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Bovis Homes Limited

Sacombe Road, Hertford

Phase II Geoenvironmental Assessment Report

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Executive Summary

Details	Comments
Introduction	This report has been prepared for Bovis Homes Limited which is proposing to develop the site at Sacombe Road, Hertford for residential use The report presents an interpretation of the ground conditions and provides advice and guidance on geotechnical and contamination issues
Current Site Setting	
Site Description	The site is occupied by the Bengeo Nursery, with a large greenhouse across the centre of the site, parking to the south and an outdoor area associated with the nursery in the northeast The remainder of the site is overgrown grassed areas The site slopes down towards the southeast, with the greenhouse structure slightly built into the slope
Site History	The site is shown to be undeveloped until 1986, when a plant nursery was built in the south This was shown on site as recently as 2011, however this has since been demolished and replaced with the existing greenhouse structure
Geology	The published site geology is the Kesgrave Catchment Sub-group (Sand and Gravel) over the Lewes Nodular and Seaford Chalk Formations
Hydrogeology	The Kesgrave Catchment Sub-group is a secondary (A) aquifer deposits, and the chalk strata is classified as a principal aquifer The site is located within an outer (zone 2) groundwater source protection zone
Hydrology	The nearest water course to the site is an unnamed ditch 57m to the east and two rivers the River Beane, located 440m north and the River Rib, located 470m east
Ground Investigation	
Ground Conditions	Made ground to depths of 1 30m, overlying medium dense sands and soft to firm clays and silts
Groundwater	Groundwater was not encountered during the site investigation
Contamination Observations	Other than the presence of made ground, no evidence of contamination was encountered
Geotechnical Assessment	
Stability Risks	The soils at the site are unlikely to be stable and excavation support will be required
Foundations/Floor Slabs	Traditional shallow strip/trench fill foundations will be appropriate in the granular soils, with an allowable bearing capacity of 125kPa considered appropriate Where clay and silt soils are encountered, a raft foundation or ground improvement will be required Following proof rolling, a ground bearing cast in situ concrete slab could be adopted on the natural soils A suspended floor slab will be required where made ground is in excess of 600mm and where vibrotreatment is proposed

Pavement Design	A design CBR value of 3% is considered appropriate for the clays and 5% for the granular soils Where made ground is encountered, following recompaction a design value of 2% should be adopted at this stage
Concrete Class	The soils at the site fall within ACEC Class AC-1 with a corresponding Design sulphate Class of DS-1
Swelling and Shrinkage Risks	Coarse soils and low shrinkability clays/silts have been encountered at foundation depth, therefore swelling and shrinkage is unlikely to be an issue at the site
Soakaways	Soakaways could be adopted at the site A soil infiltration rate of 1 x 10^{-6}m/s should be adopted for design purposes Soakaways should be located in areas of coarse soils, avoiding the clays and silts
Contamination Assessment	
Soil Contamination	Localised soil contamination has been encountered at the site PAH compounds have been recorded above the UKWIR threshold for adopting PE water supply pipes across the site
Groundwater Contamination	Groundwater was not encountered during the investigation undertaken at the site
Gas/Vapour Contamination	No gas/vapour recorded at the site
Remediation Requirements	Localised soil remediation will be required and is likely to take the form of excavation and disposal off site A remediation strategy plan is likely to be required by the local authority

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 and the development, if any, proposed

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

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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

11 Third parties should not rely on the facts, matters or opinions set out in the report without first speaking to MLM Environmental

12 Please note that MLM Environmental does not purport to provide specialist legal advice

1 Introduction

1 1 General

The report has been prepared by MLM Environmental (MLME) for Bovis Homes Limited, which is proposing a residential development of 59 units at an existing garden nursery site to the north of Hertford

The report provides a generic quantitative risk assessment (GQRA) of contamination risks to health and safety and the environment and provides a summary of recommended mitigation or remediation measures based on this GQRA

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

It is understood that this report will form part of a planning submission for the proposed development, and inform the design of foundations and infrastructure

A Preliminary Contaminated Land Risk Assessment (Phase I Desk Study) has been undertaken by MLME for the site (MLME, 2011) and should be read in conjunction with this report

1 2 Proposed Development

The proposed development is presented on Nicol Thomas Architects' drawing 'Proposed Site Layout Plan' (ref B5350 sk01, dated 21 March 2011) The development is to comprise 59 residential units with associated roads, car parking and garden/landscape areas

1 3 Terms of Reference

The terms of reference for the work were set out in the MLME proposal dated 25 May 2011, reference DMB/723463/001/DMB and included the following scope of work

- Utilities clearance at exploratory positions
- Windowless sampler boreholes
- Trial pitting
- Soakaway testing
- Gas and vapour monitoring during the fieldwork, and on 3 No return visits
- In situ geotechnical testing
- Recovery of soil and groundwater samples for chemical and geotechnical analysis
- Assessment of ground conditions with respect to foundation and infrastructure design
- Generic quantitative risk assessment of contamination and outline guidance on mitigation and remediation

1 4 Report Structure

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

- Site description
- Summary findings of previous studies
- Description of the intrusive investigations, monitoring and analyses undertaken
- Description of ground, groundwater and gas conditions
- Description of geotechnical properties and material parameters
- Geotechnical and foundation assessment and recommendations
- Comparison of chemical test results to relevant generic guideline values
- Generic quantitative risk assessment
- Updated conceptual site model (source-pathway-receptor scenarios)
- Summary of risks and proposed remedial action
- Conclusions and recommendations
- Factual data from the investigation (Appendices)

1 5 Technical Approach

The geoenvironmental and geotechnical work undertaken by MLME follows the Association of Geotechnical and Geoenvironmental Specialists (AGS) Code of Conduct for Site Investigations, and Good Practise Guidelines (AGS 1999-2005)

The process of contamination assessment adopted in this report generally follows the model procedures for the management of contaminated land described in the Environment Agency Contaminated Land Report 11 (DEFRA & Environment Agency 2004)

Table 3 2 Schedule of Chemical Testing

Test	Made Ground	Natural Soils
Metals (As, Cd, Cr, Pb, Hg, Ni, Se, Cu, Zn)	8	2
Total Petroleum Hydrocarbons (TPHCWG) AA splits	2	0
Speciated PAH	5	0
pH and water soluble sulphate	1	4
Asbestos fibre in soil	4	0
TOC	2	0

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

3 6 2 Geotechnical

Laboratory tests were scheduled on soil samples recovered from the exploratory holes as presented in Table 3 3 below

Table 3 3 Schedule of Geotechnical Testing

Test	No
Atterberg limits – 1 point method	4
Moisture content	4
Particle size distribution	4
Dry density/Moisture content relationship (2 5kg compaction)	3
CBR test at compaction points	9

Geotechnical testing was undertaken by a UKAS-accredited laboratory to BS1377 (BSI 1999) and the results are presented in Appendix F

The range of tests proposed is considered sufficient to provide design parameters for the future development However, should development plans change further testing may be required

4 Ground and Groundwater Conditions

4.1 General

The ground conditions encountered in the areas investigated comprised the general strata sequence presented in Table 4 1 below and was as anticipated from the published geology

Table 4 1 Generalised strata sequence

Strata	Depth range (m bgl)		Thickness range (m)
	Top	Base	
Made Ground	0 00	0 25 - 1 30	0 25 - 1 30
Kesgrave Catchment Subgroup	0 25 - 1 30	> 5 00	> 4 50

> Base of stratum not proven

It should be noted that features, structures or certain ground conditions may be present between exploratory hole locations which are different to these encountered during the investigation

4 2 Strata Encountered

4 2 1 Made Ground

Made ground was encountered across all investigated areas of the site apart from TP9 and TP10 at the eastern corner

The made ground comprised gravelly sand/sand and gravel with inclusions of flint, brick and ash, underlain by sandy gravelly clay and silt

At the eastern end of the site in WS3, WS7 and TP8 some organic matter was encountered in the clays and silts and a slight organic odour was observed

Near to the southern end of the site WS5 and WS6A were terminated at depths of 0 30m and 0 20m respectively due to encountering concrete (WS5) and very dense soils (WS6A)

4 2 2 Kesgrave Catchment Subgroup

Underlying the made ground, or from the surface at the eastern corner of the site (TP9 and TP10), the Kesgrave Catchment Sub-group was encountered, generally comprising loose to medium dense sand and gravel, although clay and silt deposits were encountered Interbedded with the granular soils at the following locations/depths

Table 4 2 Clay/Silt Deposits

Hole ref	Site Location	Depth Range	Description
WS2	Eastern end	0 70 - 2 90	Soft to firm very sandy gravelly silt
WS3	Central-eastern end	0 70 - 1 60	Firm sandy to very sandy slightly gravelly clay
WS4	Southern end	0 25 - 0 85	Firm sandy silt
WS5A	Southern end	0 50 - 1 5	Soft to firm sandy slightly gravelly silt
WS7	Eastern end	1 30 - 3 00	Soft to firm sandy gravelly clay
TP5	Northern end	0 50 - >2 30	Soft sandy gravelly clay
TP6	Northern end	0 50 - 0 90 1 50 - >2 70	Firm sandy clay Firm silty clay

At the southern end of the site WS4, WS6 and WS6B were terminated at depths between 0 8m and 0 9m due to encountering cobbles, which prohibited further progress

4.3 Groundwater

Groundwater was not encountered in the boreholes during the fieldwork or during subsequent monitoring visits

4 4 Contamination Observations

Made ground, which is often an indicator for the potential presence of contamination, was encountered across the majority of the site, although other than the localised presence of ash and clinker there was no significant evidence for soil contamination

There was no visual or olfactory evidence of hydrocarbon contamination in the soil

4.5 Ground Gas/Organic Vapour Conditions

Organic matter recorded within the made ground at the eastern end of the site is a potential source of ground gases

There was no visual or olfactory evidence of hydrocarbon contamination in the soil to indicate the potential presence of organic vapour

During the site investigation and on subsequent monitoring of the installed wells, the range of gas and organic vapour levels recorded was as presented in Table 4 3 below

Table 4 3 Summary of Gas/Vapour Monitoring

Monitoring date	Methane (%)	Carbon Dioxide (%)	VOC (ppm)	Gas flow (l hr $^{-1}$)	Barometric pressure (mb)
07/06/11 (field work)	<0 1	<0 1 - 0 6	-	n/a	998 - 997 (falling)
14/06/11	<0 1	<0 1 - 0 4	-	<0 1	1014 (falling)
21/06/11	<0 1	0 1 - 0 3	0 2 - 3 5	<0 1	1004 - 1005 (rising)
23/06/11	<0 1	0 1 - 1 6	0 3 - 3 0	<0 1	1010 (rising)

4 6 Underground Obstructions

An underground concrete obstruction was encountered in WS5 at the southern end of the site at a depth of 0 3m bgl, in the location of the former nursery No further obstructions were encountered during the investigations

6 Geotechnical Assessment

6.1 General

This geotechnical assessment is based on the parameters determined from the field work and laboratory analysis as described in section 5

This section presents an interpretative geotechnical assessment of possible foundation solutions and sub-base/infrastructure design It does not constitute a detailed design report for the proposed development

It should be noted at the time of the investigation, the site was occupied by a garden nursery, with buildings across the central areas of the site Therefore, access to all areas of the site was not possible and further investigation may be required to confirm ground conditions in these inaccessible areas

The merits of the available options discussed should be reviewed by the foundation/structural engineers

6 2 Proposed Development

The proposed development layout is presented on Nicol Thomas Architects drawing, 'Proposed Site Layout Plan' (ref B5350 sk01, dated 21 March 2011) The development includes 59 residential units with associated roads, car parking and garden/landscape areas

It is anticipated that construction will take place at or close to existing ground level, should this not be the case the following recommendations may need to be reviewed

6 3 Excavations

A concrete obstruction was encountered in WS5 in the southern half of the site Further underground obstructions, such as former foundations and service runs are anticipated at the site given its history and current development

Ground conditions will provide generally straight forward dig conditions for standard construction plant

Although initial short term stability has been observed as good during the excavation of the trial pits as part of the ground investigation, the soils encountered at the site are unlikely to remain stable for any length of time and as such for all excavations suitably designed trench support or battered excavations will be required

A risk assessment of the stability of any open excavation should be undertaken by a competent person, and appropriate measures adopted to ensure safe working practise in and around open excavations Further guidance on responsibilities and requirements for working near and in excavations can be obtained from the Construction Design and Management Regulations (2007)

Groundwater has not been encountered at shallow depths below the site and as such sump and pump methods of groundwater control should be adequate if required

6.4 Foundations

The appropriate foundation solution adopted for the site will not only depend on ground conditions, but also on structural loading, load distribution and the limiting criteria for movement or settlement of the buildings For this assessment it is assumed that the buildings will comprise standard residential construction for which potential settlement is to be maintained below 20mm Where the future buildings have high specification finishes and unevenly distributed loadings such that settlement, and particularly differential settlement, will need to be maintained within tight tolerances, further assessment may be required

The ground conditions encountered across the site at typical founding depths of 1 0 to 2 0m bgl generally comprise medium dense sands and gravels or soft to firm clays and silts Where encountered, the granular soils are considered suitable for supporting trench fill or strip footings and for a 0 6m wide foundation an allowable bearing capacity of 125kPa should be available, whilst maintaining settlement below 25mm

The soft to firm clays and silts however are not considered suitable for the adoption of trench fill or strip foundations without unacceptable settlement (i e greater than 25mm) occurring In these locations, raft foundations could be adopted founding at a depth of 0 50 to 0 75m within the natural soils, where allowable bearing capacities of 50kPa can be achieved Alternatively some form of ground improvement, such as vibro-stone columns, could be adopted Discussions with a ground improvement specialist is recommended to confirm the suitability of the soils, but at this time allowable bearing capacities in the order of 115-125kPa are anticipated following ground improvement

Due to the variability of the soils across the site reinforcement should be considered for all foundation types

Further investigation below existing buildings will be required to confirm the ground conditions

A summary of current foundation options based on the investigation undertaken to date is presented on Figure 4

Given the presence of sands and gravels and low shrinkability soils and the proposed foundation options, swelling and shrinkage is unlikely to be an issue at the site

6 5 Ground Floor Slabs

Where traditional trench fill/strip foundations are proposed, following thorough rolling of the formation it is anticipated that ground bearing cast in situ concrete slabs should be suitable for ground floors, where constructed on the natural ground

Based on NHBC guidance, suspended ground floors should be adopted where made ground or fill in excess of 600mm is to remain below them and this will be the case across the western, northern and parts of the eastern site area

Where vibrotreatment is considered as a foundation solution, based on NHBC guidance a suspended floor slab will be required

6.6 Pavement Construction

Following a nominal topsoil strip, the sub-grade will comprise variously clay, silts and granular soils

Recorded laboratory CBR values tested at optimum moisture contents vary between 17% to 53% for the granular soils The cohesive soils have not been tested, although CBR values of between 2% to 5% would be expected for the type of soils encountered

The testing of the granular soils has shown they are sensitive to relatively small increases in soil moisture content with recorded CBR values falling to 4 9% to 6 9% as a result of increases in a moisture content of between 3% and 6%

Rainfall, wetting and drying and trafficking will all impact on sub-grade performance and the CBR value adopted for design needs to consider all these influences On the basis of the above, taking into account the variability of the near surface soils an overall design CBR of 3% is recommended for the natural clay soils and 5% for the granular soils following thorough rolling of the formation

Where made ground is encountered at formation level it is recommended it be excavated to a depth of at least 0 5m below formation level (or to suitable natural soil, whichever is shallowest) sorted to remove any deleterious, oversized, or otherwise unsuitable materials and recompacted in thin layers compatible with the compaction plant employed Any deficit should be made up in suitable fill compacted as detailed above Following this treatment an overall design CBR of 2% should be available for the made ground

It is recommended that the sub-grade stiffness is tested just prior to pavement construction as the time of year, weather and site drainage will all have an effect on subgrade CBR values

Solutions such as lime/cement stabilisation should be considered to improve on sub-grades and reduce requirements for importing of capping and sub-base

6.7 Below Ground Concrete Design

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

6.8 Soakaway Potential

Soakaway testing has been undertaken at 3 no locations predetermined by the Client

Soil infiltration rates of between 3 38 x 10^{6}m/s and 4 58 x 10^{-6}m/s have been calculated from the soakaway tests It should be made aware that due to the slow rate at which the water fell, the results had to be extrapolated to achieve the 75% depth level, at which point extrapolated times of 595 to 976 minutes (i e in excess of 9 hours) were calculated

For design purposes a soil infiltration rate of 1 x 10^{-6}m/s is considered appropriate However, the soils are particularly variable across the site with differing silt and clay contents that will potentially impact on the effectiveness of the soakaway drainage As such soakaway construction in soils with high clay and silt content should be avoided On site inspection during the construction of the soakaways is recommended to avoid this

6.9 Reuse of Materials

Excavations for the foundation and service trenches will result in natural soil comprising silts, clays, sand and gravels These soils are likely to be suitable for general fill purposes Further earthworks testing would be required to determine the engineering properties of the soils if they are to be used as an engineering fill material The made ground is unlikely to be suitable for reuse as an engineered fill

7 Assessment of Soil Chemical Data

This section presents a generic quantitative risk assessment (GQRA) to identify potential sources of soil contamination that could impact on identified receptors GQRA involves a comparison of chemical laboratory results to generic assessment criteria (GAC) that are considered appropriate and relevant to the site

7 1 Guidelines

GAC used in human health risk assessments have been adopted from the following guidance

- Soil guideline values (SGV) derived using the Contaminated Land Exposure Assessment (CLEA) model and published on the Environment Agency website Currently these GAC are for arsenic, cadmium, mercury, nickel, selenium, BTEX compounds and phenols The new SGV's do not differentiate between *'with'* and *'without'* plant uptake For the purpose of the GQRA the term SGV is taken to mean GAC

- GAC published jointly by LQM and the Chartered Institute of Environmental Health (LQM/CIEH 2009) Currently these are for TPH aromatic/aliphatics, polyaromatic hydrocarbons, chlorophenols, chlorinated solvents and certain metals GAC for TPH and PAH compounds are soil organic matter dependent (where SOM was not determined a value of 1% is assumed)

- GAC published jointly by the Environmental Industries Commission, Association of Geotechnical and Geoenvironmental Specialists (AGS) and Contaminated Land Applications in Real Environments for a range of volatile organic compounds and certain metals (EIC/AGS/CL AIRE 2009)

- For cyanide, which is commonly included in the testing of contaminated land samples, there is currently no accepted GAC In the absence of alternative guidance for cyanide, MLME has used a Dutch Invention Value (DIV) of 50mg kg^{-1} (VROM 2000)

A full list of GAC used in the assessment is presented in Appendix G

Risks to water supply pipes have been assessed using guidance published by UKWIR The guidance provides threshold concentrations above which organic compounds can permeate water supply pipes, impact on their construction and cause a water quality issue for consumers Previous guidance from WRAS has been withdrawn but may still be in use by certain water supply companies

Potential risks to plant life, such as for proposed landscaping, are assessed through BS3882 2007 (BSI 2007) This standard sets out the threshold values in soil above which phytotoxic effects can occur from the metals copper, nickel and zinc

7 2 Risks to Human Health

The site under development is for housing which, for the purpose of human health risk assessment, is considered to be a residential land use To consider the impact on human health from soil contaminants, a GQRA has been undertaken and is presented below

Table 7 1 below provides a summary of the contaminant concentrations recorded above their respective GAC Results below GAC are not presented in the table and no further assessment of these contaminants is undertaken

Table 7.1 Soil Test Results Exceeding Human Health GAC

Compound	GAC	Min	Max	Location Exceeding (location, depth, conc, soil)
Lead	450	14	470	WS2, 0 5m, 470, MG
Benzo[a]pyrene	0 83	<0 1	2 3	WS2, 0 5m, 2 3, MG

All concentrations in mg kg ^{1}
MG denotes Made Ground

In addition to the above, four samples of made ground were tested for asbestos fibres No asbestos fibres were detected in any of these samples

7 3 Risks to Water Supply

Four of the five tests for PAH compounds recorded total PAH at levels above the threshold values (TVs) for organic compounds listed in the UKWIR guidance

It should be noted that TVs are for use by designers in the selection of appropriate pipe materials Exceedance of a TV indicates only that there could be a 'water quality issue' TVs are generally protective of taste and odour quality of water in plastic water pipes and only TVs for benzene and MTBE are protective of human health

Table 7 2 Soil Test Results Exceeding Water Supply TV

Compound	TV	Min	Max	Location Exceeding (location, depth, conc, soil)
Total PAH	0 5	<2	32	WS2, 0 5m, 32, MG WS5a, 0 4m, 5 6, MG TP7, 0 4m, 8 6, MG TP8, 0 5m, 2 9, MG

All concentrations in mg kg ^{1}
MG denotes Made Ground

7 4 Risks to Plant Life

Samples of the made ground in 3 No locations were found to contain potentially phytotoxic concentrations of metal compounds

Table 7 2 Soil Test Results Exceeding Water Supply TV

Compound	TV	Min	Max	Location Exceeding (location, depth, conc, soil)
Copper	200	7 7	360	TP8, 0 5m, 360, MG
Zinc	300	40	1000	WS2, 0 5m, 1000, MG WS5a, 0 4m, 520, MG TP8, 0 5m, 880, MG

All concentrations in mg kg ^{1}
MG denotes Made Ground

7 5 Nature and Distribution of Soil Contamination

Lead and benzo[a]pyrene (BaP) compounds were recorded above the human health generic assessment criteria in a sample of made ground recovered from WS2 at a depth of 0 5m towards the eastern end of the site The level of contamination encountered is localised to one specific location on the site and is not considered significant

PAH compounds have been recorded at concentrations above the water supply pipe TVs in samples of made ground recovered from across the site area

Copper and zinc has been recorded above phytotoxic guideline values in the made ground in the south and east areas of the site

