

Remediation Method Statement for The Coppice, Burbage, Hinckley LE10 2TF

for:

Springbourne Homes Ltd, Bosworth Marina, Carlton Road, Market Bosworth CV13
6PG

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1. **EXECUTIVE SUMMARY**

1.1. General

This report presents a method statement for the ground gas remediation works to be carried out at The Coppice, Burbage, Hinckley. At the time of writing this report the site was an undeveloped parcel of land.

1.2. Geology

1.2.1. Geological maps indicate that the site is underlain by bedrock known as the Mercia Mudstone Group, described as a red mudstone, with subordinate siltstone, designated as a secondary B aquifer.

1.2.2. Superficial deposits comprise the Wolston Sand and Gravel, described as sand and gravel, with lenses of silt clay or peat, designated as a secondary A aquifer, with the Bosworth Clay Member, described as clay, designated as an unproductive aquifer, recorded along the eastern boundary.

1.3. Contamination

During the ground investigation (ref: G16195-IR dated: July 2020) undertaken by Nicholls Colton Geotechnical, none of the contaminants tested for were recorded above the relevant published guidelines values for residential with plant uptake, therefore, no remedial measures are required.

1.4. Gaseous Contamination

1.4.1. A ground gas monitoring investigation was undertaken by Nicholls Colton Geotechnical (ref: G16195-IR dated: July 2020). During the ground gas monitoring period, a maximum level of 5.3% carbon dioxide and 0.3% methane was recorded.

1.4.2. In 1999 Nicholls Colton undertook a ground gas investigation at the site to the north/north west of the proposed development site. This investigation recorded elevated levels of methane and carbon dioxide, likely associated with fill material used to backfill a ditch. The developer built the houses prior to the completion of the gas investigation, with the majority of the houses built without gas protection measures.

- 1.4.3. The results of this investigation were provided to the Environment Agency (EA) and Environmental Health Officer (EHO), who agreed that there was a tolerable risk to residents, therefore, no ground gas remediation was required.
- 1.4.4. In accordance with BS8485:2019 the highest recorded carbon dioxide level (5.3%) and gas flow rate (0.1 l/hr) (worst case check) give the site a characteristic gas situation of 1 (CS1), defined as very low hazard potential (Table 2 of BS8485). However, as elevated levels of carbon dioxide (>5%) have been encountered over the gas monitoring period, gas protection measures are deemed necessary.
- 1.4.5. To reduce the risk from ground gas to the proposed development and the existing development to the north/north west, it was recommended that a ground gas venting trench is constructed along the common boundary between the two sites, providing a preferential pathway for ground gases to vent to the atmosphere, reducing the ground gas risk to both sites.
- 1.4.6. The approved Nicholls Colton report recommends that the gas venting trench is 3m deep and filled with a single sized stone and capped with rock gibbon baskets protruding 150mm above ground level. This will facilitate the venting of ground gases, while preventing the system from becoming blocked. This report then goes on to recommend additional ground protection measures are installed to houses within 25m of the northern boundary (plots 1-4).
- 1.4.7. PRP UK Ltd have determined that a ground gas resistant membrane would be the most suitable ground gas protection method for plots 1 to 4. The gas resistant membrane should conform to the requirements of BS 8485:2019.
- 1.4.8. Gas protection measures will need to be validated by a qualified, independent contractor (third party). As part of the verification process the independent third party is required to produce a pre verification plan by CIRIA 735. Therefore, it is recommended that they are contacted in advance of the gas protection measures installation. The verification contractor will also need to attend site during the installation process.

2. **INTRODUCTION AND BACKGROUND**

2.1. Nicholls Colton Geotechnical were appointed by Springbourne Homes Ltd to provide a ground investigation at The Coppice, Burbage, Hinckley. Overall, these reports have enabled the nature of the ground to be established in respect of the environmental conditions on the site. The following reports refer to the site and have been approved by the local authority:

- Interpretative Report on a Ground Investigation for a Proposed Residential Development on Land off The Coppice Burbage Near Hinckley Leicestershire (ref: G16195-IR dated July 2020)

2.2. In 1999 Nicolls Colton undertook a ground gas investigation at the site to the north/north west, titled Interim Report on a Landfill Gas Survey at The Coppice off Elm Tree Drive, Burbage, Leicestershire.

2.3. The following appendices are included:

Appendix I	Site Plans
Appendix II	Nicholls Colton Ground Investigation Report
Appendix III	Ground Gas Protection Location Plan
Appendix IV	General Conditions

3. LOCATION AND DESCRIPTION

- 3.1. The site is located at National Grid reference easting: 444071, northing 293733. The site lies to the south west of The Coppice, Burbage, Hinckley.
- 3.2. The site is irregular in shape and occupies an area of approximately 0.9ha.
- 3.3. At the time of writing this report the site was an area of undeveloped land.
- 3.4. Summary details of the site boundaries and adjacent land use are:

Boundary	Boundary Construction	Adjacent Land Use	Proximal Land Use
North	Hedge	Residential	Residential/ highways/ railway
East	Hedge	Agricultural land	Agricultural land
South	Hedge	Private track/ agricultural land	Residential
West	Hedge	Private road/residential	Residential

4. **GROUND CONDITIONS**

- 4.1. Within the accuracy of the available geological information (British Geological Survey (BGS) Geology of Britain at a scale of 1:50,000) the solid geology beneath the site is indicated as being the Mercia Mudstone Group, described as a red mudstone, with subordinate siltstone, designated as a secondary B aquifer. Superficial deposits comprise the Wolston Sand and Gravel, described as sand and gravel, with lenses of silt clay or peat, designated as a secondary A aquifer, with the Bosworth Clay Member, described as clay, designated as an unproductive aquifer, recorded along the eastern boundary.
- 4.2. Boreholes and trial pits excavated across the site revealed that deposits of made ground comprising a combination of granular and cohesive soils were found. Made ground deposits were recorded overlaying deposits of the Wolston Sand and Gravel and Bosworth Clay Formation. For full details of the strata encountered by the exploratory holes of this investigation, reference should be made to the appended borehole logs. The salient features are, however, summarised below.
- 4.3. **Made ground** – was recorded from ground level up to a depth of 2.90m (WS300) consisting of cohesive and granular soils. Granular soils consisted of topsoil, with gravel sized fragments of brick, concrete, rubber and polythene and clayey silty gravelly sand, with gravel sized fragments of rock, brick, concrete, slate, polythene, bituminous macadam, wood, plastic, ceramic and metal. Cohesive soils consisted of soft through to stiff sandy, gravelly clay, with gravel sized fragments of brick, concrete, rubber and polythene and clayey silty gravelly sand, with gravel sized fragments of rock, brick, concrete, slate, polythene, bituminous macadam, wood, plastic, ceramic and metal.
- 4.4. **Wolston Sand and Gravel** – encountered beneath the made ground to the base of TP5, TP7, TP8, TP9, TP10, TP11, WS100, WS200, WS500, WS600 and WS700 as predominantly granular soils. These granular soils consisted of clayey silty sand, with sandy silts and sandy clays.
- 4.5. **Wolston Sand and Gravel** – encountered beneath the made ground to the base of TP5, TP7, TP8, TP9, TP10, TP11, WS100, WS200, WS500, WS600 and WS700 as predominantly granular soils. These granular soils consisted of clayey silty sand, with sandy silts and sandy clays.

- 4.6. **Bosworth Clay Formation** – encountered beneath the made ground to the base of TP1, TP2, TP6, WS300 and WS400 as a soft through to stiff sandy, gravelly clay, with bands of clayey silty sand.
- 4.7. **Mercia Mudstone Group** – not encountered during the Nicolls Colton investigation.
- 4.8. Existing Contamination

During the ground investigation (ref: G16195-IR dated: July 2020) undertaken by Nicholls Colton Geotechnical, none of the contaminants tested for were recorded above the relevant published guidelines values for residential with plant uptake, therefore, no remedial measures are required.

4.9. Gaseous Contamination

4.9.1. The information below is based on six gas monitoring visits undertaken by Nicholls Colton. The first gas monitoring visit was carried out on 24 July 2015 with the last visit taking place on 28 October 2015.

4.9.2. Table 1: data collected from the six gas monitoring visits conducted by Nicholls Colton

Date of Site Visit	Borehole	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Lower Explosive Limit %	Flow l/hr	Atmospheric Pressure (mb)
24/06/2015	WS100	0.0	0.3	20.9	0.0	0.0	1001
10/08/2015	WS100	0.0	0.4	20.7	0.0	0.0	1003
19/08/2015	WS100	0.0	0.4	20.6	0.0	-0.3	1004
24/08/2015	WS100	0.0	0.3	20.9	0.0	-0.0	987
28/09/2015	WS100	0.0	0.2	20.9	0.0	0.1	1024
28/10/2015	WS100	0.0	0.4	21.0	0.0	0.0	993
24/06/2015	WS200	0.0	4.6	17.9	0.0	0.0	1001
10/08/2015	WS200	0.1	4.7	17.5	2.0	0.0	1003
19/08/2015	WS200	0.0	4.9	16.3	0.0	0.0	1004
24/08/2015	WS200	0.0	4.0	18.0	0.0	0.1	988
28/09/2015	WS200	0.2	3.8	18.0	4.0	0.0	1025

Date of Site Visit	Borehole	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Lower Explosive Limit %	Flow l/hr	Atmospheric Pressure (mb)
28/10/2015	WS200	0.0	3.6	17.9	0.0	0.0	990
24/06/2015	WS300	0.0	4.3	17.6	0.0	0.0	1001
10/08/2015	WS300	0.0	5.1	16.7	0.0	0.0	1003
19/08/2015	WS300	0.0	5.3	15.8	0.0	-0.7	1005
24/08/2015	WS300	0.0	5.1	16.1	0.0	0.0	988
28/09/2015	WS300	0.0	5.2	16.7	0.0	0.0	1023
28/10/2015	WS300	0.0	4.7	16.8	0.0	0.0	994
24/06/2015	WS400	0.0	3.2	18.7	0.0	0.0	1001
10/08/2015	WS400	0.0	4.1	17.4	0.0	0.0	1003
19/08/2015	WS400	0.0	4.4	16.8	0.0	-0.8	1005
24/08/2015	WS400	0.0	4.8	17.4	0.0	0.0	998
28/09/2015	WS400	0.0	4.4	17.2	0.0	0.0	1024
28/10/2015	WS400	0.0	4.1	17.6	0.0	0.0	995
24/06/2015	WS500	0.0	0.8	20.5	0.0	0.0	1001
10/08/2015	WS500	0.0	1.7	19.3	0.0	0.0	1003
19/08/2015	WS500	0.0	1.6	19.5	0.0	-0.7	1005
24/08/2015	WS500	0.0	1.8	19.8	0.0	-0.1	988
28/09/2015	WS500	0.0	2.1	19.3	0.0	0.0	1025
28/10/2015	WS500	0.0	2.4	19.4	0.0	0.0	994
24/06/2015	WS600	0.0	1.0	20.5	0.0	0.0	1001
10/08/2015	WS600	0.0	1.3	19.5	0.0	0.0	1003
19/08/2015	WS600	0.0	1.4	19.6	0.0	-0.0	1005
24/08/2015	WS600	0.0	1.3	20.5	0.0	0.0	988
28/09/2015	WS600	0.3	1.3	20.4	6.0	0.0	1026
28/10/2015	WS600	0.0	1.3	20.3	0.0	0.0	994
24/06/2015	WS700	0.0	0.5	20.8	0.0	0.0	1001

Date of Site Visit	Borehole	Methane (CH ₄) %	Carbon Dioxide (CO ₂) %	Oxygen (O ₂) %	Lower Explosive Limit %	Flow l/hr	Atmospheric Pressure (mb)
10/08/2015	WS700	0.0	0.2	20.2	0.0	0.0	1003
19/08/2015	WS700	0.0	0.2	20.7	0.0	-0.0	1004
24/08/2015	WS700	0.0	0.2	20.9	0.0	0.1	989
28/09/2015	WS700	0.3	0.1	21.0	6.0	0.0	1025
28/10/2015	WS700	0.0	0.2	21.1	0.0	0.0	994

- 4.9.3. Elevated levels of carbon dioxide (>5%) were recorded in WS300 on the second, third, fourth and fifth monitoring visits. The highest recorded carbon dioxide level was 5.3% on the third monitoring visit.
- 4.9.4. The highest recorded methane level was within WS600 and WS700 on the fifth monitoring visit, with a level of 0.3%. The majority of methane levels are 0.0% across all boreholes over the monitoring period. Methane is potentially explosive when mixed with air between the limits 5% methane (v/v) and 15% methane (v/v). These are called the lower explosive limit (LEL) and the upper explosive limit (UEL). A factor of safety should be applied when assessing the risk of the LEL being exceeded. Currently it is recommended that values equal or above the 20% of the LEL (or 1% by volume) be considered indicative of an explosive methane/air mixture. The highest recorded lower exposure limit was recorded with WS600 and WS700 on the fifth monitoring visits, with a level of 6.0%.
- 4.9.5. The oxygen content should not fall below a minimum of 18% by volume. This relates to the minimum requirements for personnel in the working environment (Health and Safety Executive Guidance Note EH/40). As oxygen content has been recorded below 18%, a risk assessment will be required for personnel entering excavations.
- 4.9.6. In accordance with BS8485:2019 the highest recorded carbon dioxide level (5.3%) and gas flow rate (0.1 l/hr) (worst case check) give the site a characteristic gas situation of 1 (CS1), defined as very low hazard potential (Table 2 of BS8485). However, as elevated levels of carbon dioxide (>5%) have been encountered over the gas monitoring period, gas protection measures are deemed necessary.

- 4.9.7. The approved Nicholls Colton report recommends that the gas venting trench is 3m deep and filled with a single sized stone and capped with rock gibbon baskets protruding 150mm above ground level. This will facilitate the venting of ground gases, while preventing the system from becoming blocked. This report then goes on to recommend additional ground protection measures are installed to houses within 25m of the northern boundary (plots 1-4).
- 4.9.8. PRP UK Ltd have determined that a ground gas resistant membrane would be the most suitable ground gas protection method for plots 1 to 4. This gas resistant membrane should conform to the requirements of BS 8485:2019.
- 4.9.9. Gas protection measure will need to be validated by a qualified, independent contractor (third party). As part of the verification process the independent third party is required to produce a pre verification plan by CIRIA 735, therefore, it is recommended that they are contacted in advance of the gas protection measures installation. The verification contractor will also need to attend site during the installation process.

5. **REMEDIATION STRATEGY**

- 5.1. To reduce the risk from ground gas to the proposed development and the existing development to the north/north west, it was recommended that in ground gas venting trench is constructed along the common boundary between the two sites, providing a preferential pathway for ground gases to vent to the atmosphere, reducing the ground gas risk to both sites.
- 5.2. The approved Nicholls Colton report recommends that the gas venting trench is 3m deep and filled with a single sized stone and capped with rock gibbon baskets protruding 150mm above ground level. This will facilitate the venting of ground gases, while preventing the system from becoming blocked. This report then goes on to recommend additional ground protection measures are installed to houses within 25m of the northern boundary (plots 1-4).
- 5.3. PRP UK Ltd have determined that a ground gas resistant membrane would be the most suitable ground gas protection method for plots 1 to 4. The gas resistant membrane should conform to the requirements of BS 8485:2019
- 5.4. Gas protection measures will need to be validated by a qualified, independent contractor (third party). As part of the verification process the independent third party is required to produce a pre verification plan by CIRIA 735, therefore, it is recommended that they are contacted in advance of the gas protection measures installation. The verification contractor will also need to attend site during the installation process.

6. METHODOLOGY FOR VALIDATION

- 6.1. Gas protection measures will need to be validated by a qualified, independent contractor (third party). As part of the verification process the independent third party is required to produce a pre verification plan by CIRIA 735, therefore, it is recommended that they are contacted in advance of the gas protection measures installation. The verification contractor will also need to attend site during the installation process.
- 6.2. Once the ground gas protection measures have been verified, the verification report should be submitted to the local authority for approval and discharge of the relevant conditions.

APPENDIX I

SITE PLANS



- A - red line clarified - May 15 - JAF
- C - scheme reduced to 9 dwellings Nov 2019
- D - site area amended Jan 2020
- E - house type numbers amended Jan 2020
- F - plots 5 - 8 and road amended Feb 2020
- G - chicane added & turning head extended Apr 2020
- H - plot 9 removed to create additional green space June 2020
- J - chicane removed and bin collection points added June 2020
- K - plots 5 - 8 amended Feb 2021
- L - plot 5 handed March 2021
- M - retained trees to Southern boundary indicated March 2021
- N - parking and turning areas to plots 5 & 8 amended March 2021
- P - proposed footpath link added April 2021

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client		
Springbourne Homes Ltd		
project		
proposed housing off The Coppice Burbage		
drawing		
site layout		
scale	1: 500	sheet
date	Jan 2015	author JRH A2
job No	12/71	drawing No 26P

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APPENDIX II

NICHOLLS COLTON GROUND INVESTIGATION REPORT

NICHOLLS COLTON

GEOTECHNICAL

INTERPRETATIVE REPORT

on

A GROUND INVESTIGATION

for

**A PROPOSED RESIDENTIAL DEVELOPMENT ON LAND OFF THE
COPPICE BURBAGE NEAR HINCKLEY LEICESTERSHIRE**



On Behalf Of

**Springbourne Homes Limited
25 Coton Road
Nuneaton
Warwickshire
CV11 5TW**

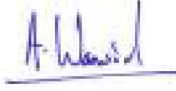
REPORT NO: G16195-IR

July 2020

**INTERPRETATIVE REPORT ON A GROUND INVESTIGATION FOR A PROPOSED RESIDENTIAL
DEVELOPMENT ON LAND OFF THE COPPICE BURBAGE NEAR HINCKLEY LEICESTERSHIRE**

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Drawings

G16195-IR/01	Site Location Plan
G16195-IR/02	Exploratory Hole Location Plan

INTERPRETATIVE REPORT ON A GROUND INVESTIGATION FOR A PROPOSED RESIDENTIAL DEVELOPMENT ON LAND OFF THE COPPICE BURBAGE NEAR HINCKLEY LEICESTERSHIRE

Factual Information

1. Introduction

- 1.1 This report has been prepared on details provided by The Pegasus Group, 4 The Courtyard, Church Street, Lockington, Derbyshire DE74 2SL (the planning consultant) in correspondence dated 29th March 2016 on behalf of Springbourne Homes Limited, 25 Coton Road, Nuneaton, Warwickshire CV11 5TW (the client) and subsequently followed by confirmation to proceed with the site work in correspondence dated 17th May 2016.
- 1.2 It is understood that Springbourne Homes are seeking planning permission from Hinckley & Bosworth Borough Council for the building of ten two storey detached houses and six associated detached garages at the site.
- 1.3 The purpose of this investigation is to provide data regarding the ground and groundwater conditions at the site (including investigation into the recorded historic landfill), so that suitable methods of design and construction may be adopted for the proposed works. As a part of this work, a desk study and collation of existing data has been undertaken and an assessment of soil contamination carried out.
- 1.4 The site is located on fallow land situated off the Coppice at the northern end of Burbage on the outskirts of Hinckley, Leicestershire (approximate grid reference 44090, 293740) as shown on the appended site location plan (Nicholls Colton Geotechnical drawing No. G16195-IR/01). Access to the site is currently gained through a gate off a spur road at the south west corner of the Coppice cul de sac.
- 1.5 This report has been prepared on the specific instructions of The Pegasus Group on behalf of Springbourne Homes and no reliance should be made by third parties as to its adequacy or completeness in relation to future development requirements of the area under consideration. Similarly, Nicholls Colton Geotechnical and Nicholls Colton Group will accept no liability in relation to the use of data contained in this report by third parties.

