REPORT ON A GEOTECHNICAL INVESTIGATION

at

ROPLEY RAILWAY STATION, BIGHTON HILL, ROPLEY, ALRESFORD, HAMPSHIRE, SO24 0BL

for

MID HANTS RAILWAY CO LTD

Report No 10/9067/A/GO **October 2010**

ALBURY S.I. LTD

Miltons Yard Petworth Road
Witley Godalming Surrey GU8 5LH

[redacted]

CONTENTS

FOREWORD

The following notes should be read in conjunction with the report. Any variations on the general procedures outlined below are indicated in the text.

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General

The recommendations made and opinions expressed in the report are based on the strata conditions revealed by the fieldworks as indicated on the boring and trialpit records, together with an assessment of the data from insitu and laboratory tests. No responsibility can be accepted for conditions, which have not been revealed by the fieldworks, for example, between borehole and/or trialpit positions. While the report may offer opinions on the possible configuration of strata, both between the excavations and below the maximum depth achieved by the investigation, these comments are for guidance only and no liability can be accepted for their accuracy. For investigations, which include environmental issues, the data obtained relate to the conditions which are relevant at the time of the investigation.

Boring Techniques

Unless otherwise stated, the light cable percussion technique of soft ground boring has been used. This method generally enables the maximum information to be obtained in respect of strata conditions, but a degree of mixing if some layered soils, for example, thin bands of coarse and fine granular soils, is inevitable. Specific attention is drawn to this occurrence where evidence of such a condition is available.

The penetration resistances quoted on the boring records have been determined generally in accordance with the procedure given in BS1377 : 1990. The suffix '+' donates that the results has been extrapolated from less than 0.3m penetration into undisturbed soil.

Routine Sampling

During construction of boreholes, sampling and insitu testing will be completed in general accordance with Eurocode EN 1997-2 : 2007 and BS5930 : 1999. Variations to this code of practice will only occur where the strata conditions preclude implementation or the contract specifies alternatives.

Samples which are required for environmental testing will be stored in suitable glass containers in accordance with current guidelines.

Groundwater

The groundwater observations entered on boring and trialpit records are those noted at the time of the investigation. The normal rate of progress does not usually permit the recording of any equilibrium water level for any one water strike. Moreover, groundwater levels are prone to seasonal variation and to changes in local drainage conditions. The table on each boring record shows the groundwater level at the quoted borehole and casing depths usually at the start and finish of a day's work. The word 'none' indicates that groundwater was sealed off by the borehole casing, or that no water was observed in the borehole.

Trialpits

The method of construction employed to form the trialpits is entered in their records. In general, it is not possible to extend machine excavated trialpits to depths significantly below the water table, especially in predominantly granular soils. Except for manually excavated pits, and unless otherwise stated, the trialpits have not been provided with temporary side support during their construction, hence personnel have not entered them and examined the insitu exposed strata.

Window Sampling

Window sampling comprises driving a probe into the ground. On extraction of the probe the strata encountered are logged and representative disturbed samples recovered. In general, window sampling cannot be completed in granular soils, or below the water table.

Laboratory Testing

Unless stated in the tests, all laboratory tests have been performed in accordance with the requirements detailed in BS1377 (1990) : Parts 1-9, or other standards or specifications that may by appropriate.

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MID HANTS RAILWAY CO LTD

Report No 10/9067/A/GO **October 2010**

Prepared by	**G C D Owens BSc Hons** **Geotechnical Engineer**
Reviewed by	**C V Sweby CEng MICE** **Managing Director**

1.0 SYNOPSIS

This investigation has demonstrated that a limited thickness of made ground overlies the Upper Chalk of late Cretaceous age. No groundwater was encountered at the time of the fieldworks. Hence, problems with respect to shallow depth excavations are unlikely.

Strip or spread foundations located at depths of the order of 1m can be designed to apply a maximum increase in load of 125kPa. Alternatively, consideration could be given to the use of piled foundation solution.

The results of laboratory analysis have not noted any significant levels of contamination. Hence, no remedial measures are likely to be required as part of the proposed redevelopment.

2.0 INTRODUCTION

It is understood that it is proposed to construct a narrow gauge railway, holiday chalets, shower block and camping areas at the farmland north of Ropley Railway Station, off Bighton Hill, Ropley, Hampshire. Consequently, a geotechnical investigation has been undertaken in order to ascertain the nature and engineering properties of the soils underlying this site, and to obtain data which will assist in the formulation of a safe and economical foundation solution.

The proposed scope of works was agreed with the Contaminated Land Officer of East Hampshire District Council, following the completion of a desk study at the site. The programme of this investigation comprised the construction of 8 boreholes using hand held window sampling techniques. During this work, samples were recovered for further examination and laboratory testing. Upon completion of two of the boreholes standpipes were installed to carry out long term gas monitoring. This report describes the work undertaken, presents the information obtained and discusses the ground conditions with respect to foundation design and construction. A copy of the order for these works is presented as Appendix 1. This report is for the benefit of the Client alone and cannot be assigned to a third party without the consent of Albury SI Ltd.

3.0 FIELDWORKS

The boreholes were completed on the 7th of October, 2010, at locations as shown on the site plan, drawing no 10/9067/A/1, which is presented in Appendix 2 to this report. The salient details of this drawing have been extracted from a site survey plan that was supplied by the client's representative; The D&M Planning Partnership.

