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# **GEO-ENVIRONMENTAL PHASE 2 SITE INVESTIGATION**

**LAND OFF MELTON ROAD**

**STANTON-ON-THE-WOLDS  
KEYWORTH  
NG12 5PJ**

On behalf of:

Stanton Brook Estates Limited

Report No.: A180820CL-R02

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# Table of Contents

- LAND OFF MELTON ROAD ..... 1
- 1 INTRODUCTION .....4
  - 1.1 Background.....4
  - 1.2 Scope and Objectives .....4
  - 1.3 Previous Reports & Supporting Information .....4
- 2 SITE DETAILS .....5
  - 2.1 Location and Description.....5
  - 2.2 Summary of Preliminary Risk Assessment .....6
- 3 PHASE 2 SITE INVESTIGATION .....6
  - 3.2 Scope of Investigation.....6
  - 3.3 Fieldworks.....6
  - 3.4 Ground Conditions .....9
- 4 CONTAMINATED LAND ASSESSMENT .....10
  - 4.1 Long Term Human Health Risk.....10
  - 4.2 Updated Conceptual Site Model .....14
- 5 CONCLUSIONS.....16
  - 5.1 Summary.....16
  - 5.2 Recommendations .....17
- APPENDIX A – SITE PLAN & EXPLORATORY HOLE LOCATIONS .....18
- APPENDIX B – SUPPORTING INFORMATION .....19
- APPENDIX C – TRIAL PIT PHOTOS.....20
- APPENDIX D – LABORATORY CERTIFICATE - SOIL RESULTS .....25
- APPENDIX E - LIMITATIONS .....26

# 1 INTRODUCTION

## 1.1 Background

Adeptus was appointed by Stanton Brook Estates Limited to undertake a Geo-Environmental Phase 2 Site Investigation at the site. The investigation is required in support of a planning application for redevelopment of the site and to further assess potentially significant contaminant linkages identified in an earlier phase 1 desk study undertaken by Adeptus.

Land contamination is a material consideration under the National Planning Policy Framework (2012). This means that local authorities must take the potential or actual presence of contamination into account when considering planning applications.

“Contamination” is defined in BS 10175:2011 as:

*presence of a substance or agent, as a result of human activity, in, on or under land, which has the potential to cause harm or to cause pollution.*

## 1.2 Scope and Objectives

The following scope of works has been undertaken:

- Review of desk study and preliminary risk assessment
- Design and implementation of suitable exploratory investigation
- Sample retrieval and laboratory chemical analysis
- Tier 1 quantitative risk assessment
- Update of the initial conceptual site model
- Factual and interpretive reporting

The objectives of the works were to:

- Obtain data on soil chemical status
- Provide an assessment of risks to relevant receptors in line with the principles of LCRM.

## 1.3 Previous Reports & Supporting Information

Phase 1 desk study A201103-R01 (Adeptus, 2018) – summarised in Section 2.2.

A site plan is included as Appendix A.

Other sources of information utilised in producing this report are listed as Appendix B.

## 2 SITE DETAILS

This section provides an overview of the site location and preliminary risk assessment.

### 2.1 Location and Description

Table 2-1: Site Summary

|                              |   |
|------------------------------|---|
| <b>Location</b>              | The site is situated on an A road in a predominantly rural location 1 mile east of the village of Keyworth. |
| <b>Grid Reference</b>        | 463940,331117 (approx.)   |
| <b>Area &amp; Shape</b>      | 0.84ha – roughly rectangular.   |
| <b>Development Proposals</b> | We are advised that the development of six detached dwellings with gardens is proposed.                     |



Figure 2-1: Site Location (based on the plan in appendix a)

## 2.2 Summary of Preliminary Risk Assessment

The risk assessment identified a number of potentially significant pollutant linkages, suggesting that further assessment should be undertaken.

Available information suggested the site had originally developed under agro-industrial use, and in the recent past been used for general commercial activities including a joinery workshop, golf buggy sales, a lawn treatment business and storage units.

At the rear of the site a stock of drums appearing to contain both new and used lubricating oils was noted, with signs of spillage to ground and probable mechanical maintenance being undertaken in the general area.

Various scrap and waste/off-cut items were noted across the site, particularly toward the north and around the storage units. Containers of what were thought to be adhesive, as well as paint and possibly solvents were also noted adjacent some of the storage units. It is considered likely that fuel and oil may be stored in some of the storage units also.

The hardstanding across the site appears to be underlain with brick rubble hardcore, as is typical of such sites. It could be seen at the east of the site close to where the brook exists, that this was up to around 1.5m thick, with the surrounding land being lowest here. It is likely that this material was imported from off-site at various times during the site's development, and may contain contaminants from various sources, including asbestos. Depending on the organic carbon content of the material, where thicker than 1m this may also present a significant source of biogenic gases.

The site setting is considered moderately-to-highly sensitive due to the proposed residential use, brook running beneath the site and surfacing immediately east, and underlying secondary aquifers.

## 3 PHASE 2 SITE INVESTIGATION

### 3.2 Scope of Investigation

An exploratory investigation has been designed based on the preliminary risk assessment. The scope of works undertaken was as listed below.

- Formation of exploratory trial pits
- Strata logging and sample retrieval
- Chemical laboratory testing and on-site PID screening of samples
- Tier 1 screening against published reference values
- Factual and interpretive reporting of investigation findings

### 3.3 Fieldworks

#### Investigation Strategy

9no. trial pits were advanced to allow targeted sampling of near surface soils, with locations determined based on the rationale set out in Table 3-1.

Fieldworks were completed on the 25<sup>th</sup> of January 2021. Weather was dry and initially bright, becoming overcast by mid-morning. Unforeseen snowfall overnight had blanketed the site and the background contrast rendered many photographs unusable.

Table 3-1: Fieldworks Summary

| Location Reference* and Rationale |   | Max Depth (mbgl) | Generalised Strata   | Depth to Base (m)** |
|-----------------------------------|---|------------------|--|---------------------|
| <b>TP1</b>                        | Close to the east corner of the site, where Made Ground was anticipated to be deepest and some surplus materials were stored. | 1.2              | MADE GROUND: Reddish brown sandy gravel. Sand is medium. Gravel is medium to coarse (roadstone/subbase).   | 0.2                 |
|                                   |   |                  | MADE GROUND: Dark grey sand and gravel with abundant rootlets. Sand is coarse. Gravel is fine to medium.   | 0.5                 |
|                                   |   |                  | MADE GROUND: Cobbles of brick and concrete with frequent fragments of clay pipe, occasional ceramic, metal and a price of electric wire, in a matrix of gravelly silty sand.                                       | 1.05                |
|                                   |   |                  | OADBY MEMBER: Firm brownish grey CLAY.   | 1.2+                |
| <b>TP2</b>                        | At the southeast of the site for general coverage.  | 0.8              | MADE GROUND: Black sandy gravel of tarmacadam.   | 0.06                |
|                                   |   |                  | MADE GROUND: Reddish brown sandy gravel. Sand is medium. Gravel is medium to coarse (roadstone/subbase).   | 0.2                 |
|                                   |   |                  | MADE GROUND: Dark grey sand and gravel with low cobble content and occasional metal. Sand is coarse. Gravel is fine to medium. Cobbles are broken brick and concrete.  | 0.6                 |
|                                   |   |                  | OADBY MEMBER: Firm grey mottled green, slightly silty CLAY with some gravel.   | 0.8+                |
| <b>TP3</b>                        | Towards the southern corner of the site, at the edge of the area used for general storage.                                    | 0.6              | MADE GROUND: Dark grey slightly gravelly silty sand with high cobble content. Sand is fine to coarse. Gravel is fine to coarse. Cobbles are broken brick and concrete. Frequent pieces of plastic, metal and wood. | 0.45                |
|                                   |   |                  | OADBY MEMBER: Soft light brown very silty CLAY.  | 0.6+                |
| <b>TP4</b>                        | Centrally within the site, just south of the access.  | 0.7              | MADE GROUND: Black sandy gravel of tarmacadam.   | 0.3                 |
|                                   |   |                  | OADBY MEMBER: Soft light brown very silty CLAY. Black staining and mild degraded hydrocarbon odour between 0.5-0.65.   | 0.7+                |
| <b>TP5</b>                        | Approximately central on the west boundary for general site coverage.   | 0.5              | TOPSOIL: Dark grey slightly clayey sandy silt.   | 0.25                |
|                                   |   |                  | OADBY MEMBER: Soft light brown very silty CLAY.  | 0.5+                |