2. Site History

- 2.1 The site was formerly owned by F.E Downes limited (F.E.D) who also developed the adjoining Coppice site immediately to the north-west during the 1990's. Nicholls Colton Geotechnical (NCG) (now Nicholls Colton Group) acted as Geo-environmental consultants on behalf of F.E.D. It is understood that F.E.D ceased trading circa 2009.
- 2.2 The original Coppice residential site to the north-west included a ditch line which was some 3.00m deep and which cut across the Coppice land in a roughly west to east orientation. The ditch was backfilled with varied soils by F.E.D and is known to extend beneath some of the existing houses and across several of the garden areas. The ditch then runs across the north eastern corner of the proposed Springbourne Homes development site prior to extending south along its north eastern boundary. There is also known to be a backfilled sewer trench which partially takes the alignment of the infilled ditch and is adjoined by an area of landfill which is backfilled with

mixed soils and building site rubble in the north eastern corner of the site. The approximate areas of the sewer trench and landfill areas are shown on drawing no. G16195-IR/02.

- 2.3 It became apparent that the backfilled ditch on the F.E.D site was emitting high levels of methane and carbon dioxide gasses when gas monitoring installations were constructed and monitored by NCG during the construction period. A report issued by NCG in 1999 summarised that there was a 'low' risk of gas ingress to a number of the new residential properties, with a resultant 'tolerable' risk to residents. Concern was at this time raised by both the Environment Agency and the Local Authority and they requested that gas monitoring should continue indefinitely. Additional gas monitoring pipes were installed mainly within the gardens of the residential properties and gas monitoring continued until 2005 during which time two further reports were compiled and submitted to the Environment Agency by Nicholls Colton Geotechnical. F.E.D failed to fund any gas monitoring after 2005.
- 2.4 In July 2015 Nicholls Colton Geotechnical were commissioned by Springbourne Homes to carry out an appraisal of the current site with a view to facilitating planning permission for the building of new residential houses. The main issue was considered to be the potential for the continued incidence of ground gases. Permission was refused from the local residents to allow access to the potentially still existing monitoring wells within the garden areas to properties adjoining the north western boundary of the site. As a consequence seven boreholes (WS100-WS700 inclusive) were formed across the Springbourne Homes site during phase 1 of the ground investigation utilising window sampling techniques and new gas monitoring wells installed. No further monitoring was possible or permitted within any of the historic installations located within the grounds of the former FED properties. A copy of the borehole logs and gas monitoring results are included in this report within Appendices D and H respectively.
- 2.5 A letter report was prepared by NCG in 2015 outlining the findings of the gas monitoring undertaken in 2015. A copy of the letter report is included in Appendix A. This concluded that there were generally no elevated levels of ground gas present on the Springbourne Homes site. However within borehole WS200 located adjacent to the FED site slightly elevated levels of Carbon Dioxide were encountered. In accordance with table 8.7 Of CIRIA document C659 it was considered that the site should be given an Amber 1 classification with certain precautions taken to protect against possible ground gas ingress.
- 2.6 A recommendation was given to consider the construction of an in ground gas vent trench along the common boundary between the existing Coppice development and the proposed Springbourne Homes site. The construction of such a trench would not only benefit the residents within the existing FED properties but could also reduce the number of properties requiring gas protective measures within the proposed Springbourne Homes development.
- 2.7 BGS records currently show the whole of the site area highlighted as being a licensed waste management facility with a closed licence status. It is known both from first-hand knowledge of the site and anecdotal evidence that the area of landfill is contained within the north eastern corner of the site. During phase 2 of the ground investigation undertaken in July 2016 trial pits (TP1 to TP11 inclusive) were formed to confirm this point and to review foundation options for the proposed new houses.

3. Site Description & Walkover Survey

3.1 A walkover survey was undertaken by a Nicholls Colton Geotechnical Engineer at the time of the latest fieldwork in July 2016 and the salient observations are summarised below:

- The site is roughly rectangular in shape and is accessed through a timber gate from the spur road at the south western corner of The Coppice cul de sac. There are local undulations in ground level but otherwise the site area is relatively flat.
- The gardens of detached houses located along The Coppice back onto the northern boundary of the Springbourne Homes site and those off the extension to Woodgate Road along the western boundary.
- The site is at present overgrown with long grass and locally nettles and thistles to waist height. Mature hedges, shrubs and trees align each of the site boundaries and a single small tree is located towards the western side of the main body of the site.
- There is a small copse in the south eastern corner of the site amongst which is an overgrown pond and a surface water sewer outfall.
- There were no obvious signs or sources of potential contamination visible on the surface of the site.

4. Desk Study

4.1 A desk study has been undertaken as part of this investigation to review the historical and environmental setting of the site and the information collated has been reviewed and is discussed as follows;

4.2 Site History

4.2.1 As part of this desk study reference to old Ordnance Survey plans has been undertaken to assess the previous site usage. Editions were reviewed dating back to the late 1800's and the extracts are included as Appendix B.

4.2.2 The earliest available O.S. map editions date from the late 1800's (1887) and they show the site in a semi-rural setting being part of a large field. A pond with adjoining trees is shown within the field traversing the centre of the eastern site boundary. Another pond is located some 25m from the north western corner of the site. 'The Outwoods' an accumulation of amalgamated buildings with adjoining orchards is located close by to the north west. Further to the north (approximately 200m from the site at its closest point) is the south Leicestershire Branch railway line which is located in a cutting. Burbage Road is shown 150m to the east. Further from the site are the south western extremities of Hinckley some 500m to the north- west and Burbage 900m to the south.

4.2.3 There is little change to the site or its environs until sometime between 1904 and 1924 (the duration between available plans) when the Woodgate Poultry Farm has been established immediately to the south west of the site. A long rectangular building of unlabelled use is shown within the north eastern section of the site. Further from the site the urban areas of Hinckley and Burbage expand to the south and north respectively.

- 4.2.4 The 1950 aerial map shows that the rectangular building shown as being on the site on earlier map editions has now been demolished.
- 4.2.5 There is little change to the site or its immediate environs until sometime between 1955 and 1961 when the available maps show that the Woodgate Poultry Farm has been disbanded and residential properties have been built on the available land extending east of Burbage Road to the west of the site, along Elm Tree Drive to the west and Woodgate Road to the south west. Extensive areas of residential houses have also been built to the south of the railway line further expanding the urban area of Hinckley to the south west of the site.
- 4.2.6 The 1967-1968 1:10,000 scale plan shows that the urban areas of Hinckley and Burbage have now adjoined to the west and south west of the site and that the urban extent of Burbage has also expanded considerably eastwards with a large new residential housing estate close by to the south east of the site.
- 4.2.7 The building of The Coppice development immediately to the north-west of the site is shown to have commenced sometime between the available plans dated 1980-1984 and 1993. A lake presumably resulting from sand and gravel extraction is shown for the first on the 1993 map some 300m to the south east of the site.
- 4.2.8 There is a slight discrepancy in the date that The Coppice development was completed. The aerial plan dated 1999 shows the full complement of houses along the northern boundary of the site but not on the 1999-2000 1:10,000 scale plan which correlates on the 2006 edition.
- 4.2.9 There are no discernible changes to either the site or its immediate environs between 2006 and the present day.

4.3 Environmental Review

- 4.3.1 As a further part of this desk study information has been obtained from an environmental database compiled by The Landmark Information Group® for the site, relating to data which may affect the development and its environs.
- 4.3.2 The data has been sourced from various organisations including the Environment Agency (EA), Coal Authority, British Geological Survey (BGS) and Local Authorities. A copy of the report is included as Appendix C. The notable findings may be summarised as follows:

4.4 Agency and Hydrological

- 4.4.1 The EA and Local Authority have no record of the following within 250 metres of the centroid of the site:
- Contaminated land register entries and notices
 - Prosecutions relating to controlled Waters
 - Enforcement and prohibition notices
 - Integrated pollution controls
 - Integrated pollution prevention and control
 - Local authority integrated pollution prevention and controls
 - Local authority pollution prevention and controls

- Local authority pollution prevention and control enforcements
- Pollution Incidents to controlled waters
- Prosecutions relating to authorised processes
- Registered radioactive substances
- River quality biology sampling points
- River quality chemistry sampling points
- Substantiated pollution incident register
- Water abstractions
- Water industry act referrals

- 4.4.2 There are four discharge consents (two for the same property) relating to domestic properties for sewage discharge, two designated as soakaways, one to groundwater and one onto the land. The records refer to properties at 55m to the west (x2), 149m to the west and 163m to the north west respectively.
- 4.4.3 The nearest surface water feature is recorded as being on site and refers to the pond located towards the central eastern section of the site.
- 4.4.4 The underlying bedrock geology is classified as a Secondary Aquifer - B and the superficial deposits as either a Secondary Aquifer - A or unproductive strata.
- 4.4.5 The site does not lie within a Source Protection Zone.
- 4.4.6 The site is not recorded to be at risk of flooding or extreme flooding as a result of extreme flooding from rivers without defences.

4.5 Waste and Hazardous Substances

- 4.5.1 There is a recorded licensed waste management facility on the site itself and an additional one at 74m to the north-west. Each relates to F. E. Downes Limited for the tipping of construction demolition waste. The license status is closed for each recorded landfill.
- 4.5.2 There is one recorded historic landfill site at 131m to the south of the site again relating to F. E. Downes Limited for the tipping of industrial waste dated 1989.
- 4.5.3 A local Authority landfill site is recorded at 132m to the south of the site there are no recorded specific details.
- 4.5.4 There are two records of potentially infilled land (water) recorded at 48m and 240m to the west and south west of the site respectively. There are no specific details registered for either but they are likely to be connected with backfilled ponds which are shown on historic plans. Additionally there is a single recorded reference to potentially infilled land (Non-water) at 200m to the south of the site. This is likely to be connected to a gravel or sand pit.

4.6 Industrial Land Use

- 4.6.1 There are two recorded industrial trade directory entries within 250m of the site, both are recorded as being inactive and related to engineering services and freight forwarders located 191m to the west and 206m to the south west of the site respectively.
- 4.6.2 There are no recorded fuel station entries within 250m of the site.

4.7 Sensitive Land Use and Ecological Issues

- 4.7.1 The site does not appear to be affected by sensitive land usage or ecological issues, although it does fall within a nitrate vulnerable zone.

5.0 Geological Review

- 5.1 The site is located in an area where the British Geological Survey (BGS) indicate that bedrock geology comprising of the Mercia Mudstone Group (Mudstone) of Rhaetian – Early Triassic age is likely to underlie superficial deposits consisting of predominantly the Wolston Sand and Gravel (Sand & Gravel) of Quaternary age and on the eastern edge of the site Bosworth Clay Member (Clay & silt) of Anglian age.
- 5.2 On site ground stability hazards (collapsible ground, ground dissolution, landslide ground stability, shrinking or swelling clays and running sand) are identified as a low risk, very low risk or a non-hazard at the site. The potential for compressible ground stability hazards at the site vary across the site from no hazard to a moderate hazard.
- 5.3 The site does not lie within a radon affected area, with less than 1% of homes being above the action level. No specific radon protective measures are necessary for new residential development on this site based on this information provided by the BGS. This aspect should be confirmed with the Local Authority Building Control.
- 5.4 There is one recorded BGS recorded mineral site listed within 250m of the site it refers to the Cock Sand Pit a ceased open cast operation formerly located 145m to the south of the site.
- 5.5 The site is not within an area associated as being affected by coal mining activities.
- 5.6 A geological report is included in this report as Appendix D.

6. Site Work

- 6.1 Seven 100mm diameter boreholes (WS100 to WS700) were formed using windowless sampling techniques across the Springbourne Homes site, each to a depth of 4.00m during the initial site visit in July 2015. Combined gas and groundwater monitoring pipes were installed to depths ranging from 3.70m to 4.00m within each of the boreholes. The borehole logs are included in this report as Appendix E.
- 6.2 In addition to the boreholes referenced above, eleven trial pits (TP1 to TP11 inclusive) were excavated in July 2016 to depths ranging from of 1.15m to 3.00m below existing ground level using a JCB back-actor. The trial pit logs are included within Appendix F.
- 6.3 Fragmentary disturbed samples were recovered from all soil horizons encountered within the trial pits. Selected geo-environmental samples were also obtained from the trial pits specifically for contamination testing.
- 6.4 The positions of the trial pits and boreholes were determined by Nicholls Colton Geotechnical to provide general site coverage after taking into consideration the location of any existing underground services, to provide information specifically for the proposed new house

foundations and to review the constituents of the soils/materials within the landfill areas. The positions of the exploratory holes are shown on the appended exploratory hole location plan (Nicholls Colton Geotechnical drawing no. G16195-IR/02).

- 6.5 The samples were taken to Nicholls Colton Analytical's laboratory for further examination and testing.
- 6.6 The fieldwork was carried out on 14th July 2015 (Boreholes) and 7th July 2016 (Trial Pits).
- 6.7 Fieldwork was generally carried out in accordance with BS5930 (1999) "Code of Practice for Site Investigations", logged in accordance with BS EN ISO 14688-1:2004 and BS EN ISO 14688-2: 2004 and the work overseen by an experienced Geotechnical Engineer.

7. In Situ Testing

- 7.1 Where possible, Hand Shear Vane (HSV) testing was carried out within the cohesive soils encountered in the trial pits. The results are presented on the appropriate logs in Appendix E.
- 7.2 Gas and groundwater monitoring has been undertaken at the site on six occasions to date during 2015. The results are included as Appendix H. Groundwater samples were obtained from the wells installed within boreholes WS200, WS400 and WS500 in August 2015. See also sections 21 and 22 for further details

8. Laboratory Testing

- 8.1 The laboratory testing schedules were prepared by Nicholls Colton Geotechnical.
- 8.2 Included in this report is information taken from the results of tests undertaken in Nicholls Colton Analytical's laboratory at 7-11 Harding Street, Leicester. This is UKAS accredited testing laboratory No. 0320. The results of the laboratory tests in this report do not include all data required by the documented test procedure. However, all such data has been recorded and will be stored for six years from the date of test. This data will be issued on the client's instructions.

The following accredited test procedures were carried out:

- Natural Moisture Content
- Plastic Limit
- Liquid Limit
- Plasticity Index
- Particle Size Distribution (Sedimentation)

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

- 8.3 The geotechnical laboratory testing has been carried out in accordance with BS 1377: 1990 using calibrated equipment specified within the British Standard.
- 8.4 The geotechnical tests were carried out during the period 12th to 27th July 2016.
- 8.5 The geotechnical test results are included in this report as Appendix G.

- 8.6 In addition to the laboratory testing outlined above six soil samples were tested for the presence of a varying selection of the contaminants as listed below. The MCERTS accredited testing was all undertaken by Nicholls Colton Analytical (NCA's) (UKAS Laboratory No. 0320).

(all values 'total' unless otherwise stated)

- | | |
|----------------------------|---------------------------------------|
| • Arsenic | • Nickel |
| • Asbestos (presence of) # | • Phenols |
| • Cadmium | • Speciated Polyaromatic Hydrocarbons |
| • Chromium (total) | • Mercury |
| • Copper | • pH |
| • Lead | • TPH (Total) # |

Selected Samples only

- 8.7 A leachate sample was also additionally prepared and tested from one of the soil samples tested for the soils contamination suite listed above.
- 8.8 A single soil sample obtained from the landfill area of the site (TP4 1.00m) was tested for a Waste Acceptance Criteria (WAC) soil suite.
- 8.9 Five additional soil samples have also been tested at NCA's Laboratory specifically for a sulphate suite (in accordance with BRE Special Digest 1, 2005) as listed below.
- Sulphate (total and water soluble)
 - Sulphur (total)
 - pH
- 8.10 The contamination and sulphate testing outlined above was carried out during the period 12th to 26th July 2016.
- 8.11 The suite of contaminants was selected by Nicholls Colton Geotechnical.
- 8.12 In addition to the soils and leachate laboratory testing outlined above three groundwater samples were tested during phase one of the ground investigation in August 2015 for the presence of a varying selection of the contaminants as listed below. The MCERTS accredited testing was all undertaken by Nicholls Colton Analytical (NCA's) (UKAS Laboratory No. 0320).

(all values 'total' unless otherwise stated)

- | | |
|--------------------|---------------------------------------|
| • Arsenic | • Nickel |
| • Ammonia (as N) | • Phenols |
| • Cadmium | • Speciated Polyaromatic Hydrocarbons |
| • Chromium (total) | • Mercury |
| • Chloride | • pH |
| • Copper | • COD |
| • Lead | • BOD |

- 8.13 The soil, leachate and groundwater contamination test results are included as Appendix H.

9. General Geology and Revealed Strata

9.1 Geological sources (including the Geological Survey of Great Britain (England and Wales), Sheet 169, Coventry) indicate that the Mercia Mudstone Group (Mudstone) of Rhaetian - Early Triassic age is likely to overlie Superficial deposits consisting of predominantly Wolston Sand and Gravel of Quaternary age and on the eastern edge of the site Bosworth Clay Member (Clay & silt) of Anglian age.

9.2 The exploratory holes revealed a general downward strata succession of:

TOPSOIL/MADE GROUND	- Brown topsoil locally with fragments of brick, concrete, polythene, plastic, rubber and metal. - Orange red brown and grey mixed variably sandy gravelly locally ashy clay, locally variably clayey silty gravelly sand with varying fragments of brick, rock, slate, ceramics, polythene, plastic, metal, wood, bituminous macadam and traces of organic matter. - Brown buried topsoil (TP1, TP2, TP4 and TP11 only). - Black fragmented bituminous macadam with occasional concrete fragments (WS300 only). - Grey and brown mixed clayey silty slightly gravelly sand with traces of organic matter and wire fragments (TP1 only).
WOOLSTONE SAND AND GRAVEL	- Orange brown locally pale grey locally clayey silty locally variably gravelly SAND. - Orange and grey brown sandy SILT (WS100 & WS600 only). - Orange brown and grey brown sandy CLAY (WS300 & WS400 only).
BOSWORTH CLAY MEMBER (East end of site only)	- Orange brown and grey variably silty sandy CLAY - Red brown and grey mottled silty sandy CLAY.

10. Groundwater

- 10.1 Groundwater seepages were encountered within six of the seven boreholes during drilling operations in July 2015 at depths ranging from 1.70m (WS500) to 3.00m (WS600) borehole WS300 was dry. Groundwater levels within the monitoring wells have subsequently been found to range from 1.61m (WS400) to 2.85m (WS100). The wells within boreholes WS300 and WS600 were on each occasion found to be dry. The groundwater monitoring results are presented in Appendix I.
- 10.2 During excavation of the trial pits in July 2016 slight groundwater seepages were encountered at a depth of 2.20m within trial pit TP11. All of the remaining trial pits were dry at the time of excavation.
- 10.3 No long term monitoring of groundwater levels has been carried out as part of this investigation. It should be noted that groundwater levels may differ at times from those reported due to seasonal variations or other effects.

