REPORT ON PHASE 2 SITE INVESTIGATION

carried out at

PLOTS 14 & 15,

HARLOW BUSINESS PARK, GREENWAY, HARLOW, ESSEX

Prepared for

RO Developments Limited
28 Bruton Street
London
W1J 6QW

Contract No: 50684

Date: September 2006

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EXECUTIVE SUMMARY

On the instructions of Train and Kemp Consulting Engineers, on behalf of RO Developments Limited, a site investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with a contamination risk assessment and preliminary waste soils characterisation.

The site is situated within Harlow Business Park, off Greenway in Harlow and may be located by National Grid Reference TL 420 098.

The site work was carried out on 4 July 2006 and comprised eight trial pits. The ground conditions encountered were generally Made Ground overlying Boulder Clay, which was underlain by Glacial Sand and Gravel.

It is recommended that consideration is given to the adoption of shallow spread foundations to support the proposed structure taken through the Made Ground into the natural strata to a minimum depth of 0.75m.

However, due to the depth of the Made Ground it is likely that foundations would have to be placed at depths up to 1.50m, this assuming the mound of soil located in the centre of the site, indicated as being approximately one metre high is to be removed.

Such foundations at a depth of 1.50m may be designed to an allowable bearing pressure of $150kN/m^2$.

In the proximity of trees either existing, recently removed or planned planting, foundations should be extended to depths recommended by the NHBC for soils of low swell potential.

The Human Health risk assessment has been based on current CLEA guidelines using appropriate SGVs or, where not available Soil Screening Values, SSVs, derived by Ian Farmer Associates in accordance with CLR documents.

The contamination risk assessment did not identify any sources of contamination on the site and therefore no pollutant linkage was established.

A preliminary assessment to determine the waste soils characteristic, carried out on chemical test results from soil samples taken from trial pits 2 and 3 indicates that the Made Ground from the soil mound encountered in the centre of the site may be treated as non-hazardous waste.

CONTENTS

1.0 INTRODUCTION

1.1 It is understood that the proposed development comprises a number of small industrial units, including three nursery units, with service yards capable of accommodating articulated lorries.

1.2 On the instructions of Train and Kemp Consulting Engineers, on behalf of RO Developments Limited, a site investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with a contamination risk assessment and preliminary waste soils characterisation.

1.3 This report should be read in conjunction with the Phase 1 Desk Study, which was carried out, by Train and Kemp in July 2006, report reference 10297.

1.4 It is recommended that a copy of this report be submitted to the relevant authorities to enable them to carry out their own site assessments and provide any comments.

1.5 This report is confidential and addressed to and may be relied upon by RO Developments Limited, its successor in title for the whole or its successors in title for parts of the property and no more than two subsequent successors in title for the whole or each part of the property. This report may also be relied upon by the funder/mortgagee providing finance to RO Developments Limited, its successor in title for the whole or its successors in title for parts of the property and no more than two subsequent successors in title for the whole or each part of the property.

1.6 The name and address of each purchaser and funder/mortgagee wishing to rely upon this report as provided for herein shall be notified in writing to Ian Farmer Associates (1998) Ltd. before the benefit of such reliance shall come into effect. This report may also be relied upon by the contractor(s) appointed by or on behalf of RO Developments Limited to build the proposed development in so far as it relates to the contractor's works and subject to all the matters contained or referred to in the report. In the case of the ultimate assignments to individual unit owners/occupiers Ian Farmer Associates (1998) Ltd. will issue letters of reliance for each individual unit owners/occupiers as and when requested for no additional fee.

1.7 The comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.

1.8 The comments on groundwater conditions are based on observations made at the time the site work was carried out. It should be noted that groundwater levels vary owing to seasonal or other effects.

2.0 SITE SETTING

2.1 Site Location

2.1.1 The site is situated within Harlow Business Park, off Greenway in Harlow and may be located by National Grid Reference TL 420 098.

2.1.2 A site plan is included in Appendix 1, Figure A1.1.

2.2 Geological Setting

2.2.1 Details of the geology underlying the site have been obtained from the British Geological Survey map, Sheet No. 240, 'Epping', solid and drift edition, 1:50,000 scale, published 1981.

2.2.2 The geological map indicates the site to be underlain by superficial deposits of Boulder Clay.

2.2.3 Glacial Sand and Gravel is shown on the geological map to be present to the north and south of the site and the Train and Kemp phase 1 report refers to a previous site investigation in 2001 where Glacial Sand and Gravel was encountered underlying the Boulder Clay.

2.2.4 London Clay underlies the superficial deposits.

2.2.5 The site is within an urban area and, although not indicated as present on the site from the geological maps, the possibility that Made Ground exists on site cannot be discounted.

3.0 SITE WORK

3.1 The site work was carried out on 4 July 2006. The locations of exploratory holes have been planned, where possible, in general accordance with CLR 4, ref. 9.1 and the site work carried out on the basis of the practices set out in BS 10175:2001, ref. 9.2, and BS 5930:1999 ref. 9.3.

3.2 Eight trial pits were dug by mechanical excavator at the positions shown on the site plan, Appendix 1, Figure A1.1. The depths of trial pits, descriptions of strata encountered and comments on groundwater conditions are given in the trial pit records, Appendix 2, Figures A2.1 to A2.8.

3.3 Representative disturbed samples were taken at the depths shown on the trial pit records and despatched to the laboratory.

3.4 An approximate assessment of soil strengths was made by undertaking hand-held penetrometer tests in the trial pits. The results of these tests are included in the trial pit records.

3.5 Samples were collected for environmental purposes in amber glass jars and kept in a cool box.

3.6 The ground levels at the trial pit locations were not determined.

4.0 LABORATORY TESTS

4.1 Geotechnical Testing

4.1.1 The natural moisture contents were determined of thirteen samples and liquid and plastic limit tests were carried out on five samples and the results included in Appendix 3, Figure A3.1 and the plasticity classification chart, Figure A3.2.

4.1.2 Chemical tests were carried out on five soil samples to determine the sulphate concentrations as a 2:1 water/soil extract and the pH values. The results of these tests are included in Figure A3.1.

4.2 Chemical Testing

4.2.1 The suite of chemical analyses was largely determined by the client. The chemical analyses were carried out on eight samples of Made Ground and one natural sample. The nature of the analyses is detailed below:

4.2.2 **Metals Suite** - arsenic, cadmium, chromium, lead, mercury, selenium, boron (water soluble), copper, nickel and zinc

4.2.3 **Organic Suite** - total petroleum hydrocarbons (TPH) – C_{10} to C_{14} and C_{15} to C_{36} aliphatic hydrocarbons, polycyclic aromatic hydrocarbons (PAH) – USEPA 16 suite, phenols

4.2.4 **Inorganics Suite** - cyanide (total)

4.2.5 **Others** - pH, organic matter content, asbestos, nitrate

4.2.6 The results of these tests are shown in Appendix 4, Figure A4.1.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 Sequence

5.1.1 The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map.

5.1.2 The sequence and indicative thicknesses of strata are provided below:

Strata Encountered	Depth Encountered (m)		Strata Thickness (m)
	From	To	
Made Ground	0.00	0.40 to 2.55	0.40 to 2.25
Boulder Clay	0.00 to 1.10	1.10 to 3.20	0.50 to 2.70
Glacial Sand and Gravel	1.00 to 2.70	2.70 to 3.25	0.10 to 2.25

5.2 Made Ground

5.2.1 Made Ground was encountered within each of the trial pits across the site, excluding trial pit 1, in the northeastern section of the site.

5.2.2 The greatest thickness of Made Ground was encountered within trial pit 3, though this exploratory location was taken through the surface of a mound within the centre of the site.

5.2.3 This stratum generally comprised stiff to very stiff, brown, slightly gravelly to very gravelly sandy clay with rare to some brick fragments and rootlets.

5.3 Boulder Clay

5.3.1 This stratum was encountered within trial pits 1, 2, 4, 6 and 8.

5.3.2 The Boulder Clay was generally encountered underlying the Made Ground and overlying the Glacial Sand and Gravel, except in trial pit 1 where it was encountered from ground level.

5.3.3 This generally comprised stiff to very stiff, brown to orange brown, slightly to very gravelly sandy clay.

5.3.4 It should be noted that this material was similar to the underlying Glacial Sand and Gravel and in some locations it was difficult to differentiate between the two strata. At the base of trial pit 7, a stiff to very stiff gravelly sandy clay was encountered however as this was below Glacial Sand and Gravel it has been interpreted as being part of that stratum as in the remaining holes Boulder Clay was not encountered below the Sand and Gravel.

5.3.5 Trial pits 4 and 8 were terminated within this stratum and as such, the full depth of Boulder Clay could not be determined at these locations.

5.4 Glacial Sand and Gravel

5.4.1 The Glacial Sand and Gravel was encountered underlying the Made Ground or the Boulder Clay within trial pits 1 to 3 and 5 to 7.

5.4.2 This material generally comprised moderately to medium dense light to dark orange brown clayey gravelly sand. In trial pit 6, from 2.80m, there were occasional pockets of very stiff clay.