|            |   |     |  |      |
|------------|---|-----|--|------|
| <b>TP6</b> | At the north of the site targeting former storage containers and for general site coverage.                   | 0.6 | MADE GROUND: Black sandy gravel of tarmacadam.   | 0.1  |
|            |   |     | MADE GROUND: Full and half bricks in a matrix of dark grey gravelly silty sand.  | 0.45 |
|            |   |     | OADBY MEMBER: Soft grey very silty CLAY.   | 0.6+ |
| <b>TP7</b> | Centrally in the northern half of the site targeting former storage containers and for general site coverage. | 0.6 | MADE GROUND: Black sandy gravel of tarmacadam.   | 0.1  |
|            |   |     | MADE GROUND: Grey sandy gravel with high cobble content. Sand is medium to coarse. Gravel is medium to coarse broken brick and concrete with some ceramic. Cobbles are full and half bricks.                             | 0.45 |
|            |   |     | OADBY MEMBER: Soft grey mottled brown silty CLAY.  | 0.6+ |
| <b>TP8</b> | On the northern gable of the main building targeting a storage area.  | 0.6 | MADE GROUND: Black sandy gravel of tarmacadam.   | 0.3  |
|            |   |     | MADE GROUND: Grey gravelly sand with some cobbles. Sand is medium to coarse. Gravel is medium to coarse broken brick and concrete. Cobbles are full and half bricks.   | 0.5  |
|            |   |     | OADBY MEMBER: Soft dark grey silty CLAY.   | 0.6+ |
| <b>TP9</b> | At the rear of the main building targeting the storage area for waste oil drums.                              | 0.8 | MADE GROUND: Beige sandy gravel. Sand is medium. Gravel is medium to coarse (roadstone/subbase).   | 0.1  |
|            |   |     | MADE GROUND: Black gravelly sand with some cobbles and occasional plastic. Sand is medium to coarse with the appearance of ash. Gravel is medium to coarse with the appearance of ash. Cobbles are full and half bricks. | 0.6  |
|            |   |     | OADBY MEMBER: Firm grey mottled green, slightly silty CLAY with some gravel.   | 0.8+ |

Notes: \* HP = Hand Pit; TP = Mechanically Excavated Trial Pit; WS = Windowless Sampler Borehole; BH = Cable Percussion Borehole | \*\* + Indicates base of stratum was not reached.

Exploratory hole locations are marked on the plan in Appendix A. Photos are attached as Appendix C.

### Environmental Testing

Selected soil samples were submitted for a range of chemical analyses as set out in Table 2.4 below.

Table 3-2: Environmental Testing Schedule

| Determinand | Trial Pit (TP) Ref. & Depth (m) |           |           |           |           |           |           |           |            |            |            |           |            |           |
|-------------|---------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|-----------|------------|-----------|
|             | 1A<br>0.3                       | 1B<br>0.6 | 2A<br>0.4 | 2B<br>0.8 | 3A<br>0.2 | 4A<br>0.1 | 4B<br>0.7 | 5A<br>0.1 | 6A<br>0.15 | 7A<br>0.15 | 8A<br>0.15 | 8B<br>0.3 | 9A<br>0.25 | 9B<br>0.6 |
| pH          | ✓                               | ✓         | ✓         | ✓         | ✓         | ✓         | ✓         | ✓         | ✓          | ✓          | ✓          | ✓         | ✓          | ✓         |



|                      |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Organic Matter (SOM) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Metals suite         | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| PAH (USEPA-16)       | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| TPH-CWG & BTEX       | ✓ | - | - | - | ✓ | ✓ | ✓ | - | ✓ | - | ✓ | - | ✓ | ✓ |
| Asbestos ID          | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

Testing results are reviewed in Section 4, and the full laboratory report is included as Appendix C.

Selected samples were also screened on site for the presence of volatile organic species using a hand-held photo ionisation detector. No positive PID reading were returned.

### 3.4 Ground Conditions

#### Topsoil

Topsoil was generally only encountered in a thin horizon in TP5 at the west of the site directly overlying the clay.

#### Made Ground

Made Ground was encountered in all trial pits except for TP5, generally consisting of a shallow surface layer of tarmacadam sandy gravel or gravely sand, underlain with hardcore forming a subbase layer to depths between circa 0.45m - 1m.

Hardcore presented generally as typical construction and demolition waste, consisting of cobbles of brick and concrete in a matrix of silty sandy gravel or gravely sand, with occasional to frequent inclusions such as fragments of clay pipe, plastic and metal.

As anticipated, Made Ground was of the greatest thickness at the east of the site, where underlying topography dips toward the former brook which is culverted beneath the site and flows from southwest to northeast.

TP9 northeast of the main workshop building encountered a thick layer of black gravely sand that had the appearance of ash, with some cobbles and occasional plastic.

Trial pits at the east of the site encountered a layer of roadstone above the hardcore.

No obvious evidence of ACM was noted in any trial pits although given the nature of waste encountered, the presence of ACM to some degree was considered likely.

#### Superficial Deposits

Brown, grey, and brown mottled grey clay was encountered in all location at depths from 1.05m at the east, to 0.25m at the west of the site where it was overlain with topsoil.

#### Ground Gas

General Made Ground consisting standard car park materials and of less than 1m thickness is not considered a significant potential source of ground gases. While this suggests the thickness of Made Ground underlying much of the site is not significant, there is potential for some areas of Made ground to be of higher organic content and therefore a source of biogenic gases such as methane and carbon dioxide.

### Groundwater

Groundwater was not encountered in any of the trial pits.

### Unexpected Ground Conditions

The ground is a product natural and artificial processes and as a result, will exhibit a variety of characteristics that vary between points both laterally and vertically as well as over time. Whilst a site investigation seeks to establish general ground conditions, the possibility of variations in between exploratory locations cannot be eliminated.

## 4 CONTAMINATED LAND ASSESSMENT

### 4.1 Long Term Human Health Risk

A Tier 1 (generic) quantitative risk assessment has been undertaken by screening measured contaminant concentrations against reference values for chronic (long term) risk to human health known as generic assessment criteria (GAC).

Concentrations exceeding the relevant screening values are described as 'elevated' and indicate a requirement to further characterise or otherwise address health and environmental risks.

In line with the initial conceptual site model, GAC for the residential with consumption of homegrown produce (RwHP) scenario have been utilised. The GAC are based on 2.5% SOM.

The assessment is summarised in Table 4-1, and the source of GAC is indicated in the final column and footnotes to the table.

Table 4-1: Summary of Soil Analytical Results vs Tier 1 Screening Values

| Determinand                                 | GAC | Units | No. of Samples | No. of Exceedances | Exceedance Locations | Summary Statistics* |         |         | **  |
|---|-----|-------|----------------|--------------------|----------------------|---------------------|---------|---------|-----|
|   |     |       |                |                    |                      | Minimum             | Maximum | Average |     |
| <b>Inorganics &amp; Metals / Metalloids</b> |     |       |                |                    |                      |                     |         |         |     |
| Asbestos                                    | N/A | -     | 14             | 2                  | TP1B-0.6; TP6A-0.15. | -                   | -       | -       | *** |
| Arsenic                                     | 37  | mg/kg | 14             | 1                  | TP9A-0.25.           | 7.1                 | 44.0    | 14.7    | 1   |
| Boron                                       | 290 | mg/kg | 14             | -                  | -                    | 0.2                 | 4.4     | 1.9     | 1   |

| Cadmium                   | 11   | mg/kg | 14             | -                  | -  | 0.4                 | 4.6     | 1.6     | 1  |
|---------------------------|------|-------|----------------|--------------------|--|---------------------|---------|---------|----|
| Chromium                  | 910  | mg/kg | 14             | -                  | -  | 12.0                | 35.0    | 21.4    | 1  |
| Copper                    | 2400 | mg/kg | 14             | -                  | -  | 14.0                | 440.0   | 116.7   | 1  |
| Lead                      | 200  | mg/kg | 14             | 5                  | TP1B-0.6; TP2B- 0.8; TP8A-0.15; TP9A-0.25; TP9B-0.6. | 8.4                 | 390.0   | 140.8   | 3  |
| Mercury                   | 1.2  | mg/kg | 14             | -                  | -  | 0.4                 | 0.7     | 0.6     | 1  |
| Nickel                    | 180  | mg/kg | 14             | -                  | -  | 13.0                | 63.0    | 25.9    | 1  |
| Selenium                  | 250  | mg/kg | 14             | -                  | -  | 1.2                 | 1.2     | 1.2     | 1  |
| Zinc                      | 3700 | mg/kg | 14             | -                  | -  | 33.0                | 990.0   | 299.1   | 1  |
| Determinand               | GAC  | Units | No. of Samples | No. of Exceedances | Exceedance Locations                                 | Summary Statistics* |         |         | ** |
|                           |      |       |                |                    |  | Minimum             | Maximum | Average |    |
| <b>PAHs - at 2.5% SOM</b> |      |       |                |                    |  |                     |         |         |    |
| Naphthalene               | 5.6  | mg/kg | 14             | -                  | -  | 5.4                 | 5.4     | 5.4     | 1  |
| Acenaphthylene            | 420  | mg/kg | 14             | -                  | -  | 0.2                 | 1.7     | 0.8     | 1  |
| Acenaphthene              | 510  | mg/kg | 14             | -                  | -  | 0.2                 | 31.0    | 6.5     | 1  |
| Fluorene                  | 400  | mg/kg | 14             | -                  | -  | 0.1                 | 39.0    | 7.4     | 1  |
| Phenanthrene              | 220  | mg/kg | 14             | -                  | -  | 0.3                 | 120.0   | 25.3    | 1  |
| Anthracene                | 5400 | mg/kg | 14             | -                  | -  | 0.3                 | 40.0    | 10.3    | 1  |
| Fluoranthene              | 560  | mg/kg | 14             | -                  | -  | 0.4                 | 110.0   | 35.6    | 1  |
| Pyrene                    | 1200 | mg/kg | 14             | -                  | -  | 0.4                 | 110.0   | 31.9    | 1  |

