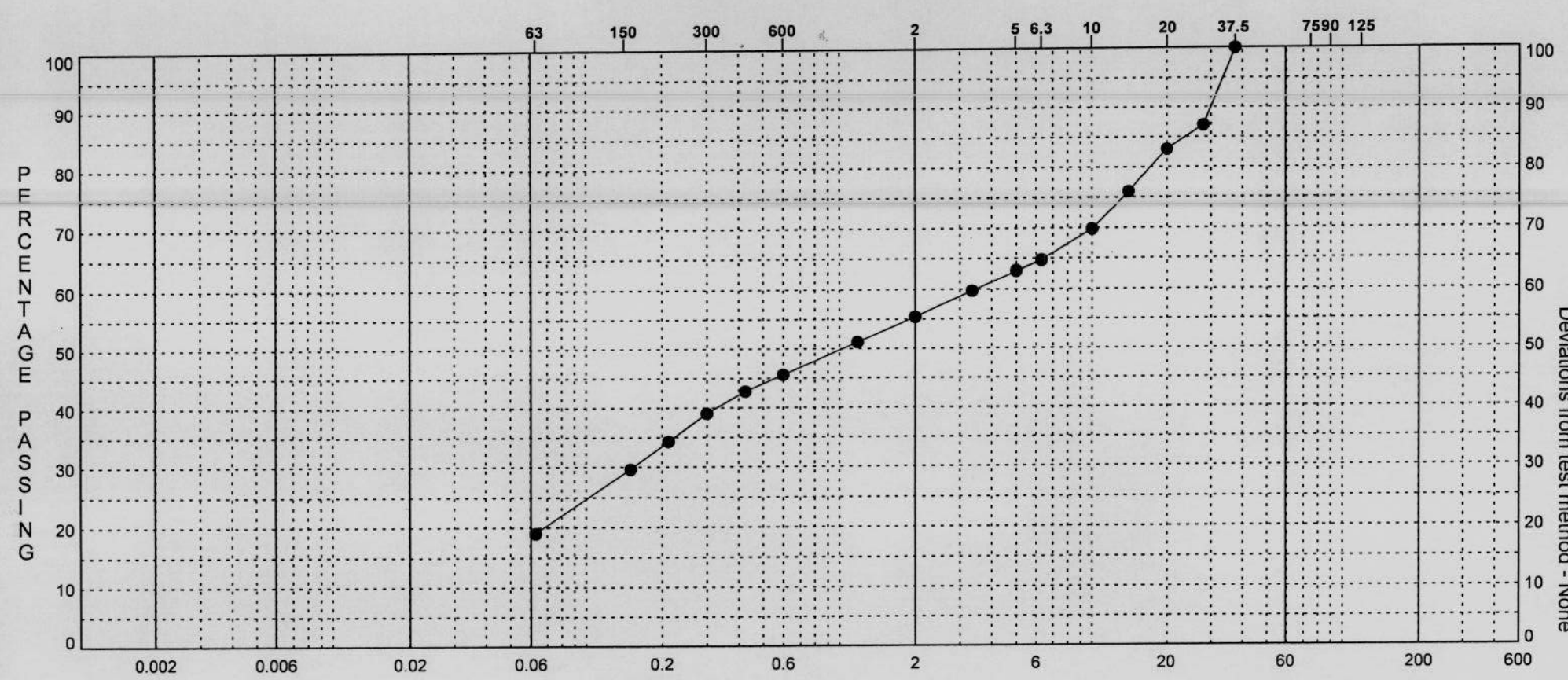
Waterside Park, Hebburn

Identification	pH	SO4 g/l	% Moisture	Liquid Limit	Plastic Limit	Plastic Index	Bulk Density Kg/m³	Vane Test	Shear Strength kN/m² 100 x 200	Shear Strength kN/m² 38 x 76	Cell Pressure kN/m²
BH1 1.00			26	36	22	14					
BH1 2.00			32								
BH1 3.00	7.9	0.14	24				1990			67	65
BH3 1.00			27	42	20	22	1901			11	40
BH4 0.60			28								
BH4 1.00			35	49	24	25					
BH5 4.00	8.7	0.21	19				2116			81	86
BH6 3.00			34				2163			149	65

Form No. 4AR Rev 2

Particle Size Distribution
Test Method BS 1377 : Part 2 : 1990 : Method 9
Deviations from test method - None

