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CONSULTING

GEO-ENVIRONMENTAL PHASE 2 INVESTIGATION

LAND WEST OF BANK HOUSE FARM

**SOUTH EAU BANK
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PE12 0QW**

On behalf of:

Mr. Reuben Price

Report No.: 9698076-R02

Date: May 2019

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

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1.0 INTRODUCTION

1.0 Report Context

Adeptus was appointed by Mr. Reuben Price in April 2019 to undertake a phase 2 intrusive investigation based on the findings of an earlier phase 1 report. This report presents the factual data obtained and provides interpretive assessment of the data and other finding. Where necessary, any suggestions to address any further requirements are also given.

1.1 Objectives and Methodology

The Phase 2 investigation was undertaken in order to obtain chemical laboratory data to enable an assessment of ground conditions on the site with respect to potential contamination and risks to human health.

1.2 Regulatory Framework

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

"Contamination" is defined in BS 10175:2011 as:

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

"Contaminated Land" is defined in Section 78A(2) of the Environmental Protection Act 1990 as:

any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that—

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused

Contaminated Land Report 11 'Model Procedures for the Management of Land Contamination', sets out three essential elements of risk in the context of land contamination, which together are described as a pollutant or contaminant linkage. Preliminary risk assessment is required to qualitatively assess the significance of potential pollutant linkages affecting the site, and establish the requirement or otherwise for further investigation.

1.3 Previous Reports/Investigations

Phase 1 Desk Study and Preliminary Risk Assessment (Adeptus, 2018) – summarised in Section 2.2.

Environmental data report (Appendix A)

2.0 SITE DETAILS

2.1 Location and Description

Table 2-1: Site Summary

Location	The site is situated ca. 500m east of the village/hamlet of Trockenholt.		
Grid Reference	535718,309498 (approx.)		
Area &Shape	0.15ha – roughly rectangular.		
Elevation & Dip	Ca. 10m above ordnance datum (AOD). Generally flat and level.		
Current Land Use	On-Site: Stables; farm yard/storage. North: Farmland East: Detached dwelling South: Farmland West: Detached dwelling		
Proposed Development	Current plans are for a single dwelling toward the centre of the site.		