| Benzo(a)anthracene                      | 11   | mg/kg | 14             | 6                  | TP3A-0.20; TP4A-0.10; TP4B-0.7; TP6A-0.15; TP8A-0.15; TP8B-0.3.                                  | 0.2                 | 81.0    | 20.7    | 1  |
|---|------|-------|----------------|--------------------|--|---------------------|---------|---------|----|
| Chrysene                                | 22   | mg/kg | 14             | 4                  | TP3A-0.20; TP4A-0.10; TP4B-0.7; TP6A-0.15; TP8A-0.15.  | 0.2                 | 51.0    | 13.8    | 1  |
| Benzo(b)fluoranthene                    | 3.3  | mg/kg | 14             | 7                  | TP3A-0.20; TP4A-0.10; TP4B-0.7; TP6A-0.15; TP7A- 0.15; TP8A-0.15; TP8B-0.3; TP9A-0.25.           | 0.5                 | 73.0    | 23.9    | 1  |
| Benzo(k)fluoranthene                    | 93   | mg/kg | 14             | -                  | -  | 0.3                 | 41.0    | 11.2    | 1  |
| Benzo(a)pyrene                          | 2.7  | mg/kg | 14             | 7                  | TP3A-0.20; TP4A-0.10; TP4B-0.7; TP6A-0.15; TP7A- 0.15; TP8A-0.15; TP8B-0.3; TP9A-0.25; TP9B-0.6. | 0.5                 | 82.0    | 24.4    | 1  |
| Indeno(1,2,3-cd)pyrene                  | 36   | mg/kg | 14             | 1                  | TP8A-0.15.   | 0.2                 | 38.0    | 10.9    | 1  |
| Dibenz(a,h)anthracene                   | 0.28 | mg/kg | 14             | 5                  | TP4A-0.10; TP4B-0.7; TP6A-0.15; TP7A- 0.15; TP8A-0.15; TP8B-0.3.                                 | 2.3                 | 11.0    | 5.0     | 1  |
| Benzo(ghi)perylene                      | 340  | mg/kg | 14             | -                  | -  | 0.3                 | 43.0    | 13.9    | 1  |
| Determinand                             | GAC  | Units | No. of Samples | No. of Exceedances | Exceedance Locations   | Summary Statistics* |         |         | ** |
|   |      |       |                |                    |  | Minimum             | Maximum | Average |    |
| <b>TPH-CWG &amp; BTEX - at 2.5% SOM</b> |      |       |                |                    |  |                     |         |         |    |
| Aromatic >EC5 - EC7                     | 140  | mg/kg | 8              | -                  | -  | 0.0                 | 0.0     | 0.0     | 1  |
| Aromatic >EC7 - EC8                     | 290  | mg/kg | 8              | -                  | -  | 0.0                 | 0.0     | 0.0     | 1  |
| Aromatic >EC8 - EC10                    | 83   | mg/kg | 8              | -                  | -  | 0.0                 | 0.0     | 0.0     | 1  |
| Aromatic >EC10 - EC12                   | 180  | mg/kg | 8              | -                  | -  | 3.5                 | 15.0    | 10.2    | 1  |
| Aromatic >EC12 - EC16                   | 330  | mg/kg | 8              | -                  | -  | 20.0                | 170.0   | 61.2    | 1  |
| Aromatic >EC16 - EC21                   | 540  | mg/kg | 8              | -                  | -  | 11.0                | 390.0   | 214.7   | 1  |
| Aromatic >EC21 - EC35                   | 1500 | mg/kg | 8              | -                  | -  | 23.0                | 990.0   | 539.4   | 1  |

|                        |       |           |   |   |   |       |       |       |   |
|------------------------|-------|-----------|---|---|---|-------|-------|-------|---|
| Aliphatic >EC6 - EC8   | 230   | mg/<br>kg | 8 | - | - | 0.0   | 0.0   | 0.0   | 1 |
| Aliphatic >EC8 - EC10  | 65    | mg/<br>kg | 8 | - | - | 0.0   | 0.0   | 0.0   | 1 |
| Aliphatic >EC10 - EC12 | 330   | mg/<br>kg | 8 | - | - | 7.5   | 7.5   | 7.5   | 1 |
| Aliphatic >EC12 - EC16 | 2400  | mg/<br>kg | 8 | - | - | 9.7   | 25.0  | 15.2  | 1 |
| Aliphatic >EC16 – EC35 | 92000 | mg/<br>kg | 8 | - | - | 168.0 | 280.0 | 199.8 | 1 |

Notes: \* Summary statistics based on targeted sampling are provided for information only.

\*\* Source of GAC: 1 = LQM / CIEH (2014) S4UL3785 | 2 = CL:AIRE (2009) Soil Generic Assessment Criteria for Human Health | 3 = Defra (2014) C4SL | 4 - As no UK derived GAC is available for Total Cyanide a screening value of 20mg/kg (Thiocyanate) has been used as an initial screening tool

\*\*\* For asbestos, the number of detections is shown and does not relate to any GAC. N.D = Not detected

The quantitative screening summarised in Table 4-3 indicates the following:

- Lead was elevated in five of the 14 samples, at up to circa twice the screening value.
- Arsenic was elevated in one of the 14 samples, at up to circa 1.2 times the screening value.
- Six of the PAH compounds were elevated in samples from TP3, TP4, TP6, TP7 and TP8, in particular with elevated benzo(a)pyrene detected in seven samples at up to circa 30 times the screening value.
- Asbestos was detected in two of the 14 samples – in TP1B-0.6m as chrysotile-paper, and TP6A-0.15 as amosite, and as chrysotile-sheeting/board debris.
- Some of the heavier TPH fractions were detected in seven of the eight samples but remained significantly below the screening values.
- None of the BTEX compounds were present above laboratory detection limits.
- No further exceedances of the screening criteria were detected.

## 4.2 Updated Conceptual Site Model

The initial conceptual site model has been updated in Table 4-2, below, to reflect the presence of sources proven by the investigation works.

Table 4-2. Updated Conceptual Site Model

| Source   | Pathway   | Receptor   | Consequence | Likelihood     | Classification*    | Rationale   |
|--|---|--|-------------|----------------|--------------------|---|
| Contaminants exceeding GAC in soil: <ul style="list-style-type: none"> <li>Asbestos</li> <li>Lead</li> <li>Arsenic</li> <li>PAHs (inc. benzo(a) pyrene)</li> </ul> | Dermal contact, ingestion, particulate inhalation | Nearby site occupants & users (from on-Site sources) | Medium      | Unlikely       | Low Risk           | Asbestos fragments were detected in two samples from Made Ground.   |
|  |   | Construction workers                                 | Medium      | Likely         | Moderate Risk      | Lead was elevated in several samples at various locations and discrete strata within the Made Ground.   |
|  |   | Future site occupants & users                        | Medium      | Likely         | Moderate Risk      | Arsenic was elevated in sample from TP9A-0.25m close to the storage barn at the northeast of the site and correlated with the highest lead concentration.<br>PAHs including benzo(a)pyrene were highly elevated in relatively numerous samples at various locations and discrete strata within the Made Ground.   |
|  | Consumption of homegrown produce                  |  | Medium      | Low Likelihood | Moderate/ Low Risk | Given the site location and surrounding land use, the likelihood of off-site residents and land users being affected by fugitive dust during any groundworks is low.<br>In the absence of safe systems of work, construction workers could be exposed, in particular via inhalation of asbestos fibres.<br>As the proposed development comprises dwellings with gardens, it is possible that sensitive receptors such as children could be exposed to the affected media should it remain in soft landscaped areas.<br>Although considered to be of low likelihood, the growing of produce in the soft landscaped areas is also possible and may lead to ingestion. |

