BROWNFIELD SOLUTIONS LTD

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

CHIPPING HOMES

Church Raike, Chipping

Geo-Environmental Assessment Report

AJH/C2179/3577

October 2016

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PROJECT QUALITY CONTROL DATA SHEET

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Report Number:	AJH/C2179/3577	
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GEO-ENVIRONMENTAL ASSESSMENT REPORT
ON A SITE OFF CHURCH RAIKE, CHIPPING

1.0 INTRODUCTION

1.1 Objectives

1.1.1 This report describes a Geo-Environmental Investigation carried out for Chipping Homes Limited on a site off Church Raike, Chipping.

1.1.2 The objectives of the investigation were to:

- Determine the near surface ground conditions through, window sampling related to the development of the site for residential development.
- Carry out suitable testing to enable the ground to be assessed for chemical contamination.
- Make recommendations for the foundations of both houses and associated roads.
- Make comments and recommendations with regard to the geo-environmental conditions encountered.

1.1.3 A Desk study has been carried out by Brownfield Solutions Limited (BSL) ref AJH/C2179/3577. The information within the desk study report details the site description and the environmental setting. This report should be read in conjunction with the Desk Study Report.

1.1.4 The main intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The main investigation was undertaken using window sampling boreholes.

1.1.5 The report has been completed to fulfil the requirements of a preliminary risk assessment in accordance with CLR11 "Model Procedures for the Management of Land Contamination".

1.2 Proposed Development

1.2.1 The proposed development is a low rise residential development with associated roads.

1.3 Limitations

1.3.1 This assessment has been carried out based on information obtained from a number of areas, BSL have assumed that this information is correct.

1.3.2 There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore not been taken into account by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

1.3.3 This report has been prepared for the sole use of the client. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report they rely on it at their own risk and BSL do not owe them any Duty of Care.

2.0 METHOD OF INVESTIGATION

2.1 Objectives

2.1.1 The aim of the fieldwork was to:

- Investigate ground conditions on the site.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Assess the need for detailed investigation.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.
- Install standpipes to allow future monitoring.
- Give an assessment of the geo - environmental risks associated with redevelopment of the site.

2.2 Site Works

2.2.1 Seven Window sample boreholes (WS01 to WS07) were drilled to depths between 1.70m and 3.80m on 14 February 2013 using a tracked window sampling rig and liners (windowless).

2.2.2 The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing C2179/03. The exploratory hole logs are presented in Appendix A.

2.2.3 The exploratory holes were positioned to establish general ground conditions on the site. The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with BS 5930 'Code of Practice for Site Investigations' 1999, BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.

2.3 Sampling

2.3.1 During the drilling of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing.

2.3.2 Twenty six disturbed soil samples were selected and taken during the site works. The type of sample being dependent upon the stratum and the purpose of analysis.

2.3.3 Disturbed samples of soil for chemical testing were placed in 1 litre plastic tubs and amber jars.

2.3.4 The distribution of samples taken across the site is recorded on the exploratory logs.

2.4 Laboratory Testing

2.4.1 As part of the assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

2.4.2 In the absence of particularly contaminative processes on site and the lack of visual evidence of contamination impaction eight representative soil samples were screened for the following general suite of determinands:

Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc, pH and Speciated PAH's.

2.4.3 Thee samples were screened for asbestos fibres. Two samples have also been scheduled for organo-phosphorus pesticides.

2.4.4 The Chemical Laboratory Testing Results are presented in Appendix B.

2.4.5 Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' 1990. The following tests were scheduled:

BS Test Number	Description	No of Samples
Part 2:	Natural Moisture Content	6
Part 2:	Plasticity Index Analysis	6
Part 3:	pH Value	6
Part 3:	Water Soluble Sulphate Content	6

2.4.6 The Geotechnical Laboratory Testing results are presented in Appendix C.

2.5 Monitoring

2.5.1 Gas standpipes were installed in the four of the boreholes on the site. The standpipes consisted of plain PVC pipe from ground level to 1.0m bgl, with slotted PVC pipe from 1.0m to the base of the borehole. A bentonite seal was made around the plain pipe. A clean gravel pack was placed around the slotted pipe

2.5.2 Six ground gas monitoring visits have been between 11th March 2013 and 2nd July 2013.

3.0 GROUND CONDITIONS

3.1 Made Ground

3.1.1 Made Ground was not encountered in any of the window sample locations.

3.2 Natural Ground

3.2.1 The natural strata underlying the topsoil was generally a firm to stiff yellow brown sandy clay, overlying a firm to stiff and very stiff dark brown grey sandy clay.

3.2.2 The upper yellow brown clay contained some angular sandstone gravel and was present to depths of between 0.60m and 0.80m. The stiff dark grey sandy clay contained much fine to coarse gravel and occasional cobbles.

3.2.3 In WS01 a soft to firm dark brown sandy clay was present between 0.95m and 1.50m. In WS05 in the centre of the site the drill string refused at 1.70m on an assumed cobble. WS04 also refused at 3.80m probably on a cobble.

3.2.4 In WS07 there was a very thin band of coarse black sand at 1.50m.

3.3 Bedrock

3.3.1 Bedrock was not encountered in this investigation.

3.4 Groundwater

3.4.1 Groundwater was not generally encountered during the investigation, although in WS04 the clay was saturated below 1.20m.

3.5 Observations

3.5.1 During the works undertaken by BSL observations for both visual and olfactory evidence of contamination were made.

3.5.2 There was no visual or olfactory evidence of contamination noted during the investigation.

4.0 TEST RESULTS

4.1 Chemical Test Results - Soils

4.1.1 The samples were tested for an assessment of the chemical contamination and results were examined with reference to a selection of guidance documents as detailed in Appendix D.

4.1.2 The apparent exceedence of the quoted Screening value is taken as indicating further detailed assessment or remedial action is required.

4.1.3 None of the chemical test results exceeded their respective screening concentrations for residential end use.

4.1.4 Asbestos fibres were not detected in the samples tested.

4.1.5 The results of the pesticide testing show the concentrations to be below the laboratory detection limit.

4.2 Geotechnical Testing

4.2.1 Water soluble sulphate testing was undertaken on six of the natural strata. The results revealed soluble sulphate (SO_4) contents of <0.01 g/l to 0.13g/l. Associated pH values were obtained which ranged between 5.2 and 8.2 and indicating slightly acid to slightly alkaline conditions.

4.2.2 Plasticity index results which ranged between 10% and 22%, moisture contents were in the range 11% to 30%.

4.2.3 After modification of particle size in accordance with NHBC Chapter 4.2 the modified plasticity indices are in the range 7.5% to 16.5% indicating the soils to be of low volume change potential.

4.3 Gas Monitoring Results

4.3.1 Peak methane concentrations of 0.1%v/v were recorded in all of the wells on at least one of the monitoring visits. Steady state values were similar to the peak concentrations.

4.3.2 The peak carbon dioxide concentrations ranged from 0.0%v/v to 0.7%v/v. Steady state values ranged from 0.0%v/v to 0.7%v/v, and were generally similar to the peak concentrations. CO2 concentrations were generally low.

4.3.3 Peak oxygen concentrations ranged from 19.3%v/v to 20.9%v/v. Steady state concentrations ranged from 19.3%v/v to 21.0%v/v and were generally similar to peak.

4.3.4 A maximum positive flow of 0.1l/hr was recorded in WS04 on 24th April. Generally flows were not recorded across the site.

4.3.5 The atmospheric pressure ranged between 1003mb and 1014mb over the monitoring period.

4.3.6 Groundwater levels within the standpipes ranged from 0.30m and 1.00m bgl.

4.3.7 Full records of the ground gas monitoring results are presented in Appendix E.

5.0 GEOTECHNICAL ASSESSMENT

5.1 General

5.1.1 The site is currently a cricket pitch with a small pavilion. Made ground has not been found across the site.

5.1.2 The eastern part of the site has many semi-mature trees on and these will need to be removed to facilitate the development.

5.2 Foundations

5.2.1 The most suitable foundations for houses on this site are likely to be unreinforced strip foundations. The clay on the site is of low volume change potential, therefore the foundations should be at a minimum depth of 750mm, deeper near trees and hedges in accordance with NHBC Chapter 4.2.

5.2.2 A nett allowable bearing pressure not exceeding 90kN/m^2 should be assumed at 750mm, the shear strength increases with depth and foundations can be deepened if higher loads are required to be supported.

5.2.3 On the eastern part of the site there is an area of soft soil that extends to 1.50m in WS01. Foundations should be extended below this to suitable firm clays. It is likely given the trees in this area that this depth will be exceeded due to the area of influence in cohesive soils.

