Report No: C531
Date: October 2022

# GEOENVIRONMENTAL APPRAISAL
# Of land at
# 7 BELTON ROAD, EPWORTH, SOUTH YORKSHIRE


Prepared for
**Cherry Lane Homes Ltd**

Prepared by
G&M Consulting Ltd, The Chestnuts, Brackenhill Road, Haxey, Doncaster DN9 2LR

| | | | |
|---|---|---|---|
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| **REPORT TYPE:** | Geoenvironmental Appraisal (Phase 2) | | |
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| **SITE:** | 7 Belton Road, Epworth, South Yorkshire | | |
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# GEOENVIRONMENTAL APPRAISAL
# for land at
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## 1.0 INTRODUCTION.

G&M Consulting Ltd (G&M) was commissioned by Cherry Lane Homes Ltd to undertake a geoenvironmental appraisal of land at 7 Belton Road, Epworth, South Yorkshire.

The proposed development comprises three detached dwellings with hardstand parking and private gardens. The development layout is shown on Drawing No 20-036-2, dated July 2020, prepared by C3 Architecture Planning & Design Ltd, a copy of which is presented in Appendix A of this report.

The location of the site is shown on Drawing No C531/1, presented in Appendix A of this report.

### 1.1 Project Brief.

The geoenvironmental appraisal of the site has been undertaken in two phases. The initial phase (Phase 1) was a preliminary investigation (desk study) which was prepared by Michael D Joyce Associates LLP, in October 2020 (Report Ref 4052). Based on the results of the preliminary investigation, and comments received from the Local Authority, G&M has undertaken an intrusive site investigation (Phase 2), of the proposed area of development.

This report details the results of the intrusive investigation and makes recommendations with regards to the proposed development. This report should be read in conjunction with the desk study, which contains a description of the site, environmental setting and initial conceptual site model (CSM) from which the rationale for the intrusive investigation was derived.

Fieldwork for the intrusive investigation was undertaken on the 19th August 2022 and comprised the drilling of seven window sample boreholes, with the installation of three combined groundwater and ground gas monitoring wells. Following completion of the fieldwork selected soil samples were scheduled for a range chemical laboratory tests. At the time of writing of this report, monitoring of the installations is on-going.

### 1.2 Site Description.

The site is a flat lying roughly rectangular shaped piece of land, approximately 0.2 Ha in size. The site lies at a level of approximately 15 m Ordnance Datum (OD). The long axis of the site is aligned roughly east-west.

The site is accessed down a gravel driveway, off Belton Road, which runs to the east of the site.

The site at time of investigation, is a construction site and comprises three partially built properties with associated building materials and equipment surrounding the buildings. Small areas to the north and west of the site are grassed former garden areas. The site is bound to the north fencing to gardens to properties off Tottermire Lane. To the west and south by fencing to residential gardens off High Street and to the east by gardens to properties off Belton Road.

### 1.3 Limitations.

This investigation report, which is designed to meet the requirements of all relevant current guidance, presents the factual information and interpretation of the data obtained during this appraisal and recommendations relevant to the defined objectives.

The comments and opinions presented in this report are based on the findings of a review of available information and ground conditions encountered during the intrusive investigation work. There may be other conditions prevailing on the site which have not been disclosed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation. Any diagram or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

During the course of the works G&M did not notice the presence of any Japanese Knotweed, or other such invasive plant species. However, it should be noted that G&M are not qualified ecologists and as such cannot guarantee the absence of knotweed or other invasive vegetation. If necessary the possible presence of such vegetation should be confirmed by a qualified ecologist if necessary.

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## 2.0 GROUND INVESTIGATION.

### 2.1 Design and Strategy.

The Phase 1 desk study prepared previously, referenced above, was used as the basis for the design of an appropriate intrusive ground investigation. The main findings of the desk study as given in the summary to the report were as follows:

- *The site has had no previously recorded commercial or industrial use recorded on historical maps. As such no specific potential contaminants have been identified.*
- *A small former gas works was recorded approximately 150m from the site, However, this closed prior to 1948, and any contamination associated with the site is unlikely to have impacted the study site.*
- *The principal receptors are groundworkers, future residents and controlled water. However based on the past history of the site, the possibility of contamination being present sufficient to affect the identified receptors is considered to be a low risk*
- *This risk can be mitigated by intrusive investigation. Contamination investigation and testing would reduce the risk of any unforeseen contamination being uncovered during construction, but it is not a requirement at this stage.*

For completeness a copy of the Phase 1 text, and the response from the Local Authority commenting on the Phase 1, are presented in Appendix B of this report.

The aim and purpose of the ground investigation was to verify the nature and depth of made ground and shallow subsoils across the site, to allow informed decisions on potential remediation options that might be required in order to break the direct contact exposure pathways that were identified at the Phase 1 stage.

The scope of the intrusive investigation is detailed below;

| Exploratory Hole Type | Purpose |
|---|---|
| Window Samples Borehole | To determine the general nature of shallow soils underlying the site, including the;<br>• Nature, distribution and thickness of any potential made ground.<br>• Nature, degree and extent of ground contamination.<br>• Determination of the presence of shallow underlying natural ground<br>• Allow for the installation of combined ground gas and groundwater monitoring wells<br>• To help identify and inform suitable remedial options |

**2.2 Scope of Works.**

Fieldwork was undertaken on the 19th August 2022, and comprised;

- Drilling of seven window sample boreholes, referenced WS1 to WS7 inclusive, to depths of between 2.0m and 3.0m below ground level (bgl).

The investigation was scoped using guidance presented in BS 10175:2011+A2:2017 and the principles of Land Contamination Risk Management (LCRM) - Environment Agency October 2020 and BS EN 1997:2004 and 2007.

The exploratory hole positions were set out and the fieldwork supervised by a G&M engineering geologist. The locations of the holes are shown on Drawing No C531/2, presented in Appendix A of this report.

Prior to the commencement of any exploratory hole a scan was carried out for buried services using a combination of cable avoidance tool (CAT) and signal generator ('Genny'), a service drawing.

The window sample holes were drilled using a Dando Terrier tracked window sampling rig. This utilises a drop weight to drive steel sampling tubes with a uPVC liner. The sampling tubes reduce in diameter with depth, to reduce the effect of friction on the sampling tubes.

**2.3 Strata Description.**

Depths and descriptions of strata encountered together with details of the samples recovered are presented on the exploratory hole record sheets presented in Appendix C of this report. Procedures and principles contained in BS EN ISO 14688-1:(2002), as amplified by BS 5930:(2015)+A2:2020 were followed.

The depths of strata on the record sheets are recorded from current ground levels at each location.

**2.4 Sampling.**

Small disturbed sub samples of soil were taken from the exploratory holes for chemical analysis, these were placed in amber glass jars as appropriate.

In accordance with best practice (BS10175:2011+A2:2017) samples were collected in appropriate containers, kept in a chilled cool box whilst on site, retained in a fridge (below 2$^{o}$C) until the day of collection, packed in a chilled cool box on the day of collection and transported in this to the laboratory.

### 2.5 Laboratory Testing.

Selected soil samples were tested for a range of potential contaminants, under a sub-contract with i2 Analytical Ltd (i2), a UKAS/MCERTS accredited laboratory. The analytes tested are listed in Section 4.2 of this report. The results of soil analysis, as received from the laboratory, are presented in Appendix D of this report.

## 3.0 GROUND CONDITIONS AND MATERIAL PROPERTIES.

A complete record of all the strata encountered is given on the attached borehole logs, presented in Appendix C of this report. In general, these show a descending sequence of topsoil over sand subsoil, with clay subsoil at depth.

### 3.1 Topsoil

Topsoil was encountered in all of the boreholes and was proved to a depth of between 0.3 m and 0.5 m bgl, The soil comprised dark brown slightly gravelly fine to coarse sand. The gravel component was recorded as subrounded to rounded fine and medium of quartzite and rare limestone. In WS3, the gravel content was noted to contain rare brick.

### 3.2 Natural Granular Deposits.

The topsoil materials are immediately underlain by across the site by a dark brown becoming dark grey with depth, fine to coarse sand to depths of between 2.1 m and 2.45 m bgl, where fully penetrated. In WS2, WS4, WS5 and WS7, this material was encountered to the base of the boreholes, which were terminated between 2.0 m and 2.5 m bgl.

### 3.3 Natural Cohesive Deposits.

In WS1, WS3 and WS6 the granular soils are underlain by a dark brown mottled light grey very gravelly clay. The gravel component is noted as subangular fine and medium of mudstone. The consistency of the cohesive soil is recorded as firm and stiff, locally very stiff. This soil is considered to represent weathered Mercia Mudstone.

In WS1 a soft greenish grey mottled light brown sandy silty clay was encountered between 2.45 m and 2.7 m bgl, immediately underlying the granular soil. The clay was noted to contain occasional pockets of brown fibrous peat.