5.4.3 Trial pits 1 to 3 and 5 to 7 were terminated within this stratum and as such, the full depth of the sand and gravel at these locations could not be determined.

5.5 Groundwater

5.5.1 Groundwater was not encountered in any of the exploratory holes.

6.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS IN RELATION TO PROPOSED DEVELOPMENT

6.1 Structural Details

6.1.1 It is understood that the proposed development is to consist of a number of small industrial units, including three nursery units, with service yards capable of accommodating articulated lorries.

6.2 Foundation Design

6.2.1 The results of laboratory tests indicate the Boulder Clay is of intermediate plasticity and of low to medium, but predominantly low, swell potential as defined by the National House Building Council, ref 9.6 and other published data, refs 9.7 and 9.8. Changes in moisture content will result in small changes in volume, seasonal changes being exacerbated by the presence of trees.

6.2.2 On the basis of observations made on site together with results of in-situ and laboratory tests, it is recommended that consideration could be given to the adoption of pad or trench fill foundations to support the proposed structures.

6.2.3 Outside the zone of influence of existing and proposed trees, it is recommended that conventional shallow spread footings should be taken through any Made Ground and placed in the underlying natural strata at a minimum depth of 0.75m.

6.2.4 Assuming the mound of soil located in the centre of the site, indicated as being approximately one metre high and covered by trial pits 2 and 3, is to be removed, due to the depth of Made Ground encountered across the remainder of the site, it is likely that foundations would have to be placed at depths up to 1.50m.

6.2.5 Within the zone of influence of recently removed, existing or proposed trees, foundations should be taken through the Made Ground and placed at depths recommended by the NHBC for soils of low swell potential. The relevant sections of the NHBC Standard are included in Appendix 5, Figures A5.1 and A5.2. Compressible material should be placed on the inside faces of foundations as specified by the NHBC.

6.2.6 Such foundations may be designed to an allowable bearing pressure of 150kN/m^2, which would provide an adequate factor of safety against shear failure and limit settlements to the order of 10mm.

6.3 Ground Floor Slabs

6.3.1 On the basis of observation on site together with the results of laboratory tests it is recommended that, outside the zone of influence of trees, consideration is given to constructing the ground floor slab on formation prepared in the Made Ground or Boulder Clay. Any soft or deleterious material should be removed and replaced with properly compacted granular fill.

6.3.2 Within the zone of influence of trees, where the end use may be sensitive to floor level changes, the floor slabs should be suspended over a void, in accordance with NHBC guidelines.

6.4 Excavations

6.4.1 On the basis of observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to less than 0.90m should stand unsupported in the short term, no groundwater was encountered and all trial pits remained open for the duration of the investigation. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those in excess of 0.90m deep, in accordance with Health and Safety Regulations.

6.4.2 Groundwater should not be expected in shallow excavations for foundations or services.

6.5 Road and Hard Standing Design

6.5.1 The structural design of a road or hard standing is based on the strength of the subgrade, which is assessed on the California Bearing Ratio, **CBR**, scale. Experience has indicated that the measurement of the in-situ CBR value tends to give unreliable results because of the influence of the moisture content of the materials. In practice, the correlation given in Transport and Road Research Laboratory, Report 1132, ref. 9.9, is usually more appropriate than direct determination of the CBR.

6.5.2 On the basis of laboratory classification tests it is recommended that for formation prepared in the Boulder Clay, a subgrade CBR value of 6% be adopted for design purposes. Any areas of soft or deleterious material in the Made Ground should be excavated and replaced with a properly compacted granular fill.

6.6 Chemical Attack on Buried Concrete

6.6.1 The results of chemical tests indicate a sulphate concentration in the soil of between <100mg/l and 100mg/l as a 2:1 water/soil extract with pH values in the range of 8.0 to 8.1. It is recommended that the guidelines given in BRE Special Digest 1, ref. 9.10, be adopted. Relevant details of this digest are included in Appendix 5, Figure A5.3.

6.6.2 It is recommended that for conventional shallow foundations, the groundwater should be regarded as mobile.

6.6.3 On the basis of the laboratory test results it is considered that a Design Sulphate Class for the site may be taken as DS-1. The site conditions would suggest that an ACEC class for the site of AC-1 would be appropriate.

7.0 WASTE SOILS CHARACTERISATION ASSESSMENT

7.1 General

7.1.1 A preliminary assessment of soil waste acceptance characteristic has been derived for the mound of Made Ground located in the centre of the site using the chemical test results from trial pits 2 and 3, and utilizing the CAT - WASTE^{SOIL} tool, ref 9.11. The output sheets for this assessment are included within Appendix 4, Figure A4.3.

7.2 Results of Assessment

7.2.1 Indications are that the soil in the mound may be treated as non-hazardous waste.

8.0 ENVIRONMENTAL RISK ASSESSMENT IN RELATION TO PROPOSED DEVELOPMENT

8.1 Contaminated Land

8.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref 9.12, which was introduced by the Environment Act 1995, ref 9.13, as;

- 'Land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused.'

8.2 Risk Assessment

8.2.1 The definition of contaminated land is based on the principles of risk assessment. Risk is defined as a combination of:

- The probability, or frequency of exposure to a substance with the potential to cause harm, and:
- The seriousness of the consequence.

8.3 Pollutant Linkage

8.3.1 The basis of an environmental risk assessment involves identifying a 'source' of contamination, a 'pathway' along which the contamination may migrate and a 'receptor' at risk from the contamination.

8.3.2 Current legislation defines the various elements of the pollution linkage as:

- A contaminant is a substance which is in or under the ground and which has the potential to cause harm or to cause pollution of controlled waters.
- A pathway is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A receptor is either a living organism, an ecological system, a piece of land or property, or controlled water.

8.3.3 A pollutant linkage indicates that all three elements have been identified. The site can only be defined as 'Contaminated Land' if a pollutant linkage exists and the contamination meets the criteria in Section 8.1 above.

8.3.4 The guidance proposes a four-stage approach for the assessment of contamination and the associated risks. The four stages are listed below:

- Hazard Identification
- Hazard Assessment
- Risk Assessment
- Risk Evaluation

8.3.5 The hazard identification and hazard assessment are part of a Phase 1 Desk Study and form the conceptual site model, the desk study at this site was carried out by Train and Kemp in July 2006, report reference 10297.

8.3.6 The risk assessment and evaluation stages are presented in this phase 2 interpretive report, after an intrusive ground investigation has taken place.

8.4 Risk Assessment – Human Health

8.4.1 The proposed development comprises a number of small industrial units with service yards. The risk assessment has therefore been based on guidelines for a commercial/industrial site use. Should the proposed end-use of the site be changed in the future then further risk assessment may be required, particularly should a more sensitive end-use be envisaged.

8.4.2 The results of the soil analyses have been compared to the CLEA Soil Guideline Values, where available, or alternatively, Soil Screening Values, SSVs, determined by Ian Farmer Associates in general accordance with recommendations in CLR 9, ref 9.14 and CLR 10, ref 9.15.

8.4.3 The SSV for benzo(a)pyrene has been derived using the Environment Agency's CLEA 2002 Software to provide a site specific guideline value. This value has been derived as 36.94mg/kg. The supporting CLEA 2002 report has been included in Appendix 4, Figure A4.2.

8.4.4 The results of chemical analyses have been processed in accordance with recommendations set out in CLR 7, ref 9.16. Where the concentrations determined on site are at or below the respective Guidance Level, they are considered not to pose a risk and are removed from further consideration, unless otherwise stated.

8.4.5 None of the soil results exceed their respective guideline values for an industrial end use of the site.

8.5 Risk Assessment - Controlled Waters

8.5.1 The site is underlain by a non aquifer, the London Clay and the closest groundwater abstraction is situated over 800m from the site. The closest surface watercourse is the River Stort, positioned some 800m to the north of the site.

8.5.2 Groundwater was not encountered and consequently not sampled as part of this investigation. However, it is considered that there would be a negligible risk to controlled waters in light of the findings of this contamination assessment and given the prevailing ground conditions at the site.

8.6 Risk Evaluation

8.6.1 No elevated determinant concentrations were identified within this site investigation. Therefore, no source of contamination has been identified and no pollutant linkage established.

9.0 REFERENCES

9.1 CLR 4, 'Sampling strategies for contaminated land'. Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994.

9.2 British Standards Institute: BS 10175 'Code of practice for the investigation of potentially contaminated sites', BSI 2001.

9.3 British Standards Institute: BS 5930 'Code of practice for site investigations', BSi 1999.

9.4 British Standard 1377:1990, Part 9, 'Methods of Test for Soils for Civil Engineering Purposes'.

9.5 Rodin S, Corbett B O, Sherwood D E and Thorburn S. 'Penetration Testing in the United Kingdom. State of the Art Report. European Symposium on Penetration Testing'. Stockholm, 1974.