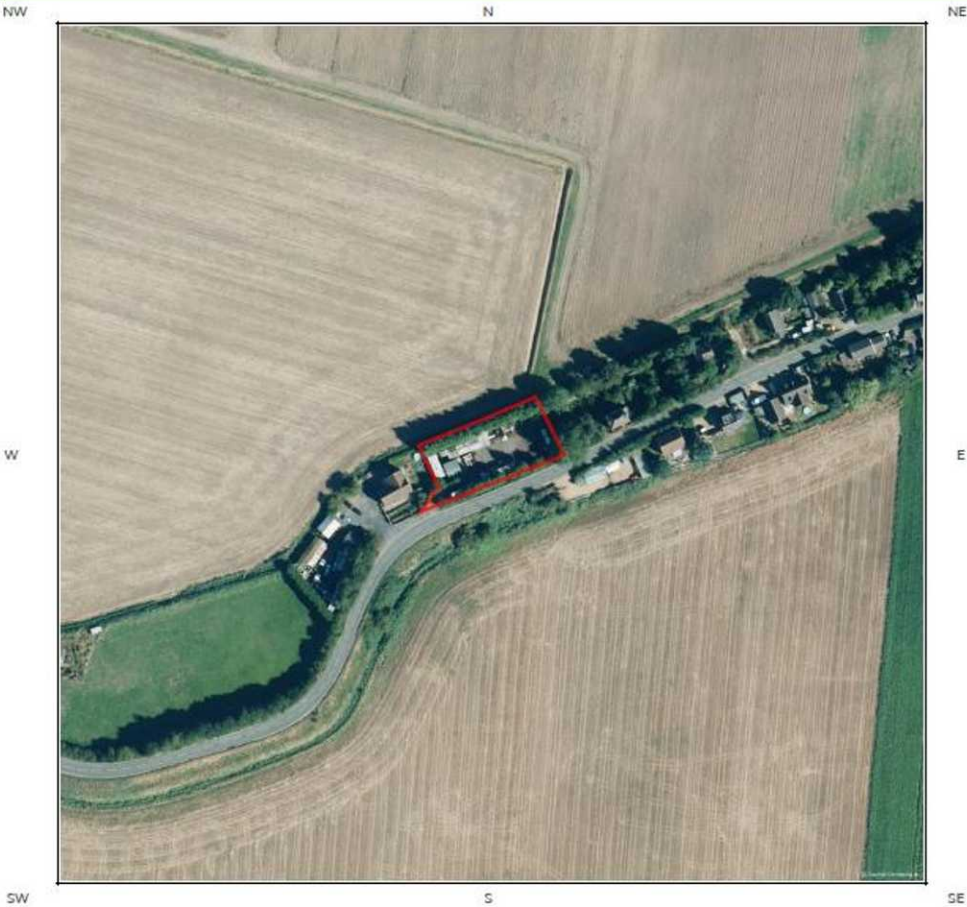


Figure2-2: Site Location (based on the plan in Appendix B)

2.2 Summary of Preliminary Risk Assessment

The desk study found the site's previous use as a farmyard and for the parking of goods vehicles presented the possibility of impacts from spillage or leakage of fuel and oils, use and storage of pesticides, burning of waste and storage/use of ACMs.

A potential source of ground gases was identified in the form of the superficial deposits underlying the site. However, the indicated lack of an active groundwater regime in the area suggests a low likelihood of significant gas flux, and current gas generation rates from such strata would be low.

The site setting is considered moderately to highly sensitive due to the proposed residential use, and immediately adjacent surface waters in the form of a ditch.

At the time of the walkover the area of the proposed building plot had been stripped of hardstanding and excavated to around 30cm below ground level. We are advised this is to allow for the importation of new aggregate to surfaced areas and topsoil to gardens.

It was suggested that additional excavation may be undertaken to allow 60cm of clean soil cover to be imported to gardens, serving as a cover system to sever direct exposure pathways and remove potential sources of shallow leachable contaminants. Water supply pipes should also be laid in clean material.

It was also noted that before occupation of the proposed dwelling, perimeter fencing or similar will be required to prevent access to the remaindered the site/yard and potential exposure to the any surface contamination remaining in those areas.

Further intrusive sampling and testing was in turn scheduled to provide evidence that levels of contamination were sufficiently low for a cover system to be suitable and that a vapour risk was not present.

3.0 INTRUSIVE INVESTIGATION

3.1 Fieldworks and Observations

3.1.1 Fieldworks

An exploratory investigation was undertaken based on the findings of the desk study and is summarised in Table 3-1, below.

Fieldworks were completed on 11th April 2019 and consisted of 2no. hand-dug trial pits and 2no. deeper machine excavated trial pits. Exploratory locations are marked on the plan in Appendix B, with photos Appendix in C.

Table 3-1: Fieldworks Summary & Rationale

Location Reference and Rationale		Method	Max Depth (bgl)	Strata Descriptions
TP1	A ca. 3m excavation had been formed at the south of the plot to allow geotechnical inspection by others. Samples were taken from its sidewall both at and 0.6m below the surface. Future garden.	Open Trial Pit	~3m	Stiff brown becoming grey CLAY (TIDAL FLAT DEPOSITS)
HP2	Surface soil at the west of the plot. Future garden.	Hand Pit	0.15m	Stiff brown CLAY (TIDAL FLAT DEPOSITS)

TP3	Surface and near surface soil at the north of the plot. Future garden.	Trial Pit	0.02m	MADE GROUND: Medium dense dark grey sandy slightly silty subrounded fine to medium gravel of tarmac, concrete and occasional brick.
			0.6m	Stiff brown becoming grey CLAY (TIDAL FLAT DEPOSITS)
HP4	Surface soil at the east of the plot. Future garden.	Hand Pit	0.015m	MADE GROUND: Medium dense dark grey sandy slightly silty subrounded fine to medium gravel of tarmac, concrete and brick.
			0.1m	Stiff brown becoming grey CLAY (TIDAL FLAT DEPOSITS)

3.2 Laboratory Analysis

A total of six (6no.) soil samples were submitted for chemical analysis comprising metals, TPH (CWG), total and speciated polycyclic aromatic hydrocarbons (PAHs) and soil organic matter (SOM).