### 3.4 Groundwater.

No groundwater was encountered during the fieldwork. The strata was noted as ‘damp’ in WS1 below 2.0 m bgl

The table below summarises the standing groundwater levels recorded within the monitoring wells installed by G&M to date. Currently only three monitoring visits have been made to site, post fieldwork.

| Exploratory Hole No | Drilled Depth (m bgl) | Depth of Monitoring Well (m bgl) | Groundwater Level (m bgl) Visit 1 – 02/09/22 | Groundwater Level (m bgl) Visit 17/09/22 | Groundwater Level (m bgl) Visit 3 –26/09/22 |
|---|---|---|---|---|---|
| WS1 | 4.5 | 2.0 | Dry | Dry | Dry |
| WS3 | 4.5 | 2.9 | 2.10 | 2.00 | 2.16 |
| WS6 | 4.5 | 2.15 | 1.61 | 1.49 | 1.32 |

It should be borne in mind that water levels are likely to fluctuate with season/rainfall and may therefore be substantially higher at wetter times of year than those found during this investigation.

### 3.5 Visual / Olfactory Evidence of Contamination.

The topsoil was found to locally include rare gravel of brick, which can produce elevated concentrations of certain toxic and phytotoxic contaminants.

No olfactory evidence of any contamination was noted during the fieldwork.

### 3.6 Ground Gas and Vapours.

Ground gas monitoring has been carried out on three occasions to date, and the result are summarised below. Full details of the ground gas monitoring are presented in Appendix E of this report.

| Well | Methane (range) % v/v | Methane (range) %LEL | Carbon Dioxide (range) %v/v* | Oxygen (range) %v/v | VOC (ppm) | Flow (range) l/hr* |
|---|---|---|---|---|---|---|
| WS1 | ND | - | 2.0 - 3.1* | 16.8-19.4 | 0.5 | 0 |
| WS2 | ND | - | 0.4 - 1.0* | 19.3-20.8 | 0.1 | 0 |
| WS3 | ND | - | 1.9- 3.3* | 15.5-19.1 | 0 | 0 |

ND - Not Detected. * Peak reading

Barometric air pressure for the visits varied between 1014 mb and 1021 mb

The scheduled programme of monitoring comprises six visits over a three month period. It is proposed to undertake three further monitoring visits, as far as possible/practicable, to coincide with worst case weather/environmental conditions identified in CIRIA C665. On completion of the monitoring, a full set of results will be issued in an addendum report.

## 4.0 RESULTS OF CHEMICAL TESTING.

### 4.1 General.

For this site, measured values were compared to Generic Assessment Criteria (GAC) derived for a residential with plant up take end use.

Chemical analysis was undertaken on representative soil samples recovered from across the site. The determinands were selected to provide information on the distribution of potential contaminants. The general analytical suite was supplemented with additional analysis where former land usage, as determined from the desk study, or visual or olfactory observations suggested the presence of additional contaminants.

The majority of initial screening levels (GAC's) used in the production of this assessment have been taken from the guidelines introduced by:

- DEFRA C4SL's, DEFRA 2015.
- Joint Land Quality Management Ltd (LQM) and Chartered Institute of Environmental Health (CIEH), Generic Assessment Criteria for Human Health Risk Assessment, S4UL's, Land Quality Press 2015.

Usually statistical testing is undertaken for the Planning Scenario by the methods described in CL:AIRE "Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration", September 2020. This statistical testing is undertaken to determine whether there was sufficient evidence that the true mean concentration of each determinand was less than the relevant critical concentration for that component. However, given the fact that a proportion of the sampling was carried out on a targeted basis, detailed statistical assessment of the data has not been conducted, instead individual contaminant concentrations have been compared to their relevant assessment criteria.

### 4.2 Testing Schedule.

Following completion of the fieldwork samples were selected for testing as follows;

| Laboratory Analysis | Topsoil | Natural Subsoils |
|---|---|---|
| Total concentrations of arsenic, cadmium, chromium (incl hexavalent), copper, lead, nickel, selenium, zinc, mercury | 6 | 2 |
| Water Soluble Sulphate, pH | 4 | 1 |
| Speciated PAH | 3 | 2 |
| Phenol | 5 | 1 |
| Asbestos | 5 | - |

### 4.3 Soil Analysis.

The chemical analysis results and screening criteria are summarised below. The results for the made ground and natural soils have been combined for an initial assessment.

**Summary of Total Soil Concentrations**

| Determinand | GAC (1% SOM) (mg/kg, unless otherwise stated) | No. of samples above screening value | No. of samples tested | Maximum concentration above GAC (mg/kg, unless otherwise stated) |
|---|---|---|---|---|
| **Metals/Metalloids** | | | | |
| Arsenic | 37 (2) | 0 | 8 | |
| Cadmium | 11(1) | 0 | 8 | |
| Chromium (IV) | 21 (2) | 0 | 8 | |
| Lead | 200 (2) | 0 | 8 | |
| Mercury | 40 (1) | 0 | 8 | |
| Selenium | 250 (1) | 0 | 8 | |
| Copper | 2400 (1) | 0 | 8 | |
| Nickel | 180 (1) | 0 | 8 | |
| Zinc | 3700 (1) | 0 | 8 | |
| **Inorganics** | | | | |
| pH | <5 | 0 | 5 | |
| Water Soluble Sulphate | 0.5 g/l (3) | 0 | 5 | |
| **Organics** | | | | |
| **PAHs** | | | | |
| Acenaphthene | 210(1) | 0 | 5 | |
| Anthracene | 2400(1) | 0 | 5 | |
| Acenaphthylene | 170(1) | 0 | 5 | |

| Determinand | GAC (1% SOM) (mg/kg, unless otherwise stated) | No. of samples above screening value | No. of samples tested | Maximum concentration above GAC (mg/kg, unless otherwise stated) |
|---|---|---|---|---|
| Benzo(a)anthracene | 7.2[(1)] | 0 | 5 | |
| Benzo(b)fluoranthene | 2.6[(1)] | 0 | 5 | |
| Benzo(k)fluoranthene | 77[(1)] | 0 | 5 | |
| Benzo(g,h,i)perylene | 320[(1)] | 0 | 5 | |
| Benzo(a)pyrene | 5.0[(2)] | 0 | 5 | |
| Chrysene | 15[(1)] | 0 | 5 | |
| Dibenz(a,h)anthracene | 0.24[(1)] | 0 | 5 | |
| Fluoranthene | 280[(1)] | 0 | 5 | |
| Fluorene | 170[(1)] | 0 | 5 | |
| Indeno(1,2,3-cd)pyrene | 27[(1)] | 0 | 5 | |
| Naphthalene | 2.3[(1)] | 0 | 5 | |
| Pyrene | 620[(1)] | 0 | 5 | |
| Phenanthrene | 95[(1)] | 0 | 5 | |
| **Other** | | | | |
| Monohydric Phenol | 120([1]) | 0 | 6 | |
| Asbestos | Fibres present | 0 | 5 | |

[1] LQM/CIEH (2015) S4UL's for Human Health Risk Assessment. 2nd Ed. (for a sandy soil with 1% SOM and pH 7.0)
[2] DEFRA C4SL's, DEFRA 2015
[3] BRE (2005) Special Digest 1, 3rd Edition, Concrete in aggressive ground. Upper limits for DS-1 Design Sulphate Class concrete.

No samples of the topsoil or natural subsoils were shown to be elevated above respective GAC levels. No made ground soils were encountered during the investigation works.

No asbestos was identified in any of the five samples tested.

## 5.0 QUALITATIVE RISK ASSESSMENT AND REVISED CONCEPTUAL MODEL.

The preliminary conceptual site model, developed from the desk study information, as presented in the Phase 1, has been revised in light of the ground investigation and chemical analysis results presented above. The revised conceptual model has been developed for the proposed future land use (residential with plant update). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

### Human Health – further considerations:

- No contaminants tested were found to be over their respective GACs

### Summary of Identified Pollutant Linkages

In summary, the revised conceptual site model has identified the following potential pollutant which could result in an unacceptable risk to the proposed end-use, denoted as a moderate or higher potential of significant pollutant linkage on the conceptual site model.

| Source | Risk | Potential Contaminants | Exposure Pathway | Primary Receptor/s | Complete Pollutant Linkage |
|---|---|---|---|---|---|
| | | Inorganic/organic contaminants | Skin contact Ingestion | End users of site; construction workers | **No**: No contaminants tested were found to be above their respective GACs. No asbestos fibres recorded within samples tested. |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Topsoil/Subsoils (on site) | Negligible | Asbestos | Inhalation | | |
| | Moderate | Ground gas | Migration (lateral and vertical) Inhalation, explosion | Built development, End users (Residential) | Further assessment required; monitoring ongoing (3 further visits to complete 6 visits over a three month period). Currently a complete pollutant linkage assumed until monitoring period completed and reported. |

## 6.0 CONCLUSIONS AND RECOMMENDATIONS.

### 6.1 General.

G&M Consulting Ltd (G&M) was commissioned by Mr Sid Cherry to undertake a geoenvironmental appraisal of land at 7 Belton Road, Epworth, South Yorkshire.

The proposed development comprises three detached dwellings with hardstand parking and private gardens. The development layout is shown on Drawing No 20-036-2, dated July 2020, prepared by C3 Architecture Planning & Design Ltd, a copy of which is presented in Appendix A of this report.