9.6 National House-Building Council, Standards, Chapter 4.2, 2003 'Building Near Trees'.

9.7 BRE Digest 240, 'Low-rise buildings on shrinkable clay soils: Part 1'. September 1993

9.8 Geotechnique, June 1983.

9.9 Transport and Road Research Laboratory, Report 1132, 'The Structural Design of Bituminous Roads'. 1984.

9.10 Building Research Establishment, Special Digest 1, 'Concrete in Aggressive Ground', 2005.

9.11 Atkins and McArdle Group, CAT-WASTE^{SOIL} tool.

9.12 The Environmental Protection Act, Part IIA, Section 78, 1990.

9.13 Environment Act 1995, Section 57, DoE 1995.CLR 3, 'Documentary research on industrial sites', Report by RPS Consultants Ltd, DoE 1994.

9.14 CLR 9, ' Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans' DEFRA/EA, March 2002.

9.15 CLR 10, 'The Contaminated Land Exposure Assessment Model (CLEA): Technical basis and algorithms'. DEFRA/EA, March 2002.

9.16 CLR 7, 'Assessment of risks to human health from land contamination: an overview of the development of soil guideline values and related research'. DEFRA/EA, March 2002.

9.17 Environment Agency 'Hydrological risk assessment for landfills and the derivation of groundwater control trigger levels'. March 2003.

9.18 Water Regulations Advisory Scheme, Information and Guidance Note, October 2002, 'The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land'.

9.19 Special Waste (Amendment) Regulations 1996, and relevant statutory guidance.

9.20 CLR 11, 'Model Procedures for the Management of Contaminated Land', DEFRA and Environment Agency, 2004.

9.21 CLR 2, 'Guidance on preliminary site inspection of contaminated land', Report by Applied Environmental, DoE 1994.

9.22 CLR 3 'Documentary Research on Industrial Sites', Report by RPS Consultants Ltd., DOE, 1994

9.23 CLR 8, 'Potential contaminants for the assessment of contaminated land'. DEFRA/EA, March 2002.

9.24 CLR 6, 'Prioritisation & categorisation procedure for sites which may be contaminated', Report by M J Carter Associates, DoE 1995.

For and on behalf of Ian Farmer Associates (1998) Limited

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APPENDIX 1

DRAWINGS

Scale :	N.T.S.
Drawn By :	P.L.E.
Job No:	50684
Fig:	A1.1

IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

SITE PLAN

Harlow Business Park.

APPENDIX 2

SITE WORK

APPENDIX 2

GENERAL NOTES ON SITE WORKS

A2.1 IN-SITU TESTS

A2.1.1 Pocket Penetrometer, PP

The pocket or dial penetrometer is intended to be used as a tool to provide a crude assessment of the presumed bearing value of a particular soil.

The presumed bearing value of a soil is given as $\frac{CuNc}{F}$ where

Cu = undrained shear strength

Nc = bearing capacity factor, generally taken as 6

F = factor of safety, generally taken as 3

Therefore, it may be seen that the penetrometer reading is approximately twice the undrained shear strength of the intact soil.

The penetrometer is 6.25mm diameter and therefore measures the intact shear strength of only a small portion of the soil. This makes the interpretation of the penetrometer difficult in terms of determining a safe bearing pressure due to the effects of fissuring on the behaviour of the soil en masse. However, it is ideal in assessing desiccation, as the strength of the intact clay between the fissures is an indicator of effective stress and therefore suction pressure in the soil.

A2.2 SAMPLES

U(x) represents undisturbed 100mm diameter sample with (x) being the number of blows required to obtain sample.

U fail indicates undisturbed sample not recovered

HV represents Hand Vane test with equivalent undrained shear strength

PP represents Pocket Penetrometer test with equivalent undrained shear strength

CBR represents California Bearing Ratio test

B represents large bulk disturbed samples

D represents small disturbed sample

W represents water sample

$\underline{\nabla}$ represents water strike

$\underline{\blacktriangledown}$ represents level to which water rose

A2.3 DESCRIPTION OF SOILS

A2.3.1 General

The procedures and principles given in Section 6 of BS 5930, ref. 9.3 have been used in the soil descriptions contained within this report.

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	**TP1**

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pits.	0.70 x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	J1 PP; 300+					Very stiff, brown, slightly sandy, very gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, angular to rounded flint and weak, medium density chalk.		
0.50	D1							
					(2.70)	Firm to stiff, gravelly, very sandy.		
1.90	D2 PP; 75							
2.70	D3				2.70 (0.10) 2.80	Medium density, dark orange brown, gravelly, very clayey fine to coarse SAND. Gravel is fine to coarse, angular to rounded, majority rounded flint.		
						Complete at 2.80m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.1

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pit.	0.70m x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	J1 PP; 300+				(1.10)	MADE GROUND; Very stiff, brown, slightly sandy, gravelly, clay with rare coarse gravel sized brick. Sand is fine to medium. Gravel is fine to coarse, angular to rounded flint.		
1.10	D1				1.10	Very stiff, brown, slightly sandy, gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, angular to rounded flint.		
2.00	D2				(2.00)			
2.80	D3 PP; 234							
					3.10	3.00m; Very sandy. Sand is fine to coarse.		
3.20	D4				(0.15) 3.25	Moderately dense, dark orange brown, very gravelly, very clayey, fine to coarse, majority coarse SAND. Gravel is fine to coarse, angular to rounded flint.		
						Complete at 3.25m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.2

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	TP3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pit.	0.70 x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	J1					MADE GROUND; Stiff to very stiff, brown, sandy, very gravelly clay with rare cobble and gravel sized brick. Gravel is fine to coarse, angular to rounded flint and weak, medium density white chalk. Occasional roots.		
0.80	D1							
					(2.55)			
1.50	D2							
						2.40m; Light brown and grey.		
2.50	D3				2.55			
2.60	D4				(0.35)	Medium density, light orange brown, slightly clayey, gravelly, fine to coarse SAND. Gravel is fine to coarse, angular to rounded flint.		
					2.90			
						Complete at 2.90m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	OWV	A2.3

IAN FARMER ASSOCIATES

Site	Harlow Business Park.		**Trial Pit Number**	**TP4**
Excavation Method Machine dug pit.	**Dimensions** 0.70 x 1.50m.	**Ground Level (mOD)**	**Client** R O Developments Ltd.	**Job Number** 50684
	Location TL 420 098	**Dates** 04/07/2006	**Engineer** Train and Kemp.	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	MADE GROUND; Stiff to very stiff, brown, gravelly, sandy clay with rare fine to medium gravel sized brick. Gravel is fine to coarse, angular to rounded flint. Sand is fine to medium.		
0.25	J1				0.40			
0.60	D1					Stiff to very stiff, brown, sandy, very gravelly CLAY. Sand is fine to medium. Gravel is fine to coarse, angular to rounded flint and majoirty rounded, weak, medium density white chalk.		
1.20	D2					1.20m; Bluey grey and brown.		
					(2.60)			
2.10	D3 PP; 245							
					3.00			
3.00	D4 PP; 265					Complete at 3.00m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.4

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	TP5

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pit.	0.70 x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	J1					MADE GROUND; Stiff to very stiff, brown gravelly, sandy clay with rare fine to medium gravel sized brick and occasional fine roots. Gravel is fine to coarse, angular to rounded flint and weak, medium density white chalk.		
0.50	D1					0.50m; Very gravelly.		
					(1.50)			
1.00	PP; 217kPa							
					1.50	Medium dense, orange brown, slightly clayey, gravelly, fine to coarse SAND. Gravel is fine to medium, angular to rounded flint and occasional weak, medium density white chalk.		
1.60	D2							
					(1.20)			
2.50	D3					2.50m; Very gravelly.		
2.70	D4				2.70	Complete at 2.70m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.5

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	TP6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pit.	0.70 x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25	J1				(0.60)	MADE GROUND; Stiff to very stiff, dark brown, gravelly, sandy clay. Gravel is fine to coarse, angular to rounded flint. Sand is fine to medium.		
0.60	D1				0.60			
					(0.50)	Stiff to very stiff, orange brown, gravelly, sandy CLAY. Gravel is fine to coarse, angular to rounded flint. Sand is fine to medium. 0.90m; Very sandy.		
					1.10			
1.20	D2					Medium dense, dark orange brown, slightly gravelly, clayey, fine to medium SAND. Gravel is fine to medium, angular to rounded flint.		
2.00	D3				(2.10)	2.00m; Light orange brown, fine to medium SAND.		
2.80	D4					2.80m; Occasional pockets of very stiff clay.		
					3.20			
3.20	D5							
						Complete at 3.20m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open. Surface of soil cracked up to 3cm wide.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.6

IAN FARMER ASSOCIATES

Site	Trial Pit Number
Harlow Business Park.	TP7

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine dug pit.	0.70 x 1.50m.		R O Developments Ltd.	50684
	Location	**Dates**	**Engineer**	**Sheet**
	TL 420 098	04/07/2006	Train and Kemp.	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	J1				(1.00)	MADE GROUND; Stiff to very stiff, brown, gravelly, sandy clay with rare gravel sized brick fragments. Gravel is fine to coarse, angular to rounded flint and occ. weak, medium density white chalk. Sand is fine to coarse. Some fine roots.		
0.80	D1				1.00			
1.10	D2				(1.90)	Medium dense, dark orange brown, slightly gravelly, clayey, fine to medium SAND. Gravel is fine to medium, angular to rounded flint. 1.80m; Fine to coarse SAND. Gravel is fine to coarse. 2.00m; Slightly clayey, gravelly, light orange brown.		
2.00	D3				2.90			
3.10	D4				(0.35)	Stiff to very stiff, gravelly, sandy, CLAY. Gravel is fine to medium, angular to rounded flint. Sand is fine to coarse.		
					3.25	Complete at 3.25m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.7

