www.mlm.uk.com

SALMON HARVESTER PROPERTIES LTD

DALES MANOR BUSINESS PARK, SAWSTON, CAMBRIDGESHIRE

SUPPLEMENTARY GEOENVIRONMENTAL ASSESSMENT REPORT

MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL

Tel : 01223 815600
Fax : 01223 815630
Email: Jason.monk@mlm.uk.com
Website: www.mlm.uk.com

Document Ref: DMB/721750/R2/F
Date: August 2008
Revision: 0

Prepared	J. E. Monk	Senior Geoenvironmental Engineer
Checked	D. J. Gill	Technical Director
Approved	D.M. Brenton	Managing Director

CONTENTS

Dales Manor Business Park, Sawston
Supplementary Geoenvironmental Assessment Report

FIGURES

APPENDICES

EXECUTIVE SUMMARY

General

This report has been prepared for Salmon Harvester Properties Ltd, who are proposing to purchase and develop the existing Marley Building Materials site off Grove Road, Sawston for light industrial/commercial purposes.

The report presents an interpretation of the ground conditions and provides advice and guidance on geotechnical and contamination issues.

Findings – Geotechnical

The intrusive investigation has revealed Made Ground generally 1.0m thick locally to depths of up to 2.6m, comprising mainly of soft to firm sandy gravelly clay. Underlying the Made Ground was a generally firm but locally soft to very stiff CLAY with a variable gravel content of flint and chalk, considered to represent Glacial Till. Alluvial deposits are present locally. The Chalk bedrock was encountered from depths of 1.1m to 3.7m bgl.

Traditional pad/trench fill footings will be appropriate for the majority of the site area, with allowable bearing pressures in the range 50 – 150kN/m2. Locally, soil conditions are such that deep pads, vibrotreatment or piling should be considered. Further consultation with a ground improvement specialist will be required. Sub grades will comprise Made Ground where for preliminary design CBR's of 2% are appropriate.

Existing foundations and sumps and pits will need to be considered in foundation design.

Findings – Contamination

Hotspots of hydrocarbon contamination have been encountered at the site in the soil and groundwater which will require remediation.

There are compounds in soil that will require water supply pipes to be upgraded and there is also potential for localised contamination and sumps and pits which will need to be taken into account during redevelopment.

The most significant issue at the site is the presence of methane and carbon dioxide.

Gas protection measures for buildings will be required.

The site will not, in our opinion, be classified as contaminated land under the Part IIa process. Development of the site can, in our opinion, proceed without any major liabilities or risk providing the remediation measures recommended in this report are adopted.

LIMITATIONS AND EXCEPTIONS

1. This report and its findings should be considered in relation to the terms and conditions proposed and scope of works agreed between MLM Environmental and the client.

2. The Executive Summary, Conclusions and Recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon until considered in the context of the whole report.

3. The assessment and interpretation of contamination and associated risks are based on the scope of work agreed with the client and the report may not be sufficient to fully address contaminations or to allow detailed remediation design to proceed without further investigation and analysis.

4. Any assessments made in this report are based on the ground conditions as revealed by the exploratory holes and pits, together with the results of any field or laboratory testing undertaken and, where appropriate, other relevant data which may have been obtained for the sites including previous site investigation reports. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available.

5. Interpretations and recommendations contained in the report represent our professional opinions, which were arrived at in accordance with currently accepted industry practices at the time of reporting and based on current legislation in force at that time.

6. Where the data available from previous site investigation reports, supplied by the Client, have been used, it has been assumed that the information is correct. No responsibility can be accepted by MLM Environmental for inaccuracies within the data supplied.

7. Whilst the report may express an opinion of possible configuration of strata between or beyond exploratory hole or pit locations, or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy.

8. Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. It should be noted, however, that groundwater levels vary due to seasonal or other effects.

9. The copyright in this report and other plans and documents prepared by MLM Environmental is owned by them and no such report, plan or document may be reproduced, published or adapted without their written consent. Complete copies of this report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its commission.

10. This report is prepared and written in the context of the proposals stated in the introduction to this report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of the report, the report should be referred to us for re-assessment and, if necessary, re-appraisal.

1. INTRODUCTION

1.1. General

This supplementary report has been prepared by MLM Environmental (MLME) for Salmon Harvester Properties Ltd. The report relates to the proposed redevelopment of the Marley Building Materials (MBM) tile factory on Grove Road, Sawston, Cambridgeshire for commercial and light industrial purposes.

MLME have previously undertaken for the site a Phase 1 Desk Study (ref. 721576/R1/F), dated March 2007 (ref. 1), and a Phase 2 Geoenvironmental Assessment (ref. 721750/R1/F), dated November 2007 (ref. 2).

This report presents the findings of a supplementary site investigation, laboratory analysis and geotechnical and contamination assessment undertaken at the site during July and August 2008.

The extent of investigation and analysis undertaken as part of this study is specific to providing information to supplement previous reports and is considered sufficient to identify potential sources of contamination, pathways and targets, with comparison of sample analysis against guideline values. It is also considered sufficient to allow assessment of ground conditions with respect to construction.

The report provides a qualitative assessment of contamination risks to health and safety and the environment and provides a summary of recommended mitigation measures based on this qualitative assessment. The document is intended to form part of the documentation submitted as part of planning and to provide information on contamination for funders, occupiers and other professionals.

The report provides and assessment of ground conditions with respect to foundations, slabs and infrastructure and gives recommendations for appropriate solutions.

1.2. Terms of Reference

The terms of reference for the supplementary works were set out in a letter by MLME, ref. DMB/721750/005/DMB dated 11 March 2008.

The proposals for the supplementary works included for the following scope of work:

- Utilities clearance at exploratory positions
- Windowless sample boreholes
- Gas and vapour monitoring during the fieldwork
- Installation of gas monitoring wells
- Soakaway Tests
- Recovery of soil and groundwater samples for chemical analysis
- Assessment of ground conditions with respect to foundation and infrastructure design
- Qualitative risk assessment of contamination and outline guidance on remediation.

1.3. Report Structure

This report is divided into a number of sections, which contain:

- Site description
- Summary of previous report findings
- Description of the intrusive investigations, monitoring and analyses undertaken
- Description of ground, groundwater and gas conditions
- Geotechnical and foundation assessment
- Comparison of chemical test results to relevant generic guideline values
- Conceptual site model
- Qualitative risk assessment using source-pathway-receptor scenarios
- Quantitative controlled water risk assessment
- Summary of risks and proposed remedial action
- Summary and conclusions
- Factual data from the investigation

1.4. Technical Approach

Based on the findings of the previous reports the following approach was adopted for this supplementary investigation:

- Investigation types of waste, and nature of the landfill to the west of the site.

- Investigate the levels and origin of the ground gases carbon dioxide and methane across the site.

- Review gas protection measures for the proposed development at the site.

- Undertake further intrusive investigations in existing buildings and areas previously inaccessible to investigation.

2. THE SITE

2.1 Location and Description

The site is located to the northeast of Sawston village centre on the northern side of Grove Road. The National Grid Reference for the site is 549040, 250430.

The site location is presented as Figure 1.

The site was formerly occupied by Marley Building Materials (MBM) in the manufacture of roofing tiles and contains several process and administration buildings and extensive areas of outdoor storage.

The site is sub-rectangular in outline and covers an area of approximately 2.5 hectares.

At the time of the site investigation, the site was occupied by the former tile factory across the central area of the site, and a mobile office at the southern corner of the site. All areas of hardstanding were accessible.

It is understood that more recently, whilst the monitoring has been ongoing, the buildings have been demolished.

2.2 Previous Report Findings

Phase 1 Desk Study

A desk study was prepared by MLME for Savills on behalf of MBM, ref. 721576/R1/F (ref 1), in March 2007 to assist in the sale of the site, and the findings are summarised below.

The tiles works occupying the site were established in 1960–1971, prior to which the site was undeveloped farmland.

The dismantled course of a railway is alongside the northern boundary while a concrete batching plant run by Tarmac Readymix is to the east. A landfill site, restored in 1977, is adjoining the site to the west. Housing is 20m to the south.

On site sources of potential contamination are present and include oil and fuel tanks, a hydrochloric acid store, an oil store and a historical flammable store. Significant thicknesses of Made Ground are not expected that could be associated with a background of contamination, such as metals.

Off site sources of contamination include a former landfill site, which is adjoining the site to the west. This could be a source of leachate and gas with the potential to migrate beneath the site. The Tarmac Readymix plant to the east is not expected to be a source of significant contamination.

The site geology is of Alluvium overlying Lower Chalk. The underlying chalk is a major aquifer and the boundary of a source protection zone is bordering the site to the east.

An open drainage ditch is alongside the western site boundary, which accepts surface runoff from the site as well as from land to the east of the site. With the presence of a spring upstream of the site, it is likely that groundwater provides baseflow to the ditch at certain times of the year. Contaminated groundwater, if present, on the site could therefore impact on surface water quality.

Potential Medium Risks are present from (a) the impact on human health by gas migration from the adjoining landfill site, (b) the impact of potential hydrocarbon contamination surrounding existing fuel tanks on groundwater in the underlying chalk aquifer, and (c) the impact of contaminated surface runoff and groundwater contamination entering the drainage ditch on the western boundary.

Phase 2 Geoenvironmental Assessment

The intrusive investigation revealed Made Ground generally 1.0m thick, but locally to depths of up to 2.6m. Underlying the Made Ground was a generally firm but locally soft to very stiff CLAY with a variable gravel content of flint and chalk, considered to represent Glacial Till. Alluvial deposits were encountered locally. The Chalk bedrock was encountered from depths of 1.1m to 3.7m bgl.

Traditional pad/strip footings will be appropriate for the majority of the site area, with allowable bearing pressures in the range 100 – 150kN/m^2. Locally, soil conditions are such that deep pads, vibrotreatment or piling will be appropriate. Sub grades will comprise Made Ground where for preliminary design CBR's of 2% are appropriate.

Existing foundations and sumps and pits will need to be considered in foundation design.

A risk assessment process has concluded that the levels of compounds in soil and groundwater do not offer risks to human health through direct exposure, inhalation and there are no risks to the chalk aquifer.

There are compounds in soil that will require water supply pipes to be upgraded and there is also potential for localised contamination and sumps and pits which will need to be taken into account during redevelopment.

The most significant issue at the site is the presence of methane and carbon dioxide probably from the adjoining restored landfill to the west, but possibly from on-site sources below the existing factory building.

Gas protection measures for buildings, gas cut-off trenches and gas venting of the site are recommended.

The site will not, in our opinion, be classified as contaminated land under the Part IIa process. Development of the site can, in our opinion, proceed without any major liabilities or risk providing the remediation measures recommended in this report are adopted.

2.3 Proposed Development

It is understood that the site is to be redeveloped for a commercial/industrial end use comprising a number of units and areas of car parking, access roads, and landscaping.

3. ASSESSMENT OF FORMER LANDFILL

3.1. General

The desk study undertaken previously by MLME for the site identified a restored landfill site immediately to the west, which represents a potential source of the ground gases carbon dioxide and methane. these compounds were recorded at significantly high levels during the phase 2 geoenvironmental assessment, within the development site.

As part of this supplementary investigation, discussions have been made with the current land owner of the landfill site, and the local authority to determine the nature of the waste deposited, and the containment system for the landfill.

Information on the landfill site is presented in the following sections.

3.2. Initial Desk Study Findings

The desk study recorded the following details relating to the landfill:

- Identified on the 1986 map as a *refuse tip.*
- Local authority recorded landfill identified 7m to the west.
    - Located at Deal Drove, ref. LS27.
    - Authority South Cambridgeshire District Council.
    - Last reported Closed.
    - Type of Waste – Cat. 3
    - Date of Closure – Not supplied

3.3. Current Landowner

The current land owner of the site Mr E. King of Dencora provided MLME with a copy of the waste disposal license for the landfill site. This is presented in Appendix A, and summarised below:

- The site is located at Deal Grove, Sawston.
- The landfill operator was William Sindall Ltd, of 347 Cherry Hinton Road, Cambridge.
- License ref. LS27.
- The site was licensed on 20 April 1977 for the disposal of topsoil, subsoil, and inert waste from the building and civil engineering construction industry.

3.4. South Cambridgeshire District Council

Following consultation with the South Cambridgeshire District Council, a email response was received, which is presented in Appendix A, and summarised below;

- The landfill is licensed to Sindall Plant Ltd, license ref. LS27
- The landfill was licensed from 2 January 1974 to 5 March 1993.
- The accepted waste type was 100% inert material.
- There is no information available, from the Environment Agency records, to suggest that the landfill is lined.
- A check of the planning records indicates the initial planning permission (S/0843/77) for 'Reclamation of the site by controlled tipping of topsoil/subsoil and inert builders materials'. This permission was renewed every couple of years until the final planning permission was given in 1992 (S/2005/90).

3.5. Summary

From the available information it is understood that the landfill was operational from the period of 2 January 1974 to 5 March 1993, and licensed for accepting inert waste. However there is mention from the Envirocheck Report that the waste types also included Cat. 3 waste types, which included chemicals and chemical compounds which are not Special Wastes within the meaning of the Control of Pollution (Special Waste) Regulations 1980, but which may require specialist control measures in order to prevent harm to the environment or risk human health.

Furthermore there from the available records the landfill site does not appear to be lined, which is not unexpected given the age of the landfill.

Based on the information it is likely that the types of waste deposited, typically topsoil and subsoil, may represent the source of gases that have been recorded at the site.

Based on the discussions, there is no evidence to suggest that ongoing monitoring of gas and leachate is being undertaken in wells in either on the landfill or around the perimeter of the landfill or surrounding areas.

4. SUPPLEMENTARY GEOENVIRONMENTAL INVESTIGATION

4.1. General

Fieldwork was carried out at the site during July 2008 comprising the construction of windowless sample and trial pits, installation of monitoring wells and groundwater/gas monitoring.

The locations of all exploratory holes were positioned by a MLME engineer to provide coverage of the site taking into account previous report findings, and the requirements of this supplementary investigation. The existing buildings, observed features, and underground services were also considered when positioning exploratory holes. The number of locations and sampling points are considered sufficient to identify potential site problems and provide an overview of site conditions.

Features, structures or certain ground conditions may be present between exploratory hole locations including beneath buildings, which are different to that encountered during the investigation and which developers should take into account during construction.

Locations of all exploratory holes are presented in Figure 2.

All boreholes were logged by a Geoenvironmental Engineer in accordance with BS 5930: 1999 (ref. 3).

4.2. Windowless Sample Boreholes

A total of 14 No. windowless sample boreholes (ref. WS101 – WS114) were constructed across the site using an Archway Dart Windowless Sampling Rig to a depth of 4.45m bgl. Boreholes were constructed adjacent to potential sources of contamination and to provide general site coverage.

Continuous soil cores were recovered in PVC liners during boring to prevent cross contamination and aid sample recovery. Standard Penetration Tests (SPT's) were undertaken in the strata to determine shear strength and density.

Engineer's windowless sample borehole logs are presented in Appendix B.

4.3. Trial Pits

A total of 2 No. trial pits (refs. TP1 and TP2) were excavated to depths of between 3.35m and 2.65m bgl to facilitate the undertaking of soakaway tests. The locations of the tests were predetermined prior to the field work in consultation with MLM Consulting Engineers, drainage team.

Upon completion of the soakaway tests the trial pits were backfilled with arisings in the reverse order to their removal and bucket-compacted upon completion. Surplus arisings due to bulking of soils were piled on top and allowed to settle with time.

Engineer's trial pit logs are presented in Appendix C.

4.4. Soakaway Tests

Upon completion of TP1 and TP2, soakaway tests were undertaken. The trial pits were filled with water to specified depths and the fall in water level was recorded over time. The tests were undertaken in general accordance with BRE 365 (ref.

4) and the soil infiltration rate was calculated from the test results using the BRE SOAK programme.

The results of the soakaway tests are presented as Appendix D.

4.5. Monitoring Wells

Gas monitoring wells were installed in WS101, WS103, WS104, WS105, WS108 and WS112 to depths of 3.0m bgl.

The monitoring wells comprised 50mm plain casing from ground level to 1.0m bgl with the annulus sealed with bentonite pellets. Below this the casing was slotted with the annulus to the hole containing pea gravel.

The installation was completed at the surface beneath a flush mounted inspection cover and gas taps installed.

The full monitoring well installation details are presented on the appropriate engineer's logs.

4.6. Gas and Groundwater Monitoring

Ground gases were monitored on 4 No. monitoring visits following the completion of fieldwork between 16 July and 5 August 2008. A further two monthly visits are also proposed.

Carbon dioxide (CO_2), methane (CH_4), oxygen (O_2) and barometric pressure were recorded using a Geotechnical Instruments GA 2000 gas analyser. The depth to groundwater from the surface was measured with the use of a tape dipmeter.