\*in the absence of any mitigation or remedial measures

| Source   | Pathway  | Receptor  | Consequence | Likelihood | Classification*       | Rationale   |
|--|--|---|-------------|------------|-----------------------|---|
| • Cont'd   | Diffusion through plastic water supply pipes                                   | Water supply pipes  | Medium      | Unlikely   | Low Risk              | <p>The absence of elevated TPH or positive VOC detections (on-site PID) suggest the likelihood of water supply pipes being impacted is low.</p> <p>Water supply connections are also likely to enter from the north or west of the site, largely avoiding the area seen to be used for the storage of drums and waste oil.</p>  |
|  | Migration of vapours via strata, structures or services; subsequent inhalation | Future site occupants & users   | Medium      | Unlikely   | Low Risk              | <p>The absence of lighter TPH fractions or positive VOC detections (on-site PID) do not indicate the presence of a vapour source in the trial pit locations.</p> <p>However, it is possible that land directly beneath the waste oil drums could have been impacted locally. The area is currently inaccessible due to the drums themselves, as well as the steel framed building and its foundations.</p> <p>It is also likely that any historical near surface sources would have been significantly attenuated by natural processes over time, including volatilisation and microbial degradation.</p> <p>Further to the above, BTEX compounds were not present in the samples above detection limits.</p> |
|  | Leaching/dissolution into shallow groundwater; subsurface migration.           | Groundwater   | Medium      | Unlikely   | Low Risk              | <p>No free product has been observed, and the heavier end compounds discussed above are of low solubility and not highly mobile in soils. Given the low permeability silty clays anticipated locally and proven beneath the site, significant effects on groundwater are considered unlikely.</p>   |
| Ground gases, such as methane and carbon dioxide | Lateral migration  | Migration via structures or services; potential explosion or asphyxiation | Severe      | Unlikely   | Moderate/<br>Low Risk | <p>Although generally limited to thicknesses less than 1m, some pockets of Made Ground could be of sufficient organic content to present a source of ground gases produced by its degradation.</p> <p>Risk classification is driven by the potential severity, rather than likelihood of a contaminant linkage.</p>   |

\*in the absence of any mitigation or remedial measures

## 5 CONCLUSIONS

### 5.1 Summary

Adeptus was appointed by Stanton Brook Estates Limited to undertake a Geo-Environmental Phase 2 Site Investigation. The investigation is required in support of a planning application for redevelopment of the site and to further assess potentially significant contaminant linkages identified in an earlier phase 1 desk study undertaken by Adeptus.

The primary objective of the works was to provide a quantitative assessment of risks to relevant receptors in line with the principles of Environment Agency publication 'Land contamination risk management' (LCRM).

Investigation works were intended to target anticipated Made Ground and possible impacts from general light commercial and storage use of the site, as well as machinery maintenance and the storage of waste oil and fuel to the rear of the main building.

The works consisted of 9no. trial pits all penetrating the Made Ground and with a max. depth of 1.2m and a max. thickness of Made Ground encountered of 1.05m. Made Ground generally consisted of construction and demolition waste, including to various degrees brick and concrete, pieces of clay pipe, ceramic, metal, and plastic.

Samples were tested for the following range of contaminants: organic matter (SOM), pH, metals suite, PAH (USEPA-16), TPH-CWG & BTEX and asbestos ID.

Lead and PAHs were found to be generally elevated in Made Ground across the site, with the highest concentrations correlating with tarmacadam road planings, and the black gravelly sand suspected to be ash/clinker, at the rear (northeast) of the main building. A single exceedance of arsenic was also detected in the suspected ash material. This suggests the planings probably are coal tar based, and gravelly sand probably is ash.

No free product contamination such as oil was observed. The heavier end compounds found to be elevated are of low volatility, solubility and not highly mobile in soils, and risk to controlled waters and from vapours is considered to be low.

Asbestos was detected in two samples from Made Ground.

The trial pits proved brown to grey silty clays underlying the site and overlain with circa 0.25m of topsoil at the west of the site, where no Made Ground was present. These cohesive deposits are considered to limit or prevent downward migration of any contaminants toward the Secondary A bedrock Aquifer.

It is considered that the testing confirms the existence of significant contaminant linkages with near surface soils/Made Ground on the site.

There is potential for some areas of Made ground to be of high organic content and therefore a source of biogenic gases such as methane and carbon dioxide capable of entering buildings. However, it was anticipated that Made Ground would require stripping back at the construction phase, therefore gas monitoring was not undertaken.

*N.B.: This summary forms part of the overall preliminary investigation/risk assessment and should not be viewed or used as an independent report.*



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## 5.2 Recommendations

The construction of new buildings and hardstandings will result in a large proportion of the affected material being excavated to enable the placement of subbase, particularly at the east of the site where Made Ground is thickest.

Made Ground is also unlikely to provide the required engineering properties for foundation bearing and is not suitable to remain as subsoil in gardens and soft landscaped areas.

It is therefore recommended that Made Ground is stripped back from the proposed dwelling plots and natural strata exposed. This will provide remediation in terms of removing any potential source of ground gases, and if extended to soft landscaped areas would also negate the requirement for 0.6m of imported clean cover above Made Ground.

It may also be advantageous to screen the Made Ground and retain the large size fraction on-site for crushing to 6F2, along with demolition arisings, subject to the correct authorisations.

Any remaining contaminated soil left in areas of road and hardstandings would effectively be capped, thereby severing relevant contaminant linkages in those areas.

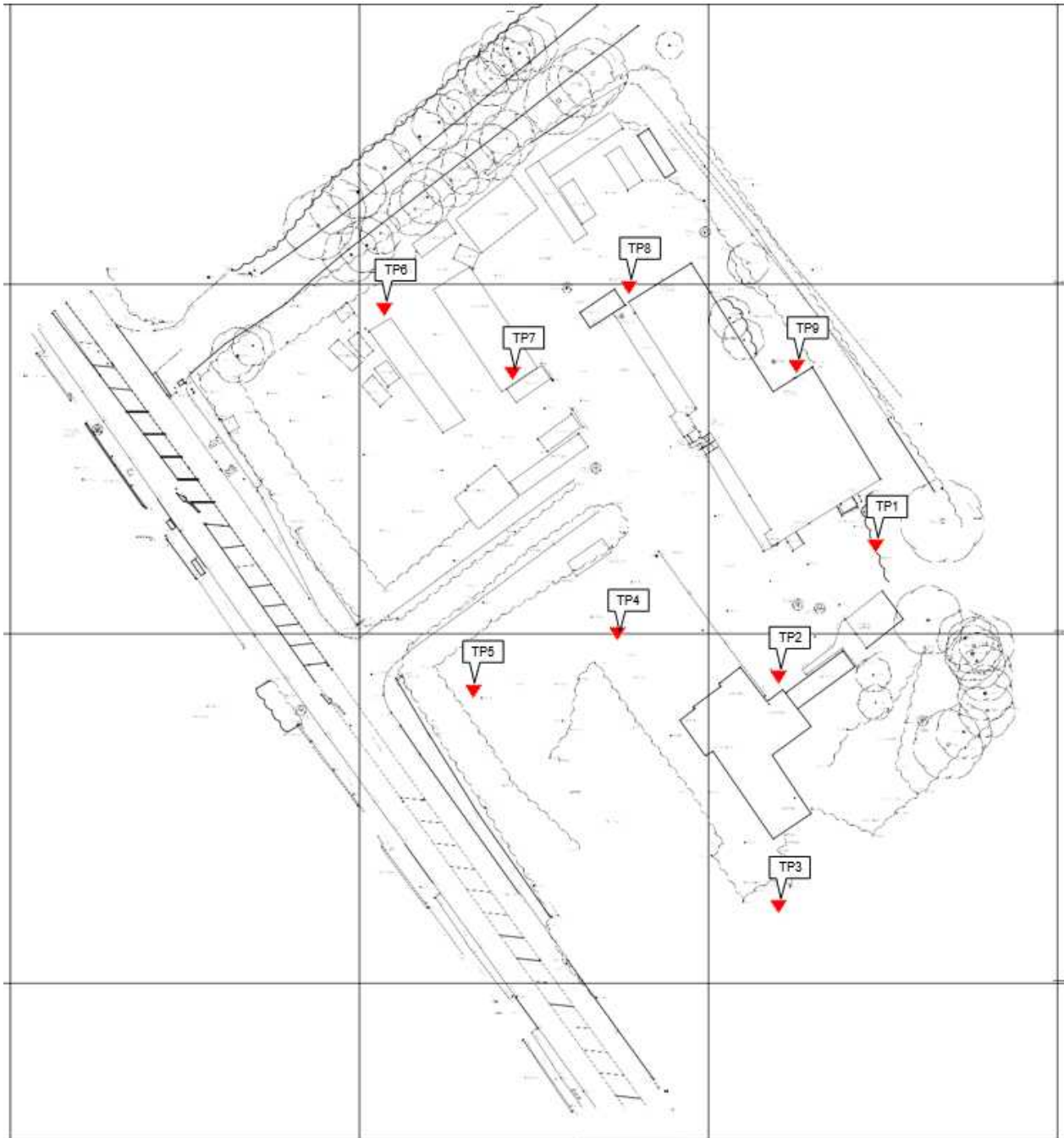
However, the LPA are likely to require evidence that at least 0.6m of clean topsoil/subsoil is achieved in soft landscaped areas. This may only require the placement of topsoil, if Made Ground is stripped back to clean underlying clay.