11. Gas

- 11.1 Gas concentrations have been obtained from the standpipe installations on six occasions to date over a period of approximately three months (July-October 2015) using portable detection equipment (Landfill Gas Analyser Model No. GA5000). A maximum level of methane of 0.3% by volume has been recorded within boreholes WS600 and WS700. A maximum level of carbon dioxide of 5.3% by volume has been recorded within borehole WS300. A full review of the gas regime is provided in section 22 of this report. The full set of gas monitoring results is included in Appendix I.

Assessment and Recommendations

12. Proposed Works

- 12.1 It is understood that consideration is being given to the building of ten new detached residential properties with six associated detached garages on the site. As part of the development a new access road will be required along with hardstanding to driveways and gardens for each property.

13. Soil Profile

13.1 *Topsoil/Made Ground*

- 13.1.1 The site is surfaced in meadow grass (overgrown at the time of trial pit excavations in July 2016) with topsoil or humic sand to a depth of generally 0.15m to 0.30m. The topsoil overlying areas of further made ground within the north eastern sector of the site was generally found to contain fragments of brick, concrete, rubber and polythene. Clayey topsoil containing fragments of brick, polythene, plastic and concrete was found to the greater depth of 0.60m within trial pit TP11 (located to the south of the Copse and pond in the central eastern area of the site). This topsoil was underlain by a further band of visually clean topsoil to a depth of 0.80m.
- 13.1.2 Underlying the topsoil, made ground consisting of variable strength soft, firm and stiff mixed orange red brown and grey locally black and ashy variably sandy gravelly clays, locally clayey silty gravelly sands with fragments of rock, brick, concrete, slate, polythene, bituminous macadam, wood, plastic, ceramics and metal with traces of organic matter was found to depths ranging from 1.10m to 1.70m (TP1, TP2, TP4, TP5, WS200 & WS400). The referenced exploratory holes are located within the north eastern sector of the site lying between the small copse located in the central eastern section of the site and the fence line at the rear of the gardens to properties along The Coppice to the north. Further bands of made ground consisting of buried topsoil or humic sand were found underlying the cohesive made ground described above at depths ranging from 1.10m to 1.90m within trial pits TP1, TP2, TP4 and WS200. These deposits are considered to be connected with the registered landfilling recorded at the site. Given the incidence of bands of buried topsoil the infilling may have taken place within a natural bowl in the former general landscape.
- 13.1.3 Similar but deeper made ground was encountered within borehole WS300 and potentially trial pit TP3 (made ground not bottomed within TP3 due to mechanical excavation in the vicinity of a live sewer) to a proven depth of 2.40m within borehole WS300 where it was underlain by further made ground consisting of fragmented bituminous macadam and concrete to a proven depth of 2.90m. It is considered that the deeper made ground within this localised area of the site is connected with both the former backfilled ditch and the backfilled sewer trench.

13.2 Woolstone Sand and Gravel

- 13.2.1 Underlying the made ground within the central, north western and south western sections of the site (TP5, TP7, TP8, TP9, TP10, TP11 and boreholes WS100, WS200, WS500, WS600 and WS700) predominantly granular soils consisting of orange and grey brown variably clayey silty sands, locally sandy silts/sandy clays were encountered to a maximum sampled depth of 4.00m. These granular soils are considered to represent the Woolstone Sand and Gravel deposits.
- 13.2.2 Based on the stability of the trial pit walls during excavation the granular soils are considered to be of a medium dense strength to depths in the range of 1.60m (TP7) to 2.50m (TP9). Below these depths the trial pit walls collapsed. The instability of the trial pit walls may however have been due to an increased moisture content rather than reduced inherent in situ strength.
- 13.2.3 Particle size analysis testing utilising the sedimentation test method was carried on two disturbed samples of the granular soils obtained from trial pit TP5 1.10m and TP7 0.80-1.00m. The test results showed the granular soils to consist of clayey very silty sand and clayey silty sand respectively. The test results are included within Appendix G and the findings reflected on the soil descriptions detailed on the trial pit logs within Appendix F.
- 13.2.4 The full depth of the Woolstone Sand and Gravel deposits has not been proven with a maximum depth of 4.00m achieved within boreholes WS100, WS200, WS400, WS500, WS600 and WS700.

13.3 Bosworth Clay Member

- 13.3.1 Underlying the made ground within the north eastern corner of the site (TP1, TP2, TP6, WS300 and WS400) mixed strength (soft, firm and stiff) orange brown and grey variably sandy gravelly clay with locally traces of organic matter and ancient roots with bands of variably clayey silty sand was encountered to a maximum sampled depth of 4.00m.
- 13.3.2 Hand Shear Vane tests were undertaken in a large mass of clay excavated at a depth of 2.50m within trial pit TP2 and within the base of TP6 at a depth of 1.10m. The mean strengths obtained were 65kPa and 68kPa respectively and representative of a stiff strength.
- 13.3.3 Two plasticity index tests have been undertaken in the laboratory on selected disturbed samples of the natural cohesive strata and the results indicate compliance with the definition of CI and CH soils (i.e. soils of an intermediate to high plasticity) after the classification system of BS 5930:1999. These deposits are considered to be of a medium volume change potential in accordance with NHBC Standards Chapter 4.2: 2014, based on the amended plasticity indices.
- 13.3.4 The full depth of the Bosworth Clay Member strata has not been proven with a maximum depth of 4.00m achieved within boreholes WS300 and WS400.

14. Excavations

- 14.1 Based on the ground conditions revealed during the fieldwork it is anticipated that where required a conventional mechanical backhoe excavator should prove suitable for excavation through the materials encountered at the site.
- 14.2 Random and potentially severe falls may be anticipated from the faces of near vertically sided unsupported excavations carried out within the made ground and particularly within the moist variably clayey silty natural sands with depth. It is recommended that where personnel are required to enter excavations, continuous support should be provided to the full depth of the excavation.
- 14.3 Excavation faces and/or any support systems provided should be continually assessed by fully trained and experienced personnel.
- 14.4 Standing groundwater levels ranging from 1.61m (WS300) to 2.85m (WS100) have been recorded in the standpipe installations within the boreholes during the monitoring period. Groundwater seepages were not encountered within any of the recently excavated trial pits apart from TP11 where slight seepages were encountered at a depth of 2.20m.
- 14.5 Groundwater seepages may be encountered within excavations depending on their depth. However it is considered that should groundwater be encountered that traditional sump and pump methods of dewatering should prove adequate within excavations, if required. However, factors such as the length of time excavations are left open and the depth of excavation will affect the efficiency/viability of such a dewatering technique.

15. Foundation Assessment

- 15.1 It is understood that consideration is being given to the building of ten two storey detached houses and six associated stand-alone garages at the site.
- 15.2 The exploratory holes formed at the site have confirmed the presence of made ground to a maximum proven depth of 2.90m (WS300) within the north eastern section of the site. Made ground was also encountered to either side of proposed plots 4 and 5 at depths ranging from 1.00m (TP5 south) to 1.65m (TP2 north), to in excess of 1.50m (TP4) to the east of proposed plot 5 and to a depth of 0.80m (TP11) in the vicinity of proposed plot 6.
- 15.3 The natural cohesive soils underlying the made ground within trial pits TP2 and TP6 to the north of plots 2, 3 and 4 were each found in each case to be soft to a depth of 2.30m.
- 15.4 Laboratory testing has confirmed the Bosworth Clay Member cohesive soils (present in the north eastern sector of the site) to be of a medium volume change potential and therefore not withstanding the penetration of any made ground or softened natural cohesive soils a minimum foundation depth of 0.90m below ground level is recommended in accordance with NHBC Standards.

- 15.5 An assortment of mature deciduous trees and hedges are present at the site boundaries and within the small copse surrounding the pond towards the central eastern section of the site. Additional deepening of the foundations over and above the depths outlined above is recommended for foundations in the cohesive soils within the influencing distance of these trees/shrubs (whether to be removed or to remain) in accordance with NHBC Standards Chapter 4.2:2016 'Building near trees'. Notwithstanding the issue with trees the probability is that the foundations for proposed plots 4 and 5 and possibly 3 will require deepened trench fill foundations in the order of 2.50m due to the depth of made ground and underlying softened natural cohesive soils. It is also possible that the excavations for the footings may need to be stepped and battered back depending on the stability of the excavations walls.
- 15.6 As a guide, for 0.60 metre wide strip/trench fill footings, bearing on the natural firm and stiffer cohesive soils, an allowable net bearing pressure of 125kN/m² is considered appropriate (equivalent to 75kN/m run for strip/trench footings). These values incorporate a factor of safety of three and total settlements are not expected to exceed approximately 20mm, thereby keeping differential settlements within acceptable limits. Notwithstanding the above assessment any localised softened horizons of the exposed natural soils should be fully penetrated by the footings.
- 15.7 Elsewhere, within the north western and central sections of the site made ground was not encountered and the site is underlain by predominantly granular soils and based on the stability of the trial pit walls considered to be of a medium dense strength at the potential founding depth.
- 15.8 Following the removal of any topsoil or humic sand a minimum foundation depth 0.75m below ground level is recommended in accordance with NHBC Standards where natural granular soils are encountered. Any localised thin bands of cohesive soils should be fully penetrated by excavations for the prepared footings.
- 15.9 As a guide, for 0.60 metre wide strip footings, bearing on the medium dense variably clayey silty sands an allowable net bearing pressure of 125kN/m² is considered appropriate (equivalent to 75kN/m run for strip footings). These values incorporate a factor of safety of three and total settlements are not expected to exceed approximately 20mm, thereby keeping differential settlements within acceptable limits. Notwithstanding the above assessment any localised loose horizons of the exposed natural soils should be fully penetrated by the footings.

16. Ground Floor Slabs

- 16.1 Given the depth of made ground encountered within the north eastern section of the site, it is considered that a suspended ground floor slab should be adopted for proposed plots 4 and 5 and potentially plots 3 and 6 (cast in situ slabs should only be considered where a traditional foundation of not more than 1.50m has been adopted and the depth of material required to achieve slab level following removal of all made ground is less than 600mm). The suspended floor slabs should be constructed in general accordance with NHBC guidelines Chapter 4.2.
- 16.2 For the remaining proposed plots (1, 2, 7, 8, 9 and 10) located in the central and western half of the site ground floor slabs may potentially be constructed as cast in situ slabs assuming that any material required to achieve slab level following removal of any made ground is less than 600mm in depth – and depending upon the requirements with respect to gas protection (see below).

16.3 As noted within section 22 of this report gas protection measures as prescribed in BS 8485:2015 should be incorporated into the proposed building foundations for some or all of the new properties to be built on the site. The number of properties requiring gas protective measures will be dependent on whether the recommended construction of an in ground gas vent trench is undertaken along the common boundary between the existing Coppice development and the proposed Springbourne Homes site. It should be noted that where gas protection is required in houses, suspended slabs are usually adopted.

16.4 As described in Section 5.3, no radon protective measures are required at the site.

17. Hardstanding

17.1 A new access road will be required for the proposed development and hardstanding for each of the housing plots driveways.

17.2 Within the north eastern section of the site (which includes the eastern end of the access road and the driveways to plots 3, 4 and 5) given the considerable variance in the depth of made ground and the potential for long term differential settlement, following a reduction in ground level and proof rolling it is advised that a suitable imported granular capping layer should be placed and compacted in engineered layers prior to placing surfacing materials. In this respect the design CBR value should be taken as being <2%.

17.3 Within the central and western sections of the site following the removal of any topsoil and or humic sand and proof rolling a layer of imported granular capping layer should be placed and compacted as a base for the driveway hardstanding. A CBR value in the order of 2-5% should be applicable for the design of the estate access road.

18. Concrete Classification

18.1 The results of water soluble sulphate, total sulphate and pH testing carried out on selected soil samples taken during the investigation have been compared with the recommendations outlined in BRE Special Digest 1:2005 in order to provide guidance on below ground concrete.

18.2 The guidelines given in BRE Special Digest 1 are based upon a site classification relating to its previous site usage. It is considered appropriate due to the former landfilling within the north eastern section to define this site as a 'Brownfield location' for the purpose of concrete classification.

18.3 The results of the water soluble sulphate tests on soil samples have recorded values in the range <10mg/l to 11mg/l as SO₄. The pH values of the soil samples lie within the range 6.0 to 8.0.

18.4 On the basis of the test results obtained it is recommended that a Basic Sulphate Class of DS-1, together with an Aggressive Chemical Environment of Concrete (ACEC) of AC-1 be adopted. Mobile groundwater conditions have been assumed for this determination.

19. Drainage

- 19.1 Soil permeability tests were not undertaken as part of the ground investigation work but given the presence of predominantly granular soils underlying the majority of the site it is considered that soakaways would prove to be a **potentially** feasible drainage option. However, full scale soakaway testing in accordance with BRE Digest 365 would be required to confirm this aspect.

20. Conceptual Model

- 20.1 The historical information dating back to the late 1800's and summarised in section 3 of this report indicates that the site has existed as a section of a larger field in a semi-rural becoming urban environment pre-dating the time of the available records. The site has never been developed but localised infilling and the installation of a sewer within the north eastern section of the site has been undertaken of more recent times.
- 20.2 The environmental data summarised in section 3 of this report concludes that the bedrock geology is classified as a secondary Aquifer - B and the superficial deposits as either a secondary Aquifer - A or unproductive strata. The site does not lie within a Source Protection Zone. The nearest surface water feature is a pond which is located on the site itself.
- 20.3 The geological information summarised in section 4 of this report indicates that the bedrock geology can be anticipated to comprise the Mercia Mudstone Group (Mudstone) of Rhaetian - Early Triassic age. The overlying superficial deposits were confirmed to consist of the Bosworth Clay Member within the eastern section of the site and Woolstone Sand and Gravel in the central and western sections of the site.
- 20.4 The boreholes have confirmed made ground consisting of mixed variably sandy gravelly clays, clayey silty gravelly sands, former mixed building site rubble and bands of buried topsoil to a maximum encountered depth of 2.90m within the north eastern section of the site. The central and western sections of the site were confirmed to be undeveloped '*green field*' land with the soils encountered predominantly comprising granular superficial deposits.
- 20.5 In accordance with current regulatory guidance, a *conceptual model* has been produced for the site and its environs in order to identify potential contaminants, pathways and receptors, on the basis of the desk study information included in this report. In order to undertake the conceptual model, the *source-pathway-receptor* linkage has been considered and the assessment is summarised, as follows:

20.6 Source

- 20.6.1 The site has existed as a section of a larger field or a field predating the earliest available plans dating from the late 1880's. Localised landfilling has however been undertaken on the site during the late 1980's and early 1990's with waste accumulated from nearby building sites.
- 20.6.2 Consideration of the guidance provided in the Department for Environment, Food and Rural Affairs (DEFRA) and Environment Agency document 'R & D Publication CLR 8: Potential Contaminants for the Assessment of Land', Tables 2.3 and 2.4 (although now withdrawn this document serves as a useful guide) suggests a series of potential contaminants which may be expected to be present within the soils and/or groundwater underlying a site. The contaminants

are dependent upon the primary land usage. The following potential contaminants are therefore considered relevant to this particular site as a *screening suite*, given the historic land use:

- *Industrial Profile*

Undeveloped fields
Inert land filling operations

- *Contaminants*

Metals and semi metals: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc
Others: pH value, Asbestos
Organic chemicals: Polyaromatic Hydrocarbons, Hydrocarbons and Phenol

20.6.3 Soils at the site might be contaminated with the substances listed. These are the *source* of contamination that may affect the future development. No visual or olfactory evidence of contamination was noted at the site during the fieldwork.

20.6.4 Licensed waste (construction, demolition and dredging's) landfilling has taken place within the north eastern section of the site. The exploratory holes confirmed this aspect with made ground consisting of mixed sandy gravelly clays, clayey silty sands, mixed building site waste and buried topsoil encountered to a maximum proven depth of 2.90m (WS300) ground gases are therefore potentially considered to represent a risk to this development and are included within this assessment.

20.7 Pathway

20.7.1 It is understood that consideration is being given to the building of ten two storey detached houses and six associated stand-alone garages on the site.

20.7.2 On this basis, it is considered that the following pathways should be considered as part of the contamination assessment of the site:

- *Human Health*

Ingestion of soil directly
Ingestion of household dust
Ingestion of contaminated vegetables
Ingestion of soil attached to vegetables
Dermal contact with soil
Dermal contact with household dust
Outdoor inhalation of fugitive dust
Indoor inhalation of fugitive dust
Inhalation of vapours outside
Inhalation of vapours inside

- *Plant/Vegetable Health*

Phytoxicity

- *Surface Water/Groundwater*

Leaching
Flow (of free product)

20.7.3 The *pathways* provide a potential route for the source of contamination to reach the receptor.

20.8 Receptor

20.8.1 The following *receptors* will be present on or near the site and will therefore be potentially linked to the identified contaminant sources via the indicated pathways:

- Groundwater
- Watercourses
- Future occupiers
- Construction workers
- Building fabric
- Underground services (water pipes etc)

20.8.2 The site overlies bedrock geology classified as a Secondary Aquifer – B with the overlying superficial deposits as either a Secondary Aquifer - A or unproductive strata. The site is not located within a Source Protection Zone. There are no groundwater abstraction licences recorded within 250m of the site. The nearest surface water feature is a pond located on the site itself.

21. Soil Contamination Assessment

21.1 A total of six individual soil samples obtained from the trial pits during this investigation have been tested to determine the presence, if any, of some or all of various scheduled potential contaminants. Five of the samples targeted the made ground, four consisting of mixed variable sandy gravelly clay and building site waste (TP1 0.30m, TP2 0.30m, TP4 1.00m and TP5 0.80m) and one of clayey topsoil with mixed building site waste (TP11 0.30m). A single sample of the topsoil (TP7 0.10m) was also tested. Four of the made ground samples were also screened for the presence of asbestos. The results are appended in Appendix H.

21.2 Guidance published by Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) has been utilised to review the results –

Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

21.3 The LQM/CIEH S4ULs ('Suitable For Use Level's) are derived from the Contaminated Land Exposure Assessment (CLEA) software produced the Environment Agency (version 1.06 released in October 2009).

21.4 The S4ULs supersede the previously published LQM/CIEH GACs (2009).

- 21.5 S4ULs are based upon the concept of either 'tolerable' risk (where the relevant health criteria value is a tolerable daily intake), or 'minimal' risk (where the health criteria is an index dose). This is consistent with the previous GACs, and also the SGVs previously published by the Environment Agency.
- 21.6 Where S4ULs are referred to and reproduced in this report, it is acknowledged that this is done with the permission of Land Quality Management Limited. **It should be noted that Nicholls Colton Group's unique LQM/CIEH publication number is S4UL3157.**
- 21.7 DEFRA has recently published a parallel set of new assessment criteria (Category 4 Screening Levels) for a very limited number of contaminants. C4SLs are based upon the concept of a 'low' risk (being a higher risk than 'tolerable' or 'minimal' risk), and on this basis, they are less stringent than the S4ULs published by LQM/CIEH. If appropriate, C4SLs may also be utilised in the assessment of the soils at the present site.
- 21.8 It should be noted that there is no S4UL (or former GAC) for lead; and that the SGV for lead has been withdrawn. As such, the only available authoritative published criteria for lead is the DEFRA C4SL. The C4SL for lead is considerably more conservative than the former SGV. On this basis, for lead, the C4SL is utilised in this assessment.
- 21.9 Exceedance of an S4UL or a C4SL implies that an unacceptable human health risk *may* be present, and therefore either further site specific risk assessment is required, or intervention (remedial) works are necessary.
- 21.10 S4ULs and C4SLs are set according to the proposed end use of the land. For the purpose of this report the results of the contamination test results were compared against '*Residential without plant uptake*' end use.
- 21.11 All of the individual contaminant concentrations were recorded at concentrations below the relevant S4ULs and in the case of lead the C4SL for the '*residential with plant uptake*' end use.
- 21.12 Asbestos was not detected within any of the samples screened for the presence of asbestos containing material.
- 21.13 On this basis, it is considered that specific remedial measures are unlikely to be required with respect to the protection of future occupiers and/or groundworkers from soil contamination.
- 21.14 Consultation with the local Environmental Health Department is recommended at an early stage to ensure any specific guidelines or planning requirements which they may have are fully satisfied.

