Supplementary Site Investigation & Remedial Strategy

Old Manor Farm House
Raveley Road
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OLD MANOR FARM HOUSE, GREAT RAVELEY

NON-TECHNICAL CLIENT SUMMARY

This report presents the findings of the Supplementary Investigation & Remedial Strategy undertaken to determine ground conditions and manage the environmental risks associated with the site and its development. Pertinent findings and conclusions may be summarised as follows:

- The site comprises several agricultural buildings and associated grounds, it is proposed that the existing buildings be demolished and replaced with five new dwellings plus gardens. EPS have previously completed a Phase I Desk Study and Phase II Geo Environmental Assessment in May and August 2023 respectively which led to an initial Remedial Strategy. In that strategy, the main requirement was that for all areas of proposed gardens/soft landscaping (not needed under buildings/hardstanding), at least 600mm of the existing soils needed to be replaced with certified clean imported soils. Scope was however made for potentially refining this requirement through further site investigation in the less-developed northern area, which is the subject of this report. The strategy also required further site investigation around the exterior vehicle inspection pit to the south of the site, which has not yet been undertaken.
- The key reasoning for undertaking this supplementary investigation was to confirm whether the less-developed shallow soils in the northern area were contaminated by the same source as elsewhere, which primarily comprised a made ground layer. There was not enough data in the previous investigation to make that conclusion.
- Seven hand auger boreholes were formed as part of this investigation, the ground conditions were found to consist of topsoil/made ground materials recorded beyond the maximum depth of the boreholes in HA01 to HA04 (to the north east) and no deeper than 0.3m in HA05 to HA07 (to the north west), these made ground soils were found to be underlain by gravelly, slightly sandy clay of the glacial Oadby Member. Seven shallow soil samples were submitted for laboratory analysis from areas of proposed private gardens in Plots 1, 4 and 5 to the north of the site, the majority of these shallow made ground samples were found to contain broadly acceptable levels of contamination (compared to the previous dataset) with the exception of HA01 to the northeast where some asbestos was detected.
- Although the soils in these northern areas are clearly less contaminated than what was encountered under the main farmyard to the south, it is still made ground (not natural topsoil) and it was not totally free of contamination, therefore a remedial measure is still deemed necessary to account for the uncertainty over how representative the previous dataset is of the soils in this area. In the northern plots a lesser remedial measure can therefore be installed to ensure future site users remain safe from risks posed by any underlying contamination. It is recommended that within proposed rear gardens/soft landscaping in Plots 1, 4 and 5, at minimum of 300mm of clean imported soils should be installed, but with no requirement to remove existing soils (not needed under buildings/hardstanding). The existing remedial measure remains valid for soft landscaping in plots 2 & 3 and a plan has been included to show the extent of these areas. Other measures including barrier drinking water pipes and the outstanding investigation around the inspection pit still apply.
- A copy of this report along with subsequent verification of the proposed remedial measures should be submitted to Huntingdonshire District Council, so that the information may be used to support the planning application.

The above points represent a simplified summary of the findings of this assessment and **must not** form the basis for key decisions for the proposed development. A thorough review of the details is contained within the following report, or alternatively get in touch and we'll talk you through it.

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Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework 2019 requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

As stated within DEFRA's Contaminated Land Statutory Guidance (2012), with any complex risk assessment it is possible that different suitably qualified people may reach slightly different conclusions when interpreting the same information. EPS recognises this and considers the conclusions presented within this report to be robust and appropriate but input from the Local Authority and their judgement in line with this guidance would still be welcomed.

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1 INTRODUCTION

In September 2023, Environmental Protection Strategies Ltd (EPS) was commissioned by [redacted] to complete a Supplementary Site Investigation & Remedial Strategy at Old Manor Farm House, Raveley Road, Great Raveley, Cambridgeshire, PE28 2QX ('the site'); see Figure 1.

The work was commissioned in order to address planning requirements relating to contamination for the development of *'replacement of agricultural barns with 5 dwellings'* under Huntingdonshire District Council's Planning Application Reference: 22/01802/FUL

Both Phase I and Phase II Geo-Environmental Assessments were previously completed for the site by EPS in May and August 2023 respectively, which identified risks from contamination and therefore a need for remediation. The Phase II report also recommended a phase of additional investigation to further delineate the area around the exterior vehicle inspection pit. These recommended works are yet to be undertaken. The objective of this supplementary investigation is to further refine the soil capping element of the remedial strategy around the proposed northern plots.

This report presents a summary of the previous Phase I & II Site Investigation reports, followed by the findings and conclusions of the Supplementary Site Investigation undertaken by EPS as instructed, and finally the updated Remedial Strategy for the site.

1.1 Objectives

The objectives of this investigation were as follows:

a) Investigate potential contaminant linkages identified and the established in the Conceptual Site Model (CSM) developed during the previous phase of works, by means of a supplementary intrusive investigation of the shallow soils and Generic Quantitative Risk Assessment.
b) Determine the potential risks posed by the site and make recommendations for further work that may be required, to ensure safe development in accordance the Environment Agency's *Land Contamination: Risk Management* guidance (LC:RM, 2023) and the *National Planning Policy Framework*.
c) Revise the appropriate form(s) of remediation necessary to remove unacceptable risks to end users to ensure safe development.

1.2 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRAs '*Contaminated Land Statutory Guidance*' (2012), BS10175 – '*Investigation of Potentially Contaminated Sites*' and BS5930:2015 *'Code of practice for ground investigations'*, the following tasks were undertaken:

<u>Intrusive Investigation:</u>

- Site walkover, inspection of any visual evidence of contamination at the site, obtaining photographic records.
- Health and safety briefing / site supervision.
- Formation of seven hand auger boreholes to a maximum depth of 0.6m below ground level (bgl).

- Continual logging of ground conditions including inspection of samples for visual and olfactory contamination, and laboratory analysis of selected representative samples.
- On site headspace testing of samples for hydrocarbon vapours using a photoionisation detector (PID).

Reporting:

- Data collection
- Interpretation of data including completion of Generic Quantitative Risk Assessment
- Revision of the Initial Remedial Strategy

The findings and conclusions of these investigations are presented in the following sections.

1.3 Limitations and Constraints

The purpose of this report is to present the findings of a soil sampling investigation conducted at the location(s) specified. When examining the data collected by third parties EPS accepts no responsibility for errors within third party materials referenced and presented in this report. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site. Where outlined in our report, we have examined the ground beneath a site by constructing a number of boreholes and / or trial pits to recover soil and / or groundwater samples. The locations of these excavations and sampling points are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the conditions encountered may differ to those found during the investigation.

This report does not include a specific survey for the presence of Potential Asbestos Containing Material (PACM), rather it is a soil-survey where asbestos may be identified as a contaminant. Specialist contractors should be commissioned to make detailed assessments and recommendations if these materials are suspected.

The investigation was carried out to assess the significance of contamination resulting from the use of the site as identified in this report. Unless EPS has otherwise indicated, no assessment of potential impact of any other previous uses has been made.

Whilst it is recognised that information contained within this report may assist relevant and suitably qualified professionals, this report does not provide a geotechnical appraisal of ground conditions with respect to suitability of foundations or future structures, nor does it intend to identify a need for any associated geotechnical ground improvement works.

2 BACKGROUND & PREVIOUS REPORTS

The following section provides a summary of the findings and conclusions of the previous Phase I & II assessments completed by EPS in May and August 2023 respectively. Detailed background information is available in the following documents:

- *Phase I Geo-Environmental Desk Study – Old Manor Farm House, Great Raveley (Issue 1),* dated 9th May 2023 (EPS Ref: UK23.6422)
- *Phase II Geo-Environmental Assessment – Old Manor Farm House, Great Raveley (Issue 1.1),* dated 16th August 2023 (EPS Ref: UK23.6422b)

2.1 Site Description (June 2023, updated for September 2023)

Site walkovers were carried out by EPS on all the previous visits and no notable changes have occurred since June 2023 with the main site area found to include several agricultural buildings. This area is accessed via a concrete track from the northern boundary of the site from Raveley Road. The main area of investigation includes several agricultural buildings and barns situated in the northwest, south west, south, and north east.