Following classification, all waste should be disposed of at a suitably licenced facility in accordance with waste duty of care requirements.

Mitigation will also be required to ensure site workers and adjacent land users are not exposed via particulate inhalation. Typically, such measures include the use of the correct PPE and wetting down to prevent fugitive dust.

No remediation work should be undertaken until LPA approval has been obtained.

## APPENDIX A – SITE PLAN & EXPLORATORY HOLE LOCATIONS



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## APPENDIX B – SUPPORTING INFORMATION

The following information and data sources are utilised in compiling this report:

- Phase 1 desk study – A180820LC-R01
- Environmental database
- Historical Ordnance Survey Maps
- Geological maps and records
- Environment Agency and Local Authority registers and permissions
- Web based archive material

This report is based on information available at the time of writing and is subject to the limitations set out in Appendix E.

## APPENDIX C – TRIAL PIT PHOTOS

*Photo 1 – Trial Pit 1*



*Photo 2 – Trial Pit 2*



*Photo 3 – Trial Pit 3*



*Photo 4 – Trial Pit 4*



*Photo 5 – Trial Pit 5*



*Photo 6 – Trial Pit 6*



*Photo 7 – Trial Pit 7*



*Photo 8 – Trial Pit 8*



Photo 9 – Trial Pit 9



Photo10 – Trial Pit 9





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## APPENDIX D – LABORATORY CERTIFICATE - SOIL RESULTS



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## **Analytical Report Number : 21-54007**

|                             |  |  |            |
|-----------------------------|--|--|------------|
| <b>Project / Site name:</b> | A180820 CL Land off Melton Road NG12 5PJ | <b>Samples received on:</b>                            | 27/01/2021 |
| <b>Your job number:</b>     |  | <b>Samples instructed on/<br/>Analysis started on:</b> | 29/01/2021 |
| <b>Your order number:</b>   |  | <b>Analysis completed by:</b>                          | 09/02/2021 |
| <b>Report Issue Number:</b> | 1  | <b>Report issued on:</b>                               | 09/02/2021 |
| <b>Samples Analysed:</b>    | 14 soil samples                          |  |            |

**Signed:**

Joanna Wawrzeczek  
Technical Reviewer (Reporting Team)  
**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 |

Excel copies of reports are only valid when accompanied by this PDF certificate.

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: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                    |       |                    |                      | 1753588       | 1753589       | 1753590       | 1753591       | 1753592       |
|--------------------------------------|-------|--------------------|----------------------|---------------|---------------|---------------|---------------|---------------|
| Sample Reference                     |       |                    |                      | TP1A          | TP1B          | TP2A          | TP2B          | TP3A          |
| Sample Number                        |       |                    |                      | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m)                            |       |                    |                      | 0.30          | 0.60          | 0.40          | 0.80          | 0.20          |
| Date Sampled                         |       |                    |                      | 25/01/2021    | 25/01/2021    | 25/01/2021    | 25/01/2021    | 25/01/2021    |
| 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                 | 7.7           | 9.6           | 15            | 19            | 10            |
| Total mass of sample received        | kg    | 0.001              | NONE                 | 0.9           | 0.7           | 0.9           | 0.9           | 1             |

| Asbestos in Soil Screen / Identification Name | Type | N/A | ISO 17025 | -            | Chrysotile- Paper | -            | -            | -            |
|---|------|-----|-----------|--------------|-------------------|--------------|--------------|--------------|
| Asbestos in Soil                              | Type | N/A | ISO 17025 | Not-detected | Detected          | Not-detected | Not-detected | Not-detected |

**General Inorganics**

|                |          |     |        |     |     |     |     |     |
|----------------|----------|-----|--------|-----|-----|-----|-----|-----|
| pH - Automated | pH Units | N/A | MCERTS | 8.1 | 8.4 | 8.5 | 7.9 | 8.7 |
| Organic Matter | %        | 0.1 | MCERTS | 0.4 | 2.2 | 0.3 | 2.5 | 3.6 |

**Speciated PAHs**

|                        |       |      |        |        |        |        |        |        |
|------------------------|-------|------|--------|--------|--------|--------|--------|--------|
| Naphthalene            | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene         | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 0.24   |
| Acenaphthene           | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 1.5    |
| Fluorene               | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 1.3    |
| Phenanthrene           | mg/kg | 0.05 | MCERTS | < 0.05 | 1.2    | < 0.05 | < 0.05 | 20     |
| Anthracene             | mg/kg | 0.05 | MCERTS | < 0.05 | 0.33   | < 0.05 | < 0.05 | 3.4    |
| Fluoranthene           | mg/kg | 0.05 | MCERTS | < 0.05 | 2.2    | < 0.05 | 0.37   | 34     |
| Pyrene                 | mg/kg | 0.05 | MCERTS | < 0.05 | 1.9    | < 0.05 | 0.36   | 27     |
| Benzo(a)anthracene     | mg/kg | 0.05 | MCERTS | < 0.05 | 0.8    | < 0.05 | 0.23   | 17     |
| Chrysene               | mg/kg | 0.05 | MCERTS | < 0.05 | 0.79   | < 0.05 | 0.19   | 10     |
| Benzo(b)fluoranthene   | mg/kg | 0.05 | MCERTS | < 0.05 | 0.71   | < 0.05 | < 0.05 | 14     |
| Benzo(k)fluoranthene   | mg/kg | 0.05 | MCERTS | < 0.05 | 0.44   | < 0.05 | < 0.05 | 8.1    |
| Benzo(a)pyrene         | mg/kg | 0.05 | MCERTS | < 0.05 | 0.76   | < 0.05 | < 0.05 | 14     |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 4.7    |
| Dibenz(a,h)anthracene  | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(ghi)perylene     | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | 6.1    |

**Total PAH**

|                             |       |     |        |        |      |        |      |     |
|-----------------------------|-------|-----|--------|--------|------|--------|------|-----|
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | < 0.80 | 9.14 | < 0.80 | 1.15 | 161 |
|-----------------------------|-------|-----|--------|--------|------|--------|------|-----|

**Heavy Metals / Metalloids**

|                                   |       |     |        |       |       |       |       |       |
|-----------------------------------|-------|-----|--------|-------|-------|-------|-------|-------|
| Arsenic (aqua regia extractable)  | mg/kg | 1   | MCERTS | 7.1   | 20    | 12    | 9.7   | 8.3   |
| Boron (water soluble)             | mg/kg | 0.2 | MCERTS | 0.2   | 1.7   | 0.7   | 3     | 1.4   |
| Cadmium (aqua regia extractable)  | mg/kg | 0.2 | MCERTS | < 0.2 | 1.4   | < 0.2 | 0.4   | 4.6   |
| Chromium (aqua regia extractable) | mg/kg | 1   | MCERTS | 12    | 27    | 14    | 22    | 22    |
| Copper (aqua regia extractable)   | mg/kg | 1   | MCERTS | 45    | 260   | 54    | 24    | 34    |
| Lead (aqua regia extractable)     | mg/kg | 1   | MCERTS | 8.4   | 210   | 25    | 280   | 100   |
| Mercury (aqua regia extractable)  | mg/kg | 0.3 | MCERTS | < 0.3 | < 0.3 | < 0.3 | < 0.3 | < 0.3 |
| Nickel (aqua regia extractable)   | mg/kg | 1   | MCERTS | 26    | 42    | 21    | 22    | 17    |
| 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 | 33    | 990   | 43    | 110   | 310   |