22 Ground Water Assessment

- 22.1 As part of the earlier investigative works carried out on the Springbourne Homes site, samples of ground water were obtained in August 2015 from the wells installed within boreholes WS200, WS400 and WS600. The samples were analysed in Nicholls Colton Group's MCERTS accredited laboratory, and the results are included within Appendix G.
- 22.2 The results indicate that the ground water samples obtained from boreholes WS400 and WS600 are not impacted by metals or other potential contaminants / pollutants.

- 22.3 The result obtained from the sample taken from borehole WS200 indicates a slightly elevated arsenic concentration of 8ug/l (though still below EQS of 50ug/l), together with a COD of 520ug/l and a BOD of 66ug/l. The COD and BOD levels are considered to be moderately elevated (a COD level of 125ug/l and a BOD of 25ug/l may be considered as 'trigger' points). It is considered that these levels indicate a possible slight impact from sewage or something similarly organic in nature. Given the location of borehole WS200, close to the boundary of plot 5, The Coppice, it is possible that there has been a localised sewage leak from the sewer known to be present in the locality (in the garden), or it is possible that the resident of plot 5 has been depositing compost / grass cuttings etc over the fence, and this has resulted in a high organic loading in this location.
- 22.4 Overall, it is considered that there is no significant concern relating to groundwater at the site, and no remedial action in this respect is considered necessary. It may be prudent however to undertake an inspection of the sewer crossing the north eastern corner of the site, to check its integrity.

23. Gas Assessment

- 23.1 Standpipes were installed across the site area in July 2015 within boreholes WS100 to WS700 inclusive to enable gas monitoring to be undertaken. Six gas monitoring visits have been carried out to date during the period July to October 2015. It is the intention to recommence gas monitoring to obtain more current data once the existing overgrown vegetation has been cut back.
- 23.2 The results available to date (2015) confirm a maximum carbon dioxide (CO₂) value of 5.3% by volume in air and a maximum value of 0.3% for methane (CH₄). A maximum gas flow of 0.1 litres per hour has been detected.
- 23.3 Made ground has been recorded within the north eastern section of the site to a maximum depth of 2.90m (WS300). The made ground more typically to depths ranging from 1.00m to 1.60m results from a registered landfill operational in that section of the site during the late 1980's and early 1990's. The made ground encountered generally comprises mixed variably silty sandy gravelly clays and clayey silty sand mixed with variable inert building site waste resulting from nearby building sites operated by F. E. Downes Limited (no longer in existence). Some organic matter and buried topsoil were also randomly encountered interspersed amongst the buried waste materials. The natural soils underlying the made ground within the north eastern section of the site are predominantly of a cohesive nature.
- 23.4 Made ground was not encountered over the remaining more extensive central and western areas of the site where under a covering of topsoil or humic sand (typically 0.10m to 0.30m) the natural soils are typically of a granular nature.
- 23.5 Reference to CIRIA document C659, '*Assessing risks posed by hazardous ground gases to buildings*' dated 2006 has been used to assess the potential risk with respect to gas at the site based on Situation B (Low rise housing with gardens). Gas concentrations and borehole flow rates are used to define a characteristic situation for the site based on the limiting borehole gas volume flow for methane and carbon dioxide. The limiting borehole gas volume flow is referred to as the Gas Screening Value (GSV).
- 23.6 The report recommends that the GSV is calculated using the maximum flow rate reading and is carried out for both methane and carbon dioxide with the worst case value adopted.

- 23.7 Based on the data obtained to date, a preliminary assessment adopting the worst case carbon dioxide concentration of 5.3% derives a Gas Screening Value of 0.0053 l/hr CO₂ and for methane a worst case concentration of 0.3% a gas screening Value of 0.0003 these figure utilise a minimum gas flow rate of 0.1 litres per hour (a present worst case scenario).
- 23.8 Reference to CIRIA document C659 table 8.7 suggests the site may initially be categorised as 'Green' under the NHBC traffic light classification for low rise housing with gardens. However, due to carbon dioxide levels regularly exceeding 5% within borehole WS300, approaching 5% within boreholes WS200 and WS400 and given the existence of the landfill within the north eastern section of the site it is recommended that the site categorisation be increased to 'Amber 1'; therefore necessitating gas protection measures as prescribed in BS 8485:2015 to be incorporated into the proposed building foundations. Typically this would include for a low gas permeable membrane within the floor slab construction and ventilation of the sub floor void.
- 23.9 A letter report was compiled by NCG in October 2015 for Springbourne Homes following stage one of the ground investigations which was primarily undertaken to assess the **then** current gas regime at the site. The report suggested that there was an opportunity to include with the planning application for the new housing development, works to reduce the risk of further ground gas ingress, on both the existing Coppice site to the north and on the proposed new site.
- 23.10 Springbourne Homes had indicated that they were willing to construct an in-ground gas venting trench along the common boundary of the two sites. This would create a preferential pathway for gases within the ground, providing a means of controlled escape of gases to atmosphere. Rather than migrating towards the houses at The Coppice, ground gases instead would have a tendency to migrate to the vent trench.
- 23.11 It is suggested that such a trench be 3.00m deep, and filled with a single size stone. At surface, the trench should be capped off with rock gabion baskets, protruding some 150mmm above ground level. This will facilitate venting, whilst ensuring that the system cannot become obstructed and clogged over time with leaves and detritus. It is recommended that the trench be constructed along the entire common boundary of The Coppice and the proposed Springbourne Homes site. In addition, it is recommended that a return of some 20m be constructed at the north- western corner of the Springbourne Homes site, in order to further protect the existing housing located in this area.
- 23.12 It is suggested that in the event that such a trench is constructed, only new housing located within 25m of The Coppice and the north-east boundary would require Amber 1 gas protection (ie/ plots 1-5 inclusive). All other proposed new plots could be constructed without gas protection ('Green' classification).
- 23.13 Notwithstanding the benefit to be provided for the proposed new development, it is considered that construction of an in-ground venting trench as described above should result in a reduction of risk to the existing residents in plots 3, 4 and 5 at The Coppice, from 'tolerable' to 'low'. The proposed new development therefore represents an opportunity to reduce the risk to the existing residents, without the need to actively involve them or disturb their properties. The Environment Agency and Local Authority Health Department is likely to be supportive of this proposal and it is likely to be viewed as a very positive reason to grant planning permission.

- 23.14 An updated assessment of the gas regime utilising current gas monitoring data has not been possible as the field has become overgrown and the gas monitoring stations covered in vegetation. It is recommended that the field is mown and a metal detector is utilised to re-locate the metal covers to the gas wells.

24. Summary and Conclusions

- 24.1 The exploratory holes have confirmed the presence of made ground within the north-eastern section of the site to a maximum depth of 2.90m but more typically to a depth of 1.60m to 2.00m. The made ground is locally underlain by soft natural cohesive soils to a depth of around 2.30m within the same area of the site. Consequently it is considered that the foundations for proposed plots 3 and 4 and potentially 5 will need to be formed in deepened trench fill construction.
- 24.2 Within the remaining central and western sections of the site medium dense natural granular soils have been encountered from shallow depth and foundations consisting of traditional strip footings should be suitable for the remaining proposed plots.
- 24.3 On the basis of the soil contamination assessment undertaken it is considered that no remedial measures are necessary with respect to the protection of future occupiers.
- 24.4 It is recommended that gas protection measures as prescribed in BS 8485:2015 be incorporated into the proposed building foundations for some or all of the proposed plots at the site. The number of properties requiring gas protective measures will be dependent on the potential construction of a gas vent trench at the common boundary between the existing Coppice development and the proposed Springbourne homes site. The construction of such a trench is encouraged and would be of considerable benefit to the existing residents at The Coppice – and is more likely to result in a positive outcome for the current application.
- 24.5 No specific radon protective measures are considered necessary for any redevelopment of this site based on this information provided by the BGS. This aspect should be confirmed with the Local Authority Building Control.
- 24.6 Soil permeability tests were not undertaken as part of the ground investigation work but given the predominantly granular nature of the natural soils underlying the site it is considered that if required soakaways may prove to be a feasible drainage option. Full scale soakaway testing in accordance with BRE Digest 365 would be required to confirm this aspect.

APPENDIX A

2015 Site Gas Regime Letter Report (issued Feb 2016)

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8th February 2016

For the attention of Adrian Burr

Re: Proposed Residential Development, Elmtree Drive, Burbage

Dear Adrian,

As instructed, we have carried out an assessment of the existing ground gas regime at the above site. We have also carried out a review of the previous works which were carried out (by ourselves) on behalf of F.E Downes Ltd, for the properties which they constructed at 'The Coppice'. We outline our various findings below.

Introduction

Springbourne Homes propose to construct a number of new houses at the site as shown on the attached drawing. It has been brought to their attention that the land adjacent to the north-west boundary has previously been the subject of concerns relating to ground gases, and that these concerns potentially affect the Springbourne Homes site also. The concerns have been raised by both the Environment Agency (EA) and the Local Authority Environmental Health Department (EHO).

The land adjacent to the north-west boundary of the site was developed for residential use by F.E. Downes Ltd (FED), during the 1990s and 2000s. The geo-environmental consultants employed by FED were Nicholls Colton Geotechnical (now Nicholls Colton Group).

Nicholls Colton Group (NCG) undertook various investigations at the FED site, and provided a series of reports for FED, EHO and EA. In 1999, following a period of significant concern raised by EHO and EA, NCG issued a comprehensive report relating to ground gas, titled *Interim Report on a Landfill Gas Survey at The Coppice, Off Elm Tree Drive, Burbage, Leicestershire*. That report provided a risk assessment for each of the houses that FED had constructed at the site.

The conclusions of the 1999 report were accepted by EHO and EA, although concerns remained that the level of risk for some properties was higher than would have been preferred – 'tolerable' risk being identified, rather than 'minimal'. Both EA and EHO required gas monitoring to continue for the foreseeable future. FED was reluctant to do this, and as a result, NCG undertook only ad hoc monitoring over the ensuing years.

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Springbourne Homes recently approached and subsequently appointed Nicholls Colton Group to carry out a review of the various works carried out at the FED site; to carry out an investigation of the gas regime at the proposed new site, and to provide recommendations as to the requirements if any for ground gas protection in the new development.

It should be noted that two of the original NCG staff involved with the FED investigations and the compilation of the 1999 report, are still employed at NCG. Mr Neil Birchenough was the site engineer, and carried out much of the gas monitoring and liaison with the house owners. He has carried out the recent gas monitoring on the Springbourne Homes site. Mr Alex Warwick was the senior geotechnical engineer and principal author of the 1999 report. He has carried out the current review of the original report and is the author of this report.

This report sets out the various findings.

Review of original FED works and the NCG 1999 Report

FED owned the land to the north-west of the Springbourne Homes site (hereinafter referred to as 'The Coppice'), and also the Springbourne Homes site itself.

The Coppice site included a ditchline which was some 3.00m deep and which cut across the Coppice land in a roughly west – east direction (running through the present day gardens), to the south – east corner of the site and then running south east along the eastern boundary of the Springbourne Homes site. FED infilled this ditch with various soils, to create a platform upon which new housing could be constructed. House construction commenced during the period of routine gas monitoring. The infilling extended to the ditch in the present day Springbourne Homes site.

Unfortunately, the gas monitoring demonstrated that the infill materials (and/or possibly original ditch materials), were emitting methane and carbon dioxide gases. In some cases, the concentrations of gases were very high. Despite this, FED continued to construct the houses – before the gas regime was fully understood and before recommendations could be made as to the potential need for gas protection to be incorporated into the house construction.

FED constructed six plots which caused concern – plots 3, 4, 5, 10, 11 and 12. These are shown on the attached drawing .

Plots 3, 4, and 5 were constructed on deepened trench fill foundations, penetrating the made ground fully. No gas protection was incorporated into the house construction.

Plots 10, 11 and 12 were constructed on deepened trench fill foundations, penetrating the made ground fully. Gas protection *was* incorporated into the house construction for these plots – comprising a gas proof barrier beneath the floor slab and a granular venting trench around the periphery of the structure.

Gas monitoring showed low levels of gas in the gardens of plots 3, 4 and 10. However, some moderate and high concentrations of gas were found in plot 5. In the gardens of plots 11 and 12, high concentrations of gas were found. Flow rates in all cases were consistently negligible.

The 1999 report concluded thus –

*It is considered that there is **no immediate threat** to the safety of residents with respect to landfill gas in any of the properties constructed at 'The Coppice'.*

*For residents at **Plots 10, 11 and 12**, it is considered that the long term risk of gas ingress to the current structures is **extremely low**, and therefore there is **no unacceptable risk to the safety of the residents**.*

*For the residents of **Plots 3, 4 and 5**, it is considered that there is a **low risk of long term gas ingress**. Although the risk is increased, it is considered that the absolute level of risk is of a magnitude that **does not demand immediate action to safeguard the residents**. Furthermore, it is considered that the risk to these residents in the longer term is **tolerable**.*

It is recommended that all future extensions to Plots 3, 4, 5, 10, 11 or 12, incorporate specific gas protection systems. This should therefore form part of any future Planning Permission granted in respect of these properties.

It is considered that sheds, greenhouses and similar garden structures are generally unlikely to be at significant risk, given the current gas regime at the site.

It is recommended that routine gas monitoring, including flow measurements, be continued for the foreseeable future. This is to ensure that the gas regime does not alter in a manner that is unexpected, and to maintain confidence in the current assessment of risk.

At the time of issue of the 1999 report, there was considerable discussion between the EA, EHO, NCG and FED about the conclusions. In particular, there was concern from the EA that a *tolerable* level of risk was unsatisfactory at best and unacceptable at worst.

It was eventually agreed that the report was acceptable, but that monitoring for gas needed to continue for the foreseeable future. Over the years, two subsequent gas reports were issued to the EA by NCG, each of which provided an update on the gas regime. No significant changes occurred. The last such report was issued circa 2005.

FED was reluctant to pay for on-going gas monitoring, and considered it to be unnecessary. It also appeared that the home-owners themselves were unwilling for the monitoring to continue, and they did not seem to be concerned about the situation at all. Eventually, the monitoring ceased altogether (circa 2005). Between then and July 2015 (when Springbourne Homes contacted the writer), NCG had no involvement with the site.

It is understood that FED ceased trading circa 2009.

Current Gas Regime at the FED Site

As part of the present-day appraisal of the site, Springbourne Homes sought permission from existing residents, for NCG to re-enter the garden areas of properties at The Coppice, in order to measure the gases present in the original FED borehole installations (assuming these could be found).

Unfortunately, permission for such an exercise was not given by the home-owners. The status of the existing gas regime at The Coppice is therefore unknown.

Gas Regime on the Springbourne Homes Site

Following discussions with Springbourne Homes, it was agreed that 7 No. gas installations would be installed across the proposed new housing site. The purpose of these new installations was to ascertain the existing gas regime at the Springbourne Homes site – specifically to determine whether there was any evidence that the new housing site was in any way impacted by the presence of known gaseous materials still being present in the FED site to the north.

The locations of these installations are shown the attached drawing, together with logs of the boreholes.

Made ground was encountered in WS 200, 300 and 400, at depths of 1.20m, 2.9m and 1.0m respectively. These materials comprised generally clays with occasional brick, metal and concrete fragments and traces of organic matter. It is noteworthy that these materials are present in the area bordering the south-eastern corner of 'The Coppice' site, and adjacent to the ditch that used to be present in the area of WS400. These materials are considered to be related to the various infilling operations carried out by FED in the 1990s.

Topsoil and natural Glacial soils comprising clays and sands was encountered from surface in the remaining four boreholes, and are present below the made ground in WS 200, 300 and 400.

Gas monitoring has been carried out on six occasions, over a three month period. This has included during a period of low (less than 1000mb) and falling pressure. The gas monitoring results are attached.

The results demonstrate that there is generally no elevated ground gas present on the Springbourne Homes site. This is consistent with the nature of the soils encountered across much of the site.

In WS 200, located adjacent to the FED site, slightly elevated concentrations of carbon dioxide were encountered throughout the monitoring period. Concentrations of between about 4% and 5% VOL were encountered. The same borehole exhibited a slightly elevated level of methane on one occasion: 4% LEL (4% of the Lower Explosive Limit). This is equivalent to 0.2% gas by volume.

The flow rate on all monitoring occasions, for all boreholes (including WS 200), was found to be negligible.

Reference to CIRIA document C659, '*Assessing risks posed by hazardous ground gases to buildings*' dated 2006 has been used to assess the potential risk with respect to gas at the site based on Situation B (low rise housing with gardens). Gas concentrations and borehole flow rates are used to define a characteristic situation for the site based on the limiting borehole gas volume flow for methane and carbon dioxide. The limiting borehole gas volume flow is referred to as the Gas Screening Value (GSV).

The report recommends that the GSV is calculated using the maximum flow rate reading and is carried out for both methane and carbon dioxide with the worst case value adopted. Given the very low methane concentration found at the site, this has been ignored for the purposes of this assessment (the carbon dioxide concentration will provide a more onerous classification in this case).

Adopting the worst case carbon dioxide concentration of 5.0% together with a flow rate of 0.1 l/hr, a Gas Screening Value of 0.005 l/hr CO₂ may be derived.

Reference to CIRIA Document C659 suggests that on this basis, the site should be categorised as 'Green'. Such a classification requires no gas protection / precautions to be incorporated into new housing.

However, given that the typical carbon dioxide level in WS 200 varies between 4 and 5%, and in accordance with Table 8.7 of CIRIA document C659, consideration needs to be given to increasing the site classification by one, from 'Green' to 'Amber 1'.

There are a number of additional factors which need to be considered in this case:

1. There have been significant historical ground gas emissions at the adjacent FED site.
2. FED undertook infilling of a former ditch on both The Coppice site and the Springbourne Homes site – works which were implicated in the historical findings of ground gas at the FED site.
3. There were no indications at the time of the last gas monitoring report undertaken on behalf of FED (circa 2005) that the gas regime was markedly improving or changing.
4. There is no data available regarding the present day gas regime at The Coppice.
5. No works were ever carried out by FED which resulted in the removal or isolation of the identified gaseous materials – they remain in the gardens of plots 3, 4, 5, 10, 11 and 12 to the present day.
6. The EHO, EA and NCG, agreed that there was an elevated level of risk of gas ingress to a number of the properties at the Coppice, but that the long term risk to these residents was '*tolerable*' – being a risk level that is acceptable, but nonetheless is higher than that which would be preferred.