The presence of organic vapours was recorded with the use of a Phocheck 3000 photoionisation detector (PID).

Results of gas and groundwater monitoring undertaken are presented in Appendix E.

4.7. Sampling

Disturbed soil samples for chemical analysis were recovered in plastic tubs and glass jars appropriate for the types of analysis and determinants tested.

Samples for chemical analysis were couriered to the laboratory the day following recovery.

Sample types and depths are recorded on the relevant exploratory hole records.

4.8. Laboratory Analysis

Chemical Analysis

The following analytical tests were scheduled on samples recovered from the boreholes. Analysis undertaken was based on the range of compounds that could be expected based on site history and process, and based on previous results of analysis.

Table 4.1 Summary Schedule of Chemical Testing

Contaminant	Made Ground	Groundwater
Toxic metals (arsenic, cadmium, chromium, lead, mercury, nickel, selenium)	6	1
Phytotoxic metals (copper, nickel, zinc)	6	1
TPH - speciated (C6 - 10, C10 - 21, C21 - 35 or 40)	7	1
Speciated PAH	2	0

Chemical analysis was undertaken by a UKAS-accredited laboratory and the results are presented in Appendix F.

5. GROUND AND GROUNDWATER CONDITIONS

5.1. General

A review of the ground conditions encountered during both phases of investigations has been undertaken, and an updated geological profile has been determined for the site based on the more recent investigations. The ground conditions encountered during both site investigations across the site comprised of the following general strata sequence (updated):

Table 5.1 Generalised strata sequence

Strata	Depth Range (m bgl) to Top of Unit	Thickness Range (m)
Surfacing	GL	0.08 – 0.45
Made Ground	0.08 – 0.45	0.10 – 2.52
Alluvium (locally)	0.55 – 2.00	0.40 – 3.00
Lowestoft Formation (Glacial)	0.20 – 2.40	0.60 – >3.00
Zig Zag Chalk Formation	1.10 – 4.00	>0.1 - >13.9

> Base of stratum not proven

5.2. Surfacing

Across the majority of the site, concrete was encountered at the surface or immediately underlying an asphalt surfacing. Locally at the eastern corner of the site (WS11), and near to the western corner and along the southwest boundary (BH1 and BH2), brick paving was present.

5.3. Made Ground

Underlying the surfacing Made Ground was encountered to depths of 2.6m bgl, comprising a cohesive clay material, although locally underlying the hardstanding, and considered to be forming a sub base material; a more granular material was encountered. The gravel fraction of the Made Ground varied comprising of flint, brick, concrete, chalk, ash and tile fragments.

The Made Ground was present at greater depths across the western half of the site, particular in the location of BH2a (near to western corner) and WS110 (mid way along northern boundary) where the Made Ground extended to depths of 2.6m bgl and 2.3m respectively. Towards the eastern end of the site, the Made Ground was generally less than 1m bgl in depth.

5.4. Underground Obstructions / Pits

Old foundations will be present in the area of the existing building, and will require removal prior to the site redevelopment.

In addition, underground pits and sumps are present on site, which contained liquid waste pigments and concrete tailings. These will need to be emptied and grubbed out as part of demolition work and backfilled with engineering fill.

Validation sampling and testing of resulting excavations should be performed as a precautionary measure to determine if contamination has occurred due to past leakages.

One pit in the northwest corner of the site is 5m by 5m in plan and is reported to be 20m deep. Investigation in this area is recommended, particularly if buildings are proposed.

5.5. Alluvium

Locally across the site, natural deposits of soft to firm organic rich clays and silts have been encountered which are considered to represent the Alluvium identified on the published geology map.

The deposits are generally encountered near to the western boundary of the site, with isolated deposits identified centrally, and close to the northern boundary.

5.6. Lowestoft Formation

Across the majority of the site underlying the Made Ground and, where encountered the Alluvium, was a generally firm to stiff but locally soft Clay, with a variable gravel content of flint and chalk.

During the construction of WS7 between 2.0m and 2.9m bgl, WS105, between 2.4->3.0m bgl, and WS108, between 2->4.45m bgl, a loose to medium dense brown gravelly SAND was present.

It is anticipated that the majority of the superficial deposits encountered represent Lowestoft Formation (glacial till), rather than the Alluvial Deposits as identified on the published geology map for the area. The cohesive deposits appear more characteristic of typical Glacial Till, and the strength of the Clays are also generally higher than would be anticipated for Alluvial deposits.

5.7. Zig Zag Chalk Formation

Underlying the Made Ground and superficial deposits from depths of 1.1m to 4.0m bgl, was a structureless Chalk, recovered as a white and brown slightly clayey Chalk GRAVEL. Locally the upper horizon of the chalk was identified by a firm to stiff Marl.

Based on the nomenclature, presented in CIRIA guidance document 'Engineering in Chalk' (ref. 5) the chalk falls within a weathering Grade Dc, and is considered to represent the Zig Zag Formation of the Grey Chalk sub-group.

5.8. Groundwater

During the construction of the windowless sample boreholes groundwater was only encountered in WS107 and WS113 at depths of 3.5m and 0.51m respectively.

Groundwater was encountered in the chalk, however, during the construction of BH1 to BH3, with water strikes at depths of 4.3m to 12m bgl rising to 4.1m to 10m bgl respectively.

During subsequent monitoring of wells installed across the site, groundwater was encountered at depths of 1.0m to 3.26m bgl.

5.9. Contamination Observations (Supplementary Investigation Only)

Made Ground, which is often an indicator for the potential presence of contamination, was encountered across the majority of the site area.

From the supplementary investigations, there was no obvious olfactory or visual evidence for widespread contamination at the site, other than locally the presence of organic odour and staining, which were encountered at the following depth

ranges:

Table 5.2 Contamination Observations

Hole Ref.	Location	Depth Range of Staining/Odour (m bgl)	Soil Description
TP1	Eastern corner	0.25-0.80	Hydrocarbon odour
WS101	Western corner	0.65 – 0.80	Dark grey staining and hydrocarbon odour
WS102	Near to western corner	0.20 – 1.00	Hydrocarbon odour
WS104	Mid way along western boundary	0.60 – 0.80	Black staining and hydrocarbon odour
		1.00 – 1.50	Hydrocarbon odour
		2.60 – 3.00	Hydrocarbon odour
WS105	NW corner	0.20 – 1.10	Hydrocarbon odour
		1.10 – 2.40	Strong hydrocarbon odour
		2.20 – 2.30	Dark grey band
WS106	Southern boundary, near to western corner	0.50 – 2.00	Faint hydrocarbon odours
WS107	Within existing building, at western end	0.30 – 0.50	Hydrocarbon odour
WS112	Mid way long existing building	0.45 – 0.55	Hydrocarbon odour
WS113	Within existing building, at eastern end	0.29 – 0.60	Strong hydrocarbon odour
WS114	Within existing building, at eastern end	0.90 – 2.10	Hydrocarbon odour

5.10. Ground Gas Conditions

The presence of Made Ground, and the proximity of the adjoining landfill to the west indicated the potential for ground gas to be present.

During monitoring of the installed wells, the range of gas levels recorded was as follows:

Table 5.3 Summary of gas monitoring after fieldwork – First Phase

Monitoring Date	Methane (%)	Carbon dioxide (%)	VOC	Gas Flow ($l\ hr^{-1}$)	Barometric Pressure (mb)
3 Oct 07	<0.1 – 30.5	<0.1 – 5.6	<1 – 2	0.1 – 0.1	1016 – 1017 (falling)
17 Oct 07	0.1 – 49.7	<0.1 – 4.6	<1	0.1 – 0.8	1013 – 1014 (falling)
24 Oct 07	0.1 – 81.8	<0.1 – 5.7	<1 – 6.3	0.1 – 0.3	1029
29 Oct 07	0.1 – 64.8	<0.1 – 5.8	<0.1 – 0.3	<1 -3	1013

Table 5.4 Summary of gas monitoring after fieldwork – Supplementary Investigations

Monitoring Date	Methane (%)	Carbon dioxide (%)	VOC	Gas Flow (l hr^{-1})	Barometric Pressure (mb)
16 July 08	<0.1 – 73	<0.1 – 4.3	<0.1 – 0.8	0.1 – 2.5	1020 – 1016 (falling)
23 July 08	0.1 – 62.7	<0.1 – 3.4	<0.1 - 33	0.1 – 0.9	1020 – 1014 (falling)
28 July 08	0.1 – 72.1	<0.1 – 4.0	-	0.1 – 0.8	1007 – 1008 (rising)
5 Aug 08	0.1 – 78.1	<0.1 – 5.8	<0.1 – 2.4	0.2 -0.7	1012 – 1011 (falling)

6. GEOTECHNICAL ASSESSMENT

6.1. Proposed Development

It is anticipated that construction will take place at or close to existing ground level following removal of surface hardstanding and any existing buildings/structures.

It is understood that the site is to be redeveloped for an industrial/commercial end use.

6.2. Material Properties and Geotechnical Parameters

A full assessment of the material properties and geotechnical parameters of the soils encountered at the site have been addressed in the previous report ref. 721750/R1/F, and should be read in conjunction with the following section.

A review of the additional in situ geotechnical testing, together with the first phase of works has been undertaken and is addressed below:

Made Ground - Granular

SPT 'N' values (uncorrected for overburden pressure) in the granular Made Ground deposits at a depth of 1m ranged from to 5 to 8 indicating a loose density which equates to angles of friction of approximately 28-29º.

A plot of SPT 'N' values for the Made Ground, for both the granular and cohesive deposits is presented as Figure 3.

Made Ground – Cohesive

SPT 'N' values (uncorrected for overburden pressure) in the cohesive Made Ground at depths of 1-2m bgl ranged from 4 to 17, which equate to approximate shear strengths of 18kPa to 76.5kPa, ie a very low to high undrained shear strength classification (BS5930).

Alluvium

SPT 'N' values (uncorrected for overburden pressure) in the Alluvium deposits at depths of 1-3m bgl ranged from 4 to 13, which equate to approximate shear strengths of 18kPa to 58.5kPa, ie a very low to medium undrained shear strength classification.

A plot of SPT 'N' values for the Alluvium is presented as Figure 4.

Lowestoft Formation – Cohesive

SPT 'N' values (uncorrected for overburden pressure) in the cohesive glacial till at depths of 1-4m bgl ranged from 6 to 63, which equate to approximate shear strengths of 27kPa to 283.5kPa, ie a low to very high undrained shear strength classification.

A plot of SPT 'N' values for the Lowestoft Formation, for both the granular and cohesive deposits is presented as Figure 5.

Lowestoft Formation – Granular

SPT 'N' values (uncorrected for overburden pressure) in the granular glacial

deposits at depths of 2-4m ranged from 9 to 25 indicating a loose to medium dense density which equates to angles of friction of approximately 30-35º.

Zig Zag Chalk Formation

SPT 'N' values uncorrected for overburden pressure recorded in the Chalk ranged from 5 to 39 which, based on published guidance, indicates the chalk to be of a weathering grade Dm/Dc to A.

A single SPT undertaken in the location of WS10, refused at a depth of 3m, possibly indicating a flint band. No further progress was possible in the borehole.

A plot of the SPT 'N' values for the Chalk is presented as Figure 6.

6.3. Excavations

Ground conditions will provide generally straight forward dig conditions for construction plant once any surface hardstanding and existing buildings are removed, however below-ground obstructions such as footings, sumps, drain runs etc, are likely to be present in areas of existing buildings and other structures. Shallow excavations may require excavation support in the short term given the presence of Made Ground, and where deeper excavations are envisaged, temporary trench support or battering of excavation sides will be required. Where deeper excavations are likely to remain open for significant lengths of time, where man entry is required beyond 1.20m or where there is a risk of collapse, trench support or battered excavations will be required.

Based on the monitoring data, where groundwater was encountered at a depth of 1.0m bgl, groundwater may be encountered at shallow depths, likely as seepages, and pumping from sumps should be sufficient to deal with anticipated flows in the generally lower permeable materials if minor inflows are encountered during wetter periods. However in the more permeable soils some form of groundwater control in the form of dewatering and cut offs may be necessary for excavations.

6.4. Foundations

Details of the likely development layout were provided at the time of this assessment. It is anticipated that following removal of any hardstanding, buildings and underground structures, the development will take place at or close to existing ground level.

The appropriate foundation solution adopted for the site will not only depend on ground conditions, but also on structural loading and load distribution and the limiting criteria for movement or settlement of the buildings. The future buildings may have high specification finishes and unevenly distributed loadings such that settlement and particularly differential settlement will be required to be maintained within tight tolerances.

The ground conditions across the site vary significantly, and foundation types and depths will be dependant on:

- Depth of Made Ground
- Depth of soft alluvial deposits
- Underground obstructions
- Variability of soils laterally across building foot prints

The allowable bearing pressures calculated are based on the in situ geotechnical testing that has been carried out at the site as part of both phases of investigation.

Generally at the site trench fill or pad foundations will be appropriate at the site, where founding into the firm to stiff glacial deposits or structureless Chalk is achievable at depths of up to 2.5-3.0m bgl. For a trench fill foundation 0.6m wide, widening to 1m for deeper foundations allowable bearing pressures (ABP's) of between 50kPa to 150kPa have been calculated at this time.

Locally at the southwest corner of the site, Mae Ground and soft alluvial deposits have been encountered to depths of greater than 3m bgl. Due to the variability and poor consolidation characteristics of these deposits, it is unlikely that trench fill foundations could be adopted in this area, and a piled foundation solution should be considered.

The ABP's calculated, with an appropriate factor of safety to ensure settlement is maintained within 25mm.

Where trench fill or strip foundations are adopted, reinforcement of the foundations are recommended due to the variability of the underlying soils, to reduce the effects of differential settlement within acceptable limits.

Where more stringent tolerances are required for settlement due to the structural design of the individual buildings, or where higher ABP's are required a piled foundation may be more appropriate at the site.

Initial discussions with a ground improvement specialist has indicated that vibrotreatment may not be suitable due to the high organic content within the alluvial deposits. Further more detailed discussions with a ground improvement specialist is recommended for the individual buildings to confirm the suitability or otherwise of vibrotreatment.

6.5. Floor Slabs

Suspended slabs would be the most appropriate solution for buildings given the presence of Made Ground and ground gasses.

However suspended slabs for large warehouse type buildings or large floor areas may not practical or economic and ground bearing solutions will be required for the larger structures. The sub grade for ground bearing slab will comprise Made Ground where a CBR value of 2% is appropriate for design. Crushed concrete screened to a suitable grading could be used as a capping layer for ground bearing slabs or alternatively the following options could be looked at, the suitability of which depend on loading and performance requirement etc.

- Pile slabs (unlikely unless significant loads)
- Cement/lime stabilisation
- Vibrotreatment

6.6. Pavement Construction

It is anticipated that development will be at or close to existing site level. Following a site surface strip, the sub-grade will comprise of variable Made Ground and natural Clays, and a design CBR value of 2% should be adopted.

To improve upon the design CBR values of the sub grade the following options could also be considered:

- Lime or cement stabilisation will improve design CBR values significantly and could be considered in order to reduce capping and or sub-base thicknesses.
- Use of geogrid support layers in capping/sub base layer.
- Use of crushed concrete from on site as capping.

6.7. Below Ground Concrete Design

The results of pH and sulphate determination on soils at the site indicate that based on BRE Special Digest 1 Concrete in Aggressive Ground (2005) (ref. 6), the at the site fall within ACEC Class AC-1 with a corresponding Design sulphate Class of DS-1.

6.8. Swelling and Shrinkage Potential

The soils at the site exhibit a low to medium swelling and shrinkage potential, and as such swelling and shrinkage is unlikely to be a major issue at the site, although foundation depths should reviewed using guidance such as NHBC 4.2 Building Near Trees (ref. 7).

The above will need to be reviewed with respect to future development levels and any proposed tree planting.

6.9. Soakaway Potential

In areas where low permeable Clays have been encountered, ie generally across the western half of the site, soakaway drainage, in our opinion, will not be viable due to the low permeability of this stratum. Any future soakaways should avoid being located in areas of Clay.

The two soakaway tests have been undertaken at the eastern end of the site, in the more permeable Sands and Gravels and Chalk deposits. The results of the soakaway tests are summarised below:

Table 6.1 Soakaway Test Results

Location	Depth Range (m bgl)	Ground Conditions	Soil Infiltration Rate (m/s)
TP1	2.35 – 3.35	1.85 – 2.50 Silty, gravelly to very gravelly SAND 2.50 – 3.35 Structureless Chalk of Gravel fragments in a sandy silt matrix	1.6×10^{-5}
TP2	1.66 – 2.65	Structureless Chalk of Gravel fragments in a sandy silt matrix	1.0×10^{-5}

NB. * Water level did not fall

Based on the calculated results, locally the more granular sands and gravels and underlying Chalk deposits do appear to have permeabilities which may be suitable for some form of sustainable drainage solution.