Analytical Report Number: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                    | 1753588       | 1753589            | 1753590              | 1753591       | 1753592       |
|--------------------------------------|---------------|--------------------|----------------------|---------------|---------------|
| Sample Reference                     | TP1A          | TP1B               | TP2A                 | TP2B          | TP3A          |
| Sample Number                        | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Depth (m)                            | 0.30          | 0.60               | 0.40                 | 0.80          | 0.20          |
| Date Sampled                         | 25/01/2021    | 25/01/2021         | 25/01/2021           | 25/01/2021    | 25/01/2021    |
| Time Taken                           | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |
| Analytical Parameter (Soil Analysis) | Units         | Limit of detection | Accreditation Status |               |               |

**Monoaromatics & Oxygenates**

| Parameter                          | Units | Limit of detection | Accreditation Status | 1753588 | 1753589 | 1753590 | 1753591 | 1753592 |
|------------------------------------|-------|--------------------|----------------------|---------|---------|---------|---------|---------|
| Benzene                            | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| Toluene                            | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| Ethylbenzene                       | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| p & m-xylene                       | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| o-xylene                           | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| MTBE (Methyl Tertiary Butyl Ether) | µg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |

**Petroleum Hydrocarbons**

| Parameter                        | Units | Limit of detection | Accreditation Status | 1753588 | 1753589 | 1753590 | 1753591 | 1753592 |
|----------------------------------|-------|--------------------|----------------------|---------|---------|---------|---------|---------|
| TPH-CWG - Aliphatic >EC5 - EC6   | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aliphatic >EC6 - EC8   | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aliphatic >EC8 - EC10  | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aliphatic >EC10 - EC12 | mg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| TPH-CWG - Aliphatic >EC12 - EC16 | mg/kg | 2                  | MCERTS               | < 2.0   | < 2.0   | -       | -       | -       |
| TPH-CWG - Aliphatic >EC16 - EC21 | mg/kg | 8                  | MCERTS               | < 8.0   | < 8.0   | -       | -       | -       |
| TPH-CWG - Aliphatic >EC21 - EC35 | mg/kg | 8                  | MCERTS               | < 8.0   | < 8.0   | -       | -       | -       |
| TPH-CWG - Aliphatic (EC5 - EC35) | mg/kg | 10                 | MCERTS               | < 10    | < 10    | -       | -       | -       |

| Parameter                       | Units | Limit of detection | Accreditation Status | 1753588 | 1753589 | 1753590 | 1753591 | 1753592 |
|---------------------------------|-------|--------------------|----------------------|---------|---------|---------|---------|---------|
| TPH-CWG - Aromatic >EC5 - EC7   | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aromatic >EC7 - EC8   | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aromatic >EC8 - EC10  | mg/kg | 0.001              | MCERTS               | < 0.001 | < 0.001 | -       | -       | -       |
| TPH-CWG - Aromatic >EC10 - EC12 | mg/kg | 1                  | MCERTS               | < 1.0   | < 1.0   | -       | -       | -       |
| TPH-CWG - Aromatic >EC12 - EC16 | mg/kg | 2                  | MCERTS               | < 2.0   | 20      | -       | -       | -       |
| TPH-CWG - Aromatic >EC16 - EC21 | mg/kg | 10                 | MCERTS               | 11      | 200     | -       | -       | -       |
| TPH-CWG - Aromatic >EC21 - EC35 | mg/kg | 10                 | MCERTS               | 23      | 740     | -       | -       | -       |
| TPH-CWG - Aromatic (EC5 - EC35) | mg/kg | 10                 | MCERTS               | 34      | 960     | -       | -       | -       |

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

Analytical Report Number: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                    | 1753593       | 1753594            | 1753595              | 1753596       | 1753597       |       |       |       |
|--------------------------------------|---------------|--------------------|----------------------|---------------|---------------|-------|-------|-------|
| Sample Reference                     | TP4A          | TP4B               | TP5A                 | TP6A          | TP7A          |       |       |       |
| Sample Number                        | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |       |       |       |
| Depth (m)                            | 0.10          | 0.70               | 0.10                 | 0.15          | 0.15          |       |       |       |
| Date Sampled                         | 25/01/2021    | 25/01/2021         | 25/01/2021           | 25/01/2021    | 25/01/2021    |       |       |       |
| 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                 | 7.1           | 13            | 23    | 11    | 12    |
| Total mass of sample received        | kg            | 0.001              | NONE                 | 1             | 0.9           | 0.9   | 1     | 0.9   |

| Asbestos in Soil Screen / Identification Name | Type | N/A | ISO 17025 | -            | -            | -            | Amosite, Chrysotile-Sheeting/Board Debris | -            |
|---|------|-----|-----------|--------------|--------------|--------------|---|--------------|
| Asbestos in Soil                              | Type | N/A | ISO 17025 | Not-detected | Not-detected | Not-detected | Detected                                  | Not-detected |

**General Inorganics**

| pH - Automated | pH Units | N/A | MCERTS | 8.7 | 8.6 | 8 | 8.7 | 8.3 |
|----------------|----------|-----|--------|-----|-----|---|-----|-----|
| Organic Matter | %        | 0.1 | MCERTS | 5.2 | 1.7 | 3 | 4   | 2.3 |

**Speciated PAHs**

| Naphthalene            | mg/kg | 0.05 | MCERTS | < 0.05 | 5.4    | < 0.05 | < 0.05 | < 0.05 |
|------------------------|-------|------|--------|--------|--------|--------|--------|--------|
| Acenaphthylene         | mg/kg | 0.05 | MCERTS | 0.85   | < 0.05 | < 0.05 | 0.69   | < 0.05 |
| Acenaphthene           | mg/kg | 0.05 | MCERTS | 1.5    | 31     | < 0.05 | 4.8    | 0.23   |
| Fluorene               | mg/kg | 0.05 | MCERTS | 1.4    | 39     | < 0.05 | 4.5    | 0.14   |
| Phenanthrene           | mg/kg | 0.05 | MCERTS | 20     | 120    | 0.44   | 38     | 1.5    |
| Anthracene             | mg/kg | 0.05 | MCERTS | 4.9    | 40     | < 0.05 | 11     | 0.38   |
| Fluoranthene           | mg/kg | 0.05 | MCERTS | 73     | 87     | 0.84   | 71     | 3.8    |
| Pyrene                 | mg/kg | 0.05 | MCERTS | 70     | 70     | 0.78   | 60     | 3.9    |
| Benzo(a)anthracene     | mg/kg | 0.05 | MCERTS | 49     | 41     | 0.5    | 32     | 2.9    |
| Chrysene               | mg/kg | 0.05 | MCERTS | 39     | 24     | 0.32   | 23     | 1.9    |
| Benzo(b)fluoranthene   | mg/kg | 0.05 | MCERTS | 61     | 29     | 0.46   | 33     | 4.2    |
| Benzo(k)fluoranthene   | mg/kg | 0.05 | MCERTS | 26     | 14     | 0.29   | 12     | 1.6    |
| Benzo(a)pyrene         | mg/kg | 0.05 | MCERTS | 60     | 31     | 0.52   | 29     | 4.3    |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 20     | 12     | 0.22   | 12     | 2      |
| Dibenz(a,h)anthracene  | mg/kg | 0.05 | MCERTS | 5.4    | 3.6    | < 0.05 | 2.8    | < 0.05 |
| Benzo(ghi)perylene     | mg/kg | 0.05 | MCERTS | 23     | 13     | 0.28   | 13     | 2.6    |

**Total PAH**

| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 455 | 557 | 4.65 | 348 | 29.4 |
|-----------------------------|-------|-----|--------|-----|-----|------|-----|------|
|-----------------------------|-------|-----|--------|-----|-----|------|-----|------|

**Heavy Metals / Metalloids**

| Arsenic (aqua regia extractable)  | mg/kg | 1   | MCERTS | 9.6   | 13    | 9.5   | 17    | 9.1   |
|-----------------------------------|-------|-----|--------|-------|-------|-------|-------|-------|
| Boron (water soluble)             | mg/kg | 0.2 | MCERTS | 0.8   | 3.3   | 1.4   | 0.8   | 0.8   |
| Cadmium (aqua regia extractable)  | mg/kg | 0.2 | MCERTS | 1.1   | < 0.2 | 0.4   | 0.8   | 0.4   |
| Chromium (aqua regia extractable) | mg/kg | 1   | MCERTS | 23    | 23    | 22    | 19    | 16    |
| Copper (aqua regia extractable)   | mg/kg | 1   | MCERTS | 39    | 14    | 21    | 57    | 26    |
| Lead (aqua regia extractable)     | mg/kg | 1   | MCERTS | 120   | 19    | 51    | 140   | 58    |
| Mercury (aqua regia extractable)  | mg/kg | 0.3 | MCERTS | < 0.3 | < 0.3 | < 0.3 | 0.7   | < 0.3 |
| Nickel (aqua regia extractable)   | mg/kg | 1   | MCERTS | 16    | 22    | 17    | 30    | 14    |
| Selenium (aqua regia extractable) | mg/kg | 1   | MCERTS | 1.2   | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable)     | mg/kg | 1   | MCERTS | 140   | 45    | 77    | 270   | 100   |

