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ENDURANCE ESTATES LTD

DALES MANOR BUSINESS PARK, SAWSTON, CAMBRIDGESHIRE

PHASE II GEOENVIRONMENTAL ASSESSMENT REPORT

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Dales Manor Business Park, Sawston
Phase II Geoenvironmental Assessment Report

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EXECUTIVE SUMMARY

General

This report has been prepared for Endurance Estates, 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/strip footings will be appropriate for the majority of the site area, with allowable bearing pressures in the range 100 – 150kN/m2. 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.

Findings – Contamination

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.

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 report has been prepared by MLM Environmental (MLME) for Endurance Estates 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.

The extent of investigations and analyses undertaken as part of this study are considered sufficient to identify sources of contamination, pathways and targets, with comparison of sample analysis against guideline values and is also considered sufficient to allow assessment of ground conditions with respect to future 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 work were set out in a letter by MLME, ref. DMB/721750/001/DMB dated 16 July 2007.

In addition to a Phase I desk study and full topographical and services survey, the proposals for site investigation included for the following scope of work:

- Utilities clearance at exploratory positions
- Cable tool boreholes
- Windowless sample boreholes
- Gas and vapour monitoring during the fieldwork
- 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.

A Phase I Desk Study, reference 721576/R1/F, was undertaken as part of a separate commission for the site owners by MLME and the findings formed the basis for the site investigation.

A Remediation Strategy is included within MLME appointment and will be reported under separate cover.

1.3. Report Structure

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

- Site description
- Summary of previous desk study 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

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 up until recently used 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.

2.2 Desk Study Findings

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 study indicated that the works were operated by MBM who manufacture mainly roof tiles. Processes comprised the mixing of sand and cement with various additives and baking in kilns.

Prior to the current factory, manufacturing of roof tiles, which commenced 1960 – 1971, the site was undeveloped.

The published geology for the site is of Alluvium over Lower Chalk. The chalk is a major aquifer and the boundary of a source protection runs alongside the eastern boundary.

A drainage ditch fed by a spring runs alongside the western boundary, beyond which is a former landfill, restored in 1977.

Arable land is to the north, a Tarmac Readymix plant is to the east and housing is to the south.

The site walkover identified sources of potential contamination including the on site storage of diesel, kerosene, oil, waste oil and acid. There is visible evidence of minor spills in the form of localised superficial staining. Unknown flammable substances, possibly including solvents, were historically stored on the western boundary adjoining the ditch.

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. GEOENVIRONMENTAL INVESTIGATION

3.1. General

Fieldwork was carried out at the site during September 2007 comprising the construction of windowless sample and cable tool boreholes, 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 existing buildings, observed features, underground services and desk study findings. 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. 2).

3.2. Cable Tool Boreholes

A total of 3 No. Cable Tool Boreholes (ref BH1, BH2A and BH3) were constructed using percussive drilling techniques to maximum depths of 15.0m below ground level (bgl), primarily for geotechnical purposes.

Small and bulk disturbed samples were recovered in tubs or bags as appropriate at each change of strata and U100 samples for geotechnical purposes.

Standard Penetration Tests (SPT's) were undertaken in the strata to determine shear strength and density.

Engineer's cable tool borehole logs are presented in Appendix A.

3.3. Windowless Sample Boreholes

A total of 11 No. windowless sample boreholes (ref. WS1 – WS11) were constructed across the site using an Archway Dart Windowless Sampling Rig to a depth of 4.0m 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.

3.4. Monitoring Wells

Combined groundwater and gas/vapour monitoring wells were installed in WS3, WS5-7, WS10, WS11 and BH1 to depths of between 3.0m and 15m 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.

3.5. Gas and Groundwater Monitoring

Ground gases were monitored on 4 No. monitoring visits following the completion of fieldwork between 3 October and 29 October 2007.

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 C.

3.6. 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.

3.7. 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.

Table 3.1 Summary Schedule of Chemical Testing

Contaminant	Made Ground	Undisturbed Soils	Groundwater
Toxic metals (arsenic, cadmium, chromium, lead, mercury, nickel, selenium)	6	6	1
Phytotoxic metals (copper, nickel, zinc)	6	6	1
Total Petroleum Hydrocarbons (TPH) (C10 – C40)	3	4	1
TPH - speciated (C6 - 10, C10 - 21, C21 - 35 or 40)	3	4	1
Speciated PAH	5	0	0
Total Organic Carbon (TOC)	5	0	0
pH and water soluble sulphate	1	0	1

Chemical analysis was undertaken by Chemtest at their UKAS accredited laboratory in Newmarket, Suffolk.

The results are presented in Appendix D.

Geotechnical Analysis

The following laboratory tests were scheduled on soil samples recovered from the boreholes:

Table 3.2 Summary schedule of geotechnical testing

Test (BS1377: 1990 part/clause) (ref 3)	No.
Moisture Content 2/3.2	6
Atterberg Limits 2/4.4, 5.3, 5.4	6
pH and Sulphate 3/5.5, 3/9.5	4

Laboratory testing was undertaken by Soil Property Testing Ltd at their UKAS accredited laboratory in Huntingdon, Cambridgeshire.

The results of geotechnical laboratory analysis are presented in Appendix E.

4. GROUND AND GROUNDWATER CONDITIONS

4.1. General

The ground conditions encountered across the site comprised of the following general strata sequence.

Table 4.1 Generalised strata sequence

Strata	Depth Range (m bgl) to Top of Unit	Thickness Range (m)
Made Ground (incl. surfacing)	GL	0.2 – 2.6
Alluvium (locally)	1.2	2.3
Glacial Till	0.2 – 2.8	0.2 – 2.35
Zig Zag Chalk Formation	1.1 – 3.7	>0.1 - >13.9

> Base of stratum not proven

4.2. Made Ground (including Surfacing)

The site was mantled by a hard surfacing, predominantly of concrete up to 0.35m thick. Locally brick paving and asphalt surfacing was also encountered.

Made Ground was encountered to depths of 2.6m bgl, with the deepest extent of Made Ground present near to the western corner of the site.

The Made Ground generally comprised 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 variably comprised flint, brick, concrete, chalk, ash and tile fragments.

4.3. Alluvium

Along the western side of the site, a soft Clay and locally organic clay was encountered between 1.2 – 3.5m in WS5.

It is anticipated that these soft clay deposits represent the Alluvium identified on the published geology map.

4.4. Glacial Till

Other than in the locations of BH1 and BH2, in the south-western area directly underlying the Made Ground was a generally firm to stiff but locally soft Clay, with a variable gravel content of flint and chalk.

During the construction of WS7 from 2.0m and 2.9m bgl a loose brown gravelly SAND was present.

It is anticipated that the majority of the superficial deposits encountered represent 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.

4.5. Zig Zag Chalk Formation

Underlying the Made Ground and superficial deposits from depths of 1.1m to 3.7m bgl, was a structureless Chalk, recovered as a white and brown slightly clayey Chalk GRAVEL.

Based on the nomenclature, presented in CIRIA guidance document 'Engineering in Chalk' (ref. 4) the chalk falls within a weathering Grade Dc, and is considered to represent the Zig Zag Formation of the Grey Chalk sub-group.

4.6. Groundwater

During the construction of the windowless sample boreholes (ref. WS1 to WS11) groundwater was not observed.

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 1.81m to 3.26m bgl.

4.7. Contamination Observations

Made Ground, which is often an indicator for the potential presence of contamination, was encountered across the majority of the site area to depths of up to 2.6m bgl, with the deepest deposits recorded in BH2A near to the western corner of the site.

In general, there was no obvious olfactory or visual evidence for widespread contamination at the site except locally during the construction of WS6, WS7 and WS11, inorganic odour and staining were encountered at the following depth ranges:

Table 4.2 Contamination Observations

Borehole	Location	Depth Range of Staining/Odour (m bgl)	Soil Description
WS6	Near to western end of main building and acid store	0.8 – 2.1	Firm bluish grey gravelly CLAY. Gravel is fine to medium flint and chalk.
WS7	Mid point along northern wall of main building and mould oil tank and waste pigment sump	0.2 – 1.3 1.3 – 2.0	MADE GROUND. Soft light grey and white chalky gravelly clay. Gravel is fine to medium brick and concrete. Stiff dark grey gravelly CLAY. Gravel is fine to medium flint.
WS11	Northern corner of site, outdoor waste store and underground waste pigment change	1.0 – 2.7 2.7 - 3.8	Firm light brown slightly gravelly CLAY. Gravel is fine to medium flint. Soft to firm light brown grey and white very chalky gravelly CLAY. Gravel is fine to medium flint and chalk.

4.8. 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 4.3 Summary of gas monitoring after fieldwork

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

5. GEOTECHNICAL ASSESSMENT

5.1 General

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.

5.2 Material Properties and Geotechnical Parameters

Made Ground

SPT 'N' values in the more cohesive Made Ground recorded at depths between 1m and 2m bgl, ranged between 10 and 29, which approximately equates to undrained shear strengths of 45kN/m^2 to 131kN/m^2, and firm to stiff consistency.

A plot of SPT 'N' values with depth is presented as Figure 3 for all strata.

A single atterberg limits test on the more cohesive element of the Made Ground recorded the following parameters:

Table 5.1 Classification Tests - Made Ground

Depth (m)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Swelling and Shrinkage Potential
1.3	21	39	22	17	CI	Low

The plasticity index recorded as part of the Atterberg limits test is not however a true representation of the volume change of the Made Ground. The actual plasticity index, and therefore the potential volume change of the Made Ground will be lower than the recorded value due to the presence of sand and gravel particles. To take some account of this factor, the modified plasticity index is calculated based on the percentage of sample passing the 0.425mm sieve (BRE Digest 240, ref. 5):

$$\text{Modified Plasticity} = Ip \times \frac{\% < 0.425mm}{100\%}$$

Table 5.2 Modified Plasticity Index - Made Ground

Depth (m)	Retained 0.425um (%)	Modified Plasticity Index (%)	Modified Moisture Content (%)	Swelling and Shrinkage Potential
1.3	23	13	27	low

Sulphate (SO_4) analysis on the Made Ground recorded a level of 0.06g l^{-1} and pH value of 7.7.

Alluvial Deposits

A single atterberg limits test revealed the alluvial clays to have the following parameters:

Table 5.3 Classification Tests – Alluvial Clays

Depth (m)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Swelling and Shrinkage Potential
1.3	17	24	14	10	CL	Low

Table 5.4 Modified Plasticity Index – Alluvial clays

Depth (m)	Retained 0.425um (%)	Modified Plasticity Index (%)	Modified Moisture Content (%)	Swelling and Shrinkage Potential
1.3	31	7	25	Low

Glacial Till

SPT 'N' values in the Glacial Till recorded at depths between 1m and 3m bgl, ranged between 6 and 63, which approximately equates to undrained shear strengths of 27kN/m^2 to 284kN/m^2, and soft to stiff consistency.

Atterberg Limits testing revealed the Glacial Till to have the following parameters:

Table 5.5 Classification Tests – Glacial Till

Depth (m)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Swelling and Shrinkage Potential
1.3	14 - 21	24 - 42	14 - 20	10 - 22	CI - CL	Low - Medium

Table 5.6 Modified Plasticity Index – Glacial Till

Depth (m)	Retained 0.425um (%)	Modified Plasticity Index (%)	Modified Moisture Content (%)	Swelling and Shrinkage Potential
1.3	23	7 - 20	15 - 25	Low - Medium

A further two samples of the Glacial Till described as 'chalky' Clay/Chalk, and very clayey 'chalky' gravelly Sand which were also subjected to moisture content and atterberg limits testing;.

The analysis recorded the following results indicates the soils to be a SILT, and shows the variability of the Glacial Till at the site:

Table 5.7 Classification Tests – Chalky Clay

Depth (m)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Swelling and Shrinkage Potential
1.1	15	23	17	6.0	ML	Low
1.1	12	18	13	5.0	ML	Low

Table 5.8 Modified Plasticity Index – Chalky Clay

Depth (m)	Retained 0.425um (%)	Modified Plasticity Index (%)	Modified Moisture Content (%)	Swelling and Shrinkage Potential
1.1	38	4.0	-	Low
1.1	20	4.0	15	Low

Sulphate (SO_4) analysis on the Glacial Till recorded levels of <0.01 to 0.02g l^{-1} and pH values of 7.9 to 8.3.

Chalk

SPT 'N' values uncorrected for overburden pressure recorded in the Chalk ranged from 6 to 39 which, based on published guidance, indicates the chalk to be of a weathering grade Dm/Dc to A.

5.3. 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 1.81m 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.

5.4. 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.

Across the majority of the site, natural soils will be generally suitable for the adoption of traditional shallow strip or pad foundations. Due to the variations in depth to the top of the chalk bedrock, the founding stratum will vary from a grade Dc Chalk to Glacial Till. Locally alternatives to the strip or pad solution will require consideration. An assessment of the foundations for the site in terms of the site areas has been presented below.

In situ testing of the Glacial Till has shown significant variations in the undrained shear strengths both lateral and vertically across the site area; therefore a conservative SPT 'N' value of 15 is adopted for the Clay soils.

Similarly SPT 'N' values recorded within the Chalk vary across the site, and for foundation design a SPT 'N' value of 15 is also considered appropriate for calculating the allowable bearing pressures within the Chalk.

