



**Castledine
Environmental**

LAND CONTAMINATION SURVEYS

Phase 2 Intrusive Contamination Risk Assessment

for

The Conversion of an Existing Agricultural Building into a Dwellinghouse

on the site of

**Ratcliffe House Farm,
Ratcliffe House Lane,
Ratcliffe Culey, Atherstone,
Leicestershire CD9 3LZ**

Date: October 2024

Status:

Final Report

Reference:

3779D P2 Garland - Atherstone

Date:

03/10/2024

Tel: 01509 880399 Email: info@castledineenvironmental.co.uk
4 Wymeswold Road, Hoton, Loughborough, Leicestershire, LE12 5SN

EXECUTIVE SUMMARY

Laboratory analysis has identified exceedances of:

- Benzo(b)fluoranthene GAC of 2.6mg/kg by readings of 7.25mg/kg and 11.19mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Benzo(a)pyrene GAC of 2.2mg/kg by readings of 7.83mg/kg and 10.47mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Dibenzo(a,h,)anthracene GAC of 0.24mg/kg by readings of 1.42mg/kg and 1.72mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Aromatic C21-C35 (1282mg/kg) exceeds the TAC of 1100mg/kg.

No further exceedances of metals, metalloids, PAH's nor TPH CWG have been identified and no elevated phenol nor asbestos has been detected with all SVOC testing below laboratory detection limits (LOD).

Based on the information contained in this report, it is the opinion of Castledine Environmental that the site represents a **MODERATE** level of risk with respect to the proposed development.

It is recommended that remediation in-line with section 16.0 is planned and carried out on site.

This report should be submitted to your Local Planning Authority for agreement to allow the Phase 3 Remediation Strategy and Verification Plan to be written.

TABLE OF CONTENTS

<u>EXECUTIVE SUMMARY</u>	<u>I</u>
<u>TABLE OF CONTENTS</u>	<u>I</u>
<u>LIST OF APPENDICES</u>	<u>II</u>
<u>LIST OF TABLES II</u>	
<u>1.0</u> <u>QUALITY ASSURANCE</u>	<u>1</u>
<u>2.0</u> <u>LIMITATIONS</u>	<u>1</u>
<u>3.0</u> <u>INTRODUCTION</u>	<u>2</u>
<u>4.0</u> <u>SCOPE 2</u>	
<u>5.0</u> <u>SITE DESCRIPTION</u>	<u>3</u>
<u>6.0</u> <u>CHEMICAL ASSESSMENT CRITERIA</u>	<u>4</u>
6.1 HUMAN HEALTH	5
<u>7.0</u> <u>FINDINGS AND RECOMMENDATIONS FROM</u> <u>PREVIOUS REPORTS</u>	<u>7</u>
7.1.1 SUMMARY OF PREVIOUS REPORTING	7
7.1.2 SUMMARY POTENTIAL SOIL CONTAMINATION	7
7.1.3 SUMMARY OF POTENTIAL GROUND GAS HAZARDS	7
7.1.4 SUMMARY OF POTENTIAL VAPOUR HAZARDS	8
<u>8.0</u> <u>PROPOSED SITE WORKS</u>	<u>8</u>
<u>9.0</u> <u>SITE WORKS AND FINDINGS</u>	<u>9</u>
9.1 FIELDWORK 16/09/24	9
9.1.1 TRIAL PIT LOCATIONS	9
9.2 GROUND CONDITIONS ENCOUNTERED	9
9.2.1 MADE GROUND	9
9.2.2 NATURAL DEPOSITS	10
9.2.3 GROUNDWATER	10
9.3 QUANTITATIVE RISK ASSESSMENT	11
9.3.1 METALS AND SEMI METALS - RESIDENTIAL WITH PLANT UPTAKE (1% SOM):	11
9.3.2 NON-METALS - RESIDENTIAL WITH PLANT UPTAKE (1% SOM):	11
9.3.3 HYDROCARBON ALI-ARO SPLIT - RESIDENTIAL PLANT UPTAKE (1% SOM):	12
9.4 ANALYSIS OF RESULTS	13
<u>10.0</u> <u>REVISED ENVIRONMENTAL RISK</u> <u>ASSESSMENT</u>	<u>16</u>
<u>11.0</u> <u>SUMMARY OF RISKS</u>	<u>17</u>
<u>12.0</u> <u>HUMAN HEALTH</u>	<u>17</u>
12.1.1 RESIDENTS / END-USERS	17
12.1.2 SITE WORKERS	17
<u>13.0</u> <u>CONTROLLED WATERS</u>	<u>17</u>
<u>14.0</u> <u>STRUCTURES</u>	<u>18</u>
14.1.1 GROUND GASES	18
14.1.2 HAZARDOUS VAPOURS	18
14.1.3 POTABLE SUPPLY PIPING	18
<u>15.0</u> <u>RECOMMENDATIONS</u>	<u>18</u>
<u>16.0</u> <u>REMEDIATION STRATEGY AND</u> <u>VERIFICATION PLAN</u>	<u>19</u>
<u>17.0</u> <u>REFERENCES</u>	<u>20</u>
17.1 LEGISLATION AND REGULATIONS	20