It has been assumed that ground levels will not change significantly from those described in this report, or that the proposed end use of the site will not change from that detailed above. If this is not the case, then amendments to the interpretation and conclusions in this report may be required.

### 6.2 Contamination Constraints to Development.

**Risk Evaluation for Proposed Land Use (Residential With Plant Update)**

No elevated concentrations of contaminants have been identified within the soils across the site. The concentrations of contaminants are considered to pose a **negligible** risk to future site users.

No evidence of any lateral migration of mobile contaminants, associated with the former gasworks. (located 150m from the site).

Although considered unlikely, should there need to be a requirement for the import of soils, within the areas of proposed soft landscaping/private gardens, then these materials should be clean, naturally derived and meet the GAC thresholds, presented in Section 4.3 of this report.

Topsoil and subsoil retained on site for use within the areas of proposed soft landscaping, should be protected, to ensure no building debris, from any development works, become incorporated into these soils

**Controlled waters**

Based on the fact that no contaminants tested exceeded their respective GAC or groundwater was encountered during the fieldwork, it is considered that the soils are considered to pose a **negligible** risk to controlled waters and that no further remediation is considered necessary, outside of that described.

**Construction and Maintenance Workers**
Based on the results of the chemical testing it is unlikely that the soils present on site pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance.

This report should be forwarded to any organisation undertaking groundworks in order for them to assess the risk to their own personnel.

**Adjacent Site Users**
Provided any materials present on site are carefully excavated and standard dust control measures are adopted, including dampening down of soils, during the development works, then it is considered that there is a negligible short term risk to adjacent site users.

**Built Development**
The water soluble sulphate content and pH value of the soils present on site was determined as part of the chemical testing. A total of five tests were carried out.

The pH value was recorded between 7.5 to 8.4 and the water soluble sulphate content was recorded between 0.015 to 0.11 g/l

Based on the Table C2 (SD1) for brown field sites the above results indicate a Design Sulphate Class for the site of DS-1 with an ACEC class of AC-1s for static groundwater conditions, for the underlying natural subsoils.

**Utilities**
Although it is considered unlikely that an upgrade in water supply pipe is likely for the site, it is recommended that the results of the chemical testing are provided to the appropriate utility companies to determine the necessity for service protection.

### 6.3 Ground Gas (Interim Findings)

Gas monitoring has only been undertaken on three occasions to date, therefore the following comments are only a preliminary assessment. A full assessment will be made once monitoring is complete and an addendum report will be issued.

Guidance on the assessment of ground gas is given in CIRIA C665 (2007) *'Assessing Risks Posed by Hazardous Ground Gases to Buildings'* and BS8485:2015+A1:2019 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*.

The gas monitoring carried out to date has recorded no methane and a peak carbon dioxide concentration of 3.3 % (WS3) and using the limit of detection of the monitoring equipment issued, a gas flow rate of 0.1l/hr (as no flows were recorded in any of the boreholes during the monitoring), derives a site GSV of 0.0033 l/hr.

Based on the above GSV, the ground gas regime for the site would initially be assessed as Characteristic Situation CS1 – No special precautions.

### 6.4 Watching Brief on Development Works.

It is possible that areas of contamination or made ground may be encountered during the development works, which have not been identified by this report. If any areas of noxious, odorous, fibrous or liquid etc. contamination are encountered, then works should stop immediately, the local authority informed and further advice sought from a suitably experienced and qualified consultant.

### 6.5 Disposal of Unsuitable Soils.

Any unsuitable materials which are to be exported from site, should be despatched to a suitably licensed landfill facility, in accordance with the requirements of the Duty of Care (DoC) Regulations, April 2006 and where appropriate, the HWR, 2005 or any superseding legislation.

### 6.6 Regulatory Approval.

The conclusions and recommendations presented above are considered practical based on the findings of this investigation. The conclusions and recommendations cannot, however, be guaranteed to gain regulatory approval, and therefore this report should be submitted to the regulators for their comment/approval as part of any planning process.

# APPENDIX A

DRAWINGS


# Site Location Plan **Drawing No C531/1**



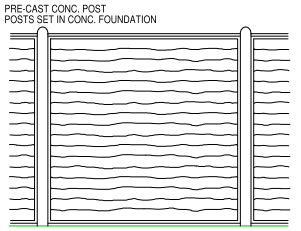
G&M CONSULTING

# AMENDED

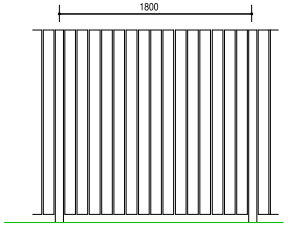

## KEY

denotes proposed shrub planting

denotes proposed tree planting




1800 HIGH LARCH LAP FENCE




1800 HIGH SCREEN FENCE

REV A - NOV 20 - PLOTS 2 AND 3 AMENDED
REV B - NOV 20 - PLOT 3 AMENDED
REV C - FEB 21 - PLOT 3 AMENDED

**CHERRY TREE HOMES LTD**

**7 BELTON ROAD**
**EPWORTH**
**DN9 1JL**

**SITE PLAN**

| scale | date | drawn | checked |
|---|---|---|---|
| 1:500 @ A3 | July 20 | PB | |

| drawing no | revision |
|---|---|
| **20 - 036 - 2** | C |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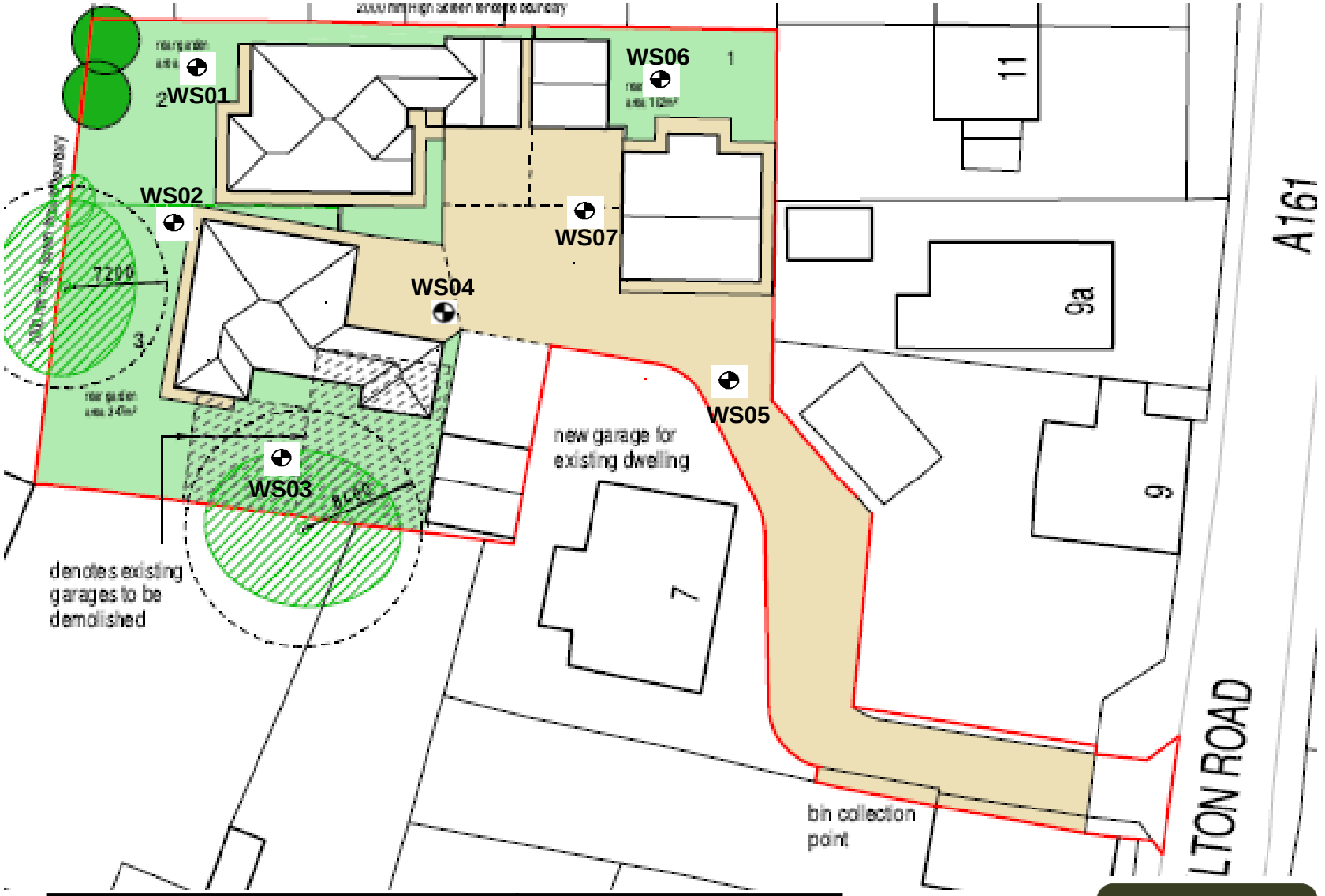


| | | | |
|---|---|---|---|
| Drawing No: C531/2 | | Scale NTS | |
| Contract | C531 – Belton Road, Epworth | Drawn AS | Approved GS |
| | | Drawing Name –Exploratory Hole Location Plan | |
| Client – Cherry Lane Homes Ltd | | | |

G&M CONSULTING

# APPENDIX B

PHASE 1 REPORT & LA CORRESPONDENCE

# Phase 1 Geoenvironmental Risk Assessment

**7 BELTON ROAD**
**EPWORTH**
**DONCASTER**

for

**Cherry Lane Homes**

Report Number 4052

October 2020

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# Phase 1 Geoenvironmental Risk Assessment

# 7 BELTON ROAD, EPWORTH, DONCASTER

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# 1 INTRODUCTION

1.1 At the request of Mr. S. Cherry of Cherry Lane Homes, a Phase I Geoenvironmental and Geotechnical Assessment (Desk Study) has been carried out at 7 Belton Road in Epworth. It is proposed to develop the garden area with three detached residential properties.