The depths and descriptions of the strata encountered in the boreholes are given on the borehole records which comprise Appendix 3 to this report. These records note the depths at which samples were taken and any groundwater observations noted at the time

of the fieldworks. Upon completion of boreholes 1 and 7 standpipes were installed to 2.5 and 3.0m respectively.

4.0 GEOLOGY AND STRATA CONDITIONS

An examination of the 1:50,000 British Geological Survey map of the area, sheet no. 300 Alresford, indicates that the site is underlain by the Upper Chalk formation of late Cretaceous age.

A study of the borehole records indicates that a limited thickness of made ground, predominantly comprising brown very silty clay with occasional chalk and flint fragments, was noted at the investigatory locations and was proved to depths of between 0.3m and 0.45m. White putty chalk with occasional flints at depth was exposed beneath the made ground and was shown to extend to the full depth of this investigation, the boreholes being completed at depths of between 1.2 and 3.1m. It is considered that these soils are indicative of the Upper Chalk formation.

No groundwater strikes were noted during the period of the fieldworks. Consequently, no short-term standing water levels were obtained. Return visits were made to monitor the standpipes. Upon each return visit the standpipes were noted to be dry.

5.0 LABORATORY TESTING

Samples of the near surface soils have been analysed for a suite of common background parameters in accordance with the current CLEA guidelines together with currently available guidance data. The works have been completed in the *M*CERT*S* and UKAS accredited laboratories operated by Exova Ltd.

6.0 DISCUSSION OF GROUND CONDITIONS

It is understood that it is proposed to construct a narrow gauge railway, holiday chalets and shower block at the site under consideration. At the time of the preparation of this report, no precise information was available with regard to the likely structural loadings.

It cannot be recommended that major structural foundations be located within the made ground revealed by this investigation. Soils of this origin are frequently present in a weak and variable condition, such that unacceptable settlement could occur even under the action of light loading intensities. Therefore, it will be necessary to continue foundation excavations through these undesirable materials where they are of less than 1m in thickness to this minimum depth in order to avoid that zone of soil which is subject to normal seasonal moisture variation. The above precautions need not necessarily be applied to light ancillary structures, which will be formed structurally discrete from the main development and in which a greater degree of settlement can be tolerated.

Consideration of the data derived from this investigation suggests that strip or spread foundations located within the Upper Chalk at a minimum depth of 1m can be designed to apply a maximum increase in load of 125kPa.

Alternatively, consideration could be given to the use of piles in order to transmit the structural loads to the more competent soils encountered at greater depth. The design of piles lies outside the scope of this report as it is dependent upon the type of pile used, its size and required bearing capacity. Therefore, when the loadings are known, it will be sensible to seek the advice of suitably experienced specialist piling contractors in order to provide a satisfactory solution to the problem. CIRIA Report, C574, Engineering in Chalk, gives information and recommendations on the design of piles in chalk. It may be necessary to construct a deeper borehole using a shell and auger rig in order to establish suitably economic pile designs.

Excavations of less than 1m depth should not require temporary support. However, where foundation excavations extend below this level then adequate support should be provided in order to comply with current statutory safety regulations and to maintain the stability of the excavation faces.

No groundwater was observed during the period of the siteworks and this should not constitute a significant engineering problem in respect of shallow depth excavations.

It is understood that the car park is to be extended into part of the site under consideration. Chalk is a frost-susceptible material. Therefore, as this material is

consistently present at depths of less than 0.6m across the site, it would be prudent to adopt appropriate measures that take this susceptibility into account when considering road and pavement designs.

In areas where limited thicknesses of made ground have been revealed it is considered that non-suspended ground floor slabs can be employed providing the superficial materials are removed and replaced by not more than 0.6m thickness of adequately compacted approved granular fill material. Should greater thicknesses of fill be required, for example to raise the level of the site, or greater thicknesses of made ground be encountered then fully suspended ground floor slabs should be employed in order to comply with the requirements of NHBC standards.

7.0 CONTAMINATION

Samples of the near surface soils have been tested for a suite of common background parameters based upon the current Contaminated Land Exposure Assessment (CLEA) Model. An assessment has been made using the currently available data which includes the CLEA guidelines and, where applicable, the Chartered Institute of Environmental Health Generic Assessment Criteria (CIEH GAC) and BRE Special Digest 1. The tables, which comprise Appendix 5, list the determinants, current guideline values and the guideline sources.

The results obtained have been compared with CLEA soil guidance values for the Commercial land-use category. This land use-category has been chosen, as the proposal is for holiday let chalets and a camping area. Hence, receptors will only be on site for brief periods of time. The western half of the site has been disregarded as this will comprise the proposed narrow gauge railway.

The laboratory test results shows that for the contaminants with available guideline data there are no elevated levels which exceed the relevant guideline. Hence, remedial measures are unlikely to be required at this site.

The landfill directive indicates that there is a duty of care that all controlled wastes are transferred to an authorised person or site. The waste holder should take all reasonable

steps to ensure that there are no unauthorised deposits and documentation is maintained for the movement and management and should include a List of Wastes code, in accordance with the 2005 Regulations. The soils descriptions and contamination test results should be used by the waste producer to provide a List of Wastes Code and thus identify sites which will accept the excavated materials. The waste regulations have stipulated that all building waste should be treated prior to disposal. A précis of the regulations is included within Appendix 5.