Analytical work was undertaken by i2 Analytical. Results are discussed below, and the lab report is attached in Appendix D.

VOC screening was also undertaken using handheld PID, with no elevated concentrations detected.

3.3 Human Health Risk Assessment

A Tier 1 (generic) quantitative risk assessment has been undertaken by screening measured contaminant concentrations derived from the exploratory investigation works against reference values (GAC) for chronic (long term) risk to human health, published by LQM/CIEH, Defra, or the Environment Agency.

Concentrations in exceedance of the screening values are considered 'elevated' and indicate that further assessment should be undertaken to determine their significance.

In line with the conceptual site model and soil organic matter content (SOM), the applicable assessment criteria are for the residential with plant uptake exposure scenario (6% SOM was used based on the average in exceeding samples). Results are reproduced in Table 3-2, below.

As the majority of TPH species were not detected above the respective LOD and none of the detections exceeded GAC, the TPH testing results are not reproduced below.

Table 3-2. Summary of Soil Analytical Results vs Tier 1 Screening Values

Analytical Parameter (Soil Analysis)	Units	LOD	TP101	TP102	HP201	TP301	TP302	HP401	GAC
---	-------	-----	-------	-------	-------	-------	-------	-------	-----

Sample Depth	Σ	0-0.1	0.5-0.6	0-0.1	0-0.1	0.5-0.6	0-0.1		
Organic Matter	%	0.1	2.8	3.8	3.3	8.2	5.4	5.1	N/A
Speciated PAHs									
Acenaphthene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	4.0	< 0.05	0.26	510 *
Acenaphthylene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	4.7	< 0.05	0.27	420 *
Anthracene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	16	< 0.05	0.93	5400 *
Benzo(a)anthracene	mg/kg	0.05	0.51	0.20	0.77	75	0.48	6.1	11 *
Benzo(a)pyrene	mg/kg	0.05	0.51	< 0.05	0.91	68	0.65	7.3	2.7 *
Benzo(b)fluoranthene	mg/kg	0.05	0.56	< 0.05	0.96	70	0.77	8.3	3.3 *
Benzo(ghi)perylene	mg/kg	0.05	0.34	< 0.05	0.56	44	0.44	4.3	340 *
Benzo(k)fluoranthene	mg/kg	0.05	0.33	< 0.05	0.52	45	0.20	2.6	93 *
Chrysene	mg/kg	0.05	0.57	0.23	0.81	57	0.53	6.0	22 *
Dibenz(a,h)anthracene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	12	< 0.05	0.87	0.28 *
Fluoranthene	mg/kg	0.05	1.0	0.33	1.4	140	0.89	12	560 *
Fluorene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	3.5	< 0.05	0.21	400 *
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	0.24	< 0.05	0.41	37	0.35	3.6	36 *
Naphthalene	mg/kg	0.05	< 0.05	< 0.05	< 0.05	0.81	< 0.05	0.30	5.6 *
Phenanthrene	mg/kg	0.05	0.39	< 0.05	0.36	43	0.24	3.6	220 *
Pyrene	mg/kg	0.05	0.92	0.33	1.3	120	0.80	11	1200 *
Total PAH									
Speciated Total EPA-16 PAHs	mg/kg	0.8	5.41	1.09	8.08	737	5.35	67.2	N/A
Heavy Metals / Metalloids									
Arsenic (aqua regia extractable)	mg/kg	1	14	18	24	17	38	21	37 *
Barium (aqua regia extractable)	mg/kg	1	95	81	94	200	120	150	1300 *
Beryllium (aqua regia extractable)	mg/kg	0.06	1.0	1.2	1.3	3.1	0.98	1.4	1.7 *
Boron (water soluble)	mg/kg	0.2	4.6	8.4	7.0	4.1	8.1	6.8	290 *
Cadmium (aqua regia extractable)	mg/kg	0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	11 *
Chromium (aqua regia extractable)	mg/kg	1	30	36	36	31	36	28	910 *
Copper (aqua regia extractable)	mg/kg	1	21	17	52	24	18	34	2400 *
Lead (aqua regia extractable)	mg/kg	1	44	22	33	49	80	140	<210 **
Mercury (aqua regia extractable)	mg/kg	0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	40 *
Nickel (aqua regia extractable)	mg/kg	1	24	31	32	18	28	24	180 *
Selenium (aqua regia extractable)	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	250 *
Vanadium (aqua regia extractable)	mg/kg	1	47	51	55	65	55	44	410 *
Zinc (aqua regia extractable)	mg/kg	1	84	72	82	90	59	120	3700 *