IAN FARMER ASSOCIATES

Site Harlow Business Park.			**Trial Pit Number** **TP8**
Excavation Method Machine dug pit.	**Dimensions** 0.70 x 1.50m.	**Ground Level (mOD)**	**Client** R O Developments Ltd.	**Job Number** 50684
	Location TL 420 098	**Dates** 04/07/2006	**Engineer** Train and Kemp.	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	J1				(0.80)	MADE GROUND; Very stiff, brown, sandy, gravelly, clay with rare gravel and cobble sized brick. Gravel is fine to coarse, angular to rounded flint and weak medium density white chalk.		
0.80	D1				0.80			
					(0.80)	Very stiff, orange brown and bluey grey, slightly sandy, very gravelly, CLAY. Gravel is fine to coarse, angular to rounded flint and weak medium density white chalk.		
1.50	D2				1.60			
2.00	D3				(1.20)	Stiff, dark orange brown, sandy, very gravelly, CLAY. Sand is fine to medium. Gravel is fine to coarse, angular to rounded flint.		
2.80	D4				2.80			
3.00	D5				(0.40)	Stiff, orange brown and bluey grey, sandy, very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to rounded flint and weak, medium density white chalk.		
					3.20	Complete at 3.20m		

Plan

Remarks

Groundwater not encountered. Trial pit remained open.

Scale (approx)	Logged By	Figure No.
1:50	owv	A2.8

APPENDIX 3

LABORATORY TESTS

APPENDIX 3

GENERAL NOTES ON LABORATORY TESTS ON SOILS

A3.1 GENERAL

A3.1.1 Where applicable all tests are carried out in accordance with the relevant British Standard. The laboratory test procedures are as below:

Test Name	Procedures BS1377:1990 Part:Clause
Moisture Content	2:3
Liquid Limit	2:4
Plastic Limit and Plastic Index	2:5
Particle Size Distribution	2:9
Mass Loss on Ignition	3.4*
Sulphate content	3:5
pH Value	3:9
Compaction Test	4:3*
California Bearing Ratio	4:7
Consolidation	5:3
Bulk Density	7:2*
Laboratory Vane Tests	7:3*
Triaxial Compression	
Total Stress Single-Stage	7:8
Total Stress Multi-Stage	7:9*
Desiccation	Note 1*

Note 1 - BRE Information paper IP4 issued February 1993
* Tests are not included in UKAS accreditation

A3.1.2 Any discussion in this report is based on the values and results obtained from the appropriate tests. Due allowance should be made, when considering any result in isolation, of the possible inaccuracy of any such individual result. Details of the accuracy of results are included in this section, where applicable.

A3.2 MOISTURE CONTENT

A3.2.1 Unless stated to the contrary, the moisture content of a soil sample was determined by the standard oven drying method, BS 1377, Part 1, Test 3. The result is reported to an accuracy of ±0.5%

A3.3 ATTERBERG LIMITS

A3.3.1 The Liquid Limit, **LL**, is the moisture content at which the soil passes from the liquid to plastic state. Unless stated to the contrary, the Liquid Limit was determined using the four point, cone penetrometer method, Test 4. The value is reported to the nearest whole number, to an accuracy of ±0.5%.

A3.3.2 The Plastic Limit, **PL**, is the moisture content at which soil passes from the plastic to solid state and becomes too dry to remain in a plastic condition. The Plastic Limit was determined using the method described in Test 5. The value is reported to the nearest whole number, to an accuracy of ±0.5%.

A3.3.3 The Plasticity Index, **PI**, is the numerical difference between the liquid and plastic limits, corresponding to the range of moisture contents over which a soil is in a plastic state. The determination of the Plasticity Index is covered by Test 5.

A3.4 SOIL CLASSIFICATION

A3.4.1 Classification of soils is usually undertaken by means of the Plasticity Classification Chart, sometimes called the A-Line Chart. This is graphical plot of PI against LL with the A-Line defined as PI = 0.73(LL - 20).

A3.4.2 This line is defined from experimental evidence and does not represent a well defined boundary between soil types, but forms a useful reference datum. When the values of LL and PI for inorganic clays are plotted on the chart they generally lie just above the A-Line in a narrow band parallel to it, while silts and organic clays plot below this line.

A3.4.3 Clays and silts are divided into five zones of plasticity:

Low Plasticity (L)	LL less than 35
Intermediate Plasticity (I)	LL between 35 and 50
High Plasticity (H)	LL between 50 and 70
Very High Plasticity (V)	LL between 70 and 90
Extremely High Plasticity (E)	LL greater than 90

A3.4.4 In general, clays of high plasticity are likely to have a lower permeability, are more compressible and consolidate over a longer period of time under load than clays of low plasticity. Clays of high plasticity are more difficult to compact as fill material.

A3.5 CHEMICAL TESTS

A3.5.1 The total sulphate content of soil was determined using the gravimetric method detailed in BS1377: Part 3:1990, Test 5. The results are recorded to an accuracy of ±0.1%.

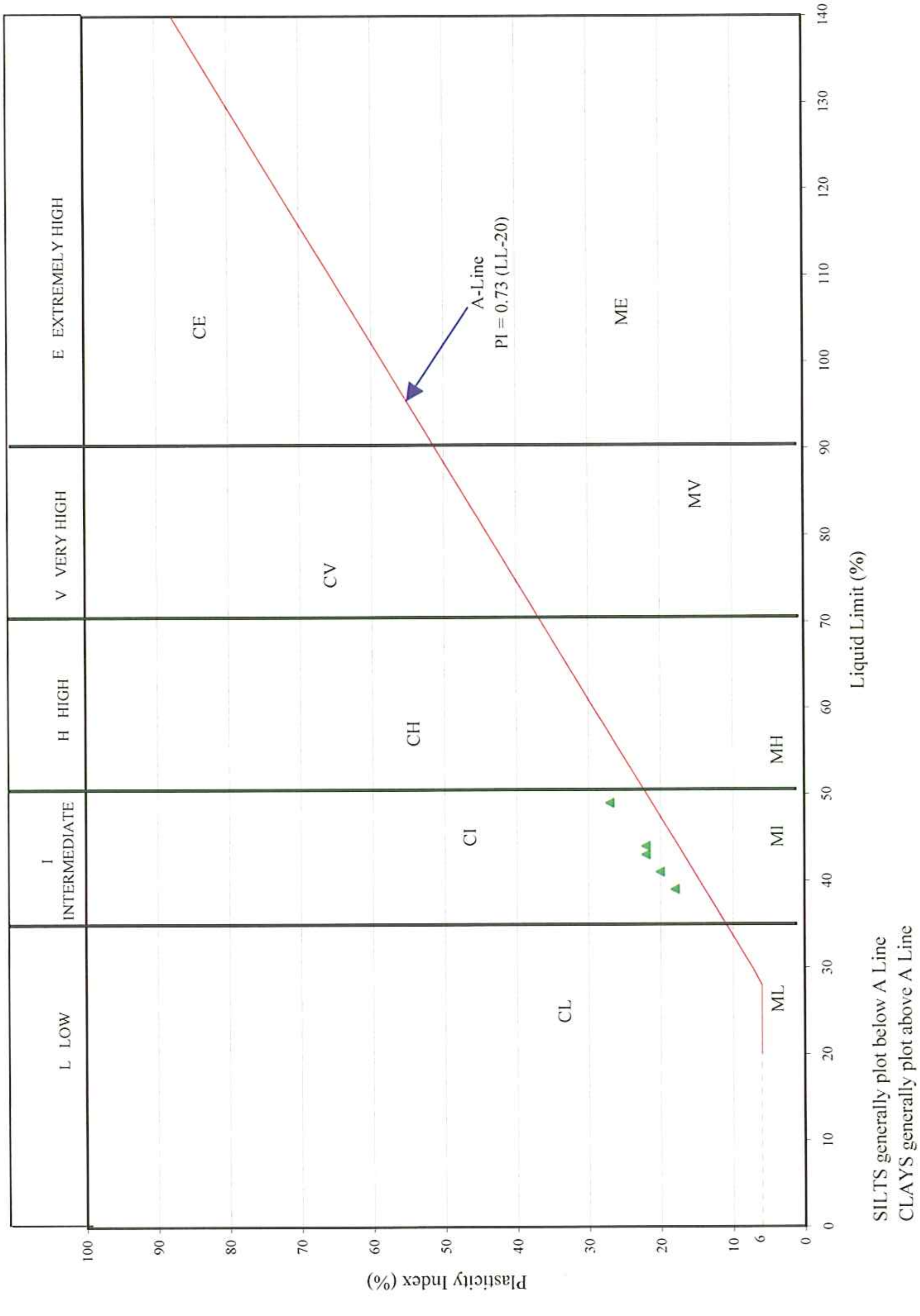
A3.5.2 The water soluble sulphate content of soil was determined using the gravimetric method detailed in BS1377: Part 3: 1990, Test 5. The results are recorded to an accuracy of ±0.1g/l.