8 Assessment of Soil Leachate and Groundwater Chemical Data

The desk study undertaken by MLME did not identify any significant potential sources of contamination and the soil contamination testing undertaken as part of this assessment similarly did not record compounds at levels that could potentially leach into and impact controlled waters Furthermore groundwater was not encountered during the investigation

Controlled waters are not considered at risk and as such soil leachate analysis was not undertaken

9 Assessment of Gas/Organic Vapour Data

This section presents a GQRA to identify potential sources of gas and organic vapour in the ground that could impact on human health

9 1 Guidelines

The proposed development is low-rise residential and the potential impact of ground gas on development is assessed through the British Standard BS8485 (BSI 2007b) and/or the Traffic Light designations published by the National House Building Council (NHBC 2007)

A generic quantitative risk assessment for organic vapour (v-GQRA) has been undertaken in accordance with the CIRIA VOC Handbook C682 (CIRIA 2009) to consider the potential impact on human health from the indoor inhalation of vapour generated by organic compounds in soil For TPH, the LQM GAC are considered to be protective of human health from the indoor inhalation of organic vapour

9 2 Observed Sources of Gas and Organic Vapour

Made ground was encountered across the majority of the site to depths of 1 3m and locally contained organic deposits, representing a potential source of ground gas

9 3 Screening Assessment - Gas

Table 9 1 presents the maximum gas concentrations recorded between 14 June and 23 June 2011

Table 9.1 Site Maximum gas concentrations and flow rate

Parameter	Site maximum	Gas screening value
Methane	0 1 %	0 0001 l hr^{-1}
Carbon dioxide	1 6 %	0 0016 l hr^{-1}
Flow rate	0 1 l hr^{-1}	-

The screening assessment places the site in a NHBC Traffic Light Green condition for low rise housing with a 150mm ventilated underfloor void

9 4 Screening Assessment – Organic Vapour

Based on soil test results for TPH and VOC compounds, v-GAC for compounds in soil are not exceeded and indicates that no risk to human health exists for the indoor inhalation of vapour generated by organic compounds in soil

The conclusion of the v-QRA is supported by the results of monitoring that indicates VOCs were not present in the boreholes either during the fieldwork or on return visits

9.5 Nature and Distribution of Gas/Vapour Contamination

Significant gas or vapour contamination has not been recorded at the site

The gas screening assessment places the site in the NHBC traffic light class of green

10 Contaminated Land Risk Assessment and Conceptual Site Model

10.1 General Approach

In the UK, the assessment of risk from contamination follows the source-pathway-target approach If one of these three elements is absent it is considered that there is no risk of harm If, however, there is considered to be a linkage between source and receptor then a risk-based approach is used to assess the significance or impact of the potential SPR-linkage

Source – Contamination that has the potential to impact on human health and/or the environment Identification of sources of contamination will normally involve generic quantitative risk assessment (GQRA), which compares test results with current guidelines GQRA was undertaken in the preceding sections of the report

Pathway – The route by which a receptor may come into contact with the source

Receptor – Receptors are typically humans or the environment (e g water resources) that could be affected by a source contamination

10 2 Review of Sources of Contamination

Based on the GQRA presented in the previous sections, sources of contamination that could impact on receptors have been identified and are summarised in Table 10 1 below

Table 10 1 Identified Sources of Contamination

Receptor type	Source
Human Health	Lead and BaP in made ground
Construction workers and services maintenance staff	Lead and BaP in made ground
Future plant life	Copper and zinc in made ground
Water supply pipes	PAH compounds in made ground

10 3 Review of Potential Exposure Pathways

Table 10 2 below presents a review of all possible pathways that could exist at the site

Table 10 2 Potential exposure pathways and receptors

Receptor	Pathway	Present (YES/NO)	Notes
Human Health			
Future site users	Dermal contact, ingestion or inhalation of soil and soil dust	YES	Private garden and amenity areas are proposed where exposure to contaminated soil could occur
	Migration in permeable strata and inhalation of gas	NO	Site designated Green (NHBC), for which gas protection is not required
	Migration in permeable strata, accumulation and risk of explosion	NO	
	Migration in permeable strata and inhalation of organic vapour	NO	Organic vapours not recorded

Adjacent site users	Ingestion/inhalation of windblown dust	YES	Housing development adjacent to the west of the site
Construction workers and services maintenance staff	Dermal contact, ingestion or inhalation of soil and soil dust	YES	Construction and services maintenance workers could be exposed to contamination when working in excavations etc
Development			
Future plant life	Plant uptake in garden or landscape area	YES	Garden and landscape areas are proposed where exposure to phytotoxins have been recorded
Water supply pipes	Contact with contaminated material	YES	Water supply pipes will be constructed in the made ground
Buildings and construction materials	Contact with contaminated material	YES	Buildings, foundations and services will be constructed on site
Environment			
Surface water	Surface runoff	NO	No surface water features encountered within close proximity to the site
	Groundwater movement	NO	No surface water features encountered within close proximity to the site
Groundwater Chalk	Leaching from soil	NO	Groundwater not encountered within top 5m at the site
	Deep foundations breaching permeable layer	NO	Groundwater not encountered within top 5m at the site

10 4 Potentially Complete SPR-Linkages

Based on the sources, pathways and receptors identified above, table 10 3 below summarises all complete pollutant linkages for the site and identifies the level of risk from each and whether remediation is required based on the level of risk Risk definitions are provided in Appendix H

Table 10.3 Complete SPR-Linkages

Source	Pathway	Receptor	Risk Level
Lead and BaP compounds encountered at the eastern end of the site in the made ground	Ingestion, dermal contact and inhalation	Future site user	Moderate
		Construction Workers	Moderate
Copper and zinc in the made ground locally in the eastern and southern areas of the site	Plant uptake in garden or landscape area	Future plant life	Low
PAH compounds encountered across site area	Contact with contaminated material	Water supply pipes	Moderate

11 Remediation and Risk Management

11 1 General

This assessment has identified potential hazards at the site with possible SPR-linkages, which could represent potentially unacceptable risks to human health and future plant growth

Mitigation of the SPR-linkages summarised in Table 10 3 is recommended to reduce the impact of contamination on site occupants

The following is for guidance only and does not represent final design of a remediation scheme Remediation schemes normally require Local Authority and/or Environment Agency approval of a remediation strategy and verification plan All remediation work should be designed, overseen and validated by environmental consultants

11.2 Soil Remediation

Limited and localised remedial action on soil contamination is advised, based on current findings

Table 11.1 Summary of Recommended Remediation or Mitigation

Aspect	Description
Gardens and soft landscaping	Capping with clean cover soils Recommended minimum thickness is 600mm in domestic gardens and 450mm in amenity or landscape areas The thickness of topsoil, if required, is normally in addition to the thickness of capping
Water supply pipes	Protected or upgraded water supply pipes in line with local water supply company requirements
Services generally	Bedding, backfill and surround to all services constructed in clean imported materials such that installation of new pipework and future maintenance is in clean soil

The choice of excavation or capping depends primarily on anticipated development levels Wherever excavations to facilitate construction take place, it is possible that soil contamination will be removed anyway and where site levels are raised, capping will be introduced

Remediation is not required beneath buildings or hardstanding as these break the pathway between source and receptor

11 3 Groundwater Remediation

Groundwater remediation is not required

11.4 Gas and Organic Vapour Protection

Gas protection is not required

11.5 Construction Health and Safety

It is recommended that construction workers adopt appropriate personal hygiene precautions at the site, particularly hand washing, wearing of gloves, avoidance of hand to mouth contact and use of designated 'clean' and 'dirty' areas

Handling of soil and water should be minimised, and dust suppression measures should be implemented Soils should be dampened during excavation to limit dust and handling and lorries suitably sheeted

Gas and vapour monitoring should be carried out before man entry into deep excavations or confined spaces

These precautions are considered to be industry standard when developing contaminated land and reference can be made to the HSE document HSG66 *Protection of workers and the general public during development of contaminated land* (HSE 1991) for further information

11.6 Additional Investigation and Assessment

No further investigations and assessments are considered to be required with respect to contamination However discussions with the local water authority are required to confirm the water supply pipe requirements in view of the findings of this report

11.7 Excavation and Disposal of Arisings

Excavation for foundations, services etc will result in the generation of soil which it is anticipated will be classified as inert for off-site disposal purposes

11.8 Material Re-Use

The excavated soils are suitable for on site re-use provided they do not offer risks to human health or the environment Examples of soil use are their inclusion in raised landscaped forms or raising site levels beneath capping, buildings and roads/paving Costs for import of material will be more cost effective than export

11 9 Remediation Documentation

Based on the findings and recommendations of this report, localised remediation will be required and as such a remediation strategy document will be required as part of any planning submission

12 Summary and Recommendations

12.1 Summary

The site is underlain by localised made ground to 1 30m bgl, over medium dense sands and soft to firm clay and silt

Buried construction has been encountered in the southern site area and is should be considered given the presence of existing construction on site

Strip/trench fill foundations should be suitable founding into the granular soils, however the soft to firm clays will not be suitable as a founding stratum without unacceptable settlement (i e greater than 20mm) occurring Raft foundations are a possible alternative for founding on to the soft to firm clay and silt soils or ground improvement

The soils are generally granular or exhibit low shrinkability and swelling and shrinkage is unlikely to be an issue

Soakaway tests have indicated that soakaway drainage can be adopted at the site, constructed in the granular soil A design soil infiltration rate of 1 x 10^{-6}m/s has been determined

Excavated natural soils should be suitable for re-use at the site, excavated made ground is not Excavated soils disposed of off-site are likely to be classified as inert

There is limited contamination of the made ground with lead and benzo[a]pyrene

There is no risk of contamination being leached from the soils at the site into the groundwater

There is no contamination of the groundwater

There is no gas/organic vapours at the site

12.2 Recommendations

The granular soils should be suitable as a founding stratum and an allowable net bearing capacity of 125kPa should be available for a strip/trench fill foundations up to 0 6m wide These values should result in settlements of not more than 20mm, keeping differential settlements within acceptable limits

As an alternative, a raft foundation could be adopted, with an allowable net bearing capacity of 50kPa, which is likely to result in settlements of not more than 20mm, keeping differential settlements within acceptable limits

Reinforcement should be considered for all shallow foundations due to variability of the soils encountered at the site

All foundations should be carried below the made ground and any existing buried construction should be fully penetrated by, and broken away from new foundations

Ground floors may generally be constructed as ground bearing slabs If rafts are adopted, the ground floor will be integral with the raft Locally ground floors will need to be suspended or placed on an increased thickness of granular fill due to the thickness of made ground, or where buildings are within the influencing distance of trees Buried construction should be broken away from the slab to avoid interaction

Following the topsoil and surfacing strip an overall design CBR of 2% should be available on the made ground following treatment, 3% on the natural fine soils or 5% on the natural coarse soils, following proof rolling of the formation

The soils at the site fall within ACEC Class AC1 with a corresponding Design Sulphate Class of DS1

Remediation is required to protect human health in the residential areas, but not in the commercial areas of the site Protection against hazardous ground gas is considered unnecessary Protection of water supplies is required

Recommended remedial measures include

- Capping of gardens/soft landscaped areas
- Excavation and removal of hotspots
- Installation of services in corridors of clean soil
- Establishment of an asbestos management protocol

Further Investigation

Further investigation is recommended across the inaccessible areas of the site to assess potential levels of contamination and soil conditions for foundation design

13 Land Remediation Relief

13 1 Outline

Land Remediation Relief (LRR) is a 150% credit on corporation tax claimable by certain corporate bodies (excluding public bodies) against qualifying expenditure when undertaking investigation and remediation of potentially contaminated or derelict sites It is to be reviewed and may be cancelled as part of the government's spending cuts, but at the time of writing this report it is in place and can be claimed for qualifying expenditure

13 2 Qualifying Expenditure

The following table lists those items that might be expected to be considered as qualifying expenditure under the LRR scheme, with an explanation of which (if any) may qualify on this site

Expenditure	Qualifying	Reasoning
Ground investigation*	Yes	Contamination at levels in excess of GAC recorded
Contamination laboratory analysis	Yes	Contamination at levels in excess of GAC recorded
Contamination assessment and reporting**	Yes	Contamination at levels in excess of GAC recorded
Remediation Method Statement	Yes	Remediation is required
Remediation (soil)	Yes	Remediation is required
Remediation (groundwater)	No	Remediation is not required
Remediation (gas)	No	Remediation/protective measures are not required

* A proportion of the ground investigation fieldwork (attributable to contamination investigation)

** All contamination assessment work (except the desk study) and the proportion of the report related to contamination should qualify

The identification of asbestos containing materials (ACMs) in the buildings on this site is outside the scope of this report However, should a subsequent asbestos survey identify ACMs requiring removal, this should count as qualifying expenditure

The identification of Japanese Knotweed is outside the scope of this report However, should this plant be noted on site, the cost of in situ treatment (but not of excavation and removal to landfill) is qualifying expenditure

14 References

Association of Geotechnical and Geoenvironmental Specialists (2004) A Clients Guide to Site Investigations

Association of Geotechnical and Geoenvironmental Specialists (2006) AGS Guidelines for Good Practise in Site Investigations

Association of Geotechnical and Geoenvironmental Specialists (1999) Code of Conduct for Site Investigations

Association of Geotechnical and Geoenvironmental Specialists (2005) Management of Risk Associated with the Preparation of Ground Reports

Association of Geotechnical and Geoenvironmental Specialists (2005) Guidelines for the Preparation of the Ground Report

Association of Geotechnical and Geoenvironmental Specialists (2000) Guidelines for Combined Geoenvironmental and Geotechnical Investigations

British Geological Survey (1996) 1 50,000 Solid and drift Geology Map Sheet 257, Romford

British Standards Institution (2004) BS EN 1997-1 2004 Eurocode 7 Geotechnical Design – Part 1 General Rules

British Standards Institution BS530 1999 Code of practice for site investigation, Incorporating Amendment No 1 (2007)

British Standards Institution (1990) BS1377 Methods of test for soils for civil engineering purposes Parts 1-9

British Standards Institution (2007a) BS3882 2007 Specification for topsoil

British Standards Institution (2007b) BS8485 2007 Code of practice for the characterization and remediation from ground gas in affected developments

Building Research Establishment (2003) BRE Digest 365 Soakaway Design

Building Research Establishment (1993) BRE report 240 – Low Rise Buildings on Shrinkable Clay Soils Part 1

Building Research Establishment (2005) BRE Special Digest 1 Concrete in aggressive ground

CIRIA Report C574 Engineering in Chalk 2002

CIRIA (2009) The VOCs Handbook Investigating, assessing and managing risks from inhalation of VOCs at land affected by contamination Report C682

Defra & Environment Agency (2004) Model procedures for the management of contaminated land Contaminated Land Report 11

Defra & Environment Agency Environment Agency Contaminated Land Exposure Assessment Model (CLEA) Soil guideline value (SGV) series reports (downloaded from the EA website and current at the time of writing)

Environment Agency (2005) UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils Science Report P5-080/TR3

Environment Agency (2006) Guidance for waste destined for disposal in landfills Interpretation of the waste acceptance requirements of the Landfill (England and Wales) Regulations 2002 (as amended)

Environment Agency (2007) Treatment of non-hazardous wastes for landfill

Environment Industries Commission, Association of Geotechnical and Geoenvironmental Specialists and Contaminated Land Applications in Real Environments (December 2009) The Soil Generic Assessment Criteria for Human Health Risk Assessment

European Community (1976) Environmental Quality Standards for List 1 and List 2 Dangerous Substances (EC Directive 76/464/EEC)

Hansen, J Brinch, A General formula for bearing capacity Danish Geotechnical Institute Bulletin No 11 (1961), also a revised extended formula for bearing capacity, Danish Geotechnical Institute Bulletin No 28 (1968), and a Code of Practise for Foundation Engineering, Danish Geotechnical Institute Bulletin No 32 (1978)

Health & Safety Executive (1991) Protection of workers and the general public during development of contaminated land Report HSG66

Land Quality Management Ltd and Chartered Institute of Environmental Health (2009) Generic assessment criteria for human health risk assessment 2nd Edition

MLM Environmental (2011) Preliminary Contaminated Land Risk Assessment Proposed Residential Property, Freeman Way, Hornchuch

National House Building Council (2007) Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present

National House Building Council (2008) Part 4 Foundations, Chapter 4 2, Building Near Trees

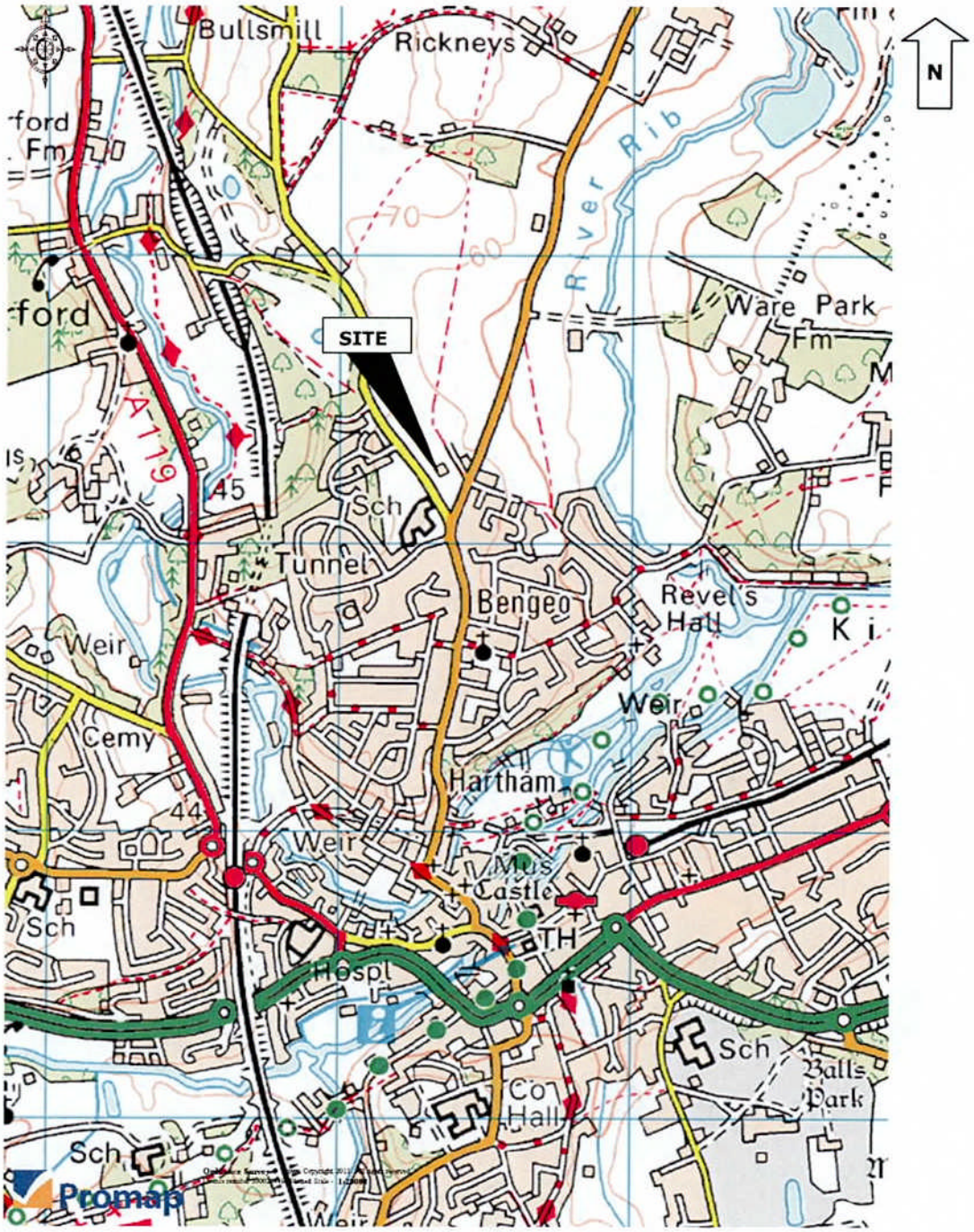
Peck, R B Hanson, W E and Thornburn, T H Foundation Engineering 2nd Edition, John Wiley, New York, 1967

Skempton A W, The Bearing capacity of Clays, Building Research Congress, Div I, 180 (1951)

Stroud, M A The standard penetration test in insensitive clays and soft rocks, Proceedings of the European Symposium on Penetration Testing in the UK 1988

TRRL laboratory report 1132 The Structural Design of Bituminous Roads (1984)

UK Water Industry Research (2010) Guidance for the selection of water supply pipes to be used brownfield sites Report 10/WM/03/21



MLM www.mlm.uk.com	Sacombe Road, Hertford **Site Location Plan**	Job No. 723463 Figure No. **1**

