DISCONS

REPORT ON A GROUND INVESTIGATION AND PRELIMINARY CONTAMINATION RISK ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT, HINCKLEY ROAD, BURBAGE, LEICESTERSHIRE

Murray Rix Geotechnical
Civil and Geotechnical Engineers
13 Willow Park
Upton Lane
Stoke Golding
Nuneaton
CV13 6EU

Tel: 01455 213311
Fax: 01455 213969
E-Mail: ted@murrayrix.co.uk

GEOREP/11-320R(A)
September 2011

REPORT ON A GROUND INVESTIGATION AND PRELIMINARY CONTAMINATION RISK ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT, HINCKLEY ROAD, BURBAGE, LEICESTERSHIRE

Contents

1. Introduction and Objectives

2. Findings of the Desk Study

3. Site Work

4. Laboratory Work

5. Engineering Assessment and Recommendations
5.1 Soil Profile
5.2 Groundwater Conditions
5.3 Excavations
5.4 Structural Foundations
5.5 Ground Floor Slabs
5.6 Chemical Attack on Concrete

6. Contamination Risk Estimation and Evaluation
6.1 Risk Estimation
6.2 Human Health Risk Assessment – Fill Materials
6.3 Human Health Risk Assessment – Natural Soils
6.4 Summary of Contamination Test Results
6.5 Risk Evaluation
6.6 Remedial Measures and Further Investigation

References
General Notes
Appendices

Appendix (i)	Windowless Sample Hole Logs (WS1-WS4)
	Hand Auger Logs (HA1-HA2)
Appendix (ii)	Laboratory Test Results - Material Properties
Appendix (iii)	Laboratory Test Results – Contamination
Appendix (iv)	ULS and SLS Calculations
Appendix (v)	Figure 1 – Investigation Location Plan
	Figure 2 – Undrained Strength against Depth

REPORT ON A GROUND INVESTIGATION AND PRELIMINARY CONTAMINATION RISK ASSESSMENT FOR A PROPOSED RESIDENTIAL DEVELOPMENT, HINCKLEY ROAD, BURBAGE, LEICESTERSHIRE

1. INTRODUCTION AND OBJECTIVES

1.1 This report has been prepared on instructions given by Stokes Evans Developments of Hall Farm Granary, St. Peters Road, Arnesby, Leicestershire LE8 5WJ.

1.2 The site has been the subject of a Desk Study, which is reported separately, but the conclusions are summarised in section 2 of this report:

- Murray Rix Geotechnical Report GEOJOB/11-320R Report on a Desk Study for a Proposed Residential Development, Hinckley Road, Burbage, Leicestershire dated August 2011.

1.3 This report presents the findings of an intrusive investigation. The aims of the investigation phase were to:

- Investigate the ground and groundwater conditions so that suitable methods of design and construction may be adopted for the foundations for the proposed residential development.
- Undertake material property and contamination testing of samples recovered from an intrusive investigation.
- Assess the nature, extent and severity of possible contamination at the site.
- Undertake a preliminary contamination risk assessment.

1.4 As shown on Figure 1, Appendix (v), the site is currently occupied by commercial premises (with blacktop hardstanding) to the south east and a bungalow (with gardens and a driveway) to the north west. It is proposed to demolish the existing buildings and construct a residential development. The exact layout of the proposed development is not as yet decided. However, it is understood that the development will include private gardens. The site is within the village of Burbage, Leicestershire at and around National Grid Reference 444149E 292852N (Reference 1). It is roughly rectangular in shape and covers an area of approximately 0.14 ha.

1.5 The geotechnical investigation, assessment and reporting has been carried out in general accordance with the following:

- BS EN ISO 14688-1:2002. Geotechnical investigation and testing – Identification and classification of a soil – Part 1: Identification and description.
- BS EN ISO 14688-1:2005. Geotechnical investigation and testing – Identification and classification of a soil – Part 2: Principles for a classification.
- BS EN ISO 22476-3:2005. Geotechnical investigation and testing – Field testing – Part 3: Standard Penetration Test.
- BS EN ISO 14689-1:2003. Geotechnical investigation and testing – Identification and classification of rock – Part 1: Identification and description.
- BS EN ISO 22475-1:2006. Geotechnical investigation and testing – Sampling methods and groundwater measurements – Part 1: Technical principles for execution.
- BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 1: General Rules.

- NA to BS EN 1997-1:2004. UK National Annex to Eurocode 7: Geotechnical design – Part 1: General Rules.
- BS EN 1997-2:2007. Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing.
- NA to BS EN 1997-2:2007. UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing.

2. FINDINGS OF THE DESK STUDY

2.1 The historic maps included in the Desk Study report indicate that the site was undeveloped land until around 1924 when buildings, possibly forming an extension to the Hosiery Manufactory to the south, crossed the area of both the commercial premises and the area of the bungalow. The maps subsequent to 1959 show the bungalow and existing commercial premises at the site as being built and subsequently extended. Around this time the buildings to the south are identified as a Builder's Yard and may include part of the area under investigation. A Hosiery Factory, Engineering Works and a Garage have been identified in areas around the site.

Small ponds 40m and beyond, to the south west, have been infilled over time. St Catherine's Church which includes a graveyard is present to the south east (a closest of 50m to the site). A shallow excavation area was identified around 150m to the north of the site but not shown subsequent to 1924-1925 and has been built over. These features represent point sources of potential ground gases and are unlikely to influence the site.

2.2 The site comprises single and two storey commercial premises in the south east part of the site with a blacktop access off Hinckley Road which leads down to the rear of the buildings. The buildings are of brick construction. The north western part of the site is occupied by a traditional brick bungalow with gardens and a driveway. The front 2-storey part of the commercial premises has most recently been used for mobile phone sales. The rear single storey structure was noted as being used for garaging, workshops and storage. It is understood from discussions with the owner that the site has been used as a builder's yard with carpenter's workshop and there was evidence of associated materials in the buildings.

2.3 To the rear west of the site is a recreation ground with playing fields and a pavilion. To the north and south is housing and to the east on the opposite side of Hinckley Road is further housing. It is known that prior to construction of the housing to the south a factory building was present and some remediation of hydrocarbon spillage was necessary. Further north along Hinckley Road is housing and a small works manufacturing timber products such as sheds, gates and similar items for gardens. Further south along Hinckley Road is a public house, housing, St Catherine's Church and graveyard, and shops.

2.4 Published geological information (Reference 2) indicates that the site as underlain by drift deposits comprising -

Pleistocene deposits (Wolston Glacial Succession) -
Oadby Till: mainly grey pebbly clay with chalk
Wolston Sand and Gravel: yellow or red sand and gravel
Wolston Clay: grey stoneless clay and silt

Thrussington Till: mainly red or brown pebbly clay
(The Dunsmore Gravel is shown to overlie the Oadby Till to the south of the site)

Overlying solid deposits comprising -

Triassic deposits -
Mercia Mudstone Group: red-brown clays and mudstones with subordinate sandstones

The drift deposits comprising the Oadby Till are classed as Unproductive Strata. The underlying solid deposits of the Mercia Mudstone are designated a Secondary B Aquifer. The site is not in a groundwater source protection zone.

2.5 The nearest surface water feature listed in the Envirocheck report is 240m from the site beyond St Catherine's Church to the south east.

2.6 For groundwater, the sensitivity is assessed as L1 (Low) to L2 (Very Low) and for surface water (excluding coastal water) the sensitivity is appraised as L1 (Low).