BS Test Sieves In mm and microns



PARTICLE SIZE IN MILLIMETRES

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

	BH No.	Depth	M	LL	PL	PI	D100	D60	D30	D10	%GRAVEL	% SAND	% SILT	% CLAY
●	BH1	2.00					37.500	3.453	0.154		44.6			

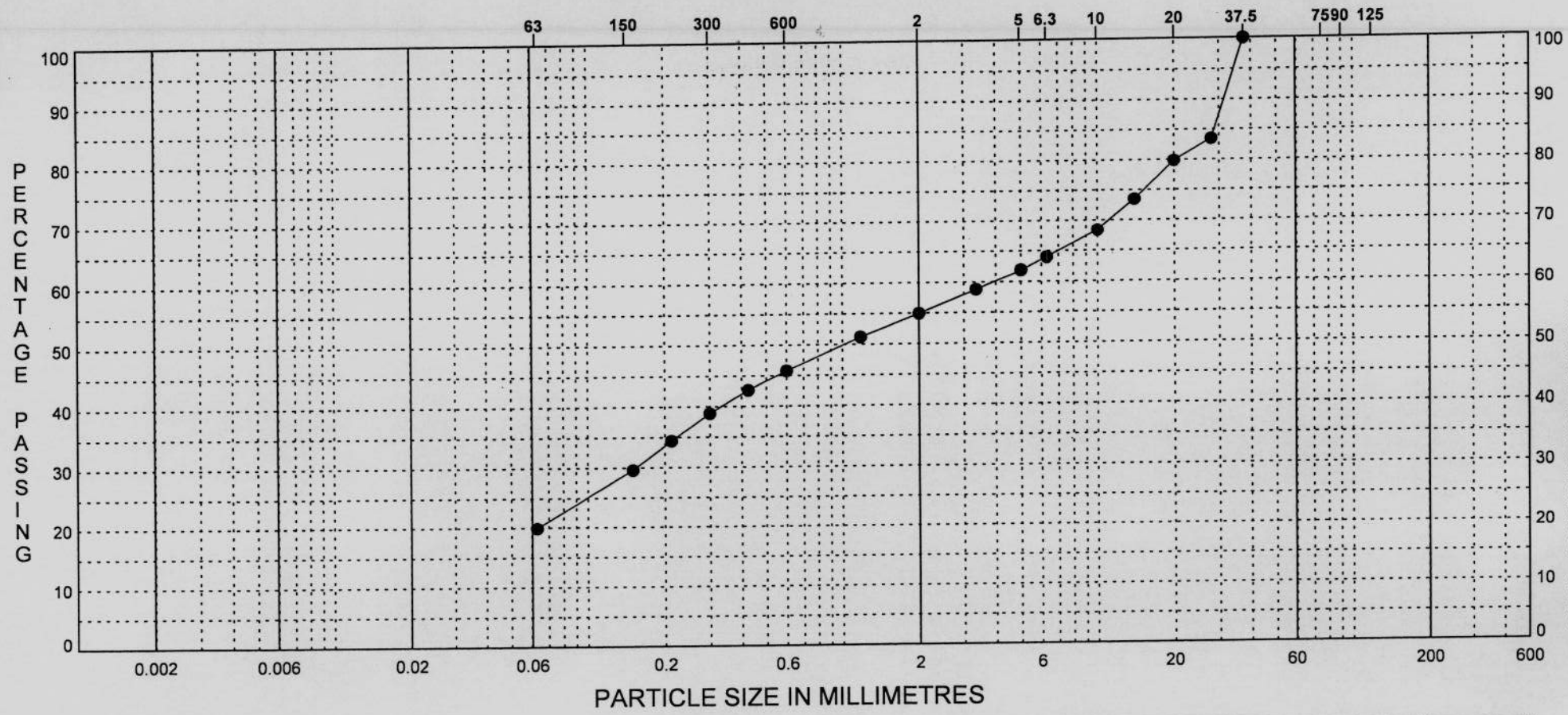
Scheme : Hebburn
Client : Hebburn Properties Ltd.

Report. S60330
Revision 0 Amd-
Page 1 of 2

Form No. 4AR Rev 2

Particle Size Distribution
Test Method BS 1377 : Part 2 : 1990 : Method 9
Deviations from test method - None

BS Test Sieves In mm and microns



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

	BH No.	Depth	M	LL	PL	PI	D100	D60	D30	D10	%GRAVEL	% SAND	% SILT	% CLAY
●	BH4	0.60					37.500	3.908	0.154		45.1			

Scheme : Hebburn
Client : Hebburn Properties Ltd.