8.0 EFFECT OF SULPHATES

The information obtained from this investigation has been compared with the criteria proposed in BRE Special Digest 1; 2005, Edition, Concrete in Aggressive Ground. Using the information in Table C1; natural ground of this publication the Aggressive Chemical Environment for Concrete Classification is AC-1s, which coincides with a Design Sulphate Class DS-1. This Design Sulphate Class can be used to establish the design mix for buried concrete in accordance with Part D of the Digest.

9.0 LANDFILL GAS

A regime of landfill gas monitoring has been undertaken at the site based upon the conclusions of the desk study, which identified infilled land within 250m of the site.

Visits were made to site on the 14th and 28th of October and 11th November, 2010 to carry out landfill gas monitoring of the standpipes installed during the course of this investigation. During this work the standpipes were observed to remain dry.

The results of this monitoring have been reviewed in accordance with BS 8485:2007 "Code of Practise for the Characterization and Remediation from Ground Gas in Affected Developments", together with tables 14.1 and 14.2, which have been extracted from the NHBC publication "Guidance on Evaluation of Development Proposals on Sites Where Carbon Dioxide and Methane Are Present", and are presented in Appendix 6 to this report.

The hazardous gas flow rate has been determined below based upon the worst case findings of the monitoring, which are Carbon Dioxide of 0.8% and a borehole flow rate of 0.0 l/h (zero flow). The detection limit of the monitoring equipment is -/+ 0.3 l/h. Therefore, this value has been used for calculating the gas screening value.

$$Q_{hg} = (C_{hg}/100)q$$

$$Q_{hg} = (0.8/100) \times 0.3$$

$$Q_{hg} = 0.0024 l/h$$

where:

$\boldsymbol{Q_{hg}}$ = calculated hazardous gas flow rate/gas screening value

$\boldsymbol{C_{hg}}$ = measured hazardous gas concentration

$\boldsymbol{q}$ = measure flow rate

Based upon this gas screening value of 0.0 l/h (zero l/h) the hazard potential of the site is considered to be very low, which corresponds with the "Green" NHBC traffic light classification. Hence, specific remedial measures with respect to ground gases are not considered to be necessary.

It should be noted that current CIRIA and NHBC guidelines stipulate a minimum of 6 monitoring visits. Therefore, as only 3 visits have been undertaken to date, it may be a requirement that additional gas monitoring rounds are carried out in order to comply with current guidance. However, the low levels of carbon dioxide recorded during this work would imply that further monitoring at this site is unnecessary. The agreement of the Local Authority and, if necessary the NHBC should be sought in this regard.

A P P E N D I X 1

Order

ALBURY S.I. LTD

Miltons Yard, Petworth Road,
Witley, Godalming, Surrey GU8 5LH
Fax No 01428 685261

Geotechnical and environmental testing specialists

ORDER MANDATE FORM
(to be completed by Client)

Client Company Name:	[redacted]		
Company Address:			
Telephone No:	[redacted]	Email Address:	
Registered Address: (if different from above)			
Company Registration No: 1117090		VAT No: 293506155	
Quotation Reference: GO/20/09/10		Quotation Total: [redacted]	

Where did you hear of our services?

I/we hereby confirm acceptance of quotation detailed above from Albury S.I. Limited, and instru[redacted]ne site investigation works as detailed in their quotation.

Signe[redacted]............ Dated.......................... ....

Print Name....C. M. CHAMBERS.... Position in Company.......M.D............

Site Address:	ROPLEY
Your Order No:	CMC
Date:	4/10/10

If Required:

I/we hereby confirm that I authorise my agent, detailed below, to specify works to Albury S.I. Limited required and accept agreed costs on my behalf.

Signed.................................... .... Dated..

Name of Agent/Consulting Engineer/Architect/Project Manager:

Address:

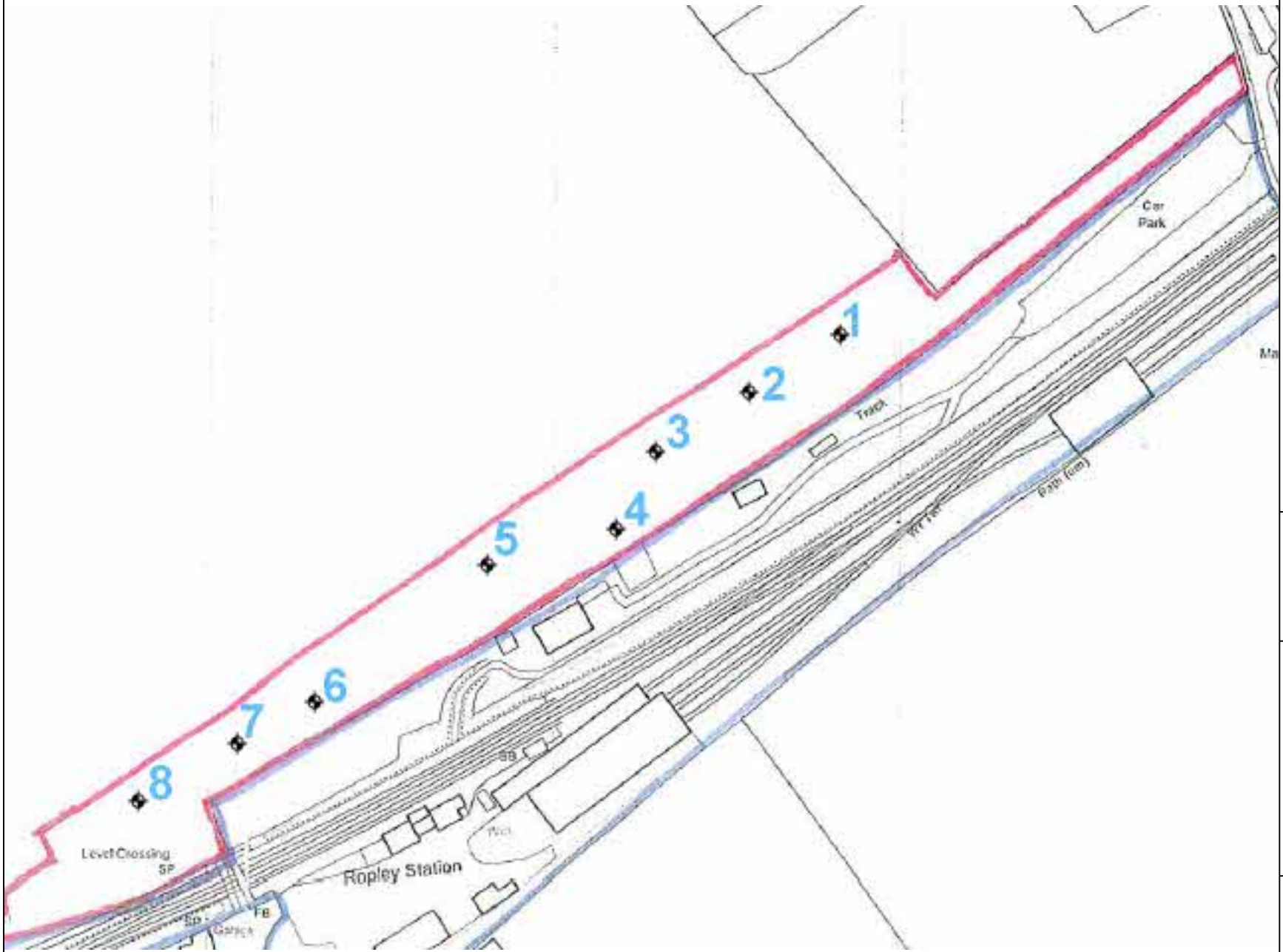
Tel No:

On receipt of this form duly completed, the required works will be placed into programme.

9067/A

A P P E N D I X 2

Site Plan



Legend:

- Borehole Location
- Trialpit Location
- Site Boundary

Title:	Site Layout Plan
Dwg No:	10/9067/A/1
Drawn by:	GO
Client:	Mid Hants Railway
Site:	Ropley Station
Job Ref:	10/9067/GO
Scale:	NTS
Revision:	A
Issue Date:	21/10/10

Albury S.I. Ltd
Miltons Yard, Petworth Road
Witley, Surrey, GU8 5LH
www.alburysi.co.uk

A P P E N D I X 3

Boring Records

ALBURY S.I. LTD			**Borehole** 1
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry

Water Strikes, m	Pit Dimensions, m	Ease of Excavation, m	
1 none	Length 0.06	Very easy	Difficult
2	Breadth	Moderate GL-2.60	Very hard 2.60+

Remarks
Standpipe installed to 2.50m.

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown very silty/sandy clay with chalk fragments and flints)
			0.30		
D	0.50				White putty chalk with occasional flints at depth
D	1.00				
D	1.50				
D	2.00				
D	2.50				
			2.60		Obstruction (flint)

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD			**Borehole** 2
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Difficult Moderate GL-1.20 Very hard	

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown very silty clay with chalk fragments and occasional large flints)
			0.30		White putty chalk
D	0.50				
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD		**Borehole** 3
Contract	Bighton Hill, Ropley	**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd	**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL	Ground Level mOD

Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Difficult Moderate GL-1.20 Very hard	

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown very silty clay with chalk fragments and occasional large flints)
			0.30		White putty chalk
D	0.50				
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD			**Borehole** 4
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Difficult Moderate GL-1.20 Very hard	

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown very silty clay with chalk fragments and occasional large flints)
			0.30		White putty chalk
D	0.50				
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD			**Borehole** 5
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Difficult Moderate GL-1.20 Very hard	

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown very silty clay with chalk fragments and occasional large flints)
			0.30		White putty chalk
D	0.50				
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD		**Borehole** 6
Contract	Bighton Hill, Ropley	**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd	**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL	Ground Level mOD

Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Moderate GL-1.20	 Difficult Very hard

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown sandy clay with chalk fragments and occasional large flints)
			0.30		White putty chalk
D	0.50				
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD			**Borehole** 7
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry

Water Strikes, m	Pit Dimensions, m	Ease of Excavation, m	
1 none	Length 0.06	Very easy	Difficult
2	Breadth	Moderate GL-3.10	Very hard

Remarks
Standpipe installed to 3.00m.