Analytical Report Number: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                     | 1753593       | 1753594            | 1753595              | 1753596       | 1753597       |   |       |   |
|---------------------------------------|---------------|--------------------|----------------------|---------------|---------------|---|-------|---|
| Sample Reference                      | TP4A          | TP4B               | TP5A                 | TP6A          | TP7A          |   |       |   |
| Sample Number                         | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |   |       |   |
| Depth (m)                             | 0.10          | 0.70               | 0.10                 | 0.15          | 0.15          |   |       |   |
| Date Sampled                          | 25/01/2021    | 25/01/2021         | 25/01/2021           | 25/01/2021    | 25/01/2021    |   |       |   |
| Time Taken                            | None Supplied | None Supplied      | None Supplied        | None Supplied | None Supplied |   |       |   |
| Analytical Parameter (Soil Analysis)  | Units         | Limit of detection | Accreditation Status |               |               |   |       |   |
| <b>Monoaromatics &amp; Oxygenates</b> |               |                    |                      |               |               |   |       |   |
| Benzene                               | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |
| Toluene                               | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |
| Ethylbenzene                          | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |
| p & m-xylene                          | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |
| o-xylene                              | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |
| MTBE (Methyl Tertiary Butyl Ether)    | µg/kg         | 1                  | MCERTS               | < 1.0         | < 1.0         | - | < 1.0 | - |

**Petroleum Hydrocarbons**

|                                  |       |       |        |         |         |   |         |   |
|----------------------------------|-------|-------|--------|---------|---------|---|---------|---|
| TPH-CWG - Aliphatic >EC5 - EC6   | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aliphatic >EC6 - EC8   | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aliphatic >EC8 - EC10  | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aliphatic >EC10 - EC12 | mg/kg | 1     | MCERTS | < 1.0   | 7.5     | - | < 1.0   | - |
| TPH-CWG - Aliphatic >EC12 - EC16 | mg/kg | 2     | MCERTS | 9.7     | 25      | - | 11      | - |
| TPH-CWG - Aliphatic >EC16 - EC21 | mg/kg | 8     | MCERTS | 28      | 32      | - | 20      | - |
| TPH-CWG - Aliphatic >EC21 - EC35 | mg/kg | 8     | MCERTS | 190     | 150     | - | 260     | - |
| TPH-CWG - Aliphatic (EC5 - EC35) | mg/kg | 10    | MCERTS | 230     | 210     | - | 290     | - |

|                                 |       |       |        |         |         |   |         |   |
|---------------------------------|-------|-------|--------|---------|---------|---|---------|---|
| TPH-CWG - Aromatic >EC5 - EC7   | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aromatic >EC7 - EC8   | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aromatic >EC8 - EC10  | mg/kg | 0.001 | MCERTS | < 0.001 | < 0.001 | - | < 0.001 | - |
| TPH-CWG - Aromatic >EC10 - EC12 | mg/kg | 1     | MCERTS | 15      | 3.5     | - | < 1.0   | - |
| TPH-CWG - Aromatic >EC12 - EC16 | mg/kg | 2     | MCERTS | 170     | 30      | - | 36      | - |
| TPH-CWG - Aromatic >EC16 - EC21 | mg/kg | 10    | MCERTS | 390     | 240     | - | 370     | - |
| TPH-CWG - Aromatic >EC21 - EC35 | mg/kg | 10    | MCERTS | 340     | 990     | - | 930     | - |
| TPH-CWG - Aromatic (EC5 - EC35) | mg/kg | 10    | MCERTS | 910     | 1300    | - | 1300    | - |

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

Analytical Report Number: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                    | 1753598       | 1753599            | 1753600              | 1753601       |       |       |       |
|--------------------------------------|---------------|--------------------|----------------------|---------------|-------|-------|-------|
| Sample Reference                     | TP8A          | TP8B               | TP9A                 | TP9B          |       |       |       |
| Sample Number                        | None Supplied | None Supplied      | None Supplied        | None Supplied |       |       |       |
| Depth (m)                            | 0.15          | 0.30               | 0.25                 | 0.60          |       |       |       |
| Date Sampled                         | 25/01/2021    | 25/01/2021         | 25/01/2021           | 25/01/2021    |       |       |       |
| Time Taken                           | 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 |
| Moisture Content                     | %             | 0.01               | NONE                 | 15            | 16    | 14    | 17    |
| Total mass of sample received        | kg            | 0.001              | NONE                 | 0.7           | 0.7   | 0.9   | 0.7   |

| Asbestos in Soil Screen / Identification Name | Type | N/A | ISO 17025 |              |              |              |              |
|---|------|-----|-----------|--------------|--------------|--------------|--------------|
| Asbestos in Soil                              | Type | N/A | ISO 17025 | Not-detected | Not-detected | Not-detected | Not-detected |

#### General Inorganics

| pH - Automated | pH Units | N/A | MCERTS | 7.6 | 7.4 | 7.2 | 7.7 |
|----------------|----------|-----|--------|-----|-----|-----|-----|
| Organic Matter | %        | 0.1 | MCERTS | 8.4 | 7.2 | 4.1 | 6.3 |

#### Speciated PAHs

|                        | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
|------------------------|-------|------|--------|--------|--------|--------|--------|
| Naphthalene            | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene         | mg/kg | 0.05 | MCERTS | 1.7    | 0.73   | < 0.05 | < 0.05 |
| Acenaphthene           | mg/kg | 0.05 | MCERTS | 5.4    | 1.2    | < 0.05 | < 0.05 |
| Fluorene               | mg/kg | 0.05 | MCERTS | 4.1    | 1.3    | < 0.05 | < 0.05 |
| Phenanthrene           | mg/kg | 0.05 | MCERTS | 58     | 18     | 0.27   | 0.72   |
| Anthracene             | mg/kg | 0.05 | MCERTS | 18     | 4      | < 0.05 | < 0.05 |
| Fluoranthene           | mg/kg | 0.05 | MCERTS | 110    | 43     | 0.41   | 1.8    |
| Pyrene                 | mg/kg | 0.05 | MCERTS | 110    | 37     | 0.43   | 1.6    |
| Benzo(a)anthracene     | mg/kg | 0.05 | MCERTS | 81     | 22     | 0.32   | 1.1    |
| Chrysene               | mg/kg | 0.05 | MCERTS | 51     | 14     | 0.27   | 0.82   |
| Benzo(b)fluoranthene   | mg/kg | 0.05 | MCERTS | 73     | 23     | < 0.05 | 1      |
| Benzo(k)fluoranthene   | mg/kg | 0.05 | MCERTS | 41     | 7.8    | < 0.05 | 0.8    |
| Benzo(a)pyrene         | mg/kg | 0.05 | MCERTS | 82     | 21     | < 0.05 | 1.1    |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | 38     | 8.6    | < 0.05 | 0.49   |
| Dibenz(a,h)anthracene  | mg/kg | 0.05 | MCERTS | 11     | 2.3    | < 0.05 | < 0.05 |
| Benzo(ghi)perylene     | mg/kg | 0.05 | MCERTS | 43     | 9.9    | < 0.05 | < 0.05 |

#### Total PAH

| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | 729 | 214 | 1.7 | 9.38 |
|-----------------------------|-------|-----|--------|-----|-----|-----|------|
|                             |       |     |        |     |     |     |      |

#### Heavy Metals / Metalloids

|                                   | mg/kg | 1   | MCERTS | 7.6   | 7.6   | 44    | 31    |
|-----------------------------------|-------|-----|--------|-------|-------|-------|-------|
| Arsenic (aqua regia extractable)  | mg/kg | 1   | MCERTS | 7.6   | 7.6   | 44    | 31    |
| Boron (water soluble)             | mg/kg | 0.2 | MCERTS | 2.6   | 3.5   | 2     | 4.4   |
| Cadmium (aqua regia extractable)  | mg/kg | 0.2 | MCERTS | 2.5   | 1.1   | 2.5   | 2     |
| Chromium (aqua regia extractable) | mg/kg | 1   | MCERTS | 23    | 14    | 35    | 28    |
| Copper (aqua regia extractable)   | mg/kg | 1   | MCERTS | 70    | 440   | 240   | 310   |
| Lead (aqua regia extractable)     | mg/kg | 1   | MCERTS | 220   | 120   | 390   | 230   |
| Mercury (aqua regia extractable)  | mg/kg | 0.3 | MCERTS | < 0.3 | < 0.3 | < 0.3 | 0.4   |
| Nickel (aqua regia extractable)   | mg/kg | 1   | MCERTS | 13    | 16    | 63    | 43    |
| Selenium (aqua regia extractable) | mg/kg | 1   | MCERTS | 1.2   | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable)     | mg/kg | 1   | MCERTS | 350   | 550   | 630   | 540   |