Laboratory results reproduced in Table 3-2 indicate the following:

- Six of the 16 PAH species, including benzo(a)pyrene, considerably exceeded the respective GAC in sample TP301
- The two PAHs benzo(a)pyrene and benzo(b)fluoranthene exceeded the respective GAC by a factor of around two in sample HP401
- Beryllium exceeded the GAC in sample TP301 (0m-0.1m) by a factor of around two
- Arsenic slightly exceeded the GAC (38mg/kg vs 37mg/kg) in sample TP302 (0.5m-0.6m)

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Investigation Summary

Results of the laboratory testing along with on-site PID screening of samples and lack of visual olfactory evidence, indicate that the proposed development plot has not been significantly impacted as a result of previous usage or possible associated fuel or oil spillage.

As suggested at the surface since reduction of site levels by around 0.4m, stiff clay was encountered in all exploratory locations, and could be seen to extend to depths greater than 3m in the open deep trial pit.

Remnants of the former hardstanding consisting of tarmac debris and/or road planings were noted at the surface in the locations of TP3 and HP4, and this material was not segregated for the purposes of the surface sampling.

A number of PAH species considerably exceeded screening levels in both of the surface soil samples in the above locations. This is particularly true for sample TP301, which contained the highest proportion of tarmac material. Beryllium was also exceeded screening level in TP301, which is also attributed to the tarmac content of the sample.

Arsenic at 38mg/kg, marginally exceeded the 37mg/kg screening level in TP302 (0m-0.6m). This is not considered to present a significant risk to future residents, due to the exceedance being marginal and at depth.

With reference to the potential ground gas risk identified in the desk study, the presence of a deep trial pit on site enabled inspection of the ground profile to a significant depth. Inspection confirmed the Tidal Flats (alluvial) Deposits, as observed in the excavation walls and arisings pile, to consists of stiff, low permeability clays, with no silt, rootlets of general organic matter of note.

These shallow strata are not considered a significant gas source¹, and are further considered to provide relatively impermeable barrier to transmission of gases from depth, should a deeper source be present. With the additional lack of an active groundwater regime as noted in the desk study making the mobilisation of any trapped gases very unlikely, the development is considered to be at low risk from ground gases.

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¹ CL:AIRE, 2012. Research bulletin 17. A Pragmatic Approach to Ground Gas Risk Assessment

4.2 Updated Conceptual Site Model and Risk Assessment

The initial conceptual site model has been updated in Table 4-1, below, to reflect the findings of the sample analysis following exploratory investigation works.

Table 4-1. Updated Conceptual Site Model

Source	Pathway	Receptor	Consequence	Likelihood	Classification*
PAH species exceeding GAC in surface soil (2 samples)	Dermal contact, ingestion, particulate inhalation	Site occupants & users	Medium	Likely	Moderate Risk
	Consumption of home grown produce	Site occupants	Medium	Low Likelihood	Moderate/ Low Risk
Beryllium exceeding GAC in surface soil (2 samples)	Dermal contact, ingestion, particulate inhalation	Site occupants	Medium	Low Likelihood	Moderate/ Low Risk
	Consumption of home grown produce	Site occupants	Medium	Low Likelihood	Moderate/ Low Risk
Arsenic exceeding GAC at 0.6m below ground level (bgl) (1 sample)	Dermal contact, ingestion, particulate inhalation	Site occupants	Medium	Unlikely	Low Risk
	Consumption of home grown produce	Site occupants	Medium	Unlikely	Low Risk

*assuming no mitigation or remedial measures are implemented

4.3 Recommendations

Removal of the small area of tarmac remnant material at the north of the building plot was discussed with the developer during the course of the investigation and it was agreed that this area should be scraped back to clean natural material and the resultant waste disposed of off-site. This should enable the source to be removed entirely from the site, along with the associated risk to future occupiers.