Based on the current investigations, it will be possible to adopt traditional pad or strip foundations in glacial till or chalk for the majority of the site area, with allowable bearing pressures calculated at between 100 – 150kN/m^2 in order to maintain settlement below 25mm.

Demolition of buildings and removal of existing foundations etc will disturb the near-surface soils and further confirmation via trial pitting or windowless sampling of the soil conditions in the area of existing buildings is recommended. A deep soakaway and various pits and sumps are present on the site which may require specific foundations locally in the area.

Along the western side of the site, ground conditions are variable with deep areas of Made Ground (BH2) and areas of either soft glacial till or soft alluvial deposits. In these areas vibrotreatment of soils above the chalk or piling may be required. Within this area deep pads/trench fill and low allowable bearing pressure may also be appropriate.

Further delineation of the variable soils and areas of deep Made Ground are recommended. All the above areas are presented on Figure 4 and 5.

5.5. 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 are 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)
- Vibrotreatment. Made Ground and glacial deposits
- Cement/lime stabilisation

5.6. 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.

5.7. 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.

5.8. 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. It is unlikely however that foundation depths will be required to extend to depths beyond which traditional trench fill or pad foundations would normally be adopted.

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

5.9. Soakaway Potential

In areas where the Glacial Till has been encountered, soakaway drainage, in our opinion, will not be viable due to the low permeability of this stratum, and any future soakaways should avoid being located in areas of Clay.

Soakaway drainage could potentially be viable at the site where Chalk has been encountered at shallow depths, 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 well away from foundations for structures or roads, as indicated below:

- In areas where dissolution features are known to be prevalent, soakaways should be avoided if at all possible but, if unavoidable, should be sited at least 20m away from any foundations
- Where the chalk is of low density, or its density is not known, soakaways should be sited at least 10m away from any foundations
- Where the chalk is of medium density (or higher), the closest part of the soakaway should be at least 5m away from any foundations.

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.

Soakaway tests will be required to confirm suitability of underlying soils for soakaway drainage.

5.10 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.

6. DISCUSSION OF SOIL TEST RESULTS

6.1 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. 7) 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. 8) 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 F.

Water Supply

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

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 PAS 100 (ref. 10) 100:2002. This sets out the minimum quality standards for composted materials, which may be used as a planting media.

The primary purpose of the guideline values are as "intervention" or "screening" values for assessment of human health risks in relation to land use. These, and any other guideline values, are indicators of potential health hazards on a site and do not necessarily indicate that risks exist or that remediation is required.

6.2 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.

6.3 Soil Dependent Factors

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

Table 6.1 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 6.2 Comparison of soil test results to MLME Generic Assessment Criteria (GAC)

Compound	MLME GAC	Number of Tests	Min.	Max.	Number Exceeding GAC
Arsenic	500	12	8.4	22	0
Cadmium	1,400	12	<0.1	0.48	0
Chromium	5,000	12	2.1	37	0
Lead	750	12	<5	100	0
Mercury	480	12	<0.1	1.1	0
Selenium	8,000	12	<0.1	0.18	0
Nickel	5,000	12	5.7	32	0
Benzo[a]pyrene	31	5	<0.1	0.8	0
TPH, C6-C10 (GRO)	310	7	<1	<1	0
TPH, C10-C21 (DRO)	72,000	7	<1	910	0
TPH, C21-C40 (ORO)	46,000	7	<1	150	0

All units mg kg^{-1}

Based on the results of testing summarised above, MLME GAC for commercial/industrial use were not exceeded across the site.

6.4. Water Supply

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

6.5. Phytotoxicity

A summary of the results of analysis when compared to the PAS100 guidelines for planted areas is tabulated below.

Table 6.3 Comparison of soil test results to PAS100 criteria

Compound	PAS100	Number of Tests	Min.	Max.	Number Exceeding PAS100
Copper	200	12	<5	77	0
Nickel	50	12	5.7	32	0
Zinc	400	12	11	580	**1**

All units mg kg^{-1}

The PAS100 guideline criteria was exceeded in one sample with an elevated level of zinc, recovered from WS5 at 0.7mbgl, in the westernmost corner of the site.

6.6. Nature and Distribution of Soil Contamination

Although levels of potential contaminants do not exceed human health criteria for future commercial development, elevated concentrations of TPH (not above guidelines however) were present in Made Ground at 0.7m bgl in WS6 on the northwest boundary. However, these hydrocarbons were not associated with any present or known historical potential source of contamination.

The elevated level of zinc in Made Ground in WS5 in the westernmost corner of the site is similarly unrelated to any present or known historical potential source of contamination and is considered to be a general feature of Made Ground soils in this one locality.

There is no evidence from the results of analysis of any sources of contamination identified in the findings of the desk study on the site that have impacted soils.

6.7. 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.

Impact on planting from the identified hotspot of potentially phytotoxic zinc is not considered to be likely since it occurs beneath the planned position of a future building.

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. However, 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.

7. DISCUSSION OF GROUNDWATER TEST RESULTS

7.1 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. 11).

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.

7.2 Groundwater Test Results

During this investigation, a total of 3 No. groundwater samples were obtained from monitoring wells and were tested for metals, and TPH.

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

Table 6.2 Comparison of groundwater test results to DWS

Compound	DWS	Number of Tests	Min.	Max.	Number Exceeding DWS
Arsenic	10	3	2	13	**1**
Boron	1000	3	69	190	0
Cadmium	5	3	<0.5	<0.5	0
Chromium	50	3	4.3	9.6	0
Copper	2000	3	3.2	100	0
Lead	25	3	<1	5.4	0
Mercury	1	3	2.1	4.4	**3**
Selenium	10	3	1.6	14	**1**
Nickel	20	3	3.6	7.7	0
Zinc	5000	3	22	30	0
TPH, C6-C10 (GRO)	10	2	<0.1	<0.1	0
TPH, C10-C21 (DRO)	10	2	<0.1	<0.1	0
TPH, C21-C40 (ORO)	10	2	<0.1	<0.1	0

All units µg l^{-1}

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

7.3 Nature and Distribution of Contamination

The identified elevated concentrations of arsenic, mercury and selenium are all from one water sample taken from WS3 during site monitoring. This water originates in the Glacial Till.

An on site source of this contamination 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.

Despite the on site presence of fuel storage tanks and hydrocarbons in soils at WS6, there is no evidence of hydrocarbon contamination in groundwater beneath the site with all measured concentrations below limits of detection.

7.4 Quantitative Risk Assessment (QRA) for Controlled Waters

The identified elevated concentrations of arsenic, mercury and selenium have been taken forward into a Groundwater Level 3 QRA using the Environment Agency R&D Publication 20 (P20) (ref. 12).

The input parameters were as follows:

Table 7.1 P20 Input Parameters

Parameter	Value	Unit	Source
Initial contaminant concentration	13 (As) 14 (Se) 4.4 (Hg)	µm l^{-1}	Groundwater test results (WS3B)
Target Concentration	10 (As) 10 (Se) 1 (Hg)	µm l^{-1}	UK DWS
Soil-water partition coefficient	117 (As) 9.5 (Se) 3845 (Hg)	l kg^{-1}	Consim
Width of plume	10	m	Localised to WS3
Plume thickness	1	m	Assumed
Saturated aquifer	10	m	Assumed
Bulk density	2.03	g cm^3	Consim - glacial till
Effective porosity	0.47	-	Consim - glacial till
Hydraulic gradient	0.00079	-	Monitoring data (flow from east to west)
Permeability	1.50E-07	m day^{-1}	Consim - glacial till
Compliance point	400	m	Cambridge Water Co. borehole (south of site)

Based on P20 calculations, the on site Remedial Targets were as follows.

Table 7.2 Remedial Targets

Contaminant	Remedial Target	Maximum Concentration	Number Exceeding Remedial Target
Arsenic	3180	13	0
Selenium	3180	14	0
Mercury	318	4.4	0

All units µg l^{-1}

7.5 Impact of Contamination on Aquifer

The potential contaminants arsenic, selenium and mercury are locally present in groundwater beneath the site.

A P20 Level 3 groundwater QRA has been performed using the nearest receptor (after groundwater itself) which is a Cambridge Water Company public water abstraction well 400m to the south.

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.

8. DISCUSSION OF GAS MONITORING RESULTS

8.1. Gas Assessment Criteria

The proposed development is understood to be industrial/commercial and the Characteristic Situations, described in CIRIA Publications C659 (ref. 12), 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

8.2. Gas Monitoring Results

The gas monitoring data indicates site maximum gas concentrations and flow rate and resulting GSV's and a CIRIA Characteristic Situation as follows.

Table 8.1 Gas Screening Values and CIRIA Characteristic Situation

Parameter	Site Maximum	GSV	Preliminary CIRIA Characteristic Situation
Methane	81.8%	0.6544	**CS3**
Carbon dioxide	13.7%	0.1096	
Flow rate	0.8 l hr^{-1}	-	

8.3. Nature and Distribution of Gas Contamination

Gas contamination from methane and carbon dioxide was identified beneath the site. The source of these gases is considered to be the historical landfill off site to the west. However, although not identified there may be a source of gas beneath the area of the existing factory building as gas levels in two wells in this area were particularly high.

Borehole construction includes a response in the glacial till/top of chalk. This is evidence that gas is migrating through natural soils beneath the site, possibly including the fissured chalk at depth.

The ditch bordering the site to the west does not appear to interrupt the flow of gas, which further supports the view that gas migration is occurring at depth.

8.4. Impact of Gas Contamination

Based on the results of monitoring to date, it has not been possible to exclude any parts of the site as being unaffected by gas.

Based on gas monitoring data the CIRIA designation for the site is a Characteristic Situation 3.

Extended gas monitoring is required to confirm the gas regime at the site and for detailed design of gas protection measures.

9 RISK ASSESSMENT

9.1. 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 zinc and TPH • Groundwater locally containing arsenic, mercury and selenium • 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

9.2. 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.

9.3. Health and Safety Risks

The human health qualitative risk assessment (section 6) has identified no risks to future occupants of the site from soils or groundwater contamination.

However, a gas monitoring and risk assessment process has identified elevated levels of methane and carbon dioxide across the site, possibly originating from the landfill to the west, although an on-site source beneath the existing building cannot be ruled out.

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

9.4. 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.

9.5. 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 residential, provided the remedial measures set out in this report are included within the Remediation Strategy Document and are adhered to.

9.6. 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.

9.7. 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.

10. REMEDIATION & RESIDUAL RISK MANAGEMENT

10.1 Soil Contamination

The site investigation has recorded deposits of Made Ground at the site. The chemical analysis 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.

- There are no specific requirements to excavate and dispose off site of any soils as part of remediation.

- There are areas of the site where no investigation was possible. Either due to the presence of buildings and structure or due to site activities and stockpiles at the time.

- 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.

10.2 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.

- Groundwater remediation is not, therefore, considered to be required.

10.3 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 historic landfill to the west of the site.

It is also possible that there are local on-site sources of gas beneath the area of the existing building. Irrespective of the source, gas levels are such that gas mitigation measures are required in order to permit safe development

The following are recommended:

- Ongoing gas monitoring of existing wells together with installation of additional wells in order to confirm the source of gas external to and/or within the site.

- Adoption of gas protection measures for all new buildings on site to prevent the ingress of methane and carbon dioxide gases.

- Gas protection measures should be appropriate for a CIRIA Characteristic Situation 3 site and based on CIRIA Publication C659 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.

- 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.

- The most likely source of gas is the restored landfill to the west of the site. In order to prevent/limit gas migration into the Dales Manor site, installation of a gas cut-off trench is recommended. The trench will allow gas to migrate to surface before entering the site area.

- Further investigation of the source of gas and migration pathways is however recommended to fully determine the details of any gas cut-off trench.

10.4 Underground Structures

Underground pits and sumps are present on site, which contained liquid waste pigments and concrete tailings. These are presented in Figure 2.

- 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.

10.5 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.

10.6 Remediation Strategy, Validation, Foundation Works, Risk Assessment

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.

A summary of proposed foundation, remediation and gas mitigation measures are depicted in Figure 5.

10.7 Further Investigation and Monitoring

As discussed in previous sections, the source of gas and the migration pathway and long term gas regime are required to be fully established through further ongoing monitoring of existing wells and further well installations.

Investigations following demolition and breaking out of slabs/footings etc is recommended to confirm the present assessment of no soil contamination risks.

11. SUMMARY AND CONCLUSIONS

- A Phase II 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 cable tool boreholes has proved Made Ground, overlying localised Alluvium, Glacial Till, in turn overlying Chalk.

- Groundwater was encountered at depths of 4.3m to 12m rising to 4.1m to 10m. During subsequent monitoring of wells installed across the site, groundwater was present at depths of 1.81m 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 100 - 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.

- 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 Chalk bedrock. The low permeable Clays would not be suitable for soakaways. Soak away tests on site will be required to confirm this.

- 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.

- Soil contamination was not identified with respect to the site end use for the purposes of light industrial or commercial development site. Remediation of the site as part of development is not 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 driving water standards was locally present in the centre of the site in Glacial Till deposits in the form of arsenic, mercury and selenium. An on-site source of these metals in soil could not be proved.

- The nearest public water supply borehole is 400m to the south, while groundwater flow is towards the west. QRA indicates this borehole is not at risk from contamination migration.