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown sandy clay with chalk fragments and occasional large flints)
D	0.50		0.45		White putty chalk with occasional flints at depth
D	1.00				
D	1.50				
D	2.00				
D	2.50				
D	3.00				
			3.10		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

ALBURY S.I. LTD			**Borehole** 8
Contract	Bighton Hill, Ropley		**Report No** 10/9067/GO
Client	The Mid Hants Railway Co Ltd		**Date** 7/10/10
Site Address	Ropley Railway Station, Bighton Hill, Ropley, Alresford, Hants, SO24 0BL		Ground Level mOD
Type of Excavator	Window Sampler	Water level after completion, m	dry
Water Strikes, m 1 none 2	Pit Dimensions, m Length 0.06 Breadth	Ease of Excavation, m Very easy Difficult Moderate GL-1.20 Very hard	

Remarks

Sample Type	Depth, m	Shear strength kPa	Scale 40mm: 1m Depth	Legend	Description
D	0.10				Made ground (brown sandy clay with chalk fragments and occasional large flints)
			0.40		
D	0.50				White putty chalk
D	1.00				
			1.20		

Sample Code: U - Undisturbed B - Large Disturbed D - Small Disturbed W - Water

A P P E N D I X 4

Laboratory Test Results

Exova (UK) Ltd
The Heath Technical Park
Runcorn
Cheshire
United Kingdom
WA7 4QX

Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Ropley Station 9067
Date Tested: 13/10/10, 14/10/10, 18/10/10, 19/10/10
Date Reported: 19 October, 2010
Date Received: 11 October, 2010
Sample Type: Solid

Certificate No: 10/3412/50/C1
File No: 10/3412/50
Client Ref: 8970

					Lab sample ref:	**B412342**	**B412343**	**B412344**	**B412345**	**B412346**
					Client sample ref:	**1**	**2**	**3**	**4**	**5**
						0.1m	**0.1m**	**0.1m**	**0.1m**	**0.1m**
					Sample matrix (see notes page):	**S**	**S**	**S**	**S**	**S**
Determinand	**Method**	**Units**	**ISO17025**	**MCERTS**	**LOD**					
Albury Standard Suite										
pH	CTP07		Y	Y		7.4	7.5	7.5	7.5	7.5
Sulphate (total)	CTP14	mg/kg	Y	Y	200	500	570	500	500	480
Sulphate (water soluble)	CTP09c	g/l	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulphide M	CTP16	mg/kg	Y	N	2	2	10	7	<2	<2
Sulphur (elemental)	SOP11	mg/kg	N	N	20	<20	<20	<20	<20	<20
Cyanide (total) M	CTP18c	mg/kg	Y	Y	10	<10	<10	<10	<10	<10
Phenols (screen) M	CTP20	mg/kg	Y	Y	1	<1	<1	<1	<1	<1
TOC	CTP22	% w/w	N	N	0.1	2.7	4.0	3.4	3.4	2.6
Arsenic	CTP11h	mg/kg	Y	Y	5	7	12	9	7	6
Beryllium	CTP11e	mg/kg	N	N	1	<1	1	1	<1	<1
Boron (water soluble)	CTP12	mg/kg	N	N	1	2	3	2	2	2
Cadmium	CTP11b	mg/kg	Y	N	0.5	1.3	2.0	1.8	1.4	1.2
Chromium (III)	CTP11h	mg/kg	Y	Y	5	17	31	26	18	15
Chromium (VI)	CTP15a	mg/kg	Y	N	1	<1	<1	<1	<1	<1
Copper	CTP11h	mg/kg	Y	Y	5	10	20	14	11	10
Lead	CTP11h	mg/kg	Y	Y	5	22	28	19	18	14
Mercury	CTP11a	mg/kg	Y	N	0.5	<0.5	1.9	1.1	0.8	0.7
Nickel	CTP11h	mg/kg	Y	Y	5	14	26	23	16	13
Selenium	CTP11i	mg/kg	Y	N	5	<5	<5	<5	<5	<5
Vanadium	CTP11f	mg/kg	Y	N	5	24	44	38	27	22
Zinc	CTP11i	mg/kg	Y	N	5	61	100	84	65	55
Sample Prep										
% Stones	Stones	% w/w	N/A	N/A	0	5.0	10.8	4.9	7.3	6.2
Moisture Content @ 35°	CTP01	% w/w	N/A	N/A	0.1	16.4	17.0	16.8	16.7	17.8
Sample Description^	SGP5		N/A	N/A		5A	5A	5A	5A	5A

Exova (UK) Ltd
The Heath Technical Park
Runcorn
Cheshire
United Kingdom
WA7 4QX

[redacted]

Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Ropley Station 9067
Date Tested: 13/10/10, 14/10/10, 18/10/10, 19/10/10
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					Lab sample ref:	**B412342**	**B412343**	**B412344**	**B412345**	**B412346**
					Client sample ref:	**1**	**2**	**3**	**4**	**5**
						0.1m	**0.1m**	**0.1m**	**0.1m**	**0.1m**
					Sample matrix (see notes page):	**S**	**S**	**S**	**S**	**S**
Determinand	**Method**	**Units**	**ISO17025**	**MCERTS**	**LOD**					
PAH (USEPA16)										
Naphthalene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	0.1	<0.1	<0.1	<0.1	<0.1
Pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benz(a)anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPH Banded										
C8-C15 M	SOP03b	mg/kg	N	N	10	<10	<10	<10	<10	<10
>C15-C20 M	SOP03b	mg/kg	N	N	10	<10	<10	<10	<10	<10
>C20-C30 M	SOP03b	mg/kg	N	N	10	<10	<10	<10	<10	<10
>C30-C36 M	SOP03b	mg/kg	N	N	10	<10	<10	<10	<10	<10