Report. S60330
Revision 0 Amd-
Page 2 of 2

UKAS TESTING
2139

dets
Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number : 06-04720_M01

Client Reference:	S60330	**Date of issue:**	27/04/2006
Our Reference:	06-04720	**Report no:**	06-04720_M01
Clients Name:	SOLMEK		
Clients Address:	12 Yarm Road Stockton On Tees Cleveland TS18 3NA		

Contract Title:	Waterside Park, Hebburn
Description:	3 leachate samples, 5 soil samples
Date Received:	18/04/2006
Date Commenced:	18/04/2006
Date Completed:	27/04/2006

Notes:

Test procedures are identified by prefix DETSn (details available upon request)
Observations and Interpretations are outside the UKAS Accreditation Scope
* Denotes test not included in laboratory scope of accreditation
$ Denotes test carried out by approved subcontractor
I/S Denotes insufficient sample to carry out test
N/S Denotes that the sample is not suitable for testing
Samples will be disposed of 1 month after the date of issue if this test certificate.

Approved By:

R Bennett — Director
R Brown — Business Manager
M Hopgood — Technical Manager

Derwentside Environmental Testing Services Limited.
Unit 2a/2b, 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
Registered in England No. 370 5645 • VAT No. 708 978 678

Client Reference S60330

Laboratory Reference 06-04720

Waterside Park, Hebburn

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 042 Arsenic mg/kg	DETS 042 Cadmium mg/kg	DETS 042 Chromium mg/kg	DETS 042 Copper mg/kg	DETS 042 Lead mg/kg	DETS 015 Mercury mg/kg	DETS 042 Nickel mg/kg	DETS 042 Selenium mg/kg	DETS 042 Zinc mg/kg	DETS 020 Boron (water soluble) mg/kg
BH1	0.00-0.40		Soil	31258	150	31	110	11000	2500	3.3	200	1.3	7500	2.6
BH2	0.50-1.00		Soil	31259	21	1.2	20	92	110	0.3	28	0.5	160	1.3
BH4	0.60-1.00		Soil	31260	170	4.1	26	1500	1500	1.4	51	4.1	1300	0.7
BH5	3.00-3.50		Soil	31261	73	2.1	21	390	630	0.9	28	43	290	1.1
BH1	0.00-0.40		Leach	31262	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH2	0.50-1.00		Leach	31263	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH5	3.00-3.50		Leach	31264	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH6	0.50-0.75		Soil	31441	210	94	73	16000	2200	11	140	12	5700	7.7

Client Reference S60330

Laboratory Reference 06-04720

Waterside Park, Hebburn

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 067 Total Cyanide mg/kg	DETS 024 Sulphide mg/kg	DETS 076* Sulphate Aqueous Extract g/l as SO4	DETS 008 pH	DETS 050 PAH mg/kg	DETS 051 TPH mg/kg	DETS 067 Phenol - Monohydric mg/kg	DETS 011 Arsenic ug/l	DETS 042 Cadmium ug/l	DETS 042 Chromium ug/l
BH1	0.00-0.40		Soil	31258	< 0.2	64	0.71	7.5	30	930	0.9	-----	-----	-----
BH2	0.50-1.00		Soil	31259	< 0.2	52	0.35	8.0	79	550	< 0.3	-----	-----	-----
BH4	0.60-1.00		Soil	31260	< 0.2	460	0.95	7.5	< 5.0	< 20	< 0.3	-----	-----	-----
BH5	3.00-3.50		Soil	31261	< 0.2	84	1.8	7.6	< 5.0	< 20	< 0.3	-----	-----	-----
BH1	0.00-0.40		Leacha	31262	-----	-----	-----	-----	-----	-----	-----	< 1	< 2	< 10
BH2	0.50-1.00		Leacha	31263	-----	-----	-----	-----	-----	-----	-----	< 1	< 2	< 10
BH5	3.00-3.50		Leacha	31264	-----	-----	-----	-----	-----	-----	-----	< 1	< 2	< 10
BH6	0.50-0.75		Soil	31441	1.1	48	1.8	7.5	< 5.0	860	0.5	-----	-----	-----

Client Reference S60330

Laboratory Reference 06-04720

Waterside Park, Hebburn

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 042 Copper ug/l	DETS 042 Lead ug/l	DETS 015 Mercury ug/l	DETS 042 Nickel ug/l	DETS 012 Selenium ug/l	DETS 042 Zinc ug/l	DETS 055 Sulphate g/l as SO4	DETS 020 Boron ug/l	DETS 067 Cyanide total ug/l	DETS 024 Sulphide ug/l
BH1	0.00-0.40		Soil	31258	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH2	0.50-1.00		Soil	31259	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH4	0.60-1.00		Soil	31260	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH5	3.00-3.50		Soil	31261	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BH1	0.00-0.40		Leacha	31262	9	6	< 0.2	< 10	< 3	430	0.25	< 100	< 40	< 500
BH2	0.50-1.00		Leacha	31263	10	7	< 0.2	< 10	< 3	470	0.39	< 100	< 40	< 500
BH5	3.00-3.50		Leacha	31264	5	28	< 0.2	< 10	< 3	230	0.30	< 100	< 40	< 500
BH6	0.50-0.75		Soil	31441	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Client Reference S60330