1.2 The purpose of the desk study was to review and assess information on the site including geological, mining and hydrogeological data, to review the past history of the site and its environmental setting, and to determine if there are any geotechnical or geoenvironmental hazards that may impair its safe and economic development.

1.3 The study has not included checks on services on or adjacent to the site, and no structural or asbestos surveys have been carried out.

## 2 THE SITE

2.1 The site covers an area of approximately 0.2 hectares. It is located within the grounds of 7 Belton Road in Epworth, approximately 20km East of the centre of Doncaster. The Ordnance National Survey Grid Reference is 478110, 404300 and it lies at approximately 12 mAOD. Figure 1 shows the general site location, whilst figure 2 shows the site in more detail.

2.2 The site was inspected on 9th October 2020. It comprises the garden area to the rear of 7 Belton Road. Access is from Belton Road, along a tarmac driveway. The garden area is largely lawned with a number of semi-mature trees. There is a small garage building on the Southwestern corner of the site which is used for domestic storage purposes. It is proposed to demolish this building. The surrounding area comprises residential properties.

*View of Garden Area*

*View of Garden Area*

*Garage Area*

*Access from Belton Road*

## 3 SITE HISTORY

3.1 The following archival Ordnance Survey maps have been examined to trace the past development of the site. These are reproduced in Appendix 2 with the current site boundary superimposed on them. The apparent displacement on the older maps is due to a change in Ordnance Survey co-ordinates.

| Scale and Year of Publication | | | |
|---|---|---|---|
| 6" to 1 mile | 1885 | 1:2500 | 1886 |
| | 1905 | | 1907 |
| | 1948 | | 1965 |
| | 1951 | | 1970 |
| | | | 1978 |
| | | | 1979 |
| | | | 1982 |
| | | | 1990 |
| | | | 1993 |
| | | | 1994 |
| | | | 1995 |
| 1:10,000 | 1974 | 1:1250 | 2003 |
| | 1981 | | |
| | 2001 | | |
| | 2010 | | |
| | 2020 | | |

3.2 The earliest available map dates from 1886, and shows the site to be undeveloped land to the rear of properties along Belton Road and High Street. A gas works with gasometer is shown approximately 150m to the Northwest of the site.

3.3 Over the subsequent years the area developed, mainly with residential properties. The gas works closed by 1948.

3.4 The map of 1970 shows No. 7 having been built with two small structures shown on the site itself, one of which is the current garage. There was also housing to the North on Tottermire Lane and a 'depot' approximately 120m to the North.

3.5 By 1980, one of the small buildings on the site had been removed, and thereafter, the site remained unchanged.

3.6 Due to time and cost constraints, it has not been possible to consult with local history journals and newspapers. This can be carried out if requested at additional cost, but is unlikely to provide any significant additional information.

3.7 The site is unlikely to be of archaeological interest. However, it would be prudent to make enquiries with North Lincolnshire Council.

# 4 GEOLOGY AND MINING

## 4.1 Geology

4.1.1 Maps of the British Geological Survey (BGS), in particular 1:10,000 scale sheet SE70SE and 1:50,000 scale sheet 088 show the site to be underlain by the Sutton Sand Formation, typically comprising fine grained silty sand. Bedrock comprises mudstone of the Mercia Mudstone Group, which is Triassic in age.

4.1.2 The site is shown to be free of faulting.

## 4.2 Mining

4.2.1 The site lies outside the Coal Mining Reporting Area.

## 4.3 GroundSure Geo-Insight

4.3.1 A GroundSure Geo-Insight Report has been obtained for the site and is reproduced in Appendix 2. The report is based on the British Geological Survey (BGS) geological maps, GroundSure data and miscellaneous other geological sources.

4.3.2 None of the following are recorded beneath the site.

| **Boreholes** |
|---|
| BGS Boreholes |

| Mining, Ground Workings and Natural Cavities |
|---|
| Natural Cavities<br>BritPits<br>Surface ground workings<br>Underground workings<br>Historical Mineral Planning Areas<br>Non-coal mining<br>Mining cavities<br>JPB mining areas<br>Coal Mining<br>Brine areas<br>Gypsum areas<br>Tin mining<br>Clay mining |

| Railway Infrastructure and Projects |
|---|
| Underground railways (Non-London)<br>Railway tunnels<br>Historical railway and tunnel features<br>Royal Mail tunnels<br>Historical railways<br>Railways<br>HS2 |

In respect of natural ground subsidence, the BGS reports the following risk ratings.

| Natural Ground Subsidence | Risk |
|---|---|
| Shrink-Swell Clay | Very Low |
| Running Sand | Low |
| Compressible Deposits | Negligible |
| Collapsible Deposits | Negligible |
| Landslide | Very Low |
| Ground Dissolution of Soluble Rocks | Negligible |

4.3.3 A number of boreholes have been sunk in the wider vicinity of the site and their records could probably be obtained if necessary. However, soil variability in the area would render them of limited use. In terms of determining the actual ground conditions on the site, there is no substitute for an intrusive ground investigation.

# 5 HYDROGEOLOGY AND FLOODING

## Hydrogeology

5.1 Since April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive.

5.2 The aquifer within the superficial deposits is designated as Secondary A. This is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

5.3 The aquifer within the bedrock deposits is designated as Secondary B. This is described as low permeable layers capable of supporting limited groundwater. These are generally aquifers formerly classified as non-aquifers.

5.4 Details provided by the Environment Agency in the GroundSure Enviro-Insight Report, indicate there to be no current licensed surface water or groundwater abstraction points within at least 2km of the site.

## Flooding

5.5 There are no open watercourses in the immediate vicinity of the site, and according to data supplied by the Environment Agency in the GroundSure Enviro-Insight report, the site is not at risk from flooding.

# 6 GROUNDSURE ENVIRO-INSIGHT REPORT

6.1 A GroundSure Enviro-Insight Report has been commissioned for this site. The following features are recorded within 250m of the centre of the site. Full details are given in Appendix 1.

## 6.2 Waste Exemptions

Lawns Farm just to the South of the site has an exemption for spreading waste on agricultural land. The Gables Business Park to the North has exemptions for burning waste in the open and storage of waste in a secure place. Other waste exemptions in the area are for "sorting and denaturing of controlled drugs". None of these activities are expected to impact the site adversely.

## 6.3 Contemporary Trade Entries

The GroundSure Enviro-Insight Report lists various trade entries in the vicinity of the site. It should be noted that these lists are rarely complete.

## 6.4 Others

None of the following are recorded within 250m of the centre of the study site.

| Waste and Landfill |
|---|
| Active or recent landfill<br>Historical landfill (BGS) records<br>Historical landfill (LA/mapping records)<br>Historical landfill (EA/NRW records)<br>Historical waste sites<br>Licensed waste sites<br>Waste Exemptions |

| **Current Industrial Land Use** |
|---|
| Current or recent petrol stations<br>Electricity cables<br>Gas pipelines<br>Sites determined as Contaminated Land<br>Control of Major Accident Hazards (COMAH)<br>Regulated explosive sites<br>Hazardous substance storage/usage<br>Historical licensed industrial activities (IPC)<br>Licensed industrial activities (Part A(1))<br>Licensed pollutant release (Part A(2)/B)<br>Radioactive Substance Authorisations<br>Licensed Discharges to controlled waters<br>Pollutant release to surface waters (Red List)<br>Pollutant release to public sewer<br>List 1 Dangerous Substances<br>List 2 Dangerous Substances<br>Pollution Incidents (EA/NRW)<br>Pollution inventory waste transfers<br>Pollution inventory radioactive waste |

| **Environmental Designations** |
|---|
| Site of Special Scientific Interest (SSSI)<br>Conserved wetland sites (Ramsar sites)<br>Special Areas of Conservation (SAC)<br>Special Protection Areas (SPA)<br>National Nature Reserves (NNR)<br>Local Nature Reserves (LNR)<br>Designated Ancient Woodland<br>Biosphere Reserves<br>Forest Parks<br>Marine Conservation Zones<br>Green Belt<br>Proposed Ramsar sites<br>Possible Special Areas of Conservation (pSAC)<br>Potential Special Protection Areas (pSPA)<br>Nitrate Sensitive Areas<br>SSSI Units |

| **Visual and Cultural Designations** |
|---|
| World Heritage Sites<br>Areas of Outstanding Natural Beauty<br>National Parks<br>Scheduled Ancient Monuments<br>Registered Parks and Gardens |

| Agricultural Designations |
|---|
| Open Access Land<br>Tree Felling Licenses<br>Countryside Stewardship Schemes |

| Habitat Designations |
|---|
| Priority Habitat Inventory<br>Habitat Networks<br>Open Mosaic Habitat<br>Limestone Pavement Orders |

6.5 The GroundSure Enviro-Insight Report is based upon known, published information and may not comprise a complete record of all features of relevance. An explanation of the datasets is provided in the report in Appendix 1.