Exova (UK) Ltd
The Heath Technical Park
Runcorn
Cheshire
United Kingdom
WA7 4QX

Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Ropley Station 9067
Date Tested: 13/10/10, 14/10/10, 18/10/10, 19/10/10
Date Reported: 19 October, 2010
Date Received: 11 October, 2010
Sample Type: Solid

Certificate No: 10/3412/50/C1
File No: 10/3412/50
Client Ref: 8970

					Lab sample ref:	**B412347**	**B412348**	**B412349**
					Client sample ref:	**6**	**7**	**8**
						0.1m	**0.1m**	**0.1m**
					Sample matrix (see notes page):	**S**	**S**	**S**
Determinand	**Method**	**Units**	**ISO17025**	**MCERTS**	**LOD**			
Albury Standard Suite								
pH	CTP07		Y	Y		7.6	7.2	7.3
Sulphate (total)	CTP14	mg/kg	Y	Y	200	470	540	480
Sulphate (water soluble)	CTP09c	g/l	Y	Y	0.1	<0.1	<0.1	<0.1
Sulphide M	CTP16	mg/kg	Y	N	2	<2	<2	<2
Sulphur (elemental)	SOP11	mg/kg	N	N	20	<20	<20	<20
Cyanide (total) M	CTP18c	mg/kg	Y	Y	10	<10	<10	<10
Phenols (screen) M	CTP20	mg/kg	Y	Y	1	<1	<1	<1
TOC	CTP22	% w/w	N	N	0.1	3.3	5.2	3.1
Arsenic	CTP11h	mg/kg	Y	Y	5	10	13	10
Beryllium	CTP11e	mg/kg	N	N	1	1	2	1
Boron (water soluble)	CTP12	mg/kg	N	N	1	2	3	2
Cadmium	CTP11b	mg/kg	Y	N	0.5	1.9	2.2	1.9
Chromium (III)	CTP11h	mg/kg	Y	Y	5	27	38	30
Chromium (VI)	CTP15a	mg/kg	Y	N	1	<1	<1	<1
Copper	CTP11h	mg/kg	Y	Y	5	15	20	19
Lead	CTP11h	mg/kg	Y	Y	5	24	36	23
Mercury	CTP11a	mg/kg	Y	N	0.5	0.7	0.6	<0.5
Nickel	CTP11h	mg/kg	Y	Y	5	24	34	26
Selenium	CTP11i	mg/kg	Y	N	5	<5	<5	<5
Vanadium	CTP11f	mg/kg	Y	N	5	41	57	44
Zinc	CTP11i	mg/kg	Y	N	5	90	126	102
Sample Prep								
% Stones	Stones	% w/w	N/A	N/A	0	8.5	6.5	4.1
Moisture Content @ 35°	CTP01	% w/w	N/A	N/A	0.1	15.0	20.4	17.4
Sample Description^	SGP5		N/A	N/A		5A	5A	5A

Exova (UK) Ltd
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Runcorn
Cheshire
United Kingdom
WA7 4QX

[redacted]

Test Certificate

Client: Albury SI Ltd
Miltons Yard, Petworth Road, Witley, Surrey, GU8 5LH
Site: Ropley Station 9067
Date Tested: 13/10/10, 14/10/10, 18/10/10, 19/10/10
Date Reported: 19 October, 2010
Date Received: 11 October, 2010
Sample Type: Solid

Certificate No: 10/3412/50/C1
File No: 10/3412/50
Client Ref: 8970

					Lab sample ref:	**B412347**	**B412348**	**B412349**
					Client sample ref:	**6**	**7**	**8**
						0.1m	**0.1m**	**0.1m**
					Sample matrix (see notes page):	**S**	**S**	**S**
Determinand	**Method**	**Units**	**ISO17025**	**MCERTS**	**LOD**			
PAH (USEPA16)								
Naphthalene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Acenaphthylene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Acenaphthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Fluorene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Phenanthrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Benz(a)anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Chrysene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene M	GCM 501	mg/kg	Y	Y	0.1	<0.1	<0.1	<0.1
TPH Banded								
C8-C15 M	SOP03b	mg/kg	N	N	10	<10	<10	<10
>C15-C20 M	SOP03b	mg/kg	N	N	10	<10	<10	<10
>C20-C30 M	SOP03b	mg/kg	N	N	10	<10	<10	<10
>C30-C36 M	SOP03b	mg/kg	N	N	10	<10	<10	<10

Notes
1. All analyses performed on the sample dried at 35ºC, except analyses suffixed with 'M'.
2. Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at 35ºC' where applicable.
3. All results are expressed as dry weight.
4. MCERTS accreditation applicable to Sample Matrix 'S' only.
5. Natural stones (pebbles, gravels etc.) which do not pass a 2mm sieve are excluded from dried analyses.
6. Tests marked * indicate subcontracted analyses.
7. ND denotes None Detected.
8. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
9. ^Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sandy loam, 5. Sandy clay, 6. Clayey loam, 7. Other.
suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:

[redacted]

S Blemings
Account Manager

Approved by:

[redacted]

A Young
Laboratory Manager

0871

A P P E N D I X 5

Contamination Guidelines

Soil Contamination Guidelines for Human Health - Inorganic Contaminants

2009 CLEA Soil Guideline Values (mg/kg^{-1} DW)*			
Determinand	Residential	Allotments	Commercial
Arsenic	32	43	640
Cadmium	10	1.8	230
Chromium			
Cyanide	*SGVs in development by Environment Agency*		
Lead			
Inorganic Mercury (Hg^{2+})	170	80	3600
Elemental Mercury (Hg^{4})	1	26	26
Methyl Mercury (Hg^{+4})	11	8	410
Nickel	130	230	1800
Selenium	350	120	13000

The 2009 CLEA Soil guideline values should be used in conjunction with the information contained in their respective technical notes.

*Based on a sandy loam soil as defined in Environment Agency 2009b, *'Updated technical background to the CLEA model.'* Science Report SC050021/SR3. Bristol: Environment Agency. And 6% SOM (Soil Organic Matter).

CIEH/LQM Generic Assessment Criteria (GAC) Metals (mg kg^{-1} DW)*			
Determinand	Residential	Allotments	Commercial
Beryllium	51	55	420
Boron	291	45	192000
Chromium III	3000	34600	30400
Chromium VI	4.3	2.1	35
Copper	2330	524	71700
Vanadium	75	18	3160
Zinc	3750	618	665000

*Based on a sandy loam soil with soil organic matter of 6% and pH 7.0

EIC/AGS/CL:AIRE Generic Assessment Criteria (GAC) Metals (mg/kg^{-1})			
Determinand	Residential*	Allotments	Commercial
Antimony	550		7500
Barium	1300		22000
Molybdenum	670		17000

*Residential without consumption of homegrown produce

Table 4.1a extracted from EIC/AGS/CL:AIRE publication *'The Soil Generic Assessment Criteria for Human Health Risk Assessment'*, December 2009

Albury S.I. Ltd

Version 4 - 2010

Soil Contamination Guidelines for Human Health - Organic Contaminants

2009 CLEA Soil Guidance Values (mg/kg^{-1} DW)			
	Residential	Allotments	Commercial
Benzene	0.33	0.07	95
Phenol	420	280	3200
Ethylbenzene	350	90	2.8×10^3
Toluene	610	120	4.4×10^3
o-xylene	250	160	2.6×10^3
m-xylene	240	180	3.0×10^3
p-xylene	230	160	3.2×10^3

The 2009 CLEA Soil guideline values should be used in conjunction with the information contained in their respective technical notes.

*Based on a sandy loam soil as defined in Environment Agency 2009b, 'Updated technical background to the CLEA model.' Science Report SC050021/SR3. Bristol: Environment Agency. And 6% SOM (Soil Organic Matter).

The Enviornment Agency is currently working on SGV and TOX reports for Dioxins, dioxin-like polychlorinated biphenyls and polycyclic aromatic hydrocarbons

LQM/CIEH GAC for Polycyclic Aromatic Hydrocarbons (PAH) mg/kg-1 dry weight soil*									
Determinand	Residential			Allotments			Commercial		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenapthene	210	480	1000	34	85	200	85000 (57) [sol]	98000 (141) [sol]	100000
Acenaphthylene	170	400	850	28	69	160	84000 (86) [sol]	97000 (212) [sol]	100000
Anthracene	2300	4900	9200	380	950	2200	530000	540000	540000
Benz(a)anthracene	3.1	4.7	5.9	2.5	5.5	10	90	95	97
Benzo(a)pyrene	0.8	0.9	1.0	0.60	1.2	2.1	14	14	14
Benzo(b)fluoranthene	5.6	6.5	7.0	3.50	7.4	13.00	100	100	100
Benzo(ghi)perylene	44.0	46.0	47.0	70.00	120	160.00	650	660	660
Benzo(k)fluoranthene	8.5	9.6	10.0	6.8	14	23.00	140	140	140
Chrysene	6.0	8.0	9.3	2.6	5.8	12.00	140	140	140
Dibenz(a,h)anthracene	0.76	0.86	0.90	0.76	1.5	2.3	13	13	13
Fluoranthene	260	460	670	52.00	130	290	23000	23000	23000
Fluorene	160	380	780	27	67	160	64000 (31) [sol]	69000	71000
Indeno(123-cd)pyrene	3.2	3.9	4.2	1.8	3.8	7.1	60	61	62
Naphthalene	1.5	3.7	8.7	4.1	9.9	23	200 (76) [sol]	480 (183) [sol]	1100 (432) [sol]
Phenanthrene	92	200	380	16	38	90	22000	22000	23000
Pyrene	560	1000	1600	110	270	620	54000	54000	54000

**Based on a sandy loam as defined in SR3 (Environment Agency, 2009c)*

[sol] GAC presented exceeds the solubility saturation limit, which is presented in brackets

Albury S.I. Ltd

WASTE TREATMENT

The Landfill (England and Wales) Regulations 2002 require that waste (including inert arisings and contaminated soil) must be treated before it is disposed of at non-hazardous and inert landfills. The proposed treatment option must be compared against a 'three-point test'.