2.7 The site does not lie in an area where radon protection measures are necessary in new dwellings (Reference 3).

2.8 The Desk Study identified the need for some preliminary contamination sampling and testing to quantify potential risks associated with previous site usage including a Hosiery Manufactory, Builder's Yard and commercial premises. No sources of infilled ground likely to give rise to ground gases that could affect the site have been uncovered and no gas monitoring was proposed unless the intrusive investigation highlighted conditions of concern.

3. SITE WORK

3.1 Four exploratory boreholes (WS1 to WS4) were drilled at the site by windowless sampling techniques and two hand auger holes (HA1 and HA2) excavated by hand in the rear garden area of the bungalow where access could not be gained by the drilling rig. The boreholes were sunk to depths between 4.45 and 5.45m and the hand auger holes to depths of 0.55 and 0.90m. A concrete floor was cored in the location of WS2 to facilitate drilling.

3.2 Continuous samples were recovered from the full depth of the boreholes and Standard Penetration Tests (SPTs) were undertaken at regular intervals. The continuous samples were logged and sub-sampled to obtain samples for contamination and material property testing. Hand shear vane strength determinations were carried out in cohesive strata. Small disturbed bag samples were recovered for material property testing. Samples for contamination testing were sealed into amber glass jars to prevent sample deterioration and placed in cool boxes for transport to the laboratory as quickly as possible.

3.3 The strata exposed in the hand auger holes were logged and as for the windowless sample boreholes, samples for contamination testing were recovered and sealed into amber glass

jars to prevent sample deterioration and placed in cool boxes for transport to the laboratory as quickly as possible.

3.5 The investigation was in general accordance with the documents of Section 1.5.

3.6 The site work was undertaken on 22 August 2011.

3.7 All of the samples were transported to the laboratory for detailed examination and selected samples were programmed for testing.

3.8 Details of the strata encountered in the exploratory holes are given on the logs presented in Appendix (i). The investigation positions are shown on Figure 1, Appendix (v).

4. LABORATORY WORK

4.1 The following laboratory testing was undertaken to assess material properties:

Natural Moisture Contents
Liquid and Plastic Limits
Soluble Sulphate Contents
pH Values

4.2 The following testing was undertaken to determine possible contamination at the site:

Arsenic	Speciated Polyaromatic Hydrocarbons
Cadmium	Cyanide (total)
Chromium	Asbestos
Chromium VI	Total Petroleum Hydrocarbons aromatic/aliphatic
Mercury	split and banded
Lead	BTEX
Selenium	Methyl tert-Butyl Ether (MTBE)
Copper	pH Value
Nickel	VOCs
Zinc	VOCs

4.3 The material property test results are presented in Appendix (ii) and the contamination results as Appendix (iii).

4.4 The laboratory testing was undertaken during the period 24 August to 9 September, 2011.

4.5 The testing was undertaken at UKAS and MCERTs accredited laboratories.

5. ENGINEERING ASSESSMENT AND RECOMMENDATIONS

5.1 Soil Profile

Floor construction of concrete was present in WS2 in the workshop/garage to the rear of the commercial building; and blacktop was present in the positions of WS3 and WS4. Below the surface construction and elsewhere from ground level, shallow fill materials

were encountered. The materials included varying proportions of black ash, glass, gravel, crushed concrete, clay, brick, clinker and topsoil and extended to depths between 0.45 and 0.60m below ground level.

Underlying the forgoing were deposits of the Oadby Till. These comprised gravelly, occasionally sandy, clays which extended to the full depth of investigation. The consistency (strength) of the deposits was highly variable as shown by the in-situ Standard Penetration Test results (Reference 4) and the hand shear vane strength results on the logs. Firm and stiffer clays were present but in some locations soft and very soft deposits were encountered near surface, notably in positions WS2 and WS4. In WS4 very soft very sandy clays extended to 2.10m depth. It was noted that there was some cracking of the adjoining structure in this area suggesting that it is founded on an inadequate bearing stratum.

The laboratory plasticity index test results indicate clays of low to intermediate plasticity (CL to CI soils) and low to (marginally) medium shrinkability in accordance with NHBC Standards (Reference 5). It is recommended that as a cautious approach, the clays are assumed as being of medium shrinkability in assessing foundation depths in relation to trees at and close to the site.

5.2 Groundwater Conditions

No groundwater seepage was detected in the investigation holes during the fieldwork. However, the very soft deposits between 1.00 and 2.10m depth in WS4 were notably wet.

It should be borne in mind that groundwater conditions can vary with seasonal and other effects and thus at times may be at variance with the conditions noted at the time of the site work.

5.3 Excavations

Random falls and collapse of vertical excavation faces can be expected particularly in fill materials, in soft strata and if water seepage is encountered. At least intermittent support is likely to be required where personnel are required to enter deepened vertical sided excavations.

5.4 Structural Foundations

It is understood that the development is to comprise conventional 2-storey housing of brick construction. Foundation recommendations are given for the following –

- Ultimate Limit State (ULS) (stability)
- Serviceability Limit State (SLS) (settlements and ground movements)

The ULS assessment of stability examines the bearing resistance of the ground. The SLS assessment limits the settlements to assessed acceptable limits. The SLS also requires that suitable foundation depths and construction are adopted to cater for the potential ground movements due to the presence of trees and other major vegetation (including future planting) in close proximity to the proposed houses.

The natural soils at the site comprise gravelly, occasionally sandy, clays of variable consistency. The stiffer clays provide a good bearing stratum but the soft and very soft clays present a weak bearing stratum. The weaker deposits were encountered in WS2 (0.45-1.60m), WS3 (0.55-1.00m) and WS4 (0.55-2.10m), but are likely to be randomly

distributed elsewhere at the site. Traditional foundations would best be carried down to the firm and stiffer clays, i.e. to depths of 1.00 to 2.10m. The alternatives would be rafted or possibly piled foundations.

The firm and stiffer glacial clays are assessed as having a lower bound characteristic undrained strength (c_u) of 50kPa[1] as shown in Figure 2, Appendix (v). The analysis of Appendix (iv) for strip footings of 0.60m width at 1.00m depth, suggests a preliminary design bearing resistance of around 90-100kPa for footings bearing on these clays. These should have an overall factor of safety against shear failure of 3 and limit settlements to less than 20-25mm. This bearing pressure is relatively low but requires removal of particularly soft materials from immediately below foundations. The use of traditional shallow foundations is likely to require new foundations to be deepened to bear below (i) soft and very soft clays; (ii) areas of deepened fill; (iii) ground disturbed in removal of existing below ground construction; and (iv) the depths of influence of trees and other major vegetation.

5.5 Ground Floor Slabs

Ground floor slabs may be cast on ground other than within the zone of influence of trees where suspended slabs over a suitable void will be required. Where deepened fill is present suspended slabs cast on ground would be acceptable.

5.6 Chemical Attack on Concrete

The results of soluble sulphate and pH determinations on soil samples carried out as part of the soil property testing are attached in Appendix (ii). The results for SO_4 may be derived from the laboratory test results by using the following equation $SO_3 = 0.833\ SO_4$. The site is taken as a 'brownfield' site with a static water table in accordance with BRE Special Digest 1 (2005) (Reference 6). The sulphate concentrations are relatively low and the pH values are near-neutral compliant with the Design Sulphate Class DS-1. The ACEC class for the site is taken as AC-1. In accordance with this standard, concrete design will depend on the form of construction and performance requirements.