Laboratory Reference 06-04720

Waterside Park, Hebburn

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 008 pH	DETS 050* PAH ug/l	DETS 051 TPH ug/l	DETS 054* Phenol ug/l
BH1	0.00-0.40		Soil	31258	-----	-----	-----	-----
BH2	0.50-1.00		Soil	31259	-----	-----	-----	-----
BH4	0.60-1.00		Soil	31260	-----	-----	-----	-----
BH5	3.00-3.50		Soil	31261	-----	-----	-----	-----
BH1	0.00-0.40		Leacha	31262	6.9	< 0.20	62	< 0.50
BH2	0.50-1.00		Leacha	31263	7.2	0.67	58	< 0.50
BH5	3.00-3.50		Leacha	31264	7.1	0.23	44	< 0.50
BH6	0.50-0.75		Soil	31441	-----	-----	-----	-----

BULK ANALYSIS REPORT - ENV03

UKAS TESTING
0244

Customer Address:	Derwentside Environmental Testing Serv. Unit 2A/2B, Park Road Industrial Estate South Consett Co. Durham DH8 5PY	**Tel No:**	01207 582333
		Fax Number:	01207 582444
		Order Number:	As Received
		Contact:	Richard Bennett

Sampled By: **Site Location:** Waterside Park, Hebburn (06-04720)

ANALYTICAL PROCEDURE (In house document based on HSE Publication HSG 248 Appendix 2)

Fibres found in the sample or small portions of the sample were mounted on glass slides in specific refractive index liquids and examined using polarised light and dispersion staining microscopy. Fibres were identified by comparison of their optical properties with those of standard asbestos materials and published data. If only 1-2 asbestos fibres seen - Trace asbestos will be reported. MIS Limited accepts responsibility only for results obtained from samples received. No responsibility is accepted for errors which may have arisen during the sampling or transportation of the samples by a third party. Re: Artex Samples - analysis is carried out to HSG 248, however we would recommend that SEM (Scanning Electron Microscopy) analysis be used for this type of material.

KEY: Crocidolite (Blue Asbestos) Amosite (Brown Asbestos) Chrysotile (White Asbestos) NAD (No asbestos Detected)

The analytical method is not quantative, typical % of asbestos content used in various products is available in MDHS 100 Table 1.

Lab Code	Analyst Code	Sample Details/Location	Material	Result
Michael Austin - 23/04/2006				
10188		Waterside Park, Hebburn, 06-04720, 31258, BH1, 0.0-0.4m, Soil	Soil	NAD

Michael Austin
(Bulk Analyst) :

Authorised Signature:

Jeff Cruddas - Laboratory Manager ☑ Peter Jackson - Bulk Analyst ☐ Laurence Bell - Laboratory Administrator ☐
Alasdair Nairn - Director ☐ Paul King - Environmental Manager ☐ Chris McConnell - Quality Manager ☐

Project Ref. No:	Job No:	Office Code:
2528	19181	Con

* Comments, observations and opinions are outside of the UKAS Accreditation Scope.

Eden House, Unit 2, Watling Street Industrial Estate, Leadgate, Consett, Co. Durham. DH8 6TA
Tel: (01207) 500463/Fax: 590240, E-mail: Info@mis-environmental.co.uk

mis Ltd ENVIRONMENTAL

SOLMEK

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Cleveland
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Email: south@solmek.com
www.solmek.com

GAS MONITORING RESULTS

GROUND CONDITIONS : DRY

WEATHER : BRIGHT, SUNNY

ATMOSPHERIC PRESSURE : 1012mb

SPECIFICATION : WASTE MANAGEMENT PAPER NO. 27 & BS 5930:1981

CLIENT : HEBBURN PROPERTIES LTD

LOCATION : WATERSIDE PARK, HEBBURN

DATE : 20/04/06

OPERATOR : ST

EQUIPMENT : LANDSURVEYOR II

RESULTS

Position	Methane Gas %	Carbon Dioxide (CO_2) %	Oxygen (O_2) %	Flow Litres/hr	Water Level in BH (mbgl)
BH1	0.0	3.1	17.9	-	1.60
BH4	0.0	0.2	20.7	-	Dry
BH5	0.0	0.0	18.6	-	Dry