- 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. Gas migration appears to occur through natural strata at depth and a cut-off wall or vent trench along the site boundary would reduce concentrations beneath buildings. Further gas monitoring is required for the design of an appropriate gas protection scheme.

- There are no significant constraints to development from contamination at the site.

- 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.

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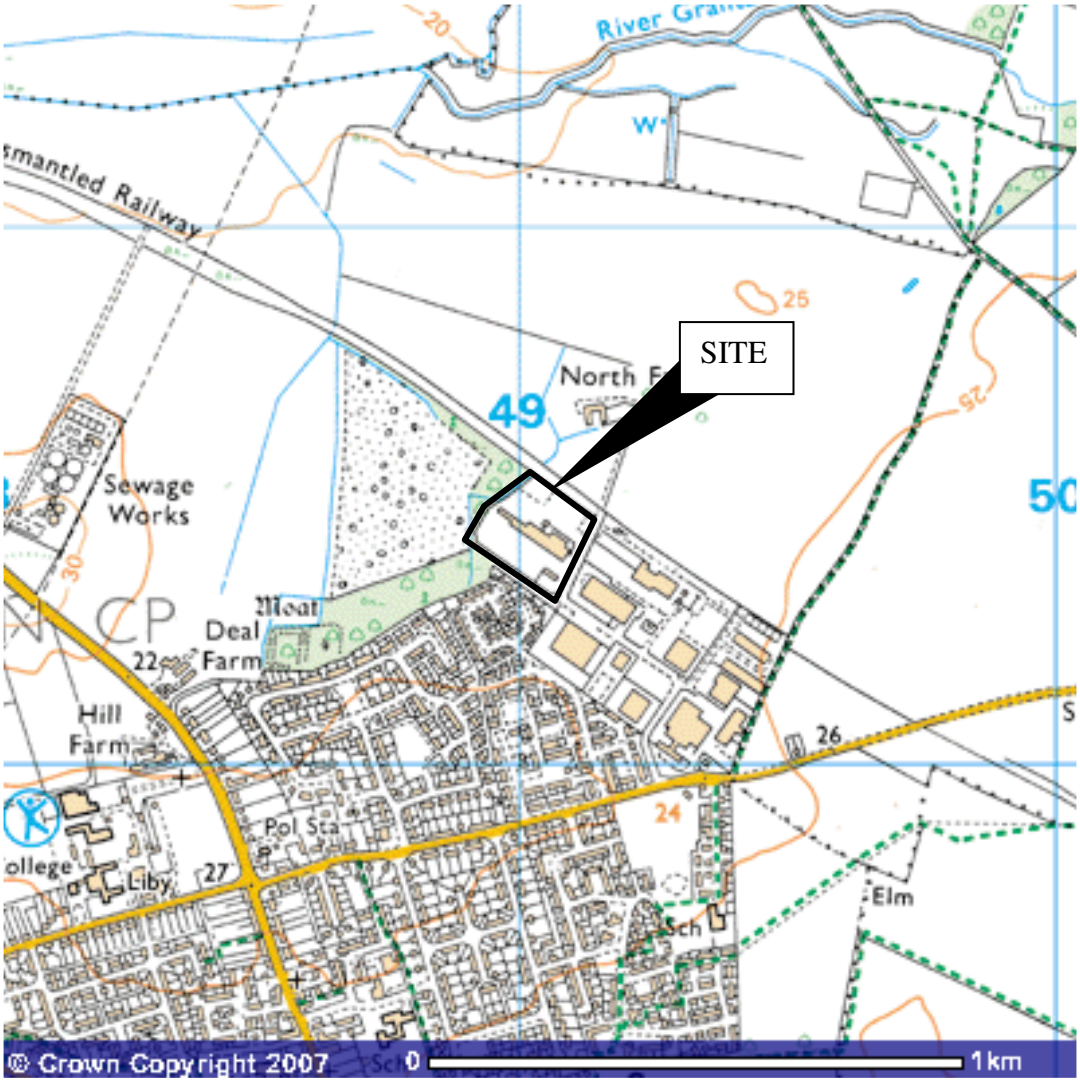
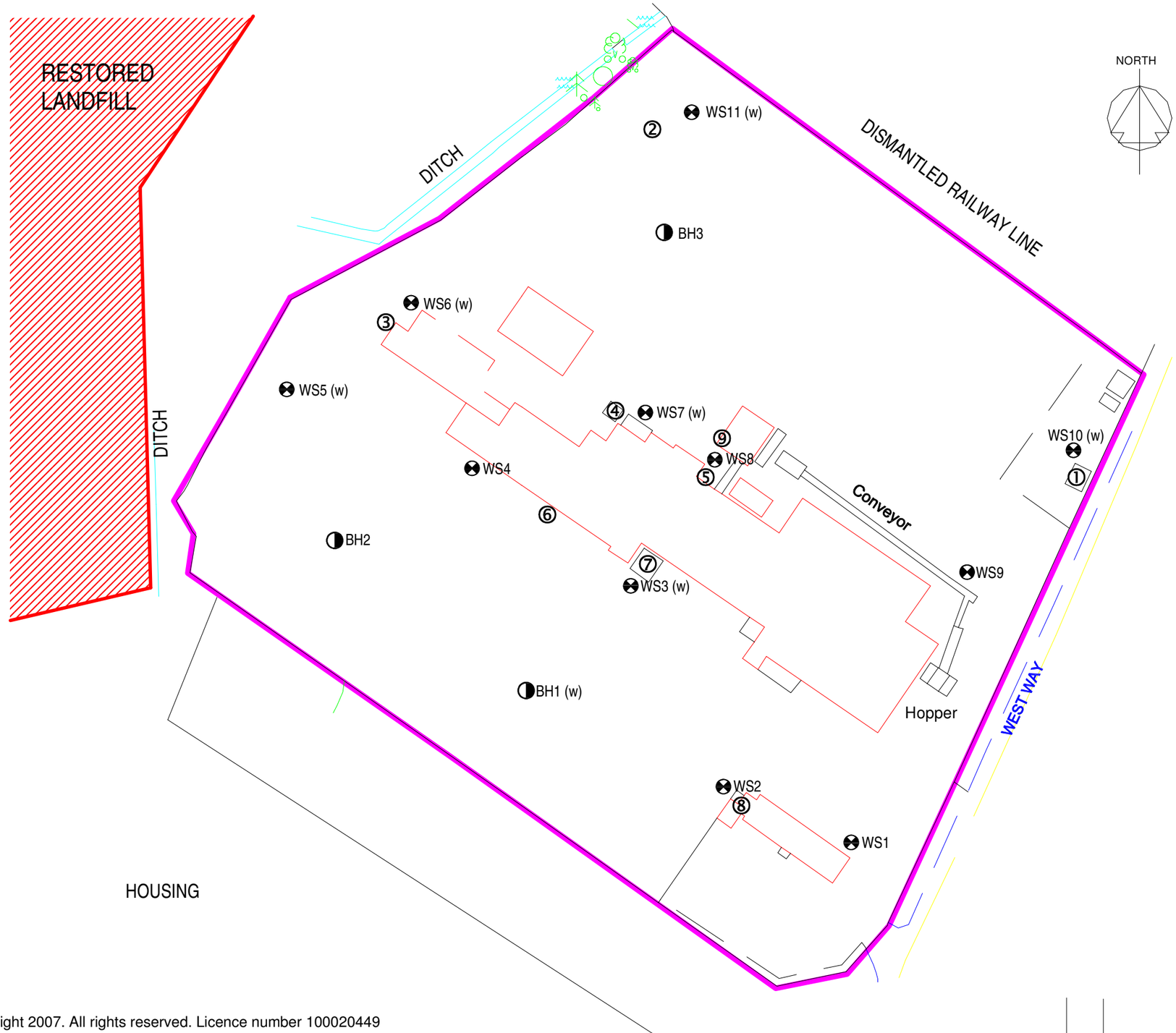
FIGURES

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





KEY

WS1	WINDOWLESS SAMPLE BOREHOLE
BH1	CABLE TOOL BOREHOLE
(w)	MONITORING WELL IN BOREHOLE

1. DIESEL AST (23,118 LITRE)
2. CONCRETE TAILINGS SUMP
3. HYDROCHLORIC ACID STORE
4. MOULD OIL AST (30,000 LITRE)
5. LIQUID WASTE SUMP
6. WASTE PIGMENT SUMP
7. KEROSENE AST (46,637 LITRE)
8. KEROSENE AST (3,600 LITRE)
9. KEROSENE AST (3,600 LITRE)

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MLM ENVIRONMENTAL

Client: ENDURANCE ESTATES

Project: DALES MANOR BUSINESS, GROVE ROAD, SAWSTON

Drawing Title: EXPLORATORY HOLE LOCATION PLAN

Rev	Date	Description	Made	Ch'd

Status of Drawing:

Drawn	Ch'd	Approved	Scales	Drawing No.
MCH				FIGURE 2

Date: 14.11.07

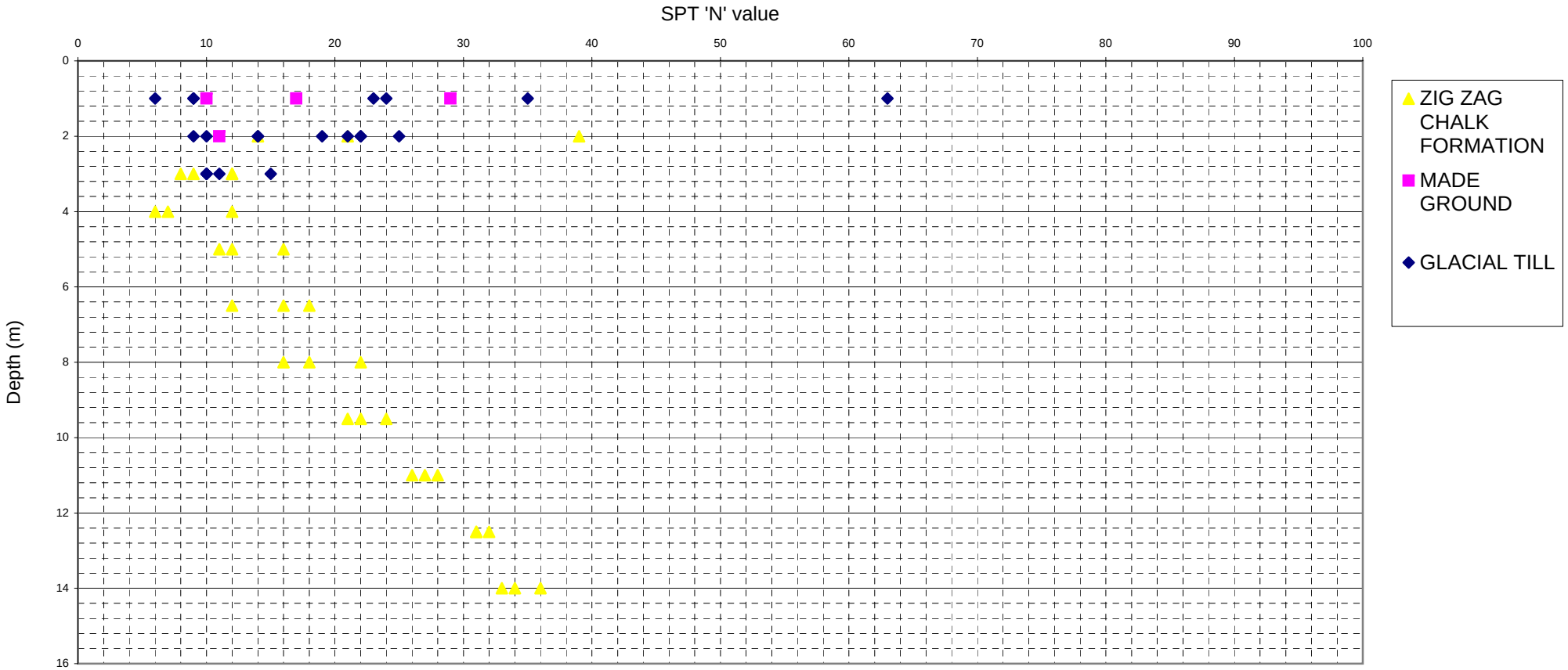
SPT 'N' VALUE vs DEPTH PLOT

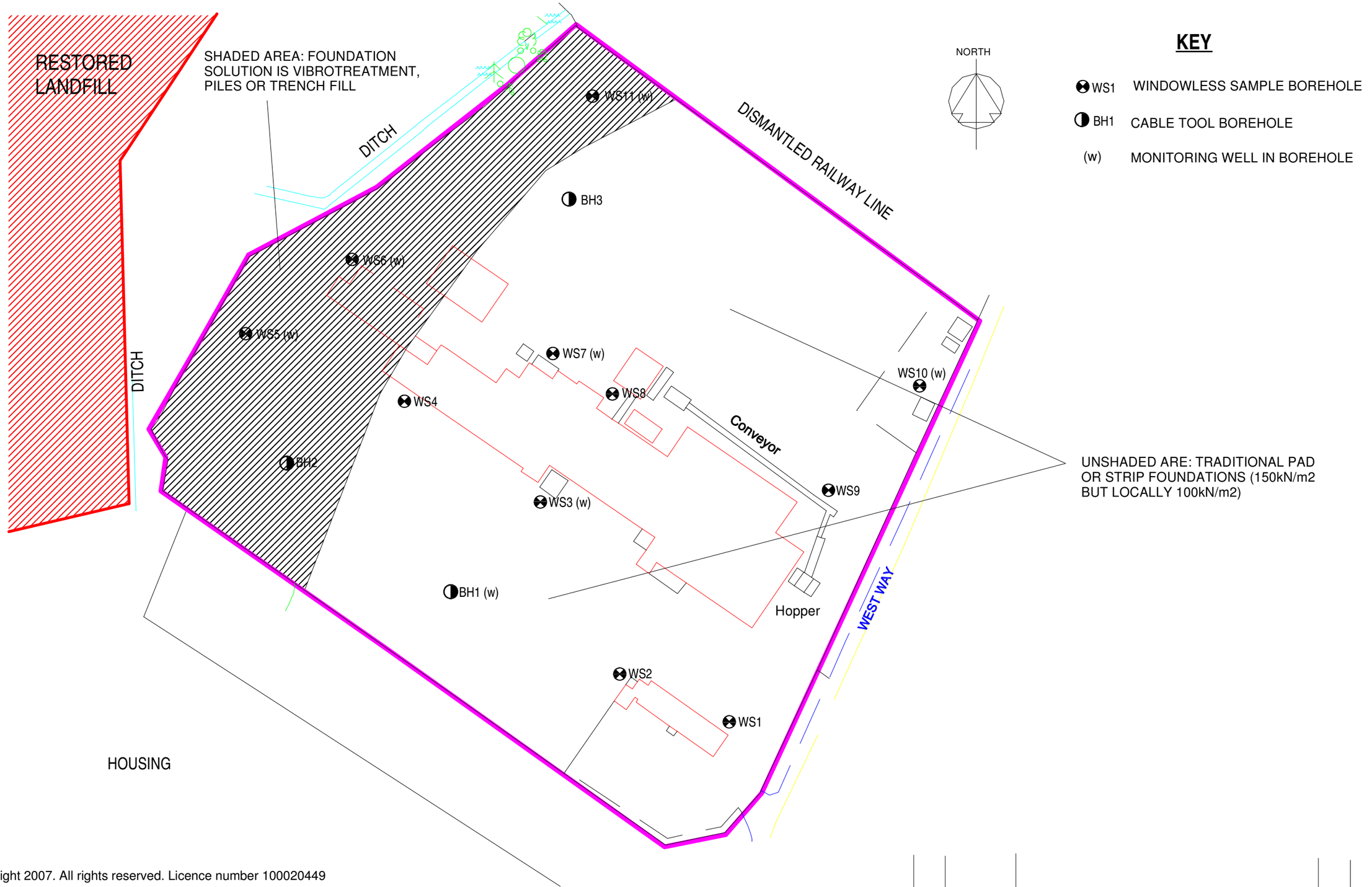
Figure: 3

Site: Dales Manor Business Park

Location: Sawston, Cambridgeshire

Job No. 721750





Environmental, Geotechnical & Waste Management Consultants

Ipswich	Tel:	01473 231100
Cambridge	Tel:	01223 235525
Chelmsford	Tel:	01245 359911
London	Tel:	020 7247 0026
Norwich	Tel:	01603 504340
Ashford	Tel:	01233 502255

MLM ENVIRONMENTAL

Client: ENDURANCE ESTATES

Project: DALES MANOR BUSINESS PARK, GROVE ROAD, SAWSTON

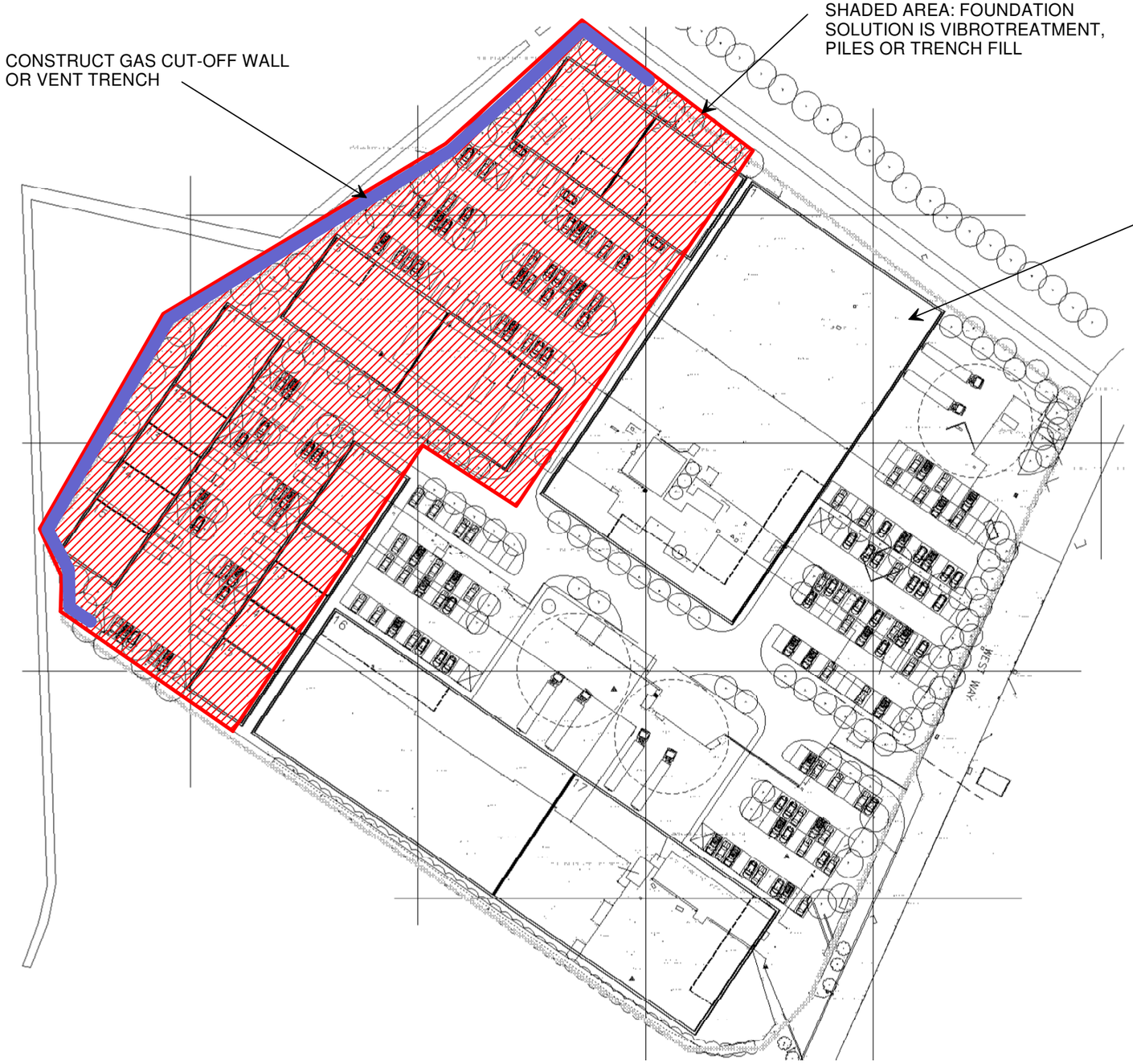
Drawing Title: PROPOSED FOUNDATION SOLUTION PLAN

Rev	Date	Description	Made	Ch'd

Status of Drawing:

Drawn	Ch'd	Approved	Scales	Drawing No.
MCH				FIGURE 4

Date: 14.11.07



REMEDIATION & GAS MITIGATION MEASURES

ADDITIONAL GAS MONITORING FOR GAS MITIGATION DESIGN

GAS PROTECTION MEASURES REQUIRED TO ALL BUILDINGS

GAS RELIEF MEASURES IN EXTERNAL AREAS

INSTALL GAS CUT-OFF WALL OR VENT TRENCH ON WESTERN BOUNDARY

REMOVAL AND VALIDATION OF UNDERGROUND SUMPS/PITS AND REINSTATE

PROTECTED SERVICES

FOUNDATION WORKS RISK ASSESSMENT AND REMEDIATION STRATEGY DOCUMENT MAY BE REQUIRED

FOUNDATION SOLUTION AREAS SHOWN

Environmental, Geotechnical & Waste Management Consultants

Ipswich	Tel: 01473 231100
Cambridge	Tel: 01223 235525
Chelmsford	Tel: 01245 359911
London	Tel: 020 7247 0026
Norwich	Tel: 01603 504340
Ashford	Tel: 01233 502255

MLM ENVIRONMENTAL

Client: ENDURANCE ESTATES

Project: DALES MANOR BUSINESS PARK, GROVE ROAD, SAWSTON

Drawing Title: FOUNDATION & GAS MITIGATION PLAN

Rev	Date	Description	Made	Ch'd

Status of Drawing:

Drawn	Ch'd	Approved	Scales	Drawing No.
MCH				FIGURE 5

Date: 14.11.07

APPENDICES

Appendix A

Cable Tool Borehole Logs

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	BH1
Drilling Method:	Cable Percussion
Date of Boring:	Start Date: 03/10/2007
	Finish Date: 04/10/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
0.00	D 1			0.08	1.00	0.08			BRICK PAVING.			
0.08	D 2			0.20		0.12						
0.20	D 3			0.50		0.30			Loose brown sand. (MADE GROUND)			
0.50	D 4					0.60						
1.10	D 5			1.10					Dense red medium brick gravel. (MADE GROUND)			
1.20	U 1											
1.70	D 6								Firm dark grey slightly gravelly CLAY. Gravel is fine to medium angular flint and chalk fragments. (GLACIAL TILL)			
2.00		(S) N=21 (5,6,7,7,4,3)			2.00							
2.50	D 7								Structureless white, brown clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
3.00		(S) N=12 (3,2,3,2,3,4)			3.00							
4.00		(S) N=6 (1,1,1,2,2,1)			4.00							4.10 4.30
5.00		(S) N=12 (1,1,2,3,3,4)			5.00							
6.50		(S) N=18 (4,3,4,4,5,5)			6.00							
8.00		(S) N=22 (4,5,5,6,5,6)			8.00	13.90						
9.50		(S) N=24 (4,5,5,6,6,7)			9.00							
11.0		(S) N=27 (5,5,6,6,7,8)			11.00							
12.5		(S) N=31 (5,6,7,7,8,9)			12.00							
14.0		(S) N=34 (5,6,8,8,9,9)			14.00							
15.0	D 8			15.00	15.00				*End of Borehole at 15.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 15m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	BH2
Drilling Method:	Cable Percussion
Date of Boring:	Start Date: 04/10/2007
	Finish Date: 04/10/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
0.08	D 1			0.08		0.08			BRICK PAVING.			Dry
0.20	D 2			0.20		0.12			Loose brown sand. (MADE GROUND)			
0.40	D 3			0.50		0.30			Dense red medium brick gravel. (MADE GROUND)			
0.50	D 4			0.75		0.25			Firm grey gravelly clay. Gravel is fine to medium brick, concrete and flint. (MADE GROUND)			
0.75	D 5								*End of Borehole at 15.00 m*			

Borehole Diameter (mm): Well Diameter (mm):

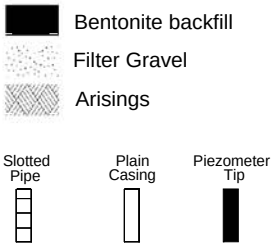
Casing Depth (m bgl):

Remarks: 1. Pipe encountered at 0.75m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:



Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	BH2A
Drilling Method:	Cable Percussion
Date of Boring:	Start Date: 04/10/2007
	Finish Date:04/10/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
0.08	D 1			0.08		0.08			BRICK PAVING.			
0.20	D 2			0.20		0.12						
0.40	D 3			0.50		0.30			Loose brown sand. (MADE GROUND)			
0.50	D 4				1.00							
1.20	U 1					2.10			Dense red medium brick gravel. (MADE GROUND)			
1.70	D 5											
2.00		(S) N=11 (2,1,3,2,3,3)			2.00				Firm grey gravelly clay. Gravel is fine to medium brick, concrete and flint. (MADE GROUND)			
2.60	D 6			2.60								
3.00		(S) N=12 (2,2,2,3,3,4)			3.00				Structureless white, brown clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
4.00		(S) N=7 (2,1,2,1,2,2)			4.00							
5.00		(S) N=11 (2,1,2,3,3,3)			5.00							5.50
6.50		(S) N=16 (3,2,3,4,4,5)			6.00							
8.00		(S) N=18 (2,1,4,4,5,5)			7.00							
9.50		(S) N=22 (2,2,5,5,6,6)			8.00							
11.0		(S) N=28 (3,2,6,7,7,8)			9.00	12.40						
12.5		(S) N=31 (3,3,7,8,8,8)			10.00							
14.0		(S) N=33 (5,5,8,8,8,9)			11.00							10.80
15.0	D 7			15.00	12.00				*End of Borehole at 15.00 m*			
					13.00							
					14.00							
					15.00							