LEGEND

TP1 TRIAL PIT LOCATION

WS1 WINDOW SAMPLE BOREHOLE LOCATION

NOTES

(w) DENOTES WELL INSTALLATION

(SA) DENOTES SOAKAWAY TEST LOCATION

NOTES

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Drawing Status: INFORMATION

Client: BOVIS HOMES LIMITED

Project: SACOMBE ROAD
HERTFORD

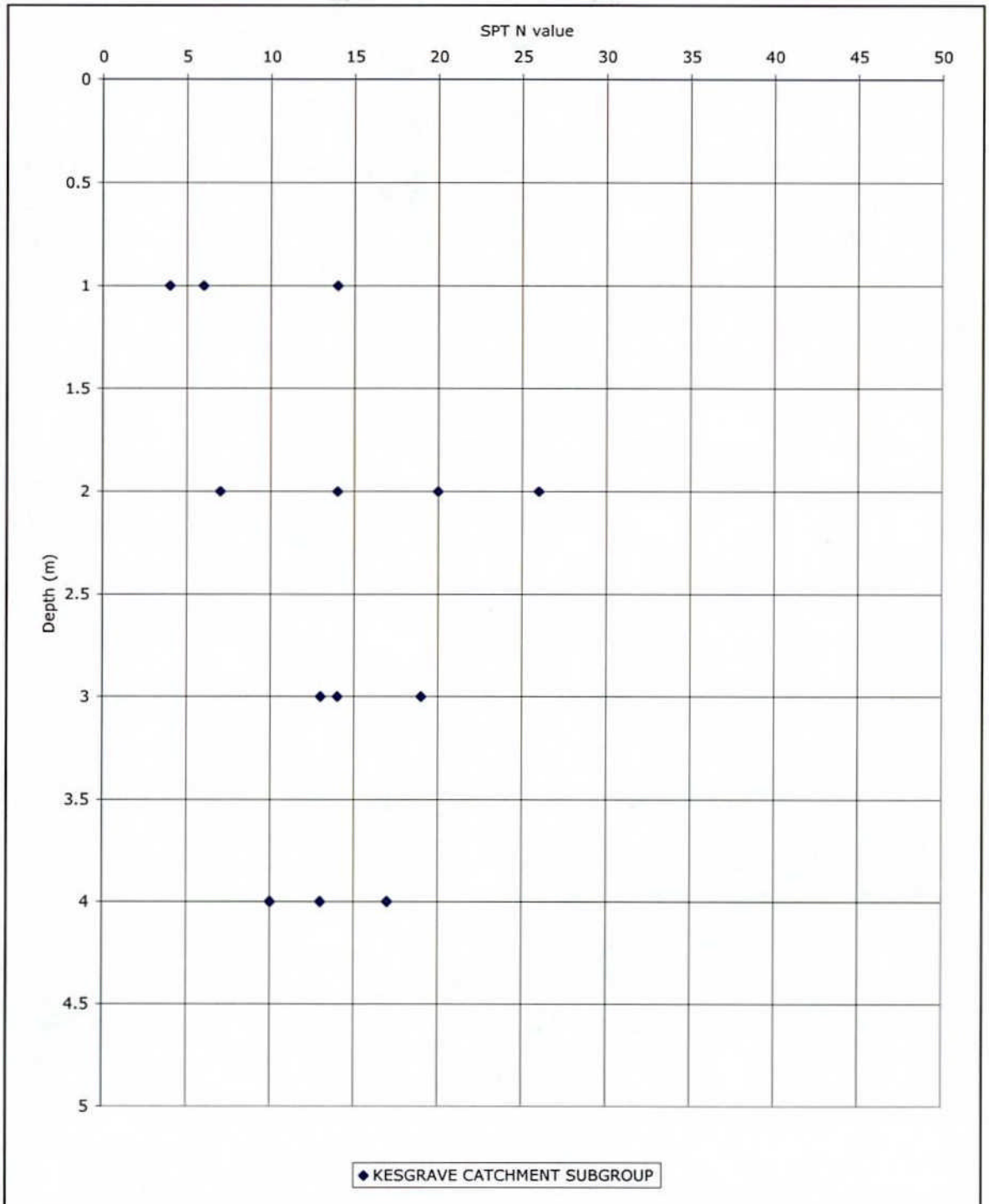
Drg Title: EXPLORATORY HOLE LOCATION PLAN

Drawn/Design	Checked	Approved	Date
HCR	JEM	JEM	JUN '11

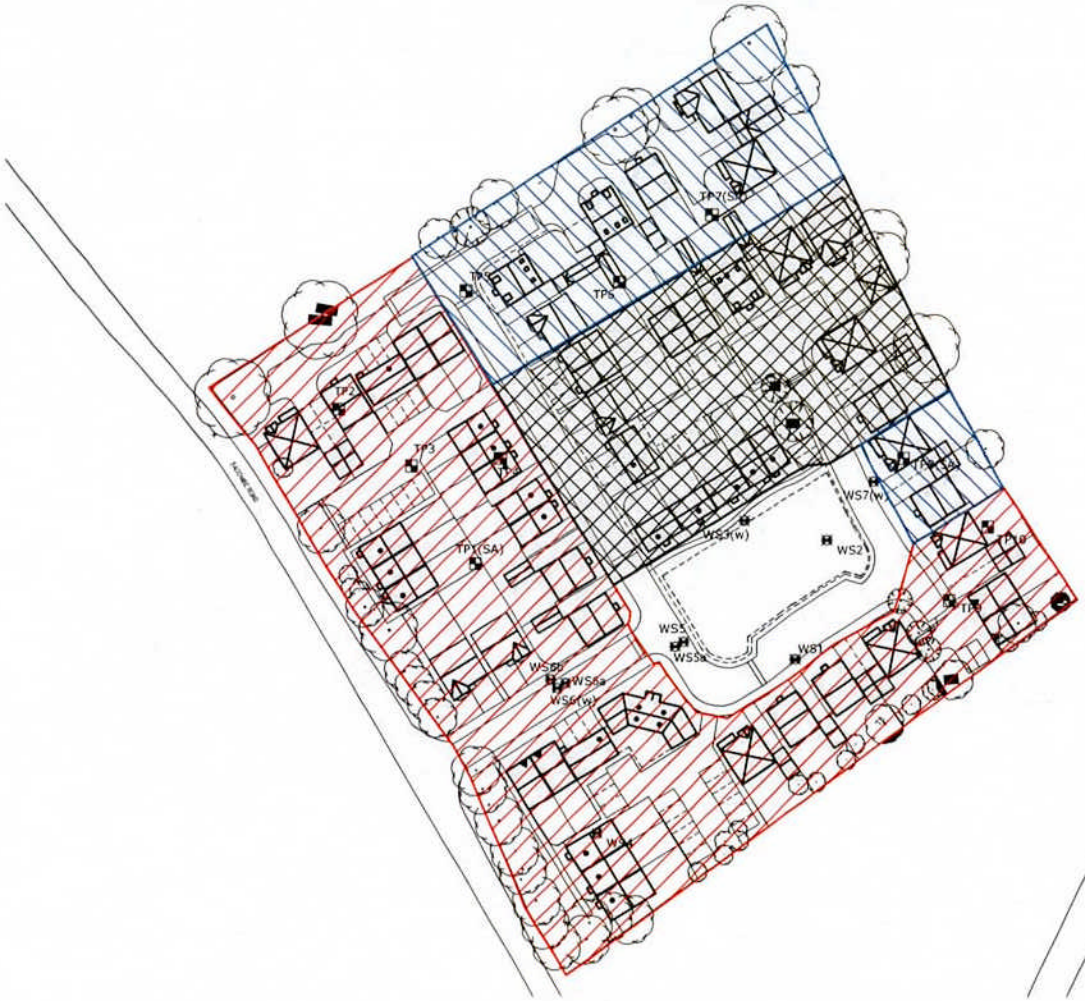
Scales: 1:1000 @ A3

Drg No.: FIGURE 2

Rev: .



MLM www.mlm.uk.com	Project Sacombe Road	Job No. 723463
	SPT N Value Depth Plot - Geology	Figure No. **3**



LEGEND

- TRENCH FILL/STRIP FOUNDATIONS
- RAFT FOUNDATIONS OR GROUND IMPROVEMENT
- FURTHER INVESTIGATION REQUIRED

NOTES

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Rev	Date	Description	Made	Ckd
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Drawing Status: INFORMATION

Client: BOVIS HOMES LIMITED

Project: SACOMBE ROAD HERTFORD

Drg Title: FOUNDATION OPTIONS

Drawn/Design	Checked	Approved	Date
HCR	JEM	JEM	JUN '11

Scales: 1:1000 @ A3

Drg No.: FIGURE 4

Rev: .

Appendices

Appendix A Trial Pit Logs
Appendix B: Windowless Sample Logs
Appendix C Soakaway Test Results
Appendix D. Results of Gas/Organic Vapour and Groundwater Monitoring
Appendix E Results of Chemical Analysis
Appendix F: Results of Geotechnical Analysis
Appendix G Assessment Criteria
Appendix H: Risk Rating

Project Sacombe Road
Location Hertford

Project ID 723463
Client Bovis Homes Limited
Project Engineer J Monk
Logged by H Carter / P Mistry

TRIAL PIT TP1

Date of Excavation 07/06/2011
Backfill Date 07/06/2011
Ground Level (mAOD) -
Coordinates -

Status

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IN SITU TESTS/SAMPLING				STRATA						
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
							Brown slightly silty very sandy GRAVEL Gravel is fine to coarse sub-rounded to angular flint, concrete and ash Occasional roots and rootlets (MADE GROUND)	0 40	Dry
					0 40		Dark grey gravelly very clayey SAND Gravel is fine to coarse rounded to angular of flint (KESGRAVE CATCHMENT SUBGROUP)	0 20	
1 05	B 1				0 60		Brownish orange gravelly to very gravelly very silty SAND Gravel is fine to coarse subrounded to angular flint Occasional cobbles <5% maximum size 80mm (KESGRAVE CATCHMENT SUBGROUP)	1 50	
					2 10		*End of Trial Pit at 2 10 m*		

Remarks
1 Soakaway test carried out between 0 9m and 2 10m bgl
2 General stability good, with only small collapse of walls during filling of pit with water

Legend
▽ Water Strike
▼ Water Standing
D Small Disturbed
B Bulk Sample
J Jar Sample
W Water Sample
E Environmental Sample (1 tub & jar)

Stability Good
Plant Used JCB 3CX
Length 2 10m Width 0 70m
Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	TRIAL PIT TP2	MLM
Location	Hertford	Date of Excavation 07/06/2011	www mlm uk com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm uk com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA						
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
							Orange SAND and GRAVEL Gravel is fine to coarse rounded to angular of flint Occasional roots and rootlets (MADE GROUND)	1 00	Dry
1 00	B 1				1 00		Orange gravelly SAND with silt bands Gravel is fine to coarse sub-angular to rounded of flint (KESGRAVE CATCHMENT SUBGROUP)	0 80	
1 80	D 1 E				1 80		Orange SAND and GRAVEL Gravel is fine to coarse rounded to angular of flint (KESGRAVE CATCHMENT SUBGROUP)	0 80	
					2 60		*End of Trial Pit at 2 60 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
▽ Water Strike
▼ Water Standing
D Small Disturbed
B Bulk Sample
J Jar Sample
W Water Sample
E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -
Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	**TRIAL PIT TP3**	MLM
Location	Hertford	Date of Excavation 07/06/2011	www.mlm.uk.com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm.uk.com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0.10	E 1						Dark brown gravelly SAND Gravel is medium to coarse rounded to angular coarse of flint and chalk Plastic and small pipe found at 0.2m bgl (MADE GROUND)	0.60	Dry
					0.60		Orangey brown gravelly SAND Gravel is medium to coarse of flint (KESGRAVE CATCHMENT SUBGROUP)	1.80	
2.50	D 2				2.40		Orange gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional flint cobbles (KESGRAVE CATCHMENT SUBGROUP)	0.40	
					2.80		*End of Trial Pit at 2.80 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	TRIAL PIT TP4	MLM
Location	Hertford	Date of Excavation 07/06/2011	www mlm uk com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm uk com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0 10	D 1						Orange SAND and GRAVEL Gravel is fine to coarse rounded to angular of flint Occasional roots and rootlets (MADE GROUND)	0 55	Dry
					0 55		Orange gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional flint cobbles (KESGRAVE CATCHMENT SUBGROUP)	0 55	
1 20	E 2				1 10		Orange gravelly SAND with silt lenses Gravel is fine to coarse sub-angular to rounded of flint (KESGRAVE CATCHMENT SUBGROUP)	0 30	
1 40	B 1				1 40		Orange brown gravelly coarse SAND Gravel is fine to coarse sub-angular to rounded of flint (KESGRAVE CATCHMENT SUBGROUP)	1 60	
					3 00		*End of Trial Pit at 3 00 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

TRIAL PIT TP5

Date of Excavation	07/06/2011
Backfill Date	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING				STRATA						
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0.10	E 1						Dark brown very gravelly SAND Gravel is fine to coarse sub-rounded to sub angular flint with rare metal Some roots and rootlets present (MADE GROUND)	0.50	Dry
					0.5 0.50		Orange slightly gravelly slightly sandy silty CLAY (KESGRAVE CATCHMENT SUBGROUP)		
1.00	B 1				1.0			1.50	
					1.5				
					2.0 2.00		Soft orangey brown sandy gravelly CLAY Gravel is fine to coarse sub-angular to rounded of flint (KESGRAVE CATCHMENT SUBGROUP)	0.30	
2.30	E 2				2.30		*End of Trial Pit at 2.30 m*		
					2.5				
					3.0				
					3.5				

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
▽ Water Strike
▼ Water Standing
D Small Disturbed
B Bulk Sample
J Jar Sample
W Water Sample
E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

TRIAL PIT TP6

Date of Excavation	07/06/2011
Backfill Date	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING				STRATA						
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0.05	E 1				0.05		Orange brown gravelly coarse SAND Gravel is fine to coarse sub-angular to rounded of flint Occasional roots and rootlets (MADE GROUND)	0.05	Dry
							Dark brown gravelly SAND Gravel is medium to coarse rounded to angular coarse of flint and chalk Metallic pipe found at 0.2m bgl (MADE GROUND)	0.45	
					0.50		Firm dark greyish brown slightly gravelly sandy clayey SILT Gravel is fine to medium angular to sub-rounded of flint (KESGRAVE CATCHMENT SUBGROUP)	0.40	
					0.90		Orange gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional flint cobbles (KESGRAVE CATCHMENT SUBGROUP)	0.60	
					1.50		Firm brown silty CLAY (KESGRAVE CATCHMENT SUBGROUP)	1.20	
2.30	B 1								
					2.70		*End of Trial Pit at 2.70 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	TRIAL PIT TP7	MLM
Location	Hertford	Date of Excavation 07/06/2011	www mlm uk com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm uk com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0 05	E 1						Brown SAND and fine to coarse sub-angular to rounded flint, ceramic and whole and broken brick GRAVEL and COBBLES (MADE GROUND)	0 90	Dry
					0 90		Orange silty SAND and fine to coarse sub-angular to rounded flint GRAVEL and COBBLES, with lenses of firm sandy gravelly CLAY from 1 5m bgl (KESGRAVE CATCHMENT SUBGROUP)	1 00	
1 60	E 2				1 90		Orange clayey slightly gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional flint cobbles (KESGRAVE CATCHMENT SUBGROUP)	0 30	
2 20	B 1				2 20		*End of Trial Pit at 2 70 m*		

Remarks
1 Soakaway carried out between 0 96m and 2 10m bgl
2 General stability good, with only small collapse of walls during filling pit with water

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability Good
Plant Used JCB 3CX
Length 2 10m Width 0 70m

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

TRIAL PIT TP8

Date of Excavation	07/06/2011
Backfill Date	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0.10	E 1				0.20		Orange-brown SAND and fine to coarse sub-angular to rounded flint and brick GRAVEL and COBBLES (MADE GROUND)	0.20	Dry
0.50	E 2				0.5		Grey-black and grey-brown organic SAND and fine to coarse angular to rounded flint, brick (whole and broken) clinker, decaying and burnt plant matter, glass and ceramic GRAVEL and COBBLES with an organic odour (MADE GROUND)	1.10	
1.50	D 1				1.30		Orange-brown very silty gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)	0.80	
					2.10		*End of Trial Pit at 2.10 m*		

Remarks
1 Soakaway test carried out between 0.81m and 2.10m bgl
2 General stability good, with only small collapse of walls during filling of pit with water

Legend
▽ Water Strike
▼ Water Standing
D Small Disturbed
B Bulk Sample
J Jar Sample
W Water Sample
E Environmental Sample (1 tub & jar)

Stability Good
Plant Used JCB 3CX
Length 1.70m Width 0.50m
Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	TRIAL PIT TP9	MLM
Location	Hertford	Date of Excavation 07/06/2011	www mlm uk com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm uk com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA						
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0 10	E 1						Orange gravelly SAND Gravel is fine to coarse sub-angular to rounded flint with occasional flint cobbles (KESGRAVE CATCHMENT SUBGROUP)	0 25	Dry
					0 25		Orange SAND and fine to coarse sub-angular to rounded flint GRAVEL and COBBLES (KESGRAVE CATCHMENT SUBGROUP)	0 25	
					0 50		Orange slightly gravelly to gravelly SAND Gravel is fine to coarse sub-angular to rounded flint (KESGRAVE CATCHMENT SUBGROUP)	0 30	
					0 80		Orange silty gravelly SAND with occasional silt lenses Gravel is fine to coarse sub-angular to rounded flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)	1 10	
1 00	B 1				1 90		Orange slightly damp slightly gravelly medium to coarse SAND Gravel is fine to coarse sub-angular to rounded flint (KESGRAVE CATCHMENT SUBGROUP)	1 20	
					3 10		*End of Trial Pit at 3 10 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road	**TRIAL PIT TP10**	MLM
Location	Hertford	Date of Excavation 07/06/2011	www mlm uk com
Project ID	723463	Backfill Date 07/06/2011	MLM Environmental IQ Cambridge Cambridge Cambridgeshire CB25 9TL Tel 01223 815600 Fax 01223 815630 contact@mlm uk com
Client	Bovis Homes Limited	Ground Level (mAOD) -	
Project Engineer	J Monk	Coordinates -	
Logged by	H Carter / P Mistry	Status	

IN SITU TESTS/SAMPLING				STRATA					
Depth (m)	Sample Ref	Organic Vapour (ppm)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Water (m)
0 30	E 1				0 5		Orange SAND and fine to coarse sub-angular to rounded flint GRAVEL and COBBLES (KESGRAVE CATCHMENT SUBGROUP)	0 60	Dry
1 00	E 2				0 60 1 0 1 5		Orange silty slightly gravelly to very gravelly SAND with cobbles from 1 5m bgl Becoming damp from approximately 2 00m bgl (KESGRAVE CATCHMENT SUBGROUP)	2 40	
3 00	B 1				2 0 2 5 3 0 3 5	3 00	*End of Trial Pit at 3 00 m*		

Remarks
1 Stability is generally good
2 Trial pit back filled with arisings

Legend
- ▽ Water Strike
- ▼ Water Standing
- D Small Disturbed
- B Bulk Sample
- J Jar Sample
- W Water Sample
- E Environmental Sample (1 tub & jar)

Stability
Plant Used JCB 3CX
Length - Width -

Notes
1 Shear strengths measured using Pilcon Hand Shear Vane
2 Organic Vapour readings from soil samples recorded using Photoionisation Detector

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS1

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA							
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.15		Gravel over dark grey sandy gravelly SILT Gravel is fine to medium and occasionally coarse sub-angular to sub-rounded flint and asphalt (MADE GROUND)	0.15		Dry
E1 0.40-0.40m				0.60		Grey brown silty to very silty gravelly to very gravelly SAND Gravel is fine to coarse angular to rounded flint and occasional brick (MADE GROUND)	0.45		
D1 1.00-1.00m	1.00m (C) N=14 (3 3,4,4 3 3)			1.00		Medium dense orange-brown silty SAND and fine to coarse angular to rounded flint GRAVEL and COBBLES (KESGRAVE CATCHMENT SUBGROUP)	0.80		
				1.40		Medium dense orange slightly gravelly to gravelly slightly organic SAND with rare organic matter Gravel is fine to coarse angular to rounded flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)			
	2.00m (C) N=14 (2 3 3 3 3 5)			2.00			1.60		
D2 3.00-3.00m	3.00m (C) N=13 (2 3 3 4 3 3)			3.00	3.00	Medium dense orange-brown slightly gravelly to gravelly SAND Gravel is fine to coarse angular to rounded flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)			
	4.00m (C) N=10 (2,2,3,3 2,2)			4.00			2.45		
	5.00m (C) N=11 (3 2,4 3 2,2)			5.00					
				5.45		*End of Borehole at 5.45 m*			

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Groundwater not encountered during the investigation
2 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS2

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING | STRATA

Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.15		Gravel over grey silty sandy GRAVEL. Gravel is fine to coarse flint and clinker (MADE GROUND)	0.15		Dry
E1 0.50-0.50m				0.70		Firm grey black and orange-brown mottled sandy gravelly SILT / silty SAND and GRAVEL. Gravel is fine to medium and occasionally coarse flint, clinker, ash, occasional plastic, ceramic and brick (MADE GROUND)	0.55		
E2 1.00-1.00m	1.00m (C) N=4 (1,1,1,1,1)			1.00		Soft to firm brown very sandy gravelly SILT becoming more sandy with depth. Gravel is fine to medium and occasionally coarse sub-angular to rounded flint. (KESGRAVE CATCHMENT SUBGROUP)	2.20		
D1 2.00-2.00m	2.00m (C) N=7 (1,2,2,2,2,1)			2.00					
	3.00m (C) N=25 (3,2,6,6,6,7)			2.90		Medium dense orange-brown silty SAND with occasional flint gravel (KESGRAVE CATCHMENT SUBGROUP)	0.55		
				3.00					
				3.45		*End of Borehole at 3.45 m*			
				4.00					
				5.00					

Notes

1. When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1. Groundwater not encountered during the investigation
2. Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS3

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA							
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.15		Flint gravel over sandy fine to coarse sub-angular to sub-rounded flint asphalt and concrete GRAVEL (MADE GROUND)	0.15		Dry
E1 0.30-0.30m				0.50		Firm brown and orange brown very sandy gravelly to very gravelly CLAY Gravel is fine to coarse angular to sub-rounded flint and occasional inactive rootlets (MADE GROUND)	0.35		
E2 0.60-0.60m				0.70		Soft to firm grey-brown slightly gravelly very sandy SILT with a faint organic odour Gravel is fine to medium ash flint, occasional rare brick and inactive rootlets (MADE GROUND)	0.20		
D1 1.00-1.00m	1.00m (C) N=6 (1 1 1 1 2 2)			1.00		Firm orange-brown sandy to very sandy slightly gravelly CLAY Gravel is fine to medium sub-angular to sub-rounded flint (KESGRAVE CATCHMENT SUBGROUP)	0.90		
				1.60		Medium dense orange slightly gravelly to gravelly SAND Gravel is fine to coarse angular flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)			
D2 2.00-2.00m	2.00m (C) N=26 (5 7 7 6 7 6)			2.00			1.90		
	3.00m (C) N=19 (3 5,6 5 5 3)			3.00					
				3.50		Medium dense orange SAND with occasional flint gravel (KESGRAVE CATCHMENT SUBGROUP)			
D3 4.00-4.00m	4.00m (C) N=17 (3 5 5,4,4,4)			4.00			1.50		
				5.00		*End of Borehole at 5.00 m*			