5.2.4 The bearing stratum should be inspected for 'soft spots' within the natural clay strata, resulting for instance from localised groundwater perched within the overlying fill materials. Any such soft spots should be dealt with in accordance with good site practice.

5.2.5 A survey of all trees and hedges on the site and within influencing distance of the site boundary should be undertaken to identify tree species and heights. This information will be required in order to assess the effects of trees on the cohesive strata.

5.2.6 Where foundation depths due to trees already present or recently removed exceeds 1.50m there is a possibility for heave to occur on removal of the tree. NHBC Guidance states that compressible material or void former is required against the inside face of all external wall foundations.

5.3 Floor Slabs

5.3.1 If required ground bearing floor slabs may generally be adopted at the site provided that once finished levels have been established, less than 600mm of suitable, appropriately compacted granular material exists beneath the slab.

5.3.2 Where foundation depths due to trees already present exceeds 1.50m there is a possibility for heave to occur on removal of the tree. NHBC Guidance states that either a precast concrete floor, a suspended timber or in-situ concrete floor must

be used. We recommend the former, the required void size for beneath floor slabs on this site is 125mm low.

5.4 Construction

5.4.1 Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

5.4.2 Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) and possibly breaking equipment may be required locally to penetrate old foundations associated with the pavilion.

5.4.3 The results of laboratory pH and sulphate content testing indicates that ACEC Class AC-1 and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

5.5 Highways

5.5.1 Cohesive soils will be encountered at road formation levels, therefore CBR values of 2% to 5% are likely to be achieved in undisturbed natural soils for pavement design purposes. However unless proven otherwise by in-situ testing at sub-base level by a specialist geotechnical engineer, a design CBR value not exceeding 2% should be assumed.

5.6 Soakaways

5.6.1 The use of soakaways within the natural ground is not feasible at the site due to the presence of relatively impermeable strata underlying the site.

5.7 Slope Stability

5.7.1 The site is elevated above the road by approximately 2m and care will be required to ensure that foundation loads do not induce instability in this bank. It is recommended that houses are set back and foundations are set below a line of 45 degrees drawn up from the base of the bank.

6.0 ENVIRONMENTAL ASSESSMENT

6.1 Contamination

Soils

6.1.1 On the basis of the testing undertaken to date it would appear that there is no made ground on the site. The chemical testing indicates that the natural ground is uncontaminated.

Permanent Ground Gases

6.1.2 The Geo-Environmental Assessment report (Ref: AJH/C2179/3577) issued in March 2013 identified a potential source of ground gas relating to a historic landfill that is located 110m south west of the site.

6.1.3 During the ground investigation works no made ground was encountered, topsoil was encountered at the surface of the site to a maximum depth of 0.30m. The natural ground generally comprised firm to stiff yellow brown sandy clay with gravel occurring locally.

6.1.4 Carbon dioxide has been recorded in all four of the standpipes at a peak concentration of 0.7%v/v and very low levels of methane were recorded with a peak concentration of 0.1%v/v.

6.1.5 No made ground has been encountered at the site and it is likely that the low concentrations of carbon dioxide and methane present are associated small amounts of organic material in the natural ground and possible made ground that may be present off site.

6.1.6 During the monitoring period the groundwater levels were relatively high and generally above the response zones of the installations. This can restrict the gas production due to gas being trapped and restricting the lateral migration towards the gas installation. The groundwater levels are indicative of the site and are unlikely to reduce.

6.1.7 In order to assess the ground gas situation and the requirement for ground gas precautions, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' and the recent publication CL:AIRE Research Bulletin 17 'A Pragmatic Approach to Ground Gas Risk Assessment'.

6.1.8 The proposed residential end use dictates that the gas monitoring results are assessed in accordance with Boyle and Witherington, 2006.

6.1.9 The Boyle and Witherington method uses the concept of a Gas Screening Value (GSV), which is calculated using the maximum concentration of the ground gas and the flow rate. Typical concentration thresholds are worked out by a "Traffic Light System". The selected traffic light classification indicates the required protection measures.

	Methane GSV (l/hr)		Carbon Dioxide GSV (l/hr)	
	GSV (l/hr)	Typical Max Concentration (% v/v)	GSV (l/hr)	Typical Max Concentration (% v/v)
Red	1.56	≥20	3.13	≥30
Amber 2	0.63	5 - 20	1.56	10 - 30
Amber 1	0.16	1 - 5	0.78	5 – 10
Green	≤0.16	≤1	≤0.78	≤5

6.1.10 The GSV for carbon dioxide has been calculated using the maximum carbon dioxide concentration, i.e. 0.7%v/v and the maximum recorded flow rate, 0.1l/hr. This results in a GSV for carbon dioxide of 0.0007l/hr which is consistent with a Green traffic light.

6.1.11 The calculated GSV for methane is 0.0001l/hr which is also consistent with a Green traffic light.

6.2 Qualitative Risk Assessment

6.2.1 The risk assessment methodology used in this instance is based on **Source – Pathway – Receptor** (SPR) philosophy. The **source** is the presence of contamination, or substance/event likely to cause harm. The **receptor** is the target that may be detrimentally affected by the source. The **pathway** is the means of the contamination to move from the source to the receptor. Where any of these three factors are removed there is deemed to be no risk.

Human Health

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
ON-SITE					
Pesticides from Farming	Ingestion, direct contact, inhalation of dusts.	End-users	Unlikely	Medium	Low
Radon from Natural Sources.	Inhalation.	End-users	Likely	Medium	Moderate

Human Health Justification

6.2.2 It is considered that there is no source of solid or liquid contamination on the site and there is therefore no a viable pollution linkage pathway for direct contact, ingestion and inhalation of dusts.

6.2.3 There is a potential source of radon gas considered to a present moderate risk to the site end-users.

6.3 Remedial Measures

6.3.1 Full radon precautions are required within the properties.

6.3.2 No other remedial measures are considered necessary

6.4 Asbestos

6.4.1 The investigation of asbestos issues within buildings was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

6.4.2 Any asbestos will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

6.5 Health and Safety Issues

6.5.1 No sources of contamination were recorded on the site, although the site is not contaminated it is good practice to prevent site workers from coming into contact with soils. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land". In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

6.7 Waste

6.7.1 Details of how material should be classified for waste disposal are presented in Appendix F.

Waste Classification - Total Concentrations

6.7.2 The total testing results indicate that generally the soils are inert (below the relevant SGV or GAC criteria). It is unlikely that the soils encountered would be classified as hazardous waste.

Waste Acceptance Criteria

6.7.3 Waste Acceptance Criteria (WAC) testing was outside the scope of this investigation and the guidance given below is general.

6.7.4 The possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are

assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- *They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source) and*
- *There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.*

General

6.7.5 If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

6.7.6 Where it is necessary to dispose material off site it is recommended that materials are segregated and where necessary sufficient time is allowed to further classify the material properly, including discussion with landfill sites and waste transfer stations to find the best disposal route.

6.7.7 As a significant proportion of the soils likely to be generated on site are clean it is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

6.7.8 If the reuse of soils is proposed on the site this should be done in accordance with the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE CoP). Further guidance is provided on this in Appendix G. Any re-use scheme should be designed to minimise disposal costs.

7.0 CONCLUSIONS

7.1 Summary

7.1.1 The site has previously been used for agriculture and from the 1960's has been used as a cricket pitch.

7.1.2 The site does not contain any made ground and the soils on the site are indicated to be uncontaminated.

7.1.3 Strip foundations with a safe bearing capacity of 90kN/m^2 are considered suitable on the site. Locally some deepening may be required to found below soft spots. Deepening wil also be required due to trees

7.1.4 Care should be taken not to load the bank adjacent to the road and it is recommended that buildings are set back from this.