6.6 It should be noted that due to time constraints the Local Authority has not been contacted, nor has the Petroleum Licensing Officer as former fuel tanks are not suspected.

## 7 CONTAMINATED LAND AND INVASIVE PLANTS

7.1 There is no visibly contaminated material on the surface of the site, nor is there any distressed vegetation suggestive of significant or serious contamination.

7.2 The inspection of the site did not indicate any obvious invasive plants. However, the identification of such is outside the expertise of this consultancy and appropriate advice should be sought.

## 8 RADON

8.1 According to the GroundSure Geo-Insight Report the site lies in an area where less than 1% of homes are above the action level recommended by Public Health England. Radon protective measures are therefore not necessary according to the BGS data provided in the GroundSure Report and as described in Building Research Publication BR 211.

# 9 GEOENVIRONMENTAL RISK ASSESSMENT

## Conceptual Site Model

9.1 A quantitative health and environmental risk assessment has been carried out as part of this assessment. The process of risk assessment is set out in Part IIA of the Environment Protection Act 1990 and amended in part by The Water Act 2003. This defines contaminated land as "*any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that there is a significant possibility of significant harm being caused, or that significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused".*

9.2 The Act introduces the concept of a pollution linkage. This linkage consists of a pollution (contaminative) source or hazard and a receptor, together with an established pathway between the two. For land to be contaminated, a pollution linkage (hazard-pathway-receptor) must exist. This forms a so-called 'conceptual model' of the site.

9.3 Examples of pathways and effects from land contamination (after PPS 23) are given below, and these are illustrated on figure 3.

### 9.3.1 Human Health (Pathways 1-5, Receptors A – C)

**Uptake of contaminants by food plants grown in contaminated soil** - Uptake will depend on concentration in soil, its chemical form, soil pH, plant species and prominence in diet.

**Ingestion and inhalation** - Substances may be ingested directly by young children playing on contaminated soil, by eating plants which have absorbed metals or are contaminated with soil or dust. Ingestion may also occur via contaminated water supplies. Metals, some organic materials and radioactive substances may be inhaled from dusts and soils.

**Skin contact -** Soil containing tars, oils and corrosive substances may cause irritation to the skin through direct contact. Some substances (e.g. phenols) may be absorbed into the body through the skin or through cuts and abrasions.

**Irradiation -** As well as being inhaled and absorbed through the skin, radioactive materials emitting gamma rays can cause a radiation response.

**Fire and explosion** - Materials such as coal, coke particles, oil, tar, pitch, rubber, plastic and domestic waste are all combustible. Both underground fires and biodegradation of organic materials may produce toxic or flammable gases. Methane and other gases may explode if allowed to accumulate in confined spaces.

### 9.3.2 Buildings (Pathways 7 and 8)

**Fire and explosion** - Underground fires may cause ground subsidence and cause structural damage. Accumulations of flammable gases in confined space leads to a risk of explosion. Underground fires may damage services.

**Chemical attack on building materials and services -** Sulphates may attack concrete structures. Acids, oils and tarry substances may accelerate corrosion of metals or attack plastics, rubber and other polymeric materials used in pipework and service conduits or as jointing seals and protective coatings to concrete and metals.

**Physical -** Blast-furnace and steel-making slag (and some natural materials) may expand. Degradation of fills may cause settlement and voids in buried tanks and drums may collapse as corrosion occurs or under loading.

### 9.3.3 Natural Environment (Pathway 6, Receptors D - E)

**Phytotoxicity (prevention/inhibition of plant growth)** - Some metals essential for plant growth at low levels are phytotoxic at higher concentrations. Methane and other gases may give rise to phytotoxic effects.

**Contamination of water resources** - Soil has a limited capacity to absorb, degrade or attenuate the effects of pollutants. When this is exceeded, polluting substances may enter into surface and groundwaters.

**Ecotoxological effects -** Contaminants in soil may affect microbial, animal and plant populations. Ecosystems or individual species on the site, in surface waters or areas affected by migration from the site may be affected.

9.4 For any contaminant source identified, judgement is used regarding the probability of a pollution linkage occurring and the potential consequences of that linkage. Based on the probability and likely consequences, the overall risk (significance) can be established. The definitions that have been used for this purpose are given in Standard Appendix B. The probability of a hazard, combined with its consequences, can be used to assess risk. This forms the so-called Conceptual Site Model.

**Sources**

9.5 The site has had no previously recorded commercial or industrial use recorded on the historical maps. As such no specific potential contaminants have been identified.

9.6 A small former gas works was recorded approximately 150m from the site. However, this closed prior to 1948, and any contamination associated with the site is unlikely to have impacted the study site.

9.7 Reference has been made to DEFRA publication CLR8 'Potential Contaminants for the Assessment of Land' and the relevant DOE Industry Profiles to identify the typical contaminants associated with the past industrial use.

## Risk Assessment based on Conceptual Site Model

## Summary of Hazards, Pathways and Receptors

| Source | Potential Pollutant | Pathways | Receptor | Risk |
|---|---|---|---|---|
| **Potential contaminated Made Ground.**<br><br>**Possible past minor spillages and metals.** | Oils, fuels, grease, hydraulic fluid, metals. | 1 - 5 | A. Present Occupants. | **Low Risk.** |
| | | | B. Groundworkers. | **Low Risk** involved with excavation work, providing personnel adopt suitable precautions, together with washing facilities. |
| | | | C. Future Occupants. | **Low Risk** for residential use. |
| | | 6 | D. Controlled Waters. | **Low Risk.** |
| | | | E. Ecosystems. | **Low Risk**. |
| | | 7 | F. Building Materials and Services. | **Low Risk.** Adequate precautions to be taken in respect of buried concrete. |
| **Organic Material.** | Landfill Gases, Radon, VOCs, SVOCs. | 8 | A - F | **Low Risk.** No recorded potential sources of ground gases. |

**Pathways and Receptors**

9.8 The principal receptors are groundworkers, future residents and controlled water (Receptors B, C and D). However based on the past history of the site, the probability of contamination being present sufficient to affect the identified receptors is considered to be a *low risk.*

9.9 The overall risk is assessed to be *low.* At this stage it is not considered that there is likely to be any significant risk and an intrusive investigation in respect of contamination is not considered to be a necessary requirement.

9.10 With any site, the possibility of contaminants being present, sufficient to cause significant harm cannot however be entirely precluded without intrusive investigation, sampling and testing since it is not always possible to determine if contaminants have been tipped on the site, or have seeped into the ground, or have migrated below the ground onto the site from adjacent pieces of land. This is however considered unlikely.

9.11 This risk can be mitigated by intrusive investigation. Contamination investigation and testing would reduce the risk of any unforeseen contamination being uncovered during construction, but it is not a requirement at this stage. Any investigation should be carried out in accordance with BS10175 "Investigation of Potentially Contaminated Sites". In any event, it is recommended that if during construction any suspicious or unusual odours, colours, liquids or soils are uncovered, these should be brought to the attention of Michael D Joyce Associates LLP and appropriate advice sought.