Furthermore, above ground storage tanks were also present throughout the area, these include a steel tank on a concrete pad south of the barn in the north east, this tank appeared to be in good condition with no obvious damage or evidence of spills/leaks, it is assumed to have contained / been used to store diesel but is likely single skinned/unbunded. Further south there are two above ground silos used to store fertiliser, these silos were based on concrete, modern and in seemingly good condition. Two above ground propane gas tanks were also noted south of the grain store in the south east.

A vehicle inspection pit is located between the barn in the south east and the building in the south west with steps leading into it from the north. This inspection pit was presumably used for servicing lorries / trailers, at the northern end of the pit, beneath a grate, there appeared to be some water with evidence of fuel at the surface. The larger part of the building in the south west appears to have been used as a vehicle garage at some point, this building has a concrete floor and includes a covered inspection pit with some work benches to the rear. The outline of another above ground storage tank used to store waste oil was evident from the paint on the north western wall of this building but the tank itself was not present. The elongated part of the building in the south west and the building in the north west are built from brick and timber with concrete flooring. These buildings were stable type buildings with overhead cables running from the southwestern corner of the site to a telegraph pole from Raveley Road to the north. East of the stable type building in the north west adjacent to the gate is a small feature which may have been a bund for an above ground tank at some point in the past (for heating oil for example). The majority of the main buildings on site appeared to be clad and roofed with cement bonded, corrugated asbestos sheeting and guttering.

To the rear of the northern buildings on either side of the access road are areas surfaced with overgrown grass that slope down gradually towards Raveley Road. Further north west are some bushes together with some mature, small to medium sized deciduous coniferous and deciduous trees.

A plan showing the site location is provided as Figure 1. Selected site photographs are included as Appendix A and a proposed development plan as Appendix B.

2.2 Phase I & II Geo-Environmental Conclusions & Recommendations

The Phase I Desk Study initially identified potentially active pollutant linkages within a Conceptual Site Model between the proposed future residential use and the current and historic site use as a farm yard with above ground storage tanks and vehicle servicing area. Risks to controlled surface waters from site-derived contamination, whilst considered unlikely, were also retained in the CSM. Risks with risks to groundwater were dismissed in the Preliminary Risk Assessment.

The Phase II Intrusive Investigation examined the above pollutant linkages by means of a series of predetermined sampling points within existing archaeological trenches and four intrusive window sample boreholes to a maximum depth of 4.0m, the recovered soils were inspected for palpable evidence of contamination, logged, and samples sent for laboratory analysis. The ground conditions were found to comprise made ground from the surface (and below concrete within the on-site buildings) to a maximum depth of 1.0m but generally around 0.5m, underlain by firm to stiff gravelly, slightly sandy clay of the Oadby Member above light grey Oxford Clay in the deeper boreholes.

Following laboratory analysis, the shallow made ground was found to contain significant levels of contamination. In borehole WS02 near the inspection pit, hydrocarbon contaminants were also found to extend into the deeper natural clays (<3.0m). Therefore the made ground soils do not meet modern planning standards for a residential land use, due to impacts from the heavy metal arsenic and benzo(a)pyrene (BaP), some petroleum hydrocarbon fractions and asbestos.

In terms of the specific north-western and north-eastern areas of the site covered by this supplementary investigation, as shown on Figure 2 an archaeological trench was available for inspection and sampling in the north-western area, but there were no sampling positons undertaken in the north eastern area. Sampling from the trench (positions SP05 & SP06) did reveal some made ground including poly-aromatic hydrocarbon contamination but generally less significant than elsewhere and the results did pass the screening criteria. Despite passing the screening criteria, those areas could not be removed from the same source of contamination as there was insufficient data to justify removing those sample results from the wider dataset.

Due to the risk posed to future site users and construction workers by these levels of contamination, it was recommended that remediation would be required, but that additional investigation should first be carried out in order to further delineate the area around the exterior inspection pit affected by deeper TPH contamination in the south of the site ideally after the hardstanding is removed. It was also recommended that barrier pipes for buried services may be required, to be resistant to hydrocarbon contamination as well as the appropriate PPE for groundworkers during the development.

For the soil capping in garden areas, the initial recommended remediation involved the removal of all made ground from proposed private garden areas and replacement with at least 600mm of imported clean cover soils. Scope was however made for potentially refining this requirement through further site investigation in the less-developed northern area, which is the subject of this report.

Risks to controlled waters were fully discounted in the Generic Quantitative Risk Assessment, and have therefore not been assessed further in this report.

The next sections detail the findings and conclusions of the supplementary investigation carried out by EPS to further refine the requirement of the above recommendations, followed by the revised Remedial Strategy for the site.

3 SUMMARY OF INTRUSIVE INVESTIGATIONS

Intrusive ground investigations were undertaken on 6th August 2023 in accordance with EPS standard operating procedures, copies of which will be made available on request. A summary of all site activities is presented in the following sections:

3.1 Exploratory Hole Locations

Exploratory hole locations were selected through consideration of the potential contaminant linkages that were identified but unresolved through the previous phase of investigation, as well as the proposed development layout, the location of below ground utilities, and other operational and health & safety considerations.

Seven hand auger boreholes (HA01 – HA07) were formed at the site to a maximum depth of 0.6m, so that samples could be collected from the recovered soils most likely to interact with future site users.

The overall objective in terms of exploratory hole locations was to provide an improved lateral coverage of the soils underlying the site in order to offer additional information relating to their quality and nature, particularly in proposed areas of private gardens within Plots 1, 4 and 5. Further rationale behind certain locations is provided in the table below.

Location	Rationale
HA01, HA02, HA03 & HA04	To refine the remedial requirements for the areas of proposed private gardens in Plots 4 & 5 (in the north east) which were included in the previous remedial strategy due to the identified PAH, TPH and asbestos contamination across the site.
HA05, HA06 & HA07	To refine the remedial requirements for the area of proposed private garden in Plot 1 (in the north west) which was included in the previous remedial strategy due to the identified PAH, TPH and asbestos contamination across the site.

A borehole location plan is presented as Figure 2.

3.2 In-Situ Testing & Soil Sampling

Each borehole was logged for ground conditions encountered and inspected for any physical evidence of contamination, such as soil staining, odour and the presence of separate phase liquids on a precautionary basis. Borehole logs are presented in Appendix C.

Where potentially volatile organic compounds are suspected, EPS carries a Photoionisation Detector (PID), which can be used to measure the relative concentrations of vapour associated with soil samples collected from different depths and locations at the site. PID readings are only used to provide EPS with a basic means to quantify areas of volatile organic compound in the field to help guide the investigation.

Soil samples were recovered from each location for laboratory testing to assess the quality of sub-surface materials present across the site.

3.3 Laboratory Testing

Soil samples were obtained for analysis of selected contaminants of concern in order to identify total potential sulphate as well as the presence of any contamination and confirm their suitability for future use as well as their waste characteristics. Samples were submitted to Element Materials Technology of Flintshire, who hold appropriate UKAS/ MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered by an approved courier.

Copies of the chain of custody documentation are held by EPS and will be made available on request. Furthermore, a laboratory testing schedule detailing all samples submitted for environmental laboratory analysis are included within Table 1.

4 FINDINGS OF THE INVESTIGATION

This section of the report provides a summary of the findings of the various aspects of the ground investigation.

4.1 Ground Conditions

A total of seven hand auger boreholes were formed at the site and the ground conditions encountered, from surface level, were found to comprise:

- Topsoil & Made Ground
- Oadby Member

Site specific borehole logs are included as Appendix C and give descriptions and depths of strata encountered. A summary of the general strata encountered across the site is provided in the table below, with more detailed description given in the following sub sections.