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	

BOREHOLE NO.	BH3
Drilling Method:	Cable Percussion
Date of Boring:	Start Date: 05/10/2007
	Finish Date:05/10/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
0.10	D 1			0.20		0.20			ASPHALT.			
0.30	D 2					0.30						
0.50	D 3			0.50					Dense grey and brown sand and medium to coarse concrete gravel. (MADE GROUND)			
1.20	U 1					1.30						
1.70	D 4			1.80					Firm grey gravelly clay. Gravel is fine to medium brick, wood, concrete and flint. (MADE GROUND)			
1.80	D 5											
2.00		(S) N=14 (3,4,4,4,3,3)										
						1.90			Firm light grey, brown sandy gravelly CLAY. Gravel is fine to medium chalk. (GLACIAL TILL)			
3.00		(S) N=15 (3,3,3,4,4,4)										
3.70	D 6			3.70					Structureless white, brown clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
4.00		(S) N=12 (1,1,2,3,3,4)										
5.00		(S) N=16 (3,2,3,4,4,5)										
6.50		(S) N=12 (1,1,3,3,3,3)										
7.90	D 7											
8.00		(S) N=16 (2,2,3,4,4,5)										
						11.30						
9.50		(S) N=21 (3,3,4,5,6,6)										10.06
11.0		(S) N=26 (4,4,6,6,7,7)										12.06
12.5		(S) N=32 (5,5,7,8,8,9)										
14.0		(S) N=36 (5,6,8,9,9,10)										
15.0	D 8			15.00					*End of Borehole at 15.00 m*			

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Appendix B

Windowless Sample Logs

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS1
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
0.30	D 1								Very stiff dark grey and brown slightly gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
						0.95						
1.00	D 2	(C) N=63 (6,10,16,16,15,16)		1.20	1.00				Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
2.00		(C) N=39 (10,9,10,10,9,10)			2.00							
2.50	D 3					2.80						
3.00		(C) N=9 (4,2,3,2,2,2)			3.00							
4.00		(C) N=11 (2,2,3,2,3,3)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

Bentonite backfill

Filter Gravel

Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS2
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
0.40	D 1								Stiff dark grey and brown gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
1.00		(S) N=24 (7,6,6,6,6,6)		1.00	1.00							
1.10	D 2					2.35						
2.00		(S) N=14 (6,4,5,3,3,3)		2.00	2.00							
				2.60					Structureless white and and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
2.80	D 3					0.40						
3.00		(S) N=10 (2,3,2,3,2,3)		3.00	3.00				*End of Borehole at 3.00 m*			
					4.00							

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS3
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date: 25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
0.70	D 1								Very stiff dark grey gravelly clay. Gravel is fine to medium flint, brick, concrete and chalk. (MADE GROUND)			
1.00		(S) N=29 (4,4,8,8,6,7)		1.10	1.00	0.85						
1.50	D 2								Firm dark grey gravelly CLAY. Gravel is fine to medium chalk and flint. (GLACIAL TILL)			
2.00		(S) N=10 (2,2,2,2,3,3)		1.80	2.00	0.70						
2.70	D 3								Firm light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
3.00		(S) N=10 (2,2,2,2,3,3)			3.00	2.20						
4.00		(S) N=12 (2,2,3,2,3,4)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 4m bgl

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS4
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
									Stiff dark grey gravelly clay. Gravel is fine to medium ash, brick and flint. (MADE GROUND)			
0.70	D 1											
1.00		(S) N=17 (3,3,4,4,4,5)			1.00	1.55						
1.30	D 2											
				1.80					Firm dark grey gravelly CLAY. Gravel is fine to medium chalk and flint. (GLACIAL TILL)			
2.00	D 3	(S) N=22 (5,6,6,5,6,5)			2.00	1.00						
				2.80					Soft to firm light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
3.00	D 4	(S) N=10 (3,3,2,2,3,3)			3.00	1.20						
4.00		(S) N=6 (2,1,1,1,2,2)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS5
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
0.70	D 1			0.25	1.00	0.95			Soft dark grey and black gravelly clay. Gravel is fine to medium brick, tile and concrete. (MADE GROUND)			
1.30	D 2			1.20		0.80			Soft light brown gravelly CLAY. Gravel is fine to medium flint and chalk. (ALLUVIUM)			
				2.00	2.00	0.70			Very soft black sandy organic CLAY. (ALLUVIUM)			
2.50	D 3			2.70		0.80			Soft to firm light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (ALLUVIUM)			
3.00	D 4			3.50	3.00	0.50			Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
4.00	D 5			4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installled to 4m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS6
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date: 25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.00		0.35			CONCRETE.			Dry
0.60	D 1			0.35		0.45			Firm red, grey and black gravelly clay. Gravel is fine to medium concrete and brick. (MADE GROUND)			
1.00	D 2	(S) N=9 (1,1,2,2,2,3)		0.80	1.00	1.30			Stiff bluish grey gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL) Strong inorganic odour and staining.			
2.00	D 3	(S) N=19 (3,5,4,4,5,6)		2.10	2.00	1.40			Firm light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
3.00	D 4	(S) N=11 (4,3,3,3,2,3)		3.50	3.00	0.50			Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
4.00	D 5	(S) N=8 (2,1,2,2,2,2)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 4m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS7
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.20		0.20			CONCRETE.			Dry
0.50	D 1								Firm light grey and white gravelly clay. Gravel is fine to medium brick and concrete. (MADE GROUND) Inorganic odour.			
1.00		(S) N=10 (2,1,1,2,2,5)			1.00	1.10						
				1.30					Very stiff dark grey gravelly CLAY. Gravel is fine to medium flint. (GLACIAL TILL)			
1.50	D 2					0.70						
2.00		(S) N=25 (4,6,7,6,6,6)		2.00	2.00				Loose brown slightly gravelly SAND. Gravel is fine to medium flint. (GLACIAL TILL)			
2.20	D 3											
2.45		( ) Error				0.90						
				2.90		0.10			Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
				3.00	3.00				*End of Borehole at 3.00 m*			
					4.00							

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 3m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS8
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.20		0.20			CONCRETE.			Dry
									Firm dark grey gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
0.80	D 1											
1.00		(S) N=9 (2,2,2,2,3,2)			1.00	1.60						
				1.80					Soft to firm orange and brown sandy CLAY. (GLACIAL TILL)			
2.00	D 2	(S) N=22 (4,4,5,5,6,6)			2.00							
				2.80		1.00			Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
3.00		(S) N=8 (2,2,2,2,2,2)			3.00							
3.50	D 3					1.20						
4.00		(S) N=7 (1,2,2,2,1,2)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

Bentonite backfill

Filter Gravel

Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS9
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date: 25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.25		0.25			CONCRETE.			Dry
0.30	D 1			0.50		0.25			Dense dark grey concrete gravel. (MADE GROUND)			
0.60	D 2			0.70		0.20			Very stiff dark bluish grey gravelly CLAY. Gravel is fine to medium chalk and flint. (GLACIAL TILL)			
1.00		(S) N=35 (4,5,8,10,9,8)			1.00				Firm to stiff light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
1.10	D 3			1.60		0.90			Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
2.00		(S) N=14 (2,3,2,4,3,5)			2.00							
2.50	D 4					1.40						
3.00		(S) N=27 (6,6,5,6,6,10)		3.00	3.00				*End of Borehole at 3.00 m*			
					4.00							

Borehole Diameter (mm): Well Diameter (mm):

Casing Depth (m bgl):

Remarks: 1. Borehole backfilled with arisings.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS10
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date:25/09/2007
Ground Level:	-
Coords:	-

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Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.08		0.08			BRICK PAVING.			
0.20	D 1			0.30		0.22			Loose red and brown clayey gravelly sand. Gravel is fine to medium brick and concrete. (MADE GROUND)			Dry
0.50	D 2			0.80		0.50			Stiff white and brown very gravelly CLAY. Gravel is fine to coarse flint and chalk (GLACIAL TILL)			
1.00	D 3	(S) N=23 (2,3,3,5,8,7)		1.10	1.00	0.30			Stiff light brown slightly sandy CLAY. (GLACIAL TILL)			
						1.00			Stiff light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
2.00	D 4	(S) N=21 (10,11,9,5,4,3)		2.10	2.00				Structureless white and brown slightly clayey CHALK. Grade Dc. (ZIG ZAG CHALK FORMATION)			
2.70	D 5					0.90						
3.00		(S) 50/135mm (15,10,25,25)		3.00	3.00				*End of Borehole at 3.00 m*			
					4.00							

Installation Details: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 3m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Project:	Dales Manor Business Park
Location:	Sawston, Cambridgeshire
Project ID:	721750
Client:	Endurance Estates Ltd
Project Engineer:	Ross Blake
Logged by:	Ross Blake

BOREHOLE NO.	WS11
Drilling Method:	Window Sampler
Date of Boring:	Start Date: 25/09/2007
	Finish Date: 25/09/2007
Ground Level:	-
Coords:	-

MLM
www.mlm.uk.com

Issue Status:

IN SITU TESTS/SAMPLING				STRATA						NOTES		
Depth (m)	Sample Ref.	SPT Type/ Results	Shear Strength	Depth (m)	Level (mAOD)	Thickness (m)	Installation Details	Legend	Description of Strata	Chiselling Depth (m)	Chiselling Time (mins)	Water (m)
				0.20		0.20			CONCRETE.			Dry
0.50	D 1					0.80			Loose light brown and black clayey sandy brick and concrete gravel. (MADE GROUND)			
1.00		(S) N=6 (3,3,1,2,1,2)		1.00	1.00				Firm light brown slightly gravelly CLAY. Gravel is fine to medium flint. (GLACIAL TILL)			
1.30	D 2								Inorganic odour and staining.			
2.00	D 3	(S) N=9 (1,1,2,2,2,3)			2.00	1.70						
				2.70					Soft to firm light brown grey and white very gravelly CLAY. Gravel is fine to medium flint and chalk. (GLACIAL TILL)			
3.00		(S) N=10 (3,2,2,3,2,3)			3.00	1.30						
3.80	D 4											
4.00		(S) N=7 (2,2,1,2,2,2)		4.00	4.00				*End of Borehole at 4.00 m*			

Borehole Diameter (mm):

Well Diameter (mm): -

Casing Depth (m bgl):

Remarks: 1. Well installed to 4m bgl.

▽	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
D	Small Disturbed Sample
U	Undisturbed Samples
B	Bulk Sample
J	Jar Sample
W	Water Sample

HV	Hand Shear Vane Result
PP	Pocket Penetrometer Result

Well Installation Legend:

- Bentonite backfill
- Filter Gravel
- Arisings

Slotted Pipe | Plain Casing | Piezometer Tip

Appendix C

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	-

Appendix D

Results of Chemical Analysis

Chemtest

Willie Snaith Road Newmarket CB8 7SQ
Tel: 01638 606070 Fax: 01638
Email admin @ chemtest.co.uk

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL
FAO M Henderson

09 October 2007

Dear M Henderson

Test Report Number **71060**
Your Project Reference **Dales Manor Business Park, Sawston**

Please find enclosed the results of analysis for the samples received 01 October 2007.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact Sally Murray in Customer Services.

Yours sincerely

Darrell Hall - Laboratory Manager
Authorised Signatory

UKAS TESTING
2183

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *Comments or interpretations are beyond the scope of UKAS accreditation*
- *The results relate only to the items tested*

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Newmarket Suffolk CB8 0AP

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

Login Batch No					71060							
Chemtest LIMS ID					AC36458	AC36460	AC36461	AC36462	AC36463	AC36464	AC36465	AC36468
Sample ID					WS1	WS2	WS2	WS3	WS3	WS3	WS4	WS5
Sample No					D1	D1	D3	D1	D2	D3	D1	D1
Depth					0.3m	0.4m	2.8m	0.7m	1.5m	2.7m	0.7m	0.7m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*								
2630	Total Organic Carbon		%	M				1.2			0.60	2.1
2210	Sulfate (2:1 water soluble)	14808798	g l-1	M								
2450	Arsenic	7440382	mg kg-1	M	14	17		22			14	17
	Cadmium	7440439	mg kg-1	M	0.20	<0.1		0.25			0.13	0.48
	Chromium	7440473	mg kg-1	U	19	2.1		27			17	37
	Copper	7440508	mg kg-1	M	13	<5		26			16	77
	Mercury	7439976	mg kg-1	M	<0.1	<0.1		0.48			0.30	0.24
	Nickel	7440020	mg kg-1	M	19	5.7		25			19	32
	Lead	7439921	mg kg-1	M	33	6.1		83			30	75
	Selenium	7782492	mg kg-1	U	<0.1	<0.1		<0.1			<0.1	<0.1
	Zinc	7440666	mg kg-1	M	45	11		88			35	580
2670	Total Petroleum Hydrocarbons		mg kg-1	M					<20	<20		
2673	TPH >C6-C10		mg kg-1	U		<1	<1	<1				
	TPH >C10-C21		mg kg-1	M		<1	<1	60				
	TPH >C21-C40		mg kg-1	M		<1	<1	26				
	Total Petroleum Hydrocarbons		mg kg-1	M		<20	<20	86				
2700	Naphthalene	91203	mg kg-1	M				0.6			<0.1	0.1
	Acenaphthylene	208968	mg kg-1	M				3.1			0.2	2.4
	Acenaphthene	83329	mg kg-1	M				0.6			<0.1	<0.1
	Fluorene	86737	mg kg-1	M				1			<0.1	<0.1
	Phenanthrene	85018	mg kg-1	M				0.9			3	0.2
	Anthracene	120127	mg kg-1	M				<0.1			0.9	<0.1
	Fluoranthene	206440	mg kg-1	M				3.8			4.1	0.2
	Pyrene	129000	mg kg-1	M				1.6			2.7	1.1
	Benzo[a]anthracene	56553	mg kg-1	M				0.6			1.1	<0.1
	Chrysene	218019	mg kg-1	M				0.6			1.3	<0.1
	Benzo[b]fluoranthene	205992	mg kg-1	M				0.9			1	0.5
	Benzo[k]fluoranthene	207089	mg kg-1	M				0.7			1	0.7
	Benzo[a]pyrene	50328	mg kg-1	M				0.8			1.1	<0.1
	Dibenzo[a,h]anthracene	53703	mg kg-1	M				0.6			0.7	<0.1