6. CONTAMINATION RISK ESTIMATION AND EVALUATION

6.1 Risk Estimation

The processes for assessing contamination should be based on the protection of human health, building materials and the environment using the SOURCE-PATHWAY-RECEPTOR concept. The sources, pathways and receptors relevant to the site have been identified in the Phase 1 Investigation using a conceptual site model in accordance with the Guidance for the Safe Development of Housing on Land Affected by Contamination (Reference 7). Reference is also made to the procedures in CLR 11 Model Procedures for the Management of Land Contamination (Reference 8). The preliminary conceptual site model presented in the Phase 1 Investigation report contains elements of conjecture and hypothesis. Where considered necessary, elements of the conceptual site model are investigated to obtain actual data on conditions below the site.

---

[1] Based on corrected Hand Shear Vane results using a correction factor of 1.491 in accordance with the manufacturer's recommendations and undrained strengths determined from Standard Penetration Tests for low to intermediate plasticity clays using a conversion factor of 5.5 in accordance with Reference 4.

To assess potential risks, samples from the site have been screened for a range of contaminants in accordance with the recommendations of the Phase 1 Desk Study report based on recent and previous site and adjoining-land uses. In accordance with current practice (Reference 9), the results of laboratory testing have been divided into data sets based on material type and where sufficient results are available they have been statistically analysed. The testing was carried out on samples recovered from the fill and natural soils. As only a limited number of results are available they have been compared directly with published guideline values which represent critical concentrations below which the site may be considered 'suitable for use'. This does not preclude the need to look carefully at individual results and the materials tested particularly in assessing the reasons for any results that indicate contaminated materials.

The selection of appropriate critical concentrations of contaminants for the assessment of risks to human health is based on the CLEA guidance (References 10 to 12). This was updated in autumn 2008 and replaced all previous guidance. This most recent guidance allows derivation of Soil Guideline Values based on:

- generic assumptions about the fate and transport of chemicals in the environment;
- a generic conceptual model for site conditions and human behaviour to estimate exposure to soil contaminants for those living, working and/or playing on contaminated sites over a long period of time; and
- Health Criteria Values that represent a tolerable or minimal risk to health from chronic exposure.

The Environment Agency has published SGVs for eleven contaminants (References 13 to 34) and was proposing to publish further SGVs during 2010 but none have been published to date. While it is recognised that the previously published SGVs have been withdrawn as they do not follow the updated approach, there are few other current published UK guidelines. In the absence of current published guidelines, the former guidelines (References 35 and 36) and the LQM/CIEH Generic Assessment Criteria (Reference 37) have been used as initial screening values in the following assessments where no new SGVs have been published. Site Specific Assessment Criteria (SSAC) and Generic Assessment Criteria (GACs) for individual contaminants can be derived using CLEA v1.06 (2009).

The published criteria relate to standard land uses for residential end use and commercial/industrial use. The residential end use criteria are protective of the health of young children (0 to 6 years) and assume daily exposure to contaminants over a six year period. The commercial/industrial use relates to adults and is for exposure durations based on a standard working week. The results have been compared with the critical concentrations for a residential end use.

6.2 Human Health Risk Assessment – Fill Materials

The assessment of possible risks to human health from the soils at the site is based on the 'suitability for use' as described in the foregoing. Table 1 below summaries the outcome of comparison of the data for the fill materials with the critical concentrations for metals (3 samples) As only a limited number of samples have been analysed, the results for the metals are compared directly with the critical concentrations.

Table 1 – Summary of Test Results – Metals and PAH – Fill Materials (assumed 6% SOM - reasonable worst cases for comparison purposes)

Contaminant	Range of Results (mg/kg)	Critical Concentration Cc (mg/kg)
Arsenic	14-18	32
Cadmium	0.3-0.5	10
Chromium	18-23	130
Chromium VI	<1	4.3
Mercury	<1.0	170
Lead	120-330	450
Selenium	<3	350
Copper	48-86	2330
Nickel	2-35	130
Zinc	160-580	3750

None of the test results for metals exceed the relevant critical concentrations and thus do not suggest contaminated conditions.

Table 2 below summaries the outcome of comparison of the data for the fill materials with the critical concentrations for PAHs (2 samples plus 3 samples in SVOC suites). As only a limited number of samples have been analysed, the results for the PAHs are compared directly with the critical concentrations.

Table 2 – Summary of Test Results – PAHs – Fill Materials (assumed 1% SOM - reasonable worst cases for comparison purposes)

Contaminant	Range of Results (mg/kg)	Critical Concentration Cc (mg/kg)
Acenaphthene	<0.1 -0.1	210
Acenaphthylene	<0.1-0.3	170
Anthracene	<0.1 – 0.5	2300
Benzo(a)Anthracene	0.2-**4.0**	3.1
Benzo(a)Pyrene	0.2-**4.3**	0.83
Benzo(b/k)Fluoranthene	0.4-**6.7**	5.6
Benzo(ghi)Perylene	0.2-4.0	44
Chrysene	0.2-4.1	6
Dibenz(ah)Anthracene	<0.1-**0.8**	0.76
Fluoranthene	0.3-8.0	260
Fluorene	<0.1-0.4	160
Indeno(123cd)Pyrene	0.1-2.9	3.2
Naphthalene	<0.1	1.5
Phenanthrene	0.1-0.4	92
Pyrene	0.3-7.0	560

A number of the results for the PAHs are elevated above the critical concentrations. All the elevated results indicated in bold are from one sample of ash fill below the floor slab in position WS2. Any ash fill at the site must be considered suspect.

While some of the other results for SVOCs are elevated above the detection limit, it is only those results in the PAH range (see Table 2) that are of concern and can be used as markers for the presence of elevated SVOCs.

No VOCs (2 samples) were detected, no asbestos (1 sample) was detected and no total cyanide (1 sample) was detected.

One sample of fill was analysed for Total Petroleum Hydrocarbons (TPH) with aromatic/aliphatic split. The results are summarised in Table 3 below. The critical concentrations are for a residential end use with 1% soil organic matter.

Table 3 - TPH aromatic/aliphatic split – Fill Materials (assumed 1% SOM - reasonable worst cases for comparison purposes)

Determinand	**Range of Results (mg/kg)**	**GAC (mg/kg)**
TPH Aromatic EC6-7	<0.01	65
TPH Aromatic EC7-8	<0.01	120
TPH Aromatic EC8-10	<0.01	27
TPH Aromatic EC10-12	<1	69
TPH Aromatic EC12-16	3	140
TPH Aromatic EC16-21	50	250
TPH Aromatic EC21-35	150	890
TPH Aliphatic EC5-6	<0.01	30
TPH Aliphatic EC6-8	<0.01	73
TPH Aliphatic EC8-10	<0.01	19
TPH Aliphatic EC10-12	<1	93
TPH Aliphatic EC12-16	<1	740
TPH Aliphatic EC16-21	7	450000
TPH Aliphatic EC21-35	27	450000

TPH levels are very low and well below the GAC values; the cumulative effects also do not present a problem. The same sample was tested for BTEX and MTBE but none was detected.

6.3 Human Health Risk Assessment – Natural Soils

The assessment of possible risks to human health from the soils at the site is based on the 'suitability for use' as described in the foregoing. Table 4 below summaries the outcome of the comparison of the data for the natural soils with the critical concentrations for metals (3 results). As only a limited number of samples have been analysed, the results are compared directly with the critical concentrations.