However, towards the central and western parts of the site low permeable Clay soils, and deep Made Ground have been encountered, which would not be suitable for soakaway drainage.

Soakaway drainage is potentially viable in the Chalk, however “puttying” of the chalk during excavation, resulting in smearing of excavation sides, will reduce chalk permeability significantly and must be avoided.

- Concentrated ingress of water into the chalk can initiate new dissolution features, particularly in low-density chalk and destabilise the loose backfill of existing ones. For this reason, any soakaways in chalk should be sited at least 10m away from any foundations. In the event that dissolution features are encountered at the site, or are known to be present soakaways should be sited a minimum 20m from any buildings.

For the drainage systems, flexible jointed pipes should be used wherever possible; particular care should be taken for the avoidance of leaks in both water supply and drainage pipework.

As the Chalk is a vitally important aquifer, the Environment Agency and local authority must be consulted when planning soakaway installations where chalk lies below the site – even where it is mantled with superficial deposits.

Consultation with a drainage engineer and the Environment Agency is recommended to confirm suitability of the site for soakaway drainage or other SUDs.

6.10. Re Use of Materials

The site has an extensive surfacing of concrete which will be broken up as part of redevelopment. The underlying sub grade is poor, requiring capping as part of pavement construction.

It should be possible to crush and screen concrete on site for use as a capping layer.

7. DISCUSSION OF SOIL TEST RESULTS

7.1 Contaminant Trigger Levels and Reference Criteria

Human Health

In assessing the levels of compounds in soil at the site, MLME have used the Soil Guideline Values (SGV's) (ref. 8) published by DEFRA and the EA. SGV's are based on research undertaken for DEFRA and Environment Agency and derived by the Contaminated Land Exposure Assessment model (CLEA).

There are currently no published SGV's for Total Petroleum Hydrocarbons (C10-C35) and MLME have used the TPH Criteria Working Group Series (TPHCWG) whole product method (ref. 9) for assessing levels of contamination by TPH.

Where carbon banding analysis of TPH has been carried out the results have been compared against Generic Assessment Criteria (GAC) calculated for different soil types by MLME using the Environment Agency CLEA Beta Version 2005 Excel spreadsheet (ref. clea-v1_0.xls).

The adopted MLME Generic Assessment Criteria are fully listed in Appendix G.

Water Supply

Risks to water supply pipes and services are assessed through the Water Regulations Advisory Scheme (WRAS) guidance note 9-04-03 (ref. 10).

The WRAS guidance note provides threshold concentrations above which permeation by organic compounds can occur through polymer supply pipes to taint or affect the quality of potable water.

Phytotoxicity

Risks from phytotoxicity have been assessed through the British Standard BS 3882:2007 (ref. 11). This standard sets out the threshold values in topsoil for potential phytotoxic effects from certain metals.

7.2. Reference Criteria vs. Proposed Land Use

Future development of the site is of a commercial nature. Appropriate soil guideline values have therefore been developed according to this end land use as follows:

- CLEA SGV's for commercial/industrial land use.

7.3. Soil Dependent Factors

Appropriate CLEA SGV's have been adopted using the following soil dependent factors:

Table 7.1 Soil dependent factors for Made Ground <1m bgl

Soil dependent factor	Range	Adopted value
pH	7.9-12.1	Median of 10.0
OMC	TOC 0.23-2.1	Median OMC of 2%
Soil type	Clay – Gravel	Assume worst case granular soils

Value for OMC derived from OMC = TOC x 1.724

A summary of the results of analysis when compared to the adopted guideline criteria is presented below.

Table 7.2 Comparison of soil test results to MLME Generic Assessment Criteria (GAC)

Compound	MLME GAC	Number of Tests	Min.	Max.	Number Exceeding GAC
Arsenic	500	6	4.4	17	0
Cadmium	1,400	6	<0.1	0.3	0
Chromium	5,000	6	5.2	20	0
Lead	750	6	<5	200	0
Mercury	480	6	<0.1	10	0
Selenium	8,000	6	<0.2	<0.2	0
Nickel	5,000	6	6.3	26	0
Benzo[a]pyrene	31	2	<0.1	<0.1	0
TPH, C6-C10 (GRO)	310	7	<1	1900	**1**
TPH, C10-C21 (DRO)	72,000	7	<1	16000	0
TPH, C21-C40 (ORO)	46,000	7	<1	1100	0

All units mg kg^{-1}

Based on the results of testing summarised above, MLME GAC for commercial/industrial use were exceeded at one location with an elevated level of TPH, C6-C10.

7.4. Water Supply

Concentrations of arsenic, mercury, PAH and TPH locally exceeded their respective WRAS guideline values in Made Ground.

7.5. Phytotoxicity

A summary of the results of analysis when compared to the BS3882:2007 guidelines for planted areas are tabulated below.

Table 7.4 Comparison of soil test results to BS3882:2007 criteria

Compound	BS3882	Number of Tests	Min.	Max.	Number Exceeding BS3882
Copper	200	6	<5	46	0
Nickel	110	6	6.3	26	0
Zinc	300	6	<10	90	0

All concentrations in mg kg^{-1}

The BS3882:2007 guideline criteria were not exceeded in any of the samples of Made Ground from across the site.

7.6. Nature and Distribution of Soil Contamination

Locally an elevated concentration of TPH was encountered in a sample recovered from WS113 at a depth of 0.4m bgl, within the eastern end of the building. The level of TPH recorded is anticipated to be related to a former above ground fuel tank located in the area of the borehole.

A plan showing the hotspots of hydrocarbon contamination is presented as Figure 7.

7.7. Impact of Soil Contamination

Based on the findings of the investigation, there are no significant impacts on occupation and development of the site for industrial or commercial purposes or on surrounding off site receptors, other than a localised level of TPH recorded at the eastern end of the existing building.

No compounds have been encountered that would impact future planting at the site.

Water supply pipes could potentially be impacted by the locally elevated metal and organic compounds recorded in the Made Ground. Water pipes are likely to require upgrading in accordance with the water supply company requirements. Discussion with the water company is recommended.

Any off-site disposal of arisings will have financial implications and testing for waste acceptance criteria was not carried out as part of this investigation. Based on metal concentrations and the presence of Made Ground it is possible that soils for off site disposal will qualify as non hazardous waste and require pre-treatment. Locally however, where elevated levels of hydrocarbons have been encountered, soils for off site disposal may be classed as hazardous.

8. DISCUSSION OF GROUNDWATER TEST RESULTS

8.1. Environmental Quality Standards (EQS)

In assessing the levels of compounds in groundwater beneath the site, the results of analyses have been compared to prescribed UK drinking water quality standards (DWS) (ref. 12).

Although the UK DWS are generally perceived to be conservative in terms of groundwater risk assessment, they do however provide a useful tool for screening groundwater test data in the context of the underlying chalk major aquifer.

8.2. Groundwater Test Results

During this supplementary investigation, a single groundwater sample was obtained during the construction of WS113 where potential soil contamination was identified.

A summary of the results of analysis when compared to the adopted guideline criteria is presented below.

Table 8.1 Comparison of groundwater test results to DWS

Compound	DWS	Number of Tests	Level	Number Exceeding DWS
Arsenic	10	1	26	**1**
Boron	1000	1	<20	0
Cadmium	5	1	<0.5	0
Chromium	50	1	<1	0
Copper	2000	1	80.8	0
Lead	25	1	<1	0
Mercury	1	1	<0.5	0
Selenium	10	1	9.3	0
Nickel	20	1	69.7	**1**
Zinc	5000	1	15.2	0
TPH, C6-C10 (GRO)	10	1	2500	**1**
TPH, C10-C21 (DRO)	10	1	2600	**1**
TPH, C21-C40 (ORO)	10	1	62	**1**

All units µg l^{-1}

Based on the results of testing summarised above, DWS were exceeded for arsenic, nickel and TPH.

8.3. Nature and Distribution of Contamination

The identified elevated concentrations of arsenic, nickel and TPH are all from one water sample taken from WS113 at the time of the site investigation. This water originates in the Chalk.

An on site source of the metal contamination has not been identified as metal concentrations in soil are not sufficiently elevated to the extent that leaching can be anticipated.

As part of the previous phase of investigation, 3 No. groundwater samples were tested for a suite of metal compounds, and 2 No. samples for TPH. The results identified elevated concentrations of arsenic, mercury and selenium, all from one

water sample taken from WS3 during site monitoring. This water originates in the Glacial Till.

An on site source of the elevated levels of metals in the groundwater has not been identified as metal concentrations in soil are not sufficiently elevated to the extent that leaching can be anticipated. The landfill site to the west remains a possible source however these metals were not present in groundwater on the northwest boundary adjoining the landfill.

The presence of the elevated levels of TPH within the groundwater at the location of WS113 is considered to represent a localised hotspot of contamination, sourced from the elevated levels of TPH recorded within the soils at the same location.

8.4. Impact of Contamination on Aquifer

A Quantitative Risk Assessment (QRA) has been undertaken as part of the previous assessment based on the elevated levels of metal compounds within the groundwater.

The results of the QRA indicate that the presence of metals arsenic, selenium and mercury beneath the site at the levels present offer no plausible risks to off site receptors of groundwater.

As part of this supplementary investigation, hydrocarbon contamination has been identified at the site, as an isolated hotspot of contamination. Due to the levels of hydrocarbons recorded within the groundwater, localised remediation will be required, with remedial targets levels determined though QRA.

9. DISCUSSION OF GAS MONITORING RESULTS

9.1. Gas Assessment Criteria

The proposed development is understood to be commercial/industrial and the Characteristic Situations described in the British Standard BS8485:2007 (ref. 13) and CIRIA publication C665 (ref. 14) are adopted according to a range of Gas Screening Values (GSV).

GSV's for methane and carbon dioxide have been derived from site maximum concentrations of gas and flow rate.

GSV's are derived according to the following formula:

- GSV = gas concentration in percent/100 x flow rate in litres per hour

9.2. Gas Monitoring Results

The gas monitoring data indicates site maximum gas concentrations and flow rate and resulting GSV's and a CIRIA Characteristic Situation for future commercial/industrial use as follows.

Table 9.1 Gas Screening Values and CIRIA Characteristic Situation

Parameter	Site Maximum	GSV	CIRIA Characteristic Situation
Methane	81.8%	2.454	**3**
Carbon dioxide	5.8%	0.174	
Flow rate	3 l hr^{-1}	-	

9.3. Nature and Distribution of Gas Contamination

Gas contamination from methane and carbon dioxide was identified beneath the site, although levels varied considerably. The higher levels of methane recorded at the site have been recorded within the wells more central to the site in the area of the existing building. Along the western perimeter of the site, adjacent to the landfill site the levels of carbon dioxide and methane are low.

The ranges of the gases carbon dioxide and methane across the site are illustrated in Figure 8.

Potential Sources

- Landfill via services entering the site, and permeable soils
- Organic alluvial deposits
- Made Ground
- Hydrocarbon

The mostly likely sources of the ground gases, based on the results of analysis:

- Elevated levels of hydrocarbons identified in the soils and groundwater.

The potential for ground gases entering the site from the landfill to the west, and from the breakdown of organic rich material within the Made Ground and alluvial deposits can not be discounted, however there is no evidence to prove this conclusively.

9.4. Impact of Gas Contamination

Based on the gas monitoring, the CIRIA designation for the site will vary between a Characteristic Situation 1-3. However the source of the methane is considered to be as a result of the elevated levels of hydrocarbons encountered locally across the central area of the site.

Gas protection measures will be required at the site, but will vary on the location of the individual buildings.

10. RISK ASSESSMENT

10.1. Updated Conceptual Site Model

The site investigation, results of chemical analysis and risk screening assessment has allowed the preliminary conceptual site model developed at the desk study and to be updated. This is then used to assess qualitative and quantitative risks to human health and the environment.

The basis for the model is presented below:

Site Summary	The site was undeveloped up to 1960-1971, following which it was developed as a concrete tile factory and operated by Cambs Tiles Ltd. From 1978 to the present time, the site has been operated by Marley Building Materials.
Site Description	The site comprises a 2.5 hectare area utilised as a works involved in the manufacture of roof tiles. Buildings are on site, which are used for batching and firing materials used in the manufacture process together with buildings used for storage and offices and extensive areas of outdoor storage.
Surrounding Area	Surrounding land is farmland to the north, industrial to the east, housing to the south and derelict land, comprising a former landfill, to the west.
Geology	The underlying strata are of Alluvium and Glacial Till over Lower Chalk.
Hydrogeology	The site is over a major aquifer and is has a source protection zone alongside its eastern boundary.
Surface Water	A drainage ditch is alongside the western site boundary.
Source Characterisation	On-site: • Made Ground locally containing TPH • Groundwater locally containing arsenic, nickel and TPH • Methane and carbon dioxide Off-site: • Landfill to the west
Potential Pathways	• Lateral gas/vapour migration and inhalation • Plant uptake • Groundwater movement • Direct contact with services and construction materials
Potential Receptors	• Site users (industrial) • Site workers (construction/maintenance/site investigation) • Buildings and services • Landscaping

10.2. Liability and Risk – General

The key environmental issues relevant to purchase, divestiture, ownership and occupation of any site are:

- Health and Safety Risks
- Environmental Risks
- Contamination Liability
- Construction Costs
- Effects on Construction and Building Materials.

10.3. Health and Safety Risks

The human health qualitative risk assessment (section 7) has identified an elevated level of TPH in soils locally at the site.

However, a gas monitoring and risk assessment process has identified elevated levels of methane and carbon dioxide across the site, likely to be originating from the elevated levels of hydrocarbons recorded within the soils and groundwater, but not discounting the potential for limited migration of gases from the landfill site to the west, and the presence of organic rich Made Ground and alluvial deposits.

The levels of gases present are in potentially explosive and toxic concentrations.

10.4. Controlled Waters

Although locally elevated concentrations of arsenic, mercury and selenium are present in groundwater, QRA indicates there is no risk of impact on the public water supply borehole 400m to the south.

In addition, an on-site source for the metals contamination was not proven in Made Ground overlying the chalk aquifer.

Hydrocarbon contamination has been identified at levels above guideline values, within locally shallow groundwater within the Chalk. The source of the contamination is likely to be from the elevated levels of hydrocarbons recorded within the soils at the site. A QRA and remediation will be required for the localised area of contamination.

10.5. Liability Issues

Under current UK liability in relation to contaminated land it is the polluter, or if the polluter cannot be found, the current landowner who is responsible for remediation of a site designated as contaminated land under the new regime.

Responsibilities for clean up could however, be transferred to future developers or site owners/occupiers on the basis of ‘sold with information’.

Based on the information and assessments to date, we consider that the site is unlikely be classified as contaminated land under Part IIa of the EPA 1990 by the local authority following a change in use to commercial, provided the remedial measures set out in this report are included within the Remediation Strategy Document and are adhered to.

10.6. Deleterious Effects on Construction Materials

Hydrocarbon compounds were identified in soil at levels which can attack or permeate certain plastics. Water supply pipes, in particular, may be impacted and guidance given in Water Regulation Advisory Scheme Guidance Note 9-04-03 should be referred to.

Polymer-based construction materials, such as DPM/DPC and belowground drainage goods will need to be specified as resistant to attack by organic compounds.

10.7. Construction Costs

Off site disposal of soil will have cost implications irrespective of the level of

compounds present in relation to human health or risks to the environment.

All material removed to facilitate construction or reduce site levels, will be subject to the landfill tax. There are no remediation measures on site and material removed as part of remediation will not be tax exempt.

Protected services attract a greater construction cost than water supply pipes laid in uncontaminated land

Gas protection measures will be required at a greater cost than if building on land that is not contaminated by potentially hazardous soil gases.

Provision should be made in contractor's costs for the use of personal protective equipment, particularly with regard to potentially toxic and asphyxiating gases and hydrocarbon vapours.

11. REMEDIATION & RESIDUAL RISK MANAGEMENT

11.1. Soil Contamination

The site investigation has recorded deposits of Made Ground at the site. Apart from an elevated hotspot of TPH, the chemical analysis generally did not, however, record elevated levels of compounds above guideline values for the proposed commercial development with respect to human health, although metals and hydrocarbon compounds were encountered above guideline values for potable water supply pipes in the ground and for potential phytotoxicity.

The localised area of zinc contamination is present beneath proposed capping of buildings and hard paving, where no landscaping is proposed. Therefore remediation to support planting is not proposed.

Based on the findings of the investigation and chemical analysis undertaken at the site, the following recommendations are made:

- Water supply pipes are likely to require upgrading in accordance with the water supply company requirements if they are constructed through Made Ground, in view of the elevated levels of metals and hydrocarbon locally. Further discussions with the local water supply company are recommended.