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Groundwater not encountered during the investigation
2 Monitoring well installed

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS4

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA							
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
E1 0 50-0 50m	0 90m (C) N=50 (11 12 12 13 13 12)			0 25		Gravel over silty to very silty sandy fine to coarse concrete asphalt and flint GRAVEL (MADE GROUND)	0 25		Dry
				0 85		Firm brown and orange brown sandy SILT with rare fine to medium sub-angular to sub-rounded flint gravel (KESGRAVE CATCHMENT SUBGROUP)	0 60		
				1 00		Dense orange-brown sandy flint COBBLES (KESGRAVE CATCHMENT SUBGROUP)	0 50		
				1 35		*End of Borehole at 1 35 m*			
				2 00					
				3 00					
				4 00					
				5 00					

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Borehole refused at 0 90m bgl
2 Groundwater not encountered during the investigation
3 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS5

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA						
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.30		Gravel over grey brown silty GRAVEL Refused in concrete at 0 30m bgl (MADE GROUND)	0 30		Dry
						End of Borehole at 0 30 m			
				1.00					
				2.00					
				3.00					
				4.00					
				5.00					

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Borehole refused at 0 30m bgl due to concrete obstruction
2 Groundwater not encountered during the investigation
3 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS5A

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING | STRATA

Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
						Gravel surfacing over grey brown sandy GRAVEL Gravel is predominantly coarse and occasionally fine to medium sub-angular brick, flint concrete and clinker Concrete from 0 30m 0 35m (MADE GROUND)	0 35		Dry
E1 0 40-0.40m				0 35			0 15		
				0 50		Soft to firm grey black sandy gravelly SILT with organic content Gravel is fine to coarse sub-angular to sub-rounded brick flint, ash and occasional clinker (MADE GROUND)			
E2 1.00-1 00m	1 00m (C) N=6 (3 2,1 1 2,2)			1 00		Soft to firm brown and orange brown sandy SILT with rare fine to medium sub-angular to sub-rounded flint gravel (KESGRAVE CATCHMENT SUBGROUP)	1 00		
				1 50		Medium dense dark orange-brown slightly gravelly to gravelly SAND Gravel is fine to coarse angular to sub-rounded flint with occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)			
	2 00m (C) N=20 (4 4 5,5 4,6)			2 00					
D1 3.00-3.00m	3 00m (C) N=14 (2,3 3 3 4 4)			3 00			3 95		
	4 00m (C) N=13 (3,3 3 4 3 3)			4 00					
	5 00m (C) N=16 (4 3 4 4 4 4)			5 00					
				5 45		*End of Borehole at 5 45 m*			

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Groundwater not encountered during the investigation
2 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS6

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA							
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
E1 0.40-0.40m				0.30		Brown and grey silty sandy fine to coarse sub-angular to sub-rounded flint brick and concrete GRAVEL (MADE GROUND)	0.30		Dry
D1 0.80-0.80m	0.90m (C) N=50 (11 12 12 12,13 13)			0.50		Firm dark orange-brown and brown sandy gravelly SILT Gravel is fine to coarse angular to sub-rounded flint and occasional brick and clinker (MADE GROUND)	0.20		
				1.00		Dark orange silty SAND and fine to coarse angular to sub-rounded flint GRAVEL and occasional cobbles (KESGRAVE CATCHMENT SUBGROUP)	0.85		
				1.35		*End of Borehole at 1.35 m*			
				2.00					
				3.00					
				4.00					
				5.00					

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Borehole refused at 0.90m bgl
2 Groundwater not encountered during the investigation
3 Monitoring well installed

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS6A

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

MLM
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email cambridge@mlm.uk.com

IN SITU TESTS/SAMPLING			STRATA						
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.20		Gravel over sandy concrete brick and flint GRAVEL Refused at 0.2m bgl (MADE GROUND)	0.20		Dry
						End of Borehole at 0.20 m			
				1.00					
				2.00					
				3.00					
				4.00					
				5.00					

Notes
1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks
1 Borehole refused at 0.20m bgl
2 Groundwater not encountered during the investigation
3 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS6B

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

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IN SITU TESTS/SAMPLING			STRATA						
Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
E1 0 35-0 35m D1 0 70-0 70m				0 25 0 40 0 80 1 00 2 00 3 00 4 00 5 00		Gravel surfacing over grey-brown silty sandy fine to coarse sub-angular to sub-rounded asphalt, flint and concrete GRAVEL. (MADE GROUND) Firm sandy gravelly SILT Gravel is fine to coarse angular to sub-rounded flint brick and concrete Concrete cobble at 0 30m bgl (MADE GROUND) Dark orange silty SAND and fine to coarse angular to rounded flint GRAVEL and COBBLES (KESGRAVE CATCHMENT SUBGROUP) *End of Borehole at 0 80 m*	0 25 0 15 0 40		Dry

Notes

1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks

1 Borehole refused at 0 80m bgl
2 Groundwater not encountered during the investigation
3 Borehole backfilled with arisings

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

Project	Sacombe Road
Location	Hertford
Project ID	723463
Client	Bovis Homes Limited
Project Engineer	J Monk
Logged by	H Carter / P Mistry

BOREHOLE REF WS7

Drilling Method	Windowless Sampler
Start of Drilling	07/06/2011
Completion	07/06/2011
Ground Level (mAOD)	-
Coordinates	-
Status	

MLM
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IN SITU TESTS/SAMPLING | STRATA

Sample Ref	SPT Results (Type)	Shear Strength (kPa)	Level (mAOD)	Depth (m)	Legend	Description of Strata	Thickness (m)	Installation Details	Water (m)
				0.30		Orange-brown silty SAND and fine to coarse flint and occasional brick GRAVEL (MADE GROUND)	0.30		Dry
E1 0.50-0.50m				1.00		Soft to firm grey and grey-brown sandy slightly gravelly to gravelly SILT with an organic odour. Gravel is fine to coarse flint, organic matter decaying plant matter brick and ash (MADE GROUND)	1.00		
D1 1.50-1.50m				1.30		Soft to firm orange-brown sandy occasionally gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded flint with occasional carbonaceous matter (KESGRAVE CATCHMENT SUBGROUP)	1.70		
				2.00					
				3.00		*End of Borehole at 3.00 m*			
				4.00					
				5.00					

Notes
1 When undertaken Shear Strengths recorded using a Pilcon Hand Shear Vane

Remarks
1 Groundwater not encountered during the investigation
2 Monitoring well installed

Legend

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

Well Installation/Backfill Legend

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

Pipe Details: Plain Pipe; Slotted Pipe; Piezometer Tip

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

www.mlm.uk.com

Project Name: Sacombe Road
Location: Hertford
Project Ref: 723463

Test Location: **SA1**

Soil Infiltration Rate (m/sec)	**3.50E-06**

Readings:

Time (mins)	Water Level (m bgl)
0	0.90
1	0.92
3	0.93
5	0.93
10	0.94
17	0.97
41	1.03
61	1.09
91	1.13
148	1.21
240	1.33
424	1.45
608	1.57
792	1.69
976	1.81
1160	1.93

Trial Pit Dimensions (m)

Length	2.10
Width	0.70
Depth	2.10

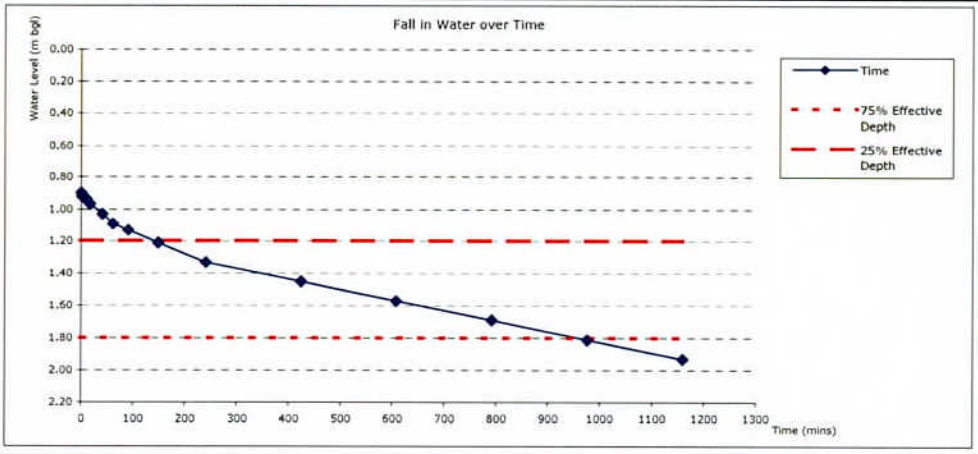
Assumed Invert Level (m bgl)	0.90

Ground Conditions:

0.0 - 0.2m	Flint, concrete and ash Gravel. (MG)
0.2 - 1.3m	Dark grey gravelly very clayey Sand.
1.3 - 2.1m	Gravelly silty Sand.

Remarks:

1. Test Undertaken in general accordance with BRE Digest 365.
2. Trial pit was not filled with aggregate.
3. Stability was moderate.
4. Results extrapolated beyond 1.33m.



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25}	Effective depth storage volume of water in the trial pit between 75% and 25%	0.88
a_{p50}	The internal surface area of the trial pit up to 50% effective depth and including the	4.83
t_{p75-25}	The time for the water level to fall from 75% to 25% effective depth	870

Soil Infiltration Rate (m/sec) $f = \frac{0.882}{252029.4}$

f **3.50E-06**

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

MLM
www.mlm.uk.com

Project Name: Sacombe Road
Location: Hertford
Project Ref: 723463

Test Location: **SA7**

Soil Infiltration Rate (m/sec)	**3.38E-06**

Readings:

Time (mins)	Water Level (m bgl)
0	0.94
1	0.96
3	0.97
5	0.98
10	1.01
20	1.03
40	1.11
60	1.15
122	1.26
187	1.34
317	1.43
447	1.52
577	1.61
707	1.70
837	1.79
967	1.88
1097	1.97

Trial Pit Dimensions (m)

Length	2.10
Width	0.70
Depth	2.20

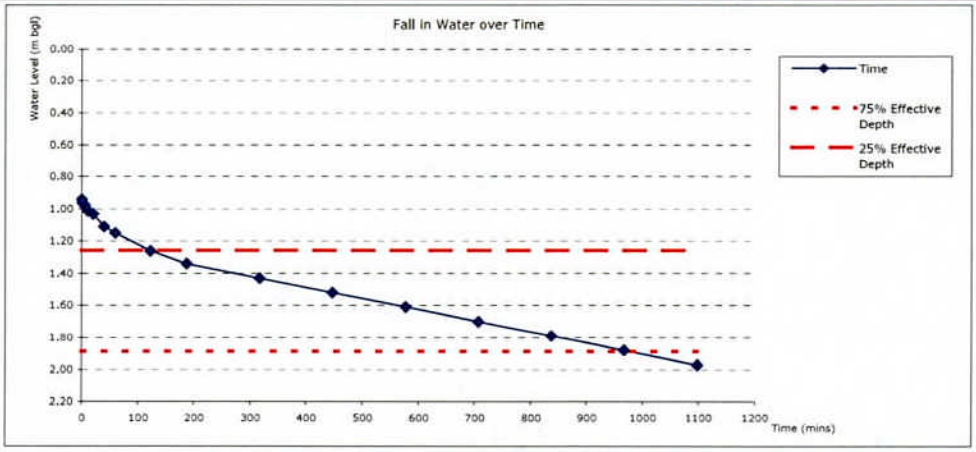
Assumed Invert Level (m bgl)	0.94

Ground Conditions:

0.0 - 0.2m	Flint, ceramic and brick Gravel and cobbles (MG)
0.2 - 1.3m	Silty Sand and flint Gravel and cobbles, with lenses of sandy gravelly clay.
1.3 - 2.1m	Flinty gravelly Sand with occasional flint cobbles.

Remarks:

1. Test Undertaken in general accordance with BRE Digest 365.
2. Trial pit was not filled with aggregate.
3. Stability was moderate.
4. Results extrapolated beyond 1.34m.



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25}	Effective depth storage volume of water in the trial pit between 75% and 25%	0.93
a_{p50}	The internal surface area of the trial pit up to 50% effective depth and including the	4.998
t_{p75-25}	The time for the water level to fall from 75% to 25% effective depth	914

Soil Infiltration Rate (m/sec) $f = \frac{0.926}{274156.96}$

f **3.38E-06**

SOAKAWAY TEST RESULTS

Based on BRE Digest 365: Soakaway Design (2007)

MLM
www.mlm.uk.com

Project Name: Sacombe Road
Location: Hertford
Project Ref: 723463

Test Location: **SA8**

Soil Infiltration Rate (m/sec)	**4.58E-06**

Readings:

Time (mins)	Water Level (m bgl)
0	0.81
2	0.84
5	0.85
10	0.86
16	0.88
32	0.92
50	0.95
85	1.01
166	1.10
205	1.14
283	1.22
361	1.30
439	1.38
517	1.46
595	1.54
673	1.62
751	1.70
829	1.78
907	1.86

Trial Pit Dimensions (m)

Length	2.10
Width	0.50
Depth	1.80

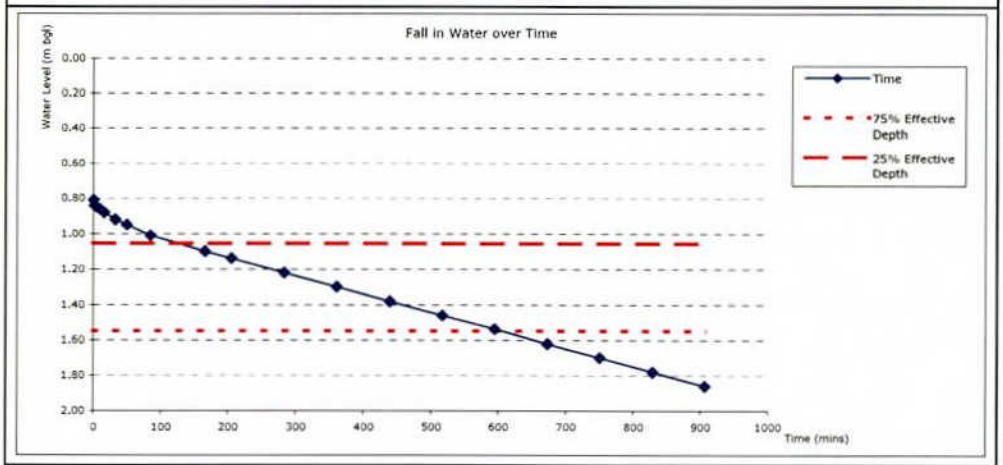
Assumed Invert Level (m bgl)	0.81

Ground Conditions:

0.0 - 0.2m	Sand and flint and brick Gravel and Cobbles (MG)
0.2 - 1.3m	Organic Sand, Gravel and Cobbles (MG)
1.3 - 2.1m	Silty gravelly Sand

Remarks:

1. Test Undertaken in general accordance with BRE Digest 365.
2. Trial pit was not filled with aggregate.
3. Stability was moderate.
4. Results extrapolated beyond 1.14m.



Soil Infiltration Rate (m/sec) $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25}	Effective depth storage volume of water in the trial pit between 75% and 25%	0.52
a_{p50}	The internal surface area of the trial pit up to 50% effective depth and including the	3.624
t_{p75-25}	The time for the water level to fall from 75% to 25% effective depth	522

Soil Infiltration Rate (m/sec) $f = \frac{0.520}{113544.45}$

f **4.58E-06**

Appendix D

Results of Gas/Organic Vapour and Groundwater Monitoring

MLM

www.mlm.uk.com

Soil-Gas & Groundwater Monitoring / Sampling Site Data

Date	07/06/11	**Project**	Sacombe Road, Hertford			**Calibrated / Checked**		**Logged in QA File**
Time	15 00	**Project Number**	723463	**Equipment Used**	GFM 435 Meter / Dip P I D	**Before**	**After**	
Technician	H Carter	**Weather**	Dry, sunny			Yes	Yes	

Notes

Well No / Location	CH_4 (%)	CO_2 (%)	O_2 (%)	Pressure (mbar)	Flow (l/hr)	Average VOC (ppm)	Peak VOC (ppm)	Instrument Accuracy Check	Height of Casing (m)	Depth to Water (mb casing)	Depth to Water (mbgl)	Sample Collected (Y/N)	Comments and Visual/Olfactory Description of Sample Collected
WS1	<0 1	0 4	19 5	998	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS2	<0 1	<0 1	19 8	997	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS3	<0 1	0 6	19 2	997	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS4	<0 1	<0 1	19 8	997	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS5a	<0 1	0 2	19 5	998	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS6	<0 1	0 2	19 5	998	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS6b	<0 1	0 5	19 3	997	n/a	-	-	Yes	n/a	n/a	Dry	N	
WS7	<0 1	0 3	19 7	997	n/a	-	-	Yes	n/a	n/a	Dry	N	

MLM

www mlm uk com

Soil-Gas & Groundwater Monitoring / Sampling Site Data

Date	14/06/11	**Project**	Sacombe Road, Hertford			**Calibrated / Checked**		**Logged in QA File**
Time	15 00	**Project Number**	723463	**Equipment Used**	GFM 435 Dip Meter P I D	**Before**	**After**	
Technician	H Carter	**Weather**	Dry, sunny			Yes	Yes	

Notes

Well No / Location	CH_4 (%)	CO_2 (%)	O_2 (%)	Pressure (mbar)	Flow (l/hr)	Average VOC (ppm)	Peak VOC (ppm)	Instrument Accuracy Check	Height of Casing (m)	Depth to Water (mb casing)	Depth to Water (mbgl)	Sample Collected (Y/N)	Comments and Visual/Olfactory Description of Sample Collected
WS3	<0 1	0 4	19 4	1014	<0 1	-	-	Yes	n/a	n/a	Dry	N	
WS6	<0 1	<0 1	19 4	1014	<0 1	-	-	Yes	n/a	n/a	Dry	N	
WS7	<0 1	<0 1	20 0	1014	<0 1	-	-	Yes	n/a	n/a	Dry	N	

MLM

www.mlm.uk.com

Soil-Gas & Groundwater Monitoring / Sampling Site Data

Date	21/06/11	**Project**	Sacombe Road, Hertford			**Calibrated / Checked**	**Logged in QA File**
Time	10 15	**Project Number**	723463	**Equipment Used**	GFM 435 Dip Meter P I D	**Before** Yes	**After** Yes	
Technician	P Mistry	**Weather**					

Notes

Well No / Location	CH_4 (%)	CO_2 (%)	O_2 (%)	Pressure (mbar)	Flow (l/hr)	Average VOC (ppm)	Peak VOC (ppm)	Instrument Accuracy Check	Height of Casing (m)	Depth to Water (mb casing)	Depth to Water (mbgl)	Sample Collected (Y/N)	Comments and Visual/Olfactory Description of Sample Collected
WS3	<0 1	0 1	20 4	1005	<0 1	0 200	2 7	Yes	n/a	n/a	Dry	N	
WS6	<0 1	0 3	19 3	1004	<0 1	2 600	3 5	Yes	n/a	n/a	Dry	N	
WS7	<0 1	0 2	19 9	1005	<0 1	0 500	2 4	Yes	n/a	n/a	Dry	N	

MLM

www mlm uk com

Soil-Gas & Groundwater Monitoring / Sampling Site Data

Date	23/06/11	**Project**	Sacombe Road, Hertford			**Calibrated / Checked**		**Logged in QA File**
Time	10 30	**Project Number**	723463	**Equipment Used**	GFM 435 Dip Meter P I D	**Before**	**After**	
Technician	P Mistry	**Weather**				Yes	Yes	

Notes

Well No / Location	CH_4 (%)	CO_2 (%)	O_2 (%)	Pressure (mbar)	Flow (l/hr)	Average VOC (ppm)	Peak VOC (ppm)	Instrument Accuracy Check	Height of Casing (m)	Depth to Water (mb casing)	Depth to Water (mbgl)	Sample Collected (Y/N)	Comments and Visual/Olfactory Description of Sample Collected
WS3	<0 1	0 1	20 2	1010	<0 1	0 300	1 4	Yes	n/a	n/a	Dry	N	
WS6	<0 1	0 1	20 2	1010	<0 1	0 300	2 9	Yes	n/a	n/a	Dry	N	
WS7	<0 1	1 6	18 8	1010	<0 1	0 500	3 0	Yes	n/a	n/a	Dry	N	

MLM
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CB25 9TL

FAO Jason Monk

LABORATORY TEST REPORT

Results of analysis of 4 samples for asbestos fibres in soil received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest

Report Date
22 June 2011

Login Batch No			137098			
Chemtest LIMS ID			AG13657	AG13658	AG13659	AG13660
Sample ID			E1	E1	E1	E1
Sample Description			WS2	WS5a	WS6	TP7
SOP↓	Determinand↓	CAS No↓	0 5	0 4	0 4	0 4
2190	Actinolite	77536664	Not detected	Not detected	Not detected	Not detected
	Amosite	12172735	Not detected	Not detected	Not detected	Not detected
	Anthophyllite	77536675	Not detected	Not detected	Not detected	Not detected
	Chrysotile	12001295	Not detected	Not detected	Not detected	Not detected
	Crocidolite	12001284	Not detected	Not detected	Not detected	Not detected
	Tremolite	77536686	Not detected	Not detected	Not detected	Not detected
	Material		soil	soil	soil	soil