7.1.5 The site requires full radon precautions.

8.0 REFERENCES

1. DETR. *'Guidelines for Environmental Risk Assessment & Management'*. Revised Departmental Guidance. July 2000.
2. British Standards Institution. *Investigation of Potentially Contaminated sites - code of practice*. BS 10175:2011 (2nd Ed).
3. British Standards Institution *'Code of Practice for Site Investigations'* BS 5930:1999
4. British Standards Institution *"Geotechnical investigation and testing – Identification and classification of soil"* BS EN ISO 14688:2002.
5. British Standards Institution *"Geotechnical investigation and testing – Identification and classification of rock"* BS EN ISO 14689:2002.
6. BRE Report BR211 *'Radon – Guidance on protective measures for new dwellings'* 2007 Ed.
7. BRE Special Digest 1: *"Concrete in Aggressive Ground"* 3rd Ed 2005.
8. CIRIA 149 "Protecting development from methane" 1995.
9. CIRIA 150 "Methane Investigation Strategies" 1995.
10. CIRIA 151 "Interpreting measurements of gas in the ground" 1995.
11. CIRIA 152 "Risk assessment for methane and other gases from the ground" 1995.
12. CIRIA 552 "Contaminated Land Risk Assessment – A guide to good practice" 2001.
13. CIRIA C665 "Assessing Risks Posed by Hazardous Ground Gases to Buildings" 2007.
14. Wilson & Card *"Proposed method classifying gassing sites"* Ground Engineering 1999.
15. The Hazardous Waste (England) Regulations 2005.
16. Environment Agency Hazardous Waste: *"Interpretation of the definition and classification of hazardous waste"* WM2 2003.
17. Department for Communities and Local Government *"National Planning Policy Framework"* 2012
18. DETR. Circular 02/2000 Contaminated Land.
19. Environment Agency, 2009 'Using Soil Guideline Values'.
20. Environment Agency, 2009 'Updated Technical Background to the CLEA model'.
21. Environment Agency, 2009 'Human health toxicological assessment of contaminants in soil'.
22. Department of the Environment, 1994, CLR Report No 1 'A framework for assessing the impact of contaminated land on groundwater and surface water'.
23. Department of the Environment, 1994, CLR Report No 2 'Guidance on Preliminary Site Inspection of Contaminated Land'.
24. Department of the Environment, 1994, CLR Report No 3 'Documentary research on Industrial Sites'.

25. Department of the Environment, 1994, CLR Report No 4 'Sampling Strategies for Contaminated Land'.

26. DEFRA and the Environment Agency, 2002, CLR Report No 7 'Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research'.

27. DEFRA and the Environment Agency, 2002, CLR Report No 8 'Priority Contaminants for the Assessment of Land'.

28. DEFRA and the Environment Agency, 2002, CLR Report No 9 'Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans'.

29. DEFRA and the Environment Agency, 2002-2004, CLR9 'Toxicological Reports for Individual Soil Contaminants.

30. DEFRA and the Environment Agency, 2002, CLR Report No 10 'The Contaminated Land Exposure Assessment Model (CLEA): Technical basis and algorithms'.

31. DEFRA and the Environment Agency, 2002-2004, CLR10 'Soil Guideline Value Reports for Individual Soil Contaminants'.

32. DEFRA and the Environment Agency, 2004, CLR Report No 11 'Model Procedures for the Management of Contaminated Land'.

33. Nathanial, C P, McCaffrey, C, Ashmore, M, Cheng, Y, Gillett A, Ogden, R C 2009 and Scott D. "Generic Assessment Criteria for Human Health Risk Assessment" 2nd Ed, CIEH/LQM.

34. Environmental Quality Standards.

35. UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations

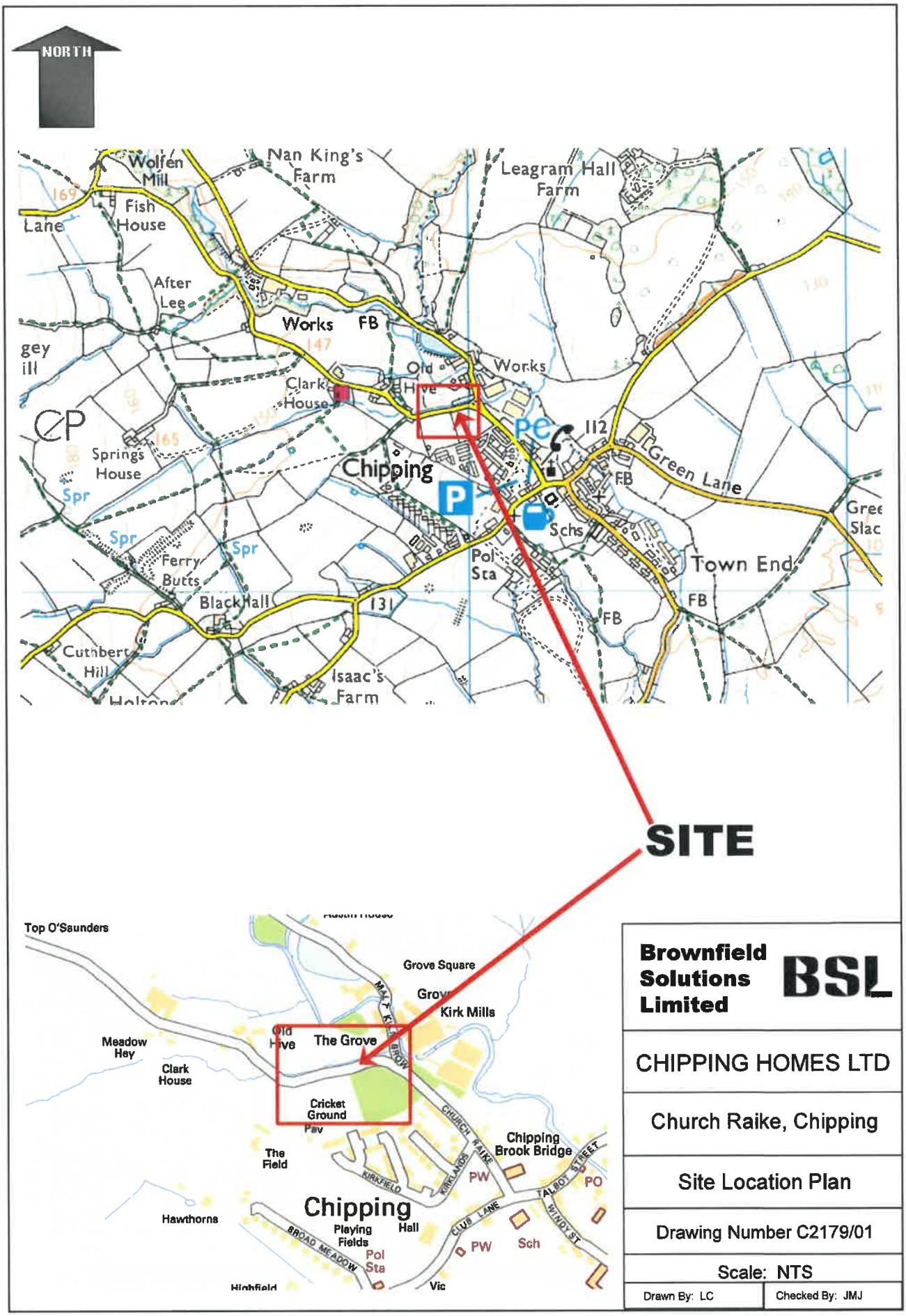
36. Health & Safety Executive, 1991. 'Protection of Workers & the General Public during the Development of Contaminated Land'.

37. Environment Agency & NHBC, 2000. R&D Publication 66. Guidance for the Safe Development of Housing on Land Affected by Contamination.