17.1.1	ACTS	20
17.1.2	PLANNING REGULATIONS	20
17.1.3	CONTAMINATED LAND REGULATIONS	20
17.2	STATUTORY GUIDANCE	20
17.3	BRITISH STANDARDS	21
17.4	NON-STATUTORY TECHNICAL GUIDANCE	21
17.4.1	ENVIRONMENT AGENCY	21
17.4.2	CIRIA PUBLICATIONS	21
17.4.3	CL:AIRE	21
18.0	APPENDICES	22
	APPENDIX A PHASE 1 REPORT	22
	APPENDIX B SITE PLAN INCLUDING TRIAL PIT LOCATIONS	23
	APPENDIX C TRIAL PIT LOGS	24
	APPENDIX D TRIAL PIT PHOTOGRAPHS	27
	APPENDIX E TEST RESULTS	30
	APPENDIX F WATCHING BRIEF	31

LIST OF APPENDICES

APPENDIX A	PHASE 1 REPORT	22
APPENDIX B	SITE PLAN INCLUDING TRIAL PIT LOCATIONS	23
APPENDIX C	TRIAL PIT LOGS	24
APPENDIX D	TRIAL PIT PHOTOGRAPHS	27
APPENDIX E	TEST RESULTS	30
APPENDIX F	WATCHING BRIEF	31

LIST OF TABLES

TABLE 1	SUMMARY OF SIGNIFICANT POLLUTION LINKAGES	14
TABLE 2	RISK CLASSIFICATION MATRIX	15
TABLE 3	CLASSIFICATION OF RISK	16

1.0 QUALITY ASSURANCE

Castledine Environmental can confirm that all reasonable efforts have been made to ensure that the information outlined within this report is accurate.

Castledine Environmental would further confirm that due care, attention and technical skill were used in the creation of this report.

2.0 LIMITATIONS

The conclusions and recommendations made in this report are limited to those based on the findings of the investigation. Where comments are made based on information obtained from third parties, Castledine Environmental assumes that all third-party information is true and correct. No independent action has been undertaken to validate the findings of third parties. The assessments and interpretation have been made in line with legislation and guidelines in force at the time of writing, representing best practice at the time.

This survey has not included asbestos within existing structures, invasive plant species, geotechnical considerations or any elements unconnected with potential ground contamination at the site. If required, such surveys should be undertaken by suitably accredited organisations.

There may be other conditions prevailing at the site which have not been disclosed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation.

3.0 INTRODUCTION

Castledine Environmental have been appointed by Ms. Garland to undertake a Phase 2 investigation of a site at Ratcliffe House Farm, Ratcliffe House Lane, Ratcliffe, Culey, Atherstone, Leicestershire CV9 3LZ

A Phase 1 report was carried out by Castledine Environmental:

- Phase 1 Land Contamination Risk Assessment for site at Ratcliffe House Farm, Atherstone, Leicestershire – Produced by Castledine Environmental in May of 2024 and referenced: 3730D

The previous Phase 1 report is attached as Appendix A.

4.0 SCOPE

Castledine Environmental have prepared this report for the sole use and reliance of Ms. Garland and appointees for the purpose of ensuring compliance with:

- National Planning Policy Framework (NPPF) December 2023
- Part C1 of the building regulations
- Support of Planning Application No. 23/01207/P3CQ

This report should be read in conjunction with the reports listed in section 3.0.

This report may not be used or relied upon by any unauthorised third party, or for any other proposed use than that specified above, without the explicit written agreement of Castledine Environmental.