- Where Made Ground is encountered, the bedding, backfill and surround to all services constructed at the site must be clean imported materials such that future maintenance is in clean soil.

- Construction workers should adopt appropriate personal hygiene standards during the construction phase at the site, including a designated eating and drinking area, washing facilities and the wearing of appropriate PPE, i.e. gloves, overalls, particularly where Made Ground is present.

- Handling of soil and water should be minimised, and dust suppression measures should be implemented, particularly during any excavation through Made Ground. Soils should be dampened during excavation to limit dust and handling and lorries suitably sheeted.

- Locally remediation of the elevated level of hydrocarbons will be required. This may take the form of bulk excavation and disposal off site, in situ or ex situ remediation, using bioremediation techniques.

- It is recommended that MLME are retained to provide a watching brief and, if necessary, undertake sampling and analysis during site development, particularly during the grubbing-up of slabs, exiting footings and along foundation construction to ensure any residual contamination in these areas is properly managed.

11.2. Groundwater Contamination

Levels of the metals, arsenic, mercury and selenium, were locally present in groundwater above UK DWS. A P20 QRA of controlled waters indicates there is no off-site impact on the nearest abstraction borehole which is 400m to the south.

Measured levels of total metals in soil on site are not considered to be elevated with respect to the potential for leaching to groundwater.

Hydrocarbon contamination of the groundwater in the Chalk aquifer has been encountered at the site, and remediation will therefore be required. The following is given as guidance at this stage, but a more detailed remediation strategy, will be required following a QRA.

- Remediate existing soil contamination to remove source of groundwater contamination.
- Remediation of groundwater, via dual phase extraction.

11.3. Gas Contamination

Gas contamination by locally high levels of methane together with carbon dioxide is present above background which appears to be originating from the elevated levels of hydrocarbons within the site boundary, but not discounting the presence of organic rich Made Ground and alluvial deposits, and the historic landfill to the west of the site.

Irrespective of the source, gas levels are such that gas mitigation measures are required in order to permit safe development. The variation of gas levels recorded across the site is such that gas protection measures will vary depending on the location of the proposed building.

Based on the gas assessment undertaken at the site, significant gas migration from the landfill is not considered the major source of the ground gases recorded within the site area. As such the use of a cut off wall along the western boundary of the site is no longer necessary.

The following are recommended:

Block A and H - Gas Characterisation CS1

Low gas levels recorded, no gas protection measures required.

Blocks B, C, F, and G – Gas Characterisation CS2

Gas protections measures, based on CIRIA Publication C665 they should incorporate the following:

a. Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200g DPM.
b. Beam and block or pre cast concrete slab and minimum 2000g DPM/gas proof membrane
c. Possibly underfloor venting or pressurisation in combination with a) and b) above depending on use

Blocks D and E – Gas Characterisation CS3

Gas protection measures, based on CIRIA Publication C665 they should incorporate the following:

- Methane and carbon dioxide resistant membrane
- Passive underfloor sub-space venting or positively pressurised underfloor sub-space (‘clean air blanket’)
- All joints and penetrations sealed.

In addition to the above, the following should be considered;

- Services act as preferential pathways for the increment of gas through the site and will result not only in potential risks to building occupiers from gas ingress, but from build-up of gasses in manholes and other structure.

- Venting of manholes and use of intrinsically safe electrical equipment is recommended for below ground or surface structures.

- Hardstanding adopted across the site will exacerbate the build-up of gas by preventing gas to vent naturally to atmosphere, gas venting of external areas through vent boxes, strips etc is recommended.

11.4. Underground Structures

Underground pits and sumps are present on site, which contained liquid waste pigments and concrete tailings.

- These will need to be emptied and grubbed out as part of demolition work and backfilled with engineering fill.

- Validation sampling and testing of resulting excavations should be performed as a precautionary measure to determine if contamination has occurred due to past leakages.

- One pit in the northwest corner of the site is 5m by 5m in plan and is reported to be 20m deep. This depth has been confirmed more than once by site staff and is possibly a borehole soakaway beneath the pit. Investigation in this area is recommended, particularly if buildings are proposed.

11.5 Excavation and Disposal of Arisings

Excavation for foundations, services etc will result in generation of soil which we anticipate will be classified as non-hazardous (Made Ground) and inert (glacial till, chalk) for off-site disposal purposes.

All non-hazardous soils require pre-treatment prior to disposal, this pre-treatment could be separation, sorting, screening etc. Costs for disposal of non-hazardous soils are significant compared to disposal of inert.

There is no specific requirement to dispose of soils off-site and where possible soil could be used for screening bunds for example to minimise arisings. Consideration should be given to monitoring finished site levels as high as possible. Costs for import of material will be more cost effective than export.

11.6. Remediation Strategy, Validation, Foundation Works, Risk Assessment

A QRA will be required to determine target levels for the groundwater remediation at the site.

A remediation strategy setting out in further detail the requirement summarised in this section to protect site users primarily from gas is in preparation. In addition to this a Foundation Works Risk Assessment may be required by the Environment Agency to support the proposed foundation solution given that the site lies above a major aquifer.

Any remediation and gas protection work undertaken will also require verification and validation which will include ongoing gas monitoring, inspections and production of a validation report.

12. SUMMARY AND CONCLUSIONS

- A Phase II supplementary Geoenvironmental Investigation has been undertaken to provide an assessment of potential environmental risks and contamination associated with the site.

- At the time of the investigation, the site comprised approximately 2.5 hectares of existing commercial/industrial land.

- The investigation, involving windowless sampling, and trial pits has proved Made Ground, overlying localised Alluvium, Glacial Till, in turn overlying Chalk.

- Groundwater was encountered at depths of 1.0m to 3.26m bgl.

- Trench fill and pad foundations, extended in the Glacial Till and Chalk could be adopted at the site with allowable bearing pressures of 50- 150kN/m^2.

- In areas of deep Made Ground, or soft Clays, alternative foundations solutions include:

  - Piled Foundations, founding piles in to the underlying Chalk.
  - Ground Improvement, Vibrotreatment of the underlying Made Ground/Soft Clays to accommodate shallow trench fill or pad foundations. (Further discussions with a ground improvement specialist will be required)

- Suspended floor slabs are recommended for all building structures, however for larger buildings where ground bearing slabs are required the following options should be considered:

  - Pile slabs
  - Vibrotreatment of slab areas
  - Cement/lime stabilisation

- For pavement construction, the sub grade will comprise of variable Made Ground. For design purposes a CBR value of 2% should be considered to improve upon CBR values the following could be adopted.

  - Lime/cement stabilisation
  - Use of geogrid support layers
  - Use of crushed concrete from on-site as capping

- The Made Ground at the site falls within ACEC Class AC-1 with a corresponding Design sulphate Class of DS-1.

- Soakaway drainage can be considered at the site, within the sand deposits and Chalk bedrock present across the eastern half of the site. The low permeable Clays would not be suitable for soakaways across the western half of the site.

- Swelling and shrinkage is unlikely to be an issue at the site. However, this will need to be reviewed in the light of future development levels and tree planting.

- It should be possible to crush and screen existing concrete on site for use as a capping layer.

- Locally elevated levels of TPH have been recorded above guideline values for the purposes of light industrial or commercial development site. Remediation of the site as part of development is therefore required.

- Low levels of soil contamination are, however, present that would require protected services in line with WRAS guidance and local water company requirements.

- Locally, zinc contamination was present in soil that could impact on planting in proposed areas of landscaping, based on criteria set out in BS PAS100. Specialist advice should be sought as to appropriate plant selection as opposed to the importation of potentially large volumes of clean capping soils.

- Groundwater contamination in excess of UK drinking water standards was locally present in the form of arsenic, mercury, selenium and TPH.

- QRA, undertaken as part of the initial phase of work for the elevated metal contamination of the groundwater indicates no remediation is required.

- A QRA will be required to assess the potential risks to the groundwater from the elevated level of TPH.

- Below-ground structures are present on site that include pits and sumps for the storage of waste pigment and concrete tailings. It is recommended that dynamic probing of the concrete tailings sump is carried out as its full depth is unconfirmed and may be in excess of 6m bgl.

- Following the removal of below-ground sumps, excavations should be validated to prove no significant contamination has occurred from past leakage.

- Gas monitoring during the investigation recorded elevated methane (maximum 81%) and carbon dioxide. Gas protection measures will be required within each building and over external areas of the site.

- Remediation of hotspots of hydrocarbon contamination in the soil and groundwater will be required.

- We consider that the site is unlikely to be classed as contaminated land in accordance with Part IIa of the EPA 1990 for its current or future commercial/light industrial use.

- Although significant soil contamination was not detected, Made Ground has been proved on site and site workers involved in construction, maintenance or site investigation should observe a good standard of site hygiene and appropriate PPE and health and safety procedures used.

13. REFERENCES

1. Desk Study Report. Dales Manor Business Park, Sawston. ref. 721576/R1/F March 2007.

2. Dales Manor Business Park, Sawston - Phase II Contamination Assessment Report. ref. 721750/R1/F November 2007.

3. British Standards Institution (1999): BS5930: Code of Practice for Site Investigation, London: British Standards Institution.

4. Building Research Establishment (2003): 365 – Soakaway Design.

5. CIRIA Report C574. Engineering in Chalk. 2002.

6. BRE Special Digest 1 Concrete in Aggressive Ground (2005), British Research Establishment.

7. NHBC. Chapter 4.2 Building Near Trees. (2007)

8. The Contaminated Land Exposure Assessment Model (CLEA). CLR10 March 2002, including accompanying CLR, TOX and SGV series reports and CLEA 2005 software.

9. Total Petroleum Hydrocarbon Criteria Working Group Series, June 1999. Volume 5 – Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach.

10. Water Regulations Advisory Scheme. Information and Guidance Note 9-04-03, October 2002. The selection of materials for water supply pipes to be laid in contaminated land.

11. British Standards Institution (2007) BS3882:2007. Specification for topsoil.

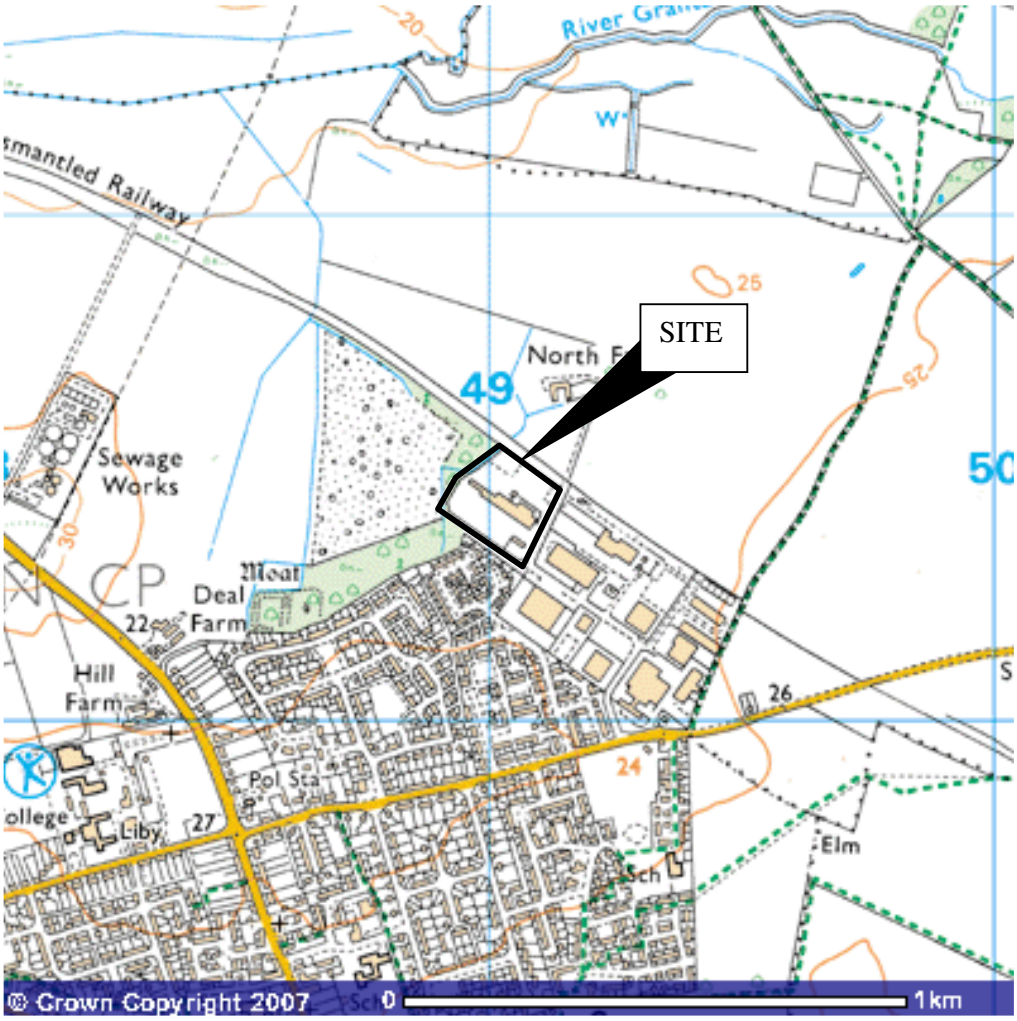
12. Water Supply (Water Quality) Regulations 2000.

13. NHBC Report 10627-R01, Edition No. 04; Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present.

14. CIRIA (2006) Report C665 Assessing risks posed by hazardous ground gases to buildings.

FIGURES

Project			Made MCH	Job No.	MLM ENVIRONMENTAL
DALES MANOR BUSINESS PARK, GROVE ROAD, SAWSTON			Date 14.11.07	721750	
Drawing Title			Checked	Drg. No	
SITE LOCATION PLAN			Approved	FIGURE 1.	
Status of Drawing				Scale NTS	
Rev.	Date	Description		Made	Checked



LEGEND

PREVIOUS SI

WS1 WINDOW SAMPLE BOREHOLE LOCATION

PROPOSED SI

TP1 TRIAL PIT LOCATION

WS1 WINDOW SAMPLE BOREHOLE LOCATION

Rev	Date	Description	Made	Checked
.	.	.	.	.

Drawing Status: INFORMATION

Environmental, Geotechnical & Waste Management Consultants
7200 Cambridge Research Park, Cambridge, CB25 9TL
Tel: 01223 815600 Fax: 01223 815630
Website: www.mlm.uk.com
Ashford * Chelmsford * Ipswich * London * Norwich.

Client: SALMON HARVESTER PROPERTIES LTD

Project: DALES MANOR BUSINESS PARK SAWSTON

Drawing Title: EXPLORATORY HOLE LOCATION PLAN

Drawn/Design	Checked	Approved	Date
JEM	...	...	02/07/08

Scales: 1:1000 @ A3

Drawing No.: FIGURE 2

Rev: .