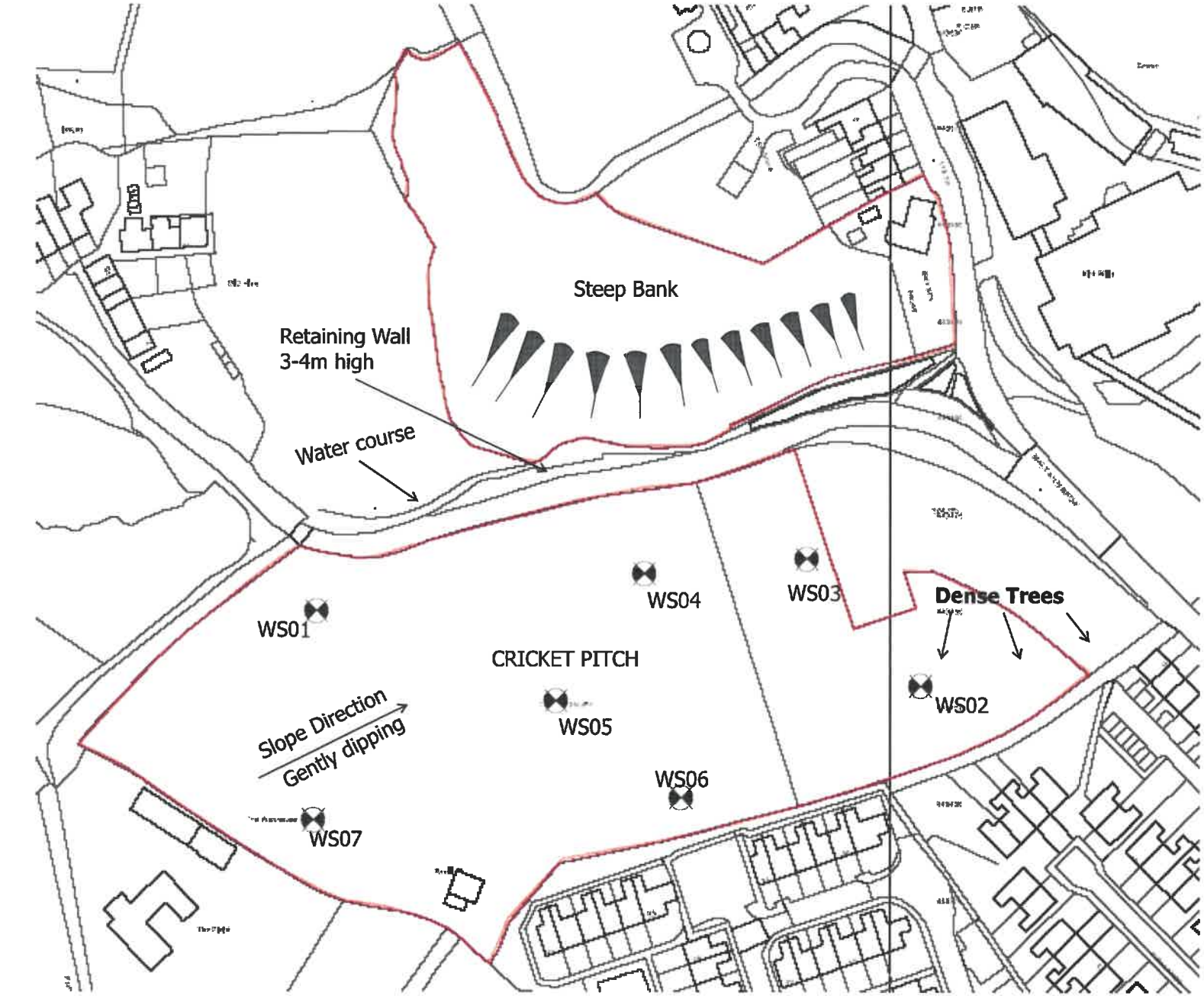
38. Department of the Environment, 1992. Waste Management Paper No. 27. Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas.

39. NHBC Standards 2006

DRAWINGS



Brownfield Solutions Limited	**BSL**
CHIPPING HOMES LTD	
Church Raike, Chipping	
Site Location Plan	
Drawing Number C2179/01	
Scale: NTS	
Drawn By: LC	Checked By: JMJ



Key:

Window Sample
Borehole

Brownfield Solutions Limited BSL

CHIPPING HOMES LTD

Church Raike, Chipping

Proposed Exploratory Hole Plan

Drawing No. C2179/03

Date: 18 Feb 13	Scale: NTS
Drawn By: AJH	Checked By: JMJ

APPENDIX A
Exploratory Hole Logs

BSL
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Borehole No **WS01**
Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013	Checked by: RW / Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.90	D		0.95			Firm yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		1.00	SPT	N=5 (2,1,0,2,1,2)				Soft to firm dark brown sandy CLAY with some angular gravel
		1.50	D		1.50			Firm to stiff dark brown grey sandy CLAY with much gravel. Gravel is fine to coarse angular sandstone
		2.00	SPT	N=21 (3,4,4,5,5,7)				Becoming friable and very stiff below 2.00
		2.50	D					
		3.00	SPT	N=31 (6,5,5,10,8,8)	3.00			End of Borehole at 3.00 m

Remarks: 1. Groundwater not encountered.

AGS

BSL

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Borehole No **WS02**
Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013	Checked by: RW / Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.80	D		0.80			Firm yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		1.00	SPT	N=6 (2,2,2,1,1,2)				Firm to stiff to becoming very stiff dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
		1.50	D					
		2.00	SPT	N=21 (1,2,6,4,4,7)				
		3.00	SPT	N=42 (5,5,5,12,15,10)	3.00			End of Borehole at 3.00 m

1
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4

Remarks: 1. Groundwater not encountered.

AGS

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Brownfield Solutions Ltd
Wychwood House
1 Queen Street
Northwich
Cheshire
CW9 5JL
Tel: 01606 334844
www.brownfield-solutions.com

Borehole No **WS03** Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013 — Checked by: RW	Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.60	D		0.80			Firm to stiff yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		1.00	SPT	N=11 (1,1,1,2,4,4)				Firm to stiff becoming very stiff dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
		1.20	D					
		2.00	SPT	N=19 (3,4,4,5,4,6)				
		2.50	D					
		3.00	SPT	N=24 (6,5,5,5,6,8)	3.00			End of Borehole at 3.00 m

Remarks: 1. Groundwater not encountered.

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Borehole No **WS04**
Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013	Checked by: RW / Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.50	D					Firm light grey mottled brown slightly sandy CLAY with occasional angular gravel of sandstone
		1.00	SPT	N=9 (1,0,1,1,3,4)	0.70			Firm dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
	▼	1.25	D					Dark grey coarse sand band 1.20m to 1.30m becoming stiff to very stiff with much gravel and occasional cobbles below 1.30m
		1.80	D					
		2.00	SPT	N=23 (5,4,5,6,6,6)				
		3.00	SPT	N=25 (6,5,5,6,7,7)				
		3.80	SPT	N=27 (4,5,5,7,7,8)	3.80			End of Borehole at 3.80 m

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4

Remarks:
1. Clay saturated below 1.20m.
2. Sampler bouncing at at 3.80m

AGS

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Borehole No **WS05** Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013	Checked by: RW / Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.50	D					Firm yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		1.00	SPT	N=9 (1,2,2,2,2,3)	0.80			Firm to stiff becoming very stiff dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
		1.60	D					
		1.70	SPT	50/45mm 45mm (25,50)	1.70			End of Borehole at 1.70 m

Remarks:
1. Groundwater not encountered.
2. Refusal at 1.70m on cobble.

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Borehole No **WS06** Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013 — Checked by: RW	Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
					0.60			Firm to stiff yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		0.90	D					Stiff dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
		1.00	SPT	N=17 (4,5,5,5,4,3)				
		1.80	D					
		2.00	SPT	N=17 (2,3,3,4,5,5)				
		3.00	SPT	N=29 (6,5,5,6,9,9)	3.00			End of Borehole at 3.00 m

Remarks: 1. Groundwater not encountered.

AGS

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Borehole No **WS07** Sheet 1 of 1

Project Name: Church Raike, Chipping	Project No.: C2179	Co-ords: -	Hole Type: WLS
Location: Chipping		Level: -	Scale: 1:25
Client: Prospect (GB) Ltd		Dates: 14/02/2013 — Checked by: RW	Logged By: AJH

Well	Water Strikes	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
		0.20	D		0.30			Dark brown sandy clayey TOPSOIL
		0.50	D		0.60			Firm to stiff yellow brown mottled grey sandy CLAY with some angular gravel of sandstone
		1.00	SPT	N=11 (2,1,1,4,3,3)				Firm to stiff dark brown grey sandy CLAY with much gravel and occasional cobbles. Gravel is fine to coarse angular sandstone
		1.50	D					very thin band of black coarse sand at 1.50m
		1.60	D					
		2.00	SPT	N=28 (13,4,6,5,5,12)				becoming very stiff below 2.0m
		2.00-2.45	D					
		3.00	SPT	N=36 (9,12,8,9,8,11)	3.00			End of Borehole at 3.00 m

1
2
3
4

Remarks: 1. Groundwater not encountered.

AGS

APPENDIX B
Chemical Testing Results

Chemtest
The right chemistry to deliver results

Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070

Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

FAO Tony Hewitt
22 February 2013

Dear Tony Hewitt

Test Report Number **224002**
Your Project Reference **C2179 - Church Raike, Chipping**

Please find enclosed the results of analysis for the samples received 19 February 2013.