On the basis of the above, it is considered that there is a slightly elevated risk of gas ingress at the Springbourne Homes site. The presence of low levels of gas within WS 200 confirms the potential link between the two sites. It is therefore considered, in accordance with CIRIA C659, that the appropriate gas classification for the Springbourne Homes site, is 'Amber 1'.

Amber 1 protection requires that new housing be constructed with certain precautions taken to protect against possible gas ingress. Typically this would include a low gas permeable membrane within the floor slab construction and ventilation of the sub floor void. The gas protection measures should be designed as set out in BRE Report 414.

It should be noted that the above requires the approval and agreement of the EHO.

Additional Suggestions and Recommendations

The proposed new development is an opportunity to address the on-going risk to existing residents. It is unfortunate that access has been denied by the residents to their gardens, which means that the status of the current gas regime cannot be identified.

It is of note that despite the apparent lack of concern of the existing residents of The Coppice, they have in some cases been living with an elevated risk of gas ingress into their homes. This is a situation which has historically been of concern to EHO and EA, albeit they recognise that the risk is '*tolerable*', as assessed by NCG.

With the demise of FED in 2009, there is no longer a clear and simple way in which EHO and EA can continue to address any on-going concerns they may have about the site.

With the current proposal to construct new housing on the land to the south of The Coppice, there is now an opportunity to reduce the risk of ground gas ingress further, on both The Coppice and on the new site. Springbourne Homes have indicated that they are willing to construct an in-ground gas venting trench along the common boundary of the two sites. This would create a preferential pathway for gases within the ground, providing a means of controlled escape of gases to atmosphere. Rather than migrating towards the houses at The Coppice, ground gases instead would have a tendency to migrate to the vent trench.

It is suggested that such a trench be 3.00m deep, and filled with a single size stone. At surface, the trench should be capped off with rock gabion baskets, protruding some 150mm above ground level. This will facilitate venting, whilst ensuring that the system cannot become obstructed and clogged over time with leaves and detritus.

It is recommended that the trench be constructed along the entire common boundary of The Coppice and the Springbourne Homes site. In addition, it is recommended that a return of some 20m be constructed at the north west corner of the Springbourne Homes site, in order to further protect the existing housing located in this area.

It is suggested that in the event that such a trench is constructed, only new housing located within 25m of The Coppice and the north-east boundary would require Amber 1 gas protection. All other new plots could be constructed without gas protection ('Green' classification).

It is considered that construction of an in-ground venting trench as described above should result in a reduction of risk to the existing residents in plots 3, 4 and 5 at The Coppice, from '*tolerable*' to '*low*'.

Given the historical concerns that have been raised regarding the safety of the existing residents at The Coppice, it is strongly recommended that construction of the vent trench as described above, be undertaken. The proposed new development represents an opportunity to reduce the risk to the existing residents, without the need to actively involve them or disturb their properties.

It should be noted that in the event that an in-ground gas vent trench is not constructed at the boundary between 'The Coppice' and the land to the south east, there will remain an on-going elevated risk of gas ingress to the existing properties at 'The Coppice'. This risk will continue for the foreseeable future. Whilst the level of risk to the existing residents is 'tolerable', this site nevertheless continues to be of concern to the EHO and EA.

Result of Water Analysis

As part of the investigative works carried out on the Springbourne Homes site, samples of water were obtained from WS 200, 400 and 600. The samples were analysed in Nicholls Colton Group's MCERTS accredited laboratory, and the results are attached.

The results indicate that the waters at the site in WS 400 and WS 600 are not impacted by metals or other potential contaminants / pollutants.

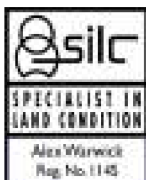
The result obtained from WS 200 indicates a slightly elevated arsenic concentration of 8ug/l (though still below EQS of 50ug/l), together with a COD of 520ug/l and a BOD of 66ug/l. The COD and BOD levels are considered to be moderately elevated (a COD level of 125ug/l and a BOD of 25ug/l may be considered as 'trigger' points).

It is considered that the water results in WS 200 indicate an impact from sewage or something similarly organic in nature. Given the location of WS 200, close to the boundary of plot 5, Elmtree Drive, it is possible that there has been a localised sewage leak from the sewer known to be present in the locality (in the garden), or it is possible that the resident of plot 5 has been depositing compost / grass cuttings etc over the fence, and this has resulted in a high organic loading in this location.

Overall, it is considered that there is no significant concern relating to groundwater at the site, and no remedial action in this respect is considered necessary. It may be prudent however to undertake an inspection of the sewer at this location, to check its integrity.



A Warwick
BEng CEng MICE SiLC
Managing Director
Nicholls Colton Group





 Window Sample Borehole

NICHOLLS COLTON GEOTECHNICAL
7-11 Harding Street
Leicester LE1 4DH

Client:
Springbourne Homes Limited.

Project:
Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

Drawing No:
G15147-IR/02

Title:
Exploratory Hole Location Plan.

Date:
October 2015

FIGURE 3.

LOCATION OF PROPOSED
FUTURE MONITORING INSTALLATIONS
(includes currently operable and replacement
installations).
GOS110

- F ● Alphabet = NCP Window Sample Holes
- 1 ● No's = Surviving F.E Downes Installations
- 5+ No's = Destroyed F.E Downes Installations

NICHOLLS COLTON GEOTECHNICAL

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Client: F.E DOWNES LTD

Project: The Coppice, Off Elm Tree Drive, Burbage, Hinckley,
Leicestershire

Title: Exploratory Hole Location Plan

Scale: 1:500

Date: December 1999

Dr'g No: G00009/02



BOREHOLE RECORD - WS100

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.15	Overgrown turf over brown TOPSOIL with many roots.		
						Orange brown silty slightly gravelly fine SAND (gravel is medium to coarse sub-angular to sub-rounded flint and quartz).		
					0.70	Orange locally clayey silty fine to medium SAND with rare coarse sub-rounded quartz gravel.		
						. . . becoming very clayey from 1.20m.		
					1.40	Firm orange and pale grey sandy CLAY.		
					1.60	Orange brown locally pale grey clayey silty fine to coarse SAND.		
					2.30	Very moist orange brown silty fine to coarse SAND.		
					3.50	Grey brown sandy SILT. . . . borehole squeezed in to 3.70m.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.80m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 0.70m) installed to 3.70m.

BOREHOLE RECORD - WS200

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.17	MADE GROUND - overgrown turf over brown topsoil with occasional polythene fragments and many roots.		
					0.55	MADE GROUND - orange brown silty gravelly fine to medium sand with occasional concrete fragments and roots (gravel is fine to coarse angular to sub-rounded flint and quartz).		
					0.70			
					0.90	MADE GROUND - orange brown silty gravelly fine to medium sand (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					1.20			
					1.70	MADE GROUND - stiff orange brown locally grey sandy slightly gravelly clay with occasional fine roots (gravel is fine angular to sub-rounded sandstone, quartz and siltstone).		
					1.90	MADE GROUND - grey brown silty humic fine sand with occasional fine brick fragments and root hairs.		
						Firm orange brown sandy CLAY with occasional roots. . . . becoming soft from 1.60m.		
						Firm grey locally orange brown silty sandy CLAY.		
						Moist grey locally orange brown clayey silty fine to medium SAND with occasional ancient roots.		
					3.70	Orange brown silty fine to medium SAND. . . . borehole squeezed in to 3.70m.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.50m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 0.70m) installed to 3.70m.

BOREHOLE RECORD - WS300

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	MADE GROUND - overgrown turf over brown topsoil with occasional plastic fragments and roots.		
					0.75	MADE GROUND - brown clayey silty fine to medium sand and fine to coarse angular to sub-rounded flint and quartz gravel with many concrete, brick and rock fragments.		
					1.30	MADE GROUND - stiff orange brown and pale grey sandy slightly gravelly clay with occasional brick fragments (gravel is fine angular to sub-rounded quartz and siltstone).		
					2.40	MADE GROUND - stiff grey and brown locally black and ashy sandy slightly gravelly clay with occasional brick fragments, traces of organic matter and a slight organic odour (gravel is fine to coarse angular to sub-rounded quartz, siltstone and sandstone).		
					2.90	MADE GROUND - black fragmented bituminous macadam with occasional concrete fragments.		
					3.20	Soft orange brown and grey sandy CLAY with traces of organic matter.		
					3.70	Moist grey brown clayey silty slightly gravelly fine to medium SAND (gravel is medium to coarse sub-rounded quartz).		
					4.00	Soft grey brown sandy slightly gravelly CLAY (gravel is coarse sub-angular to sub-rounded quartz). ... borehole squeezed in to 3.85m. <i>End of Borehole at 4.00 m</i>		
Sheet 1 of 1								

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- No groundwater seepages were encountered during window sampling operations.
- Gas monitoring pipe (slotted from 0.85m) installed to 3.85m.

BOREHOLE RECORD - WS400

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	MADE GROUND - overgrown turf over brown topsoil with a concrete boulder and many roots.		
					0.55	MADE GROUND - brown clayey silty gravelly fine to medium sand with occasional fragments of metal, ceramic, concrete and plastic (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					0.70			
					1.00	MADE GROUND - brown clayey silty slightly gravelly fine sand with occasional concrete and ceramic fragments (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					1.70	Firm orange brown locally pale grey sandy slightly gravelly CLAY (gravel is fine sub-angular siltstone).		
					1.90	Stiff orange brown and grey mottled slightly sandy CLAY with occasional carbonaceous fragments and root hairs. ... becoming firm from 1.50m. ... becoming soft from 1.60m.		
						Orange brown and grey clayey silty fine to medium SAND.		
						Orange brown silty fine to coarse SAND.		
					3.80	Firm orange brown and grey sandy CLAY. ... becoming stiff from 3.90m.		
					4.00			
						End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.00m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 0.80m) installed to 3.80m.

BOREHOLE RECORD - WS500

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.17	Turf over brown TOPSOIL.		
					0.70	Orange brown silty fine to medium SAND with rare medium to coarse sub-angular to sub-rounded quartz gravel. . . . becoming clayey from 0.50m.		
						Orange brown and pale grey silty fine to coarse SAND. . . . becoming moist from 1.30m. . . . becoming orange brown locally grey from 1.60m.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 1.70m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.



Land Off The Coppice, Burbage, Leicestershire.

Project No.:
G15147

Scale: 1:30

1. Hand dug starter pit to 1.20m to check for services.
2. Groundwater seepages were encountered at 3.00m (casing at 2.00m) during window sampling operations.
3. Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.

BOREHOLE RECORD - WS700

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	Turf over brown TOPSOIL with many roots.		
						Orange brown silty slightly gravelly fine to medium SAND (gravel is medium to coarse sub-angular to sub-rounded quartz). . . . reducing to rare gravel only from 0.50m.		
					1.00	Moist orange brown locally pale grey clayey silty fine to coarse SAND.		
					1.70	Moist orange brown silty fine to coarse SAND.		
					2.80	Grey brown silty fine to medium SAND.		
					3.40	Orange brown silty fine to medium SAND.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.80m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS100	Time		8.45	9.00	10.50	12.20	12.35	12.38
	Barometric Pressure (mb)		1001	1003	1004	987	1024	993
	Relative Pressure (mb)		-7.82	-5.81	-0.03	-0.02	-0.02	0.00
	Flow (l/hr)	Peak	0.0	0.0	-0.3	-0.0	0.1	0.0
		Steady	0.0	0.0	-0.3	-0.0	0.1	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.3	0.4	0.4	0.3	0.2	0.4
		Steady	0.3	0.4	0.4	0.3	0.2	0.4
	Oxygen (% v/v)	Min	20.9	20.7	20.6	20.9	20.9	21.0
		Steady	20.9	20.7	20.6	20.9	20.9	21.0
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
WS200	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		2.75	2.78	2.79	2.78	2.84	2.85
	Pipe depth (m bgl)		3.00	3.00	3.00	3.00	2.99	3.00
	Time		8.50	9.05	11.00	12.31	14.22	12.50
	Barometric Pressure (mb)		1001	1003	1004	988	1025	990
	Relative Pressure (mb)		-9.01	-0.46	0.03	-0.03	-0.03	-0.03
	Flow (l/hr)	Peak	0.0	0.0	0.0	0.1	0.0	0.0
		Steady	0.0	0.0	0.0	0.1	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.1	0.0	0.0	0.2	0.0
		Steady	0.0	0.0	0.0	0.0	0.2	0.0
	Methane (% LEL)	Peak	0.0	2.0	0.0	0.0	4.0	0.0
		Steady	0.0	0.0	0.0	0.0	4.0	0.0
	Carbon Dioxide (% v/v)	Peak	4.6	4.7	4.9	4.0	3.8	3.6
		Steady	4.6	4.7	4.9	4.0	3.8	3.6
	Oxygen (% v/v)	Min	17.9	17.5	16.3	18.0	18.0	17.9
		Steady	17.9	17.5	16.3	18.0	18.0	17.9
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	1
		Steady	0	0	0	0	0	1
	Groundwater Level (m bgl)		1.92	1.92	1.92	1.92	1.89	1.98
	Pipe depth (m bgl)		2.69	2.63	2.63	2.63	3.31	3.28

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS300	Time		8.55	9.10	11.10	12.44	14.12	13.00
	Barometric Pressure (mb)		1001	1003	1005	988	1023	994
	Relative Pressure (mb)		0.03	-8.42	-0.07	-0.02	0.00	0.00
	Flow (l/hr)	Peak	0.0	0.0	-0.7	0.0	0.0	0.0
		Steady	0.0	0.0	-0.7	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	4.3	5.1	5.3	5.1	5.2	4.7
		Steady	4.3	5.1	5.3	5.1	5.2	4.7
	Oxygen (% v/v)	Min	17.6	16.7	15.8	16.1	16.7	16.8
		Steady	17.6	16.7	15.8	16.1	16.7	16.8
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
WS400	Carbon Monoxide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		Dry	Dry	Dry	Dry	Dry	Dry
	Pipe depth (m bgl)		3.64	3.63	3.63	3.63	3.64	3.64
	Time		9.00	9.15	11.20	12.56	14.00	13.15
	Barometric Pressure (mb)		1001	1003	1005	988	1024	995
	Relative Pressure (mb)		-6.79	-8.56	0.09	0.02	0.01	-0.03
	Flow (l/hr)	Peak	0.0	0.0	-0.8	0.0	0.0	0.0
		Steady	0.0	0.0	-0.8	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	3.2	4.1	4.4	4.8	4.4	4.1
		Steady	3.2	4.1	4.4	4.8	4.4	4.1
WS400	Oxygen (% v/v)	Min	18.7	17.4	16.8	17.4	17.2	17.6
		Steady	18.7	17.4	16.8	17.4	17.2	17.6
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	1	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		1.88	1.91	1.82	1.84	1.74	1.61
	Pipe depth (m bgl)		2.62	2.60	3.00	2.97	2.96	2.97

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS500	Time		9.05	9.20	11.30	13.10	13.54	13.35
	Barometric Pressure (mb)		1001	1003	1005	988	1025	994
	Relative Pressure (mb)		-5.40	-0.36	0.02	-0.02	0.07	-0.07
	Flow (l/hr)	Peak	0.0	0.0	-0.7	-0.1	0.0	-0.0
		Steady	0.0	0.0	-0.7	-0.1	0.0	-0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.8	1.7	1.6	1.8	2.1	2.4
		Steady	0.8	1.7	1.6	1.8	2.1	2.4
	Oxygen (% v/v)	Min	20.5	19.3	19.5	19.8	19.3	19.4
		Steady	20.5	19.3	19.5	19.8	19.3	19.4
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
WS600	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		1.63	1.65	1.67	1.67	1.72	1.73
	Pipe depth (m bgl)		2.27	2.23	2.43	2.45	2.43	2.40
	Time		9.10	9.30	11.40	13.30	13.43	13.55
	Barometric Pressure (mb)		1001	1003	1005	988	1026	994
	Relative Pressure (mb)		-5.07	-5.48	0.00	-0.02	0.02	-0.07
	Flow (l/hr)	Peak	0.0	0.0	-0.0	0.0	0.0	0.0
		Steady	0.0	0.0	-0.0	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.3	0.0
		Steady	0.0	0.0	0.0	0.0	0.3	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	6.0	0.0
		Steady	0.0	0.0	0.0	0.0	6.0	0.0
	Carbon Dioxide (% v/v)	Peak	1.0	1.3	1.4	1.3	1.3	1.3
		Steady	1.0	1.3	1.4	1.3	1.3	1.3
	Oxygen (% v/v)	Min	20.5	19.5	19.6	20.5	20.4	20.3
		Steady	20.5	19.5	19.6	20.5	20.4	20.3
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	1	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		Dry	Dry	Dry	Dry	Dry	Dry
	Pipe depth (m bgl)		3.39	3.38	3.37	3.37	3.39	3.39

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS700	Time		9.20	9.25	11.50	13.19	13.48	13.45
	Barometric Pressure (mb)		1001	1003	1004	989	1025	994
	Relative Pressure (mb)		-5.40	-5.52	-0.03	0.02	-0.05	0.03
	Flow (l/hr)	Peak	0.0	0.0	-0.0	0.1	0.0	-0.0
		Steady	0.0	0.0	-0.0	0.1	0.0	-0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.3	0.0
		Steady	0.0	0.0	0.0	0.0	0.3	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	6.0	0.0
		Steady	0.0	0.0	0.0	0.0	6.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.5	0.2	0.2	0.2	0.1	0.2
		Steady	0.5	0.2	0.2	0.2	0.1	0.2
	Oxygen (% v/v)	Min	20.8	20.2	20.7	20.9	21.0	21.1
		Steady	20.8	20.2	20.7	20.9	21.0	21.1
	Hydrogen Sulphide (ppm)	Peak	0	1	1	0	0	0
		Steady	0	0	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	2	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		2.58	2.60	2.60	2.61	2.65	2.67
	Pipe depth (m bgl)		3.00	2.96	2.94	2.95	2.96	2.96
	Time							
	Barometric Pressure (mb)							
	Relative Pressure (mb)							
	Flow (l/hr)	Peak						
		Steady						
	Methane (% v/v)	Peak						
		Steady						
	Methane (% LEL)	Peak						
		Steady						
	Carbon Dioxide (% v/v)	Peak						
		Steady						
	Oxygen (% v/v)	Min						
		Steady						
	Hydrogen Sulphide (ppm)	Peak						
		Steady						
	Carbon Monoxide (ppm)	Peak						
		Steady						
	Groundwater Level (m bgl)							
	Pipe depth (m bgl)							



Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

Nicholls Colton Geotechnical
7-11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: **G15147-A/001**

Your Project Reference:	Land off The Coppice, Burbage, Leicestershire	Samples Received on:	12.08.2015
Your Order Number:	G15147-A	Testing Instruction Received:	12.08.2015
Report Issue Number:	1	Sample Tested:	12 to 20.08.2015
Samples Analysed:	3 Waters	Report issued:	20.08.2015

Signed

M. Shelbourne
Director - Operations UK & Ireland
Nicholls Colton Analytical

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples were supplied by customer.