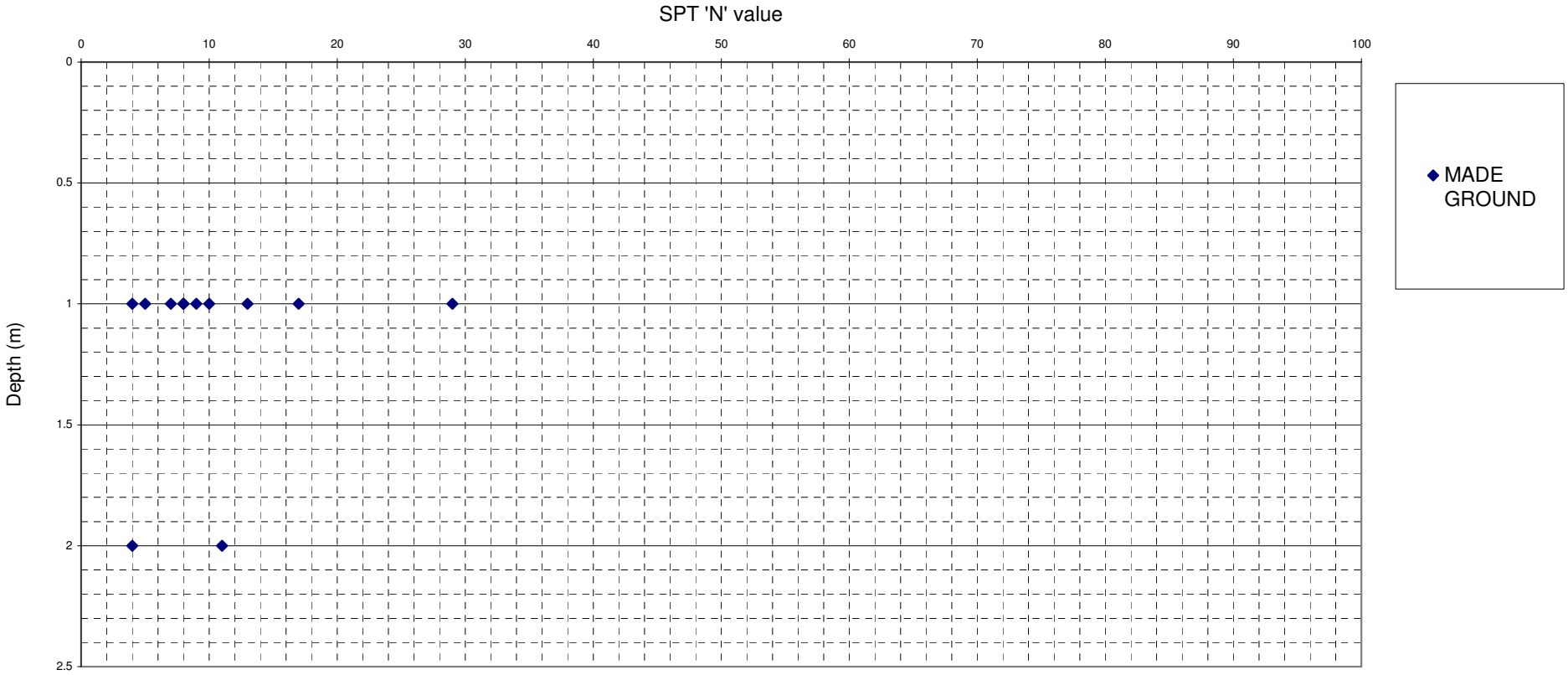
SPT 'N' VALUE vs DEPTH PLOT

Figure: 3

Site: Dales Manor Business Park

Location: Sawston, Cambridgeshire

Job No. 721750



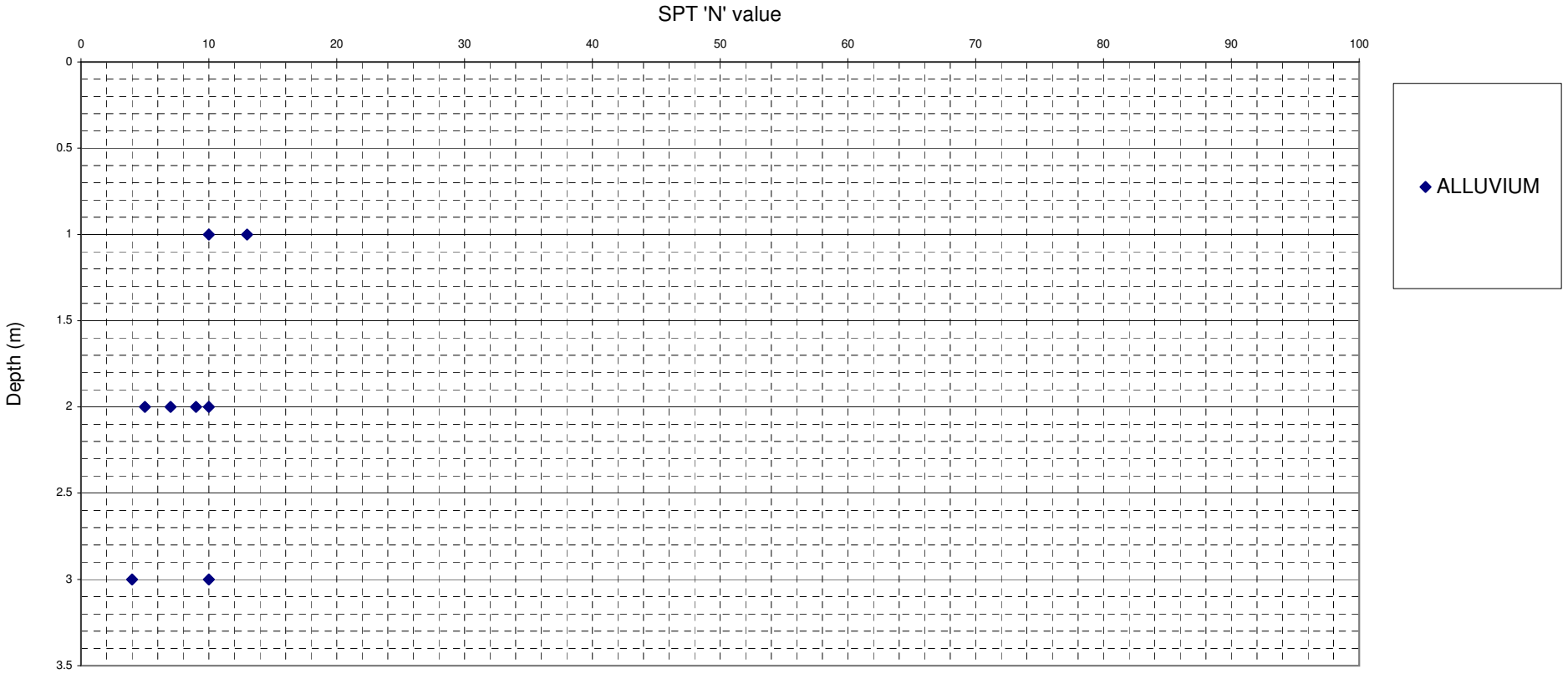
SPT 'N' VALUE vs DEPTH PLOT

Figure: 4

Site: Dales Manor Business Park

Location: Sawston, Cambridgeshire

Job No. 721750



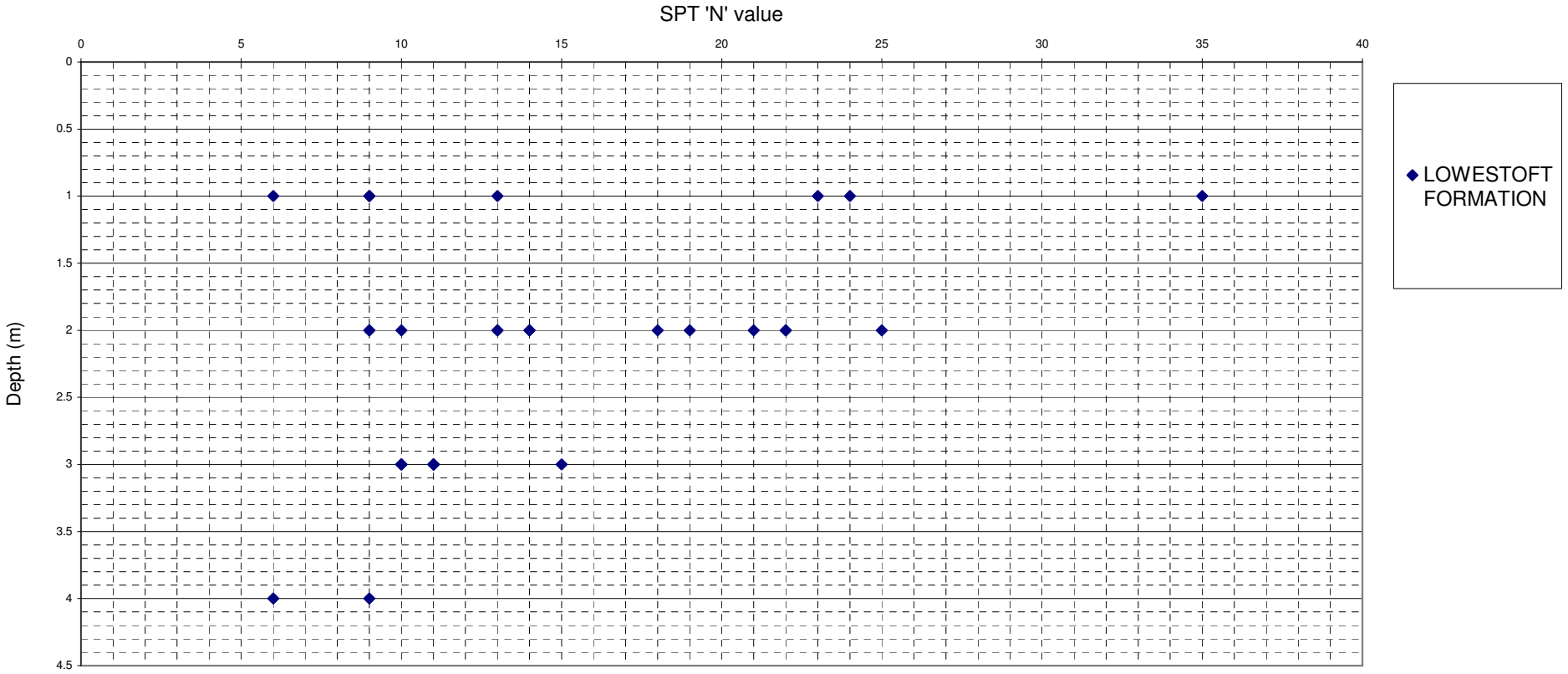
SPT 'N' VALUE vs DEPTH PLOT

Figure: 5

Site: Dales Manor Business Park

Location: Sawston, Cambridgeshire

Job No. 721750



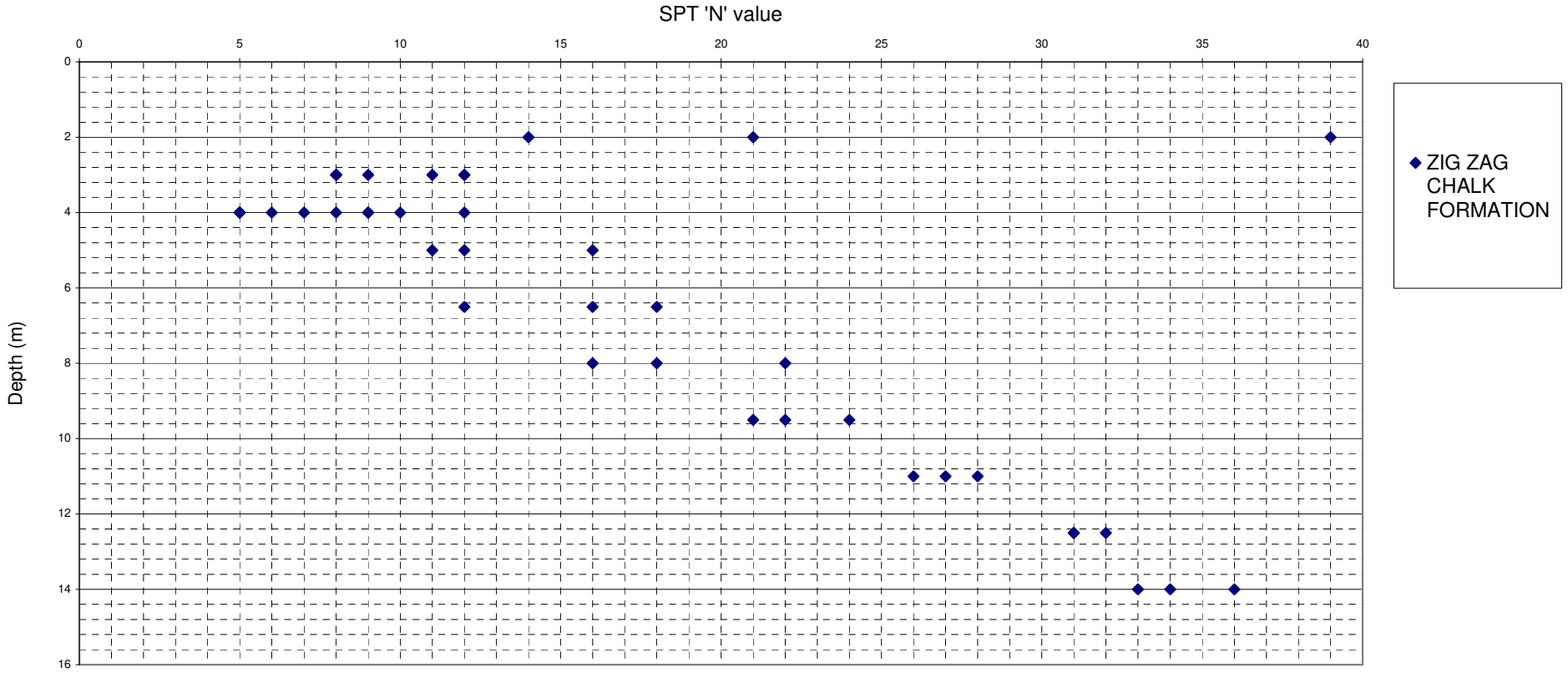
SPT 'N' VALUE vs DEPTH PLOT

Figure: 5

Site: Dales Manor Business Park

Location: Sawston, Cambridgeshire

Job No. 721750



LEGEND

PREVIOUS SI

WINDOW SAMPLE BOREHOLE LOCATION

PROPOSED SI

TRIAL PIT LOCATION

TP1

WINDOW SAMPLE BOREHOLE LOCATION

Rev	Date	Description	Made	Checked
.	.	.	.	.

Drawing Status:

INFORMATION

Environmental, Geotechnical & Waste Management Consultants

7200 Cambridge Research Park, Cambridge, CB25 9TL

Tel: 01223 815600 Fax: 01223 815630

Website: www.mlm.uk.com

Ashford * Chelmsford * Ipswich * London * Norwich.

Client

SALMON HARVESTER PROPERTIES LTD

Project

DALES MANOR BUSINESS PARK
SAWSTON

Drawing Title

HYDROCARBON HOTSPOT
GROUNDATER AND SOIL
CONTAMINATION

Drawn/Design	Checked	Approved	Date
JEM	...	...	02/07/08

Scales

1:1000 @ A3

Drawing No.

FIGURE 7

Rev

.

LEGEND

GAS CONCENTRATIONS (% v/v)
METHANE
CARBON DIOXIDE

Rev	Date	Description	Made	Checked
.	.	.	.	.

Drawing Status:
INFORMATION

MLM
Environmental, Geotechnical & Waste Management Consultants
7200 Cambridge Research Park, Cambridge, CB25 9TL
Tel: 01223 815600 Fax: 01223 815630
Website: www.mlm.uk.com
Ashford * Chelmsford * Ipswich * London * Norwich.

Client
SALMON HARVESTER PROPERTIES LTD

Project
DALES MANOR BUSINESS PARK
SAWSTON

Drawing Title
CARBON DIOXIDE AND
METHANE CONCENTRATIONS

Drawn/Design	Checked	Approved	Date
JEM	...	...	02/07/08

Scales
1:1000 @ A3

Drawing No.
FIGURE 8

Rev
.

APPENDICES

Appendix A

Correspondence Relating to Landfill

Hester Carter

From: Sproats Claire [Claire.Sproats@scambs.gov.uk]
Sent: 18 August 2008 10:52
To: Chris McCartney
Subject: Landfill at Sawston

Dear Chris,

Thank you for your enquiry regarding a landfill at 549040, 250430. From your coordinates, I have located the Sindals landfill in Sawston and can confirm the following information.

The landfill is licensed to Sindal Plant Ltd with licence reference number LS27.
The landfill was licensed from 2/1/74 to 5/3/93 to dispose of 100% inert material. There is no information to suggest that the landfill is lined. This information is provided by the Environment Agency for our database.
A check of our planning records gives the initial planning permission (S/0843/77) for "Reclamation of the site by controlled tipping of top/sub soil and inert builders materials". The permission was renewed every couple of years until the final planning permission was given in 1992 (S/2005/90).

I trust that this contains information that is useful to you, though please do not hesitate to contact me should you require any further information.

Kind regards,

Claire Sproats
Scientific Officer (Contaminated Land)

South Cambridgeshire District Council
South Cambridgeshire Hall
Cambourne Business Park
Cambourne
Cambridge
CB23 6EA

Tel: 01954 713444
Fax: 01954 713248

claire.sproats@scambs.gov.uk

General enquiries: 08450 450 500

Ref. No.: W.D. 200 LS27

CAMBRIDGESHIRE COUNTY COUNCIL

HIGHWAYS AND TRANSPORTATION DEPARTMENT
WASTE DISPOSAL DIVISION

CONTROL OF POLLUTION ACT, 1974 (Sections 3—11)

WASTE DISPOSAL LICENCE

To:

William Sindall Ltd
347 Cherry Hinton Road
CAMBRIDGE
CB1 4DJ

Cambridgeshire County Council hereby grant a licence for the disposal of waste by means of a

LANDFILL SITE

at DEAL GROVE, SAWSTON, CAMBS

in accordance with your application dated 20 APRIL 1977

and subject to the following conditions :—

✓1. The licence holder shall notify Cambridgeshire County Council Waste Disposal Division of any proposed change in the conduct of operations at least one month before the plan is implemented.

✓2. The site shall be used for the disposal of top-soil, sub-soil and inert waste from the building and civil engineering construction industry.

✓3. The site shall be operated so as to be nuisance free and any deposited material capable of becoming wind-blown shall be immediately covered with suitable material.