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

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Keith Jones, Technical Manager

UKAS TESTING
2183

ISO 14001 Registered Company
sira CERTIFICATION SERVICE
UKAS ENVIRONMENTAL MANAGEMENT
011

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *u/s means 'unsuitable sample'*
- *Comments or interpretations are beyond the scope of UKAS accreditation*
- *The results relate only to the items tested*
- *All results are expressed on a dry weight basis*
- *The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, phenols*
- *For all other tests the samples were dried at < 37°C prior to analysis*
- *Uncertainties of measurement for the determinands tested are available upon request*
- *None of the test results included in this report have been recovery corrected*

Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

FAO Tony Hewitt

AMENDED LABORATORY TEST REPORT

Results of analysis of 13 samples received 18 February 2013

C2179 - Church Raike, Chipping

Chemtest
The right chemistry to deliver results

Report Date
14 March 2013

Login Batch No					224002					
Chemtest LIMS ID					AI31467	AI31468	AI31469	AI31470	AI31472	AI31473
Sample ID					WS1	WS1	WS2	WS2	WS3	WS3
Sample No										
Sampling Date					14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013
Depth					0.20m	0.90m	0.20m	0.80m	0.60m	2.50m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*						
2010	pH			M	6.3	6.9	5.5	7.4	6.3	8.0
2120	Sulfate (2:1 water soluble) as SO4	14808798	g l^{-1}	M		<0.01		<0.01		0.13
2490	Chromium (hexavalent)	18540299	mg kg^{-1}	N	<0.5	<0.5	<0.5		<0.5	
2450	Arsenic	7440382	mg kg^{-1}	M	12	13	7.7		19	
	Cadmium	7440439	mg kg^{-1}	M	0.83	1.3	0.59		5.7	
	Chromium	7440473	mg kg^{-1}	M	12	16	7.6		12	
	Copper	7440508	mg kg^{-1}	M	43	33	28		36	
	Mercury	7439976	mg kg^{-1}	M	0.19	<0.10	0.10		<0.10	
	Nickel	7440020	mg kg^{-1}	M	12	29	9.9		65	
	Selenium	7782492	mg kg^{-1}	M	1.4	1.1	0.80		0.90	
	Zinc	7440666	mg kg^{-1}	M	78	110	59		160	
2800	Naphthalene	91203	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Acenaphthylene	208968	mg kg^{-1}	N	<0.10	<0.10	<0.10		<0.10	
	Acenaphthene	83329	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Fluorene	86737	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Phenanthrene	85018	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Anthracene	120127	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Fluoranthene	206440	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Pyrene	129000	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Benzo[a]anthracene	56553	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Chrysene	218019	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Benzo[b]fluoranthene	205992	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Benzo[k]fluoranthene	207089	mg kg^{-1}	N	<0.10	<0.10	<0.10		<0.10	
	Benzo[a]pyrene	50328	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	

All tests undertaken between 19/02/2013 and 13/03/2013

* Accreditation status

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

Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
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FAO Tony Hewitt

AMENDED LABORATORY TEST REPORT

Chemtest
The right chemistry to deliver results

Results of analysis of 13 samples
received 18 February 2013

C2179 - Church Raike, Chipping

Report Date
14 March 2013

Login Batch No					224002					
Chemtest LIMS ID					AI31474	AI31475	AI31476	AI31477	AI31478	AI31479
Sample ID					WS4	WS5	WS5	WS6	WS6	WS7
Sample No										
Sampling Date					14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013
Depth					0.50m	0.20m	0.50m	0.20m	1.80m	1.60m
Matrix					*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*						
2010	pH			M	6.7	4.7	5.8	5.2	7.9	8.2
2120	Sulfate (2:1 water soluble) as SO4	14808798	g l-1	M			<0.01		<0.01	
2490	Chromium (hexavalent)	18540299	mg kg-1	N	<0.5	<0.5		<0.5		<0.5
2450	Arsenic	7440382	mg kg-1	M	3.6	9.4		12		15
	Cadmium	7440439	mg kg-1	M	0.35	0.57		0.71		2.2
	Chromium	7440473	mg kg-1	M	22	8.4		8.6		13
	Copper	7440508	mg kg-1	M	9.3	32		33		31
	Mercury	7439976	mg kg-1	M	<0.10	0.20		0.11		<0.10
	Nickel	7440020	mg kg-1	M	17	9.4		13		48
	Selenium	7782492	mg kg-1	M	0.42	0.89		1.3		11
	Zinc	7440666	mg kg-1	M	56	53		62		110
2800	Naphthalene	91203	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Acenaphthylene	208968	mg kg-1	N	<0.10	<0.10		<0.10		<0.10
	Acenaphthene	83329	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Fluorene	86737	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Phenanthrene	85018	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Anthracene	120127	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Fluoranthene	206440	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Pyrene	129000	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Benzo[a]anthracene	56553	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Chrysene	218019	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Benzo[b]fluoranthene	205992	mg kg-1	M	<0.10	<0.10		<0.10		<0.10
	Benzo[k]fluoranthene	207089	mg kg-1	N	<0.10	<0.10		<0.10		<0.10
	Benzo[a]pyrene	50328	mg kg-1	M	<0.10	<0.10		<0.10		<0.10

* Accreditation status

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AMENDED LABORATORY TEST REPORT

Results of analysis of 13 samples received 18 February 2013

C2179 - Church Raike, Chipping

Chemtest
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Report Date
14 March 2013

Login Batch No					**224002**
Chemtest LIMS ID					AI31480
Sample ID					WS7
Sample No					
Sampling Date					14/2/2013
Depth					2.00m - 2.45m
Matrix					*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*	
2010	pH			M	7.8
2120	Sulfate (2:1 water soluble) as SO4	14808798	g l-1	M	0.11
2490	Chromium (hexavalent)	18540299	mg kg-1	N	
2450	Arsenic	7440382	mg kg-1	M	
	Cadmium	7440439	mg kg-1	M	
	Chromium	7440473	mg kg-1	M	
	Copper	7440508	mg kg-1	M	
	Mercury	7439976	mg kg-1	M	
	Nickel	7440020	mg kg-1	M	
	Selenium	7782492	mg kg-1	M	
	Zinc	7440666	mg kg-1	M	
2800	Naphthalene	91203	mg kg-1	M	
	Acenaphthylene	208968	mg kg-1	N	
	Acenaphthene	83329	mg kg-1	M	
	Fluorene	86737	mg kg-1	M	
	Phenanthrene	85018	mg kg-1	M	
	Anthracene	120127	mg kg-1	M	
	Fluoranthene	206440	mg kg-1	M	
	Pyrene	129000	mg kg-1	M	
	Benzo[a]anthracene	56553	mg kg-1	M	
	Chrysene	218019	mg kg-1	M	
	Benzo[b]fluoranthene	205992	mg kg-1	M	
	Benzo[k]fluoranthene	207089	mg kg-1	N	
	Benzo[a]pyrene	50328	mg kg-1	M	

* Accreditation status

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Results of analysis of 13 samples
received 18 February 2013

C2179 - Church Raike, Chipping

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Report Date
14 March 2013

					224002					
					AI31467	AI31468	AI31469	AI31470	AI31472	AI31473
					WS1	WS1	WS2	WS2	WS3	WS3
					14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013
					0.20m	0.90m	0.20m	0.80m	0.60m	2.50m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2800	Dibenzo[a,h]anthracene	53703	mg kg^{-1}	N	<0.10	<0.10	<0.10		<0.10	
	Indeno[1,2,3-cd]pyrene	193395	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Benzo[g,h,i]perylene	191242	mg kg^{-1}	M	<0.10	<0.10	<0.10		<0.10	
	Total (of 16) PAHs		mg kg^{-1}	N	<2.0	<2.0	<2.0		<2.0	
2820	Azinphos methyl	86500	mg kg^{-1}	N						
	Coumaphos	56724	mg kg^{-1}	N						
	Demeton (O+S)	8065483	mg kg^{-1}	N						
	Disulfoton	298044	mg kg^{-1}	N						
	Fensulfothion	115902	mg kg^{-1}	N						
	Fenthion	55389	mg kg^{-1}	N						
	Phorate	298022	mg kg^{-1}	N						
	Prothiophos	34643464	mg kg^{-1}	N						
	Sulprofos	35400432	mg kg^{-1}	N						
	Trichloronate	327980	mg kg^{-1}	N						

All tests undertaken between 19/02/2013 and 13/03/2013

* Accreditation status

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Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