A D Joyce

BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC SQP

October 2020

# APPENDIX C

EXPLORATORY HOLE LOGS

# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| **BH No** | | | | | **WS1** |
| **Contract No** | | | | | **C531** |
| **Method:** | Windowless sampling borehole using a Dando Terrier | **Site** | **Belton Road Sandtoft** | **Date** | **19/08/22** |
| | | | | **Scale** | **01:25** |
| | | **Client** | **Cherry Lane Homes Ltd** | **Logged By** | **AS** |

| Sample Details | | | Description | Depth (m) | Level (mAOD) | Legend |
|---|---|---|---|---|---|---|
| **Type** | **Depth To-from (m)** | **Records** | | | | |
| ES | 0.10 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine and medium of quartzite | 0.50 | | |
| ES | 0.60 | | Dark brown fine to coarse SAND | 1.10 | | |
| ES | 1.00 | | Dark grey fine to coarse SAND<br>From 2.00: Sand becoming damp | 2.45 | | |
| | | | Soft, greenish grey mottled light brown slightly sandy silty CLAY. Sand is fine, occasional 2-3cm pockets of brown fiberous peat | 2.70 | | |
| | | | Stiff, locally very stiff dark brown mottled light grey very gravelly CLAY. Gravel is subangular fine and medium of mudstone. Frequent 2-5mm lithorelict bedding noted | | | |
| | | | **Window Sample Complete at 3.00m (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Monitoring Well Installed

**Sample Types**
D - Disturbed
U - Undisturbed
W - Water



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| | | | | BH No | WS2 |
| | | | | Contract No | C531 |
| Method: | Windowless sampling borehole using a Dando Terrier | Site | Belton Road Sandtoft | Date | 19/08/22 |
| | | | | Scale | 01:25 |
| | | Client | Cherry Lane Homes Ltd | Logged By | AS |

| Sample Details | | | Description | Depth (m) | Level (mAOD) | Legend |
|---|---|---|---|---|---|---|
| Type | Depth To-from (m) | Records | | | | |
| ES | 0.20 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine and medium of quartzite | | | |
| ES | 0.50 | | | 0.50 | | |
| | | | Dark brown fine to coarse SAND | | | |
| ES | 1.00 | | | 1.10 | | |
| | | | Dark grey fine to coarse SAND | | | |
| | | | **Window Sample Complete at 2.00m (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Borehole backfilled upon completion

**Sample Types**
D - Disturbed
U - Undisturbed
W - Water



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| | | | | BH No | WS3 |
| | | | | Contract No | C531 |
| Method: | Windowless sampling borehole using a Dando Terrier | Site | Belton Road Sandtoft | Date | 19/08/22 |
| | | | | Scale | 01:25 |
| | | Client | Cherry Lane Homes Ltd | Logged By | AS |

| Sample Details | | | Description | Depth (m) | Level (mAOD) | Legend |
|---|---|---|---|---|---|---|
| Type | Depth To-from (m) | Records | | | | |
| ES | 0.10 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel sized fragments are subangular fine and medium of quartzite and rare brick | 0.30 | | |
| | | | Dark brown fine to coarse SAND | | | |
| ES | 0.80 | | | | | |
| ES | 1.10 | | | 1.10 | | |
| | | | Dark grey fine to coarse SAND<br>From 2.00m: becoming clayey | 2.10 | | |
| | | | Firm, becoming stiff dark brown mottled light grey very gravelly CLAY. Gravel is subangular fine and medium of mudstone. Frequent 2-5mm lithorelict bedding noted<br>From 2.70m: Frequent 2-5mm lithorelict bedding noted | | | |
| | | | **Window Sample Complete at 3.00m. (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Monitoring Well Installed

**Sample Types**
D - Disturbed W - Water
U - Undisturbed



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| **BH No** | | | | | **WS4** |
| **Contract No** | | | | | **C531** |
| **Method:** | Windowless sampling borehole using a Dando Terrier | **Site** | **Belton Road Sandtoft** | **Date** | **19/08/22** |
| | | | | **Scale** | **01:25** |
| | | **Client** | **Cherry Lane Homes Ltd** | **Logged By** | **AS** |

| Sample Details | | | Description | Depth (m) | Level (mAOD) | Legend |
|---|---|---|---|---|---|---|
| **Type** | **Depth To-from (m)** | **Records** | | | | |
| ES | 0.20 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine and medium of quartzite | 0.30 | | |
| ES | 0.40 | | Dark brown fine to coarse SAND | 0.90 | | |
| ES | 1.00 | | Orange brown locally slightly gravelly fine to coarse SAND. Gravel is subrounded fine to medium of quartzite | 1.30 | | |
| | | | Dark grey fine to coarse SAND | | | |
| | | | **Window Sample Complete at 2.00m (Target Depth)** | | | |

**Remarks**

No groundwater encountered

Borehole backfilled upon completion

**Sample Types**

D - Disturbed W - Water

U - Undisturbed



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| **BH No** | | | | | **WS5** |
| **Contract No** | | | | | **C531** |
| **Method:** | Windowless sampling borehole using a Dando Terrier | **Site** | **Belton Road Sandtoft** | **Date** | **19/08/22** |
| | | | | **Scale** | **01:25** |
| | | **Client** | **Cherry Lane Homes Ltd** | **Logged By** | **AS** |

| Sample Details | | | Description | | | |
|---|---|---|---|---|---|---|
| **Type** | **Depth To-from (m)** | **Records** | | **Depth (m)** | **Level (mAOD)** | **Legend** |
| ES | 0.20 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel sized fragments are subangular fine and medium of quartzite and rare limestone | 0.40 | | |
| ES | 0.50 | | Dark brown fine to coarse SAND | | | |
| ES | 1.00 | | Orange brown locally slightly gravelly fine to coarse SAND. Gravel is subrounded fine to medium of quartzite | 1.00 | | |
| | | | Dark grey fine to coarse SAND | 1.20 | | |
| | | | **Window Sample Complete at 2.50m (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Borehole backfilled upon completion

**Sample Types**
D - Disturbed W - Water
U - Undisturbed



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| **BH No** | | | | | **WS6** |
| **Contract No** | | | | | **C531** |
| **Method:** | Windowless sampling borehole using a Dando Terrier | **Site** | **Belton Road Sandtoft** | **Date** | **19/08/22** |
| | | | | **Scale** | **01:25** |
| | | **Client** | **Cherry Lane Homes Ltd** | **Logged By** | **AS** |

| Sample Details | | | Description | | | |
|---|---|---|---|---|---|---|
| **Type** | **Depth To-from (m)** | **Records** | | **Depth (m)** | **Level (mAOD)** | **Legend** |
| ES | 0.20 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine and medium of quartzite | 0.30 | | |
| | | | Dark brown fine to coarse SAND | 0.80 | | |
| ES | 1.20 | | Orange brown locally slightly gravelly fine to coarse SAND. Gravel is subrounded fine to medium of quartzite | 1.20 | | |
| | | | Dark grey fine to coarse SAND | 2.20 | | |
| | | | Stiff, light grey very gravelly CLAY. Gravel is subangular fine and medium of mudstone and siltstone. Frequent 2-5mm lithorelict bedding<br><br>From 2.70-3.00m: Becoming very silty with rare 20-30mm plant rootlets | | | |
| | | | **Window Sample Complete at 3.00m (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Monitoring Well Installed

**Sample Types**
D - Disturbed W - Water
U - Undisturbed



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# Window Sampling Borehole

| | | | | | |
|---|---|---|---|---|---|
| **BH No** | | | | | **WS7** |
| **Contract No** | | | | | **C531** |
| **Method:** | Windowless sampling borehole using a Dando Terrier | **Site** | **Belton Road Sandtoft** | **Date** | **19/08/22** |
| | | | | **Scale** | **01:25** |
| | | **Client** | **Cherry Lane Homes Ltd** | **Logged By** | **AS** |

| Sample Details | | | Description | | | |
|---|---|---|---|---|---|---|
| **Type** | **Depth To-from (m)** | **Records** | | **Depth (m)** | **Level (mAOD)** | **Legend** |
| ES | 0.10 | | TOPSOIL: Dark brown slightly gravelly fine to coarse SAND. Gravel sized fragments are subangular fine and medium of quartzite and rare limestone | 0.40 | | |
| ES | 0.50 | | Dark brown fine to coarse SAND | 1.20 | | |
| | | | Dark grey fine to coarse SAND | | | |
| | | | **Window Sample Complete at 2.00m (Target Depth)** | | | |

**Remarks**
No groundwater encountered
Borehole backfilled upon completion

**Sample Types**
D - Disturbed W - Water
U - Undisturbed



G&M CONSULTING

# APPENDIX D

LABORATORY TEST RESULTS

**Andrew Swinbourne**
G & M Consulting Ltd
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East Lound
Haxey
Doncaster
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**t:** 07743 319788

**e:** graeme@soilexperts.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

**t:** 01923 225404
**f:** 01923 237404
**e:** reception@i2analytical.com

# Analytical Report Number : 22-79751

| | | | |
|---|---|---|---|
| **Project / Site name:** | Belton Road Epworth | **Samples received on:** | 22/08/2022 |
| **Your job number:** | C531 | **Samples instructed on/ Analysis started on:** | 23/08/2022 |
| **Your order number:** | | **Analysis completed by:** | 06/09/2022 |
| **Report Issue Number:** | 1 | **Report issued on:** | 06/09/2022 |
| **Samples Analysed:** | 8 soil samples | | |

**Signed:**

Adam Fenwick
Technical Reviewer
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