Table 4 – Summary of Test Results – Metals and PAH – Natural Soils (assumed 6% SOM for metals - reasonable worst cases for comparison purposes)

Contaminant	Range of Results (mg/kg)	Critical Concentration Cc (mg/kg)
Arsenic	8.3-14	32
Cadmium	0.3-0.7	10
Chromium	18-56	130
Chromium VI	<1	4.3
Mercury	<1.0	170
Lead	22-**600**	450
Selenium	<3	350
Copper	29–63	2330
Nickel	25-75	130
Zinc	84-250	3750

The results do not indicate any levels of contaminants in excess of the relevant critical concentrations other than one sample from HA2 which indicates elevated lead in the natural soil. In this excavation position an old pipe in an ash surround was encountered just above the natural soil. The contamination could have emanated from the pipe or possibly be a result of cross contamination during sampling.

No PAHs were detected (2 samples plus 2 samples in SVOC suites), no total cyanide was detected (1 sample), no SVOCs were detected (2 samples), no VOCs were detected (2 samples), no TPH was detected (2 samples), and no BTEX or MTBE contamination was detected (2 samples).

6.4 Summary of Contamination Test Results

In summary, the results of the contamination sampling and testing have revealed only localised contamination within ash fill (PAHs in WS2) and natural soil (lead in HA2), though it is suspected that the contamination in the latter position may have emanated from the overlying ash fill as a result of cross contamination during sampling.

6.5 Risk Evaluation

The purpose of the risk evaluation is to assess whether there are any unacceptable risks to potential receptors from contamination at the site. The risk evaluation considers individually the receptors and pathways identified in the original conceptual model and represents a further refinement of the model. The contamination testing to date has revealed only localised contaminates of concern.

Site Workers

Risks to site workers are considered to come through direct and indirect contact with contaminated soils either by direct skin contact, inhalation of dust/vapour or ingestion by hand to mouth transfer. In accordance with good practice gloves, boots and overalls should be worn to reduce the risks of skin contact. A high standard of personal hygiene should be maintained on site to reduce risks of hand to mouth transfer.

End Users

Risks to end users usually come from direct contact with the ground, ingestion or inhalation of soil particles/vapour or indirect contact such as ingestion of plants or vegetables grown in contaminated soils. Where the site is covered by buildings and other hard standing there is not deemed to be a pathway by which end users could come into contact with the ground. The elevated contaminants identified should not present problems below covered areas. In areas of garden or other soft landscaping a potential pathway exists for direct contact.

Building Materials

There are levels of some contaminants in the soils that may be considered toxic in relation to water supply pipes. Guidance can be obtained from Reference 39 and the local Water Authority. Plastic water supply pipes may be unsuitable and some form of barrier pipe may be necessary.

Local Environment

Groundwater resources and surface water can be affected by the migration of contaminants. The Environment Agency website suggests the Oadby Till at the site represents Unproductive Strata. The underlying solid deposits of the Mercia Mudstone are designated a Secondary B Aquifer. The site is not in a groundwater source protection zone. The levels of contaminants encountered in the fill and natural soils are very low and the available information indicates that the risks to groundwater resources are very low.

6.6 Remedial Measures and Further Investigation

The investigation has identified levels of some contaminants locally as being of concern. Based on the available information some remedial measures are deemed necessary within the ground. The following is proposed:

(i) The elevated PAHs in the ash fill in WS2 are of concern and it is recommended that all ash fill is removed from garden areas. The extent of the ash will need to be carefully identified and care taken not to spread it around the site during demolition works. This includes the ash fill in WS4 and the surround to the old pipe in position HA2 which need to be chased back.

(ii) The elevated lead in the natural ground in HA2 is of concern and further investigation should be carried out in this area to verify or otherwise the findings of the intrusive investigation (note that the suspect ash fill surrounding the pipe in this area may have led to cross contamination of the underlying natural ground and should be removed as required by (i)).

(iii) A Method Statement will need to be drawn up detailing the remedial measures to be adopted, the testing requirements (including Waste Acceptance Criteria (WAC) testing of materials to be removed from site), supply of Conveyance and Delivery Notes, approvals of imported soils and other matters to be addressed in ensuring the site is fit for purpose.

The foregoing does not preclude the need to identify possible sources of contamination during the development works. If suspect materials are uncovered these should be reported immediately. Consideration should also be given to the acceptability of leaving fill materials in gardens due to their physical properties. As the fill is generally of limited thickness it may be appropriate to remove it from the proposed gardens.



E.J. Murray BSc, PhD, CEng, FICE, CGeol, FGS, MaPS

REFERENCES

1. Ordnance Survey 1:50,000 Series Sheet 140 Leicester and Coventry area 2002.

2. British Geological Survey 1:50,000 Series Sheet 169 Coventry. Solid and Drift Edition 1994.

3. Building Research Establishment 2007 Radon: guidance on protective measures for new dwellings. BRE.

4. Stroud, M. A. and Butler, F. G. 1975. 'The Standard Penetration Test and the Engineering Properties of Glacial Materials' Proceedings of the Symposium of University of Birmingham 21-23 April 1975.

5. NHBC (2008). NHBC Standards: Chapter 4.2, Building Near Trees.

6. BRE Special Digest 1:2005 Third Edition Concrete in Aggressive Ground. BRE Construction Division.

7. Environment Agency and NHBC (2008) 'Guidance for the Safe Development of Housing on Land Affected by Contamination' R & D Publication 66. Environment Agency.

8. Department of the Environment, Food and Rural Affairs and Environment Agency 2004. Model Procedures for the Management of Land Contamination. Contaminated Land Report 11.

9. CL:AIRE and CIEH 2008 Guidance on Comparing Soil Contamination Data with a Critical Concentration.

10. Environment Agency 2009 Updated technical background to the CLEA model: Science Report – Final SC050032/SR3.

11. Environment Agency 2009 Human Health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2.

12. Environment Agency 2008 Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values. Science Report SC050021/SR7.

13. Environment Agency 2009 Soil Guideline Values for Selenium in Soil. Science Report SC050021/Selenium SGV.

14. Environment Agency 2009 Soil Guideline Values for Mercury in Soil. Science Report SC050021/Mercury SGV.

15. Environment Agency 2009 Soil Guideline Values for Benzene in Soil. Science Report SC050021/Benzene SGV.

16. Environment Agency 2009 Soil Guideline Values for Ethyl benzene in Soil. Science Report SC050021/Ethylbenzene SGV.

17. Environment Agency 2009 Soil Guideline Values for Toluene in Soil. Science Report SC050021/Toluene SGV.

18. Environment Agency 2009 Soil Guideline Values for Xylene in Soil. Science Report SC050021/Xylene SGV.

19. Environment Agency 2009 Soil Guideline Values for Arsenic in Soil. Science Report SC050021/Arsenic SGV.

20. Environment Agency 2009 Soil Guideline Values for Nickel in Soil. Science Report SC050021/Nickel SGV.

21. Environment Agency 2009 Soil Guideline Values for Cadmium in Soil. Science Report SC050021/Cadmium SGV.

22. Environment Agency 2009 Soil Guideline Values for Phenol in Soil. Science Report SC050021/Phenol SGV.

23. Environment Agency 2009 Soil Guideline Values for Dioxins, Furans and Dioxin Like PCBs in Soil. Science Report SC050021/Dioxins, Furans and Dioxin Like PCBs SGV.