✓4. Such action as may be necessary shall be taken to ensure that no mud or other material from the site is deposited on the highway.

✓5. The site shall be made secure to prevent unauthorised access and disposal.

6. A suitable site office shall be provided.

✓7. No waste material shall be burned within the boundaries of the site.

✓8. Records shall be kept of the quantities and types of waste deposited at the site, and these shall be made available to the Waste Disposal Division on request.

✓9. The site shall be adequately manned.

Dated 1 September

Ref. No.: W.D. 200 LS27

CAMBRIDGESHIRE COUNTY COUNCIL

HIGHWAYS AND TRANSPORTATION DEPARTMENT
WASTE DISPOSAL DIVISION

CONTROL OF POLLUTION ACT, 1974 (Sections 3—11)

WASTE DISPOSAL LICENCE

Conditions (continued)

10. The terms of the licence shall be made known to any person who is given the responsibility for the management or control of the site and a copy of this licence shall be displayed at the site office.

11. A site identification board of durable material shall be displayed at the site entrance showing the hours when the site is open and giving the name address and telephone number of the operator and of Cambridgeshire County Council as the Authority responsible for issuing the licence.

12. The site shall be kept clean and tidy and any deposited waste levelled at least weekly.

13. The waste shall be deposited in layers not exceeding 2 metres in depth.

14. Adequate pest control measures shall be taken.

15. The stream running along the North and North-Eastern boundary of the site shall be kept free of waste deposits.

Dated 1 September 1977

Shire Hall, Castle Hill, Cambridge, CB3 0AP

Appendix B

Windowless Sample Logs

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS101

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.10		CONCRETE pavoirs.	0.10		Dry
					0.20		Coarse yellow sand. (MADE GROUND)	0.10		
							Red very sandy coarse brick gravel with occasional clinker and ash. (MADE GROUND)	0.45		
					0.65		Firm to stiff grey-brown sandy gravelly clay. Gravel is fine to coarse of flint, concrete, and chalk with occasional ash streaks. Dark grey staining and faint hydrocarbon odour from 0.65 - 0.8m bgl. (MADE GROUND)			
D1: 0.90-1.00m										
	1.00m (S) N=4 (1,1,1,1,1,1)				1.00			1.35		
D2: 1.90-2.00m										
	2.00m (S) N=5 (1,1,1,1,1,2)				2.00		Soft dark grey stained sandy slightly gravelly SILT. Gravel is fine to coarse of chalk and flint. Organic odour. (ALLUVIUM)			
D3: 2.40-2.50m								0.75		
					2.75		Firm pale grey silty slightly sandy gravelly MARL. Gravel is fine to coarse sub-rounded to sub-angular chalk and occasional flint in a grey silt matrix. (ZIG ZAG CHALK FORMATION)			
	3.00m (S) N=11 (2,2,2,3,3,3)				3.00			1.70		
D4: 3.90-4.00m										
	4.00m (S) N=9 (3,2,3,2,2,2)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS102

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level: (mAOD) -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		CONCRETE.	0.20		Dry
D1: 0.40-0.50m					0.20		Dark grey sandy to very sandy fine to coarse sub-rounded to angular clinker, brick, chalk and flint gravel. Hydrocarbon odour. (MADE GROUND)	0.30		
					0.50		Firm to stiff dark grey sandy gravelly clay. Gravel is fine to cobble sized of clinker, brick, charcoal, chalk and tile. Hydrocarbon odour. (MADE GROUND)	0.50		
D2: 0.90-1.00m					1.00		Stiff grey-brown slightly sandy gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded of chalk and flint with a band of broken up flint and chalk GRAVEL from 1.4 - 1.6m bgl. (LOWESTOFT FORMATION)	0.60		
	1.00m (S) N=13 (2,3,3,2,4,4)				1.60		Soft to firm grey-brown occasionally gravelly CLAY. Gravel is fine to coarse chalk, flint and carbonaceous material. (LOWESTOFT FORMATION)	0.80		
D3: 1.90-2.00m					2.40		Structureless grey-white and yellow stained slightly sandy silty gravelly MARL. Gravel is fine to coarse of weak chalk and rare flint and carbonaceous streaks. (ZIG ZAG CHALK FORMATION)	2.05		
	2.00m (S) N=13 (2,2,2,3,4,4)									
D4: 2.90-3.00m										
	3.00m (S) N=8 (2,2,2,2,2,2)									
D5: 3.90-4.00m										
	4.00m (S) N=5 (1,1,1,1,1,2)				4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS103

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		CONCRETE.	0.30		Dry
					0.30		Dark grey very sandy very gravelly clay. Gravel is fine to cobble sized sub-angular to sub-rounded clinker, ash, flint, chalk, tile and concrete. (MADE GROUND)	1.00		
D1: 0.90-1.00m	1.00m (S) N=8 (2,4,2,2,2,2)				1.00					
					1.30		Firm pale brown to beige gravelly CLAY. Gravel is fine to coarse chalk and occasional flint. (ALLUVIUM)	0.70		
D2: 1.90-2.00m	2.00m (S) N=4 (1,1,1,1,1,1)				2.00		Poor recovery.	0.70		
					2.70		Dark brown to black organic silty sandy gravelly CLAY. Gravel is fine flint and chalk. Rootlets and decaying wood fragments encountered. Organic odour. (ALLUVIUM)	1.10		
D3: 2.90-3.00m	3.00m (S) N=4 (1,1,1,1,1,1)				3.00					
					3.80		Black PEAT. Organic odour. (ALLUVIUM)	0.20		
D4: 3.90-4.00m					4.00		Structureless CHALK composed of silty fine to medium weak chalk GRAVEL in a grey-white and yellow stained silt matrix. (ZIG ZAG CHALK FORMATION)	0.45		
D5: 4.00-4.45m	4.00m (S) N=9 (1,2,2,3,2,2)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS104

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.04		ASPHALT.	0.04		Dry
							CONCRETE.	0.24		
					0.28		Sandy brick and concrete gravel. (MADE GROUND)	0.12		
					0.40		Dark grey-brown sandy very gravelly clay. Gravel is fine to coarse sub-rounded to angular clinker, tile, brick, flint and chalk. Black staining and faint hydrocarbon odour from 0.6-0.8m bgl. (MADE GROUND)	0.40		
D1: 0.70-0.80m					0.80		Pale grey - beige sandy chalk, brick, clinker and flint gravel. (MADE GROUND)	0.20		
	1.00m (C) N=8 (3,3,3,3,1,1)				1.00		Pale grey, red-stained sandy brick, flint, clinker and occasional chalk gravel. Hydrocarbon odour. (MADE GROUND)	0.50		
D2: 1.40-1.50m					1.50		Soft to firm grey red streaked CLAY. Faint hydrocarbon odour. (ALLUVIUM)	1.10		
D3: 1.90-2.00m	2.00m (S) N=7 (1,1,1,2,2,2)				2.60		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a cream, black and red stained matrix. Faint hydrocarbon odour. (ZIG ZAG CHALK FORMATION)	0.40		
D4: 2.90-3.00m	3.00m (S) N=10 (2,2,2,3,3,2)				3.00		*End of Borehole at 3.00 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS105

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata		Thickness (m)	Installation Details	Water (m)
					0.05		ASPHALT.		0.05		Dry
					0.20		CONCRETE.		0.15		
							Grey-brown sandy gravelly sand. Gravel is fine to coarse tile, brick, concrete, wood and rare clinker. Hydrocarbon odour. (MADE GROUND)		0.90		
D1: 0.90-1.00m					1.00						
					1.10		Bright red-stained broken up tiles with a dark grey band from 2.2 to 2.3m bgl. Strong hydrocarbon odour. (MADE GROUND)		1.30		
D2: 1.90-2.00m					2.00						
					2.40		Pale grey and orange stained gravelly SAND. Gravel is fine chalk and rare fine to coarse flint. (LOWESTOFT FORMATION)		0.60		
D3: 2.90-3.00m					3.00		*End of Borehole at 3.00 m*				
					4.00						

Notes:

1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:

1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS106

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.10		CONCRETE pavoirs.	0.10		Dry
							Red sandy brick gravel. (MADE GROUND)	0.40		
					0.50		Firm grey-brown gravelly clay. Gravel is fine to coarse sub-angular chalk, flint, brick, clinker and ash gravel. Faint hydrocarbon odour in places. (MADE GROUND)			
D1: 0.90-1.00m										
	1.00m (S) N=7 (1,1,2,1,2,2)				1.00			1.50		
D2: 1.90-2.00m										
	2.00m (S) N=9 (1,1,1,2,3,3)				2.00		Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse chalk and flint. (LOWESTOFT FORMATION)			
D3: 2.40-2.50m								0.70		
					2.70		Structureless CHALK composed of grey-cream and yellow stained sandy gravelly MARL. Gravel is weak, sub-angular to rounded fine to coarse chalk and occasional flint. (ZIG ZAG CHALK FORMATION)	0.30		
	3.00m (S) N=9 (2,2,3,2,2,2)				3.00		No recovery	0.50		
					3.50		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a grey-white and yellow stained matrix. (ZIG ZAG CHALK FORMATION)			
D4: 3.90-4.00m										
	4.00m (S) N=10 (2,2,2,3,2,3)				4.00			0.95		
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS107

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level: (mAOD) -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		Reinforced CONCRETE.	0.18		
D1: 0.30-0.40m					0.18		Yellow brown sand and fine to coarse sub-angular flint and concrete gravel. (MADE GROUND)	0.12		
					0.30		Loose dark brown-black gravelly sand. Gravel is clinker, ash and flint. Hydrocarbon odour. (MADE GROUND)	0.20		
					0.50		Dense brown occasionally grey stained clayey gravelly sand. Gravel is fine to cobble sized flint, chalk, brick, ash and wood fragments. Organic odour. (MADE GROUND)	0.50		
D2: 0.90-1.00m					1.00		Brown sandy becoming very sandy CLAY. Gravel is fine to coarse chalk, flint and wood fragments with rare carbonaceous streaks. (ALLUVIUM)	1.40		
	1.00m (S) N=13 (3,5,4,3,3,3)									
D3: 1.90-2.00m					2.00					
	2.00m (S) N=10 (2,2,2,3,2,3)				2.40		Pale grey and yellow stained sandy gravelly calcareous SILT. Gravel comprises fine to medium weak chalk. Peat bands and black banding from 3-4m bgl. Organic odour. (ALLUVIUM)	1.60		3.50
D4: 2.90-3.00m					3.00					
	3.00m (S) N=10 (2,1,2,2,3,3)									
D5: 3.90-4.00m					4.00		Structureless CHALK compsed of cream, yellow stained sandy gravelly SILT. Gravel is predominantly fine and medium weak chalk. (ZIG ZAG CHALK FORMATION)	0.45		
	4.00m (S) N=8 (1,1,2,2,2,2)				4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS108

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		CONCRETE.	0.22		Dry
					0.22		Orange-brown sand and chalk, flint, concrete, clinker and brick gravel. (MADE GROUND)	0.28		
D1: 0.50-0.60m					0.50		Dark grey sandy flint, concrete, clinker and brick gravel. (MADE GROUND)	0.15		
					0.65		Stiff dark grey gravelly clay. Gravel is chalk, flint and rare ash and brick. (MADE GROUND)	0.35		
	1.00m (S) N=13 (1,2,2,3,4,4)				1.00		Stiff dark grey gravelly clay. Gravel is fine to coarse chalk and flint with rare ash. (MADE GROUND)	1.00		
D2: 1.90-2.00m										
	2.00m (C) N=18 (3,3,5,4,5,4)				2.00		Beige very silty SAND and fine becoming fine to coarse chalk GRAVEL. (LOWESTOFT FORMATION)	2.45		
D3: 2.90-3.00m										
	3.00m (C) N=11 (2,2,2,3,3,3)				3.00					
	4.00m (C) N=9 (1,1,2,2,2,3)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS109

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.03		ASPHALT.	0.03		Dry
					0.10		ASPHALT.	0.07		
					0.20		Yellow brown sand and flint and concrete gravel. (MADE GROUND)	0.10		
							Stiff gravelly clay. Gravel is flint, chalk, brick and ash. (MADE GROUND)	0.80		
D1: 0.90-1.00m					1.00		Soft black organic slightly sandy PEAT. Gravel is chalk and flint. Faint organic odour. (ALLUVIUM)	0.70		
	1.00m (S) N=10 (2,2,2,3,2,3)									
D2: 1.60-1.70m					1.70		Orange-grey slightly clayey SAND and fine to medium flint and chalk GRAVEL. (LOWESTOFT FORMATION)	1.80		
	2.00m (S) N=13 (3,4,3,2,4,4)				2.00					
D3: 2.90-3.00m										
	3.00m (C) N=11 (3,3,3,2,3,3)				3.00					
					3.50		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a cream and orange stained matrix. (ZIG ZAG CHALK FORMATION)	0.95		
D4: 3.90-4.00m										
	4.00m (C) N=5 (1,1,2,1,1,1)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS110

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.18		Reinforced CONCRETE.	0.18		Dry
D1: 0.50-0.60m							Dark grey sandy gravelly clay. Gravel is fine to cobble sized brick, ash, tile, chalk and flint. (MADE GROUND)	0.62		
					0.80					
D2: 0.90-1.00m	1.00m (S) N=5 (1,1,1,2,1,1)				1.00		Structureless chalk and occasional flint and ash gravel in a grey-white silt matrix. (MADE GROUND)	0.70		
					1.50		Dark grey sandy gravelly clay. Gravel is fine to coarse chalk, flint and rare ash and brick. (MADE GROUND)	0.80		
D3: 1.90-2.00m	2.00m (S) N=4 (1,1,1,1,1,1)				2.00					
					2.30		Orange-beige very sandy gravelly CLAY. Gravel is fine to coarse chalk and flint. (LOWESTOFT FORMATION)	2.15		
D4: 2.90-3.00m	3.00m (S) N=11 (2,2,3,3,3,2)				3.00					
D5: 3.90-4.00m	4.00m (S) N=6 (1,1,2,2,1,1)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS111

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING | STRATA

Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.04		ASPHALT.	0.04		Dry
							Reinforced CONCRETE.	0.26		
					0.30		Stiff dark grey-brown slightly gravelly clay. Gravel is fine to coarse brick, chalk, ash, clinker and wood. (MADE GROUND)	0.70		
D1: 0.40-0.50m										
	1.00m (S) N=9 (1,1,1,2,3,3)				1.00 1.00		Soft to firm pale grey and dark grey stained sandy gravelly clay. Gravel is fine to coarse chalk, flint and occasional brick and ash. (MADE GROUND)	0.70		
D2: 1.40-1.50m										
					1.70		Firm pale grey silty slightly sandy gravelly MARL. Gravel is fine to coarse sub-rounded to sub-angular chalk and occasional flint in a grey silt matrix. (ALLUVIUM)	0.20		
D3: 1.90-2.00m					1.90					
	2.00m (S) N=9 (2,1,2,2,2,3)				2.00 2.10		Dark brown sandy PEAT with wood fragments and rootlets. Faint organic odour. (ALLUVIUM)	0.20		
							Firm pale grey silty slightly sandy gravelly MARL. Gravel is fine to coarse sub-rounded to sub-angular chalk and occasional flint in a grey silt matrix. (ZIG ZAG CHALK FORMATION)	0.90		
D4: 2.90-3.00m										
	3.00m (S) N=8 (2,1,2,2,2,2)				3.00 3.00		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a pale grey and orange stained matrix. (ZIG ZAG CHALK FORMATION)	1.45		
D5: 3.90-4.00m										
	4.00m (S) N=5 (1,1,1,2,1,1)				4.00					
					4.45		*End of Borehole at 4.45 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details: Concrete; Bentonite; Filter Gravel; Arisings Backfill

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS112

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		Reinforced CONCRETE.	0.27		Dry
D1: 0.30-0.40m					0.27		Yellow brown sand and fine to coarse sub-angular flint and concrete gravel. (MADE GROUND)	0.18		
					0.45			0.10		
					0.55		Loose dark brown-black gravelly sand. Gravel is clinker, ash and flint. Hydrocarbon odour. (MADE GROUND)			
D2: 0.90-1.00m					1.00		Brown sandy becoming very sandy CLAY. Gravel is fine to coarse chalk, flint and abundant wood fragments and carbonaceous material. Organic odour. (ALLUVIUM)	1.45		
D3: 1.90-2.00m										
D4: 2.00-2.10m					2.00		Soft to firm pale grey-brown gravelly CLAY. Gravel is chalk, shell fragments and carbonaceous material. (ALLUVIUM)	0.20		
					2.20		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a cream and yellow stained matrix. (ZIG ZAG CHALK FORMATION)	0.80		
D5: 2.90-3.00m					3.00		*End of Borehole at 3.00 m*			
					4.00					

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Monitoring well installed to 3m bgl.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS113

Drilling Method: Windowless Sampler
Start of Drilling: 08/07/2008
Completion: 08/07/2008
Ground Level: (mAOD) -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata		Thickness (m)	Installation Details	Water (m)
					0.09		Red ASPHALT.		0.09		
							Reinforced CONCRETE.		0.20		
					0.29		Dense dark grey-brown clayey very gravelly sand. Gravel is fine to coarse clinker, flint, brick, chalk and ash. Strong hydrocarbon odour. (MADE GROUND)		0.31		▽ 0.51
D1: 0.40-0.50m W1: 0.51-0.51m					0.60		Light grey-brown sandy gravelly clay. Gravel is fine to coarse chalk, flint and occasional wood fragments and carbonaceous material. (MADE GROUND)		0.50		
D2: 0.90-1.00m					1.00						
					1.10		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a cream and yellow stained matrix. (ZIG ZAG CHALK FORMATION)				
D3: 1.90-2.00m					2.00				1.90		
D4: 2.90-3.00m					3.00		*End of Borehole at 3.00 m*				
					4.00						

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

BOREHOLE REF: WS114

Drilling Method: Windowless Sampler
Start of Drilling: 09/07/2008
Completion: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA							
Sample Ref.	SPT Results (Type)	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
					0.00		CONCRETE.	0.45		Dry
					0.45		Sandy coarse concrete gravel. (MADE GROUND)	0.45		
D1: 0.90-1.00m					0.90		Beige sandy slightly gravelly SILT. Gravel is fine chalk and occasional flint. Hydrocarbon odour. (LOWESTOFT FORMATION)	1.20		
D2: 1.90-2.00m					2.10		Structureless CHALK composed of cream, slightly sandy silty sub-angular to rounded GRAVEL in a cream and yellow stained matrix. (ZIG ZAG CHALK FORMATION)	0.90		
D3: 2.90-3.00m					3.00		*End of Borehole at 3.00 m*			

Notes:
1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane.
2. When undertaken PID Readings recorded using Photoionisation Detector

Remarks:
1. Borehole backfilled with arisings.