Geological Strata	Maximum Depth to Base of Strata (m bgl)	Strata Thickness (m)
Topsoil & Made Ground	>0.55	0.3 - >0.55
Oadby Member	>0.6	>0.3

4.1.1 Topsoil & Made Ground

A consistent thickness of disturbed topsoil was encountered in each borehole from surface, described as a dark brown, sandy clay. Below this was made ground, this was generally observed as a dark greyish brown, slightly clayey, gravelly sand and contained varying quantities of brick and asphalt fragments up to cobble size. This material progressed as deep as 0.55m in HA03 beyond the maximum extent of the borehole.

Whilst this made ground was visually similar across the sampling area the depths varied, in the raised embankment to the north east of the site (future Plots 4 & 5) made ground extended beyond the maximum depth of the boreholes which also refused into large fragmented brick layers. Further west (at road level) in HA05, HA06 and HA07 (or the future gardens of Plot 1), the made ground was consistently proven to a lesser depth of 0.3m before natural soils were encountered. This made ground did also differ in appearance from the fill/sub-base type of material found beneath the farmyard to the south, being closer to topsoil in appearance.

4.1.2 Oadby Member

The made ground material, where the base was encountered, was underlain by material interpreted as the Oadby Member. This generally consists of a greyish brown to light bluish grey, gravelly, slightly sandy clay. This material was only encountered in HA05, HA06 and HA07 and progressed to beyond the formation depth of each borehole.

4.2 Groundwater

No groundwater was encountered at any of the other locations, either during or upon completion of excavation.

4.3 Physical Evidence of Contamination

Whilst made ground materials were recovered, no palpable evidence of contamination was encountered at any of the borehole locations formed during the ground investigation. The soils did not include any notable evidence of waste or putrefiable material, with hydrocarbon staining/ odours also absent.

4.4 Laboratory Analysis

A laboratory analysis testing schedule is presented as Table 1 and all environmental sample results obtained from the laboratory are included as Appendix D. The key results of laboratory testing on environmental soil samples are summarised below.

Contaminant	No. of Samples	No of Detections	Range of Detections (mg/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	7	7	15.3	20.6	HA05 (0.1-0.3)
Cadmium	7	1	-	0.2	HA06 (0.1-0.3)
Chromium	7	7	36.2	54.7	HA01 (0.1-0.4)
Copper	7	7	22	62	HA05 (0.1-0.3)
Lead	7	7	48	175	HA01 (0.1-0.4)
Mercury	7	5	0.1	0.4	HA05 (0.1-0.3)
Nickel	7	7	29.2	35.1	HA05 (0.1-0.3)
Selenium	7	3	-	1	HA02 (0.1-0.3) HA03 (0.1-0.3) HA05 (0.1-0.3)
Zinc	7	7	104	291	HA05 (0.1-0.3)
Chromium (VI)	7	0	-		-
Naphthalene	7	3	0.06	0.09	HA07 (0.1-0.3)
Benzo(a)pyrene	7	7	0.44	1.49	HA06 (0.1-0.3)
Dibenz(ah)anthracene	7	7	0.07	0.20	HA06 (0.1-0.3)
PAH (Total of 16)	7	7	4.9	15.6	HA06 (0.1-0.3)
Phenols	7	0	-		-
Cyanide	7	0	-		-
BTEX/MTBE	1	0	-		-
TPH CWG (Total)	1	1	-	376	HA06 (0.1-0.3)
Asbestos (% by mass)	7	1	Fibres & Bundles of Amosite & Chrysotile		HA01 (0.1-0.4)

Notes: - Contaminant not found above laboratory detection limits; PAH Polycyclic Aromatic Hydrocarbons; BTEX Benzene, Toluene, Ethylbenzene, Xylenes; MTBE Methyl Tertiary Butyl Ether; TPH Total Petroleum Hydrocarbons

- Concentrations of PAHs were recorded in reduced concentrations in a majority of the shallow soil samples with HA06 proving to be the most affected with a combined PAH (total 16) of 15.6mg/kg this was followed by HA07 which was 12.9mg/kg.
- Concentrations of total petroleum hydrocarbons comprising longer chain Aliphatic and Aromatic TPH fractions up to 376mg/kg of C21-C35 were recorded in one sample (HA06) of made ground. Laboratory analysis suggests that PAH's and possible lubricating oil are the source of these TPH compounds.
- Asbestos containing material was detected by the laboratory within one of the seven shallow made ground soil samples submitted for laboratory analysis, it was revealed to be fibres and bundles of both chrysotile and amosite debris in HA01.

5 ENVIRONMENTAL APPRAISAL

The following section outlines the approach applied to assessing the risks posed to human health, then identifies any sample results found by this investigation which warrant further consideration. In accordance with the Environment Agency's Land Contamination: Risk Management, this section represents the second tier of Stage 1, the Generic Quantitative Risk Assessment.

5.1 Human Health

5.1.1 Land Use Setting and Generic Screening - Soils

In order to screen laboratory data for concentrations of contaminants in soil with potential to cause harm to human health, a Residential (with home-grown produce) land use has been adopted as it is considered the most representative of the anticipated setting and also aligns with the conclusions of the Phase I Desk Study.

The technical framework used to derive the screening values and the documents in which they are published are summarised as follows:

- *EA Science Reports* (SC050021/SR2, SC050021/SR3, and SC050021/SR7)
- *EA Soil Guideline Value Science Reports*
- *Suitable For Use Levels (S4ULs) for Human Health Risk Assessment* – LQM and CIEH (2015).
- *Soil Generic Assessment Criteria for Human Health Risk Assessment* - EIC/AGS/CL:AIRE (2010)
- *Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010* – DEFRA (2013)

Category 4 Screening Levels (C4SLs) provide generic suitable for use screening values for common contaminants in a variety of land uses and are also utilised as appropriate generic screening criteria. For concentrations of Arsenic, Lead and BaP in soil, EPS has used DEFRAs C4SL as an appropriate guide for professional judgement with respect to reasonable 'low risk' levels in the context of this site and its suitability for use.

Where assessment of the risk to human health from asbestos in soil is concerned, there is no nationally recognised suitable for use / generic screening value commonly referred to through the planning system. Due to this, it is necessary to take a more qualitative approach to the risks posed to future site users from asbestos on a site-specific basis.

A summary of the screening criteria and the methodology used to derive them is included in Appendix E.

5.1.2 Assessment of Results- Human Health

The results of the screening process for on-site human receptors showed that generic screening criteria representative of risks to future site users, where available were not exceeded for any contaminant at any location investigated by EPS.

With respect to the detection of asbestos within the made ground at HA01, it is considered that this could pose an unacceptable level of risk to future site users and groundworkers, especially in the context of other asbestos detections within the wider site quantified during the previous investigation.

This supplementary investigation was undertaken in the northern areas as it appeared less developed and may not be affected with the same made ground contamination as recorded elsewhere on the site. This investigation has shown that the made ground does physically differ in those areas and more closely resembles topsoil, and it also has been shown to be less contaminated. It does still contain low levels of PAHs and asbestos though, and the made ground particularly in the north eastern area is deeper than anticipated (as no made ground at all was envisaged). Although the made ground does differ to that encountered under the concrete in the main farmyard, on a numerical basis it would not be possible to separate them statistically. Therefore to account for this uncertainty, a remedial measure is still considered necessary in the northern plots but less onerous than what was recommended for the main farmyard to the south.

Statistical analysis has not been carried out as the data set is too limited, in accordance with the current statistical guidance (CL:AIRE, 2020).

5.2 Summary of Findings

Site investigation of the northern areas encountered made ground materials recorded beyond the maximum depth of the boreholes in HA01 to HA04 (to the north east) and no deeper than 0.3m in HA05 to HA07 (to the north west), these made ground soils were found to be underlain by gravelly, slightly sandy clay of the glacial Oadby Member. Seven shallow soil samples were submitted for laboratory analysis from areas of proposed private rear gardens in Plots 1, 4 and 5 to the north of the site, the majority of these shallow made ground samples were found to contain reduced levels of contamination (compared to the previous dataset), although some PAHs and asbestos was still recorded, albeit at below published screening vales.