A3.5.3 The sulphate content of groundwater was determined using the gravimetric method detailed in BS1377: Part 3: 1990, Test 5. The results are record to an accuracy of ±0.1g/l.

A3.5.4 The pH value was determined electrometrically using the procedures given in BS 1377: Part 3: 1990, Test 9. The results are recorded to an accuracy of ±0.1 pH units.

A3.5.5 The total sulphur content of soil was determined using the ignition in oxygen method detailed in TRL Report 447, Test 4B.

Location		Sample		Index properties									Chemical Tests						
BH/TP	Depth (m)	No	Type	Nat/ Sieve	NMC (%)	LL (%)	PL (%)	PI (%)	Test Type	<425μm (%)	Class	Liquidity Index	2:1 Extract Mg (mg/l)	2:1 Extract NO_3 (mg/l)	Total Sulphur (% S)	Sulphate as SO_4 Total (%)	Sulphate as SO_4 2:1 Extract (mg/l)	Sulphate as SO_4 G.W mg/l	pH
TP1	0.50	1	D	Nat	17														
TP1	1.90	2	D	Nat	26	39	21	18	4pt	98	CI	0.33					<100		8.0
TP2	1.10	1	D	Nat	17														
TP2	2.00	2	D	Nat	22	49	22	27	4pt	77	CI	0.22					100		8.1
TP2	2.80	3	D	Nat	22														
TP4	0.60	1	D	Nat	20														
TP4	1.20	2	D	Nat	18	44	22	22	4pt	67	CI	0.23					100		8.1
TP4	2.10	3	D	Nat	19												100		8.1
TP4	3.00	4	D	Nat	19	41	21	20	4pt	86	CI	0.05							
TP8	0.80	1	D	Nat	19														
TP8	1.50	2	D	Nat	18	43	21	22	4pt	67	CI	0.23					<100		8.1
TP8	2.00	3	D	Nat	20														
TP8	2.80	4	D	Nat	13														



	PLASTICITY CLASSIFICATION CHART	Job no. 50684
	Plots 14 & 15, Harlow Business Park, Greenway, Harlow, Essex	Fig no. A3.2

APPENDIX 4

CHEMICAL TESTS

APPENDIX 4

GENERAL NOTES ON CHEMICAL TESTS

A4.1 ANALYTICAL CHEMISTRY TEST METHODS FOR SOILS

Soils Standards Procedures					
Test/Determinand	**Units**	**LOD**	**MCERTS**	**UKAS**	**Standard Procedures Notes**
Arsenic (total)	mg/kg	1.0	√	√	Metals are extracted from soil samples in aqua-regia (hydrochloric/nitric acids 3:1 ration). The extracts are then analysed by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). In house method based on British Gas.
Barium (total)	mg/kg	1.0	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Beryllium (total)	mg/kg	1.0	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Boron (water soluble)	mg/kg	0.2	-	√	Soils are extracted with boiling water and analysed by Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES).
Cadmium (total)	mg/kg	0.3	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
BTEX (**B**enzene, **T**oluene, **E**thylbenzene & **X**ylenes)	mg/kg	0.02	√	√	Headspace collection followed by determination of BTEX compounds by GC-MS analysis.
Chromium (hexavalent)	mg/kg	0.1	-	-	Chromium hexavalent is extracted from soil in dilute hydrochloric acid. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Chromium (total)	mg/kg	0.3	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Copper (total)	mg/kg	10	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Cyanide (free)	mg/kg	1.0	-	√	Free Cyanide is extracted by steam distillation at pH4 which liberates free cyanide. Cyanide is then analysed by titration with silver nitrate and rhodanine indicator. In house method based on British Gas.
Cyanide (complex)	mg/kg	1.0	-	√	Complex Cyanide is extracted by steam distillation with hydrochloric acid, copper sulphate, tin chloride and orthophosphoric acid after free cyanide has been removed.

Soils Standards Procedures					
Test/Determinand	**Units**	**LOD**	**MCERTS**	**UKAS**	**Standard Procedures Notes**
					Cyanide is then analysed by titration with silver nitrate and rhodanine indicator. In house method based on British Gas.
Cyanide (total)	mg/kg	1.0	-	√	Total Cyanide is extracted as complex cyanide without first removing the free cyanide and titrated as above. Alternatively the free and complex cyanide values are added to give total cyanide. In house method based on British Gas.
Electrical Conductivity (EC)	mS/cm µS/cm	0.01 1.0	-	-	A 2:1 water to soil extract is analysed using an EC meter. In house method.
Lead (total)	mg/kg	2.0	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Mercury (total)	mg/kg	1.0	-	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Nickel (total)	mg/kg	2.0	√	√	Metals are extracted from soil samples in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.
Organic Matter	%	0.2	-	-	Organic matter is oxidised using dichromate. The dichromate left is determined titrimetrically using iron (II) ammonium sulphate and ferroin indicator. In house method based on Walkley and Black.
pH	PH units	0.1	√	√	A (5:2) water to soil extract is analysed using a pH meter. In house method.
Phenol	mg/kg	0.5	-	√	Phenol is extracted by steam distillation with sodium chloride and the phenol is determined colourimetrically using a UV/VIS spectrophotometer. In house method.
Low Level Polyaromatic Hydrocarbons (LLPAH) (total & 16 EPA)	mg/kg	0.1	√	√	LLPAHs are extracted by dichloromethane under pressure in a soxtherm. The extract is then reduced in a turbovap. The reduced extract is analysed by GC-MS where the separated LL PAHs are quantitatively determined by the Mass Selective detector. In house method using soil as received.
Polyaromatic Hydrocarbons (PAH) (total & 16 EPA)	mg/kg	5	-	√	PAHs are extracted by dichloromethane under pressure in a soxtherm. The reduced extract is then analysed by GC-FID (Gas Chromatography-Flame Ionisation Detector) where the separated PAHs are quantitatively determined. In house method usng air dried soil.
Petrol Range Organics (PRO) (C_6-C_{10})	mg/kg	50	-	-	Headspace collection followed by determination of PROs by GC-MS Analysis. PRO are analysed on a wet sample.
Selenium (total)	mg/kg	1.2	√	√	Metals are extracted from soil in aqua-regia. The extracts are then analysed by ICP-OES. In house method based on British Gas.

Soils Standards Procedures					
Test/Determinand	**Units**	**LOD**	**MCERTS**	**UKAS**	**Standard Procedures Notes**
Cyclohexane Extract	mg/kg	100	-	-	Soils are extracted in solvent and dried. Any extractable material is then determined gravimetrically. In house method.
Toluene Extract	mg/kg	100	-	-	Soils are extracted in solvent and dried. Any extractable material is then determined gravimetrically. In house method
Dichloromethane Extract	mg/kg	100	-	-	Soils are extracted in solvent and dried. Any extractable material is then determined gravimetrically. In house method.
Sulphate (2:1 water soluble)	g/l	0.02	-	√	Soils are shaken in a 1:2 ratio with water. These are filtered and barium chloride added. Sulphate is then determined by measuring the turbidity by UV/VIS spectrometer. In house based on MAFF.
Sulphate (total)	mg/kg	200	-	√	Total Sulphate is extracted from soil with hydrochloric acid. The filtrate is then determined, as water soluble sulphate, by adding barium chloride and measuring the turbidity by UV/VIS spectrophotometer. In house based on MAFF.
Sulphide	mg/kg	10	-	√	Sulphide is extracted by steam distillation using sulphuric acid and then determined by titration with sodium thiosulphate and iodine as an indicator. In-house method.
Sulphur (elemental)	mg/kg	50	-	√	Sulphur is extracted by dichloromethane under pressure in a soxtherm. The extract is then injected into a HPLC (High Performance Liquid Chromatogram) and quantitatively determined by a variable wavelength detector. In house method based on British Gas
Thiocyanate	mg/kg	0.1	-	√	Thiocyanate is extracted in water (ratio 2:1, water:soil) and then determined colourimetrically using UV/VIS spectrophotometer. In house method.
Total Petroleum Hydrocarbons (C_{5-40})	mg/kg	50	-	-	TPHs are extracted in dichloromethane on soxtherm and determined by GC-FID. In house method. TPHs are analysed on a wet sample.
Zinc (total)	mg/kg	4.0	√	√	Metals are extracted from soil in aqua-regia. The extracts are then analysed by ICP-OES. In house based on British Gas.
B (avail) Cu (avail) Ni (avail) Pb (avail) Hg (avail) Zn (avail)	mg/kg	1.0	-	-	Metals in soils available. Metals are extracted from soil in EDTA solution, filtered and then analysed by ICP-OES. In house method based on HMSO publications 'Methods for the Examination of Waters and Associated Materials.