1) It must be a physical, thermal, chemical or biological process including sorting.
2) It must change the characteristics of the waste; and
3) It must do so in order to:
    a) reduce its volume; or
    b) reduce its hazardous nature; or
    c) facilitate its handling; or
    d) enhance its recovery.

There are limited exceptions to the above:

it is inert waste for which treatment is not technically feasible
it is waste other than inert waste and treatment would not reduce its quantity or the hazards that it poses to human heath or the environment

The waste producer should either

treat their own waste and provide information about the treatment for subsequent holders, or
ensure that the waste would be treated by a subsequent holder prior to landfilling

The waste producer or holder should produce a written statement detailing the type of treatment and if relevant the amount of waste sorted out for recovery or alternative treatment.

Based on the foregoing Guidance, it is evident that the current methods of simply removing "contaminated" soil from the site will have to be amended. Preferably as much soil as possible should remain on site, where possible; for example, under areas of hard cover, paths, drives etc. Soils that are to be removed from site must be treated and this may simply be sorting for example the removal of brick and concrete, which can be crushed and used elsewhere. Contaminated soils will require treatment either on site or at a specialist facility prior to disposal. It will be important therefore to ensure that the new guidelines are followed during the development of the site. This is likely to have implications on the development both in terms of cost and these should be carefully considered prior to commencement.

A P P E N D I X 6

Landfill Gas

Monitoring Equipment

Methane, Oxygen and Carbon Dioxide monitored using Geotechnical Instruments Landfill Gas Analyser Model GA45+.

Accuracy

Methane Gas	0	-	5%	±	0.50%
	5	-	15%	±	1%
	15	-	100%	±	3%
Methane % LEL	0	-	100%	±	0.50%
Oxygen	0	-	100%	±	1.00%
Carbon Dioxide	0	-	5%	±	0.50%
	5	-	15%	±	1.00%
	15	-	100%	±	3.00%
Flow				±	0.3 l/h

Landfill Gas Results

Date	Location BH/TP no.	Depth to water (m)	Oxygen (% by vol)	Carbon Dioxide (% by vol)	Methane (% LEL)	Methane (% by vol)	Flow Rate (l/hr)
14/10/10	1	DRY	19.7	0.7	0.1	2	0.0
	7	DRY	20.2	0.2	0.0	0.0	0.0
Barometric Pressure = 1008mb							
28/10/10	1	DRY	19.5	0.4	0.0	0.0	0.0
	7	DRY	18.5	0.8	0.0	0.0	0.0
Barometric Pressure = 1003mb							
11/11/10	1	DRY	20.3	0.0	0.0	0.0	0.0
	7	DRY	20.1	0.2	0.0	0.0	0.0
Barometric Pressure = 971mb							

Site:	Ropley Station, Bighton Hill, Ropley, Hants
Drawing No:	10/9067/A/2
Title:	Landfill Gas Results and Accuracy
Scale:	NTS
Revision:	A
Issue Date:	1.0 – 12/11/10

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NHBC Landfill Gas Guidance Tables

Traffic Light Classification	Methane [1]		Carbon Dioxide [2]	
	Typical Maximum Concentrations [3] (%v/v)	Gas Screening Value [2,4] (l/hr)	Typical Maximum Concentrations [3] (%v/v)	Gas Screening Value [2,4] (l/hr)
Green				
	1	0.13	5	0.78
Amber 1				
	5	0.63	10	1.60
Amber 2				
	20	1.60	30	3.10
Red				

1. The worst case ground gas regime identified on the site, etiher methane or carbon dioxide at the worst case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated.

2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered

3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate that it is safe to do so.

4. The Gas Screening Value thresholds should not generally be exceeded without the completeion of a detailed ground gas risk Assessment taking into account site-specific conditions.

Table 14.1 Gas Risk Assessment
Traffic Lights with typical maximum concentrations and gas screening values.

Traffic Light	Ground Gas Protection Measures Required
Green	Ground gas protection measures are not required
Amber 1	Low-level ground gas protection measures are required, using a membrane and ventilated sub-floor void that creates a permeability contrast to limit the ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. Ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24hrs
Amber 2	High-level ground gas protection measures are required, creating a permeability contrast to prevent ingress of gas into buildings. Gas protection measures are to be installed as prescribed in BRE 414. **Membranes used should always be fitted be a specialist contractor and should be fully certified.** As with Amber 1, ventilation of the sub-floor void should be designed to provide a minimum of one complete volume change per 24 hours.
Red	Standard residential housing is not normally acceptable without further Ground Gas Risk Assessment and/or possible remedial mitigation measures to reduce/remove the source of the ground gases. In certain circumstances, active protection methods could be applied, but only when there is a legal agreement assuring the management and maintenance of the system for the life of the property.

Table 14.2 Ground Gas Protection Measures Required for Traffic Lights

The above tables have been extracted from the NHBC publication "Guidance on Evaluation of Development Proposals On Sites Where Methane And Carbon Dioxide Are Present" Report Edition No.: 4 (March 2007)