All tests undertaken between 15-Jun-2011 and 15-Jun-2011

Signed

Albert Vella
Senior Environmental Surveyor

UKAS TESTING
2183

Notes to accompany report

- *The in-house procedure SOP 2190 is employed to identify fibres in soil*
- *Sample size is reduced by coning and quartering to obtain a representative sub-sample*
- *The bulk identification is in accordance with the requirements of the analyst guide (HSG 248)*
- *Samples associated with asbestos are retained for six months*
- *The results relate only to the items tested as supplied by the client*
- *Comments or interpretations are beyond the scope of UKAS accreditation*

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IQ Cambridge
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CB25 9TL

FAO Jason Monk

LABORATORY TEST REPORT

Results of analysis of 4 samples for asbestos fibres in soil received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest

Report Date
22 June 2011

Signed

Albert Vella
Senior Environmental Surveyor

UKAS TESTING
2183

Notes to accompany report

- *The in-house procedure SOP 2190 is employed to identify fibres in soil*
- *Sample size is reduced by coning and quartering to obtain a representative sub-sample*
- *The bulk identification is in accordance with the requirements of the analyst guide (HSG 248)*
- *Samples associated with asbestos are retained for six months*
- *The results relate only to the items tested as supplied by the client*
- *Comments or interpretations are beyond the scope of UKAS accreditation*

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CB25 9TL

FAO Jason Monk

LABORATORY TEST REPORT

Results of analysis of 15 samples received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest
The right chemistry to deliver results

Report Date
22 June 2011

Login Batch No					137099					
Chemtest LIMS ID					AG13661	AG13662	AG13663	AG13664	AG13665	AG13666
Sample ID					WS1	WS2	WS3	WS5a	WS5a	WS5a
Sample No					E1	E1	E2	E1	E2	D1
Sampling Date					07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011
Depth					0 4m	0 5m	0 6m	0 4m	1m	3m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*						
2010	pH			M						7 3
2625	Total Organic Carbon		%	M						
2120	Sulfate (2 1 water soluble) as SO4	14808798	g l-1	M						0 01
2450	Arsenic	7440382	mg kg-1	M	11	21	30	17	13	
	Cadmium	7440439	mg kg-1	M	0 21	6 8	0 61	<0 10	<0 10	
	Chromium	7440473	mg kg-1	M	25	49	36	30	25	
	Copper	7440508	mg kg-1	M	9 5	170	26	84	9 1	
	Mercury	7439976	mg kg-1	M	<0 10	0 25	<0 10	0 14	<0 10	
	Nickel	7440020	mg kg-1	M	18	44	31	28	20	
	Lead	7439921	mg kg-1	M	41	470	49	410	14	
	Selenium	7782492	mg kg-1	M	0 59	0 73	0 65	0 21	0 28	
	Zinc	7440666	mg kg-1	M	40	1000	120	520	48	
2675	TPH aliphatic >C5-C6		mg kg-1	N						
	TPH aliphatic >C6-C8		mg kg-1	N						
	TPH aliphatic >C8-C10		mg kg-1	N						
	TPH aliphatic >C10 C12		mg kg-1	N						
	TPH aliphatic >C12 C16		mg kg-1	N						
	TPH aliphatic >C16 C21		mg kg-1	N						
	TPH aliphatic >C21 C35		mg kg-1	N						
	TPH aliphatic >C35 C44		mg kg-1	N						
	TPH aromatic >C5 C7		mg kg-1	N						
	TPH aromatic >C7 C8		mg kg-1	N						
	TPH aromatic >C8 C10		mg kg-1	N						
	TPH aromatic >C10-C12		mg kg-1	N						
	TPH aromatic >C12-C16		mg kg-1	N						
	TPH aromatic >C16-C21		mg kg-1	N						
	TPH aromatic >C21-C35		mg kg-1	N						

All tests undertaken between 15/06/2011 and 22/06/2011

* Accreditation status

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

MLM
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FAO Jason Monk

LABORATORY TEST REPORT

Results of analysis of 15 samples received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest
The right chemistry to deliver results

Report Date
22 June 2011

Login Batch No					137099					
Chemtest LIMS ID					AG13667	AG13668	AG13669	AG13670	AG13671	AG13672
Sample ID					WS6	WS7	TP3	TP5	TP7	TP8
Sample No					E1	E1	E1	E1	E1	E2
Sampling Date					07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011
Depth					0 4m	0 5m	0 1m	0 1m	0 4m	0 5m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓							
2010	pH			M					7 9	
2625	Total Organic Carbon		%	M			1 9			2 4
2120	Sulfate (2 1 water soluble) as SO4	14808798	g l-1	M					0 03	
2450	Arsenic	7440382	mg kg-1	M			24	18	17	20
	Cadmium	7440439	mg kg-1	M			1 5	1 2	1 4	7 2
	Chromium	7440473	mg kg-1	M			22	24	23	30
	Copper	7440508	mg kg-1	M			69	32	42	360
	Mercury	7439976	mg kg-1	M			0 12	<0 10	<0 10	0 31
	Nickel	7440020	mg kg-1	M			23	21	22	37
	Lead	7439921	mg kg-1	M			120	66	85	420
	Selenium	7782492	mg kg-1	M			0 73	0 51	0 51	1 4
	Zinc	7440666	mg kg-1	M			240	170	210	880
2675	TPH aliphatic >C5-C6		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C6-C8		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C8-C10		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C10-C12		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C12-C16		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C16-C21		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C21-C35		mg kg-1	N	< 0 1	< 0 1				
	TPH aliphatic >C35-C44		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C5-C7		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C7-C8		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C8-C10		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C10-C12		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C12-C16		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C16-C21		mg kg-1	N	< 0 1	< 0 1				
	TPH aromatic >C21 C35		mg kg-1	N	< 0 1	< 0 1				

* Accreditation status

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

MLM
Building 7200
IQ Cambridge
Cambridge
CB25 9TL

FAO Jason Monk

LABORATORY TEST REPORT

Results of analysis of 15 samples received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest
The right chemistry to deliver results

Report Date
22 June 2011

Login Batch No					137099		
Chemtest LIMS ID					AG13673	AG13681	AG13689
Sample ID					TP8	WS4	TP4
Sample No					D1	E1	E2
Sampling Date					07/06/2011	07/06/2011	07/06/2011
Depth					1 5m	0 5m	1 2m
Matrix					*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓				
2010	pH			M	6 5	7 0	7 5
2625	Total Organic Carbon		%	M			
2120	Sulfate (2 1 water soluble) as SO4	14808798	g l-1	M	0 07	0 02	<0 01
2450	Arsenic	7440382	mg kg-1	M	8 9		
	Cadmium	7440439	mg kg-1	M	0 20		
	Chromium	7440473	mg kg-1	M	18		
	Copper	7440508	mg kg-1	M	7 7		
	Mercury	7439976	mg kg-1	M	<0 10		
	Nickel	7440020	mg kg-1	M	15		
	Lead	7439921	mg kg-1	M	15		
	Selenium	7782492	mg kg-1	M	0 23		
	Zinc	7440666	mg kg-1	M	46		
2675	TPH aliphatic >C5-C6		mg kg-1	N			
	TPH aliphatic >C6-C8		mg kg-1	N			
	TPH aliphatic >C8-C10		mg kg-1	N			
	TPH aliphatic >C10-C12		mg kg-1	N			
	TPH aliphatic >C12-C16		mg kg-1	N			
	TPH aliphatic >C16-C21		mg kg-1	N			
	TPH aliphatic >C21-C35		mg kg-1	N			
	TPH aliphatic >C35-C44		mg kg-1	N			
	TPH aromatic >C5-C7		mg kg-1	N			
	TPH aromatic >C7-C8		mg kg-1	N			
	TPH aromatic >C8-C10		mg kg-1	N			
	TPH aromatic >C10-C12		mg kg-1	N			
	TPH aromatic >C12-C16		mg kg-1	N			
	TPH aromatic >C16-C21		mg kg-1	N			
	TPH aromatic >C21-C35		mg kg-1	N			

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LABORATORY TEST REPORT

Results of analysis of 15 samples
received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest
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Report Date
22 June 2011

					137099					
					AG13661	AG13662	AG13663	AG13664	AG13665	AG13666
					WS1	WS2	WS3	WS5a	WS5a	WS5a
					E1	E1	E2	E1	E2	D1
					07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011
					0 4m	0 5m	0 6m	0 4m	1m	3m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2675	TPH aromatic >C35 C44		mg kg-1	N						
	Total Petroleum Hydrocarbons		mg kg-1	N						
2700	Naphthalene	91203	mg kg-1	M		< 0 1	< 0 1	< 0 1		
	Acenaphthylene	208968	mg kg-1	M		0 34	< 0 1	< 0 1		
	Acenaphthene	83329	mg kg-1	M		0 55	< 0 1	< 0 1		
	Fluorene	86737	mg kg-1	M		0 28	< 0 1	< 0 1		
	Phenanthrene	85018	mg kg-1	M		3 8	< 0 1	0 44		
	Anthracene	120127	mg kg-1	M		1	< 0 1	< 0 1		
	Fluoranthene	206440	mg kg-1	M		6 5	< 0 1	1 1		
	Pyrene	129000	mg kg-1	M		4 9	< 0 1	0 93		
	Benzo[a]anthracene	56553	mg kg-1	M		2 3	< 0 1	0 62		
	Chrysene	218019	mg kg-1	M		2 7	< 0 1	0 58		
	Benzo[b]fluoranthene	205992	mg kg-1	M		2 6	< 0 1	0 57		
	Benzo[k]fluoranthene	207089	mg kg-1	M		1 9	< 0 1	0 33		
	Benzo[a]pyrene	50328	mg kg-1	M		2 3	< 0 1	0 5		
	Dibenzo[a,h]anthracene	53703	mg kg-1	M		0 13	< 0 1	< 0 1		
	Indeno[1,2,3-cd]pyrene	193395	mg kg-1	M		1 5	< 0 1	0 27		
	Benzo[g h i]perylene	191242	mg kg-1	M		1 3	< 0 1	0 21		
	Total (of 16) PAHs		mg kg-1	M		32	< 2	5 6		

All tests undertaken between 15/06/2011 and 22/06/2011

* Accreditation status

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LABORATORY TEST REPORT

Results of analysis of 15 samples received 14 June 2011

723463 - Sacombe Road, Hertford

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Report Date
22 June 2011

					137099					
					AG13667	AG13668	AG13669	AG13670	AG13671	AG13672
					WS6	WS7	TP3	TP5	TP7	TP8
					E1	E1	E1	E1	E1	E2
					07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011	07/06/2011
					0 4m	0 5m	0 1m	0 1m	0 4m	0 5m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2675	TPH aromatic >C35-C44		mg kg⁻¹	N	< 0 1	< 0 1				
	Total Petroleum Hydrocarbons		mg kg⁻¹	N	< 2	< 2				
2700	Naphthalene	91203	mg kg⁻¹	M					< 0 1	< 0 1
	Acenaphthylene	208968	mg kg⁻¹	M					< 0 1	< 0 1
	Acenaphthene	83329	mg kg⁻¹	M					< 0 1	< 0 1
	Fluorene	86737	mg kg⁻¹	M					< 0 1	< 0 1
	Phenanthrene	85018	mg kg⁻¹	M					0 59	< 0 1
	Anthracene	120127	mg kg⁻¹	M					< 0 1	< 0 1
	Fluoranthene	206440	mg kg⁻¹	M					1 8	0 45
	Pyrene	129000	mg kg⁻¹	M					1 5	0 3
	Benzo[a]anthracene	56553	mg kg⁻¹	M					0 81	0 34
	Chrysene	218019	mg kg⁻¹	M					0 88	0 39
	Benzo[b]fluoranthene	205992	mg kg⁻¹	M					1	0 42
	Benzo[k]fluoranthene	207089	mg kg⁻¹	M					0 5	0 27
	Benzo[a]pyrene	50328	mg kg⁻¹	M					0 79	0 45
	Dibenzo[a,h]anthracene	53703	mg kg⁻¹	M					< 0 1	< 0 1
	Indeno[1 2 3-cd]pyrene	193395	mg kg⁻¹	M					0 51	0 32
	Benzo[g,h,i]perylene	191242	mg kg⁻¹	M					0 18	< 0 1
	Total (of 16) PAHs		mg kg⁻¹	M					8 6	2 9

* Accreditation status

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

MLM
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Cambridge
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LABORATORY TEST REPORT

Results of analysis of 15 samples
received 14 June 2011

723463 - Sacombe Road, Hertford

Chemtest
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Report Date
22 June 2011

					137099		
					AG13673	AG13681	AG13689
					TP8	WS4	TP4
					D1	E1	E2
					07/06/2011	07/06/2011	07/06/2011
					1 5m	0 5m	1 2m
					SOIL	*SOIL*	*SOIL*
2675	TPH aromatic >C35 C44			mg kg⁻¹	N		
	Total Petroleum Hydrocarbons			mg kg⁻¹	N		
2700	Naphthalene	91203		mg kg⁻¹	M		
	Acenaphthylene	208968		mg kg⁻¹	M		
	Acenaphthene	83329		mg kg⁻¹	M		
	Fluorene	86737		mg kg⁻¹	M		
	Phenanthrene	85018		mg kg⁻¹	M		
	Anthracene	120127		mg kg⁻¹	M		
	Fluoranthene	206440		mg kg⁻¹	M		
	Pyrene	129000		mg kg⁻¹	M		
	Benzo[a]anthracene	56553		mg kg⁻¹	M		
	Chrysene	218019		mg kg⁻¹	M		
	Benzo[b]fluoranthene	205992		mg kg⁻¹	M		
	Benzo[k]fluoranthene	207089		mg kg⁻¹	M		
	Benzo[a]pyrene	50328		mg kg⁻¹	M		
	Dibenzo[a,h]anthracene	53703		mg kg⁻¹	M		
	Indeno[1 2 3-cd]pyrene	193395		mg kg⁻¹	M		
	Benzo[g,h,i]perylene	191242		mg kg⁻¹	M		
	Total (of 16) PAHs			mg kg⁻¹	M		

* Accreditation status

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

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : 15/07/11 **PAGE** 1 of 20 Pages

Contract Sacombe Road, HERTFORD

Serial No. S24687

UKAS TESTING 0998

CLIENT:

MLM ENVIRONMENTAL LIMITED
7200 Cambridge Research Park
Cambridge
CB5 9TL

Soil Property Testing

18 Halcyon Court, St Margarets Way,
Stukeley Meadows, Huntingdon,
Cambs. PE29 6DG

Telephone (01480) 455579 Fax (01480) 453619
Email SPTownend@btclick com

SAMPLES SUBMITTED BY:

MLM ENVIRONMENTAL LIMITED

APPROVED SIGNATORIES:

☐ **S.P.TOWNEND FGS**
Technical Director

☐ **W.JOHNSTONE**
Deputy Technical/Quality Manager

☑ **J.C.GARNER B.Eng (Hons.) FGS**
Quality Manager

SAMPLES LABELLED:

Sacombe Road, HERTFORD

DATE RECEIVED: 15/06/11

SAMPLES TESTED BETWEEN 15/06/11 **and** 15/07/11

REMARKS: For the attention of Mr J Monk
Your ref: 723463

NOTES:

1. All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary.
2. (a) UKAS - United Kingdom Accreditation Service.
   (b) Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
3. Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory.
4. This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory.

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 1 of 10

Contract: Sacombe Road, HERTFORD

Serial No. S24687

SCHEDULE OF LABORATORY TESTS

Bh / Tp No	Sample Ref	Depth (from)	7 PSD by Wet Sieve BS1377	28 Dry Density/MC 2 5Kg (CBR)	19 California Bearing Ratio Test	1 Moisture Content Determination	4 Liquid/Plastic Limit 1 point	5 Wet Sieve Preparation for Lim.	27 DRY Density/MC 2 5Kg (Proctor)	Remarks
TP1	B1	1 05	*							
TP2	B1	1 00		*	*					
TP5	B1	1 00	*							
TP6	D1	0 50				*	*	*		
	B1	2 50				*	*			
TP7	B1	2 20	*							
TP9	B1	1 00			*				*	
WS3	D1	1 00				*	*	*		
WS7	D1	1 50				*	*			
TP10	B1	3 00	*							
-	-	-	4	1	2	4	4	2	1	← Total Number of Tests →

Scheduled by MLM ENVIRONMENTAL LIMITED

Target Date 28/06/11

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 3 of 10

Contract: Sacombe Road, HERTFORD.

Serial No.: S24687

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 425mm (%)	Corr'd M/C to 0 425mm	Curing Time (hrs)	Description	CLASS
TP6	0 50	D1	21	36	26	10	0 40*	S	29(M)	30	98	Dark greyish brown slightly gravelly sandy clayey SILT with occasional light yellowish brown and brownish yellow mottling and recently active and decayed roots Gravel is fine and medium angular to subrounded	MI
TP6	2 50	B1	20	28	17	11	0 27	N	0(A)		120	Firm brown silty CLAY with occasional light orangey brown mottling and rare recently active and decayed roots	CL
WS3	1 00	D1	15	31	17	14	0 14*	S	22(M)	19	77	Firm brown slightly gravelly slightly sandy silty CLAY with occasional reddish yellow mottling and rare decayed roots Gravel is fine and medium angular to subrounded	CL
WS7	1 50	D1	18	29	17	12	0 08	N	0(A)		120	Firm orangey brown silty CLAY with occasional reddish yellow mottling	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.

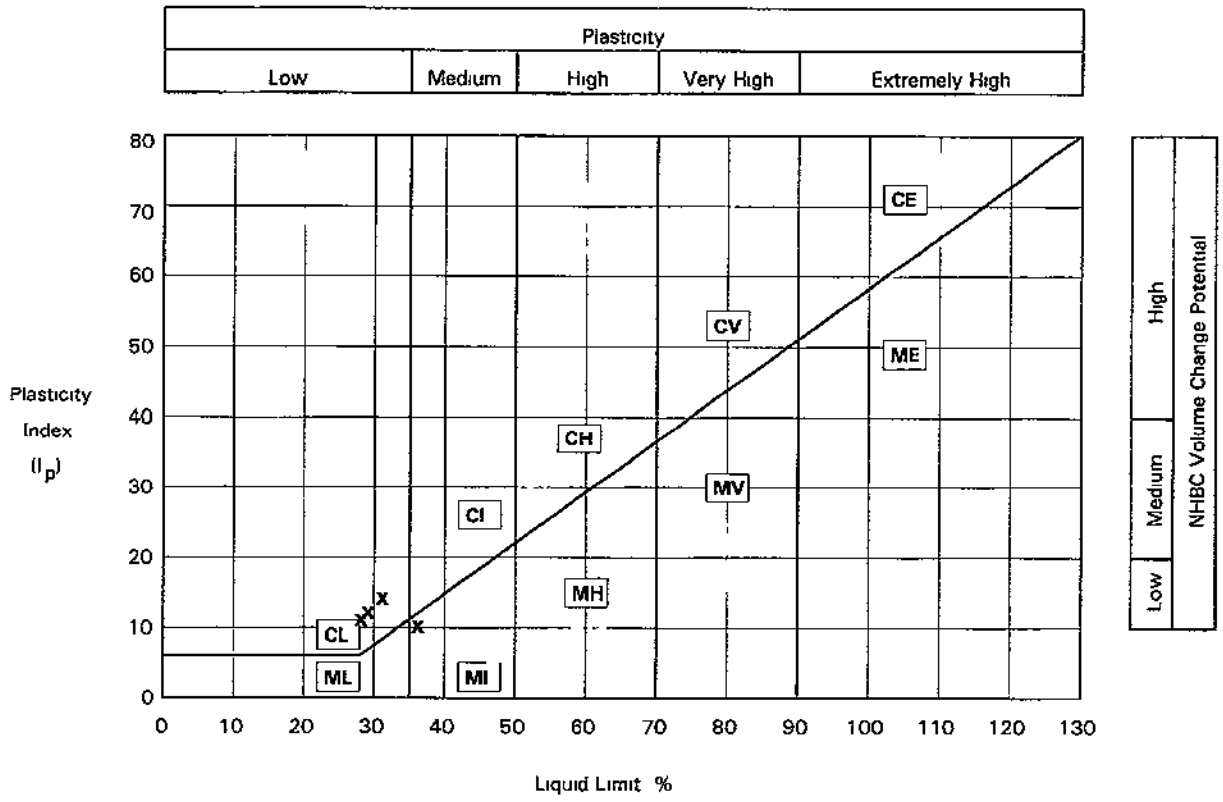
ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 4 of 20

Contract
Sacombe Road, HERTFORD.

Serial No.
S24687

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: VOLUME CHANGE POTENTIAL NHBC Standards Chapter 4 2 Unmodified Plasticity Index 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: Sacombe Road, HERTFORD.