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited



Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

G15147-A/001

Project Reference - Land off The Coppice, Burbage, Leicestershire

Analytical Test Results - NCG Water Suite

NCA Reference			15-22391	15-22392	15-22393
Client Sample Reference			W1	W2	W3
Client Sample Location			WS200	WS400	WS500
Depth (m)			1.92-2.63	1.91-2.60	1.65-2.23
Date of Sampling			10.08.2015	10.08.2015	18.08.2015
Time of Sampling			AM	AM	AM
Sample Matrix			Water	Water	Water
Determinant	Units	Accreditation			
Arsenic	(µg/l)	u	8	< 2.5	< 2.5
Cadmium	(µg/l)	u	< 2.5	< 2.5	< 2.5
Chromium (Total)	(µg/l)	u	< 2.5	< 2.5	< 2.5
Copper	(µg/l)	u	2	1	2
Lead	(µg/l)	u	1	< 1	< 1
Mercury	(µg/l)	u	< 1	< 1	< 1
Nickel	(µg/l)	u	11	< 2.5	3
Zinc	(µg/l)	u	< 1	< 1	< 1
pH	pH Units	UKAS	7.9	6.6	8.5
Phenols (Total)	(mg/l)	u	<0.1	<0.1	<0.1
Ammonia (as N)	(mg/l)	u	0.1	<0.002	<0.002
Chloride	(mg/l)	u	8.6	13	6.3
Acenaphthene	(µg/l)	u	<0.01	<0.01	<0.01
Acenaphthylene	(µg/l)	u	<0.01	<0.01	<0.01
Anthracene	(µg/l)	u	<0.01	0.01	<0.01
Benzo (a) anthracene	(µg/l)	u	<0.01	<0.01	<0.01
Benzo (a) pyrene	(µg/l)	u	<0.01	<0.01	<0.01
Benzo (b) fluoranthene	(µg/l)	u	<0.01	<0.01	<0.01
Benzo (g, h, i) perylene	(µg/l)	u	<0.01	<0.01	<0.01
Benzo (k) fluoranthene	(µg/l)	u	<0.01	<0.01	<0.01
Chrysene	(µg/l)	u	<0.01	<0.01	<0.01
Dibenzo (a,h) anthracene	(µg/l)	u	<0.01	<0.01	<0.01
Fluoranthene	(µg/l)	u	<0.01	0.03	<0.01
Fluorene	(µg/l)	u	<0.01	0.02	<0.01
Indeno (1, 2, 3,-cd) pyrene	(µg/l)	u	<0.01	<0.01	<0.01
Naphthalene	(µg/l)	u	0.13	<0.01	<0.01
Phenanthrene	(µg/l)	u	0.03	0.08	<0.01
Pyrene	(µg/l)	u	<0.01	0.02	<0.01
Total PAH (Sum of USEPA 16)	(µg/l)	u	0.30	0.27	<0.16
COD	(mg/l)	u	520	33	61
BOD	(mg/l)	u	66	5	<3



Nicholls Colton Analytical
7 - 11 Harding Street
Leicester
LE1 4DH

G15147-A/001

Project Reference - Land off The Coppice, Burbage, Leicestershire

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Water	Metals	As Received	In house method statement - MS - CL - ICP Metals Water
Water	PAH	As Received	In house method statement - MS - CL - PAH Water
Water	Phenols	As Received	In house method statement - MS - CL - Phenols (Skalar)
Water	pH	As Received	BS 1377, Part 3, 1990
Water	Chloride	As Received	In house method statement - MS - CL - Anions (Aquakem)
Water	Ammonical Nitrogen	As Received	In house method statement - MS - CL - Ammonia
Water	BOD	-	Subcontract Analysis
Water	COD	-	Subcontract Analysis

APPENDIX B

Historical O.S. Map Extracts

APPENDIX C

Environmental Data

APPENDIX D

Geology Report

APPENDIX E

Windowless Sample Borehole Logs

SYMBOLS USED IN BOREHOLE LOGS

S	-	Standard Penetration Test using Split tube sampler
C	-	Standard Penetration Test using solid steel Cone
N	-	blow count for 300 mm penetration in Standard Penetration Test, where the full 300 mm penetration could not be achieved the number of blows for a smaller depth is shown e.g. 50/150 which means 50 blows for 150mm penetration.
U	-	Undisturbed nominal 105 mm diameter sample from borehole, obtained by percussive sampling methods unless otherwise stated
(20)	-	blow count to drive U sample (in N column on log)
B	-	large (Bulk) sample of disturbed soil from borehole
D	-	small Disturbed sample of soil from borehole
SD	-	very Small Disturbed sample of soil from borehole
G	-	Environmental sample, small disturbed sample of soil from borehole (taken in amber glass jar for contamination testing)
E	-	Environmental sample, consisting of an amber glass jar and a plastic tub
W	-	Water sample (groundwater) from borehole
TCR	-	Total Core Recovery - percentage of rotary core run recovered
SCR	-	Solid Core Recovery - percentage of rotary core run recovered as intact core
RQD	-	Rock Quality Designation - percentage of rotary core run recovered as intact lengths of 100mm or more
FS	-	Fracture Spacing per core run (mm) - minimum spacing maximum spacing average spacing
FI	-	Fracture Index (number of fractures per core run)
NI	-	Non Intact

GROUNDWATER



- Water strike



- Water level

The information concerning groundwater noted on the borehole logs has been obtained (unless otherwise stated) only during the period of drilling the borehole.

To obtain complete data on groundwater conditions at any site (including fluctuations in level), observations and readings in properly constructed standpipes or piezometers are required over a period of several months. Information noted on the logs for this site therefore may be incomplete. In particular, groundwater levels either higher or lower than those found during this investigation may occur, and in some cases where no groundwater was encountered, this may be a temporary condition.

BOREHOLE RECORD - WS100

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
---------------------------------------	-------------------------------------	-------------------------------------	------------------------

Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
---------------	---------------	------------------	-------------	-------------

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.15	Overgrown turf over brown TOPSOIL with many roots.		
						Orange brown silty slightly gravelly fine SAND (gravel is medium to coarse sub-angular to sub-rounded flint and quartz).		
					0.70	Orange locally clayey silty fine to medium SAND with rare coarse sub-rounded quartz gravel.		
						. . . becoming very clayey from 1.20m.		
					1.40	Firm orange and pale grey sandy CLAY.		
					1.60	Orange brown locally pale grey clayey silty fine to coarse SAND.		
					2.30	Very moist orange brown silty fine to coarse SAND.		
					3.50	Grey brown sandy SILT. . . . borehole squeezed in to 3.70m.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.80m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 0.70m) installed to 3.70m.

BOREHOLE RECORD - WS200

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes Limited.

Boring diameter:
100 mm to 4.00m

Casing diameter:
100 mm to 2.00m

Project No.:
G15147

Logged by: NB

Ground Level:

Date: 14/07/2015

Location: -

Scale: 1:30

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.17	MADE GROUND - overgrown turf over brown topsoil with occasional polythene fragments and many roots.		
					0.55	MADE GROUND - orange brown silty gravelly fine to medium sand with occasional concrete fragments and roots (gravel is fine to coarse angular to sub-rounded flint and quartz).		
					0.70			
					0.90	MADE GROUND - orange brown silty gravelly fine to medium sand (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					1.20			
					1.70	MADE GROUND - stiff orange brown locally grey sandy slightly gravelly clay with occasional fine roots (gravel is fine angular to sub-rounded sandstone, quartz and siltstone).		
					1.90	MADE GROUND - grey brown silty humic fine sand with occasional fine brick fragments and root hairs.		
						Firm orange brown sandy CLAY with occasional roots. . . . becoming soft from 1.60m.		
						Firm grey locally orange brown silty sandy CLAY.		
						Moist grey locally orange brown clayey silty fine to medium SAND with occasional ancient roots.		
					3.70	Orange brown silty fine to medium SAND. . . . borehole squeezed in to 3.70m.		
					4.00	End of Borehole at 4.00 m		

Sheet 1 of 1

Remarks and Water Observations

1. Hand dug starter pit to 1.20m to check for services.
2. Groundwater seepages were encountered at 2.50m (casing at 2.00m) during window sampling operations.
3. Gas monitoring pipe (slotted from 0.70m) installed to 3.70m.

BOREHOLE RECORD - WS300

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
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Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
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Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	MADE GROUND - overgrown turf over brown topsoil with occasional plastic fragments and roots.		
					0.75	MADE GROUND - brown clayey silty fine to medium sand and fine to coarse angular to sub-rounded flint and quartz gravel with many concrete, brick and rock fragments.		
					1.30	MADE GROUND - stiff orange brown and pale grey sandy slightly gravelly clay with occasional brick fragments (gravel is fine angular to sub-rounded quartz and siltstone).		
					2.40	MADE GROUND - stiff grey and brown locally black and ashy sandy slightly gravelly clay with occasional brick fragments, traces of organic matter and a slight organic odour (gravel is fine to coarse angular to sub-rounded quartz, siltstone and sandstone).		
					2.90	MADE GROUND - black fragmented bituminous macadam with occasional concrete fragments.		
					3.20	Soft orange brown and grey sandy CLAY with traces of organic matter.		
					3.70	Moist grey brown clayey silty slightly gravelly fine to medium SAND (gravel is medium to coarse sub-rounded quartz).		
					4.00	Soft grey brown sandy slightly gravelly CLAY (gravel is coarse sub-angular to sub-rounded quartz).		
						... borehole squeezed in to 3.85m. <i>End of Borehole at 4.00 m</i>		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- No groundwater seepages were encountered during window sampling operations.
- Gas monitoring pipe (slotted from 0.85m) installed to 3.85m.

BOREHOLE RECORD - WS400

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
---------------------------------------	-------------------------------------	-------------------------------------	------------------------

Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
---------------	---------------	------------------	-------------	-------------

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	MADE GROUND - overgrown turf over brown topsoil with a concrete boulder and many roots.		
					0.55	MADE GROUND - brown clayey silty gravelly fine to medium sand with occasional fragments of metal, ceramic, concrete and plastic (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					0.70			
					1.00			
					1.70	MADE GROUND - brown clayey silty slightly gravelly fine sand with occasional concrete and ceramic fragments (gravel is medium to coarse angular to sub-rounded flint and quartz).		
					1.90	Firm orange brown locally pale grey sandy slightly gravelly CLAY (gravel is fine sub-angular siltstone).		
						Stiff orange brown and grey mottled slightly sandy CLAY with occasional carbonaceous fragments and root hairs.		
						. . . becoming firm from 1.50m.		
						. . . becoming soft from 1.60m.		
						Orange brown and grey clayey silty fine to medium SAND.		
						Orange brown silty fine to coarse SAND.		
					3.80	Firm orange brown and grey sandy CLAY.		
					4.00			
						. . . becoming stiff from 3.90m.		
						End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.00m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 0.80m) installed to 3.80m.

BOREHOLE RECORD - WS500

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
---------------------------------------	-------------------------------------	-------------------------------------	------------------------

Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
---------------	---------------	------------------	-------------	-------------

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.17	Turf over brown TOPSOIL.		
					0.70	Orange brown silty fine to medium SAND with rare medium to coarse sub-angular to sub-rounded quartz gravel. . . . becoming clayey from 0.50m.		
					4.00	Orange brown and pale grey silty fine to coarse SAND. . . . becoming moist from 1.30m. . . . becoming orange brown locally grey from 1.60m.		
						End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 1.70m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.

BOREHOLE RECORD - WS600

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
---------------------------------------	-------------------------------------	-------------------------------------	------------------------

Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
---------------	---------------	------------------	-------------	-------------

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.13	Turf over brown TOPSOIL.		
						Orange brown clayey silty fine to medium SAND with rare medium to coarse sub-angular to sub-rounded quartz gravel.		
					0.70	Firm orange brown and pale grey mottled sandy CLAY with occasional roots. ... becoming stiff from 1.00m.		
					1.20	Orange silty fine to coarse SAND.		
					1.35	Firm orange brown sandy CLAY.		
					1.55	Orange brown silty fine to coarse SAND. ... becoming moist from 2.30m.		
					3.60	Orange brown sandy SILT.		
					3.70	Grey brown silty fine SAND.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 3.00m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.

BOREHOLE RECORD - WS700

(Window Sampler)

Site
Land Off The Coppice, Burbage, Leicestershire.

Client Springbourne Homes Limited.	Boring diameter: 100 mm to 4.00m	Casing diameter: 100 mm to 2.00m	Project No.: G15147
---------------------------------------	-------------------------------------	-------------------------------------	------------------------

Logged by: NB	Ground Level:	Date: 14/07/2015	Location: -	Scale: 1:30
---------------	---------------	------------------	-------------	-------------

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	SPT N						
					0.20	Turf over brown TOPSOIL with many roots.		
						Orange brown silty slightly gravelly fine to medium SAND (gravel is medium to coarse sub-angular to sub-rounded quartz). . . . reducing to rare gravel only from 0.50m.		
					1.00	Moist orange brown locally pale grey clayey silty fine to coarse SAND.		
					1.70	Moist orange brown silty fine to coarse SAND.		
					2.80	Grey brown silty fine to medium SAND.		
					3.40	Orange brown silty fine to medium SAND.		
					4.00	End of Borehole at 4.00 m		

Remarks and Water Observations

- Hand dug starter pit to 1.20m to check for services.
- Groundwater seepages were encountered at 2.80m (casing at 2.00m) during window sampling operations.
- Gas monitoring pipe (slotted from 1.00m) installed to 4.00m.

APPENDIX F

Trial Pit Logs & Photographs

SYMBOLS USED IN

TRIAL PIT LOGS

SAMPLES

- G - Environmental sample, Amber Glass jar of disturbed soil for contamination testing
- J - Environmental sample, Plastic Jar samples of disturbed soil for contamination testing
- V - Environmental sample, small glass Vial samples of disturbed soil for contamination testing
- E - Environmental sample, consisting of a G, J & V sample (1 of each)
- B - large (bulk) sample of disturbed soil from trial pit
- D - small disturbed sample of soil from trial pit
- W - sample of groundwater from trial pit

TESTS

- HSV - Hand Shear Vane (the resultant number being an average of several readings and stated in kN/m² or kPa)
- CBR - California Bearing Ratio (test carried out in situ the result being a percentage)

GROUNDWATER



- Water strike



- Water level

The information concerning groundwater noted on the trial pit logs has been obtained (unless otherwise stated) only during the period of the excavation of the trial pit.

To obtain complete data on groundwater conditions at any site (including fluctuations in level), observations and readings in properly constructed standpipes or piezometers are required over a period of several months. Information noted on the logs for this site therefore may be incomplete. In particular, groundwater levels either higher or lower than those found during this investigation may occur, and in some cases where no groundwater was encountered, this may be a temporary condition.

TRIAL PIT RECORD - TP1

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
D1	0.10				0.10	MADE GROUND - overgrown grass over brown topsoil.		
E2	0.30					MADE GROUND - firm and stiff orange and red brown slightly sandy slightly gravelly clay with occasional fragments of brick, slate, polythene, small pockets of black ash and occasional rock cobbles (gravel is medium to coarse sub-angular to sub-rounded quartz).		
D3	1.20				1.10	MADE GROUND - buried topsoil.		
D4	1.40				1.25	MADE GROUND - grey and brown mixed clayey silty slightly gravelly fine to medium sand with occasional fragments of wire and traces of organic matter (gravel is fine to coarse angular to sub-rounded quartz, sandstone and siltstone).		
D5	1.70				1.65			
					1.80	Soft orange brown and grey sandy CLAY. <i>End of Trial Pit 1.80 m</i>		

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP2

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
D1	0.30	65 kPa			0.10	MADE GROUND - overgrown grass over brown clayey topsoil.		
E2	0.30				0.45	MADE GROUND - orange brown and grey brown mixed slightly sandy slightly gravelly clay with many whole bricks and fragments and occasional concrete, plastic and polythene fragments (gravel is medium to coarse sub-rounded quartz).		
E2	0.80					MADE GROUND - firm orange and red brown sandy clay.		
D3	1.30-1.40				1.30	MADE GROUND - buried topsoil with pockets of soft brown sandy clay.		
					1.65	Soft orange brown and grey silty sandy CLAY.		
D4	2.00				2.30	Firm red brown and grey mottled silty sandy CLAY.		
HSV	2.50							
D5	2.70				2.80	End of Trial Pit 2.80 m		

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP3

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

[illegible]

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP4

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 2.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

[illegible]

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP5

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 2.50m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

[illegible]

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP6

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

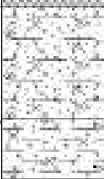
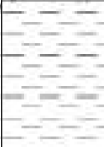
Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill	
Ref:	Depth (m)	Result							
E1	0.10	68 kPa			0.33	MADE GROUND - overgrown grass over brown topsoil with occasional fragments of brick.			
D2	0.50					(Medium dense) orange brown clayey silty slightly gravelly fine to medium SAND (gravel is medium to coarse sub-angular to sub-rounded quartz). ... the density of the sand is based on a visual assessment and the stability of the trial pit walls and not in situ testing.			
D3	0.70-0.90								0.70
HSV D4	1.10 1.10					0.90	Stiff orange brown and pale grey mottled sandy slightly gravelly CLAY (gravel is coarse sub-rounded quartz).		
	1.40					Stiff orange brown and pale grey mottled CLAY.			
D5	1.70					2.30	Soft orange brown and pale grey silty CLAY with pockets of moist silty fine to medium sand.		
							(Medium dense) moist grey locally orange brown clayey silty fine to medium SAND. ... the density of the sand is based on a visual assessment and the stability of the trial pit walls and not in situ testing.		
D6	2.50	3.00	End of Trial Pit 3.00 m						

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP7

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
E1	0.10					Overgrown grass over brown sandy TOPSOIL.		
B2	0.30-0.50				0.25	Orange brown clayey silty fine to medium SAND with rare coarse sub-rounded quartz gravel.		
D3	0.50-0.80				0.50	Stiff orange brown locally grey sandy CLAY.		
D4	0.80-1.00				0.80	(Medium dense) orange brown clayey silty fine to coarse SAND.		
					1.20	. . . the density of the sand from 0.80m to 1.60m is based on a visual assessment and the stability of the trial pit walls and not in situ testing.		
					1.60	(Medium dense) orange brown and grey clayey silty fine to coarse SAND with many pockets of soft and firm sandy clay.		
D5	1.80					(Possibly Loose) moist orange brown silty fine to coarse SAND.		
						. . . the density of the sand is assessed to possibly be loose based on the collapse of the trial pit walls and not in situ testing.		
D6	2.60							
					2.90	End of Trial Pit 3.00 m		

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls collapsed from a depth of 1.90m when a maximum excavation depth of 2.90m had been achieved.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP8

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
E1	0.10				0.20	Overgrown grass over orange brown humic silty fine to medium SAND.		
D2	0.60					(Medium dense) orange brown locally clayey silty slightly gravelly fine to coarse SAND (gravel is coarse sub-rounded quartz). ... the density of the sand is based on a visual assessment and the stability of the trial pit walls and not in situ testing.		
D3	1.20							
D4	1.50				1.40	Soft orange brown and pale grey mottled silty sandy CLAY with pockets of clayey silty fine to coarse sand.		
D5	2.20				1.90	(Possibly Loose) moist orange brown clayey silty fine to coarse SAND. ... the density of the sand is assessed to possibly be loose based on the collapse of the trial pit walls and not in situ testing.		
					3.00	End of Trial Pit 3.00 m		

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls collapsed from a depth of 1.60m when a maximum excavation depth of 3.00m had been achieved.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP9

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

[illegible]

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls remained stable during excavation of the trial pit.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP10

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
E1	0.00-0.10				0.35	Turf and overgrown vegetation over brown humic silty fine to medium SAND.		
D2	1.00				1.40	(Medium dense) orange brown silty slightly gravelly fine to coarse SAND (gravel is medium to coarse sub-angular to sub-rounded quartz). ... the density of the sand is based on a visual assessment and the stability of the trial pit walls and not in situ testing. ... becoming locally dark brown from 0.90m.		
D3	1.50				1.90	(Medium dense) orange and dark brown clayey silty fine to coarse SAND with pockets of soft sandy clay.		
D4	2.00				2.50	Soft locally firm orange brown and pale grey silty sandy CLAY with many pockets of clayey silty sand.		
D5	2.90				3.00	(Possibly Loose) moist orange brown silty fine to coarse SAND. ... the density of the sand is assessed to possibly be loose based on the collapse of the trial pit walls and not in situ testing.		
						<i>End of Trial Pit 3.00 m</i>		

Sheet 1 of 1

Remarks and Water Observations

1. No groundwater seepages were encountered during excavation of the trial pit.
2. The trial pits walls collapsed from a depth of 2.50m when a maximum excavation depth of 3.00m had been achieved.
3. The trial pit was backfilled with the accumulated spoil.