This report is to be regarded as a Preliminary Risk Assessment in accordance with the Environment Agency's Land Contamination Risk Management (LCRM – 2021), which replaces CLR11 *“Model Procedures for the Management of Land Contamination”*, carried out in accordance with BS 10175:2011+A2:2017, *“Investigation of Potentially Contaminated Land - Code of Practice”* and relevant sections of BS5930:2015+A1:2020, *“Code of Practice for Ground Investigations”*.

The objectives of the report are:-

- To assess historical activities at the site with respect to their potential impact on the site environment;
- To characterise the environmental setting of the site, identify migration pathways and vulnerable receptors for contamination originating at the site, focusing on potential soil and groundwater liabilities;
- To assess historical and current surrounding land use in relation to known or potential off site contamination issues that may impact on the subject site; and;
- To develop a preliminary conceptual site model (CSM).

This report has been produced in order to discharge any relevant planning conditions outlined by the Local Authority and Environment Agency; however, further requirements may be imposed after the findings of this report that may need to be addressed at a later date.

5.0 SITE DESCRIPTION

The site is located in Atherstone, Leicestershire at National Grid Reference: 433677,298839 and is approximately 0.1ha in area.

The site is rectangular in shape and is orientated slightly north east to south west. The site is located within a wider, associated farmyard and is directly bounded by a wooded area to the north, a parking and turning area associated with the adjacent dwelling to the east, a concreted yard area directly south and west with 2 No. large barns located directly west and north west of site.

The site interior comprises a large, relatively modern and well-maintained Dutch-barn, with the southern face of the structure being open and very limited exterior areas. Access to site was provided via a private access route of approximately 0.37km length and leading southwards off Ratcliffe House Lane, to the north of site.

The barn was seen to be constructed of concrete flooring and walling, timber cladding and steel structuring with corrugated roofing materials (which post-

date asbestos regulations). The southern half of the roofing was seen to be occupied by solar panelling. The interior of the structure was seen to be in use for the storage of various large tractors and their associated trailers and agricultural attachments.

Some minor staining, including a small oil stain was noted atop the concrete within the barn, however, the concrete was seen to be intact and in a good condition.

The eastern face of the structure is then occupied by storage units, which are outside the site boundary, however are adjoined to the barn itself. These units were seen to be constructed of brick with concrete flooring (again, noted to be in a good condition). The units were seen to contain a quad bike and chemical / pesticide tank and sprayer attachment and associated agricultural items.

The remaining areas on site then comprise a thin strip of soft-landscaping to the rear (north) of the barn, where some made ground gravels were noted underfoot, beneath the vegetation; and the concreted yard / vehicle movement area directly south of the barn. Just offsite and directly north west of site a propane tank was noted.

The storage and usage of heavy machinery, the minor staining noted beneath the machinery and the potentially asbestos containing, corrugated roofing materials are considered potential sources of contamination noted on the site walkover. Topographically, the site is level.

Photos of the site can be found as Appendix D of the previous report for the site.

6.0 CHEMICAL ASSESSMENT CRITERIA

On establishing the presence of pollutant linkages, it is then necessary to assess whether or not any of the linkages are significant, whereby significant harm is being caused or there is significant possibility of significant harm being caused to human health or the environment. In the absence of any evidence of 'significant harm', the risks will be assessed on

the basis of a 'significant possibility of significant harm' being caused. In order to initially assess the risks, appropriate Tier 1 assessment criteria are derived which represent benchmark contamination concentrations with respect to relevant receptors. Concentrations recorded in excess of these levels **may** represent a significant risk to a specific receptor when considered as part of a pollutant linkage.

6.1 HUMAN HEALTH

The Environment Agency, through its Contaminated Land Exposure Assessment (CLEA) framework, published toxicological reports (TOX) and soil guideline values (SGVs).

SGVs are science-based generic assessment criteria that indicate human health risks from long-term exposure to soil contaminants. They are set at levels where there are 'no appreciable' or 'minimal' risks to human health. For each substance, different SGVs are applicable according to land use, for example, whether residential, allotment or commercial. They have been widely seen as over precautionary and offering councils a very weak indication of whether sites represent a "significant possibility of significant harm" (SPOSH) requiring determination under the contaminated land regime.