Although the soils in these northern areas are clearly less contaminated than what was encountered under the main farmyard to the south, it is still made ground (not natural topsoil) and it was not totally free of contamination, therefore a remedial measure is still deemed necessary to account for the uncertainty over how representative the previous dataset is of the soils in the northern area. In the northern plots (rear gardens of Nos 1, 4 & 5) a lesser remedial measure could be installed to ensure future site users remain safe from risks posed by any underlying contamination. The remedial measures needed in the southern areas (Nos 2 & 3) remain unchanged by this phase of works. The updated Remedial Strategy is presented in the following section.

In the context of potentially unacceptable or acceptable risks as outlined within the Environment Agency's *Land Contamination: Risk Management* guidance (LC:RM, 2023), the risks identified by this work can be addressed through implementation of a revised Remedial Strategy. This is detailed further in in the next section.

6 REVISED REMEDIAL STRATEGY

It has been established that the risks associated with this site are driven by the presence of elevated concentrations of PAH and TPH compounds and asbestos within the shallow made ground and deeper natural soils near WS02, as a result of the previous agricultural land use. The key receptor is human health, of both future residents and construction workers.

Whilst recommendations have been made for a modest follow up investigation around the exterior vehicle inspection pit to the south near WS02, this report focussed on refining the extent of the initial remedial measures required to the north of the site within the gardens of proposed Plots 1, 4 and 5 with the remaining Plots (not the target of this report) subject to the same remedial measures outlined in the previous Phase II report.

This section represents the updated Remedial Strategy for the site and its proposed residential development, which can be updated again once part a) is completed:

a) SUPPLEMENTARY INVESTIGATION: The nature and quality of the shallow and deeper soils around WS02 near the existing external inspection pit cannot be concluded and require further assessment. It is therefore recommended that, initially, the identified plausible contaminant linkages should be further investigated by means of a modest supplementary intrusive investigation, which should target the soils around and beneath the existing external inspection pit, this area of concern is highlighted in Figure 3. Ideally this would be undertaken once the hardstanding had been removed from this area. The aim of this process would be to identify the extent of the contamination as well as the soil impacts which would pose a potentially unacceptable risk to future site users, property, or the environment, as well as construction workers.

To clarify which areas require certain thickness of source removal/cover systems, a remedial plan is included as Figure 4.

b) I) SOURCE REMOVAL/COVER SYSTEM (SOUTHERN AREA): Given the high levels of PAH contamination in this area, a conventional soil-based cover system would not be sufficient in isolation to comply with the BRE's *Cover systems for land regeneration - thickness of cover systems for contaminated land* (BR465). Therefore a process of 'source removal' is also required.

It is recommended that a minimum of **600mm** (source removal) of the existing soils are removed from garden areas and replaced with a simple cover system of **600mm** certified clean imported soils. The made ground, which is the main source of PAH contamination, typically extends to around 0.5m so this process should remove the majority of the source and therefore allow a simple cover system to provide sufficient risk mitigation. The imported soils must be free from contamination and accompanied by appropriate laboratory analysis to comply with the Cover Soils Checklist included as Appendix F.

This thickness has been recommended based on the typical 'double-dig' thickness. It should be noted that this recommendation is made only for areas of soft landscaping and gardens and there is no such requirement for areas beneath any proposed permanent hardstanding or building footprints.

These remedial works must be verified and reported to the Local Authority to support the associated planning application, EPS can provide further assistance / consultation in regards to this recommendation on request. All waste transfer documentation must be retained, with

photographs of any excavations including any exposed clean natural soils provided together with the compiled information outlined in the Cover Soils Checklist. If an established supplier such as British Sugar was used, then the soil is tested at source and no further analysis would typically be needed.

II) COVER SYSTEM (NORTHERN AREA): The risks posed by made ground in the northern area appear less significant than elsewhere on the site so a lesser remedial measure is required. No source removal is deemed essential (although it may be needed to maintain levels) and a minimum BRE recommended thickness of 300mm clean imported soil is recommended, for all gardens and areas of soft landscaping in this area.

c) BARRIER PIPES: To reduce any risk associated with the ingestion of potable water which may have been affected by the diffusion of contaminants in soil into buried water supply pipes, barrier drinking water pipework should be used for all water supply pipes in the development. This may mean excavating any existing pipes and replacing them if they are to be retained. Water Industry Standard 4-32-19 and associated fittings should be used subject to agreement with the local water company. Reference should be made to UK Water Industry Research (UKWIR) - *Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* and any relevant local water company guidance.

It is considered that any potential short-term risks associated with exposure of shallow made ground material to construction workers involved with redevelopment works can most appropriately be controlled through standard health and safety precautions, detailed below:

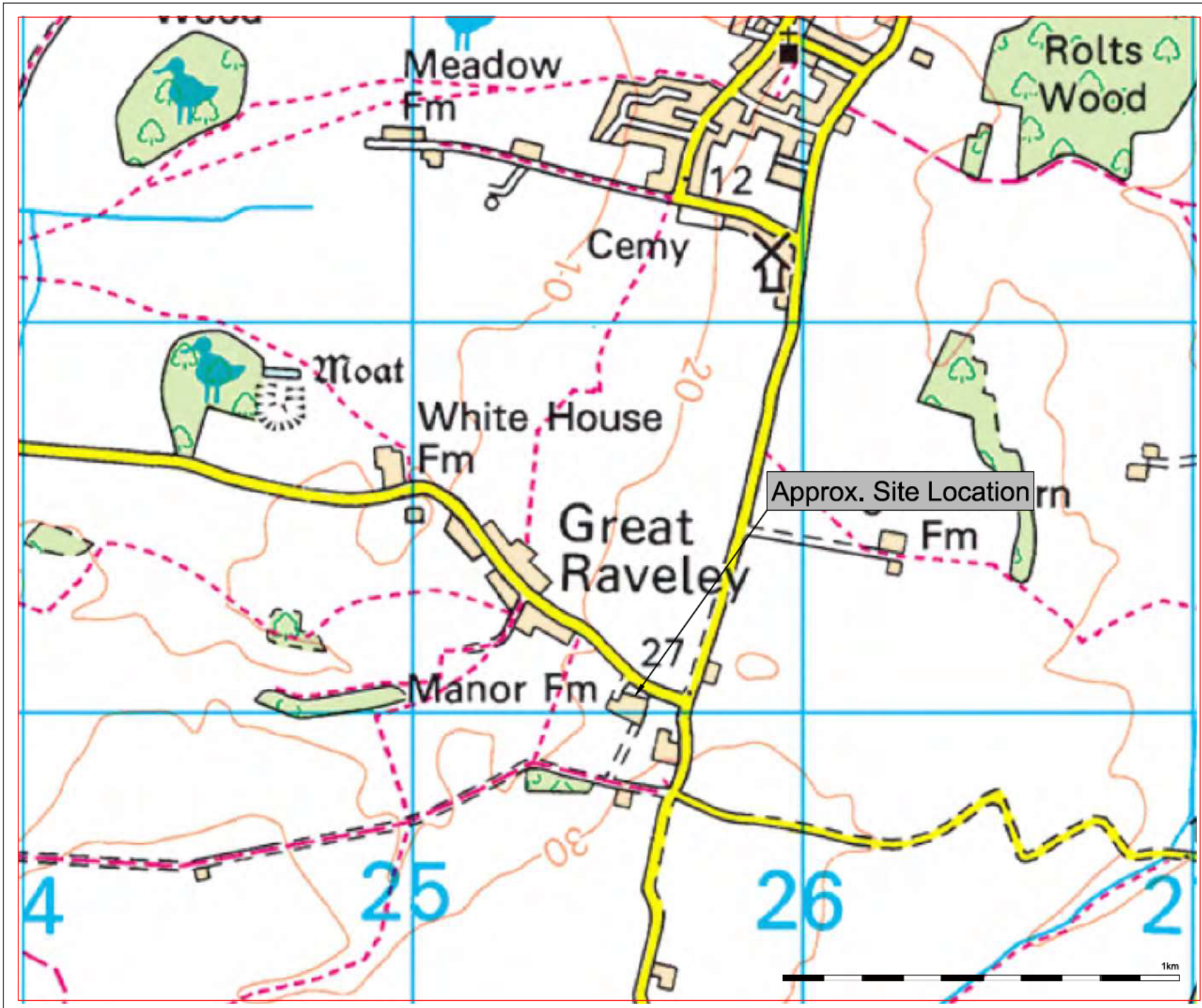
a) Workers operating at the site should be advised of the potential for contact with asbestos-contaminated made ground within the subsurface. Appropriate health and safety precautions should also be adopted, and care should be taken during all groundworks to minimise/avoid exposure to soils and asbestos fibres. Reference should be made to relevant health & safety guidance including the following CIRIA document: *R132 Guide to Safe Working on Contaminated Sites*. It is also recommended that a Safe Working Method (SWM) is created to supplement the ground worker's risk assessment method statements with regards to handling soils containing asbestos. EPS can assist in this aspect if required and would base the SWM on guidance from CIRIA as well as the CL:AIRE / Joint Industry Working Group industry guidance on *Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials* (2016).