Serial No. S24687

UKAS TESTING 0998

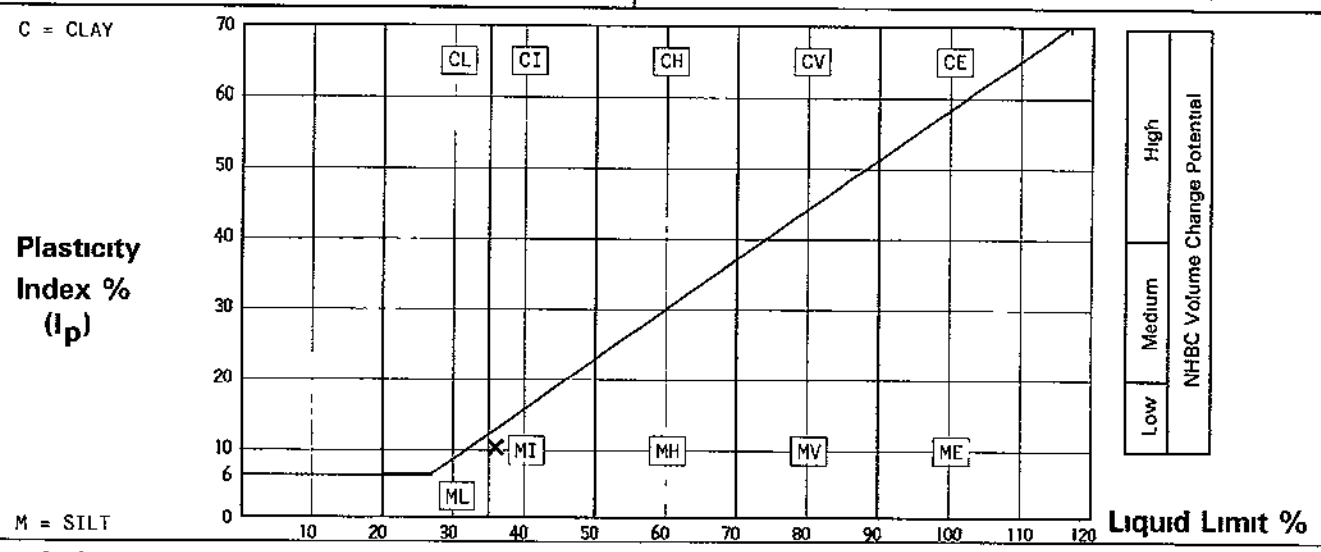
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No	Depth m	Sample	Moisture Content %	Description	Remarks
TP6	0 50	D1	21	Dark greyish brown slightly gravelly sandy clayey SILT with occasional light yellowish brown and brownish yellow mottling and recently active and decayed roots Gravel is fine and medium angular to subrounded	

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0 425 sieve (Measured)	29 %
Corrected moisture content for material passing 0 425mm	30 %
Curing Time	98 Hours

Liquid Limit	36 %
Plastic Limit	26 %
Plasticity Index	10 %
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
VOLUME CHANGE POTENTIAL NHBC Standards Chapter 4 2 Unmodified Plasticity Index
NOTE Modified Plasticity Index I'p = Ip x (% less than 425 microns/100)
16% RETAINED ON 2mm SIEVE
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.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 6 of 10

Contract: Sacombe Road, HERTFORD

Serial No.: S24687

UKAS TESTING 0998

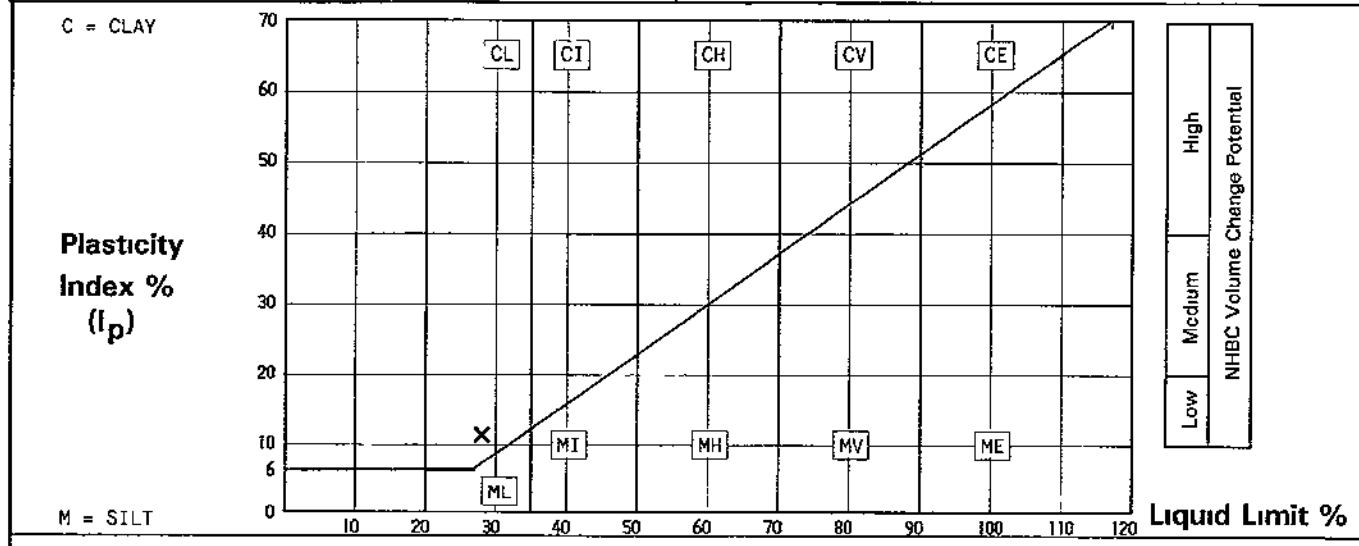
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No	Depth m	Sample	Moisture Content %	Description	Remarks
TP6	2 50	B1	20	Firm brown silty CLAY with occasional light orangey brown mottling and rare recently active and decayed roots	

PREPARATION

Method of Preparation	Specimen from Natural Soil
Sample retained 0 425 sieve (Assumed)	0 %
Corrected moisture content for material passing 0 425mm	%
Curing Time	120 Hours

Liquid Limit	28 %
Plastic Limit	17 %
Plasticity Index	11 %
Liquidity Index	0 27
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
VOLUME CHANGE POTENTIAL NHBC Standards Chapter 4 2 Unmodified Plasticity Index
NOTE Modified Plasticity Index I'p = Ip x (% less than 425 microns/100)

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 7 of 10

Contract: Sacombe Road, HERTFORD. Serial No. S24687

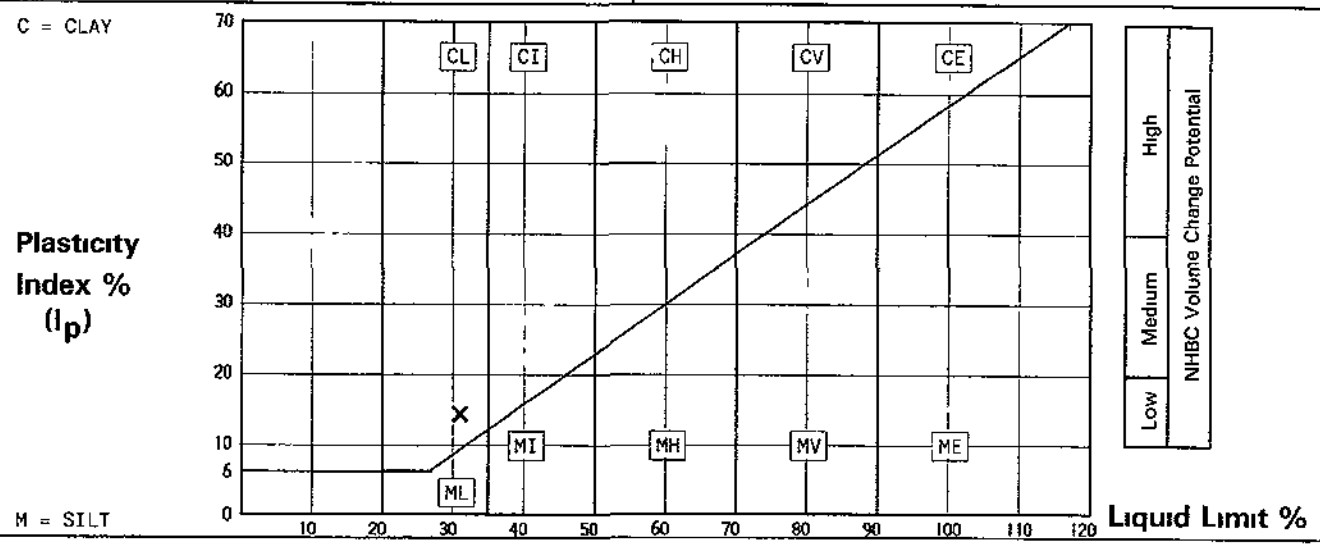
UKAS TESTING 0998

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
WS3	1 00	D1	15	Firm brown slightly gravelly slightly sandy silty CLAY with occasional reddish yellow mottling and rare decayed roots Gravel is fine and medium angular to subrounded	

PREPARATION

Method of Preparation	Sieved Specimen	Liquid Limit	31 %
Sample retained 0 425 sieve	(Measured) 22 %	Plastic Limit	17 %
Corrected moisture content for material passing 0 425mm	19 %	Plasticity Index	14 %
Curing Time	77 Hours	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
VOLUME CHANGE POTENTIAL NHBC Standards Chapter 4 2 Unmodified Plasticity Index
NOTE Modified Plasticity Index I'p = Ip x (% less than 425 microns/100)
13% RETAINED ON 2mm SIEVE
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.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 8 of 10

Contract Sacombe Road, HERTFORD.

Serial No. S24687

UKAS TESTING 0998

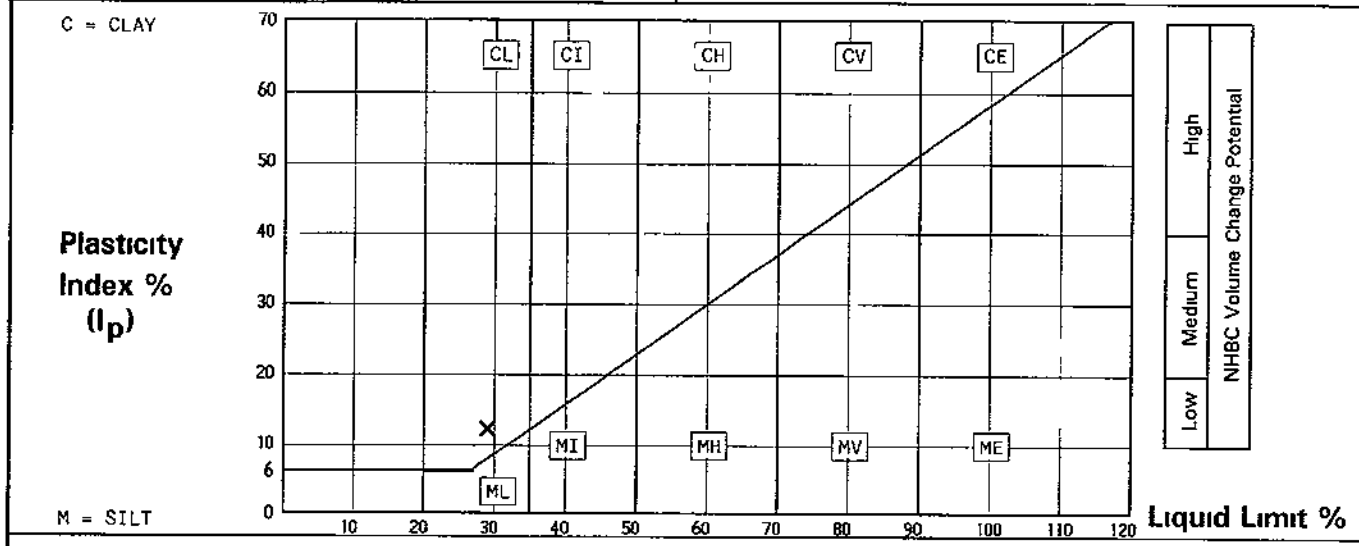
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No	Depth m	Sample	Moisture Content %	Description	Remarks
WS7	1 50	D1	18	Firm orangey brown silty CLAY with occasional reddish yellow mottling	

PREPARATION

Method of Preparation	Specimen from Natural Soil
Sample retained 0 425 sieve (Assumed)	0 %
Corrected moisture content for material passing 0 425mm	%
Curing Time	120 Hours

Liquid Limit	29 %
Plastic Limit	17 %
Plasticity Index	12 %
Liquidity Index	0 08
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
VOLUME CHANGE POTENTIAL NHBC Standards Chapter 4 2 Unmodified Plasticity Index
NOTE Modified Plasticity Index I'p = Ip x (% less than 425 microns/100)

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 9 of 10

Contract: Sacombe Road, HERTFORD.

Serial No.: S24687

UKAS TESTING 0998

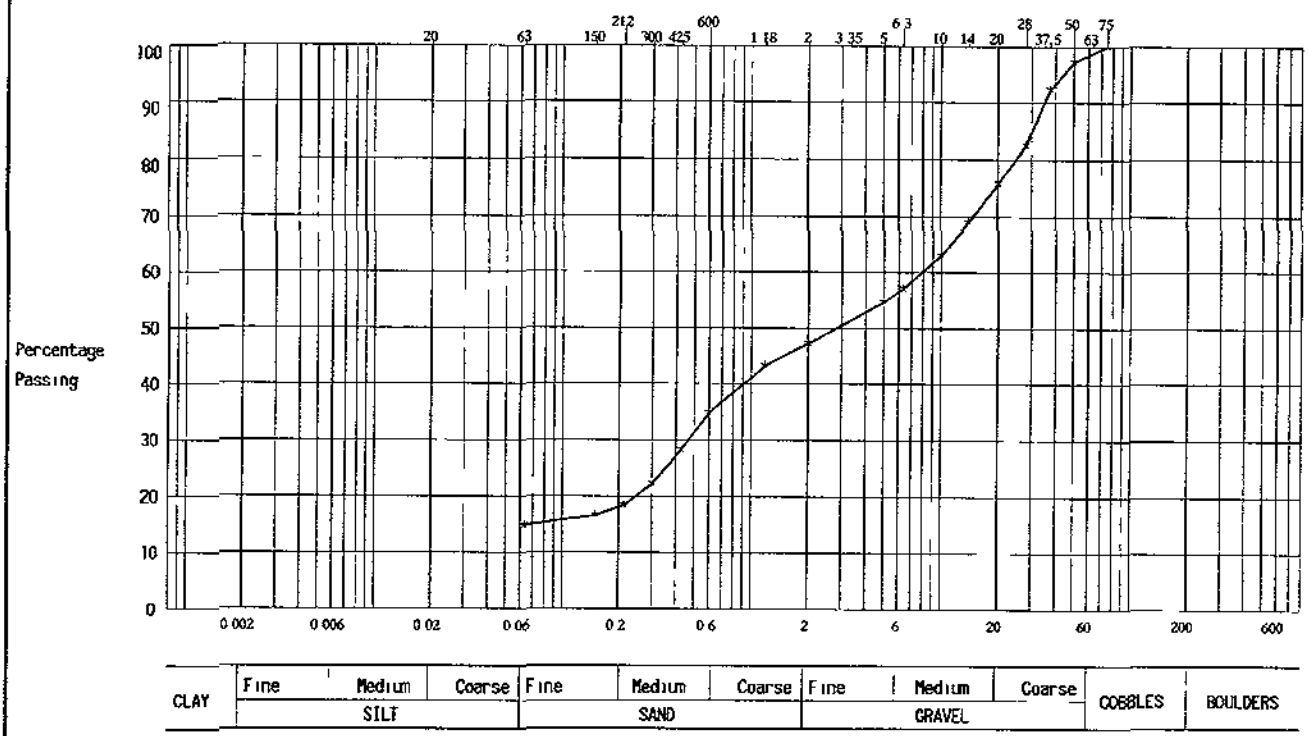
DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole/ Pit No	Depth m	Sample	Description	Remarks
TP1	1 05 -2 00	B1	White, black and brown clayey very sandy angular to subrounded GRAVEL Sand is brown	

Method of Test: Wet Sieve

Method of pre-treatment:

Size (microns)												Size (mm)											
Sieve Size	20	63	150	212	300	425	600	1 18	2	3 35	5	6 3	10	14	20	28	37 5	50	63	75			
Percentage by Mass passing Sieve	15	17	18	22	28	35	43	47	55	57	63	69	76	82	92	97	100						



METHOD OF PREPARATION BS 1377 PART 1 1990 7 3 & 7 4 5

METHOD OF TEST BS 1377 PART 2 1990 9 2

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

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 10 of 10

Contract: Sacombe Road, HERTFORD

Serial No.: S24687

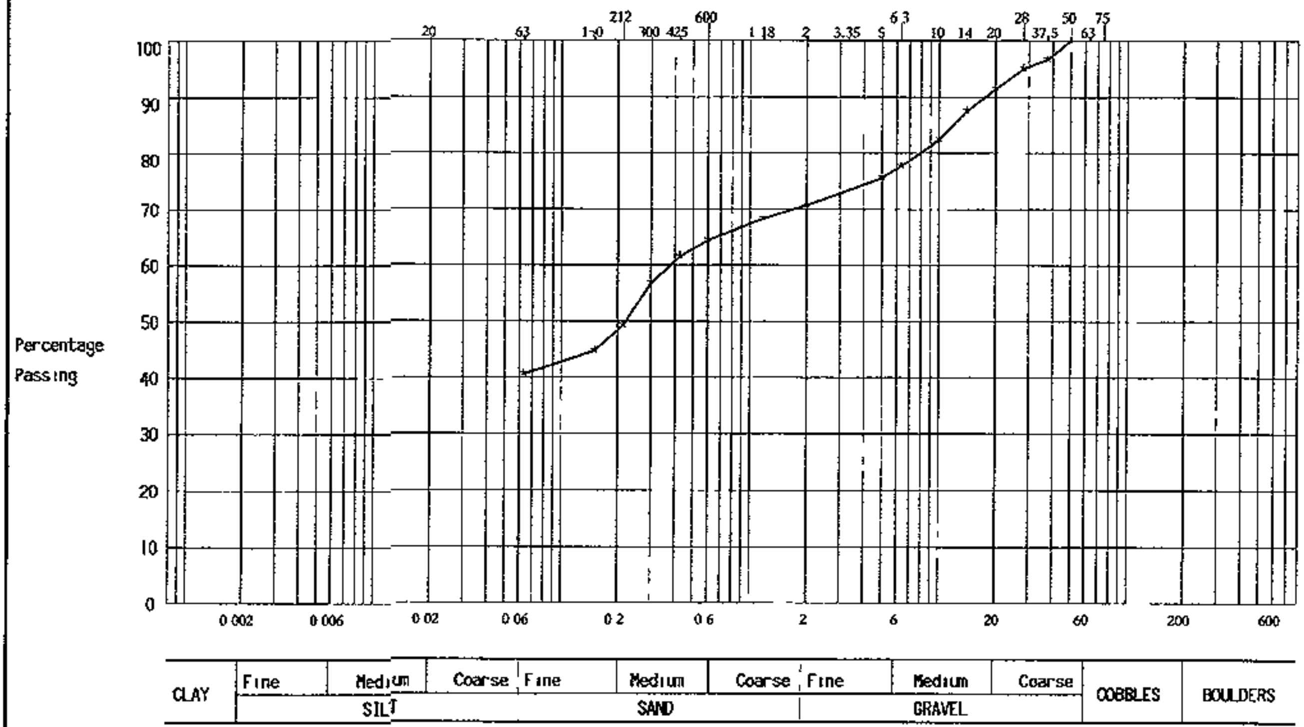
UKAS TESTING 0998

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole/ Pit No	Depth m	Sample	Description	Remarks
TP5	1 00	B1	Firm brown slightly gravelly slightly sandy silty CLAY with occasional recently active roots Gravel is brown white and black angular to subrounded	

Method of Test	Wet Sieve	Method of pre-treatment	

	Size (microns)						Size (mm)										
Sieve Size	63	150	212	300	425	600	1 18	2	5	6 3	10	14	20	28	37 5	50	75
Percentage by Mass passing Sieve	41	45	49	57	61	64	68	71	76	78	82	87	91	95	97	100	-



METHOD OF PREPARATION BS 1377: PART 1 1990 7 3 & 7 4 5

METHOD OF TEST BS 1377 PART 2 1990 9 2

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

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 11 of 20

Contract Serial No.