A4.2 ANALYTICAL CHEMISTRY TEST METHODS FOR WATER

Waters/Leachates Standards Procedures				
Test/Determinand	**Units**	**LOD**	**UKAS**	**Standard Procedures Notes**
Alkalinity in waters	mg/l	5.5	√	Determination of alkalinity to pH8.3 using phenolphthalein pH indicator and to pH4.5 using a mixed indicator. Titration method. In house method based on HMSO publications 'Methods for the Examination of Waters and Associated Materials. Method is currently being validated.
Alkalinity in leachates	mg/l	5.0	√	Determination of alkalinity to pH8.3 using phenolphthalein pH indicator and to pH4.5 using a mixed indicator. Titration method. In house method based on HMSO publications 'Methods for the Examination of Waters and Associated Materials. Method is currently being validated.
Arsenic	µg/l	13	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Barium	µg/l	10	-	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Beryllium	µg/l	10	-	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Boron	mg/l	0.05	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
BTEX Benzene Toluene Ethylbenzene M/p-Xylenes o-Xylenes	µg/l	 5 5 5 10 5	√	Headspace collection followed by determination of BTEX compounds by GC-MS analysis.
Cadmium	µg/l	0.5	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Calcium	µg/l	0.01	-	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Chromium	µg/l	2.5	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Copper	µg/l	3.0	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Cyanide (free)	mg/l	0.1	√	Free Cyanide is extracted by steam distillation at pH4 which liberates free cyanide. Cyanide is then analysed by titration with silver nitrate and rhodanine indicator. In house method.
Cyanide (complex)	mg/l	0.1	√	Complex Cyanide is extracted by steam distillation with hydrochloric acid and copper sulphate after free cyanide has been removed. Cyanide is then analysed by titration with silver nitrate and rhodanine indicator. In house method.
Cyanide (total)	mg/l	0.1	√	Total Cyanide is extracted as complex cyanide without first removing the free cyanide and titrated as above. Alternatively the free and complex cyanide values are added to give total cyanide. In house method.
Electrical Conductivity (EC)	MS/cm µS/cm	0.01 1.00	-	Samples are measured directly with an EC meter. In house method

Waters/Leachates Standards Procedures				
Test/Determinand	**Units**	**LOD**	**UKAS**	**Standard Procedures Notes**
Iron	µg/l	10	-	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Lead	µg/l	10	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Mercury	µg/l	5.0	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Nickel	µg/l	2.0	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
pH	PH units	0.1	√	Samples are measured directly with a pH meter. In house method
Phenol	mg/l	0.05	√	Phenol is extracted by steam distillation with sodium chloride and the phenol is determined colourimetrically using UV/VIS. In house method
Polyaromatic Hydrocarbons (PAH) (total & 16 EPA)	µg/l	5	-	PAHs are extracted by a liquid/liquid extraction and the extract is reduced in a turbotrap. The extract is then injected into a GC-FID where the separated PAHs are quantitatively determined. In house method.
Selenium	µg/l	10	√	Metals in waters and leachates are filtered and determined by ICP-OES. In house method.
Sulphate	mg/l	20	√	Samples are filtered, barium chloride added and the turbidity determined by UV/VIS spectrophotometer. In house method.
Sulphide	mg/l	0.2	-	Sulphide is extracted by steam distillation using sulphuric acid and then determined by titration with sodium thiosulphate and iodine as an indicator. In-house method.
Thiocyanate	mg/l	0.7	√	Thiocyanate in water is determined after filtration colourimetrically using UV/VIS. In house method.
Total Petroleum Hydrocarbons (C_{10-40})	µg/l	50	-	TPHs are extracted in dichloromethane on soxtherm and determined by GC-FID. In house method.
Zinc	µg/l	5.0	√	Samples are filtered. Dissolved metals determined by ICP-OES. In house method.
Anions Fluoride as F Chloride as Cl Nitrite as NO_2 Bromide as Br Nitrate as NO_3 Phosphate as PO_4 Sulphate as SO_4 Iodide as I	 mg/l mg/l mg/l mg/l mg/l mg/l mg/l mg/l	 0.1 1.0 0.1 0.1 0.2 1.0 0.5 1.0	√	Anions are determined after filtration by ion chromatography. In house method.
Cations Aluminium Barium Beryllium Calcium Iron Magnesium Potassium Sodium	 µg/l µg/l µg/l µg/l µg/l µg/l µg/l µg/l	 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01	-	Samples are filtered. Dissolved metals determined by ICP-OES. In house method.

		Laboratory reference	1	2	3	4	5
		Borehole/trial pit	TP1	TP2	TP3	TP3	TP4
		Date Sampled	04/07/06	04/07/06	04/07/06	04/07/06	04/07/06
		Depth (m)	0.20	0.40	0.30	2.50	0.25
Analysis	**Units**	**SP No**					
Asbestos*	presence	137	-	nd	nd	-	-
Arsenic (total)	mg/kg	122	15	12	12	9.7	11
Boron (water sol)	mg/kg	124	1.1	1.5	1.3	0.44	0.89
Cadmium (total)	mg/kg	122	<0.30	0.66	0.52	<0.30	<0.30
Chromium (total)	mg/kg	122	49	40	38	29	37
Copper (total)*	mg/kg	122	26	24	24	13	18
Lead (total)	mg/kg	122	22	39	32	11	24
Mercury (total)	mg/kg	122	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (total)*	mg/kg	122	64	41	32	26	35
Selenium (total)	mg/kg	122	3.0	2.6	<1.2	1.5	2.1
Zinc (total)	mg/kg	122	88	87	80	51	73
pH	pH units	119	8.0	8.0	8.0	8.1	8.0
Nitrate (2:1) as NO_3	mg/kg	158	-	-	-	-	-
Phenol (total)	mg/kg	120	<0.50	<0.50	<0.50	<0.50	<0.50
Organic Matter*	%	128	-	1.2	1.3	-	-
TPH (C10-14)*	mg/kg	133	-	<50	<50	-	-
TPH (C15-36)*	mg/kg	133	-	<50	<50	-	-
Naphthalene	mg/kg	163	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	163	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	163	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	163	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	163	<0.10	<0.10	<0.10	0.42	<0.10
Anthracene	mg/kg	163	<0.10	<0.10	<0.10	0.39	<0.10
Fluoranthene	mg/kg	163	<0.10	<0.10	0.44	0.47	<0.10
Pyrene	mg/kg	163	<0.10	<0.10	0.37	0.40	<0.10
Benzo(a)anthracene	mg/kg	163	<0.10	<0.10	0.43	<0.10	<0.10
Chrysene	mg/kg	163	<0.10	<0.10	0.38	<0.10	<0.10
Benzo(b)fluoranthene	mg/kg	163	<0.10	<0.10	0.31	<0.10	<0.10
Benzo(k)fluoranthene	mg/kg	163	<0.10	<0.10	0.38	<0.10	<0.10
Benzo(a)pyrene	mg/kg	163	<0.10	<0.10	0.42	<0.10	<0.10
Indeno(123cd)pyrene	mg/kg	163	<0.10	<0.10	0.38	<0.10	<0.10
Dibenzo(ah)anthracene	mg/kg	163	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo(ghi)perylene	mg/kg	163	<0.10	<0.10	0.34	<0.10	<0.10
PAH (total)	mg/kg	163	<0.10	<0.10	3.5	1.7	<0.10

UKAS TESTING No. 1464

For UKAS accreditation see General Notes
Checked and issued by:
C Lopez Garabito; Laboratory Manager
Date:

IAN FARMER ASSOCIATES
Geotechnical & Environmental Specialists

RESULTS OF CHEMICAL TESTS

Job no. 50684

Plots 14 & 15, Harlow Business Park, Greenway, Harlow, Essex

Fig. A4.1

Laboratory reference			6	7	8	9
Borehole/trial pit			TP5	TP6	TP7	TP8
Date Sampled			04/07/06	04/07/06	04/07/06	04/07/06
Depth (m)			0.30	0.25	0.30	0.20
Analysis	**Units**	**SP No**				
Asbestos*	presence	137	nd	nd	nd	-
Arsenic (total)	mg/kg	122	11	10	12	12
Boron (water sol)	mg/kg	124	0.99	0.74	0.94	1.1
Cadmium (total)	mg/kg	122	<0.30	<0.30	0.4	0.33
Chromium (total)	mg/kg	122	40	31	35	40
Copper (total)*	mg/kg	122	20	15	24	23
Lead (total)	mg/kg	122	28	13	41	31
Mercury (total)	mg/kg	122	<1.0	<1.0	<1.0	<1.0
Nickel (total)*	mg/kg	122	38	32	36	37
Selenium (total)	mg/kg	122	1.6	1.2	1.8	2.1
Zinc (total)	mg/kg	122	75	58	82	79
pH	pH units	119	8.1	8.2	8.1	7.9
Nitrate (2:1) as NO_3	mg/kg	158	-	14	-	30
Phenol (total)	mg/kg	120	<0.50	<0.50	<0.50	<0.50
Organic Matter*	%	128	1.0	0.47	1.1	-
TPH (C10-14)*	mg/kg	133	<50	<50	<50	-
TPH (C15-36)*	mg/kg	133	<50	<50	<50	-
Naphthalene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Acenaphthene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Acenaphthylene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Fluorene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Phenanthrene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Anthracene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Fluoranthene	mg/kg	163	<0.10	<0.10	0.44	0.41
Pyrene	mg/kg	163	<0.10	<0.10	0.39	0.36
Benzo(a)anthracene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Chrysene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Benzo(b)fluoranthene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Benzo(k)fluoranthene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Benzo(a)pyrene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Indeno(123cd)pyrene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Dibenzo(ah)anthracene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
Benzo(ghi)perylene	mg/kg	163	<0.10	<0.10	<0.10	<0.10
PAH (total)	mg/kg	163	<0.10	<0.10	0.83	0.77

UKAS TESTING
No. 1464

For UKAS accreditation see General Notes
Checked and issued by:
C Lopez Garabito; Laboratory Manager
Date:

IAN FARMER ASSOCIATES
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RESULTS OF CHEMICAL TESTS

Job no. 50684

Plots 14 & 15, Harlow Business Park, Greenway, Harlow, Essex

Fig. A4.1 (cont'd.)