A high degree of vigilance is recommended to ensure the site is developed safely ensuring that appropriate duty of care obligations is met for any off-site disposal of waste materials which may contain asbestos. All ACM will need to be handled and, where necessary, disposed of in accordance with the *Control of Asbestos Regulations* (2012). This process should remove any risks posed by this material to construction workers or end users at the site. Care should be taken during this process, as if asbestos were to be broken up during removal/ demolition it will have a significant and costly impact on soil quality, both in terms of protecting future users and waste arisings.

b) Should any palpable evidence of unexpected contamination be encountered during the redevelopment work, which significantly varies from the conditions described above (including any previously unknown below ground features such as tanks for example), it should be reported to EPS so that an inspection can be made and appropriate sampling and assessment work carried out. A method statement for encountering any unexpected contamination is included as Appendix G of this report.

It is also recommended that a copy of this report be provided to the Environmental Health Department of the Huntingdonshire District Council for inclusion in their land quality records and to support the current planning application.

FIGURES



N

Rev	Date	Drawn	Description	Check

The Geotechnical and Environmental Engineers
www.epstrategies.co.uk

Site: Old Manor Farm House
Raveley Road, Great Raveley, PE28 2QX

Client: David Ward

Title: Figure 1 - Current Site Layout

Surveyed:		Drawn by:	MC
Checked by:	MB	Date:	October 2023

Scale	[A4 Sheet]	Drawing Reference	
1:50,000		UK23.6422c_01	

Job No	Rev
UK23.6422c	01



N

KEY:

- SITE BOUNDARY
- EPS HAND AUGER BOREHOLE (>0.6m)
- PREVIOUS EPS SAMPLING POINT
- PREVIOUS EPS WINDOW SAMPLE BOREHOLE (<4m)
- PREVIOUS ARCHITECTURAL SAMPLING PITS

Rev	Date	Drawn	Description	Chkd

The Geotechnical and Environmental Engineers
www.epstrategies.co.uk

Site: Old Manor Farm House
Raveley Road, Great Raveley, PE28 2QX

Client: David Ward

Title: Figure 2 - Sampling & Borehole Location Plan

Surveyed:		Drawn by:	MC
Checked by:	MB	Date:	October 2023
Scale:	[A4 Sheet]	Drawing Reference:	
Not to Scale		UK23.6422c_02	
Job No:	UK23.6422c	Rev:	01



N

KEY:

SITE BOUNDARY

PREVIOUS EPS WINDOW SAMPLE BOREHOLE (<4m)

AREA REQUIRING FOLLOW-UP INVESTIGATION

Rev	Date	Drawn	Description	Check

The Geotechnical and Environmental Engineers
www.epstrategies.co.uk

Site
Old Manor Farm House
Raveley Road, Great Raveley, PE28 2QX

Client
David Ward

Title
Figure 3 - Areas Requiring Follow-Up Investigation

Surveyed:		Drawn by:	MC
Checked by:	MB	Date:	October 2023

Scale [A4 Sheet]: Not to Scale
Drawing Reference: UK23.6422c_03

Job No: UK23.6422c
Rev: 01



N

KEY:

- PROPOSED SITE BOUNDARY
- APPROX. EXTENT OF AREA REQUIRING 600MM COVER SYSTEM IN SOFT LANDSCAPED AREAS
- APPROX. EXTENT OF AREA REQUIRING 300MM COVER SYSTEM IN SOFT LANDSCAPED AREAS

Rev	Date	Drawn	Description	Chkd

eps

The Geotechnical and Environmental Engineers
www.epstrategies.co.uk

Site: Old Manor Farm House
Raveley Road, Great Raveley, PE28 2QX

Client: David Ward

Title: Figure 4 - Remediation Plan (Soil Capping)

Surveyed:		Drawn by:	MC
Checked by:	MB	Date:	October 2023
Scale [A4 Sheet]: Not to Scale		Drawing Reference: UK23.6422c_04	
Job No: UK23.6422c			Rev: 01

TABLES

Table 1 – Laboratory Testing Schedule (Environmental)

Sample Location	Sample Depth (m bgl)	EPS Mini Suite	EPS TPH Suite
HA01	0.1-0.4	1	-
HA02	0.1-0.3	1	-
HA03	0.1-0.3	1	-
HA04	0.1-0.3	1	-
HA05	0.1-0.4	1	-
HA06	0.1-0.3	1	1
HA07	0.1-0.4	1	-

Notes:

mbgl	meters below ground level
1	Sample Taken
-	Sample Not Analysed
EPS Mini Suite	Organic Matter, Cyanide, Metals, PAH's, Phenols, Asbestos
EPS TPH Suite	Speciated Total Petroleum Hydrocarbons (incl. Benzene, Toluene, Ethylbenzene, Xylene and Methyl Tertiary Butyl Ether)

APPENDICES

APPENDIX A

Selected Site Photographs

Photo 1 – *A photo looking west across the site.*



Photo 2 *- A photo looking east up the embankment near the farm entrance.*



Photo 3 – *A photo showing the site of HA04.*



Photo 4 – *A photo showing the material recovered from HA01.*



Photo 5 – *A photo showing the finished hole at HA07.*



Photo 5 – *A photo showing the material recovered from HA07.*



APPENDIX B

Proposed Development Plan


RAVELEY ROAD
Manor Farmhouse
Boundary to Manor Farmhouse (Retrospective) from adjacent property owner
Existing tree to be removed
Existing non native trees to be removed and replaced with native trees
Proposed area of land to be kept clear to allow for visibility splay to be maintained at depth agreed with Manor Farmhouse.
Existing non native trees to be removed and replaced with native trees
Location of soakaway for disposal of surface water. Size and design to be confirmed
Crossover and surface water drainage to be designed to prevent runoff into public highway
Provided surface water drainage to highway land to comply with highway requirements.
Low post and rail fencing with native species hedging
Line of new boundary with Manor Farmhouse
Package treatment plant for foul drainage to all units to be installed under hard-back to the collection point.Access to treatment plant to be provided at all times.
1.8m high close boarded fence and gate
Fire appliance hardstanding
Surface water drainage channel
1.8m high boundary wall and corner gate
1.8m high boundary wall
Existing brickwork wall to demolished building to be retained as boundary wall.
Existing brickwork wall to demolished building to be retained as boundary wall.
Existing brickwork wall to demolished building to be retained as boundary wall.
Fencing wall to be demolished. Native species hedging to be planted inboard of low post and rail fence.
1.8m high close boarded fence with 0.3m retaining
1.8m high close boarded fence and gate
1.8m high close boarded fence and gate
1.8m high close boarded fence and gate
Ground to be regraded to maintain existing boundary bund
Ground to be regraded to maintain existing boundary bund
Low post and rail fencing with native species hedging
Low post and rail fencing
Low post and rail fencing
Low post and rail fencing with native species hedging
Low post and rail fencing with native species hedging
Low post and rail fencing with native species hedging