TRIAL PIT RECORD - TP11

Site

Land Off The Coppice, Burbage, Leicestershire.

Client
Springbourne Homes.

Method of excavation
Mechanical Excavator

Dimensions
0.60m x 3.00m

Project No:
G16195

Logged by: NB

Ground Level:

Date: 07/07/2016

Location: -

Scale: 1:25

Samples & In situ Tests			Water	Level (mAOD)	Depth (m)	Strata Description	Legend	Backfill
Ref:	Depth (m)	Result						
D1 E2	0.30 0.30					MADE GROUND - overgrown grass and vegetation over brown clayey topsoil with many brick fragments and occasional polythene, plastic and sections of concrete kerbs.		
D2	0.60-0.80				0.60	MADE GROUND - buried topsoil.		
					0.80	(Medium dense) orange brown and pale grey silty fine to coarse SAND.		
D3	1.00							
HSV	1.30	52 kPa			1.20	Firm orange brown and pale grey sandy CLAY.		
					1.70	(Possibly Loose) moist orange brown and pale grey clayey silty fine to coarse SAND. ... the density of the sand is assessed to possibly be loose based on the collapse of the trial pit walls and not in situ testing.		
D4	1.90							
D5	2.40				2.50	End of Trial Pit 2.50 m		

Sheet 1 of 1

Remarks and Water Observations

1. Slight groundwater seepages were encountered at 2.20m during excavation of the trial pit.
2. The trial pits walls collapsed from a depth of 1.60m when a maximum excavation depth of 2.50m had been achieved.
3. The trial pit was backfilled with the accumulated spoil.

PHOTOGRAPHS

Trial Pit No: TP1.



PHOTOGRAPHS

Trial Pit No: TP2.



PHOTOGRAPHS

Trial Pit No: TP3.



PHOTOGRAPHS

Trial Pit No: TP4.



PHOTOGRAPHS

Trial Pit No: TP5.



Trial Pit No: TP5 Continued.



PHOTOGRAPHS

Trial Pit No: TP6.



PHOTOGRAPHS

Trial Pit No: TP7.



PHOTOGRAPHS

Trial Pit No: TP8.



PHOTOGRAPHS

Trial Pit No: TP9.



PHOTOGRAPHS

Trial Pit No: TP10.



PHOTOGRAPHS

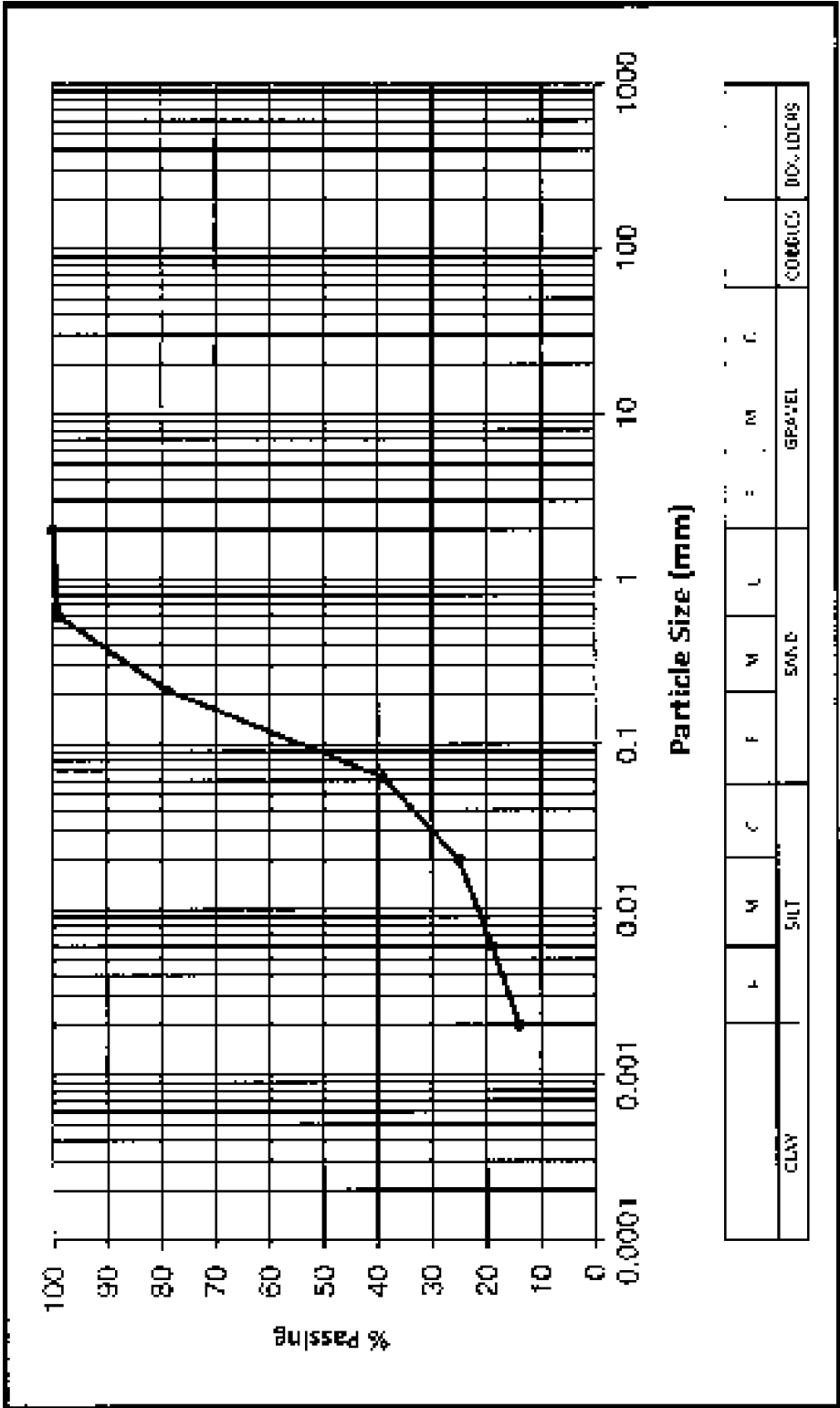
Trial Pit No: TP11.



APPENDIX G

Laboratory Test Results - Geotechnical

B.S.1377 1990 PART 2 PARTICLE SIZE ANALYSIS BY SEDIMENTATION

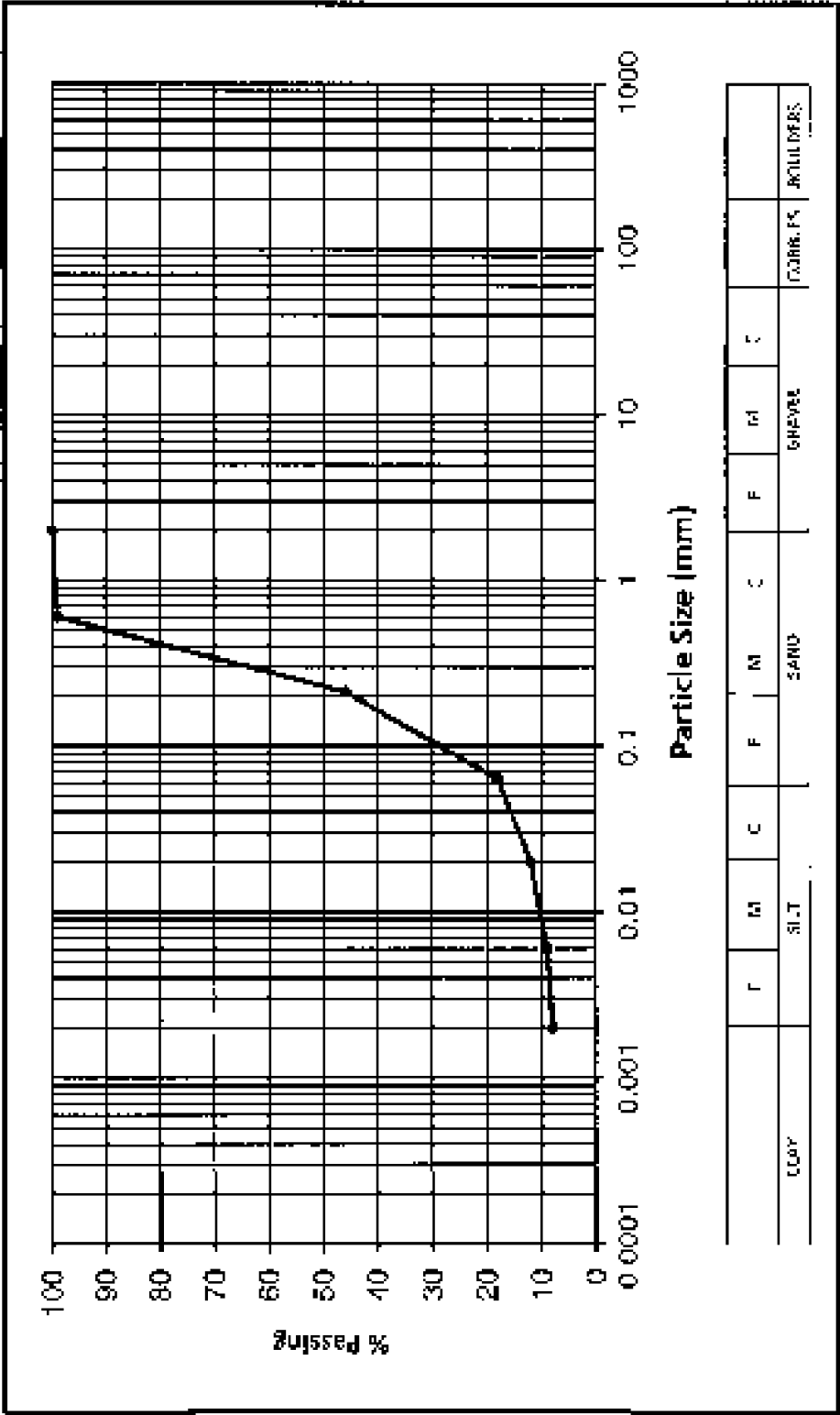


Sieve Size	Percentage Passing	Group % Retained
2	100	Sand
0.6	90	
0.212	70	
0.063	39	61
0.02	25	Silt
0.006	19	
0.002	12	25
		Clay
		14

Key: F - Fine; M - Medium; C - Coarse

N.C.A	Site Ref:	Job No:	Sample No:	Date:
	Land Off The Coppice, Burbage, Leicestershire.	TP5	D3	27/07/2016
		Note No.	Depth (m)	
			1.10	

B.S.1377 1990 PART 2 PARTICLE SIZE ANALYSIS BY SEDIMENTATION



APPENDIX H

Laboratory Test Results - Contamination



Nicholls Colton Analytical
7-11 Harding Street
Leicester
LE1 4DH

Nicholls Colton Geotechnical
7-11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: G16195-A/001

Your Project Reference:	Land off the Coppice, Burbage, Leics.	Samples Received on:	12.07.2016
Your Order Number:	G16195-A	Testing Instruction Received:	12.07.2016
Report Issue Number:	1	Sample Tested:	12 to 26.07.2016
Samples Analysed:	10 Soils 1 Leachate	Report issued:	26.07.2016

Signed

James Gane
Manager - Data Logistics
Nicholls Colton Analytical

Notes:

General

For the purpose of this report, the following information has been provided by the client:

The site is located at Land off the Coppice, Burbage, Leics. The site is currently used for agricultural purposes.

The site is located at Land off the Coppice, Burbage, Leics. The site is currently used for agricultural purposes.

The site is located at Land off the Coppice, Burbage, Leics. The site is currently used for agricultural purposes.

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The site is located at Land off the Coppice, Burbage, Leics. The site is currently used for agricultural purposes.

Analysis

The analysis was carried out in accordance with the following standards:

Drawn Samples

Number of samples drawn	10
Number of samples analysed	10
Number of samples rejected	0

The analysis was carried out in accordance with the following standards:

The analysis was carried out in accordance with the following standards:

The analysis was carried out in accordance with the following standards:

QA/QC Testing

The analysis was carried out in accordance with the following standards:

The analysis was carried out in accordance with the following standards:

The analysis was carried out in accordance with the following standards:

Interpretation Key

UKAS = UKAS Accredited, MFL = MFL Accredited, N/A = Not Applicable

G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

Analytical Test Results - NCG Soil Suite

NCA Reference			16-22683	16-22684	16-22685	16-22686	16-22687	16-22688
Client Sample Reference			E2	E1	E2	E2	E1	E1
Client Sample Location			TP1	TP2	TP4	TP5	TP7	TP11
Depth (m)			0.30	0.30	1.00	0.80	0.10	0.30
Date of Sampling			07.07.2016	07.07.2016	07.07.2016	07.07.2016	07.07.2016	07.07.2016
Time of Sampling			AM	AM	AM	AM	AM	PM
Sample Matrix			Clay	Clay	Loam	Loam		Clay
Determinant	Units	Accreditation						
Arsenic	(mg/kg)	MCERTS	< 10	11.1	12.0	12.2	< 10	< 10
Cadmium	(mg/kg)	MCERTS	0.5	0.8	0.5	0.6	0.4	1.4
Chromium (Total)	(mg/kg)	UKAS	14.5	8.4	12.5	13.2	9.1	14.4
Copper	(mg/kg)	MCERTS	19.7	26.1	12.4	19.6	11.8	32.1
Lead	(mg/kg)	MCERTS	12.2	39.2	24.8	28.7	30.6	42.6
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	19.5	19.5	11.7	17.9	9.4	19.4
Zinc	(mg/kg)	MCERTS	51.2	72.3	64.8	90.0	54.4	124
Phenols (Total)	(mg/kg)	MCERTS	< 1	< 1	< 1	< 1	< 1	< 1
pH	pH Units	MCERTS	8.0	7.6	7.6	7.6	6.0	7.7
Acenaphthene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	(mg/kg)	UKAS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	(mg/kg)	UKAS	0.03	<0.02	<0.02	<0.02	<0.02	0.03
Benzo (a) anthracene	(mg/kg)	MCERTS	0.14	0.04	0.04	<0.02	0.03	0.14
Benzo (a) pyrene	(mg/kg)	MCERTS	0.16	0.04	0.04	0.02	0.03	0.16
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.26	0.06	0.07	0.03	0.04	0.25
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.15	0.04	0.05	<0.02	0.03	0.15
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.09	0.02	<0.02	<0.02	<0.02	0.10
Chrysene	(mg/kg)	MCERTS	0.21	0.07	0.08	0.03	0.04	0.18
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	(mg/kg)	MCERTS	0.28	0.09	0.09	0.05	0.05	0.28
Fluorene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	0.18	0.04	0.04	<0.02	0.03	0.16
Naphthalene	(mg/kg)	MCERTS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	(mg/kg)	MCERTS	0.07	<0.02	0.03	<0.02	<0.02	0.10
Pyrene	(mg/kg)	MCERTS	0.27	0.08	0.09	0.05	0.05	0.27
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	1.96	0.63	0.69	0.43	0.48	1.93
Total TPH (>C ₈ to C ₄₀)	(mg/kg)	MCERTS	-	-	39	86	-	-
SOM (via TOC)	(%)	UKAS	-	3.4	-	2.4	-	2.5
Asbestos	-	UKAS	-	No asbestos detected	No asbestos detected	No asbestos detected	-	No asbestos detected



Nicholls Colton Analytical
7 - 11 Harding Street
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G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

Analytical Test Results - BRE Suite

NCA Reference			16-22686	16-22689	16-22690	16-22691	16-22692
Client Sample Reference			E2	E2	D3	D2	D2
Client Sample Location			TP2	TP5	TP6	TP9	TP11
Depth (m)			0.80	0.80	0.7-0.9	0.80	0.6-0.8
Date of Sampling			07.07.2016	07.07.2016	07.07.2016	07.07.2016	07.07.2016
Time of Sampling			AM	AM	AM	PM	PM
Sample Matrix			Loam	Loam	Clay	Sand	Loam
Determinant	Units	Accreditation					
Water soluble sulphate	(mg/l)	u	11	<10	<10	<10	<10
Acid Soluble Sulphate	(%)	u	0.05	0.05	0.01	<0.01	0.04
Total Sulphur	(%)	u	0.03	0.02	<0.01	<0.01	0.02
pH Value	pH Units	MCERTS	7.6	7.9	7.6	6.8	7.3



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G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

Certificate Of Analysis - WAC Suite

NCA Reference			16-22685			
Client Sample Reference			E2, TP4			
Sample Description			Brown sandy silt with organic matter.			
Depth (m)			1.0			
Date of Sampling			07.07.2016			
Time of Sampling			AM			
Sample Matrix			Loam			
Moisture Content (%)			17			
Stone content (%)			0			
			Determined Result	Inert Waste Landfill	Stable non reactive hazardous waste in a non hazardous landfill	Hazardous Waste Landfill
Solid Analysis						
Total Organic Carbon	%	MCERTS	1.6	3.0	5.0	6.0
Loss on Ignition	%	UKAS	4.9	-	-	10.0
BTEX	mg/kg	MCERTS	<0.3	6.00	-	-
PCB's (7 Congeners)	mg/kg	u	<0.04	1.00	-	-
Mineral Oil (>C ₁₀ to C ₄₀)	mg/kg	u	37	500	-	-
PAH	mg/kg	u	0.7	100	-	-
pH	units	MCERTS	7.6	-	> 6	-
Eluate Analysis						
Arsenic	mg/kg	u	< 0.03	0.50	2	25
Barium	mg/kg	u	0.10	20	100	300
Cadmium	mg/kg	u	< 0.03	0.04	1	5
Chromium (total)	mg/kg	u	0.00	0.5	10	70
Copper	mg/kg	u	< 0.10	2.0	50	100
Mercury	mg/kg	u	< 0.01	0.01	0.2	2
Molybdenum	mg/kg	u	< 0.03	0.5	10.0	30
Nickel	mg/kg	u	< 0.03	0.4	10.0	40
Lead	mg/kg	u	< 0.10	0.5	10.0	50
Antimony	mg/kg	u	< 0.01	0.06	0.7	5
Selenium	mg/kg	u	0.01	0.1	0.5	7
Zinc	mg/kg	u	< 0.10	4	50	200
Chloride	mg/kg	u	1	800	15000	25000
Fluoride	mg/kg	u	4.5	10	150	500
Sulphate (as SO ₄)	mg/kg	u	34	1000	20000	50000
Phenol Index	mg/kg	u	< 1.0	1	-	-
Dissolved Organic Carbon	mg/kg	u	65	500	800	1000



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G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

Sample Descriptions

NCA Reference	Client Sample Reference	Sample Location	Description	Moisture Content (%)	Stone Content (%)
16-22683	E2	TP1	Brown silty sandy gravelly clay with bituminous material and organic matter.	12	9.3
16-22684	E1	TP2	Brown silty sandy gravelly clay with organic matter.	11	14
16-22685	E2	TP4	Brown sandy silt with organic matter.	17	0
16-22686	E2	TP5	Brown sandy gravelly clayey silt with brick fragments and organic matter. (Made ground)	12	20
16-22687	E1	TP7		16	0
16-22688	E1	TP11	Brown silty sandy gravelly clay with brick fragments and organic matter. (Made ground)	9.3	39

NCA Reference	Client Sample Reference	Sample Location	Description	% Passing 2mm BS test sieve
16-22689	E2	TP5	Brown sandy clayey silt with organic matter and bituminous material.	100
16-22690	D3	TP6	Brown sandy clay.	100
16-22691	D2	TP9	Brown silty sand with organic matter.	100
16-22692	D2	TP11	Brown sandy gravelly silt with organic matter.	97



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G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	Metals	Air Dried	In house method statement - MS - CL - ICP metals
Soil	PAH	As Received	In house method statement - MS - CL - PAH (As received)
Soil	Phenols	As Received	In house method statement - MS - CL - Phenols (Skalar)
Soil	pH	As Received	In house method statement - MS - CL - pH (Soil) using a 1:3 soil to water extraction
Soil	SOM	Air Dried	In house method statement - MS - CL - TOC
Soil	Sulphate	Air Dried	In house method statement - MS - CL - Anions (Aquakem)
Soil	Acid Sulphate	Air Dried	In house method statement - MS - CL - BRE
Soil	Total Sulphur	Air Dried	In house method statement - MS - CL - BRE
Soil	Total TPH	As Received	In house method statement - MS - CL - TPH - Sample was not subject to a 'scrubbing' cleanup step prior to analysis
Soil	Asbestos	As Received	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
Soil	Leaching	As Received	NRA R&D note 301 using a 10 : 1 by wet mass of sample extraction ratio
Leachate	Metals	As Received	In house method statement - MS - CL - ICP Metals Water
Leachate	PAH	As Received	In house method statement - MS - CL - PAH Water
Leachate	Phenol	As Received	In house method statement - MS - CL - Phenols (HPLC)
Leachate	pH	As Received	BS 1377, Part 3, 1990



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G16195-A/001

Project Reference - Land off the Coppice, Burbage, Leics.