Additionally to the mitigation described above, finished site levels will be approximately 0.4m higher than the current ground level, resulting in the arsenic exceedance being at an effective depth of around 1m bgl.

Upon completion of the above measures, no further action is considered necessary.

Gas Protection Measures

Taking a precautionary approach, gas protection measures equivalent to characteristic situation 2 (CIRIA C665), or Amber 1 (NHBC) may be specified.

As the development consists of a 'Type A' building (low-rise private residential housing) and based on CS2 classification, a gas protection score of 3.5 would be required.

As an example, this could be achieved using the following design specification:

- Suspended block and beam floor (0 points)
- Passive sub-floor dispersal layer (clear void, ventilated with air bricks, as required by building regulations) achieving a 'good performance' as defined in Annex B of BS8485 (1.5 points)
- Installation of a gas-resistant membrane meeting the criteria specified in Table 7 of BS8485:2015 (2 points)

Remediation Method Statement

In respect of the scattering of remnant tarmac planings material exhibiting GAC exceedances in the vicinity of TP3 and HP4, removal of this source may be achieved manually or by mechanical means.

The material in question should be scraped away until the underlying clean soil is visible with no particles of stone, mortar or asphalt present. The arising should be transferred into a skip or similar for removal off-site.

There is a requirement for imported topsoil at the site to achieve formation levels in gardens, etc. Following complete removal of all source material, the imported soils will further provide ca. 0.4m of clean material.

Topsoil shall be supplied from a reputable, traceable source and fully certified, with all records being retained on-site.

Given the nature of these works, it is suggested that photos of the area in question will provide sufficient verification and should be forwarded to the EPU following removal of all source material and placement of certified soils.

However, the EPU will typically require verification sampling to confirm the status imported materials.

APPENDIX A – ENVIRONMENTAL DATA REPORT

Double click the cover sheet below to open the full PDF.



Adeptus Environmental

Hill Quays, 14 COMMERCIAL STREET,
MANCHESTER, M15 4PZ

Groundsure
Reference:

GS-5336438

Your Reference: Land_west_of_Bank_House_Farm

Report Date 17 Aug 2018

Report Delivery Email - pdf
Method:

Enviro Insight

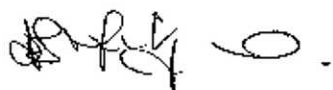
Address: BANK HOUSE, SOUTH EAU BANK, THROCKENHOLT, SPALDING, PE12 0QW

Dear Sir/ Madam,

Thank you for placing your order with Groundsure. Please find enclosed the Groundsure Enviro Insight as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 08444 159000 quoting the above Groundsure reference number.

Yours faithfully,



Managing Director
Groundsure Limited

Enc.
Groundsure Enviroinsight

[illegible]

Appendix C – PHOTOS

Photo 1 – Trial Pit 1



Photo 2 – Trial Pit 1 Arisings



Photo 3 – Hand Pit 2 Location



Photo 4 – Trial Pit 3 Location



Appendix D - LABORATORY REPORT

Double click the link or cover sheet below to open the full PDF.

https://drive.google.com/file/d/1htNLVp6YUN03gsCgdVwOs_G9Pfy7910/view?usp=sharing



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Analytical Report Number : 19-37437

Project / Site name:	Land W of Bankhouse Farm	Samples received on:	12/04/2019
Your job number:		Samples instructed on:	12/04/2019
Your order number:		Analysis completed by:	23/04/2019
Report Issue Number:	1	Report issued on:	23/04/2019
Samples Analysed:	6 soil samples		

Signed:



Rexona Rahman
Head of Customer Services
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

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