APPENDIX C

Site Specific Borehole Logs

Borehole Log

Borehole No. **HA01**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17225E - 6875127N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.40	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00				MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with occasional brick fragments.
					0.50			End of Borehole at 0.500m

Remarks

No Groundwater Encountered & Refusal Into Dense Brick

Borehole Log

Borehole No. **HA02**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17244E - 6875138N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.30	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00				MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with occasional brick fragments.
					0.40			End of Borehole at 0.400m

Remarks

No Groundwater Encountered & Refusal Into Dense Brick

Borehole Log

Borehole No. **HA03**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17258E - 6875141N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.30	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00				MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with occasional large brick fragments.
					0.55			End of Borehole at 0.550m

Remarks

No Groundwater Encountered & Refusal Into Dense Brick

Borehole Log

Borehole No. **HA04**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17270E - 6875129N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.30	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00				MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with rare brick fragments.
					0.50			End of Borehole at 0.500m

Remarks

No Groundwater Encountered & Refusal Into Dense Brick

Borehole Log

Borehole No. **HA05**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17286E - 6875150N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: David Ward		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.40	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00	0.30			MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with rare brick fragments.
					0.60			Greyish brown to light bluish grey, gravelly, slightly sandy CLAY. Gravel is fine to cobble size, angular to subrounded white chert, chalk and occassional flint, and oolitic limestone. (OADBY MEMBER)
								End of Borehole at 0.600m

Remarks

No Groundwater Encountered & Reached Target Depth

Borehole Log

Borehole No. **HA06**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17296E - 6875167N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.30	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00	0.30			MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with common asphalt and rare brick fragments.
					0.60			Greyish brown to light bluish grey, gravelly, slightly sandy CLAY. Gravel is fine to cobble size, angular to subrounded white chert, chalk and occassional flint, and oolitic limestone. (OADBY MEMBER)
								End of Borehole at 0.600m

Remarks

No Groundwater Encountered & Reached Target Depth

Borehole Log

Borehole No. **HA07**

Sheet 1 of 1

Project Name: Old Manor Farm House	Project No. UK23.6422c	Co-ords: -17314E - 6875155N	Hole Type HA
Location: Old Manor Farm House, Great Raveley		Level:	Scale 1:10
Client: [redacted]		Dates: 09/09/2023	Logged By MC

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	In Situ Results				
		0.10 - 0.40	ES		0.10			Dark brown, sandy CLAY (DISTURBED TOPSOIL)
		0.20	PID	PID=0.00	0.30			MADE GROUND: Dark greyish brown, slightly clayey, gravelly SAND with rare, large brick fragments.
					0.60			Greyish brown to light bluish grey, gravelly, slightly sandy CLAY. Gravel is fine to cobble size, angular to subrounded white chert, chalk and occassional flint, and oolitic limestone. (OADBY MEMBER)
								End of Borehole at 0.600m

1

2

Remarks

No Groundwater Encountered & Reached Target Depth

APPENDIX D

Laboratory Results – Environmental

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

EPS Ltd
7B Caxton House
Broad Street
Cambourne
Cambridgeshire
United Kingdom
CB23 6JN

4225

Attention :	[redacted]
Date :	19th September, 2023
Your reference :	UK23.6422C
Our reference :	Test Report 23/14868 Batch 1
Location :	Manor Farm, Great Raveley
Date samples received :	8th September, 2023
Status :	Final Report
Issue :	1

Seven samples were received for analysis on 8th September, 2023 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 24.109 kg of CO2

Scope 1&2&3 emissions - 56.976 kg of CO2

Authorised By:

[redacted]

[redacted] **BSc**
Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name: EPS Ltd
Reference: UK23.6422C
Location: Manor Farm, Great Raveley
Contact: [redacted]
EMT Job No: 23/14868

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28				LOD/LOR	Units	Method No.
Sample ID	HA01 ES1	HA02 ES1	HA03 ES1	HA04 ES1	HA05 ES1	HA06 ES1	HA07 ES1						
Depth	0.10-0.40	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.40	0.10-0.30	0.10-0.30						
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023						
Sample Type	Clay	Clay	Clay	Clay	Clay	Clay	Clayey Loam						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023						
Arsenic #M	15.9	18.7	15.3	16.3	20.6	17.4	15.3				<0.5	mg/kg	TM30/PM15
Cadmium #M	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1				<0.1	mg/kg	TM30/PM15
Chromium #M	54.7	48.6	38.5	41.2	46.4	36.2	46.6				<0.5	mg/kg	TM30/PM15
Copper #M	24	29	22	24	62	48	47				<1	mg/kg	TM30/PM15
Lead #M	175	55	48	50	158	85	114				<5	mg/kg	TM30/PM15
Mercury #M	<0.1	0.1	<0.1	0.2	0.4	0.2	0.2				<0.1	mg/kg	TM30/PM15
Nickel #M	31.5	31.6	27.1	30.6	35.1	31.0	29.2				<0.7	mg/kg	TM30/PM15
Selenium #M	<1	1	1	<1	1	<1	<1				<1	mg/kg	TM30/PM15
Total Sulphate as SO4 #M	590	816	682	602	1089	1373	763				<50	mg/kg	TM50/PM29
Zinc #M	117	114	104	106	281	291	196				<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #M	<0.04	<0.04	<0.04	<0.04	0.07	0.06	0.09				<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.05	<0.03	0.06	0.03	0.06	0.14	0.05				<0.03	mg/kg	TM4/PM8
Acenaphthene #M	0.07	<0.05	0.07	<0.05	<0.05	0.11	0.16				<0.05	mg/kg	TM4/PM8
Fluorene #M	0.07	<0.04	0.06	<0.04	<0.04	0.08	0.12				<0.04	mg/kg	TM4/PM8
Phenanthrene #M	0.94	0.52	0.73	0.45	0.58	1.17	1.54				<0.03	mg/kg	TM4/PM8
Anthracene #	0.15	0.08	0.16	0.08	0.12	0.38	0.23				<0.04	mg/kg	TM4/PM8
Fluoranthene #M	1.55	0.88	1.46	0.86	1.17	2.62	2.20				<0.03	mg/kg	TM4/PM8
Pyrene #	1.21	0.70	1.20	0.67	0.95	2.18	1.80				<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.87	0.42	0.73	0.42	0.59	1.19	1.02				<0.06	mg/kg	TM4/PM8
Chrysene #M	0.82	0.48	0.79	0.47	0.68	1.33	1.20				<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #M	1.32	0.74	1.26	0.79	1.15	2.49	1.90				<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.76	0.44	0.76	0.46	0.64	1.49	1.11				<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #M	0.47	0.29	0.46	0.30	0.43	1.11	0.69				<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	0.09	0.07	0.10	0.07	0.09	0.20	0.15				<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.42	0.26	0.43	0.27	0.41	1.08	0.66				<0.04	mg/kg	TM4/PM8
PAH 16 Total	8.8	4.9	8.3	4.9	6.9	15.6	12.9				<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.95	0.53	0.91	0.57	0.83	1.79	1.37				<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.37	0.21	0.35	0.22	0.32	0.70	0.53				<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	96	96	94	98	96	94	97				<0	%	TM4/PM8
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL) #M	-	-	-	-	-	<0.1 SV	-				<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL) #M	-	-	-	-	-	<0.1 SV	-				<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	-	-	-	-	-	<0.1 SV	-				<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL) #M	-	-	-	-	-	<0.2	-				<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL) #M	-	-	-	-	-	<4	-				<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #M	-	-	-	-	-	<7	-				<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #M	-	-	-	-	-	90	-				<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	-	-	-	-	-	14	-				<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_CU_1D_AL)	-	-	-	-	-	104	-				<26	mg/kg	TM5/PM8/PM12/PM16