ND = Not Detected * not measured
N/A = Not applicable % = By volume

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GAS MONITORING RESULTS

GROUND CONDITIONS : DAMP

WEATHER : OVERCAST

ATMOSPHERIC PRESSURE : 1003mb

SPECIFICATION : WASTE MANAGEMENT PAPER NO. 27 & BS 5930:1981

CLIENT : HEBBURN PROPERTIES LTD

LOCATION : WATERSIDE PARK, HEBBURN

DATE : 25/04/06

OPERATOR : ST

EQUIPMENT : LANDSURVEYOR II

RESULTS

Position	Methane Gas %	Carbon Dioxide (CO_2) %	Oxygen (O_2) %	Flow Litres/hr	Water Level in BH (mbgl)
BH1	0.0	2.8	18.5	-	1.61
BH4	0.0	0.0	20.6	-	Dry
BH5	0.0	0.0	19.4	-	Dry

ND = Not Detected * not measured
N/A = Not applicable % = By volume

APPENDIX 4

CONTAMINATION GUIDELINES

A qualitative approach using the statutory definition of Contaminated land as defined within Section 78A (2) of Part 11A of the Environmental Protection Act 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 the Government guidance DETR 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 judgment on whether "*significant harm*" and the significant possibility of harm is being caused they are required 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 6 for additional notes on contamination guidelines.

The contamination testing results have been compared to a range of site specific threshold values devised in relation to the nature of the site and the proposed development. These thresholds are based on the CLEA Soil Guideline Values (SGV). Current soil guideline values are given in the DEFRA and Environment Agency's R&D Publications SGV 1, 3, 4, 5, 7, 9, and 10.

Contaminated Land Report 10 *"The Contaminated Land Exposure Assessment Model (CLEA): Technical basis and algorithms"* and the various SGV Reports describe residential land use as land on which a people live in a wide range of dwellings including for example detached, semi detached, terraced, converted and purpose built flats. The land use takes into account several different house designs including houses based on suspended floors and ground bearing slabs. It assumes that residents have access to private gardens and/or community open space close to the home. Two SGV are provided, calculated with and without a contribution from eating home grown vegetables. This represents the key difference in potential exposure to contamination between those living in a house with or without a private garden.

Pathways and Receptors

The receptors listed below are considered in CLR8 to be potentially at risk from contamination related to industrial land due to the pathways also described.

Humans

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.

Water

The principal pathway by which the contaminants in the made ground may reach the water environment is through a slow seepage or leaching to either 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.

Vegetation and the Ecosystem

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 may accumulate within the plant or be excreted naturally. Plants form a secondary pathway for contaminants if consumed by humans or animals.

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. 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.

Contamination Guidelines

There are various guidelines which relate to contamination of water, soils and gas in the UK.

The CLEA values provide the most recent and appropriate guidance on soil contamination that applies to the UK. These give soil guideline values (SGV) at which a risk to human health may exist and are primarily intended as a guide to site redevelopment. Values are given for different land uses; these include residential gardens and commercial areas where the risks are less.

CLEA SOIL GUIDELINE VALUES (mg/kg)					
DETERMINANT	SOURCE	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	ALLOTMENTS	COMMERCIAL/ INDUSTRIAL
ARSENIC	SGV1	20	20	20	500
CADMIUM	SGV3	pH6 1 pH7 2 pH8 8	30	pH6 1 pH7 2 pH8 8	1400
CHROMIUM	SGV4	130	200	130	5000
LEAD	SGV10	450	450	450	750
MERCURY	SGV5	8	15	8	480
NICKEL	SGV7	50	75	50	5000
SELENIUM	SGV9	35	260	35	8000

These figures need to be compared with the modified average given in the Environment Agency document CLR7 "*Assessment of risks to human health from land contamination. An overview of the development of soil guideline values and related research*".

There are various guidelines employed for assessing water quality. There are some UK guidelines which are derived from EC Regulations. In addition, Dutch ground water quality thresholds are commonly referred to due to their ease of use and the stringent nature of the need for ground water quality control in a country which is low lying. Other information and guidelines used are taken from waste management and are termed leachate quality thresholds. However, some professional judgement and modelling may be required where the contamination is in close proximity to a sensitive receptor such as a lake, river or aquifer.

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 surface and groundwater. 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 the there are grounds for action.

♣Solmek conditions of offer, notes on limitations & basis for contract (ref: version3/2006)

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 is 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, soil gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. 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. 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 advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 7% 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.

APPENDIX 1