Analytical Report Number: 21-54007

Project / Site name: A180820 CL Land off Melton Road NG12 5PJ

| Lab Sample Number                     | 1753598       |                    |                      | 1753599       | 1753600       | 1753601       |
|---------------------------------------|---------------|--------------------|----------------------|---------------|---------------|---------------|
| Sample Reference                      | TP8A          |                    |                      | TP8B          | TP9A          | TP9B          |
| Sample Number                         | None Supplied |                    |                      | None Supplied | None Supplied | None Supplied |
| Depth (m)                             | 0.15          |                    |                      | 0.30          | 0.25          | 0.60          |
| Date Sampled                          | 25/01/2021    |                    |                      | 25/01/2021    | 25/01/2021    | 25/01/2021    |
| Time Taken                            | None Supplied |                    |                      | None Supplied | None Supplied | None Supplied |
| Analytical Parameter (Soil Analysis)  | Units         | Limit of detection | Accreditation Status |               |               |               |
| <b>Monoaromatics &amp; Oxygenates</b> |               |                    |                      |               |               |               |
| Benzene                               | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |
| Toluene                               | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |
| Ethylbenzene                          | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |
| p & m-xylene                          | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |
| o-xylene                              | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |
| MTBE (Methyl Tertiary Butyl Ether)    | µg/kg         | 1                  | MCERTS               | < 1.0         | -             | < 1.0         |

**Petroleum Hydrocarbons**

|                                  |       |       |        |         |   |         |         |
|----------------------------------|-------|-------|--------|---------|---|---------|---------|
| TPH-CWG - Aliphatic >EC5 - EC6   | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC6 - EC8   | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC8 - EC10  | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aliphatic >EC10 - EC12 | mg/kg | 1     | MCERTS | < 1.0   | - | < 1.0   | < 1.0   |
| TPH-CWG - Aliphatic >EC12 - EC16 | mg/kg | 2     | MCERTS | < 2.0   | - | < 2.0   | < 2.0   |
| TPH-CWG - Aliphatic >EC16 - EC21 | mg/kg | 8     | MCERTS | < 8.0   | - | 18      | 13      |
| TPH-CWG - Aliphatic >EC21 - EC35 | mg/kg | 8     | MCERTS | 170     | - | 150     | 160     |
| TPH-CWG - Aliphatic (EC5 - EC35) | mg/kg | 10    | MCERTS | 170     | - | 170     | 170     |

|                                 |       |       |        |         |   |         |         |
|---------------------------------|-------|-------|--------|---------|---|---------|---------|
| TPH-CWG - Aromatic >EC5 - EC7   | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC7 - EC8   | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC8 - EC10  | mg/kg | 0.001 | MCERTS | < 0.001 | - | < 0.001 | < 0.001 |
| TPH-CWG - Aromatic >EC10 - EC12 | mg/kg | 1     | MCERTS | 12      | - | < 1.0   | < 1.0   |
| TPH-CWG - Aromatic >EC12 - EC16 | mg/kg | 2     | MCERTS | 50      | - | < 2.0   | < 2.0   |
| TPH-CWG - Aromatic >EC16 - EC21 | mg/kg | 10    | MCERTS | 270     | - | < 10    | 22      |
| TPH-CWG - Aromatic >EC21 - EC35 | mg/kg | 10    | MCERTS | 660     | - | < 10    | 93      |
| TPH-CWG - Aromatic (EC5 - EC35) | mg/kg | 10    | MCERTS | 990     | - | < 10    | 120     |

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



**Analytical Report Number : 21-54007**

**Project / Site name: A180820 CL Land off Melton Road NG12 5PJ**

\* 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 *                            |
|-------------------|------------------|---------------|-----------|---|
| 1753588           | TP1A             | None Supplied | 0.3       | Brown sand with gravel and plastic.             |
| 1753589           | TP1B             | None Supplied | 0.6       | Brown loam and sand with vegetation and gravel. |
| 1753590           | TP2A             | None Supplied | 0.4       | Brown clay and sand with gravel.                |
| 1753591           | TP2B             | None Supplied | 0.8       | Brown clay and loam with vegetation and gravel  |
| 1753592           | TP3A             | None Supplied | 0.2       | Brown loam and clay with rubble and vegetation. |
| 1753593           | TP4A             | None Supplied | 0.1       | Brown loam and sand with vegetation and gravel. |
| 1753594           | TP4B             | None Supplied | 0.7       | Brown clay and sand with gravel.                |
| 1753595           | TP5A             | None Supplied | 0.1       | Brown loam and clay with vegetation and gravel  |
| 1753596           | TP6A             | None Supplied | 0.15      | Brown clay and sand with vegetation and gravel  |
| 1753597           | TP7A             | None Supplied | 0.15      | Brown sand with rubble.                         |
| 1753598           | TP8A             | None Supplied | 0.15      | Brown loam and sand with vegetation and gravel. |
| 1753599           | TP8B             | None Supplied | 0.3       | Brown loam and sand with vegetation and gravel. |
| 1753600           | TP9A             | None Supplied | 0.25      | Brown loam and sand with rubble and gravel      |
| 1753601           | TP9B             | None Supplied | 0.6       | Grey sand with vegetation and gravel.           |

**Analytical Report Number : 21-54007**

**Project / Site name: A180820 CL Land off Melton Road NG12 5PJ**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)**

| Analytical Test Name                  | Analytical Method Description  | Analytical Method Reference  | Method number | Wet / Dry Analysis | Accreditation Status |
|---------------------------------------|--|--|---------------|--------------------|----------------------|
| 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 disperion staining techniques.                                  | In house method based on HSG 248   | A001-PL       | D                  | ISO 17025            |
| Boron, water soluble, in soil         | Determination of water soluble boron in soil by hot water extract followed by ICP-OES.   | In-house method based on Second Site Properties version 3                            | L038-PL       | D                  | MCERTS               |
| Moisture Content                      | Moisture content, determined gravimetrically. (30 oC)  | In house method.   | L019-UK/PL    | W                  | NONE                 |
| Organic matter (Automated) in soil    | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.                          | In house method.   | L009-PL       | D                  | 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                 |
| BTEX and MTBE in soil (Monoaromatics) | Determination of BTEX in soil by headspace GC-MS.  | In-house method based on USEPA8260   | L073B-PL      | W                  | MCERTS               |
| TPHCWG (Soil)                         | Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.  | In-house method with silica gel split/clean up.                                      | L088/76-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.**

## APPENDIX E - LIMITATIONS

This report was prepared by Adeptus (registered in England: 05908395) for the use of the client, named on page 1. The report has been prepared specifically on the basis of the end use as defined by the client. Any change of end use would necessitate review of this report and its findings. Use of or reliance on this report by any third party is not permitted without our express written agreement, and where this is given, will be subject to our terms and conditions.

We have prepared this report in our professional capacity using reasonable skill, care and diligence. The assessments, conclusions and recommendations within this report pertain to the study site (the extents of which are in Figure 1, below) and the immediate area in continuity with the Site. They are based on the established historical uses, information available at the time of writing and the proposed use of the Site. Where any information supplied by the client or other sources have been utilised, it has been assumed that the information is correct. No responsibility can be accepted by Adeptus for inaccuracies in data supplied by any other party.

Any plans, diagrams, cross sections or images are for illustrative purposes only and should be checked for accuracy on-site. In the event of changes to the proposed end use of the Site, the report may require updating to reflect such changes. Although reference may be made to archaeological, ecological or geotechnical issues, invasive species, flood risk and the presence of asbestos containing materials (ACMs), this report does not constitute an archaeological assessment, ecological assessment, geotechnical assessment, invasive species survey, flood risk assessment or asbestos survey and liability for any claim caused by arising out of or in any way involving asbestos is excluded.

New information relating to environmental matters can come to light after the report has been prepared and changes in conditions and regulatory requirements may occur in future. Either of those factors may change the conclusions presented in our report. If development does not take place within the expected timescales, consideration should be given to reviewing this assessment to confirm that no changes to the site or relevant legislation have taken place. No part of this report is intended to provide legal advice or opinion of any nature.