Please see attached notes for all abbreviations and acronyms

Client Name: EPS Ltd
Reference: UK23.6422C
Location: Manor Farm, Great Raveley
Contact: [redacted]
EMT Job No: 23/14868

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	LOD/LOR	Units	Method No.
Sample ID	HA01 ES1	HA02 ES1	HA03 ES1	HA04 ES1	HA05 ES1	HA06 ES1	HA07 ES1			
Depth	0.10-0.40	0.10-0.30	0.10-0.30	0.10-0.30	0.10-0.40	0.10-0.30	0.10-0.30			
COC No / misc										
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T			
Sample Date	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023	06/09/2023			
Sample Type	Clay	Clay	Clay	Clay	Clay	Clay	Clayey Loam			
Batch Number	1	1	1	1	1	1	1			
Date of Receipt	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023	08/09/2023			
TPH CWG										
Aromatics										
>C5-EC7 (HS_1D_AR) #	-	-	-	-	-	<0.1 SV	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	-	-	-	-	-	<0.1 SV	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #M	-	-	-	-	-	<0.1 SV	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	-	-	-	-	-	<0.2	-	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	-	-	-	-	-	<4	-	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	-	-	-	-	-	27	-	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) #	-	-	-	-	-	209	-	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	-	-	-	-	-	36	-	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_CU_1D_AR)	-	-	-	-	-	272	-	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	-	-	-	-	-	376	-	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
Benzene #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
Toluene #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
Ethylbenzene #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
m/p-Xylene #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
o-Xylene #	-	-	-	-	-	<5 SV	-	<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15	<0.15	<0.15	0.15	<0.15	<0.15	<0.15	mg/kg	TM26/PM21B
Natural Moisture Content	15.5	19.9	15.8	14.4	13.6	18.5	15.6	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #M	0.0059	0.0149	<0.0015	0.0203	0.0085	0.0573	0.0430	<0.0015	g/l	TM38/PM20
Chromium III	54.7	48.6	38.5	41.2	46.4	36.2	46.6	<0.5	mg/kg	NONE/NONE
Total Cyanide #M	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Organic Matter	5.0	6.6	6.0	4.2	15.1	10.5	11.2	<0.2	%	TM21/PM24
pH #M	7.89	7.73	7.88	8.05	7.44	7.81	7.70	<0.01	pH units	TM73/PM11
Sample Type	Clay	Clay	Clay	Clay	Clay	Clay	Clayey Loam		None	PM13/PM0
Sample Colour	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown	Medium Brown		None	PM13/PM0
Other Items	stones, vegetation	stones, vegetation	stones, vegetation, brick	stones, vegetation	stones, vegetatio, brick	stones, vegetation	stones, vegetation		None	PM13/PM0

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Client Name: EPS Ltd

Reference: UK23.6422C

Location: Manor Farm, Great Raveley

Contact: [redacted]

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
23/14868	1	HA06 ES1	0.10-0.30	21-24	trace of possible Lubricating Oil, possible PAHs, possible Naturally Occurring Compounds

Client Name: EPS Ltd
Reference: UK23.6422C
Location: Manor Farm, Great Raveley
Contact: [redacted]

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

Where trace asbestos is reported the amount of asbestos will be <0.1%.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
23/14868	1	HA01 ES1	0.10-0.40	3	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	16/09/2023	**Asbestos Fibres**	Fibre Bundles
					Catherine Coles	16/09/2023	**Asbestos Fibres (2)**	Free Fibres
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM (2)**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	Chrysotile
					Catherine Coles	16/09/2023	**Asbestos Type (2)**	Amosite
23/14868	1	HA02 ES1	0.10-0.30	7	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,vegitation
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD
23/14868	1	HA03 ES1	0.10-0.30	11	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,vegitation
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD
23/14868	1	HA04 ES1	0.10-0.30	15	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,vegitation
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD
23/14868	1	HA05 ES1	0.10-0.40	19	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil, vegitation
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD
23/14868	1	HA06 ES1	0.10-0.30	23	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD
23/14868	1	HA07 ES1	0.10-0.30	27	Catherine Coles	16/09/2023	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	16/09/2023	**Asbestos Fibres**	NAD
					Catherine Coles	16/09/2023	**Asbestos ACM**	NAD
					Catherine Coles	16/09/2023	**Asbestos Type**	NAD

Element Materials Technology

Notification of Deviating Samples

Client Name: EPS Ltd
Reference: UK23.6422C
Location: Manor Farm, Great Raveley
Contact: [redacted]

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 23/14868						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 23/14868

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above quantitative calibration range. The result should be considered the minimum value and is indicative only. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 23/14868

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	No

EMT Job No: 23/14868

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Preparation of Soil and Marine Sediment Samples for Total Organic Carbon.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes	Yes	AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM50	Acid soluble sulphate (Total Sulphate) analysed by ICP-OES	PM29	A hot hydrochloric acid digest is performed on a dried and ground sample, and the resulting liquor is analysed.	Yes	Yes	AD	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	

EMT Job No: 23/14868

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes	Yes	AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

APPENDIX E

Generic Screening Criteria

EPS Generic Quantitative Risk Assessment - Residential Land Use

Contaminant	Soil Targets			Groundwater Targets		
	Human Health	Controlled Waters		Human Health	Controlled Waters	
		Surface Water	Groundwater		Surface Water	Groundwater
Unit	mg/kg			µg/l		
Arsenic	See C4SL	n/c	n/c	n/c	50	10
Cadmium	See C4SL	n/c	n/c	n/c	2.5#	5
Chromium III	910	n/c	n/c	n/c	4.7	50
Chromium VI	See C4SL	n/c	n/c	n/c	3.4	
Copper	2400	n/c	n/c	n/c	93.1#	2000
Mercury (elemental)	1.2	0.085	1.22	1.1	1	1
Nickel	180	n/c	n/c	n/c	14.8#	20
Lead	See C4SL	n/c	n/c	n/c	27.7#	10
Selenium	250	n/c	n/c	n/c	10	10
Zinc	3700	n/c	n/c	n/c	373#	3000
Benzene	See C4SL	0.064	0.0064	210	10	1
Toluene	130	1.33	12.6	230,000	74	700
Ethylbenzene	47	0.77	11.5	10,000	20	300
Xylene (para)	56	1.18	19.6	9,900	30	500
MTBE#	49	4.41	0.026	83,000	2600	15
Benzo(a)Pyrene	See C4SL	n/c	n/c	n/c	0.005 (0.00017)	0.01
Naphthalene	2.3	0.11	0.11	220	2	2
Aliphatic C5-C6	42	4.06	0.81	1,900	50	10
Aliphatic C6-C8	100	17.8	3.57	1,500	50	10
Aliphatic C8-C10	27	n/c	n/c	57	50	10
Aliphatic C10-C12	130(48)*	n/c	n/c	37	50	10
Aliphatic C12-C16	1100(8.48)**	n/c	n/c	n/c	50	10
Aliphatic C16-C35	65000 (8.48)**	n/c	n/c	n/c	50	10
Aromatic C8-C10	34	6.71	1.34	1,900	50	10
Aromatic C10-C12	74	10.6	2.13	6,800	50	10
Aromatic C12-C16	140	21.2	4.23	39,000	50	10
Aromatic C16-C21	260	n/c	n/c	n/c	50	10
Aromatic C21-C35	1100	n/c	n/c	n/c	50	10
Tetrachloroethene	See C4SL	0.24	0.24	34	10	10
Trichloroethene	See C4SL	0.13	0.13	5.7	10	10
cis-1,2 Dichloroethene		0.21	0.21	130	50	50
Vinyl Chloride	See C4SL	0.0012	0.0012	0.62	0.5	0.5

Notes:
f = Oral, dermal and inhalation exposure compared with oral HCV N/C = Not Calculated
* = S4UL exceeds vapour saturation limit (in brackets) ** = S4UL exceeds solubility saturation limit (in brackets)
n/c = not calculated. Under normal conditions contaminant exhibits low solubility /volatility, therefore risks from leaching and or vapour pathways are considered low.