FAO Tony Hewitt

AMENDED LABORATORY TEST REPORT

Results of analysis of 13 samples received 18 February 2013

C2179 - Church Raike, Chipping

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Report Date
14 March 2013

					224002					
					AI31474	AI31475	AI31476	AI31477	AI31478	AI31479
					WS4	WS5	WS5	WS6	WS6	WS7
					14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013	14/2/2013
					0.50m	0.20m	0.50m	0.20m	1.80m	1.60m
					SOIL	*SOIL*	*SOIL*	*SOIL*	*SOIL*	*SOIL*
2800	Dibenzo[a,h]anthracene	53703	mg kg^{-1}	N	<0.10	<0.10		<0.10		<0.10
	Indeno[1,2,3-cd]pyrene	193395	mg kg^{-1}	M	<0.10	<0.10		<0.10		<0.10
	Benzo[g,h,i]perylene	191242	mg kg^{-1}	M	<0.10	<0.10		<0.10		<0.10
	Total (of 16) PAHs		mg kg^{-1}	N	<2.0	<2.0		<2.0		<2.0
2820	Azinphos methyl	86500	mg kg^{-1}	N		< 0.2		< 0.2		
	Coumaphos	56724	mg kg^{-1}	N		< 0.2		< 0.2		
	Demeton (O+S)	8065483	mg kg^{-1}	N		< 0.2		< 0.2		
	Disulfoton	298044	mg kg^{-1}	N		< 0.2		< 0.2		
	Fensulfothion	115902	mg kg^{-1}	N		< 0.2		< 0.2		
	Fenthion	55389	mg kg^{-1}	N		< 0.2		< 0.2		
	Phorate	298022	mg kg^{-1}	N		< 0.2		< 0.2		
	Prothiophos	34643464	mg kg^{-1}	N		< 0.2		< 0.2		
	Sulprofos	35400432	mg kg^{-1}	N		< 0.2		< 0.2		
	Trichloronate	327980	mg kg^{-1}	N		< 0.2		< 0.2		

* Accreditation status

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Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

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AMENDED LABORATORY TEST REPORT

Results of analysis of 13 samples
received 18 February 2013

C2179 - Church Raike, Chipping

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Report Date
14 March 2013

		224002
		AI31480
		WS7
		14/2/2013
		2.00m - 2.45m
		SOIL
2800	Dibenzo[a,h]anthracene	53703	mg kg-1	N
	Indeno[1,2,3-cd]pyrene	193395	mg kg-1	M
	Benzo[g,h,i]perylene	191242	mg kg-1	M
	Total (of 16) PAHs		mg kg-1	N
2820	Azinphos methyl	86500	mg kg-1	N
	Coumaphos	56724	mg kg-1	N
	Demeton (O+S)	8065483	mg kg-1	N
	Disulfoton	298044	mg kg-1	N
	Fensulfothion	115902	mg kg-1	N
	Fenthion	55389	mg kg-1	N
	Phorate	298022	mg kg-1	N
	Prothiophos	34643464	mg kg-1	N
	Sulprofos	35400432	mg kg-1	N
	Trichloronate	327980	mg kg-1	N

* Accreditation status

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

Chemtest
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Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070

Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

FAO Tony Hewitt
26 February 2013

Dear Tony Hewitt

Test Report Number **224002**
Your Project Reference **C2179 - Church Raike, Chipping**

Please find enclosed the results of analysis for the samples received 19 February 2013.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Darrell Hall, Director

UKAS TESTING
2183

ISO 14001 Registered Company
sira
UKAS ENVIRONMENTAL MANAGEMENT
011

Notes to accompany report:

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

Brownfield Solutions Limited
Wychwood House
1 Queen Street
Northwich, Cheshire
CW9 5JL

FAO Tony Hewitt

LABORATORY TEST REPORT
Asbestos in Soils

Chemtest

Results of analysis of 3 samples
received 18 February 2013
C2179 - Church Raike, Chipping

Report Date
26 February 2013

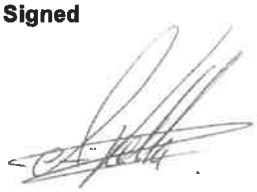
Login Batch No: 224002

Qualitative Results

				SOP 2190	
				ACM Type	Asbestos Identification
Chemtest ID	Sample ID	Sample Desc	Depth (m)		
AI31467		WS1	0.20	-	No Asbestos Detected
AI31471		WS3	0.20	-	No Asbestos Detected
AI31477		WS6	0.20	-	No Asbestos Detected

The detection limit for this method is 0.001%

Signed



Albert Vella
Senior Environmental Surveyor

All tests undertaken between 22-Feb-2013 and 22-Feb-2013

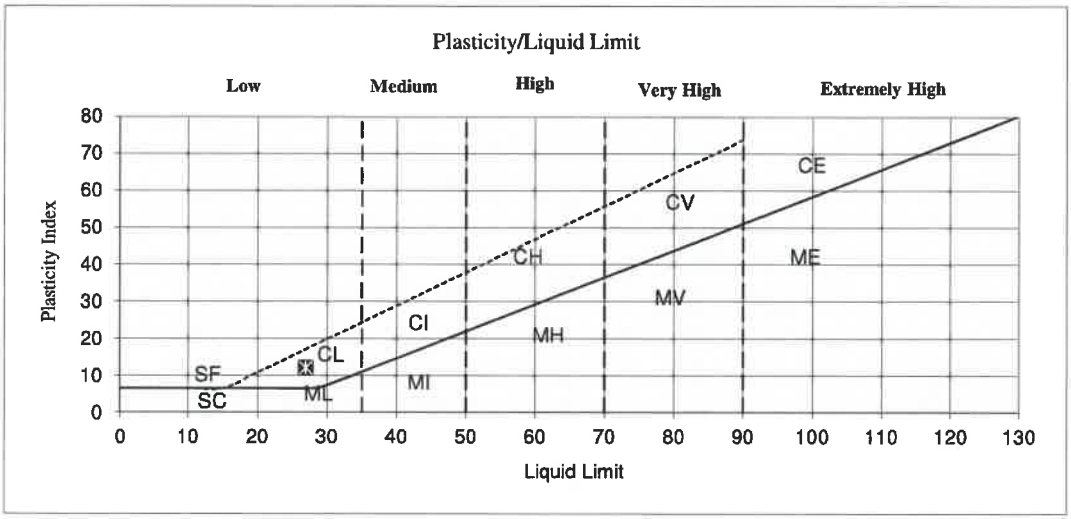
APPENDIX C
Geotechnical Testing Results

TESTCONSULT LIMITED
Ruby House, 40A Hardwick Grange, Warrington WA1 4RF
Tel (01925) 286880 Fax (01925) 286881

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/01
	Wychwood House	**Sample Ref.:**	WS1 @ 1.50m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Gravelly Clay**
Retained 425 micron (%)	**30**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**27**
Plastic Limit (%)	**15**
Plasticity Index	**12**



Approved Signature
TESTCONSULT LIMITED

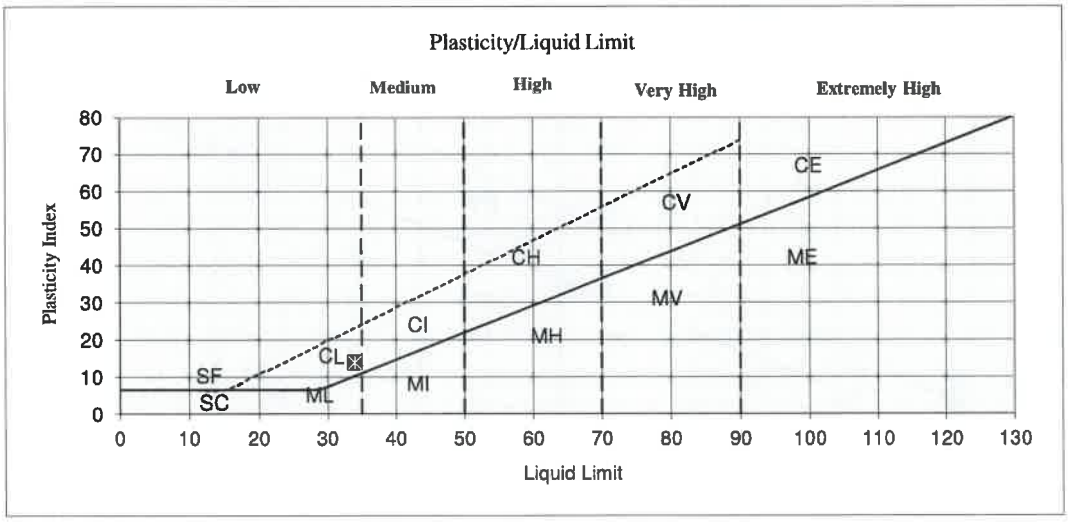
☐ Gary Foy, Laboratory Manager; ■ Marcus Baker, Operations Manager; ☐ Liam Williams, Operations Manager

TESTCONSULT LIMITED
Ruby House, 40A Hardwick Grange, Warrington WA1 4RF
Tel (01925) 286880 Fax (01925) 286881

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/05
	Wychwood House	**Sample Ref.:**	WS5 @ 1.60m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Gravelly Clay**
Retained 425 micron (%)	**25**
Natural Moisture Content (%)	**15**
Liquid Limit (single point)(%)	**34**
Plastic Limit (%)	**20**
Plasticity Index	**14**