**Analytical Report Number: 22-79751**
**Project / Site name: Belton Road Epworth**

| Lab Sample Number | | | | 2399842 | 2399843 | 2399844 | 2399845 | 2399846 |
|---|---|---|---|---|---|---|---|---|
| Sample Reference | | | | WS01 | WS01 | WS02 | WS03 | WS04 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.20 | 0.60 | 0.10 | 0.10 | 0.80 |
| Date Sampled | | | | 19/08/2022 | 19/08/2022 | 19/08/2022 | 19/08/2022 | 19/08/2022 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Moisture Content | % | 0.01 | NONE | 16 | 16 | 8.7 | 13 | 11 |
| Total mass of sample received | kg | 0.001 | NONE | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Asbestos in Soil | Type | N/A | ISO 17025 | Not-detected | - | Not-detected | - | - |
| Asbestos Analyst ID | N/A | N/A | N/A | SSZ | N/A | SSZ | N/A | N/A |
| **General Inorganics** | | | | | | | | |
| pH - Automated | pH Units | N/A | MCERTS | 7.5 | - | 8.2 | - | 8.4 |
| Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent) | g/l | 0.00125 | MCERTS | 0.031 | - | 0.11 | - | 0.015 |
| **Total Phenols** | | | | | | | | |
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | - | - |
| **Speciated PAHs** | | | | | | | | |
| Naphthalene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Acenaphthene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Fluorene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Phenanthrene | mg/kg | 0.05 | MCERTS | 0.4 | < 0.05 | - | 0.23 | < 0.05 |
| Anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Fluoranthene | mg/kg | 0.05 | MCERTS | 1.1 | < 0.05 | - | 0.53 | < 0.05 |
| Pyrene | mg/kg | 0.05 | MCERTS | 1.1 | < 0.05 | - | 0.48 | < 0.05 |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | 0.85 | < 0.05 | - | 0.33 | < 0.05 |
| Chrysene | mg/kg | 0.05 | MCERTS | 0.81 | < 0.05 | - | 0.32 | < 0.05 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | MCERTS | 1 | < 0.05 | - | 0.39 | < 0.05 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | MCERTS | 0.48 | < 0.05 | - | 0.19 | < 0.05 |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | 0.82 | < 0.05 | - | 0.28 | < 0.05 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 0.41 | < 0.05 | - | < 0.05 | < 0.05 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | - | < 0.05 | < 0.05 |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | 0.5 | < 0.05 | - | < 0.05 | < 0.05 |
| **Total PAH** | | | | | | | | |
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 7.52 | < 0.80 | - | 2.75 | < 0.80 |
| **Heavy Metals / Metalloids** | | | | | | | | |
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 6 | < 1.0 | 10 | 7.5 | 1.7 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | 0.5 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Chromium (hexavalent) | mg/kg | 1.8 | MCERTS | < 1.8 | < 1.8 | 4 | < 1.8 | < 1.8 |
| Chromium (aqua regia extractable) | mg/kg | 1 | MCERTS | 12 | 4 | 14 | 15 | 5.5 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 34 | 9.5 | 38 | 32 | 12 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 68 | 5.2 | 99 | 85 | 13 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | 0.7 | < 0.3 | 1.8 | < 0.3 | < 0.3 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 11 | 3.4 | 13 | 15 | 3.7 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 260 | 13 | 120 | 110 | 22 |

U/S = Unsuitable Sample  I/S = Insufficient Sample

**Analytical Report Number: 22-79751**
**Project / Site name: Belton Road Epworth**

| Lab Sample Number | | | | 2399847 | 2399848 | 2399849 |
|---|---|---|---|---|---|---|
| Sample Reference | | | | WS05 | WS06 | WS07 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.30 | 0.20 | 0.10 |
| Date Sampled | | | | 19/08/2022 | 19/08/2022 | 19/08/2022 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | < 0.1 | < 0.1 |
| Moisture Content | % | 0.01 | NONE | 7.6 | 9.6 | 8 |
| Total mass of sample received | kg | 0.001 | NONE | 0.4 | 0.4 | 0.4 |
| Asbestos in Soil | Type | N/A | ISO 17025 | Not-detected | Not-detected | Not-detected |
| Asbestos Analyst ID | N/A | N/A | N/A | SSZ | SSZ | SSZ |
| **General Inorganics** | | | | | | |
| pH - Automated | pH Units | N/A | MCERTS | - | 7.9 | 8.0 |
| Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent) | g/l | 0.00125 | MCERTS | - | 0.0047 | 0.017 |
| **Total Phenols** | | | | | | |
| Total Phenols (monohydric) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 |
| **Speciated PAHs** | | | | | | |
| Naphthalene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Acenaphthene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Fluorene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Phenanthrene | mg/kg | 0.05 | MCERTS | 0.4 | - | - |
| Anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Fluoranthene | mg/kg | 0.05 | MCERTS | 0.99 | - | - |
| Pyrene | mg/kg | 0.05 | MCERTS | 0.85 | - | - |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | 0.61 | - | - |
| Chrysene | mg/kg | 0.05 | MCERTS | 0.61 | - | - |
| Benzo(b)fluoranthene | mg/kg | 0.05 | MCERTS | 0.62 | - | - |
| Benzo(k)fluoranthene | mg/kg | 0.05 | MCERTS | 0.35 | - | - |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | 0.53 | - | - |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 0.25 | - | - |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | - | - |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | 0.36 | - | - |
| **Total PAH** | | | | | | |
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 5.57 | - | - |
| **Heavy Metals / Metalloids** | | | | | | |
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 7.9 | 9.4 | 4.3 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | 0.7 | 0.6 | < 0.2 |
| Chromium (hexavalent) | mg/kg | 1.8 | MCERTS | < 1.8 | < 1.8 | < 1.8 |
| Chromium (aqua regia extractable) | mg/kg | 1 | MCERTS | 14 | 19 | 10 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 30 | 46 | 17 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 86 | 120 | 40 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | < 0.3 | < 0.3 | < 0.3 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 14 | 15 | 7.9 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 300 | 150 | 55 |

U/S = Unsuitable Sample  I/S = Insufficient Sample

**Analytical Report Number : 22-79751**
**Project / Site name: Belton Road Epworth**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

| Lab Sample Number | Sample Reference | Sample Number | Depth (m) | Sample Description * |
|---|---|---|---|---|
| 2399842 | WS01 | None Supplied | 0.2 | Brown sand with gravel and vegetation. |
| 2399843 | WS01 | None Supplied | 0.6 | Brown sand. |
| 2399844 | WS02 | None Supplied | 0.1 | Brown sand with gravel and vegetation. |
| 2399845 | WS03 | None Supplied | 0.1 | Brown sand with gravel and vegetation. |
| 2399846 | WS04 | None Supplied | 0.8 | Brown sand with gravel and vegetation. |
| 2399847 | WS05 | None Supplied | 0.3 | Brown sand with gravel and vegetation. |
| 2399848 | WS06 | None Supplied | 0.2 | Brown sand with gravel and vegetation. |
| 2399849 | WS07 | None Supplied | 0.1 | Brown sand with gravel and vegetation. |

**Analytical Report Number : 22-79751**
**Project / Site name: Belton Road Epworth**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Sulphate, water soluble, in soil (16hr extraction) | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent). | In house method. | L038-PL | D | MCERTS |
| Metals in soil by ICP-OES | Determination of metals in soil by aqua-regia digestion followed by ICP-OES. | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil. | L038-PL | D | MCERTS |
| Asbestos identification in soil | Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques. | In house method based on HSG 248 | A001-PL | D | ISO 17025 |
| Moisture Content | Moisture content, determined gravimetrically. (30 oC) | In house method. | L019-UK/PL | W | NONE |
| Monohydric phenols in soil | Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar) | L080-PL | W | MCERTS |
| Speciated EPA-16 PAHs in soil | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270 | L064-PL | D | MCERTS |
| pH in soil (automated) | Determination of pH in soil by addition of water followed by automated electrometric measurement. | In house method. | L099-PL | D | MCERTS |
| Stones content of soil | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight. | In-house method based on British Standard Methods and MCERTS requirements. | L019-UK/PL | D | NONE |
| Hexavalent chromium in soil | Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry. | In-house method | L080-PL | W | MCERTS |

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**
**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**
**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**

**Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.**

# APPENDIX E

GAS MONITORING RESULTS

# Ground Gas and Groundwater Monitoring Record Sheet

**JOB DETAILS:**

**Client:** Mr Sid Cherry **Job No:** C531
**Site:** Epworth **Visit No:** 1 **of** 6
**Date:** 02/09/2022 **Operator:** VF **Project Manager:** AS

| Monitoring Point | GAS CONCENTRATIONS | | | | | | | | | | | | VOLATILES | | FLOW DATA | | | | WELL AND WATER DATA | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Methane (%v/v) | | %LEL | | Carbon dioxide (%v/v) | | Carbon monoxide (ppmv) | | Hydrogen sulphide (ppmv) | | Oxygen (%v/v) | | PID Peak (ppm) | Product thickness (mm) | Flow rate (l/hr) | | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Water level (mbgl) | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) | Response Zone | |
| | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Minimum | Steady | | | Peak | Steady | | | | | | | | |
| WS1 | 0 | 0 | 0 | 0 | 2.0 | 2.0 | 0 | 0 | 0 | 0 | 19.0 | 19.0 | 0.3 | | 0 | | | | DRY | 2.00 | | | | |
| WS3 | 0 | 0 | 0 | 0 | 1.0 | 0.8 | 8 | 6 | 2 | 0 | 20.0 | 20.2 | 0 | | 0 | | | | 2.10 | 2.90 | | | | |
| WS6 | 0 | 0 | 0 | 0 | 1.9 | 1.8 | 4 | 0 | 2 | 0 | 19.1 | 19.4 | 0 | | 0 | | | | 1.61 | 2.15 | | | | |
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| **Max** | **0** | **0** | **0** | **0** | **2** | **2** | **8** | **6** | **2** | **0** | **20** | **20.2** | **0.3** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **Min** | **0** | **0** | **0** | **0** | **1** | **0.8** | **0** | **0** | **0** | **0** | **19** | **19** | **0** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **GSV (l/hr)** | **0** | | | | | | | | | | | | | | | | | | | | | | | |