WAC Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	TOC	Air Dried	In house method statement - MS - CL - TOC
Soil	LoI	Air Dried	BS 1377, Part 3, 1990
Soil	BTEX	As Received	In house method statement - MS - CL - VOC and BTEX
Soil	PCB	As Received	In house method statement - MS - CL - PCB
Soil	Mineral Oil	As Received	In house method statement - MS - CL - TPH
Soil	PAH	As Received	In house method statement - MS - CL - PAH (As received)
Soil	pH	As Received	In house method statement - MS - CL - pH (Soil) using a 1:3 soil to water extraction
Eluate	Metals	Leached	In house method statement - MS - CL - Water Metals
Eluate	Anions	Leached	In house method statement - MS - CL - Anions (Aquakem)
Eluate	Phenol Index	Leached	In house method statement - MS - CL - Phenols (Skalar)
Eluate	DOC	Leached	In house method statement - MS - CL - DOC

APPENDIX I

Gas & Groundwater Monitoring Results

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS100	Time		8.45	9.00	10.50	12.20	12.35	12.38
	Barometric Pressure (mb)		1001	1003	1004	987	1024	993
	Relative Pressure (mb)		-7.82	-5.81	-0.03	-0.02	-0.02	0.00
	Flow (l/hr)	Peak	0.0	0.0	-0.3	-0.0	0.1	0.0
		Steady	0.0	0.0	-0.3	-0.0	0.1	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.3	0.4	0.4	0.3	0.2	0.4
		Steady	0.3	0.4	0.4	0.3	0.2	0.4
	Oxygen (% v/v)	Min	20.9	20.7	20.6	20.9	20.9	21.0
		Steady	20.9	20.7	20.6	20.9	20.9	21.0
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
WS200	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		2.75	2.78	2.79	2.78	2.84	2.85
	Pipe depth (m bgl)		3.00	3.00	3.00	3.00	2.99	3.00
	Time		8.50	9.05	11.00	12.31	14.22	12.50
	Barometric Pressure (mb)		1001	1003	1004	988	1025	990
	Relative Pressure (mb)		-9.01	-0.46	0.03	-0.03	-0.03	-0.03
	Flow (l/hr)	Peak	0.0	0.0	0.0	0.1	0.0	0.0
		Steady	0.0	0.0	0.0	0.1	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.1	0.0	0.0	0.2	0.0
		Steady	0.0	0.0	0.0	0.0	0.2	0.0
	Methane (% LEL)	Peak	0.0	2.0	0.0	0.0	4.0	0.0
		Steady	0.0	0.0	0.0	0.0	4.0	0.0
	Carbon Dioxide (% v/v)	Peak	4.6	4.7	4.9	4.0	3.8	3.6
		Steady	4.6	4.7	4.9	4.0	3.8	3.6
	Oxygen (% v/v)	Min	17.9	17.5	16.3	18.0	18.0	17.9
		Steady	17.9	17.5	16.3	18.0	18.0	17.9
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	1
		Steady	0	0	0	0	0	1
	Groundwater Level (m bgl)		1.92	1.92	1.92	1.92	1.89	1.98
	Pipe depth (m bgl)		2.69	2.63	2.63	2.63	3.31	3.28

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS300	Time		8.55	9.10	11.10	12.44	14.12	13.00
	Barometric Pressure (mb)		1001	1003	1005	988	1023	994
	Relative Pressure (mb)		0.03	-8.42	-0.07	-0.02	0.00	0.00
	Flow (l/hr)	Peak	0.0	0.0	-0.7	0.0	0.0	0.0
		Steady	0.0	0.0	-0.7	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	4.3	5.1	5.3	5.1	5.2	4.7
		Steady	4.3	5.1	5.3	5.1	5.2	4.7
	Oxygen (% v/v)	Min	17.6	16.7	15.8	16.1	16.7	16.8
		Steady	17.6	16.7	15.8	16.1	16.7	16.8
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
WS400	Carbon Monoxide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		Dry	Dry	Dry	Dry	Dry	Dry
	Pipe depth (m bgl)		3.64	3.63	3.63	3.63	3.64	3.64
	Time		9.00	9.15	11.20	12.56	14.00	13.15
	Barometric Pressure (mb)		1001	1003	1005	988	1024	995
	Relative Pressure (mb)		-6.79	-8.56	0.09	0.02	0.01	-0.03
	Flow (l/hr)	Peak	0.0	0.0	-0.8	0.0	0.0	0.0
		Steady	0.0	0.0	-0.8	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	3.2	4.1	4.4	4.8	4.4	4.1
		Steady	3.2	4.1	4.4	4.8	4.4	4.1
WS400	Oxygen (% v/v)	Min	18.7	17.4	16.8	17.4	17.2	17.6
		Steady	18.7	17.4	16.8	17.4	17.2	17.6
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	1	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		1.88	1.91	1.82	1.84	1.74	1.61
	Pipe depth (m bgl)		2.62	2.60	3.00	2.97	2.96	2.97

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny periods	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS500	Time		9.05	9.20	11.30	13.10	13.54	13.35
	Barometric Pressure (mb)		1001	1003	1005	988	1025	994
	Relative Pressure (mb)		-5.40	-0.36	0.02	-0.02	0.07	-0.07
	Flow (l/hr)	Peak	0.0	0.0	-0.7	-0.1	0.0	-0.0
		Steady	0.0	0.0	-0.7	-0.1	0.0	-0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	0.0	0.0
		Steady	0.0	0.0	0.0	0.0	0.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.8	1.7	1.6	1.8	2.1	2.4
		Steady	0.8	1.7	1.6	1.8	2.1	2.4
	Oxygen (% v/v)	Min	20.5	19.3	19.5	19.8	19.3	19.4
		Steady	20.5	19.3	19.5	19.8	19.3	19.4
	Hydrogen Sulphide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
WS600	Carbon Monoxide (ppm)	Peak	0	0	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		1.63	1.65	1.67	1.67	1.72	1.73
	Pipe depth (m bgl)		2.27	2.23	2.43	2.45	2.43	2.40
	Time		9.10	9.30	11.40	13.30	13.43	13.55
	Barometric Pressure (mb)		1001	1003	1005	988	1026	994
	Relative Pressure (mb)		-5.07	-5.48	0.00	-0.02	0.02	-0.07
	Flow (l/hr)	Peak	0.0	0.0	-0.0	0.0	0.0	0.0
		Steady	0.0	0.0	-0.0	0.0	0.0	0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.3	0.0
		Steady	0.0	0.0	0.0	0.0	0.3	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	6.0	0.0
		Steady	0.0	0.0	0.0	0.0	6.0	0.0
	Carbon Dioxide (% v/v)	Peak	1.0	1.3	1.4	1.3	1.3	1.3
		Steady	1.0	1.3	1.4	1.3	1.3	1.3
	Oxygen (% v/v)	Min	20.5	19.5	19.6	20.5	20.4	20.3
		Steady	20.5	19.5	19.6	20.5	20.4	20.3
	Hydrogen Sulphide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	1	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	1	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		Dry	Dry	Dry	Dry	Dry	Dry
	Pipe depth (m bgl)		3.39	3.38	3.37	3.37	3.39	3.39

MONITORING REPORT

SITE: Land Off The Coppice, Burbage, Near Hinckley, Leicestershire.

GAS AND GROUNDWATER MONITORING RESULTS

Date	24/07/15	10/08/15	19/08/15	24/08/15	28/09/15	28/10/15
Monitored By	NB	NB	AW	AW	AW	AW
Time Start	8.45	9.00	10.47	12.18	13.33	12.36
Gas Monitoring Unit	GA5000	GA5000	GA5000	GA5000	GA5000	GA5000
Unit Serial Number	G501285	G501285	G501285	G501285	G501285	G501285
Dipmeter	Dip 5	Dip 6	Dip 5	Dip 5	Dip 5	Dip 5
Weather	Overcast	Sunny	Sunny	Raining	Sunny	Raining
Pressure Trend	Falling	Falling	Steady	Falling	Falling	Steady

WS700	Time		9.20	9.25	11.50	13.19	13.48	13.45
	Barometric Pressure (mb)		1001	1003	1004	989	1025	994
	Relative Pressure (mb)		-5.40	-5.52	-0.03	0.02	-0.05	0.03
	Flow (l/hr)	Peak	0.0	0.0	-0.0	0.1	0.0	-0.0
		Steady	0.0	0.0	-0.0	0.1	0.0	-0.0
	Methane (% v/v)	Peak	0.0	0.0	0.0	0.0	0.3	0.0
		Steady	0.0	0.0	0.0	0.0	0.3	0.0
	Methane (% LEL)	Peak	0.0	0.0	0.0	0.0	6.0	0.0
		Steady	0.0	0.0	0.0	0.0	6.0	0.0
	Carbon Dioxide (% v/v)	Peak	0.5	0.2	0.2	0.2	0.1	0.2
		Steady	0.5	0.2	0.2	0.2	0.1	0.2
	Oxygen (% v/v)	Min	20.8	20.2	20.7	20.9	21.0	21.1
		Steady	20.8	20.2	20.7	20.9	21.0	21.1
	Hydrogen Sulphide (ppm)	Peak	0	1	1	0	0	0
		Steady	0	0	0	0	0	0
	Carbon Monoxide (ppm)	Peak	0	2	0	0	0	0
		Steady	0	0	0	0	0	0
	Groundwater Level (m bgl)		2.58	2.60	2.60	2.61	2.65	2.67
	Pipe depth (m bgl)		3.00	2.96	2.94	2.95	2.96	2.96
	Time							
	Barometric Pressure (mb)							
	Relative Pressure (mb)							
	Flow (l/hr)	Peak						
		Steady						
	Methane (% v/v)	Peak						
		Steady						
	Methane (% LEL)	Peak						
		Steady						
	Carbon Dioxide (% v/v)	Peak						
		Steady						
	Oxygen (% v/v)	Min						
		Steady						
	Hydrogen Sulphide (ppm)	Peak						
		Steady						
	Carbon Monoxide (ppm)	Peak						
		Steady						
	Groundwater Level (m bgl)							
	Pipe depth (m bgl)							

DRAWINGS

G16195-IR/01 Site Location Plan

G16195-IR/02 Exploratory Hole Location Plan



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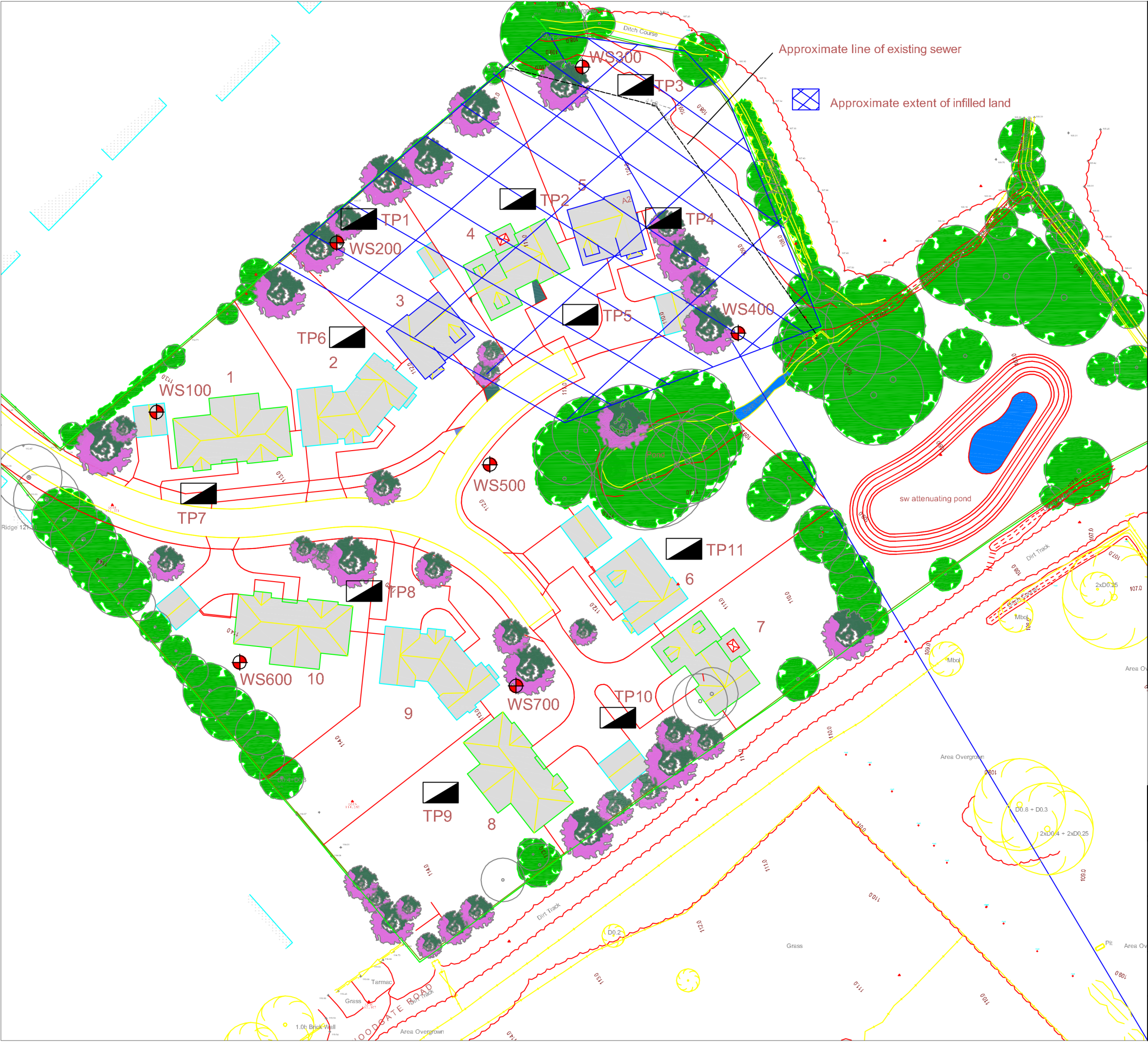
Client:
Springbourne Homes Limited.

Project:
Proposed Residential Development On Land Off The Coppice, Burbage Near Hinckley, Leicestershire.

Drawing No:
G16195-IR/01

Title:
Site Location Plan

Date:
August 2016



Key

- Trial Pit
- Windowless Sample Borehole
- Approximate Extent of Infilled Land

Client,
Springbourne Homes Limited

Project,
Proposed Residential Development
Off The Coppice, Burbage

Title,
Exploratory Hole Location Plan

Scale, NTS	Date, August 2016
Drawing No. G16195-IR/02	Project No. G16195

APPENDIX III

GROUND GAS PROTECTION LOCATION PLAN



- A - red line clarified - May 15 - JAF
- C - scheme reduced to 9 dwellings Nov 2019
- D - site area amended Jan 2020
- E - house type numbers amended Jan 2020
- F - plots 5 - 8 and road amended Feb 2020
- G - chicane added & turning head extended Apr 2020
- H - plot 9 removed to create additional green space June 2020
- J - chicane removed and bin collection points added June 2020
- K - plots 5 - 8 amended Feb 2021
- L - plot 5 handed March 2021
- M - retained trees to Southern boundary indicated March 2021
- N - parking and turning areas to plots 5 & 8 amended March 2021
- P - proposed footpath link added April 2021

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client Springbourne Homes Ltd			
project proposed housing off The Coppice Burbage			
drawing site layout			
scale 1: 500	sheet A2		
date Jan 2015	author JRH		
job No 12/71	drawing No 26P		

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APPENDIX IV

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2. The executive summary and recommendations sections of this report only provide an overview of the guidance and should not be specifically relied upon in their own right but should be considered in relation to the whole report and the development described in this report.
3. This report has been prepared and written in the context of the proposals for the development of the site as stated by the client and will not be valid in a differing context. Furthermore, new information, improved practices, or legislation may necessitate alterations to the report in whole or in part after its submission. Therefore, with any change in circumstances or after the expiry of one year from the date of this report, it should be referred to us for reassessment.
4. The assessment and interpretation of contamination and associated risks are based upon the scope of the work described in the fee proposal and agreed with the client, the report may not be sufficient to fully address the contamination or allow a detailed remediation scheme to proceed without further investigation or analysis.
5. Any assessments made in this report are based on the ground conditions and as revealed by the test pits and boreholes together with the results of any field or laboratory testing undertaken and where appropriate other relevant data which may have been obtained for the site. The sources of such information are detailed in this report and while PRP use only such sources as are believed to be reliable, PRP will not be liable for the authenticity or reliability of information obtained from others.
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8. Whilst an opinion may be expressed or implied in this report on possible configurations of strata between or beyond test pit or borehole locations, or on the possible presence of features based on either visual, verbal or published evidence, this is for guidance only and no liability can be accepted for the accuracy of such opinions.
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10. This report is not a site categorisation and hazards could occur which have not been detected.
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