Approved Signature
TESTCONSULT LIMITED

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TESTCONSULT LIMITED
Ruby House, 40A Hardwick Grange, Warrington WA1 4RF
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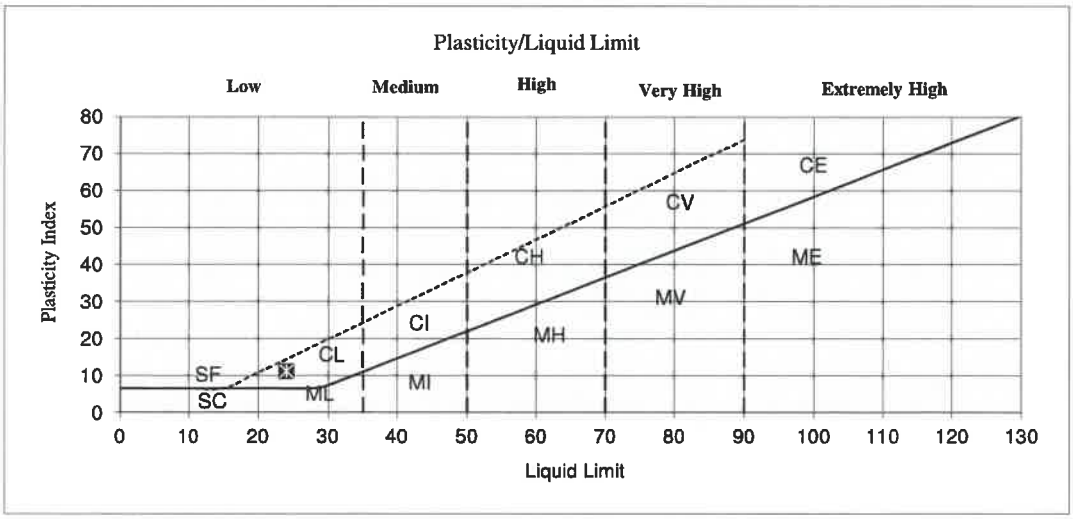
UKAS TESTING 0956

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/04
	Wychwood House	**Sample Ref.:**	WS4 @ 1.80m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Gravelly Clay**
Retained 425 micron (%)	**25**
Natural Moisture Content (%)	**11**
Liquid Limit (single point)(%)	**24**
Plastic Limit (%)	**13**
Plasticity Index	**11**



Approved Signature
TESTCONSULT LIMITED

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TESTCONSULT LIMITED
Ruby House, 40A Hardwick Grange, Warrington WA1 4RF
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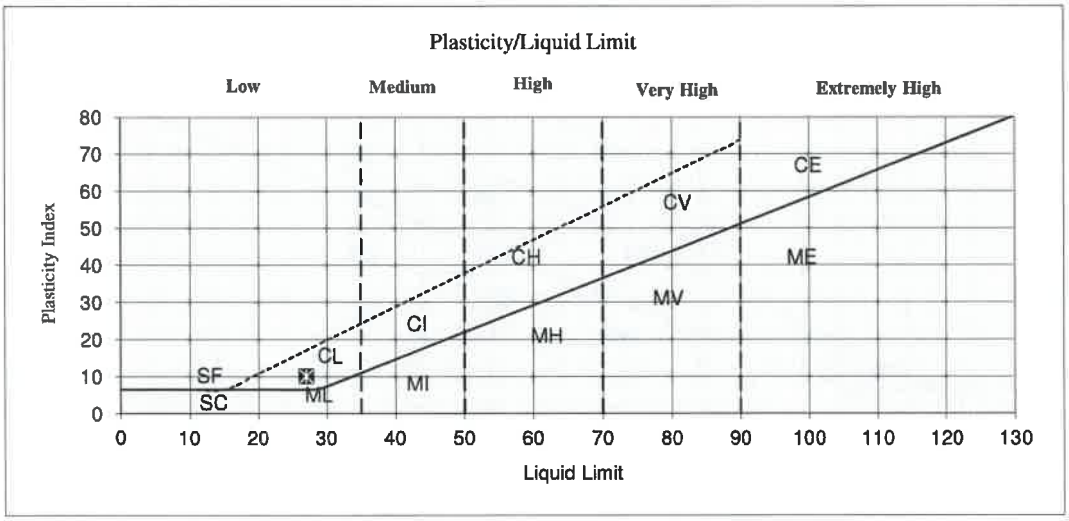
UKAS TESTING 0965

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/03
	Wychwood House	**Sample Ref.:**	WS3 @ 1.20m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Gravelly Clay**
Retained 425 micron (%)	**25**
Natural Moisture Content (%)	**13**
Liquid Limit (single point)(%)	**27**
Plastic Limit (%)	**17**
Plasticity Index	**10**



Approved Signature
TESTCONSULT LIMITED

☐ Gary Foy, Laboratory Manager; ■ Marcus Baker, Operations Manager; ☐ Liam Williams, Operations Manager

TESTCONSULT LIMITED
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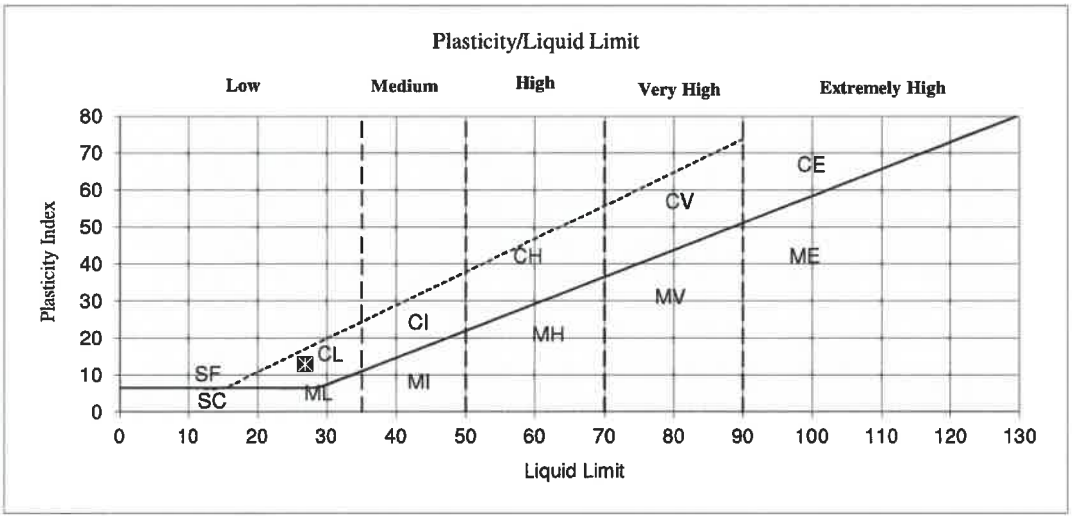
UKAS TESTING 0955

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/02
	Wychwood House	**Sample Ref.:**	WS2 @ 1.50m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Gravelly Clay**
Retained 425 micron (%)	**30**
Natural Moisture Content (%)	**12**
Liquid Limit (single point)(%)	**27**
Plastic Limit (%)	**14**
Plasticity Index	**13**



Approved Signature
TESTCONSULT LIMITED

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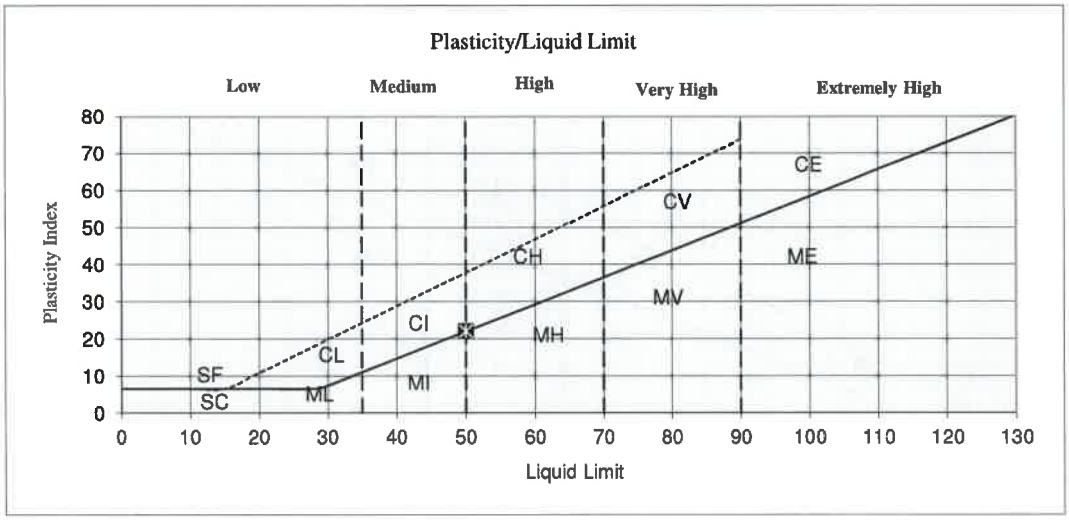
UKAS TESTING
0955