To establish suitable compliance criteria for Surface Water review of basline groundwater quality in England and Wales was completed following research reported in Shand, P, Edmunds, W M, Lawrence, A R, Smedley, P L, and Burke, S. 2007. The natural (baseline) quality of groundwater in England and Wales. British Geological Survey Research Report No. RR/07/06. Where compliance criteria was found below the 97.7 percentile of baseline value, the latter was adopted as GAC.

Soil Targets

Targets for Human Health have been taken from *S4ULs 'Suitable For Use Levels for Human Health Risk Assessment' – LQM and CIEH (2014)* derived using standard sandy loam soil with 1% SOM, except (#) = *EIC/AGS/CL:AIRE GAC 'Soil Generic Assessment Criteria' (2010)*. For sites where ground conditions differ significantly from sandy loam or site-specific SOM and pH are available, the generic human health targets may be revised.

Targets for Controlled waters have been derived using EA Remedial Targets Worksheet (v3.1) - using standard Sandy Loam ground conditions as described in Science Report SC050021/SR3, assuming no degradation for a 10m compliance distance with criteria of EQS or UKDWS for Surface Water and Groundwater respectively (see notes for GW targets).

Groundwater Targets
For Surface Water, targets have been taken as Freshwater EQS where available. For MTBE Predicted No Effect Concentration (European Risk Assessment Report, 2002) was used. For individual TPH fractions, in absence of UK EQS, a 5 times multiplier of UKDWS has been taken.

For Groundwater, targets have been taken as UKDWS where available. In the absence of UK targets internationally recognised criteria were adopted. For MTBE, WHO taste threshold has been adopted.

Targets for Human Health have been taken from *Society of Brownfield Risk Assessment (SoBRA) 'Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater' - Version 1.0, February 2017,* derived using sandy soil and 1%SOM. GAC were set up assuming source at 50cm below typical ground bearing slab of 15cm thickness. GAC were derived for vapour pathways only. For sites where ground conditions, or differ significantly from described above, the generic human health targets may be revised.

May-23

EPS Generic Quantitative Risk Assessment

Generic Screening Criteria (C4SLs) - All Land Uses

Contaminant	Soil Targets					
	Residential		Allotments	Commercial	Public Open Spaces	
	With Home Grown Produce	Without Home Grown Produce			Residential	Parks
Unit	mg/kg					
Arsenic	37	40	49	640	79	168
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5	5.3	5.7	76	10	21
Cadmium	26	149	4.9	410	220	880
Chromium (VI)	21	21	170	49	23	250
Lead	200	310	80	2330	630	1300
Chloroethene (Vinyl Chloride)	0.017	0.029	0.0058	2.2	7.8	19
Trichloroethene (TCE)	0.043	0.045	0.16	3.4	79	69
Tetrachloroethene (PCE)	1.6	1.6	11	130	3400	2500

Notes:

Targets for Human Health have been taken from the publicly available Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination issued by DEFRA/CL:AIRE in December 2013 and May 2021.

Within the modelling for C4SLs, a Soil Organic Matter content of 6% has been used. Reference to site-specific data should be made where possible.

The C4SLs for the contaminant benzene along with the three chlorinated solvents are the most susceptable to changes in SOM.

May-23

APPENDIX F

Cover Soils Checklist

ADVISORY NOTE

SOILS FOR USE IN COVER SYSTEMS

This note applies where there is a need for a control measure in the form of a defined thickness of clean soil to be used in gardens and soft landscaped areas in order to reduce risks from underlying contamination (a 'cover system'). Where a specific thickness has been presented, it is what EPS consider sufficient provided the soil forming the cover system is good quality, as it is assumed that over time this soil will become intermixed with the underlying soils and therefore needs to have the necessary 'dilution' effect. The aim being that an acceptable reduction in exposure to contamination is achieved, rather than absolute prevention.

These simple cover systems are designed in general accordance with the BRE 2004 guidance *'Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land'*. In many cases guidance from a Local Planning Authority or NHBC/Approved Inspector may also apply and need to be taken into account. In most cases, to design the cover system EPS have to assume a certain quality of cover soils in advance. In these circumstances, we utilise what we consider to represent 'good quality soil' in that the soil could never be considered 'contaminated' but is also pragmatic and does not represent an unrealistic or unsustainable objective for much of the soils in the UK. In numerical terms, this standard typically equates to soil containing contaminants at around 25% of their adopted screening values in the risk assessment.

For the cover system itself, EPS would usually carry out a verification process of your site to demonstrate the control measure has been implemented as intended to satisfy all interested parties such as planning authorities, the NHBC and the future property owner. To document this process, EPS will prepare a Verification Report. If you wish for EPS to do this, we will need the following points confirmed relating to the soils preferably before they are installed in gardens.

If there are any queries, please contact EPS before purchasing any soil.

EPS Contact Details:

Tel: [redacted]

Email: info@epstrategies.co.uk

Pre-Verification Cover System Checklist		Yes?
Soil Source	The soil must not be a waste. Has it been confirmed that the soil is not a waste and has never been deemed as such in the past?	
	Has the source of the soil been provided?	
	Have all the delivery notes confirming the source, volume and type of soil been provided for all that is to be used? Where suppliers such as British Sugar are used, the soils should be delivered direct to site (not via an intermediary depot).	
Soil Quality	The soils are free of invasive plant species such as Japanese Knotweed, and have not been sourced from an affected area?	
	Do the soils look clean and of a high quality? I.e. the soil must not have an odour or contain any visual evidence of contamination, including oils, asbestos, glass, plastic, rubble, metal, ash, sharp objects or tarmac/bitumen?	
	Testing to 'BS 3882:2015 *Specification for topsoil and requirements for use*' is preferable but generally not essential for public health regulation, provided you can confirm the soils comply with the above points, are suitable for their intended purpose and will provide an adequate growing medium?	
	Has the soil been chemically tested prior to it arriving at site? Any soil test results presented to EPS by a third party must be current and clearly relate to the soil used, i.e. the testing must generally be dated within 6 weeks of delivery. The quantity of testing will be dependent on how much confidence is generated in the quality of the material, as well any specific local regulatory requirements. If the soil is clean soil from an established source such as British Sugar, the testing they provide at source may be sufficient alone without further testing (by EPS). For other soils, EPS can advise on the likely testing frequencies but as a rule of thumb, anticipate at least one sample per average-sized plot. The testing would usually comprise the following: Heavy Metals, Poly Aromatic Hydrocarbons, Asbestos and Total Petroleum Hydrocarbons at an accredited lab. If adequate testing has not been completed, then EPS will need to test it from stockpiles prior to installation. Installing the soils into gardens without any testing data is not advised, as it may need to all be removed later.	
Cover Thickness	Are all excavations ready which will allow the necessary thickness of cover soils to be installed?	
	If yes, can you provide waste transfer documentation for any excavated soils?	

APPENDIX G

Method Statement for Encountering Unexpected Contamination

METHOD STATEMENT

ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

If at any point during intrusive groundworks at a site, evidence of unforeseen contamination is encountered in the form of significant noxious odours, discolouration, or instability within soils or sheen/ discolouration in groundwater, the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered
- In cases where EPS consider the unforeseen contamination likely to pose a significant risk of significant harm to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken
- Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and validation samples obtained and conclusions and recommendations for any further actions considered necessary
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

EPS Contact Details:

[redacted] Associate Director Tel: [redacted]
Director Tel:
Director Tel:

Email: info@epstrategies.co.uk (Automatically forwarded to the above and office-based personnel)

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