Legend:

▽	Water Strike
▼	Water Standing
S	Standard Penetration Test - Split Spoon Method
C	Standard Penetration Test - Solid Cone Method
N=17	SPT "N" Value with number of blows per 75mm in brackets
55/25	55 blows to achieve 25mm
ES	Environmental Sample (1 tub & 1 jar)
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

Well Installation/Backfill Legend:

Backfill Details:
- Concrete
- Bentonite
- Filter Gravel
- Arisings Backfill

Pipe Details:
- Plain Pipe
- Slotted Pipe
- Piezometer Tip

Appendix C

Trial Pit Logs

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

TRIAL PIT: TP1

Date of Excavation: 09/07/2008
Backfill Date: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref.	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
					0.20		Reinforced CONCRETE.	0.20	Dry
0.30	D 1				0.25		Sand and gravel comprising concrete, clinker and ash. (MADE GROUND)	0.05	
0.50	D 2				0.35		Dark grey very sandy very gravelly clay. Gravel is brick, ash, flint and chalk. Hydrocarbon odour. (MADE GROUND)	0.10	
					0.80		Pale grey, dark grey stained clayey sand and gravel of fine to coarse flint, chalk, brick and ash. Hydrocarbon odour. (MADE GROUND)	0.45	
1.00	D 3		44		1.85		Firm dark grey-brown very sandy slightly gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded chalk and flint. (LOWESTOFT FORMATION)	1.05	
2.00	D 4				2.50		Orange silty gravelly to very gravelly SAND. Gravel is predominantly fine to coarse sub-rounded chalk. Gravel content increases with depth. (LOWESTOFT FORMATION)	0.65	
3.35	B 1				3.35		Structureless CHALK with weak cream fine to coarse sub-rounded GRAVEL in a pale grey-cream and yellow stained sandy silt matrix. (ZIG ZAG CHALK FORMATION)	0.85	
							End of Trial Pit at 3.35 m		

Soakaway Test Details (where applicable)
Depth Range:
Soil Infiltration Rate:

Remarks:
1. Soakaway test undertaken at depth of between 2.35m to 3.35m bgl.
2. Trial pit backfilled with arisings.

Dimensions:

2.00m
0.70m

Stability: Good
Plant Used:

Legend:
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed Sample
- B Bulk Sample
- J Jar Sample
- W Water Sample

Notes:
1. When undertaken shear strengths recorded using Pilcon Hand Shear Vane
2. When undertaken PID Readings recorded using Photoionisation Detector

Project: Dales Manor Business Park
Location: Sawston, Cambridgeshire

Project ID: 721750
Client: Salmon Harvester Properties Limited
Project Engineer: Hester Carter
Logged by: HC

TRIAL PIT: TP2

Date of Excavation: 09/07/2008
Backfill Date: 09/07/2008
Ground Level (mAOD): -
Coordinates: -

MLM
www.mlm.uk.com
MLM Environmental
7200 Cambridge Research Park
Cambridge
CB25 9TL
Tel: 01223 815600
Fax: 01223 815630
email: cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref.	PID Reading (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
					0.06		ASPHALT.	0.06	Dry
							CONCRETE.	0.24	
					0.30				
					0.40		Loose orange sand and gravel. Gravel comprising of flint, concrete and brick. (MADE GROUND)	0.10	
0.50	D 1				0.5		Grey-brown sandy gravelly CLAY. Gravel is flint and chalk. (LOWESTOFT FORMATION)	0.45	
					0.85		Pale grey-white and orange-brown SAND and GRAVEL. Gravel is fine to coarse of chalk and occasional flint. (LOWESTOFT FORMATION)		
1.00	D 2				1.0			0.35	
					1.20		Structureless CHALK with weak cream fine to coarse sub-rounded GRAVEL in a pale grey-cream and yellow stained sandy silt matrix. (ZIG ZAG CHALK FORMATION)		
1.50	D 3				1.5				
					2.0			1.45	
2.50	B 1				2.5				
					2.65		*End of Trial Pit at 2.65 m*		
					3.0				
					3.5				

Soakaway Test Details (where applicable)
Depth Range:
Soil Infiltration Rate:

Remarks:
1. Soakaway test undertaken at depth of between 1.66m to 2.65m bgl.
2. Trial pit backfilled with arisings.

Dimensions:

1.70m
0.70m

Stability: Good
Plant Used:

Legend:
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed Sample
- B Bulk Sample
- J Jar Sample
- W Water Sample

Notes:
1. When undertaken shear strengths recorded using Pilcon Hand Shear Vane
2. When undertaken PID Readings recorded using Photoionisation Detector

Appendix D

Soakaway Test Results

SOAKAWAY TEST RESULTS

Project Name: Dales Manor Business Park
Location: Sawston
Project Ref: 721750

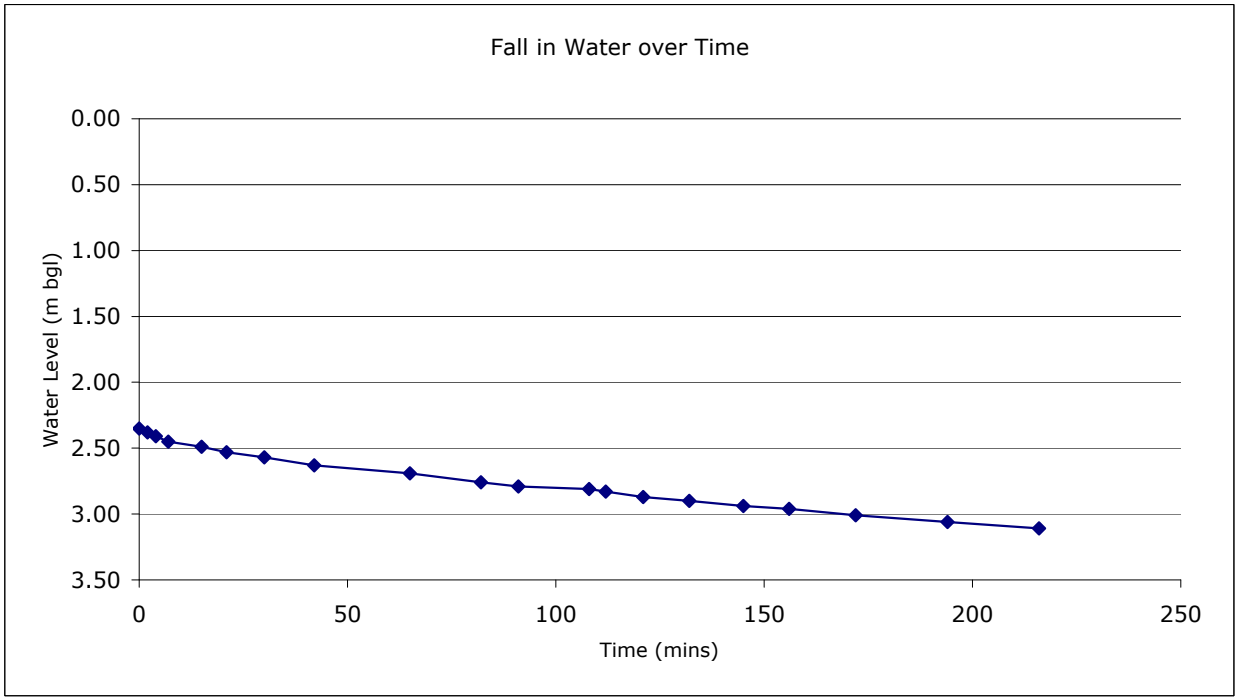
Test Location: **SA1**

Trial Pit Dimensions (m)

Top Length:	1.60	Top Width:	0.60
Bottom Length:	1.60	Bottom Width:	0.60

www.mlm.uk.com

Time (mins)	Water Level (m bgl)
0	2.35
2	2.38
4	2.41
7	2.45
15	2.49
21	2.53
30	2.57
42	2.63
65	2.69
82	2.76
91	2.79
108	2.81
112	2.83
121	2.87
132	2.9
145	2.94
156	2.96
172	3.01
194	3.06
216	3.11



Soil Infiltration Rate
1.6x10-5m/s

Remarks
1. Test Undertaken in general accordance with BRE Digest 365.
2. Trial pit was not filled with aggregate.
3. Stability was variable
4. Results were extrapolated to ensure water level reached 75% effective depth.

SOAKAWAY TEST RESULTS

Project Name: Dales Manor Business Park
Location: Sawston
Project Ref: 721750

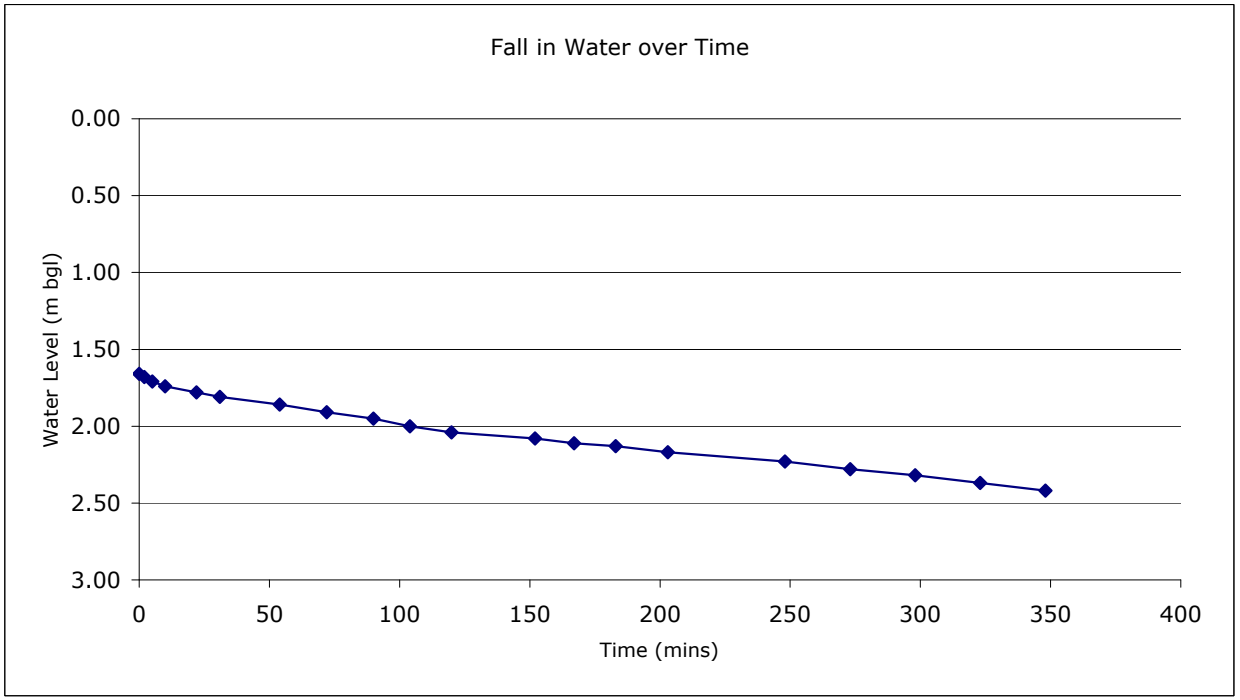
Test Location: **SA2**

Trial Pit Dimensions (m)

Top Length:	1.70	Top Width:	0.70
Bottom Length:	1.70	Bottom Width:	0.70

www.mlm.uk.com

Time (mins)	Water Level (m bgl)
0	1.66
2	1.68
5	1.71
10	1.74
22	1.78
31	1.81
54	1.86
72	1.91
90	1.95
104	2.00
120	2.04
152	2.08
167	2.11
183	2.13
203	2.17
248	2.23
273	2.28
298	2.32
323	2.37
348	2.42



Soil Infiltration Rate
1x10-5m/s

Remarks
1. Test Undertaken in general accordance with BRE Digest 365.
2. Trial pit was not filled with aggregate.
3. Stability was variable.
4. Results were extrapolated to ensure water level reached 75% effective depth.

Appendix E

Results of Gas and Groundwater Monitoring

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: Ross Blake

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **3-Oct-07**
Barometric Pressure (mb): **Start:** 1017
Finish: 1016

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS3	25.4	0.1	4.0	0	-0.1	3.26
WS5	0.1	3.9	13.7	2	0.0	1.98
WS6	3.0	0.0	10.6	1	0.1	2.54
WS7	30.5	1.0	11.7	1	0.0	DRY
WS10	0.0	5.6	8.7	2	0.1	DRY
WS11						Covered over

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: Ross Blake

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **17-Oct-07**
Barometric Pressure (mb): **Start:** 1014
Finish: 1013

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS5	0.1	4.6	9.1	0	0.8	1.81
WS6	6.2	0.0	3.0	0	0.8	2.48
WS7	49.7	1.4	8.0	0	0.1	2.42
WS10	0.1	0.1	19.9	0	0.3	3.00
BH1	0.1	0.1	20.0	0	0.1	End cap jammed
WS11	*					Covered over
WS3	*					Covered over

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: Ross Blake

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **24-Oct-07**
Barometric Pressure (mb): **Start:** 1029
Finish: 1029

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS3	67.2	0.0	2.6	3	0.2	DRY
WS5	0.1	5.3	10.1	1	0.2	2.15
WS6	19.2	0.0	1.6	0	0.2	2.80
WS7	81.8	2.8	2.1	0	0.2	DRY
WS10	0.1	5.7	10.2	1	0.3	3.00
WS11	-	-	-	-	-	Covered over
BH1	0.1	0.4	18.5	6.3	0.1	-

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: Ross Blake

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **29-Oct-07**
Barometric Pressure (mb): **Start:** 1013
Finish: 1013

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS3	64.8	0.0	0.8	3	0.2	2.74
WS5	0.1	5.3	9.5	0	0.1	2.11
WS6	14.6	0.0	3.8	0	0.0	2.80
WS7	56.1	2.2	5.6	0	0.3	DRY
WS10	0.1	5.8	8.9	0	0.2	3.00
BH1	0.1	0.1	19.4	1	0.2	-

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: CM

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **16-Jul-08**
Barometric Pressure (mb): **Start:** 1020
Finish: 1016

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS3	48.2	0.0	7.3	0	0.4	3.13
WS5	0.1	3.8	12.0	0	0.8	1.87
WS6	10.5	0.0	11.1	0	0.5	2.52
WS7	44.3	1.3	9.7	0	0.7	2.38
WS10	0.1	0.0	20.8	0	1.0	2.99
BH1	0.2	0.1	21.0	0	0.1	3.14
WS101	0	0.1	18.2	0	0.7	1.82
WS103	0.1	0.3	18.8	0.4	1	2.25
WS104	0.1	0	20.3	0.8	1	DRY
WS105	0.2	0	20.1	0	2.5	1.08
WS11	-	-	-	-	-	-
WS108	73	4.3	0.9	0	0.5	DRY
WS112	19.6	0	15	0	0.4	2.14