CONTAMINATED LAND EXPOSURE ASSESSMENT MODEL 2002

Prepared by the Centre for Research into the Built Environment, for the Environment Agency (1993 - 2002)

Summary of Results

Contaminant :	BENZO(A)PYRENE	*User Name:*	Super User	*Report Date:*	18/08/2006
Soil Concentration (mg/Kg):	36.938	*Chemical Type :*	Organic / Non-Threshold	*Simulation Date:*	18/08/2006
Health Criteria Value: (mg/Kg bw / day):	Index Dose 2E-5	*Details:*	50684A		
Background (mg/day):	Not Applicable				

Model Parameters

Entry Route:	Oral		
Applied Dose Data To:	Oral Route Only		
No. of Iterations:	5000		
Scenario Type :	Commercial / Industrial		
Receptor Used :	Female height / weight database	*Age Class:*	17 To 17
Averaging Method :	Elapsed exposure time	*Soil Type :*	Clay
Dermal Uptake Routine :	N/A	*Soil PH :*	8
Plant Uptake Routine :	N/A	*Soil Organic Matter (%):*	1
Building Type :	N/A	*Molecular Weight (g) :*	252.3
Flow Type:	N/A	*Air Diffusivity (m2 /s) :*	5E-6

Exposure Routes Analysis

Route 1 : Soil ingestion pathway
Route 2 : Ingestion of indoor dust

Average Contribution of Each Exposure Route to ADE

Exposure route	*Mean (%)*	*Standard Dev (%)*	*Minimum (%)*	*Maximum (%)*
1	100.0	0.0	100.0	100.0

Contributions for each exposure route

CONTAMINATED LAND EXPOSURE ASSESSMENT MODEL 2002

Prepared by the Centre for Research into the Built Environment, for the Environment Agency (1993 - 2002)

Summary of Results

Contaminant : **BENZO(A)PYRENE**

Report Date: **18/08/2006**
Simulation Date: **18/08/2006**

Total Average Daily Exposure (mg/Kg bodyweight / day)

Ratio of ADE/TDI at 95th percentile : **0.997**

Ageclass	*Percentiles*			
	99 th	*95 th*	*90 th*	*50 th*
17	**2.37E-5**	**1.99E-5**	**1.81E-5**	**1.36E-5**

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CLEA Output Sheets for Benzo(a)pyrene Value	Job no.	50684
Plots 14 and 15, Harlow Business Park, Greenway, Harlow	Fig.	A4.2 cont.

CONTAMINATED LAND EXPOSURE ASSESSMENT MODEL 2002

Prepared by the Centre for Research into the Built Environment, for the Environment Agency (1993 - 2002)

Contaminant BENZO(A)PYRENE

Report Date: 18/08/2006
Simulation Date: 18/08/2006

Oral Settings

Tolerable Daily Intake (mg.kg-1.bw.day-1)	N/A
Index Dose (mg.kg-1.bw.day-1)	2E-5
Adult Background Value (mg.day-1)	N/A

Inhalation Settings

Tolerable Daily Intake (mg.kg-1.bw.day-1)	N/A
Index Dose (mg.kg-1.bw.day-1)	N/A
Adult Background Value (mg.day-1)	N/A

Dermal Settings

Tolerable Daily Intake (mg.kg-1.bw.day-1)	N/A
Index Dose (mg.kg-1.bw.day-1)	N/A
Adult Background Value (mg.day-1)	N/A

Miscellaneous Settings

Skin Permeability (cm.hr-1)	0.108
Air Diffusion Coefficient (m2.s-1)	5E-6
Water Diffusion Coefficient (m2.s-1)	5E-10
Water Solubility (mg.l-1)	0.0038
Experimental Organic Carbon Distribution Coefficient (l.kg-1)	1140000
Experimental Octanol-Water Partition Coefficient (log, dimensionless)	6.06
Relative Molecular Weight (g.mol-1)	252.3
Vapour Pressure at 20C (Pa)	7E-7
Henry's Constant (Pa.m3.mol-1)	0.157
Henry's Constant (Dimensionless)	6.46E-5
Experimental Soil Water Distribution Coefficient (l.kg-1)	N/A

CAT-WASTE SOIL

Classification Assessment Tool of Soil Wastes - Hazard Summary Sheet

McArdle ATKINS

Site Name	Harlow Business Park
Location	Harlow
Site ID	F1
Job Numbe	50684
Date	9/5/2006 4:11:20 PM
User Name	enquiries@ifaharpenden.co.uk
Company N	Ian Farmer Associates

Hole ID	Sample Depth	Hazardous Waste Y/N	H1	H2	H3A	H3B	H4	H5	H6	H7
TP2	0.4m	N	False	False	False	False	False	False	False	False
TP3	0.3m	N	False	False	False	False	False	False	False	False
TP3	2.5m	N	False	False	False	False	False	False	False	False

Hole ID	Sample Depth	Hazardous Waste Y/N	H8	H9	H10	H11	H12	H13	H14
TP2	0.4m	N	False	False	False	False	False	False	False
TP3	0.3m	N	False	False	False	False	False	False	False
TP3	2.5m	N	False	False	False	False	False	False	False

CAT-WASTE SOIL

Classification Assessment Tool of Soil Wastes - Individual Compound Information

Site Name	Harlow Business Park
Location	Harlow
Site ID	F1
Job Number	50684
Date	9/5/2006 4:11:20 PM
User Name	enquiries@ifaharpenden.co.uk
Company Name	Ian Farmer Associates

Hole ID	Sample Depth	Contaminant	Contaminant Concentration (%)	Hazardous Waste Y/N	Additional Risk Phrases (see notes section)
TP2	0.4m	Boron	0.003472222	N	R14 (this risk phrase alone will not constitute a waste as being hazardous)
TP2	0.4m	Nickel	0.01080939	N	R42 see comment, R43 see comment
TP3	0.3m	Boron	0.003009259	N	R14 (this risk phrase alone will not constitute a waste as being hazardous)
TP3	0.3m	Nickel	0.008436594	N	R42 see comment, R43 see comment
TP3	2.5m	Boron	0.001018518	N	R14 (this risk phrase alone will not constitute a waste as being hazardous)
TP3	2.5m	Nickel	0.006854733	N	R42 see comment, R43 see comment

APPENDIX 5

DESIGN CONSIDERATIONS

Broad leafed trees		
Water demand	Species	Mature height (m)
High	Elm	
	English	24
	Wheatley	22
	Wych	18
	Eucalyptus	18
	Hawthorn	10
	Oak	
	English	20
	Holm	16
	Red	24
	Turkey	24
	Poplar	
	Hybrid black	28
	Lombardy	25
	White	15
	Willow	
	Crack	24
	Weeping	16
	White	24
Moderate	Acacia False	18
	Alder	18
	Apple	10
	Ash	23
	Bay Laurel	10
	Beech	20
	Blackthorn	8
	Cherry	
	Japanese	9
	Laurel	8
	Orchard	12
	Wild	17
	Chestnut	
	Horse	20
	Sweet	24
	Lime	22
	Maple	
	Japanese	8
	Norway	18
	Mountain ash	11
	Pear	12
	Plane	26
	Plum	10
	Sycamore	22
	Tree of Heaven	20
	Walnut	18
	Whitebeam	12
Low	Birch	14
	Elder	10
	Fig	8
	Hazel	8
	Holly	12
	Honey Locust	14
	Hornbeam	17
	Laburnum	12
	Magnolia	9
	Mulberry	9
	Tulip tree	20

Coniferous trees		
Water demand	Species	Mature height (m)
High	Cypress	
	Lawson's	18
	Leyland	20
	Monterey	20
Moderate	Cedar	20
	Douglas fir	20
	Larch	20
	Monkey Puzzle	18
	Pine	20
	Spruce	18
	Wellingtonia	30
	Yew	12

Note

1. Where hedgerows contain trees, their effects should be assessed separately. In hedgerows, the height of species likely to have the greatest effect should be used