24. Environment Agency 2009 Supplementary Information for the derivation of SGV for Selenium. Science Report: SC050021/Technical Review selenium.

25. Environment Agency 2009 Supplementary Information for the derivation of SGV for Mercury. Science Report: SC050021/Technical Review mercury.

26. Environment Agency 2009 Supplementary Information for the derivation of SGV for Benzene. Science Report: SC050021/Technical Review benzene.

27. Environment Agency 2009 Supplementary Information for the derivation of SGV for Ethyl benzene. Science Report: SC050021/Technical Review ethyl benzene.

28. Environment Agency 2009 Supplementary Information for the derivation of SGV for Toluene. Science Report: SC050021/Technical Review toluene.

29. Environment Agency 2009 Supplementary Information for the derivation of SGV for Xylene. Science Report: SC050021/Technical Review xylene.

30. Environment Agency 2009 Supplementary Information for the derivation of SGV for Arsenic. Science Report: SC050021/Technical Review arsenic.

31. Environment Agency 2009 Supplementary Information for the derivation of SGV for Nickel. Science Report: SC050021/Technical Review nickel.

32. Environment Agency 2009 Supplementary Information for the derivation of SGV for Cadmium. Science Report: SC050021/Technical Review cadmium.

33. Environment Agency 2009 Supplementary Information for the derivation of SGV for Phenol. Science Report: SC050021/Technical Review phenol.

34. Environment Agency 2009 Supplementary Information for the derivation of SGV for Dioxins, Furans and Dioxin Like PCB's. Science Report: SC050021/Technical Review dioxins, furans and dioxin like PCB's.

35. Department of the Environment, Food and Rural Affairs and Environment Agency 2002 Soil Guideline Values for Chromium Contamination R & D Publication SGV 4.

36. Department of the Environment, Food and Rural Affairs and Environment Agency 2002 Soil Guideline Values for Lead Contamination R & D Publication SGV 10.

37. Nathanail, C. P., et al 2009 The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment. 2nd Edition. Land Quality Press, Nottingham.

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

39. Water Regulations Advisory Scheme. Information and Guidance Note No 9-04-03 October 2002. The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land.

GENERAL NOTES

The copyright of this report and other plans and documents prepared by Murray Rix Limited are owned by them. The copyright in the written materials shall remain the property of Murray Rix Limited but with a royalty-free perpetual license to the client deemed to be granted on payment in full to Murray Rix Limited by the client of the outstanding monies.

The report is provided for the sole use of the client and is confidential to them, their professional advisors, no responsibility whatsoever for the contents of the report will be accepted to any person other than the client.

New information, improved practices, changes in legislation, or changes in guidelines from Statutory Bodies may necessitate a re-interpretation of the report in whole or part after its original submission.

The report and/or opinion will be prepared and written for the specific purposes and/or development stated in the document and in relation to the nature and extent of proposals made available to us at the time of writing. The recommendations should not be used for other schemes on or adjacent to the site.

The report is based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. Conditions between exploratory holes have been interpolated, however soil conditions are highly variable and may differ from the interpolation. There may be conditions, appertaining to the site, which may not be revealed by the investigation, and which may not be taken into account in the report.

The accuracy of the results reported will depend on the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristic of the strata as a whole. Where such measurements are critical, the technique of the investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the company where necessary.

The economic viability of the proposal referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to the geotechnical considerations hence its evaluation will be outside the scope of the report.

Where any data supplied by the Client or from other sources, including previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by Murray Rix Limited for inaccuracies in the data supplied by any other party.

The investigation does not include the identification of Japanese Knotweed. Any such survey should be undertaken by a specialist.

Appendix (i)

Windowless Sample Hole Logs (WS1-WS4)
Hand Auger Logs (HA1-HA2)

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. WS1
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:50	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
0.30	J1			Turf on gravelly TOPSOIL (gravel mainly flint but including glass, clinker and concrete fragments) (desiccated) (0.60)		
0.30	J1A				0.60	
0.80	HSV1	(155)		Stiff (medium to high strength) fissured orange-brown and red-brown, occasionally grey mottled, slightly gravelly CLAY with occasional black carbonaceous material (gravel fine to coarse rounded to angular chalk, sandstone, siltstone, flint) (OT) (3.85)		
0.90	J2					
0.90	J2A					
0.90	HSV2	(119)				
1.00 - 1.45	S1	6				
1.50	J3					
1.50	J3A					
1.50	HSV3	(128)				
1.60	D1					
1.80	HSV4	(104)				
2.00 - 2.45	S2	13				
2.60	HSV5	(113)				
2.80	HSV6	(142)				
3.00 - 3.45	S3	14				
3.50	HSV7	(119)				
3.80	HSV8	(113)				
4.00 - 4.45	S4	17				
				BOTTOM OF BOREHOLE	4.45	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Windowless sampling
J-glass jar sample; D-disturbed soil sample; S-Standard Penetration Test; HSV-hand shear vane strength (kPa)
OT-Oadby Till

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. WS2
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:50	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				Concrete (0.08)	0.08	
0.20	J1			MADE GROUND: Black ash and glass with a trace of decayed leather? (0.38)		
0.20	J1A				0.45	
0.60	HSV1	(48)		Soft to firm (medium strength) brown silty sandy slightly gravelly CLAY (gravel fine to coarse rounded to angular quartz, flint) (OT) (0.35)	0.80	
0.75	J2					
0.75	J2A					
0.85	HSV2	(39)		Soft (low strength) brown silty sandy gravelly CLAY (gravel fine to coarse rounded to angular quartz, flint) (OT) (0.80)		
1.00 - 1.45	S1	5				
1.50	J3					
1.50	J3A				1.60	
1.70	HSV3	(60)		Soft to firm and firm (medium strength) red-brown, brown and grey mottled slightly gravelly CLAY with occasional black carbonaceous material (gravel fine to coarse roudned to angular quartz, flint, sandstone) (OT) (3.85)		
1.80	D1					
1.80	HSV4	(110)				
1.90	HSV5	(97)				
2.00 - 2.45	S2	7				
2.55	HSV6	(51)				
2.60	HSV7	(51)				
2.90	HSV8	(66)				
3.00 - 3.45	S3	8				
3.65	HSV9	(47)				
3.80	HSV10	(37)				
3.90	HSV11	(75)				
4.00 - 4.45	S4	11				
4.65	HSV12	(55)				
4.95	HSV13	(54)				
5.00 - 5.45	S5	13				
				BOTTOM OF BOREHOLE	5.45	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Windowless sampling
J-glass jar sample; D-disturbed soil sample; S-Standard Penetration Test; HSV-hand shear vane strength (kPa)
OT-Oadby Till