**METEOROLOGICAL AND SITE INFORMATION:** (Select correct box with X or enter data, as applicable)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State of ground: | X | Dry | | Moist | | Wet | | Snow | | Frozen | **Notes** | |
| Wind: | X | Calm | | Light | | Moderate | | Strong | | | NR- | Not recorded |
| Cloud cover: | | None | | Slight | X | Cloudy | | Overcast | | | | |
| Preciptation: | X | None | | Slight | | Moderate | | Heavy | | | | |
| Barometric pressure (mbar): | | | 1014 | Before | | | 1014 | After | | | | |
| Pressure trend: | | | | Falling | X | Steady | | Rising | | | | |
| Air Temperature (Deg. C): | | | | Before | | | | After | | | | |

**INSTRUMENTATION TECHNICAL SPECIFICATIONS:**

**Ground gas meter:** GFM 430
Gas concentration: **$CH_4$** 0.2%@5%, 1.0@30%, 3.0@100% **$CO_2$** 0.1%@10%, 3.0%@30%,3.0%@100% **$O_2$**
Gas Range: **$CH_4$** 0 - 100% **$CO_2$** 0 - 100% **$O_2$** 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
**Date of last calibration:** 29/09/2021
**Date of next calibration:** 29/09/2022

**PID:** MiniRAE 3000
Calbrated range:
Calibration gas:
Response time:
Accuracy:
**Date of last calibration:** On site calibration using 100ppm Isobutylene
**Date of next calibration:**

## Ground Gas and Groundwater Monitoring Record Sheet

**JOB DETAILS:**

**Client:** Mr Sid Cherry **Job No:** C531
**Site:** Epworth **Visit No:** 2 **of** 6
**Date:** 17/09/2022 **Operator:** VF **Project Manager:** AS

| Monitoring Point | GAS CONCENTRATIONS | | | | | | | | | | | | VOLATILES | | FLOW DATA | | | | WELL AND WATER DATA | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Methane (%v/v) | | %LEL | | Carbon dioxide (%v/v) | | Carbon monoxide (ppmv) | | Hydrogen sulphide (ppmv) | | Oxygen (%v/v) | | PID Peak (ppm) | Product thickness (mm) | Flow rate (l/hr) | | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Water level (mbgl) | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) | Response Zone | |
| | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Minimum | Steady | | | Peak | Steady | | | | | | | | |
| WS1 | 0 | 0 | 0 | 0 | 2.2 | 2.2 | 0 | 0 | 3 | 0 | 19.4 | 19.4 | 0.5 | | 0 | | | | DRY | 2.00 | | | | |
| WS3 | 0 | 0 | 0 | 0 | 0.6 | 0.6 | 0 | 0 | 0 | 0 | 19.3 | 19.3 | 0.1 | | 0 | | | | 2.00 | 2.90 | | | | |
| WS6 | 0 | 0 | 0 | 0 | 3.2 | 3.0 | | 0 | 1 | 0 | 15.5 | 15.5 | 0 | | 0 | | | | 1.49 | 2.15 | | | | |
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| **Max** | **0** | **0** | **0** | **0** | **3.2** | **3** | **0** | **0** | **3** | **0** | **19.4** | **19.4** | **0.5** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **Min** | **0** | **0** | **0** | **0** | **0.6** | **0.6** | **0** | **0** | **0** | **0** | **15.5** | **15.5** | **0** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **GSV (l/hr)** | **0** | | | | | | | | | | | | | | | | | | | | | | | |

**METEOROLOGICAL AND SITE INFORMATION:** (Select correct box with X or enter data, as applicable)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State of ground: | X | Dry | | Moist | | Wet | | Snow | | Frozen | **Notes** | |
| Wind: | X | Calm | | Light | | Moderate | | Strong | | | NR- | Not recorded |
| Cloud cover: | | None | X | Slight | | Cloudy | | Overcast | | | | |
| Preciptation: | X | None | | Slight | | Moderate | | Heavy | | | | |
| Barometric pressure (mbar): | | | 1021 | Before | | | 1021 | After | | | | |
| Pressure trend: | | | | Falling | X | Steady | | Rising | | | | |
| Air Temperature (Deg. C): | | | | Before | | | | After | | | | |

**INSTRUMENTATION TECHNICAL SPECIFICATIONS:**

**Ground gas meter:** GFM 430
Gas concentration: **$CH_4$** 0.2%@5%, 1.0@30%, 3.0@100% **$CO_2$** 0.1%@10%, 3.0%@30%,3.0%@100% **$O_2$**
Gas Range: **$CH_4$** 0 - 100% **$CO_2$** 0 - 100% **$O_2$** 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
**Date of last calibration:** 29/09/2021
**Date of next calibration:** 29/09/2022

**PID:** MiniRAE 3000
Calbrated range:
Calibration gas:
Response time:
Accuracy:
**Date of last calibration:** On site calibration using 100ppm Isobutylene
**Date of next calibration:**

## Ground Gas and Groundwater Monitoring Record Sheet

**JOB DETAILS:**

**Client:** Mr Sid Cherry **Job No:** C531
**Site:** Epworth **Visit No:** 3 **of** 6
**Date:** 26/09/2022 **Operator:** VF **Project Manager:** AS

| Monitoring Point | GAS CONCENTRATIONS | | | | | | | | | | | | VOLATILES | | FLOW DATA | | | | WELL AND WATER DATA | | | | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Methane (%v/v) | | %LEL | | Carbon dioxide (%v/v) | | Carbon monoxide (ppmv) | | Hydrogen sulphide (ppmv) | | Oxygen (%v/v) | | PID Peak (ppm) | Product thickness (mm) | Flow rate (l/hr) | | Differential borehole Pressure (Pa) | Time for flow to equalise (secs) | Water level (mbgl) | Depth of well (m) | Reduced level (mAOD) | Water level (mAOD) | Response Zone | |
| | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Peak | Steady | Minimum | Steady | | | Peak | Steady | | | | | | | | |
| WS1 | 0 | 0 | 0 | 0 | 3.1 | 3.1 | 3 | 0 | 0 | 0 | 16.8 | 17.2 | 0 | | 0 | | | | DRY | 2.00 | | | | |
| WS3 | 0 | 0 | 0 | 0 | 0.4 | 0.4 | 0 | 0 | 0 | 0 | 20.8 | 20.8 | 0 | | 0 | | | | 2.16 | 2.90 | | | | |
| WS6 | 0 | 0 | 0 | 0 | 3.3 | 3.3 | 6 | 0 | 0 | 0 | 15.7 | 15.8 | 0 | | 0 | | | | 1.32 | 2.15 | | | | |
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| **Max** | **0** | **0** | **0** | **0** | **3.3** | **3.3** | **6** | **0** | **0** | **0** | **20.8** | **20.8** | **0** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **Min** | **0** | **0** | **0** | **0** | **0.4** | **0.4** | **0** | **0** | **0** | **0** | **15.7** | **15.8** | **0** | **0** | **0** | **0** | **0** | **0** | | | | | | |
| **GSV (l/hr)** | **0** | | | | | | | | | | | | | | | | | | | | | | | |

**METEOROLOGICAL AND SITE INFORMATION:** (Select correct box with X or enter data, as applicable)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State of ground: | X | Dry | | Moist | | Wet | | Snow | | Frozen | **Notes** | |
| Wind: | X | Calm | | Light | | Moderate | | Strong | | | NR- | Not recorded |
| Cloud cover: | | None | X | Slight | | Cloudy | | Overcast | | | | |
| Preciptation: | X | None | | Slight | | Moderate | | Heavy | | | | |
| Barometric pressure (mbar): | | | 1021 | Before | | | 1021 | After | | | | |
| Pressure trend: | | | | Falling | X | Steady | | Rising | | | | |
| Air Temperature (Deg. C): | | | | Before | | | | After | | | | |

**INSTRUMENTATION TECHNICAL SPECIFICATIONS:**

**Ground gas meter:** GFM 430
Gas concentration: **$CH_4$** 0.2%@5%, 1.0@30%, 3.0@100% **$CO_2$** 0.1%@10%, 3.0%@30%,3.0%@100% **$O_2$**
Gas Range: **$CH_4$** 0 - 100% **$CO_2$** 0 - 100% **$O_2$** 0 - 25%
Gas Flow range: +100/-50 l/hour
Differential Pressure: (+/-) 1000 Pa
**Date of last calibration:** 29/09/2021
**Date of next calibration:** 29/09/2022

**PID:** MiniRAE 3000
Calbrated range:
Calibration gas:
Response time:
Accuracy:
**Date of last calibration:** On site calibration using 100ppm Isobutylene
**Date of next calibration:**