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* 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 M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

Login Batch No					71060							
Chemtest LIMS ID					AC36472	AC36474	AC36477	AC36479	AC36481	AC36483	AC36485	AC36488
Sample ID					WS6	WS6	WS7	WS8	WS8	WS9	WS10	WS10
Sample No					D1	D3	D1	D1	D3	D2	D1	D5
Depth					0.6m	2.0m	0.5m	0.8m	3.5m	0.6m	0.2m	2.7m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*								
2630	Total Organic Carbon		%	M	0.58		0.23					
2210	Sulfate (2:1 water soluble)	14808798	g l-1	M								
2450	Arsenic	7440382	mg kg-1	M	18		8.4	21		22		
	Cadmium	7440439	mg kg-1	M	0.13		<0.1	0.20		0.16		
	Chromium	7440473	mg kg-1	U	25		6.9	14		9.0		
	Copper	7440508	mg kg-1	M	16		<5	15		12		
	Mercury	7439976	mg kg-1	M	0.44		<0.1	0.19		0.23		
	Nickel	7440020	mg kg-1	M	24		8.7	19		13		
	Lead	7439921	mg kg-1	M	66		6.4	62		100		
	Selenium	7782492	mg kg-1	U	<0.1		<0.1	0.18		<0.1		
	Zinc	7440666	mg kg-1	M	58		11	35		52		
2670	Total Petroleum Hydrocarbons		mg kg-1	M		<20		<20	<20			
2673	TPH >C6-C10		mg kg-1	U	<1						<1	<1
	TPH >C10-C21		mg kg-1	M	910						<1	<1
	TPH >C21-C40		mg kg-1	M	150						<1	<1
	Total Petroleum Hydrocarbons		mg kg-1	M	1100						<20	<20
2700	Naphthalene	91203	mg kg-1	M			<0.1					
	Acenaphthylene	208968	mg kg-1	M			0.1					
	Acenaphthene	83329	mg kg-1	M			<0.1					
	Fluorene	86737	mg kg-1	M			0.5					
	Phenanthrene	85018	mg kg-1	M			0.2					
	Anthracene	120127	mg kg-1	M			<0.1					
	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					

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* 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 M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

Login Batch No					71060		
Chemtest LIMS ID					AC36489	AC36490	AC36492
Sample ID					WS11	WS11	WS11
Sample No					D1	D2	D4
Depth					0.5m	1.3m	3.8m
Matrix					*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*			
2630	Total Organic Carbon		%	M			
2210	Sulfate (2:1 water soluble)	14808798	g l-1	M	0.46		
2450	Arsenic	7440382	mg kg-1	M	19	19	13
	Cadmium	7440439	mg kg-1	M	0.11	<0.1	<0.1
	Chromium	7440473	mg kg-1	U	26	17	3.5
	Copper	7440508	mg kg-1	M	15	19	<5
	Mercury	7439976	mg kg-1	M	0.13	1.1	<0.1
	Nickel	7440020	mg kg-1	M	24	23	7.7
	Lead	7439921	mg kg-1	M	57	72	<5
	Selenium	7782492	mg kg-1	U	<0.1	<0.1	0.17
	Zinc	7440666	mg kg-1	M	96	62	11
2670	Total Petroleum Hydrocarbons		mg kg-1	M			
2673	TPH >C6-C10		mg kg-1	U			<1
	TPH >C10-C21		mg kg-1	M			<1
	TPH >C21-C40		mg kg-1	M			<1
	Total Petroleum Hydrocarbons		mg kg-1	M			<20
2700	Naphthalene	91203	mg kg-1	M	<0.1		
	Acenaphthylene	208968	mg kg-1	M	2		
	Acenaphthene	83329	mg kg-1	M	0.3		
	Fluorene	86737	mg kg-1	M	2.2		
	Phenanthrene	85018	mg kg-1	M	<0.1		
	Anthracene	120127	mg kg-1	M	<0.1		
	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		

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* 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 M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

					71060							
					AC36458	AC36460	AC36461	AC36462	AC36463	AC36464	AC36465	AC36468
					WS1	WS2	WS2	WS3	WS3	WS3	WS4	WS5
					D1	D1	D3	D1	D2	D3	D1	D1
					0.3m	0.4m	2.8m	0.7m	1.5m	2.7m	0.7m	0.7m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2700	Indeno[1,2,3-cd]pyrene	193395	mg kg-¹	M				0.7			0.8	<0.1
	Benzo[g,h,i]perylene	191242	mg kg-¹	M				0.1			0.4	<0.1
	Total (of 16) PAHs		mg kg-¹	M				17			18	5.3
2010	pH		-	M				12.1			9.8	9.9

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* Accreditation status

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MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

					71060							
					AC36472	AC36474	AC36477	AC36479	AC36481	AC36483	AC36485	AC36488
					WS6	WS6	WS7	WS8	WS8	WS9	WS10	WS10
					D1	D3	D1	D1	D3	D2	D1	D5
					0.6m	2.0m	0.5m	0.8m	3.5m	0.6m	0.2m	2.7m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2700	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			<2					
2010	pH		-	M	11.9		9.4					

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* Accreditation status

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MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M Henderson

LABORATORY TEST REPORT

Results of analysis of 19 samples
received 01 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 October 2007

					71060		
					AC36489	AC36490	AC36492
					WS11	WS11	WS11
					D1	D2	D4
					0.5m	1.3m	3.8m
					SOIL	*SOIL*	*SOIL*
2700	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	5.1		
2010	pH		-	M	11.8		

All tests undertaken between 04-Oct-2007 and 9-Oct-2007

* Accreditation status

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

Chemtest

Willie Snaith Road Newmarket CB8 7SQ
Tel: 01638 606070 Fax: 01638
Email admin @ chemtest.co.uk

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL
FAO Mark Henderson

24 October 2007

Dear Mark Henderson

Test Report Number **54093**
Your Project Reference **Dales Manor Business Park, Sawston**

Please find enclosed the results of analysis for the samples received 16 October 2007.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact Ryan Hyden in Customer Services.

Yours sincerely

Darrell Hall - Laboratory Manager
Authorised Signatory

UKAS TESTING
2183

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *Comments or interpretations are beyond the scope of UKAS accreditation*
- *The results relate only to the items tested*

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Registration Number 3006780
Reg Office 7 Laureate Paddocks
Newmarket Suffolk CB8 0AP

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO Mark Henderson

LABORATORY TEST REPORT

Results of analysis of 8 samples
received 16 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
24 October 2007

Login Batch No					54093							
Chemtest LIMS ID					AC40836	AC40837	AC40838	AC40839	AC40840	AC40841	AC40842	AC40843
Sample ID					WS1	WS3	WS3	WS5	WS5	WS6	WS7	WS11
Sample No					D3	D1	D3	D1	D3	D1	D1	D3
Depth					2.5m	0.7m	2.7m	0.7m	2.5m	0.6m	0.5m	2.0m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*								
2210	Sulfate (2:1 water soluble)	14808798	g l-¹	M	<0.01	0.34	0.06	0.17	<0.01	0.13	0.02	0.03
2450	Arsenic	7440382	mg kg-¹	M					3.5			
	Cadmium	7440439	mg kg-¹	M					<0.1			
	Chromium	7440473	mg kg-¹	U					8.2			
	Copper	7440508	mg kg-¹	M					6.6			
	Mercury	7439976	mg kg-¹	M					<0.1			
	Nickel	7440020	mg kg-¹	M					7.9			
	Lead	7439921	mg kg-¹	M					6.0			
	Selenium	7782492	mg kg-¹	U					0.39			
	Zinc	7440666	mg kg-¹	M					11			
2670	Total Petroleum Hydrocarbons		mg kg-¹	M					<20			
2700	Naphthalene	91203	mg kg-¹	M					<0.1			
	Acenaphthylene	208968	mg kg-¹	M					<0.1			
	Acenaphthene	83329	mg kg-¹	M					<0.1			
	Fluorene	86737	mg kg-¹	M					<0.1			
	Phenanthrene	85018	mg kg-¹	M					<0.1			
	Anthracene	120127	mg kg-¹	M					<0.1			
	Fluoranthene	206440	mg kg-¹	M					<0.1			
	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					<2			
2010	pH		-	M	8.4		8.1		8.4			8.6

All tests undertaken between 18-Oct-2007 and 24-Oct-2007

* Accreditation status

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

Chemtest

Willie Snaith Road Newmarket CB8 7SQ
Tel: 01638 606070 Fax: 01638
Email admin @ chemtest.co.uk

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL
FAO M.Henderson

15 October 2007

Dear M.Henderson

Test Report Number **45412**
Your Project Reference **Dales Manor Business Park, Sawston**

Please find enclosed the results of analysis for the samples received 05 October 2007.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact Ryan Hyden in Customer Services.

Yours sincerely

Keith Jones
Authorised Signatory

UKAS TESTING
2183

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
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MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M.Henderson

LABORATORY TEST REPORT

Results of analysis of 3 samples
received 05 October 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
15 October 2007

Login Batch No					45412		
Chemtest LIMS ID					AC38527	AC38528	AC38529
Sample ID					WS3	WS5	WS6
Sample No							
Depth							
Matrix					*WATER*	*WATER*	*WATER*
SOP↓	Determinand↓	CAS No↓	Units↓	*			
1010	pH	PH	-	U			7.9
1450	Arsenic	7440382	µg l⁻¹	U	13	2	3.4
	Boron	7440428	µg l⁻¹	U	190	110	69
	Cadmium	7440439	µg l⁻¹	U	<0.5	<0.5	<0.5
	Chromium	7440473	µg l⁻¹	U	9.6	4.3	9.4
	Copper	7440508	µg l⁻¹	U	100	3.2	9.9
	Lead	7439921	µg l⁻¹	U	5.4	<1	<1
	Mercury	7439976	µg l⁻¹	U	4.1	4.4	2.1
	Nickel	7440020	µg l⁻¹	U	4.6	3.6	7.7
	Selenium	7782492	µg l⁻¹	U	14	1.6	4.9
	Zinc	7440666	µg l⁻¹	U	22	30	23
1673	TPH >C6-C10		µg l⁻¹	U	<0.1	<0.1	
	TPH >C10-C21		µg l⁻¹	U	<0.1	<0.1	
	TPH >C21-C40		µg l⁻¹	U	<0.1	<0.1	
	Total Petroleum Hydrocarbons		µg l⁻¹	U	<10	<10	

All tests undertaken between 15-Oct-2007 and 15-Oct-2007

* Accreditation status

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

Chemtest

Willie Snaith Road Newmarket CB8 7SQ
Tel: 01638 606070 Fax: 01638
Email admin @ chemtest.co.uk

MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M Henderson
09 November 2007

Dear M Henderson

Test Report Number **45638**
Your Project Reference **Dales Manor Business Park, Sawston**

Please find enclosed the results of analysis for the samples received 5 November 2007.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact Dianne Sellers in Customer Services.

Yours sincerely

Darrell Hall - Laboratory Manager
Authorised Signatory

UKAS TESTING
2183

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
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MLM Environmental Ltd
7200 Cambridge Research Park
Cambridge

CB25 9TL

FAO M Henderson

LABORATORY TEST REPORT

Results of analysis of 2 samples
received 05 November 2007

Dales Manor Business Park, Sawston

Chemtest

Report Date
09 November 2007

Login Batch No					45638	
Chemtest LIMS ID					AC47552	AC47553
Sample ID					WS6	BH1
Sample No						
Depth						
Matrix					*WATER*	*WATER*
SOP↓	Determinand↓	CAS No↓	Units↓	*		
1675	TPH >C5-C7		µg l-¹	U	<0.1	<0.1
	TPH >C7-C8		µg l-¹	U	<0.1	<0.1
	TPH >C8-C10		µg l-¹	U	<0.1	<0.1
	TPH >C10-C12		µg l-¹	U	<0.1	<0.1
	TPH >C12-C16		µg l-¹	U	<0.1	<0.1
	TPH >C16-C21		µg l-¹	U	<0.1	<0.1
	TPH >C21-C35		µg l-¹	U	<0.1	<0.1
	Total Petroleum Hydrocarbons		µg l-¹	U	<10	<10

All tests undertaken between 08-Nov-2007 and 8-Nov-2007

* Accreditation status

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

Appendix E

Results of Geotechnical Analysis

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1

Contract: Dales Manor, SAWSTON.