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. WS3
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:50	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				Blacktop on sub-base of gravel and crushed concrete (0.45)		
0.50	J1				0.45	
0.50	J1A			MADE GROUND: Black organic sandy gravelly CLAY (0.10)	0.55	
0.70	HSV1	(27)		Soft (low strength) friable brown sandy gravelly CLAY with occasional small carbonaceous pocket (gravel fine to coarse rounded to angular flint, quartz) (OT) (0.45)		
0.80	J2					
0.80	J2A				1.00	
0.85	HSV2	(30)		Firm (medium strength) orange-brown and brown very gravelly CLAY (gravel fine to coarse angular to rounded flint, quartz, sandstone) (OT) (1.10)		
1.00 - 1.45	S1	8				
1.45	D1					
1.60	J3					
1.60	J3A					
1.60	HSV3	(63)				
1.60	J3					
1.60	J3A				2.10	
2.00 - 2.45	S2	14		Firm to stiff and stiff (high strength) orange-brown and brown slightly gravelly CLAY (gravel fine to coarse rounded to angular flint, quartz, sandstone, siltstone) (OT) (2.35)		
2.40	D2					
2.50	HSV4	(95)				
2.60	HSV5	(89)				
2.70	HSV6	(75)				
3.00 - 3.45	S3	10				
3.50	HSV7	(75)				
3.60	HSV8	(119)				
3.75	HSV9	(104)				
3.85	HSV10	(116)				
4.00 - 4.45	S4	18				
				BOTTOM OF BOREHOLE	4.45	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Windowless sampling
J-glass jar sample; D-disturbed soil sample; S-Standard Penetration Test; HSV-hand shear vane strength (kPa)
OT-Oadby Till

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. WS4
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:50	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				Blacktop on black ash, brick, clay and clinker (0.55)		
0.30	J1					
0.30	J1A					
0.60	HSV1	(60)			0.55	
0.80	HSV2	(54)		Soft to firm (medium strength) orange-brown very gravelly CLAY (gravel mainly coarse flint) (OT) (0.45)		
0.90	J2				1.00	
0.90	J2A			Very soft (very low strength) very sandy gravelly CLAY (OT) (1.10)		
1.00 - 1.45	S1	4				
1.50	J3					
1.50	J3A					
2.20	HSV3	(133)			2.10	
2.00 - 2.45	S2	9		Stiff (medium to high strength) fissured red-brown and grey mottled slightly gravelly CLAY (OT) (0.70)		
2.50	D1					
2.50	HSV4	(130)				
2.60	J4					
2.60	J4A				2.80	
2.60	HSV5	(140)		Firm (medium to high strength) red-brown slightly gravelly CLAY (gravel fine to coarse rounded to angular flint, quartz, sandstone) (OT) (1.65)		
2.80	HSV6	(104)				
3.00 - 3.45	S3	10				
3.50	HSV7	(54)				
3.65	HSV8	(78)				
3.75	HSV9	(99)				
4.00 - 4.45	S4	12				
				BOTTOM OF BOREHOLE	4.45	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Windowless sampling
J-glass jar sample; D-disturbed soil sample; S-Standard Penetration Test; HSV-hand shear vane strength (kPa)
OT-Oadby Till

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. HA1
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:25	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
0.05	J1			MADE GROUND: Turf on gravelly topsoil (gravel of concrete, brick, quartz, glass, clinker) (0.55)		
0.05	J1A					
0.55	J2				0.55	
0.55	J2A			BOTTOM OF BOREHOLE		

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Hand excavation and augering
J-glass jar sample

All dimensions are in metres unless otherwise stated

BOREHOLE LOG - MURRAY RIX GEOTECHNICAL

HOLE NO. HA2
Sheet 1 of 1

CLIENT	SITE
STOKES EVANS DEVELOPMENTS	HINCKLEY ROAD, BURBAGE

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
22/08/11	1:25	SEE LOCATION PLAN	GE	EJM	GEOJOB/11-320

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m^2)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				MADE GROUND: Turf on gravelly topsoil (gravel of concrete, brick, quartz, glass, clinker) (0.35)		
0.40	J1				0.35	
0.40	J1A			MADE GROUND: Grey ash and broken pot pipe (0.25)		
					0.60	
0.75	J2			Stiff red-brown gravelly CLAY (OT) (0.30)		
0.75	J2A					
					0.90	
				BOTTOM OF BOREHOLE		

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
-					No groundwater seepage encountered

BORING METHOD AND REMARKS

Hand excavation and augering
J-glass jar sample
OT-Oadby Till

All dimensions are in metres unless otherwise stated

Appendix (ii)

Laboratory Test Results – Material Properties

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : 09/09/11 PAGE 1 of 9 Pages

Contract
Hinckley Road, Burbage.

Serial No.
S24874

UKAS TESTING
0998

CLIENT:

MURRAY RIX GEOTECHNICAL
13 WILLOW PARK
UPTON LANE
STOKE GOLDING
NUNEATON
WARWICKSHIRE
CV13 6EU

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:

MURRAY RIX GEOTECHNICAL

APPROVED SIGNATORIES:

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

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

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

S.P. Townend

SAMPLES LABELLED:

Hinckley Road, Burbage.

DATE RECEIVED: 24/08/11

SAMPLES TESTED BETWEEN 24/08/11 **and** 09/09/11

REMARKS: For the attention of Dr E Murray

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 2 of 9

Contract
Hinckley Road, Burbage.

Serial No.
S24874

SCHEDULE OF LABORATORY TESTS

Bh./ Tp No.	Sample Ref	Depth (from)	1:Moisture Content Determination	4:Liquid/Plastic limit 1 point	5:Wet Sieve Preparation for Limi	34:Sulphate Test (2:1 Water Soil)	36:ph value of Soil or Water	Remarks
WS1	D1	1.60	*	*	*	*	*	
WS2	D1	1.80	*	*				
WS3	D2	2.40	*	*	*	*	*	
-	-	-	3	3	2	2	2	<— Total Number of Tests —

Scheduled by: MURRAY RIX GEOTECHNICAL

Target Date: 08/09/11

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 3 of 9

Contract
Hinckley Road, Burbage.

Serial No.
S24874

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				Description	CLASS
								Method S/N	Ret'd 0.425mm (%)	Corr'd M/C <0.425mm	Curing Time (hrs.)		
WS1	1.60	D1	16	32	15	17	0.12*	S	10(M)	17	24	Stiff locally very stiff mottled light olive brown grey and reddish brown slighty gravelly slightly sandy silty CLAY with rare calcareous silt and decayed roots. Gravel is fine and medium sub angular and sub rounded chert and claystone lithorelicts	CL
WS2	1.80	D1	17	37	17	20	0.05*	N	5(A)	18	25	Stiff locally very stiff mottled light olive brown grey and reddish brown slightly sandy silty CLAY with pockets of medium sand and rare fine and medium sub angular and sub rounded chert gravel and black specs	CI
WS3	2.40	D2	18	36	16	20	0.20*	N	10(M)	20	24	Firm mottled grey and reddish brown slighty gravelly slightly sandy silty CLAY with pockets of medium sand and calcareous aggregations. Gravel is fine and medium sub angular and sub rounded chert and rare claystone lithorelicts	CI

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.