Sacombe Road, HERTFORD. S24687

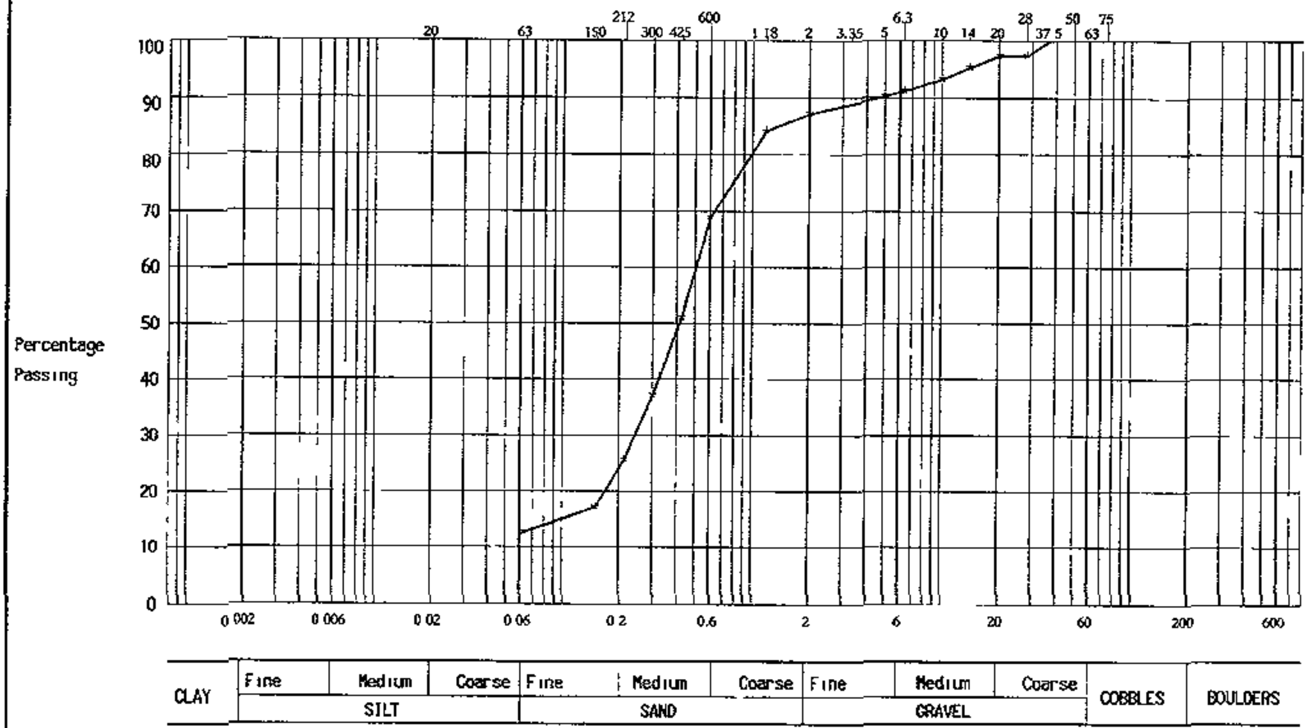
DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole/ Pit No	Depth m	Sample	Description	Remarks
TP7	2 20	B1	Orangey brown gravelly clayey SAND Gravel is brown, black and white angular and subangular	

Method of Test: Wet Sieve

Method of pre-treatment:

	Size (microns)						Size (mm)										
Sieve Size	63	150	212	300	425	600	1 18	2	5	6 3	10	14	20	28	37 5	50	75
Percentage by Mass passing Sieve	13	17	25	37	51	69	84	87	90	91	93	95	97	97	100	-	-



METHOD OF PREPARATION BS 1377 PART 1 1990 7 3 & 7 4 5

METHOD OF TEST BS 1377 PART 2 1990 9 2

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

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 12 of 20

Contract: Sacombe Road, HERTFORD

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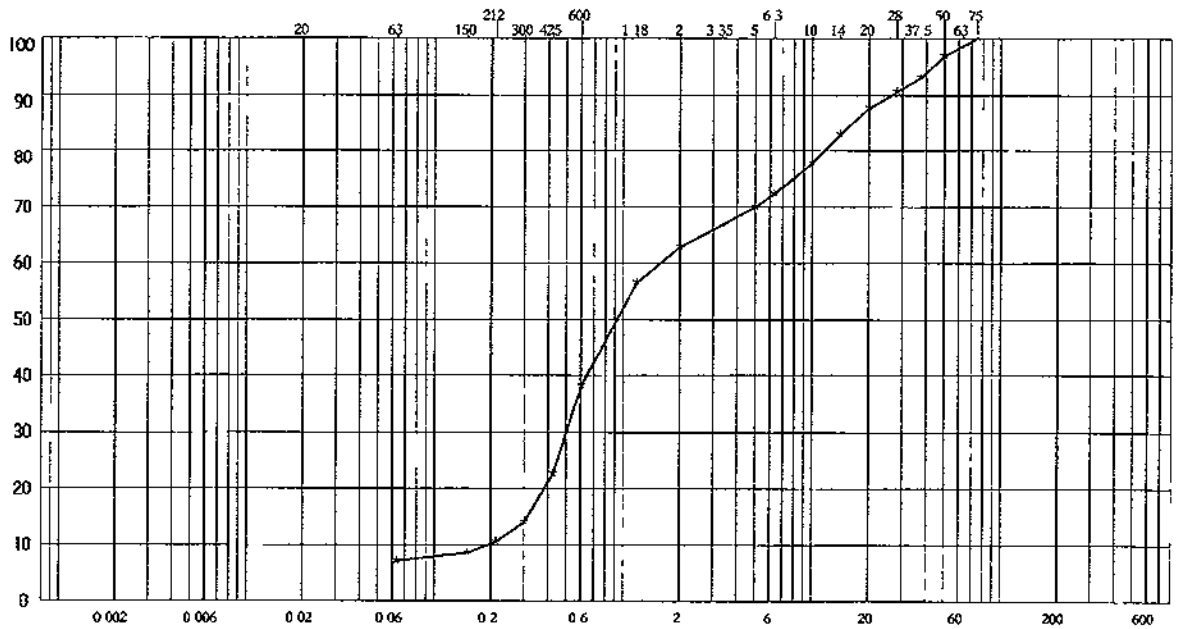
DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole/ Pit No	Depth m	Sample	Description	Remarks
TP10	3 00	B1	Orangey brown silty very gravelly SAND Gravel is black, white and brown angular to subrounded	

Method of Test: Wet Sieve

Method of pre-treatment:

Size (microns)													Size (mm)												
Sieve Size							63	150	212	300	425	600	1 18	2	5	6 3	10	14	20	28	37 5	50	75		
Percentage by Mass passing Sieve							7	8	10	14	22	38	56	63	70	72	78	83	88	90	93	97	100		



METHOD OF PREPARATION BS 1377 PART 1 1990 7 3 & 7 4 5

METHOD OF TEST BS 1377 PART 2 1990 9 2

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

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

SPTR2M

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

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Contract
Sacombe Road, HERTFORD.

Serial No.
S24687

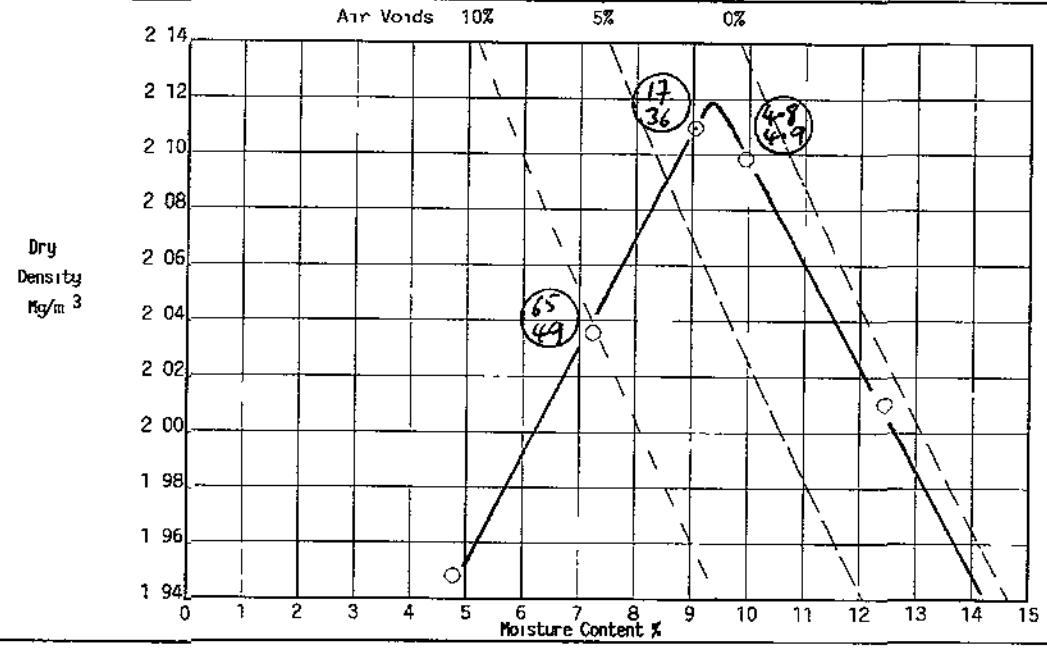
UKAS TESTING
0998

DETERMINATION OF DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Borehole/ Pit No	Depth m	Sample	Moisture Content %	Description	Remarks
TP2	1 00	B1	7 3	Brown, black and white fine to coarse angular to subrounded GRAVEL in a stiff brown sandy clay matrix	

Percentage retained 37 5mm	12 %	Max size of cohesive lumps	mm
Percentage retained 20 0mm	30 %	Single or separate samples	Single
Grading Zone	X	Particle density	2 71 Assumed
Mould Type	CBR	METHOD OF COMPACTION	B S 2 5 kg Rammer Method (BS 1377 Part 4 1990 3 4)

MAX DRY DENSITY 2 12 Mg/m^3 **OPTIMUM MOISTURE CONTENT** 9 3 %



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6

METHOD OF TEST BS 1377 PART 2 1990 3 2 & PART 4 1990 3

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

COMMENTS - CBR VALUES (see following pages) TEST DEEMED NOT APPROPRIATE DUE TO THE GRADING OF THE MATERIAL

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.

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Contract: Sacombe Road, HERTFORD.

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UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP2	1 00	B1	Brown, black and white fine to coarse angular to subrounded GRAVEL in a stiff brown sandy clay matrix	

Moisture Content % TOP 7 5 BOTTOM 7 1 Average 7 3

Bulk Density Mg/m^3 2 18 Dry Density Mg/m^3 2 04

CBR VALUES

	Penetration mm	Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %
TOP *	2 5	8 59	65		65
	5 0	11 78	59		
BOTTOM ○	2 5	6 33	48		49
	5 0	9 89	49		

Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)

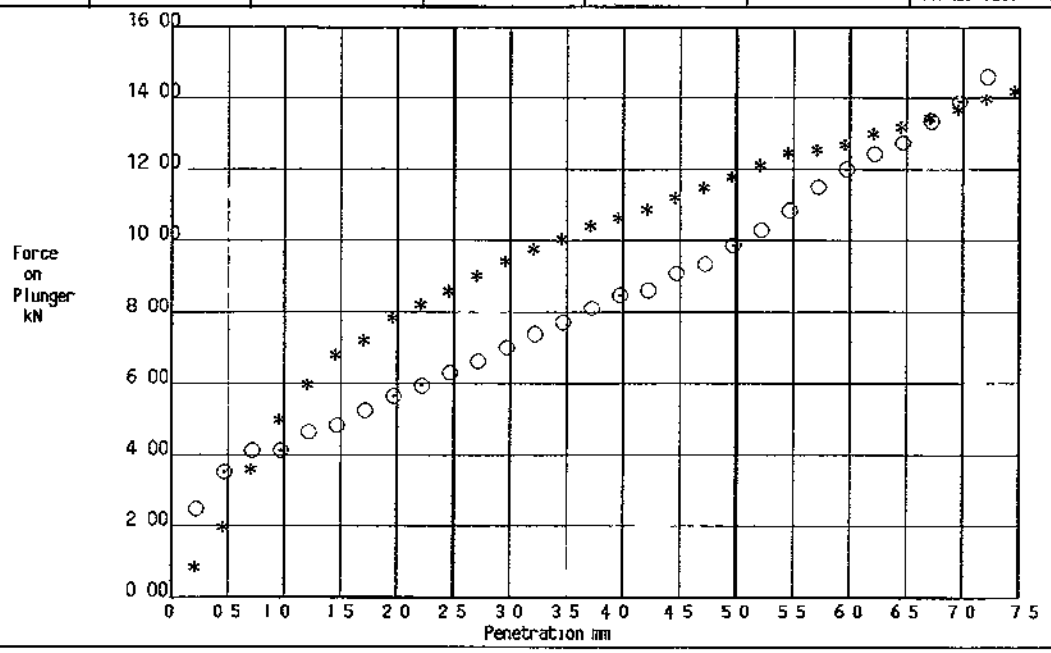
% material retained on 20mm sieve and removed before test 30

METHOD OF PREPARATION

BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

COMMENTS TEST DEEMED NOT APPROPRIATE DUE TO GREATER THAN 25% RETAINED ON 20mm SIEVE

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.

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Contract: Sacombe Road, HERTFORD.

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UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP2	1 00	B1A	Brown, black and white fine to coarse angular to subrounded GRAVEL in a stiff brown sandy clay matrix	

Moisture Content % TOP 9 2 BOTTOM 9 0 Average 9 1

Bulk Density Mg/m^3 2 21

Dry Density Mg/m^3 2 02

CBR VALUES

Penetration mm		Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %	Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)
TOP	2 5	1 46	11		17	
*	5 0	3 31	17			
BOTTOM	2 5	3 87	29		36	
○	5 0	7 16	36			

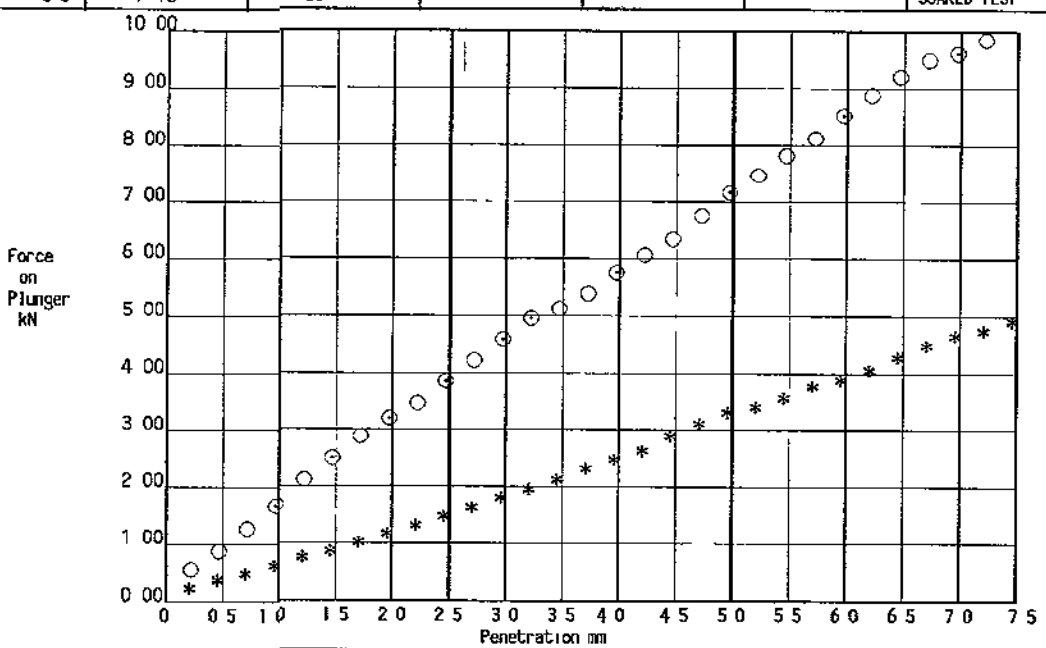
% material retained on 20mm sieve and removed before test 30

METHOD OF PREPARATION

BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

COMMENTS TEST DEEMED NOT APPROPRIATE DUE TO GREATER THAN 25% RETAINED ON 20mm SIEVE

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 16 of 20

Contract: Sacombe Road, HERTFORD.

Serial No. S24687

UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP2	1 00	B1B	Brown, black and white fine to coarse angular to subrounded GRAVEL in a stiff brown sandy clay matrix	

Moisture Content % TOP 9 7 BOTTOM 10 Average 10

Bulk Density Mg/m^3 2 31 Dry Density Mg/m^3 2 10

CBR VALUES

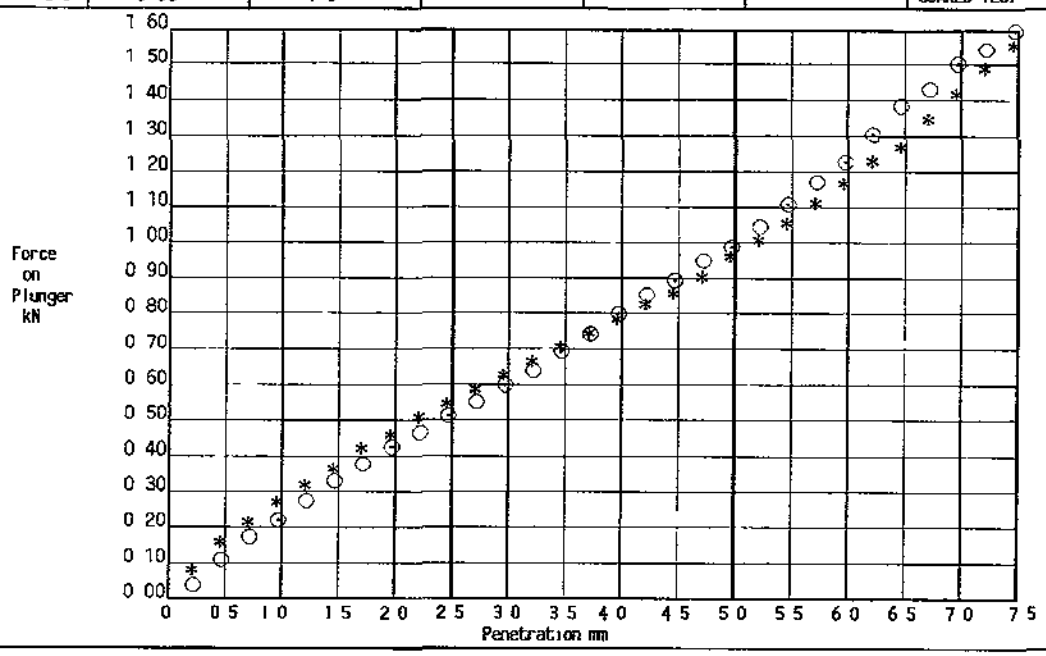
Penetration mm		Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %	Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)
TOP *	2 5	0 55	4 1		4.8	4 9
	5 0	0 96	4 8			
BOTTOM ○	2 5	0 51	3 9		4 9	
	5 0	0 99	4 9			

% material retained on 20mm sieve and removed before test 30

METHOD OF PREPARATION: BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

COMMENTS TEST DEEMED NOT APPROPRIATE DUE TO GREATER THAN 25% RETAINED ON 20mm SIEVE

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 17 of 20

Contract: Sacombe Road, HERTFORD.

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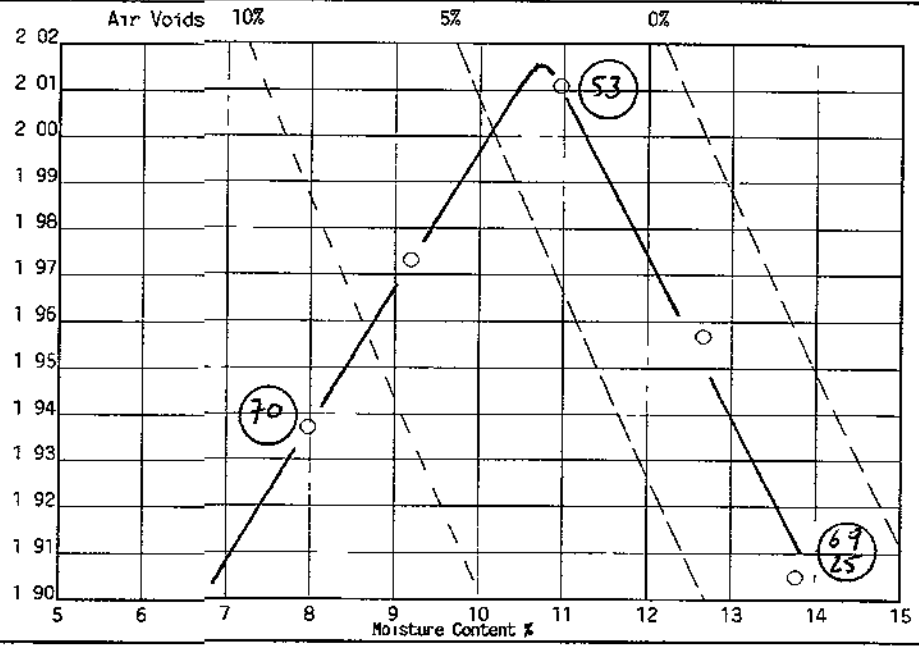
UKAS TESTING 0998

DETERMINATION OF DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

Borehole/ Pit No	Depth m	Sample	Moisture Content %	Description	Remarks
TP9	1 00	B1	11	Orangey brown silty very gravelly fine and medium SAND with occasional lumps of soft orangey brown clay Gravel is fine to coarse	

Percentage retained 37 5mm	3 0 %	Max size of cohesive lumps	mm
Percentage retained 20 0mm	6 0 %	Single or separate samples	Separate
Grading Zone	4	Particle density	2 68 Assumed
Mould Type	CBR	METHOD OF COMPACTION	B S 2 5 kg Rammer Method (BS 1377 Part 4 1990 3 4)
MAX DRY DENSITY	2 00 Mg/m^3	**OPTIMUM MOISTURE CONTENT**	11 %



METHOD OF PREPARATION: BS 1377 PART 1 1990 7 6

METHOD OF TEST: BS 1377 PART 2 1990 3 2 & PART 4 1990 3

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

COMMENTS: - ◯ CBR VALUES (see following sheets)

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 14 of 20

Contract: Sacombe Road, HERTFORD.

Serial No. S24687

UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP9	1 00	B1B	Orangey brown silty very gravelly fine and medium SAND with occasional lumps of soft orangey brown clay Gravel is fine to coarse	

Moisture Content % TOP 8 0 BOTTOM 8 1 Average 8 0

Bulk Density Mg/m^3 2 09 Dry Density Mg/m^3 1 94

CBR VALUES

Penetration mm		Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %	Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)
TOP	2 5	8 73	66		66	70
*	5 0	10 40	52			
BOTTOM	2 5	8 87	67		74	
○	5 0	14 78	74			

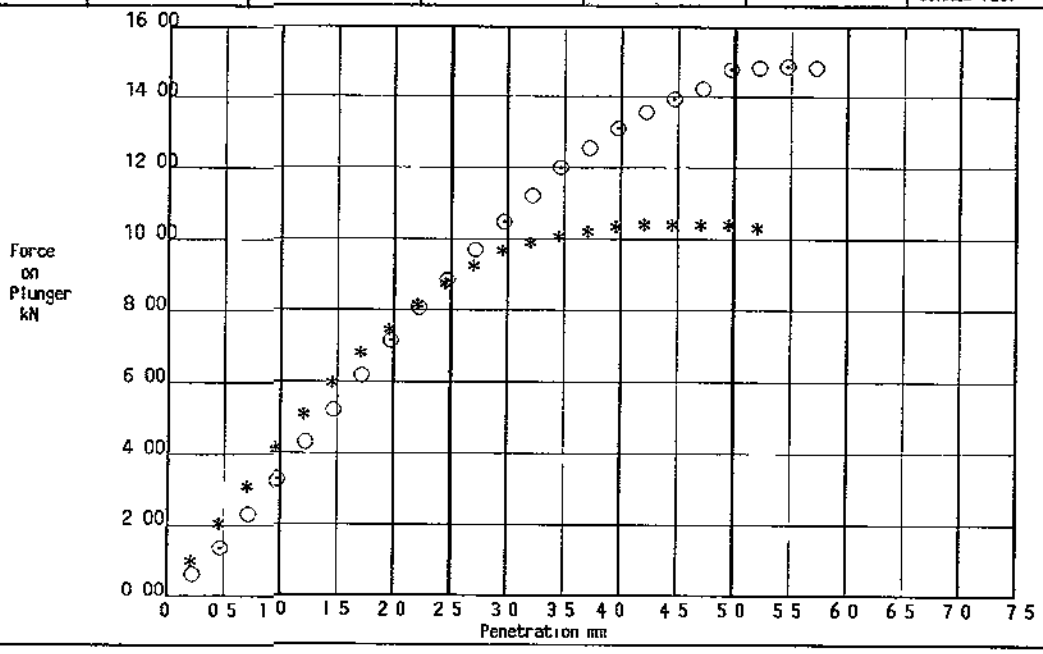
% material retained on 20mm sieve and removed before test 6

METHOD OF PREPARATION

BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

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 19 of 20

Contract: Sacombe Road, HERTFORD.