Serial No. S20340

UKAS TESTING 0998

SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)	SAMPLE PREPARATION Method S/N	Ret'd 0.425um (%)	Corr'd M/C <0.425um	Curing Time (hrs.)	Description	CLASS
WS1	1.00	D2	21	42	20	22	0.14*	S	10(M)	23	73	Stiff mottled dark yellowish brown and light yellowish brown slightly gravelly slightly sandy CLAY. Gravel is fine and medium chalk and flint	CI
WS2	1.10	D2	15	23	17	6.0		S	38(M)		98	Mottled yellow and light grey chalky CLAY/CHALK with occasional pale yellow pockets and intact chalk fragments	ML
WS4	1.30	D2	21	39	22	17	0.29*	S	23(M)	27	97	Stiff mottled light brownish grey and very dark greyish brown slightly gravelly CLAY with occasional dark brown and light grey pockets. Gravel is flint, chalk and mudstone	CI
WS5	1.30	D2	17	24	14	10	1.10*	S	31(M)	25	42	Soft dark brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse chalk and flint	CL
WS9	1.10	D3	12	18	13	5.0	0.40*	S	20(M)	15	97	Orange gravelly very clayey chalky fine and medium SAND. Gravel is fine and medium chalk and rare flint	ML
WS10	1.00	D3	14	30	16	14	-0.07*	S	9(M)	15	69	Stiff dark brown slightly gravelly sandy CLAY with occasional dark orangey brown mottling. Gravel is fine and medium rounded to subangular chalk and flint	CL

METHOD OF PREPARATION : BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2 S = Wet Sieved Specimen N = prepared from Natural

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter. A = Assumed, M = Measured

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

TEST REPORT.

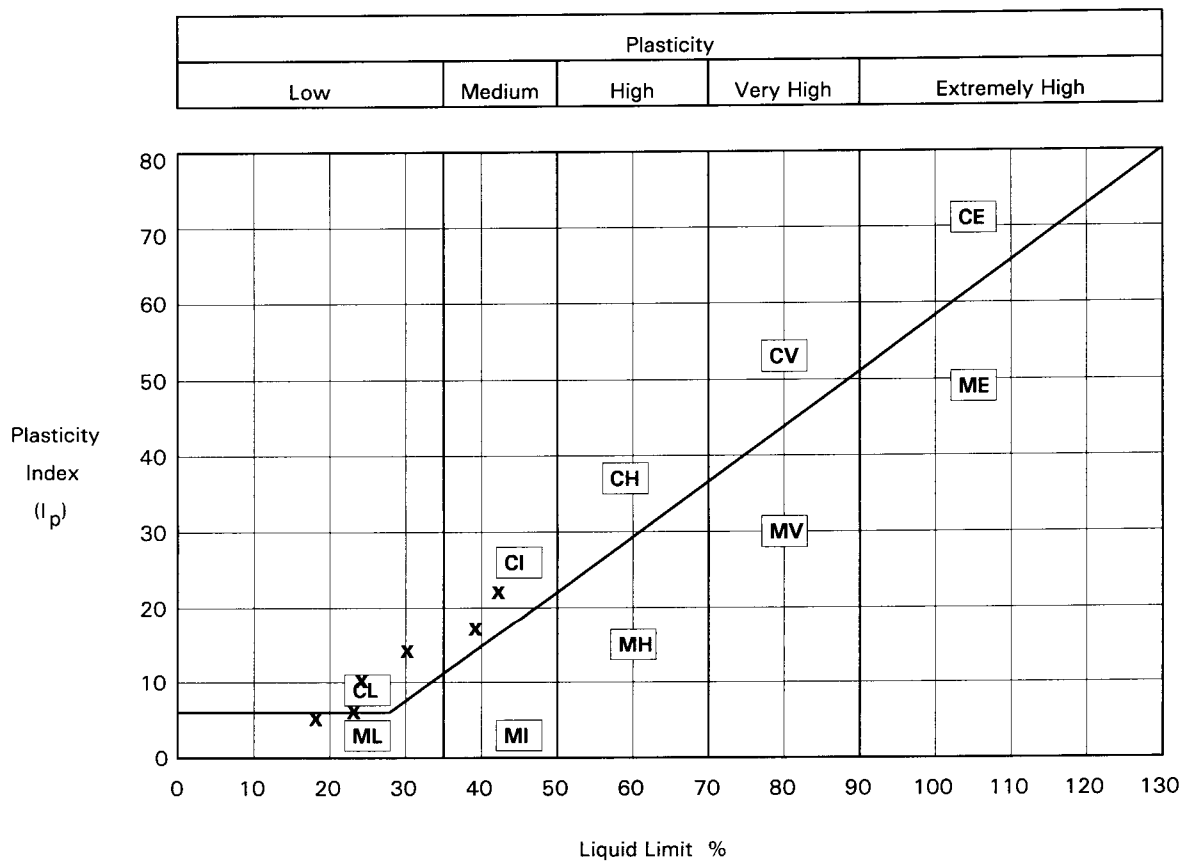
ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 4 of 10

Contract
Dales Manor, SAWSTON.

Serial No.
S20340

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 5 of 10

Contract: Dales Manor, SAWSTON.

Serial No. S20340

UKAS TESTING 0998

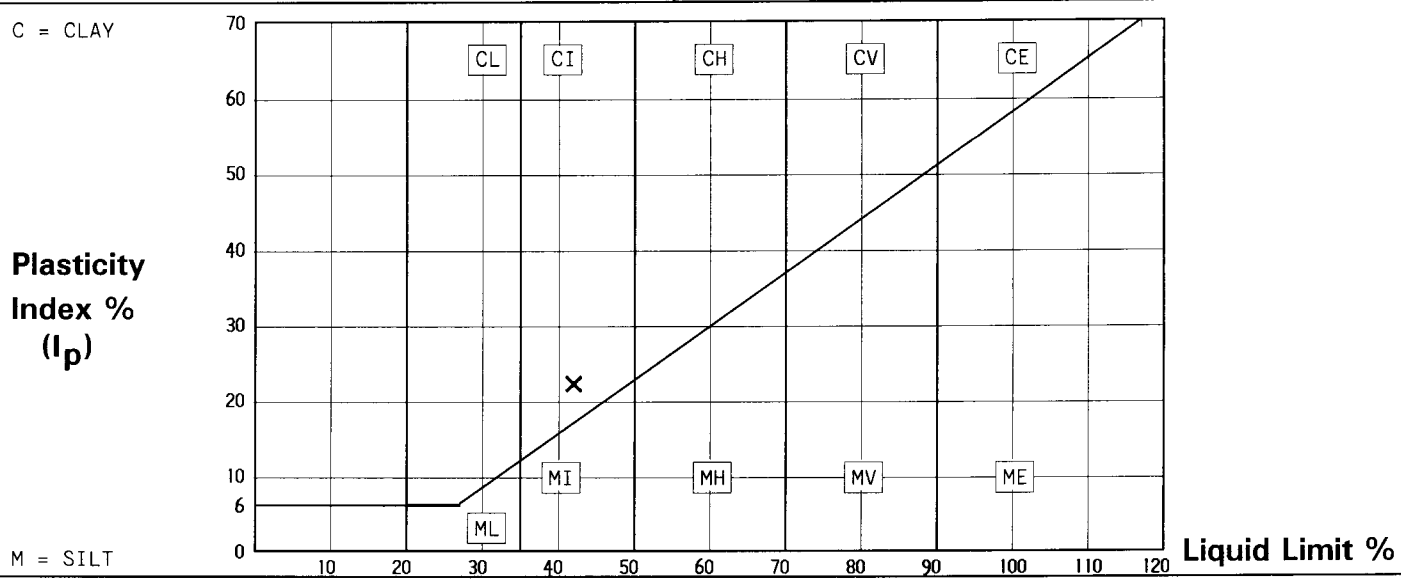
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS1	1.00	D2	21	Stiff mottled dark yellowish brown and light yellowish brown slightly gravelly slightly sandy CLAY. Gravel is fine and medium chalk and flint	

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	10 %
Corrected moisture content for material passing 0.425mm	23 %
Curing Time	73 Hours

Liquid Limit	42 %
Plastic Limit	20 %
Plasticity Index	22 %
Liquidity Index	0.14
Clay Content	Not analysed. %
Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
Corrected moisture content and calculated liquidity index assume material greater than 0.425mm non porous. See BS1377:Part2:1990 Clause 3 Note 1.

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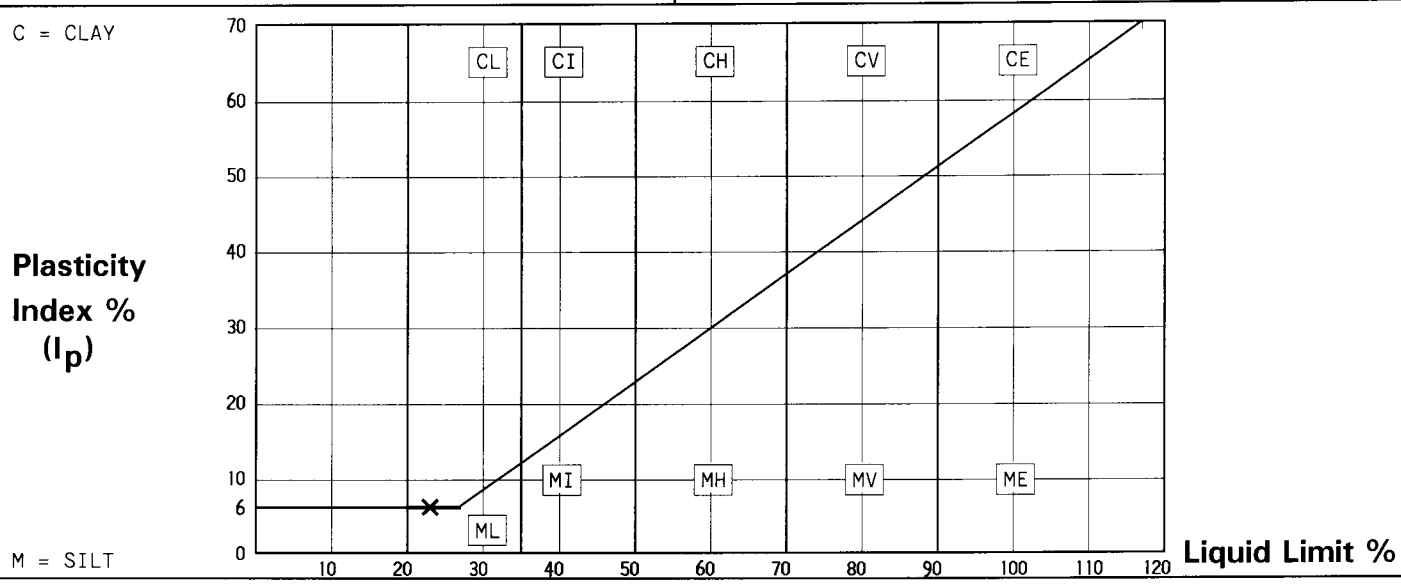
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS2	1.10	D2	15	Mottled yellow and light grey chalky CLAY/CHALK with occasional pale yellow pockets and intact chalk fragments	

PREPARATION			
Method of Preparation	Sieved Specimen	Liquid Limit	23 %
Sample retained 0.425 sieve (Measured)	38 %	Plastic Limit	17 %
Corrected moisture content for material passing 0.425mm	%	Plasticity Index	6.0 %
Curing Time	98 Hours	Liquidity Index	
		Clay Content	Not analysed. %
		Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE

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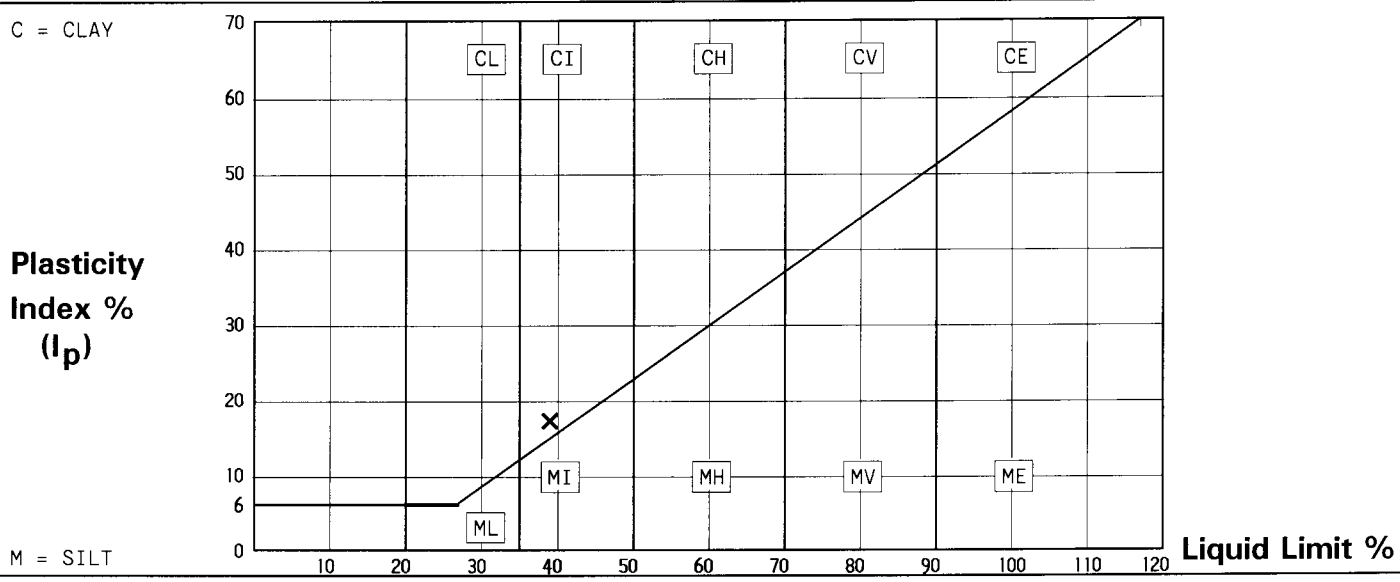
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS4	1.30	D2	21	Stiff mottled light brownish grey and very dark greyish brown slightly gravelly CLAY with occasional dark brown and light grey pockets. Gravel is flint, chalk and mudstone	Strong smell of rubber

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	23 %
Corrected moisture content for material passing 0.425mm	27 %
Curing Time	97 Hours

Liquid Limit	39 %
Plastic Limit	22 %
Plasticity Index	17 %
Liquidity Index	0.29
Clay Content	Not analysed. %
Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
Corrected moisture content and calculated liquidity index assume material greater than 0.425mm non porous. See BS1377:Part2:1990 Clause 3 Note 1.