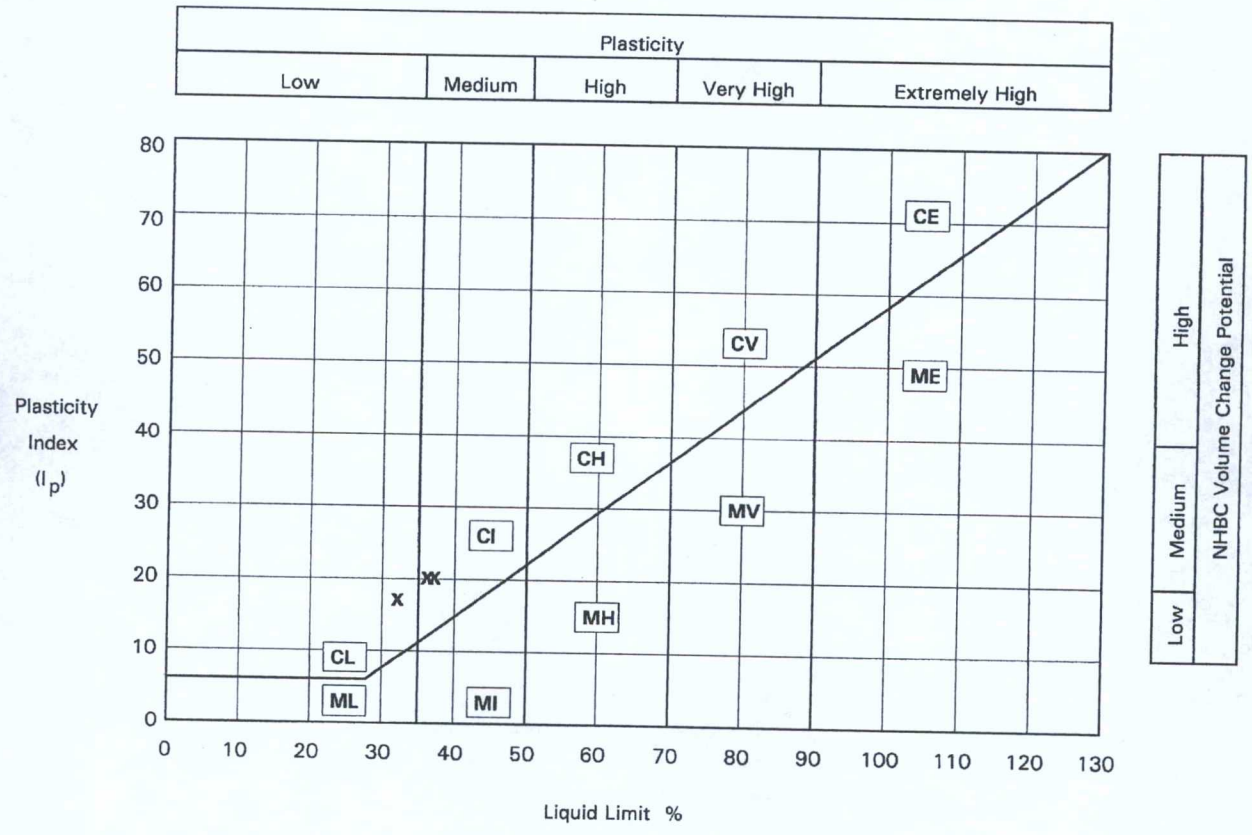
ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 4 of 9

Contract: Hinckley Road, Burbage.

Serial No. S24874

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 9

Contract: Hinckley Road, Burbage.

Serial No. S24874

UKAS TESTING 0998

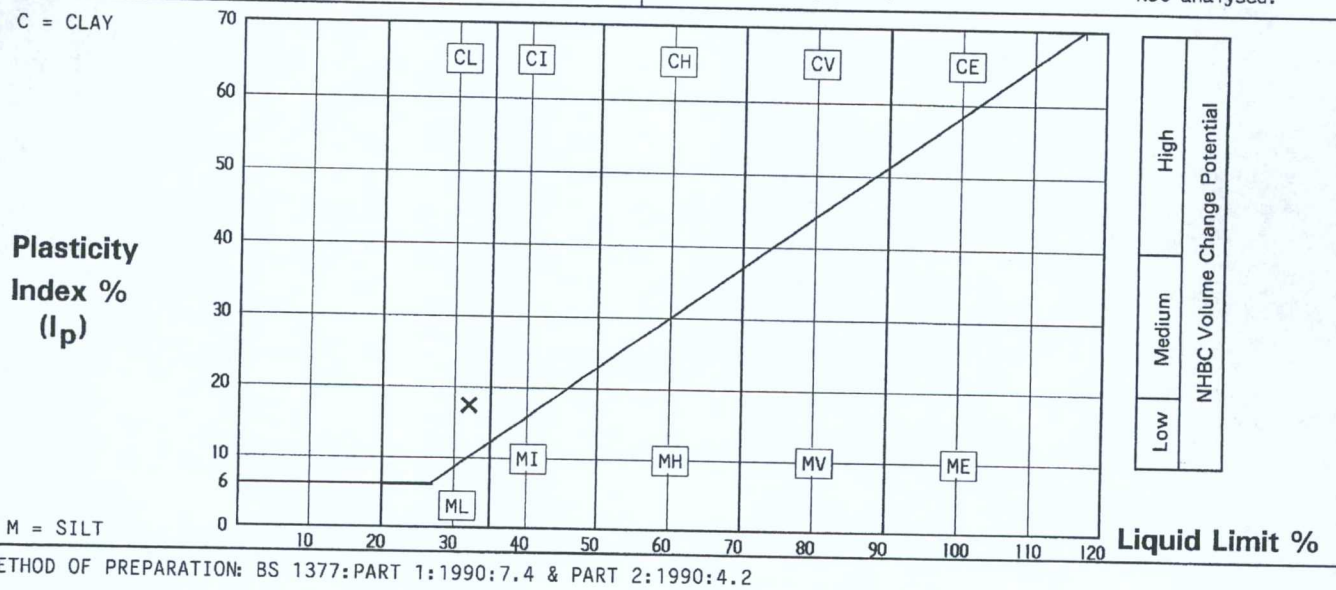
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS1	1.60	D1	16	Stiff locally very stiff mottled light olive brown grey and reddish brown slighty gravelly slightly sandy silty CLAY with rare calcareous silt and decayed roots. Gravel is fine and medium sub angular and sub rounded chert and claystone lithorelicts	

PREPARATION

Method of Preparation	Sieved Specimen
Sample retained 0.425 sieve (Measured)	10 %
Corrected moisture content for material passing 0.425mm	17 %
Curing Time	24 Hours

Liquid Limit	32 %
Plastic Limit	15 %
Plasticity Index	17 %
Liquidity Index	0.12
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)
6% GRAVEL BY DRY MASS 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 9

Contract: Hinckley Road, Burbage.