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: HC

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **23-Jul-08**
Barometric Pressure (mb): **Start:** 1020
Finish: 1014

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)
WS3	57.3	0.0	6.3	0	0.4	3.20
WS5	0.3	3.4	12.4	0	0.8	1.93
WS6	10.5	0.0	11.1	0	0.5	2.52
WS7	62.7	2.7	3.3	0	0.7	2.41
WS10	0.1	0.0	20.8	0	0.7	2.99
BH1	0.6	0.2	20.4	33	0.1	3.23
WS101	0.3	0.3	15.3	0	0.7	1.85
WS103	0.5	0.4	17.8	0.4	0.8	2.33
WS104	0.3	0	20.1	0.8	0.7	DRY
WS105	0.5	0	18.8	5	0.9	1.19
WS108	43.6	3.2	3.4	9	0.5	DRY
WS112	12.2	0	17.8	0	0.4	2.1

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: MCC

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **28-Jul-08**
Barometric Pressure (mb): **Start:** 1007
Finish: 1008

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)	Sample Taken	Notes
WS3	62.2	0.0	4.4	-	0.8	3.10	N	Depth 4.0m
WS5	0.1	4.0	11.9	-	0.1	1.98	N	Depth 4.0m
WS6	-	-	-	-	-	-	N	Could not locate.
WS7	-	-	-	-	-	-	N	Covered over.
WS10	0.2	3.9	10.3	-	0.3	3.01	N	Depth 3.1m
WS11	-	-	-	-	-	-	N	Could not locate.
BH1	0.1	0.0	20.5	-	0.2	3.14	N	Depth 13.7m
WS101	0.1	0.5	15.2	-	0.3	1.77	N	Depth 1.85m
WS103	0.1	0.8	15.8	-	0.1	2.26	N	Depth 3.15m
WS104	1.5	1.7	16.3	-	0.2	Dry	N	Depth 3.0m
WS105	0.2	0.0	19.8	-	0.1	1.07	N	Depth 2.55m
WS108	72.1	3.2	0.8	-	0.4	3.03	N	Depth 3.13m
WS112	31.1	0.0	13.5	-	0.4	1.93	N	Depth 3.05m

GAS/GROUND WATER MONITORING RESULTS

Project: Dales Manor Business Park
Location: Sawston
Project No. 721750
Operator: MCC

Instruments Used:
Geotechnical Instruments GA2000
Tape Dipmeter
Phocheck 3000 PID

Date: **5-Aug-08**
Barometric Pressure (mb): **Start:** 1012
Finish: 1011

Position Number	Methane (% Vol)	Carbon Dioxide (% Vol)	Oxygen (% Vol)	Organic Vapours (ppm)	Gas Flow (Litres/hr)	Water Level (m bgl)	Sample Taken	Notes
WS3	78.1	0.0	0.4	0.3	0.4	3.21	N	Depth 4.0m
WS5	0.1	5.7	9.4	0.0	0.3	2.19	N	Depth 4.0m
WS6	20.9	0.0	0.5	0.1	0.2	2.51	N	Depth 4.0m
WS7	-	-	-	-	-	-	N	Covered over.
WS10	0.1	5.8	9.1	0.0	0.3	3.02	N	Depth 3.1m
WS11	-	-	-	-	-	-	N	Could not locate.
BH1	0.1	0.0	20.1	0.0	0.2	3.21	N	Depth 13.7m
WS101	0.1	0.5	14.9	0.0	0.2	1.79	N	Depth 1.85m
WS103	0.0	0.9	18.5	2.4	0.5	1.35	N	Depth 3.15m
WS104	0.1	0.1	20.2	1.4	0.7	Dry	N	Depth 3.0m
WS105	0.1	0.0	20.6	0.0	0.3	1.03	N	Depth 2.55m
WS108	-	-	-	-	-	-	N	Cover stuck.
WS112	43.0	0.0	14.9	0.1	0.3	1.90	N	Depth 3.05m

Appendix F

Results of Chemical Analysis

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO Hester Carter

AMENDED LABORATORY TEST REPORT

Results of analysis of 11 samples
received 18 July 2008

Dales Manor Business Park, Sawston 721750

Chemtest

Report Date
04 August 2008

Login Batch No					100436							
Chemtest LIMS ID					AD25574	AD25575	AD25576	AD25577	AD25578	AD25579	AD25580	AD25581
Sample ID					TP1	WS101	WS101	WS104	WS105	WS107	WS107	WS110
Sample No					1	1	4	1	2	1	2	1
Depth					0.3	0.9	3.9	0.7	1.9	0.3	0.9	0.5
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*								
2450	Arsenic	7440382	mg kg⁻¹	M			4.4			9.1	9.8	17
	Cadmium	7440439	mg kg⁻¹	M			<0.1			0.10	0.16	0.30
	Chromium	7440473	mg kg⁻¹	M			5.2			16	18	20
	Copper	7440508	mg kg⁻¹	M			<5			9.6	18	46
	Mercury	7439976	mg kg⁻¹	M			<0.1			<0.1	0.24	10
	Nickel	7440020	mg kg⁻¹	M			6.3			16	18	26
	Lead	7439921	mg kg⁻¹	M			<5			10	32	200
	Selenium	7782492	mg kg⁻¹	M			<0.2			<0.2	<0.2	<0.2
	Zinc	7440666	mg kg⁻¹	M			<10			25	45	82
2670	TPH >C6-C10		mg kg⁻¹	N	5	< 1	< 1	< 1	< 1	1		
	TPH >C10-C21		mg kg⁻¹	N	380	< 1	< 1	750	7	3300		
	TPH >C21-C40		mg kg⁻¹	N	23	< 1	< 1	100	34	330		
	Total Petroleum Hydrocarbons		mg kg⁻¹	M	410	< 10	< 10	850	41	3700		
2700	Naphthalene	91203	mg kg⁻¹	M						0.2		
	Acenaphthylene	208968	mg kg⁻¹	M						23		
	Acenaphthene	83329	mg kg⁻¹	M						36		
	Fluorene	86737	mg kg⁻¹	M						40		
	Phenanthrene	85018	mg kg⁻¹	M						1.4		
	Anthracene	120127	mg kg⁻¹	M						38		
	Fluoranthene	206440	mg kg⁻¹	M						1.4		
	Pyrene	129000	mg kg⁻¹	M						0.5		
	Benzo[a]anthracene	56553	mg kg⁻¹	M						0.2		
	Chrysene	218019	mg kg⁻¹	M						0.2		
	Benzo[b]fluoranthene	205992	mg kg⁻¹	M						0.2		
	Benzo[k]fluoranthene	207089	mg kg⁻¹	M						<0.1		
	Benzo[a]pyrene	50328	mg kg⁻¹	M						<0.1		
	Dibenzo[a,h]anthracene	53703	mg kg⁻¹	M						<0.1		
	Indeno[1,2,3-cd]pyrene	193395	mg kg⁻¹	M						<0.1		
	Benzo[g,h,i]perylene	191242	mg kg⁻¹	M						0.1		
	Total (of 16) PAHs		mg kg⁻¹	M						140		

All tests undertaken between 24-Jul-2008 and 28-Jul-2008

* Accreditation status

This report should be interpreted in conjunction with the notes on the accompanying cover page

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO Hester Carter

AMENDED LABORATORY TEST REPORT

Results of analysis of 11 samples
received 18 July 2008

Dales Manor Business Park, Sawston 721750

Chemtest

Report Date
04 August 2008

Login Batch No					**100436**	
Chemtest LIMS ID					AD25582	AD25583
Sample ID					WS112	WS113
Sample No					1	1
Depth					0.3	0.4
Matrix					*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓			
2450	Arsenic	7440382	mg kg-1	M	11	10
	Cadmium	7440439	mg kg-1	M	0.20	0.14
	Chromium	7440473	mg kg-1	M	19	19
	Copper	7440508	mg kg-1	M	14	13
	Mercury	7439976	mg kg-1	M	0.12	<0.1
	Nickel	7440020	mg kg-1	M	18	19
	Lead	7439921	mg kg-1	M	19	10
	Selenium	7782492	mg kg-1	M	<0.2	<0.2
	Zinc	7440666	mg kg-1	M	39	90
2670	TPH >C6-C10		mg kg-1	N		1900
	TPH >C10-C21		mg kg-1	N		16000
	TPH >C21-C40		mg kg-1	N		1100
	Total Petroleum Hydrocarbons		mg kg-1	M		20000
2700	Naphthalene	91203	mg kg-1	M		0.9
	Acenaphthylene	208968	mg kg-1	M		29
	Acenaphthene	83329	mg kg-1	M		56
	Fluorene	86737	mg kg-1	M		58
	Phenanthrene	85018	mg kg-1	M		4.8
	Anthracene	120127	mg kg-1	M		51
	Fluoranthene	206440	mg kg-1	M		0.6
	Pyrene	129000	mg kg-1	M		<0.1
	Benzo[a]anthracene	56553	mg kg-1	M		<0.1
	Chrysene	218019	mg kg-1	M		0.1
	Benzo[b]fluoranthene	205992	mg kg-1	M		<0.1
	Benzo[k]fluoranthene	207089	mg kg-1	M		<0.1
	Benzo[a]pyrene	50328	mg kg-1	M		<0.1
	Dibenzo[a,h]anthracene	53703	mg kg-1	M		<0.1
	Indeno[1,2,3-cd]pyrene	193395	mg kg-1	M		<0.1
	Benzo[g,h,i]perylene	191242	mg kg-1	M		<0.1
	Total (of 16) PAHs		mg kg-1	M		200

All tests undertaken between 24-Jul-2008 and 28-Jul-2008

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO Hester Carter

AMENDED LABORATORY TEST REPORT

Results of analysis of 11 sample
received 18 July 2008

Dales Manor Business Park, Sawston 721750

Chemtest

Report Date
04 August 2008

Login Batch No					**100436**
Chemtest LIMS ID					AD25584
Sample ID					WS113
Sample No					1
Depth					0.51
Matrix					*WATER*
SOP↓	Determinand↓	CAS No↓	Units↓	*	
1450	Arsenic	7440382	µg l-¹	U	26.6
	Boron	7440428	µg l-¹	U	<20
	Cadmium	7440439	µg l-¹	U	<0.5
	Chromium	7440473	µg l-¹	U	<1
	Copper	7440508	µg l-¹	U	80.8
	Lead	7439921	µg l-¹	U	<1
	Mercury	7439976	µg l-¹	U	<0.5
	Nickel	7440020	µg l-¹	U	69.7
	Selenium	7782492	µg l-¹	U	9.3
	Zinc	7440666	µg l-¹	U	15.2
1673	TPH >C6-C10		µg l-¹	U	2500
	TPH >C10-C21		µg l-¹	U	2600
	TPH >C21-C40		µg l-¹	U	62
	TPH (Aqueous Phase)		µg l-¹	U	5200

All tests undertaken between 24-Jul-2008 and 28-Jul-2008

* Accreditation status

This report should be interpreted in conjunction with the notes on the accompanying cover page

Appendix G

MLM E Generic Assessment Criteria

MLM E GENERIC ASSESSMENT CRITERIA (GAC)

METALS[1]

Contaminant	Residential with Plant Uptake	Residential without Plant Uptake	Industrial and Commercial
Arsenic	20	20	500
Cadmium – pH6 Cadmium – pH7 Cadmium – pH8	1 2 8	30	1,400
Chromium	130	200	5,000
Lead	450	450	750
Mercury	8	15	480
Nickel	50	75	5,000
Selenium	35	260	8,000

[1] The SGV's above for metals are reprinted directly from their respective SGV reports.

MLM E GENERIC ASSESSMENT CRITERIA (GAC)

TPH COMPOUNDS – SANDY SOIL

Contaminant	Residential with Plant Uptake			Residential without Plant Uptake			Industrial and Commercial		
'Total' TPH (C10-C35) [1,2]	500 (inhalation) 1,000 (dermal/oral)								
OMC	1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Basic carbon banding[3]									
C6-C10 (GRO)	3	7	13	3	7	14	135	310	600
C10-C21 (DRO)	10	24	46	67	162	200		72,000	
C21-C35 (ORO)		800			2,100			46,000	
TPHCWG carbon banding[3]									
aliphatic C5-C6	10	17	29	10	17	29	445	760	1,300
aliphatic C6-C7	23	50	94	24	49	94		NL	
aliphatic C7-C8	23	50	94	24	49	94		NL	
aliphatic C8-C10	7	17	33	7	17	33		154,000	
aliphatic C10-C12	42	100	200	42	100	200		180,000	
aliphatic C12-C16		4,800			7,000			154,000	
aliphatic C16-C21		110,000			140,000			NL	
aliphatic C21-C35		110,000			140,000			NL	
aromatic C5-C6	3	7	13	3	7	14	135	310	600
aromatic C6-C7	3	7	13	3	7	14	135	310	600
aromatic C7-C8	3	8	15	4	8	16	160	370	720
aromatic C8-C10	5	13	26	11	28	55	510	1,300	2,400
aromatic C10-C12	10	24	46	67	162	300		72,000	
aromatic C12-C16	12	28	54		2,700			62,000	
aromatic C16-C21		480			2,000			46,000	
aromatic C21-C35		800			2,000			46,000	

[1] Based on TPHCWG whole product method assuming contamination by weathered diesel (not containing BTEX or C5-C10)

[2] Additional carbon banding or request chromatogram recommended to establish likely type of hydrocarbon contamination

[3] Based on aromatic fractions

MLM E GENERIC ASSESSMENT CRITERIA (GAC)

TPH COMPOUNDS – CLAY SOIL

Contaminant	Residential with Plant Uptake			Residential without Plant Uptake			Industrial and Commercial		
'Total' TPH (C10-C35) [1,2]	500 (inhalation) 1,000 (dermal/oral)								
OMC	1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Basic carbon banding[3]									
C6-C10 (GRO)	3	100	190	330	680	1,200		310,000	
C10-C21 (DRO)	12	30	60		3,000			72,000	
C21-C35 (ORO)		800			2,000			47,000	
TPHCWG carbon banding[3]									
aliphatic C5-C6	10	360k	380k		340,000			NL	
aliphatic C6-C7	23	360k	460k		340,000			NL	
aliphatic C7-C8	23	360K	460k		340,000			NL	
aliphatic C8-C10	7	2,000	2,000		7,000			156,000	
aliphatic C10-C12	42	3,400	3,400		7,500			181,000	
aliphatic C12-C16		5,000			6,800			156,000	
aliphatic C16-C21		110,000			135,000			NL	
aliphatic C21-C35		110,000			135,000			NL	
aromatic C5-C6	3	100	190	330	680	1,200		310,000	
aromatic C6-C7	3	100	190	330	680	1,200		310,000	
aromatic C7-C8	3	72	140	410	850	1,500		310,000	
aromatic C8-C10	5	26	50		2,800			62,000	
aromatic C10-C12	10	30	60		3,000			72,000	
aromatic C12-C16	12	30	60		2,800			62,000	
aromatic C16-C21		460			2,100			47,000	
aromatic C21-C35		800			2,100			47,000	

[1] Based on TPHCWG whole product method assuming contamination by weathered diesel (not containing BTEX or C5-C10)

[2] Additional carbon banding or request chromatogram recommended to establish likely type of hydrocarbon contamination

[3] Based on aromatic fractions

MLM E GENERIC ASSESSMENT CRITERIA (GAC)

OTHER COMPOUNDS – SANDY SOIL

Contaminant	Residential with Plant Uptake			Residential without Plant Uptake			Industrial and Commercial		
OMC	1%	2.5%	5%	1%	2.5%	5%	1%	2.5%	5%
Benzene	3	7	13	3	7	14	135	310	600
Toluene	3	7	14	3	8	15	150	350	680
Ethylbenzene	9	21	41	16	41	80		48,000	
Xylene (mix)	3	8	15	4	9	17	152	360	725
Phenol	78	150	280	>SAT	34,400	37,300		>SAT	
Benzo[a]pyrene		1.3			1.3			31	

[1] The GAC above for toluene, ethylbenzene and phenol are reprinted directly from their respective SGV reports.

OTHER COMPOUNDS – CLAY SOIL (where different to sandy soil)

Contaminant	Residential with Plant Uptake			Residential without Plant Uptake			Industrial and Commercial
OMC	1%	2.5%	5%	1%	2.5%	5%	n/a
Benzene	3	100	190	330	680	1,200	312,000
Toluene	3	72	140	410	850	1,500	312,000
Ethylbenzene	20	44	86		6,800		156,000
Xylene (mix)	3	80	160	480	1,100	2,200	324,000