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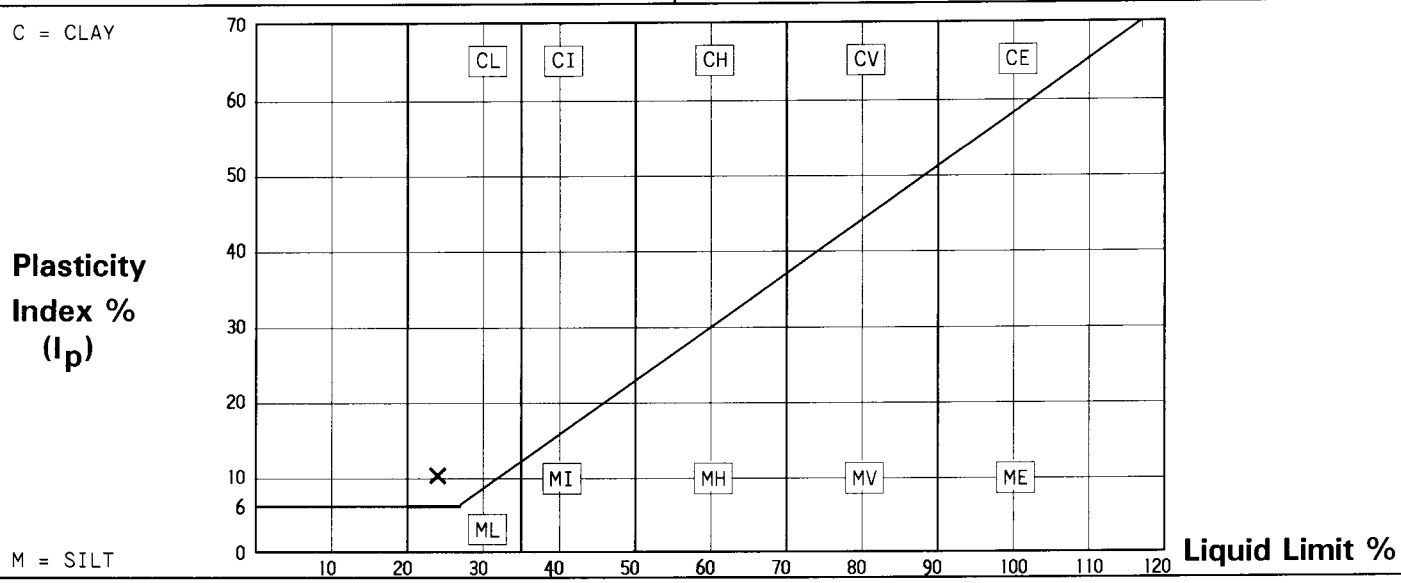
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS5	1.30	D2	17	Soft dark brown slightly gravelly slightly sandy CLAY. Gravel is fine to coarse chalk and flint	

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	31 %
Corrected moisture content for material passing 0.425mm	25 %
Curing Time	42 Hours

Liquid Limit	24 %
Plastic Limit	14 %
Plasticity Index	10 %
Liquidity Index	1.10
Clay Content	Not analysed. %
Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
Corrected moisture content and calculated liquidity index assume material greater than 0.425mm non porous. See BS1377:Part2:1990 Clause 3 Note 1.

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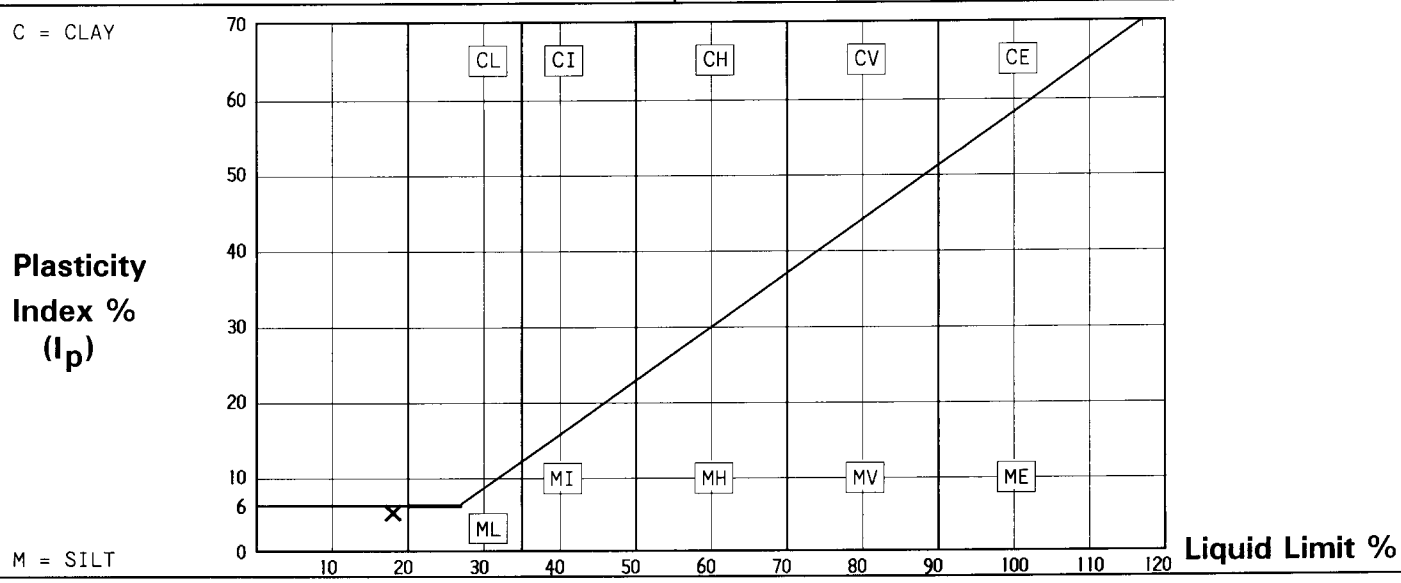
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS9	1.10	D3	12	Orange gravelly very clayey chalky fine and medium SAND. Gravel is fine and medium chalk and rare flint	Unknown odour noted

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	20 %
Corrected moisture content for material passing 0.425mm	15 %
Curing Time	97 Hours

Liquid Limit	18 %
Plastic Limit	13 %
Plasticity Index	5.0 %
Liquidity Index	0.40
Clay Content	Not analysed. %
Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
Corrected moisture content and calculated liquidity index assume material greater than 0.425mm non porous. See BS1377:Part2:1990 Clause 3 Note 1.

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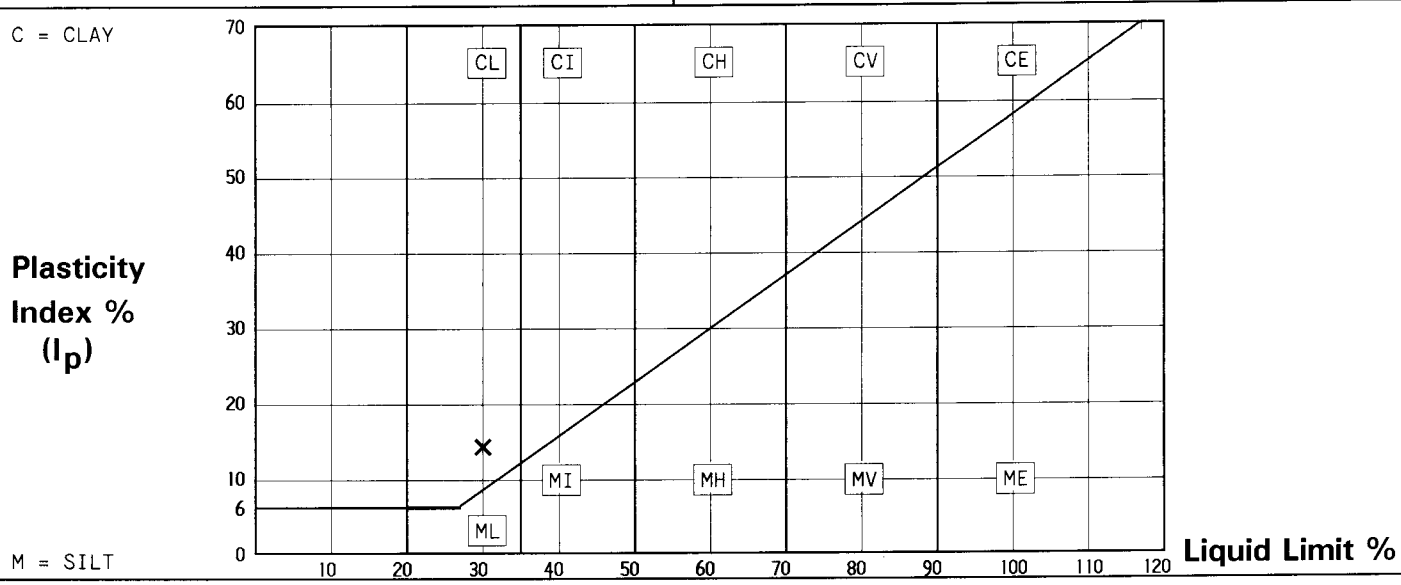
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS10	1.00	D3	14	Stiff dark brown slightly gravelly sandy CLAY with occasional dark orangey brown mottling. Gravel is fine and medium rounded to subangular chalk and flint	

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	9 %
Corrected moisture content for material passing 0.425mm	15 %
Curing Time	69 Hours

Liquid Limit	30 %
Plastic Limit	16 %
Plasticity Index	14 %
Liquidity Index	-0.07
Clay Content	Not analysed. %
Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
Corrected moisture content and calculated liquidity index assume material greater than 0.425mm non porous. See BS1377:Part2:1990 Clause 3 Note 1.

TEST REPORT.

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DETERMINATION OF THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Pit No.	Depth m.	Sample	Concentration of Soluble Sulphate: Soil: Acid Soluble SO3 %	Concentration of Soluble Sulphate: Soil: Water Soluble 2:1 SO3 g/l	Concentration of Soluble Sulphate: Groundwater g/l	% of sample passing 2mm sieve	Description	Remarks
WS1	1.00	D2		0.02		100	Stiff mottled dark yellowish brown and light yellowish brown slightly gravelly slightly sandy CLAY. Gravel is fine and medium chalk and flint	Gravel crushed to pass 2mm sieve
WS2	1.10	D2		<0.01		77	Mottled yellow and light grey chalky CLAY/CHALK with occasional pale yellow pockets and intact chalk fragments	
WS4	1.30	D2		0.06		98	Stiff mottled light brownish grey and very dark greyish brown slightly gravelly CLAY with occasional dark brown and light grey pockets. Gravel is flint, chalk and mudstone	Strong smell of rubber
WS9	1.10	D3		< 0.01		92	Orange gravelly very clayey chalky fine and medium SAND. Gravel is fine and medium chalk and rare flint	Unknown odour noted

METHOD OF PREPARATION: BS 1377:PART 1:1990:7.5 BS1377:PART 3:1990:5.2 Acid Soluble, 5.3 Soil/Water Extract :5.4 Groundwater

METHOD OF TEST : BS 1377:PART 3:1990:5.5

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : Test not UKAS accredited.

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

TEST REPORT.

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DETERMINATION OF THE pH VALUE

Borehole/ Pit No.	Depth m.	Sample	pH Value	Description	Remarks
WS1	1.00	D2	7.9	Stiff mottled dark yellowish brown and light yellowish brown slightly gravelly slightly sandy CLAY. Gravel is fine and medium chalk and flint	Gravel crushed to pass 2mm sieve
WS2	1.10	D2	8.1	Mottled yellow and light grey chalky CLAY/CHALK with occasional pale yellow pockets and intact chalk fragments	
WS4	1.30	D2	7.7	Stiff mottled light brownish grey and very dark greyish brown slightly gravelly CLAY with occasional dark brown and light grey pockets. Gravel is flint, chalk and mudstone	Strong smell of rubber
WS9	1.10	D3	8.3	Orange gravelly very clayey chalky fine and medium SAND. Gravel is fine and medium chalk and rare flint	Unknown odour noted

METHOD OF PREPARATION: BS 1377:PART 1:1990:7 BS 1377:PART 3:1990:9.4

METHOD OF TEST : BS 1377:PART 3:1990:9.5

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : Test not UKAS accredited.

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.

Appendix F

MLM E Generic Assessment Criteria

MLM EL 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 EL 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 EL 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 EL 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