Serial No. S24874

UKAS TESTING 0998

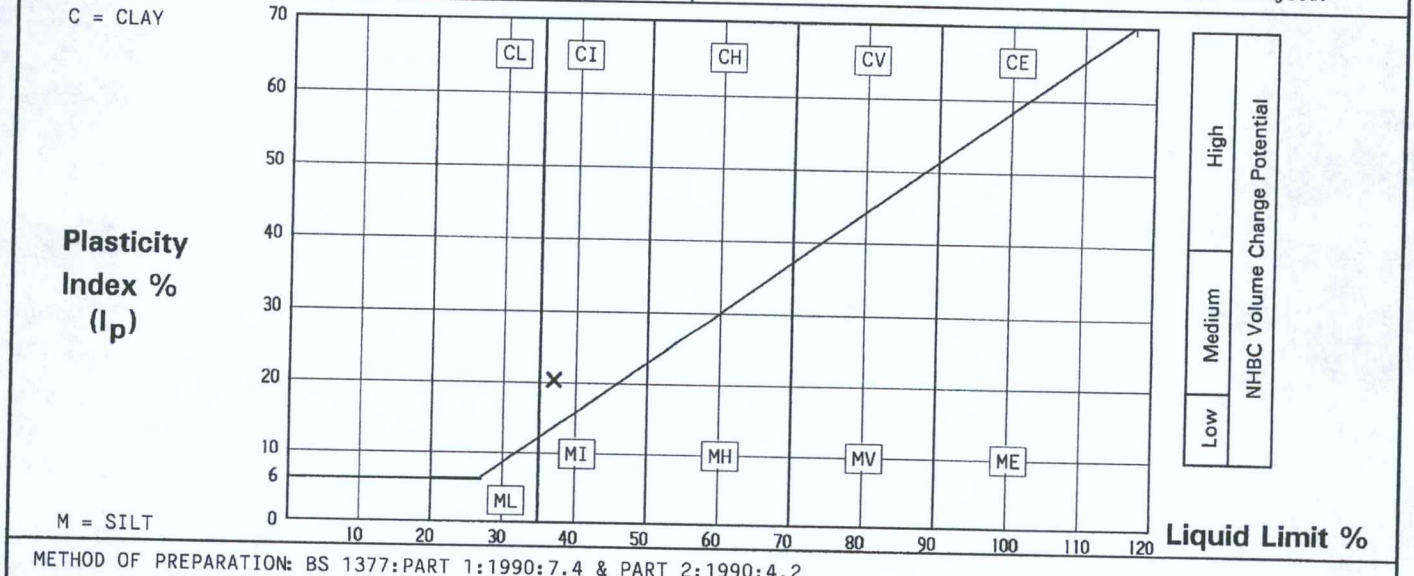
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS2	1.80	D1	17	Stiff locally very stiff mottled light olive brown grey and reddish brown slightly sandy silty CLAY with pockets of medium sand and rare fine and medium sub angular and sub rounded chert gravel and black specs	

PREPARATION

Method of Preparation	Specimen from Natural Soil
Sample retained 0.425 sieve (Assumed)	5 %
Corrected moisture content for material passing 0.425mm	18 %
Curing Time	25 Hours

Liquid Limit	37 %
Plastic Limit	17 %
Plasticity Index	20 %
Liquidity Index	0.05
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)
5% GRAVEL BY DRY MASS PICKED OUT BY HAND AND EXCLUDED FROM LIMITS TESTS
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 7 of 9

Contract: Hinckley Road, Burbage.

Serial No. S24874

UKAS TESTING 0998

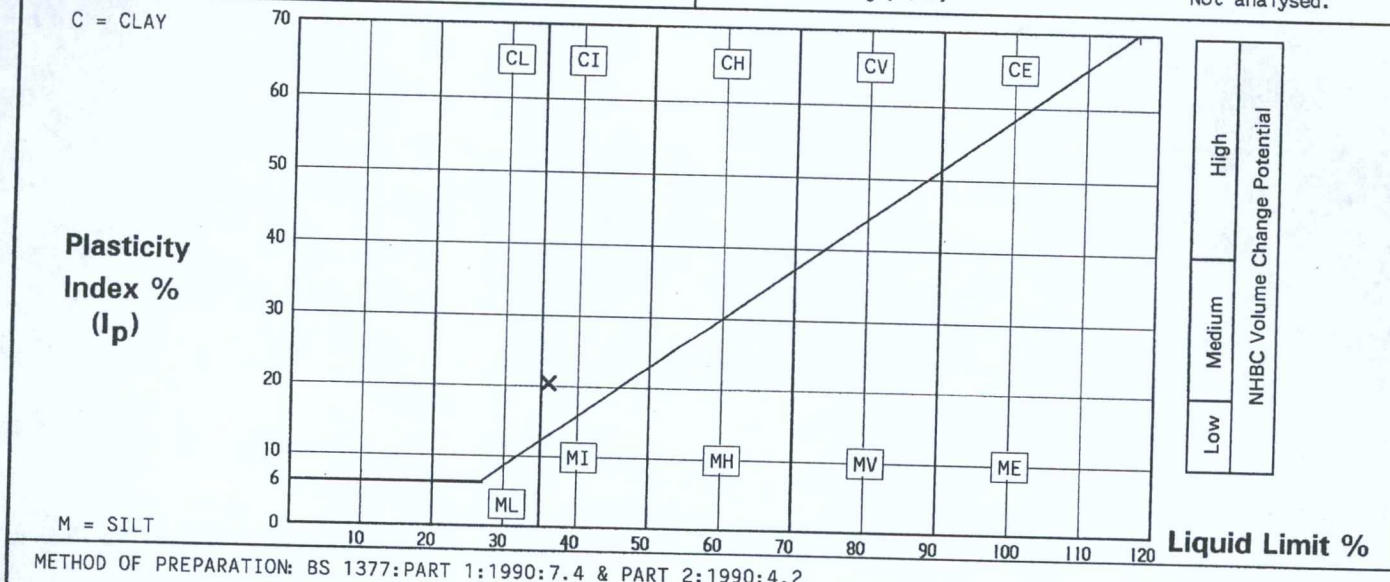
DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS3	2.40	D2	18	Firm mottled grey and reddish brown slighty gravelly slightly sandy silty CLAY with pockets of medium sand and calcareous aggregations. Gravel is fine and medium sub angular and sub rounded chert and rare claystone lithorelicts	

PREPARATION

Method of Preparation	Specimen from Natural Soil
Sample retained 0.425 sieve (Measured)	10 %
Corrected moisture content for material passing 0.425mm	20 %
Curing Time	24 Hours

Liquid Limit	36 %
Plastic Limit	16 %
Plasticity Index	20 %
Liquidity Index	0.20
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)
6% GRAVEL BY DRY MASS 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 9

Contract: Hinckley Road, Burbage.

Serial No.: S24874

DETERMINATION OF THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Pit No.	Depth m.	Sample	Concentration of Soluble Sulphate			% of sample passing 2mm sieve	Description	Remarks
			Soil		Groundwater			
			Acid Soluble SO3 %	Water Soluble 2:1 SO3 g/l	g/l			
WS1	1.60	D1		0.03		94	Stiff locally very stiff mottled light olive brown grey and reddish brown slighty gravelly slightly sandy silty CLAY with rare calcareous silt and decayed roots. Gravel is fine and medium sub angular and sub rounded chert and claystone lithorelicts	
WS3	2.40	D2		0.05		94	Firm mottled grey and reddish brown slighty gravelly slightly sandy silty CLAY with pockets of medium sand and calcareous aggregations. Gravel is fine and medium sub angular and sub rounded chert and rare claystone lithorelicts	

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

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

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

COMMENTS : Test not UKAS accredited.

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

TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : As page 1 PAGE 9 of 9

Contract: Hinckley Road, Burbage.

Serial No. S24874

DETERMINATION OF THE pH VALUE

Borehole/ Pit No.	Depth m.	Sample	pH Value	Description	Remarks
WS1	1.60	D1	7.2	Stiff locally very stiff mottled light olive brown grey and reddish brown slighty gravelly slightly sandy silty CLAY with rare calcareous silt and decayed roots. Gravel is fine and medium sub angular and sub rounded chert and claystone lithorelicts	
WS3	2.40	D2	7.2	Firm mottled grey and reddish brown slighty gravelly slightly sandy silty CLAY with pockets of medium sand and calcareous aggregations. Gravel is fine and medium sub angular and sub rounded chert and rare claystone lithorelicts	

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

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

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

COMMENTS : Test not UKAS accredited.

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