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UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP9	1 00	B1	Orangey brown silty very gravelly fine and medium SAND with occasional lumps of soft orangey brown clay Gravel is fine to coarse	

Moisture Content % TOP 11 BOTTOM 11 Average 11

Bulk Density Mg/m^3 2 23 Dry Density Mg/m^3 2 01

CBR VALUES

	Penetration mm	Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %
TOP	2 5	4 39	33	48	49
*	5 0	9 61	48	49	
BOTTOM	2 5	6 61	50	56	56
○	5 0	10 86	54	54	

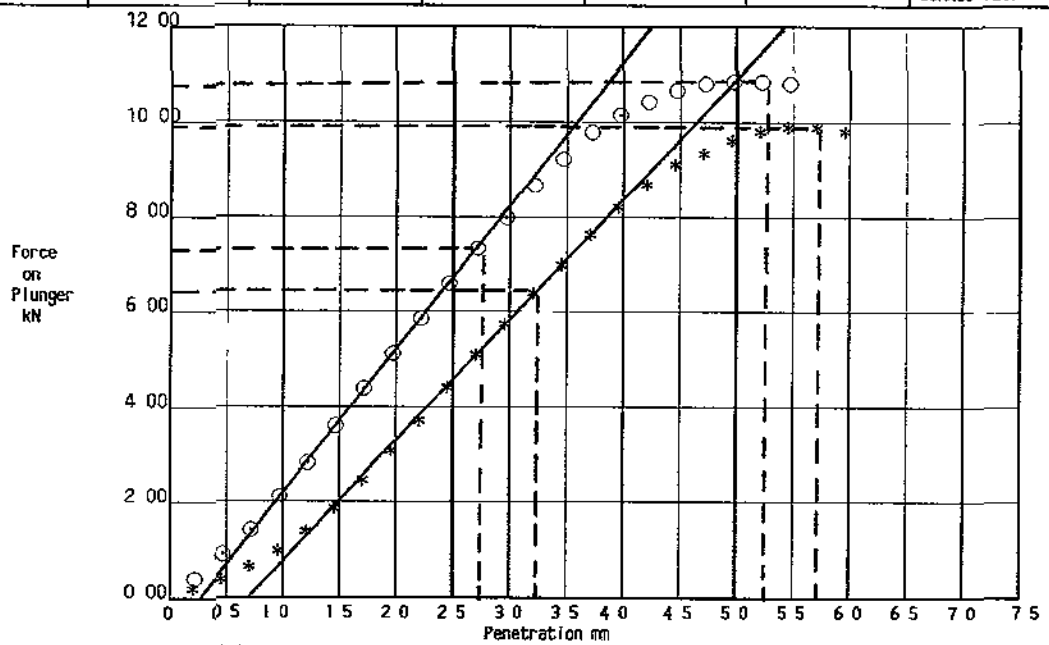
Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value): 53

% material retained on 20mm sieve and removed before test 6

METHOD OF PREPARATION: BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

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

SPTR4E

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

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Serial No.: S24687

UKAS TESTING 0998

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No / Chainage	Depth m	Sample	Description	Remarks
TP9	1 00	B1A	Orangey brown silty very gravelly fine and medium SAND with occasional lumps of soft orangey brown clay Gravel is fine to coarse	

Moisture Content % TOP 14 BOTTOM 14 Average 14

Bulk Density Mg/m^3 2 17

Dry Density Mg/m^3 1 90

CBR VALUES

Penetration mm		Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %
TOP	2 5	0 65	4 9		6,9
*	5 0	1 39	6 9		
BOTTOM	2 5	2 68	20		25
○	5 0	5 08	25		

Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)

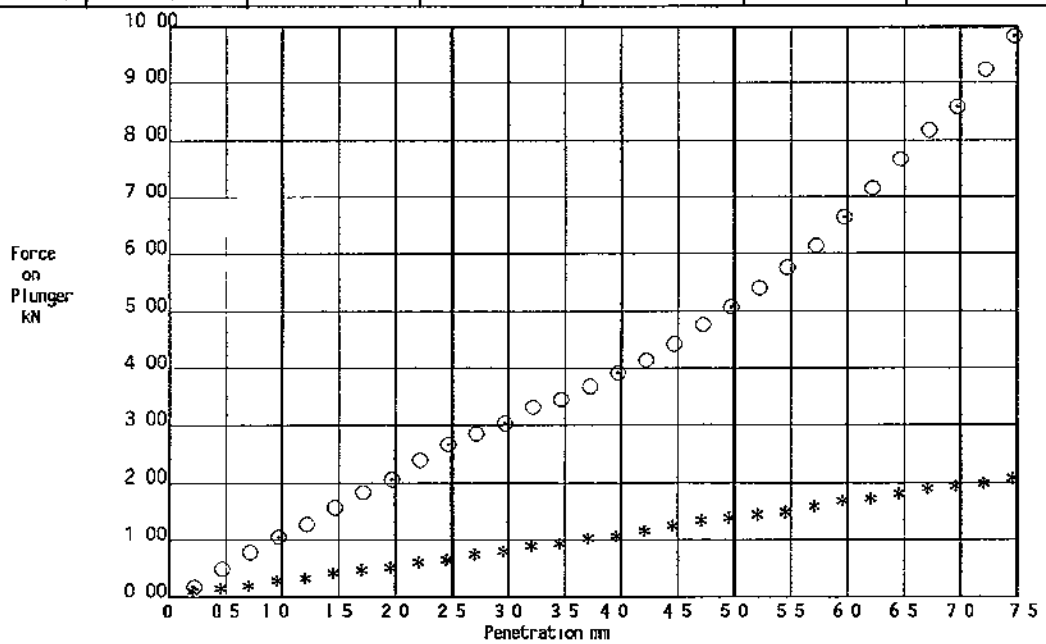
% material retained on 20mm sieve and removed before test 6

METHOD OF PREPARATION

BS 1377 Part 4 1990 7 2 4 2 5kg Rammer Method

Surcharge weights (kg) 15

SOAKED TEST NO



METHOD OF PREPARATION BS 1377 PART 1 1990 7 6 1 & 7 6 5 & PART 4 1990 7 2

METHOD OF TEST BS 1377 PART 4 1990 7 4

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

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

Appendix G

Assessment Criteria

Threshold Values for Water Supply Pipes REVISED MCH/04.04.11

Assessment Criteria – Human Health (soil)

Substance	Criteria Source	Residential			Industrial and Commercial		
Metals							
Arsenic	SGV 05.09	32			640		
Cadmium	SGV 07.09	10			230		
Chromium, III (total)	LQM/CIEH	3000			3.04 E+04		
Chromium, IV	LQM/CIEH	4.3			35		
Copper	LQM/CIEH	2330			7.17 E+04		
Lead	SGV 10	450			750		
Mercury	SGV 03.09	170			3600		
Nickel	SGV 03.09	130			1800		
Selenium	SGV 03.09	350			1.3 E+04		
Zinc	LQM/CIEH	3750			6.65 E+05		
Other Metals							
Antimony	EIC/AGS/CL:AIRE	550			7500		
Barium	EIC/AGS/CL:AIRE	1300			2.20 E+04		
Beryllium	LQM/CIEH	12			1950		
Boron	LQM/CIEH	291			1.92 E+05		
Molybdenum	EIC/AGS/CL:AIRE	670			1.70 E+04		
Vanadium	LQM/CIEH	140			4250		
TPHCWG carbon banding							
	Soil Organic Matter	1%	2.5%	6%	1%	2.5%	6%
aliphatic EC>5-6	LQM/CIEH	30	55	110	3400	6200	1.3E+4
aliphatic EC>6-8	LQM/CIEH	73	160	370	8300	1.8E+4	4.2E+4
aliphatic EC>8-10	LQM/CIEH	19	46	110	2100	5100	1.2E+4
aliphatic EC>10-12	LQM/CIEH	93	230	540	1.0E+4	2.4E+4	4.9E+4
aliphatic EC>12-16	LQM/CIEH	740	1700	3000	6.1E+4	8.3E+4	9.1E+4
aliphatic EC>16-35	LQM/CIEH	4.5E+4	6.4E+4	7.6E+4	1.6E+6	1.8E+6	1.8E+6
aromatic EC>5-7 (benzene)	LQM/CIEH	65	130	280	2.8E+4	4.9E+4	9.0E+4
aromatic EC>7-8 (toluene)	LQM/CIEH	120	270	611	5.9E+4	1.1E+5	1.9E+5
aromatic EC>8-10	LQM/CIEH	27	65	151	3700	8600	1.8E+4
aromatic EC>10-12	LQM/CIEH	69	160	346	1.7E+4	2.9E+4	3.45E+4
aromatic EC>12-16	LQM/CIEH	140	310	593	3.6E+4	3.7E+4	3.78E+4
aromatic EC>16-21	LQM/CIEH	250	480	770	2.8E+4	2.8E+4	2.8E+4
aromatic EC>21- 35	LQM/CIEH	890	1100	1230	2.8E+4	2.8E+4	2.8E+4
PAH Compounds							
	Soil Organic Matter	1%	2.5%	6%	1%	2.5%	6%
Acenaphthene	LQM/CIEH 2009	210	480	1000	8.5E+4	9.8E+4	1.0E+5
Acenaphthylene	LQM/CIEH 2009	170	400	850	8.4E+4	9.7E+4	1.0E+5
Anthracene	LQM/CIEH 2009	2300	4900	9200	5.3E+5	5.4E+5	5.4E+5
Benzo[a]anthracene	LQM/CIEH 2009	3.1	4.7	5.9	90	95	97
Benzo[a]pyrene	LQM/CIEH 2009	0.83	0.94	1		14	
Benzo[b]fluoranthene	LQM/CIEH 2009	5.6	6.5	7		100	
Benzo[ghi]perylene	LQM/CIEH 2009	44	46	47	650	660	660
Benzo[k] fluoranthene	LQM/CIEH 2009	8.5	9.6	10		140	
Chrysene	LQM/CIEH 2009	6	8	9.3		140	
Dibenzo[ah]anthracene	LQM/CIEH 2009	0.76	0.86	0.9		13	
Fluoranthene	LQM/CIEH 2009	260	460	670		2.3E+4	
Fluorene	LQM/CIEH 2009	160	380	780	6.4E+4	6.9E+4	7.1E+4
Indeno[123-cd]pyrene	LQM/CIEH 2009	3.2	3.9	4.2	60	61	62
Naphthalene	LQM/CIEH 2009	1.5	3.7	8.7	200	480	1100
Phenanthrene	LQM/CIEH 2009	92	200	380	2.2E+4	2.2E+4	2.3E+4
Pyrene	LQM/CIEH 2009	560	1000	1600		5.4E+4	
BTEX Compounds							
Benzene	SGV 03.09	0.33			95		
Toluene	SGV 03.09	610			4,400		
Ethylbenzene	SGV 03.09	350			2,800		
o-Xylene	SGV 03.09	250			2,600		
m-Xylene	SGV 03.09	240			3,500		
p-Xylene	SGV 03.09	230			3,200		
Other Compounds							
Cyanide, total	Dutch IV	50			50		
Phenol, total	SGV 06.09	420			3200		

Notes:

1. GAC based on sandy loam soil with SOM 6% (except TPH and PAH compounds)
2. All units mg kg^{-1}
3. Where GAC for TPH are exceeded, consider calculating SSAC to determine if risk is from ingestion (for which capping may be required) or from inhalation (for which vapour protection may be required)
4. GAC for TPH may be used as v-GAC for organic vapour assessment

Threshold Values for Water Supply Pipes REVISED MCH/04.04.11

Assessment Criteria – Controlled Waters

	EQS (µg l^{-1})			UK DWS (µg l^{-1})		EQS (µg l^{-1})	UK DWS (µg l^{-1})
List 1 dangerous substances							
	Fresh	Estuary	Marine				
Mercury	1	0.5	0.3	1	Endrin	0.005	0.1
Cadmium	5	5	2.5	5	Total 'Drins	0.03	-
Hexachlorocyclohexane	0.1	0.02	0.02	-	Hexachlorobenzene	0.03	-
Carbon tetrachloride	12			-	Hexachlorobutadiene	0.1	-
Total DDT	0.025			0.5	Chloroform	12	-
pp DDT	0.01			-	1,2-dichloroethane	10	-
Pentachlorophenol	2			0.1	Trichlorethylene	10	-
Dieldrin	0.01			0.03	Perchlorethylene	10	-
Isodrin	0.005			0.1	Trichlorobenzene	0.4	-
Aldrin	0.01			0.03			

List 2 dangerous substances					
1,1,1-Trichloroethane	100	-	Fenitrothion	0.01	0.1
1,1,2-Trichloroethane	400	-	Flucofuron	1	0.1
2,4-D (ester)	1	-	Iron	1000	200
2,4-D (non-ester)	40	-	Linuron	2	0.1
2,4-Dichlorophenol	20	-	Malathion	0.01	0.1
2-Chlorophenol	50	-	Mecoprop	20	0.1
4-Chloro-3-methyl-phenol	40	-	Mevinphos	0.02	0.1
Arsenic	50	10	Naphthalene (use for PAH)	10	0.1
Atrazine & Simazine	2	0.1	Omethoate	0.01	0.1
Azinphos-methyl	0.01	0.1	PCSDs	0.05	0.1
Bentazone	500	0.1	Permethrin	0.01	0.1
Benzene (use for TPH)	30	1	pH	6 - 9	6.5 - 10
Biphenyl	25	-	Sulcofuron	25	0.1
Boron	2000	1	Toluene	50	0.1
Chloronitrotoluenes	10	-	Triazaphos	0.005	0.1
Cyfluthrin	0.001	0.1	Tributyltin	0.02	0.1
Demeton	0.5	0.1	Trifluralin	0.1	0.1
Dichlorvos	0.001	0.1	Triphenyltin	0.02	0.1
Dimethoate	1	0.1	Xylene (m and p, o)	30	-
Endosulphan	0.003	0.1			

List 2 dangerous substances (hardness related)							
Hardness (mg l^{-1} $CaCO_3$)	0-50	>50 -100	>100 -150	>150 -200	>200 -250	>250	
Suitable for all fish							
Copper	1	6	10	10	10	28	2000
Nickel	50	100	150	150	200	200	20
Vanadium	20	20	20	20	60	60	-
Suitable for salmonid (game) fish							
Chromium	5	10	20	20	50	50	50
Lead	4	10	10	20	20	20	25
Zinc	8	50	75	75	75	125	-
Suitable for Cyprinid (coarse) fish							
Chromium	150	175	200	200	250	250	50
Lead	20	125	125	250	250	250	25
Zinc	75	175	250	250	250	500	-

Other Compounds			
Acrylamide	0.1	Tetrachloroethene and Trichloroethene	10
Antimony	5	Trihalomethanes (ii)	100
Benzo(a)pyrene	0.01	Vinyl chloride	0.5
Bromate	10	Aluminium	200
Cyanide	50	Iron	200
1, 2-dichloroethane	3	Manganese	50
Epichlorohydrin	0.1	Sodium	200
Fluoride	1.5	Tetrachloromethane	3
Heptachlor	0.03	Ammonium	0.5 mg l^{-1}
Heptachlor epoxide (iii)	0.03	Nitrate	50 mg l^{-1}
Other pesticides	0.1	Nitrite	0.5 mg l^{-1}
Pesticides (total)	0.5	Chloride	250 mg l^{-1}
Polycyclic aromatic hydrocarbons (i)	0.1	Sulphate	250 mg l^{-1}
Selenium	10	TPH (1989 Regs)	10

Notes:

i. Specified compounds are benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]-perylene, indeno[1,2,3-c,d]pyrene.
ii. Specified compounds are chloroform, bromoform, dibromochloromethane, bromodichloro-methane.

Unless stated otherwise all units µg l^{-1}

Threshold Values for Water Supply Pipes REVISED MCH/04.04.11

Substance [1]	WRAS (withdrawn)	Anglian Water	UK WIR	
			PE	PVC
Organic compounds				
TPH	50	50 – 1000 [2]	-	
TPH >C5-C10	-	-	2	1.4
TPH >C11-C20	-	-	10 [3]	NL
TPH >C21-C40	-	-	500 [3]	NL
Extended VOC suite	-	-	0.5 [3]	0.125 [3]
Extended SVOC suite	-	-	2 [3]	1.4 [3]
BTEX + MTBE	-	-	0.1	0.03
Chlorinated hydrocarbons				
Dichloromethane	-	1	-	-
1,2-dichloroethane	-	0.2	-	-
1,1,1-trichloroethane	-	8	-	-
1,2-dichloropropane	-	0.1	-	-
Tetrachloromethane	-	0.15	-	-
Trichloroethene	-	1.5	-	-
Tetrachloroethene	-	0.5	-	-
Vinyl chloride	-	0.1	-	-
Methyl bromide	-	10	-	-
Total	-	7	-	-
Aromatic hydrocarbons				
Benzene	-	0.5	0.1	0.03
Ethylbenzene	-	0.5	0.1	0.03
Trimethyl benzene	-	0.1	-	-
Propylbenzene	-	2	-	-
Toluene	-	0.25	0.1	0.03
Xylenes	-	0.5	0.1	0.03
Phenol	5	1	2 [3]	0.4 [3]
Cresol	-	1	2 [3]	0.04 [3]
Total	-	7	-	-
Chlorinated phenols				
Chlorophenols	-	0.5	-	-
Dichlorophenols	-	0.5	-	-
Trichlorophenols	-	0.5	-	-
2,4,6-trichlorophenol	-	0.5	-	-
Pentachlorophenol	-	0.5	-	-
Total	-	1	2 [3]	0.04 [3]
Chlorinated aromatic hydrocarbons				
Chlorobenzene	-	0.5	-	-
Dichlorobenzene	-	0.5	-	-
Trichlorobenzene	-	0.5	-	-
Pentachlorobenzene	-	0.5	-	-
Total	-	1	-	-
Polyaromatic hydrocarbons				
Naphthalene	-	5	-	-
Anthracene	-	10	-	-
Phenanthrene	-	10	-	-
Fluoranthene	-	10	-	-
Pyrene	-	10	-	-
Benzo[a]pyrene	-	1	-	-
Total	50	20	2	1.4
Other organic compounds				
Tetrahydrafurane	-	4	-	-
Styrene	-	5	-	-
Pyridine	-	2	-	-
Ethers	-	-	0.5	1
Nitrobenzene	-	-	0.5 [3]	0.4 [3]
Ketones	-	-	0.5 [3]	0.02 [3]
Aldehydes	-	-	0.5	0.02
Amines	-	-	Detected	NL

Notes:

1. All units mg kg^{-1} in soil.
2. The threshold for TPH is 1000mg kg^{-1} provided no other organic compounds are present. If the TPH level exceeds 50mg kg^{-1} then the sum of TPH plus other organic compounds must not be greater than the upper threshold. If the other compounds are not tested for then the threshold for TPH must be set at the lower threshold.
3. All UKWIR TV's (except BTEX and MTBE) are based on taste and odour detection threshold.
4. PE – polyethylene; PVC – polyvinyl chloride

Appendix H

Risk Assessment Matrices

Risk Assessment Matrices

The environmental risks identified for each pollutant linkage have been derived using a matrix based on the model provided in CIRIA C552 Contaminated Land Risk Assessment, A guide to Good Practice, which considers both the magnitude of consequence and the likelihood of occurrence. The overall risk is determined by using a worst case scenario matrix as follows.

		Likelihood of Occurrence				
		Almost Certain	**Likely**	**Possible**	**Unlikely**	**Very Unlikely**
Potential Magnitude of Consequence	**Severe**	Very High	High	Moderate	Low	Low
	Moderate	High	Moderate	Moderate	Low	Very Low
	Mild	Moderate	Moderate	Low	Very Low	Very Low
	Negligible	Low	Low	Very Low	Very Low	Very Low

Input for the matrix above is based on the following scenarios for the potential magnitude of the consequence and the likely occurrence of the event.

Potential Magnitude of the Consequence

Severe	• Permanent damage to buildings and structure • Long term irreversible damage to human health • Acute contamination of groundwater and/or surface water
Moderate	• Major (but reversible) damage to buildings and structures. • Long term (but curable) effects on human health • Heavy contamination of groundwater and /or surface water
Mild	• Minor reversible damage to building and structure • Short term effects on human health. • Minor contamination of groundwater and/or surface water
Negligible	• Very little or no damage to buildings and structures. • Very minor, short term or no effects on human health. • Very little or no contamination of groundwater and/or surface water

Likelihood of Occurrence

Almost Certain	• There is a clear pollutant linkage and circumstances are such that an event will inevitably occur or there is already evidence of harm to receptors
Likely	• There is a pollutant linkage and circumstances are such that an event is likely to occur in either the long or short term
Possible	• There is a pollutant linkage and circumstances are possible under which the event could occur in the sort term but more likely in the long term
Unlikely	• There is a pollutant linkage and circumstances are possible under which the event could occur. It is however, unlikely in long term and even less so in the short term
Very Unlikely	• There is a pollutant linage however circumstances are such that it is unlikely that an event would ever occur