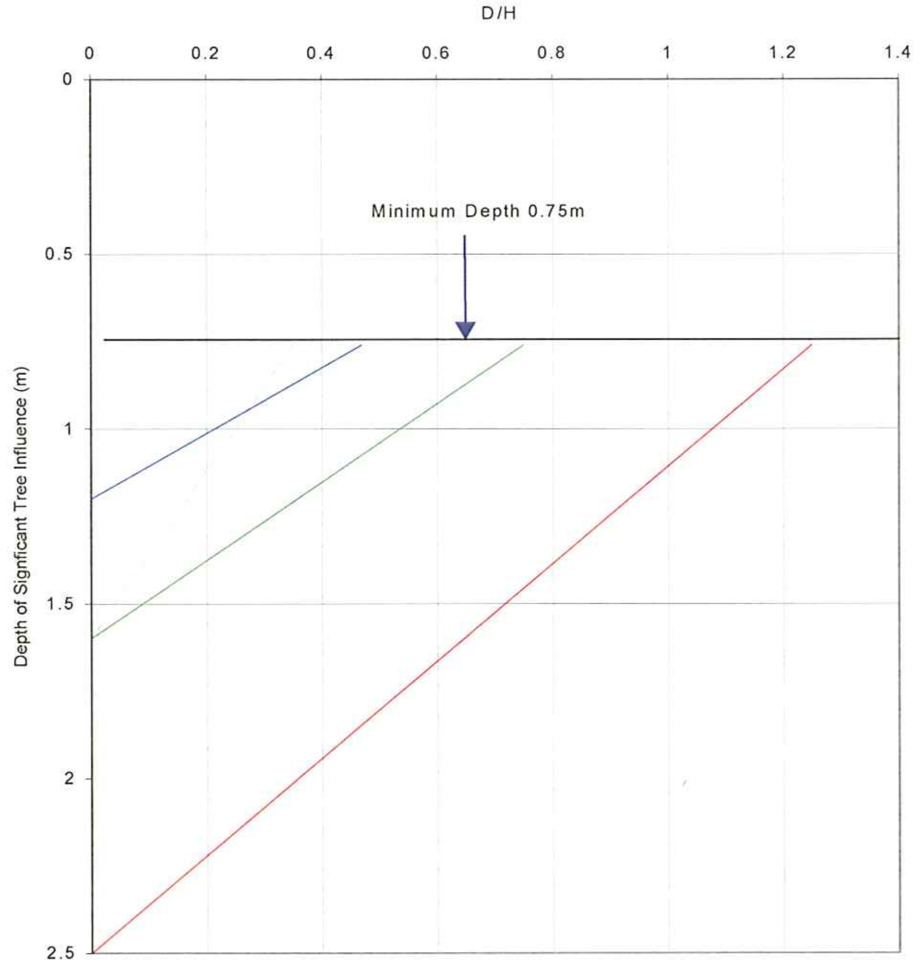
2. Within the classes of water demand, species are listed alphabetically; the order does not signify any graduation in water demand

3. When the species is known but the sub-species is not, the greatest height listed for the species should be assumed

4. Further information regarding trees may be obtained from the Arboricultural Association or the Arboricultural Advisory and Information Service

Reproduced from National House Building Council, Standards, 2003, Chapter 4.2, 'Building Near Trees'

IAN FARMER ASSOCIATES Geotechnical & Environmental Specialists	WATER DEMAND AND MATURE HEIGHT OF TREES	Job no. 50684
	Plots 14 & 15, Harlow Business Park, Greenway, Harlow, Essex	Fig. A5.1



Broad Leaf ———— D = Distance between tree and foundation

Conifers ------ H = Height of Tree

—— Low water demand	- - - - Moderate water demand	—— Moderate water demand
High water demand	—— High water demand	

Reproduced from National House Building Council, Standards 2003, Chapter 4.2, 'Building Near Trees'

IAN FARMER ASSOCIATES Geotechnical & Environmental Specialists	DETERMINATION OF FOUNDATION DEPTH – LOW SHRINKAGE SOILS	Job no. 50684
	Plots 14 & 15, Harlow Business Park, Greenway, Harlow, Essex	Fig. A5.2

Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations

Sulphate				Groundwater		
Design Sulphate Class for location	2:1 water/soil extract[b]	Groundwater	Total potential sulphate[c]	Static water	Mobile water	ACEC class for location
	(SO_4 mg/l)	(SO_4mg/l	(SO_4 %)	(pH)	(pH)	
DS-1	<500	<400	0.24	≥2.5		AC-1s
					>5.5[d]	AC-1[d]
					2.5-5.5	AC-2z
DS-2	500-1500	400-1400	0.24-0.6	>3.5		AC-1s
					>5.5	AC-2
				2.5-3.5		AC-2s
					2.5-5.5	AC-3z
DS-3	1600-3000	1500-3000	0.7-1.2	>3.5		AC-2s
					>5.5	AC-3
				2.5-3.5		AC-3s
					2.5-5.5	AC-4
DS-4	3100-6000	3100-6000	1.3-2.4	>3.5		AC-3s
					>5.5	AC-4
				2.5-3.5		AC-4s
					2.5-5.5	AC-5
DC5	>6000	>6000	>2.4	>3.5		AC-4s
				2.5-3.5	≥2.5	AC-5

Notes

a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield) or clean fill derived from such ground.

b The limits of Design Sulphate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests

c Applies only to locations where concrete will be exposed to sulphate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance

d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l, increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

- Suffix 's' indicates that the water has been classified as static
- Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements or combinations listed in Digest

APPENDIX 6

CONTAMINATION ASSESSMENT

APPENDIX 6

GENERAL NOTES ON CONTAMINATION ASSESSMENT

A6.1 STATUTORY FRAMEWORK AND DEFINITIONS

A6.1.1 The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref 9.12, which was introduced by the Environment Act 1995, ref 9.13;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused.'

A6.1.2 The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 9.20 was published in 2004.

A6.1.3 In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A6.1.4 A *'pollutant linkage'* may be defined as the link between a contaminant *'source'* and a *'receptor'* by means of a *'pathway'*.

A6.2 ASSESSMENT METHODOLOGY

A6.2.1 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A6.2.2 Stages 1 and 2 develop a *'conceptual model'* based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref 9.21.

A6.2.3 The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref 9.22. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. CLR 8, ref. 9.23, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes.

A6.2.4 In most cases the recommendations will indicate that a site investigation is required to further refine the conceptual model, which should be planned in general accordance with CLR 4, ref 9.1. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. To this end a two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

A6.2.5 All site works should be in general accordance with the British Standards, BS 5930:1999, ref. 9.3 and BS 10175:2001, ref 9.2.

A6.2.6 The risk estimation stage compares the results of the analysis with generic guidance values. Soils will be compared with the available generic Soil Guideline Values (SGVs) as published by the Department of Environment Food and Rural Affairs (DEFRA) and The Environment Agency (EA), and developed using the Contaminated Land Exposure Assessment (CLEA) Model.

A6.2.7 Where there are no currently available SGVs for specific soil contaminants, Ian Farmer Associates (1998) Ltd has developed Soil Screening Values (SSV) using the CLEA model or other relevant and appropriate risk assessment models. Where insufficient data exists, such as toxicity, to permit the calculation of SSVs in accordance with the CLR documents, other internationally acceptable toxicity data has been used.

A6.2.8 Although now withdrawn, in the absence of any other relevant UK guidance, the ICRCL levels are utilised for the assessment of phytotoxicity.

A6.2.9 The CLEA developed SGV are not applicable to contaminants in groundwater. Where specifically required, site specific SGVs may be developed utilising the CLEA model.

A6.2.10 Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CLR 7, ref 9.16. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

A6.2.11 The mean value test is applied to determine whether the mean characteristics of the selected soil unit present a significant possibility of significant harm to human health. The significance of the data is further tested using the maximum value test. This determines whether the highest recorded contaminant concentrations are from the same statistical distribution or whether they may represent a 'hot spot'.

A6.2.12 Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

A6.2.13 The risk evaluation will address the potential pollutant linkages between an identified source of contamination and the likely receptors both on and off site.

A6.2.14 The potential receptors include:

1) Humans – current site occupants, construction workers, future site users and neighbouring site users.

2) Controlled Waters – surface water and groundwater resources

3) Plants – current and future site vegetation

4) Building materials

A6.2.15 The potential hazards to be considered in relation to contamination are:

a) Ingestion and inhalation.

b) Uptake of contaminants via cultivated vegetables.

c) Dermal contact

d) Phytotoxicity (the prevention or inhibition of plant growth)

e) Contamination of water resources

f) Chemical attack on building materials and services

g) Fire and explosion

A6.2.16 It should be noted that throughout the above process the conceptual model is refined and amended based upon data generated from each stage of the work, and from the input of any additional information that may be available, such as potential changes to the proposed land-use.

A6.2.17 Based upon the Client requirements, recommendations will be made on ways to minimise or mitigate the potential impacts of the contamination, if present. Further work may be recommended to assist in a cost effective and site-specific remediation and validation methodology, as well as procedures for the appropriate handling of the contaminated material; or, procedures and recommendations for the long-term maintenance and monitoring of the site.