LABORATORY TEST REPORT
LIQUID & PLASTIC LIMIT TESTS BS 1377: Part 2: 1990 Cl 4.4,5.3

Site:	Church Raike, Chipping	**Job No.:**	-
Client:	Brownfield Solutions Ltd	**Lab Ref No.:**	SA13268/06
	Wychwood House	**Sample Ref.:**	WS7 @ 0.50m
	1 Queen Street	**Date Received:**	20/02/2013
	Northwich CW9 5JL	**Date Tested:**	27/02/2013
Originator:	**Anthony Hewitt**	**Date Reported:**	27/02/2013

Sampling Certificate	**No**
Sampled By	**Client**
Sample Type	**Disturbed**
Sample Preparation Method	**Washed**
MATERIAL	**Brown Sandy Clay**
Retained 425 micron (%)	**25**
Natural Moisture Content (%)	**30**
Liquid Limit (single point)(%)	**50**
Plastic Limit (%)	**28**
Plasticity Index	**22**



Approved Signature
TESTCONSULT LIMITED

☐ Gary Foy, Laboratory Manager; ■ Marcus Baker, Operations Manager; ☐ Liam Williams, Operations Manager

APPENDIX D
Contaminated Land Screening Values

Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

General

The current recommended method for assessing contamination is on the basis of:

Source-Pathway-Receptor

Where any one of these "pollution linkages" is absent there is deemed to be no risk.

Fundamentally receptors can be considered as humans and controlled waters (surface and ground waters).

The purpose of using screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

Human Health

Current UK guidance is provided by DEFRA and the Environment Agency(EA). Publications forming part of the guidance include; CLEA Model, toxicological reports and soil guideline values (SGV), collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions, all of the original SGV's that were published have been withdrawn and publication of new SGV's started in 2009.
The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances BSL uses the following data sources in the order of preference given below:

- Current UK SGV's
- CIEH GAC values (derived by LQM)
- Withdrawn UK SGV's
- Guidance from other European countries
- Guidance from the rest of the World.

Controlled Waters

The impaction of contamination on controlled waters is assessed by the comparison with Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.
Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

Further Assessment

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further more detailed investigation, including the deriving of site specific values to better define the risk and to design appropriate remedial measures.

APPENDIX E
Ground Gas Monitoring Results

Church Raike, Chipping

Prospect GB Ltd

C2179 Ground Gas Monitoring Results

11/03/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	20.9	0.4	0.1	2.0	ND	ND	0.78	ND	N	
	Steady	21.0	0.1	0.1	2.0	ND	ND				
WS04	Peak	20.9	0.1	ND	ND	ND	ND	0.68	ND	N	
	Steady	21.0	ND	ND	ND	ND	ND				
WS06	Peak	20.3	0.6	ND	ND	ND	ND	0.37	ND	N	
	Steady	20.7	0.1	ND	ND	ND	ND				
WS07	Peak	20.0	0.3	0.1	2.0	ND	ND	0.50	ND	N	
	Steady	20.3	ND	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.2	ND	ND	ND	ND	ND	1010	LC	GA2000	SNOWING
Finish	21.0	ND	ND	ND	ND	ND	1010			

Key

ND Not Detected

N/A Not Available

Church Raike, Chipping

Prospect GB Ltd

C2179 **Ground Gas Monitoring Results**

26/03/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	20.0	0.2	ND	ND	ND	ND	0.43	ND	N	
	Steady	20.4	ND	ND	ND	ND	ND				
WS04	Peak	20.5	ND	ND	ND	ND	ND	0.37	ND	N	
	Steady	20.5	ND	ND	ND	ND	ND				
WS06	Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	
	Steady	N/A	N/A	N/A	N/A	N/A	N/A				FLOODED
WS07	Peak	20.1	0.1	ND	ND	ND	ND	0.31	ND	N	
	Steady	20.4	ND	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.5	ND	ND	ND	ND	ND	1014	LC	GA2000	SNOWING
Finish	20.5	ND	ND	ND	ND	ND	1014			

Key	
ND	Not Detected
N/A	Not Available

Church Raike, Chipping

Prospect GB Ltd

C2179 **Ground Gas Monitoring Results**

15/04/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	20.0	0.3	0.1	2.0	ND	ND	0.70	ND	N	
	Steady	20.0	0.3	0.1	2.0	ND	ND				
WS04	Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	FLOODED
	Steady	N/A	N/A	N/A	N/A	N/A	N/A				
WS06	Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N	FLOODED
	Steady	N/A	N/A	N/A	N/A	N/A	N/A				
WS07	Peak	20.5	ND	ND	ND	ND	ND	0.30	ND	N	
	Steady	20.5	ND	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.5	ND	ND	ND	ND	ND	1003	JB	GA2000	Sunny
Finish	20.5	ND	ND	ND	ND	ND	1003			

Key	
ND	Not Detected
N/A	Not Available

Church Raike, Chipping

Prospect GB Ltd

C2179 **Ground Gas Monitoring Results**

24/04/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	20.6	0.3	ND	ND	ND	ND	0.60	ND	N	
	Steady	20.6	0.3	ND	ND	ND	ND				
WS04	Peak	20.9	0.1	0.1	2.0	N/A	N/A	0.60	0.1	N	
	Steady	20.9	0.1	0.1	2.0	N/A	N/A				
WS06	Peak	20.8	0.3	0.1	2.0	N/A	N/A	0.30	ND	N	
	Steady	20.8	0.3	0.1	2.0	N/A	N/A				
WS07	Peak	20.6	0.1	ND	ND	ND	ND	0.40	ND	N	
	Steady	20.6	0.1	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.5	ND	ND	ND	ND	ND	1012	JB	GA2000	Cloudy
Finish	20.5	ND	ND	ND	ND	ND	1012			

Key	
ND	Not Detected
N/A	Not Available

Church Raike, Chipping

Prospect GB Ltd

C2179 **Ground Gas Monitoring Results**

07/06/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Unable to locate.
	Steady	N/A	N/A	N/A	N/A	N/A	N/A				
WS04	Peak	20.3	ND	ND	ND	ND	ND	0.80	ND	N	
	Steady	20.3	ND	ND	ND	ND	ND				
WS06	Peak	19.3	0.7	ND	ND	ND	ND	0.65	ND	N	
	Steady	19.3	0.7	ND	ND	ND	ND				
WS07	Peak	20.1	0.2	ND	ND	ND	ND	1.00	ND	N	
	Steady	20.1	0.2	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.9	ND	ND	ND	ND	ND	1010	JB	GA2000	Sunny, dry
Finish	20.9	ND	ND	ND	ND	ND	1010			

Key	
ND	Not Detected
N/A	Not Available

Church Raike, Chipping

Prospect GB Ltd

C2179 **Ground Gas Monitoring Results**

02/07/2013

		Percentage Concentrations				Parts per Million		m bgl	litres/hour		
Location	State (Peak/Steady)	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH_4)	LEL	Hydrogen Sulphide (H_2S)	Carbon Monoxide (CO)	Water Level	Flow	Sheen (Y/N)	Notes
WS02	Peak	20.6	0.2	ND	ND	ND	ND	0.98	ND	N	
	Steady	20.6	0.1	ND	ND	ND	ND				
WS04	Peak	20.5	0.1	ND	ND	ND	ND	0.80	ND	N	
	Steady	20.6	ND	ND	ND	ND	ND				
WS06	Peak	19.5	0.6	ND	ND	ND	ND	0.65	ND	N	
	Steady	20.2	0.3	ND	ND	ND	ND				
WS07	Peak	20.3	0.1	ND	ND	ND	ND	1.00	ND	N	
	Steady	20.4	0.1	ND	ND	ND	ND				

	Percentage Concentrations				Parts per Million		mb			
Ambient	Oxygen (O_2)	Carbon Dioxide (CO_2)	Methane (CH4)	LEL	Hydrogen Sulphide (H2S)	Carbon Monoxide (CO)	Atm Pressure	Monitored by	Equipment	Weather
Start	20.7	ND	ND	ND	ND	ND	1009	LC	GA2000	Sunny, dry
Finish	20.7	ND	ND	ND	ND	ND	1009			

Key	
ND	Not Detected
N/A	Not Available

APPENDIX F
Waste Disposal Guidance