Following publication of the revised Part IIa Statutory Guidance DEFRA has commissioned the creation of Category 4 Screening levels (C4SLs) They are set at levels where there is a "Low" risk to Human Health (i.e. higher than that of SGVs but still sufficiently low to defiantly not be "Contaminated Land" as defined by section 78A of the Environmental Protection Act 1990 as amended). The C4SLs are calculated using the CLEA model using less conservative exposure and toxicological assumptions than the SGVs. C4SLs have also been calculated for Open Space land use. Atkins Ltd has derived ATRISKsoil Soil Screening Values SSVs using the 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for commercial/industrial, residential without home grown produce, residential with home grown produce and allotment land uses. These are

based these on the default assumptions provided in the CLEA framework. Atkins SSVs for 6% soil organic matter (SOM) have been derived in line with the new guidance using the CLEA model.

LQM in association with the CIEH have produced S4ULs are reproduced with permission; Publication Number S4UL3693

The pathways considered for the standard land uses include:

- Ingestion of soils;
- Ingestion of household dust;
- Ingestion of contaminated vegetables (residential with plant uptake only);
- Ingestion of soil attached to vegetables (residential with plant uptake only);
- Dermal contact with soils;
- Dermal contact with household dust;
- Inhalation of fugitive dusts from soils;
- Inhalation of fugitive household dust;
- Inhalation of vapours in outdoor air; and
- Inhalation of vapours in buildings.

These exposure routes have been evaluated independently of one another to identify the most sensitive exposure route. The SSV adopted for a given land use scenario is the most stringent screening value of all those relevant to the site.

The current proposals are to redevelop the site for a residential use with gardens. It is considered appropriate to compare the chemical testing results to those SGVs/SSVs with the appropriate 'residential with plant uptake' settings. Selected Tier 1 Human Health Assessment Criteria Values are detailed in the following table.

7.0 FINDINGS AND RECOMMENDATIONS FROM PREVIOUS REPORTS**7.1.1 SUMMARY OF PREVIOUS REPORTING**

The previous report for the site found that the site is currently occupied by a Dutch-barn – in use for the storage of heavy farm machinery and adjoined storage units – and limited exterior areas comprising both concrete and a thin strip of soft-landscaping, which have been present on site since at least circa.2006.

7.1.2 SUMMARY POTENTIAL SOIL CONTAMINATION

The general, arable agricultural usage of the site from at least circa.1885/86 to being developed with a farmyard and barn structures by circa.2006 are considered potential sources of contamination; however, prior arable soils were likely removed as part of the site development by circa.2006, and the relatively short length of time since development, coupled with the clean, well-maintained nature of the site act to somewhat reduce the risk. Specific potential sources of contamination include the development of the site for agricultural purposes, the potential for imported or produced made ground materials as part of the development, the usage of the site for storage of vehicles and machinery (and likely fuel, oil and/or lubricant storages) and the potential for asbestos presence atop the barn structure (whilst unlikely, due to being erected post asbestos regulations i.e. circa.2000, it is recommended that this is confirmed).

7.1.3 SUMMARY OF POTENTIAL GROUND GAS HAZARDS

The previous report for the site identified no significant potential sources of ground gas generation, with ponds in the local area remaining persistent until the present-day (allowing for vertical release of any ground gases) and an unspecified pit located approximately 354m east of site (infilled by circa.1965-1966) has been discounted as a potential hazards to site, as no credible pathways are present (no superficial geological deposits present and bedrock geology – Gunthorpe Member – is predominantly low in permeability) nor has any clear pressure gradient been identified nor topographical difference noted.

7.1.4 SUMMARY OF POTENTIAL VAPOUR HAZARDS

The previous report considered the storage of plant / farm machinery on site along with noted, very small-scale staining of hydrocarbons atop the concrete within the barn and the general agricultural usage of the site to be potential sources of hazardous vapours which should be investigated further.

8.0 PROPOSED SITE WORKS

On the basis of the information found in the previous Phase 1 Report and Section 7.0 above, the proposed site investigation for the site is as follows:

TP/BH/HP Sampling	Purpose of the Location or Sampling
Trial pits (TP)	Trial pits were formed to allow an assessment of ground conditions on site, i.e. made ground, natural, reworked natural deposits, their nature, extent and depth and for the taking of environmental for laboratory analysis.
TP01	Formed directly east of the existing barn, in an area of proposed soft-landscaping – sampled for generic contaminants (i.e. metals, metalloids, PAH's, phenol, SOM, pH) alongside TPH CWG and SVOC (prior agricultural soils)
TP02	Formed directly south of the existing barn, in an area of existing hardstanding – sampled for generic contaminants (i.e. metals, metalloids, PAH's, phenol, SOM, pH) alongside TPH CWG (barn usage and storages, subbase)
TP03	Formed directly north of the existing barn, in an area of proposed soft-landscaping – sampled for generic contaminants (i.e. metals, metalloids, PAH's, phenol, SOM, pH) alongside TPH CWG (adj. tank and made ground deposits)
Targeted Sampling	TP01 and TP05 were sampled for TPH CWG and BTEX and MTBE due to their location adjacent to former vehicle fuelling / maintenance areas.

9.0 SITE WORKS AND FINDINGS**9.1 FIELDWORK 16/09/24**

Castledine Environmental attended site on the 16th of September 2024 with the intention of forming trial pit locations across the site. The purpose of the trial pit formation was to facilitate the assessment of ground conditions on site (i.e. made ground, natural or reworked natural deposits, their nature, extent and depth) alongside the taking of environmental samples for laboratory analysis.

9.1.1 TRIAL PIT LOCATIONS

A total of 3 No. trial pit locations were formed, to final depths of 0.80m, 1.00m and 0.90m, respectively. The purposes of the locations were to assess the ground conditions in areas of proposed soft-landscaping (TP01 and TP03) and the potential for hydrocarbon presence that may impact the site development proposals (TP02).

The locations of all exploratory holes formed during the investigation were laid out by Castledine Environmental and a location plan of the exploratory hole locations can be found as Appendix B.

9.2 GROUND CONDITIONS ENCOUNTERED

The ground conditions on site can be broadly summarised as made ground overlying natural deposits at TP01 and TP02 and made ground to a depth of 0.90m (water-pipe service strike) at TP03.

All soil descriptions, logging and sampling were carried out in accordance with BS:5930:2015+A1:2020.

9.2.1 MADE GROUND

Made ground was encountered at all 3 No. locations and extended from surface level to depths of 0.35m at TP01 and 0.50m at both TP02 and TP03, respectively. The made ground encountered at TP01 comprised 0.15m depth of rolled pea gravels (forming a hardstanding parking area) atop a black, slightly clayey Gravel Made Ground with gravels (and

occasional cobble sized inclusions) of tarmac / road planings, sandstone and mudstone with rare brick and concrete, which extended to 0.35m depth. At TP02, made ground comprised a similar, black Gravelly Made Ground with further road planings, tarmac, building stone and concrete (some cobble sized) noted alongside further mudstone, rounded, mixed natural lithologies and rare ceramic, metal and plastic. At TP03, where the greatest depth of made ground was encountered again comprised a similar deposit to a depth of 0.50m, with additional full and half brick and brick fragments noted here with further rare ceramic and metal noted. At the base of this made ground stratum a fabric membrane was noted at 0.50m depth, separating the below, brown, clayey Sand Made Ground from the above black road planings. This sand stratum was considered to be made ground backfill due to encountering a water pipe at 0.80m depth, with sandy made ground confirmed to 0.90m depth (pit cancelled at this depth due to close-confines of the area and with service running centrally through the area).

9.2.2 NATURAL DEPOSITS

Natural deposits were encountered at both TP01 and TP02 below made ground deposits and were confirmed to final depths of 1.00m and 0.90m, respectively. The deposits comprised a dark grey, sandy, firm Clay and tally well with the known bedrock formation in the local area (Gunthorpe Member – mudstone – no superficial deposits mapped on or nearby to site).

9.2.3 GROUNDWATER

Groundwater was not encountered during the site investigation.

9.3 QUANTITATIVE RISK ASSESSMENT

Sample results have been compared directly against a generic screening criterion (GAC) for a residential with plant uptake scenario. In order to adopt a conservative approach, a Soil Organic Matter (SOM) of 1% has been used in the below assessment.

9.3.1 METALS AND SEMI METALS - RESIDENTIAL WITH PLANT UPTAKE (1% SOM):

Determinant	Units	Accreditation	S4UL (mg/kg)	Highest Value(s) (mg/kg)	Location of Highest value	Exceedance? Y/N
Arsenic	(mg/kg)	MCERTS	37	7.9	TP02 0.20m	N
Cadmium	(mg/kg)	MCERTS	11	<1.6	All	N
Chromium (total)	(mg/kg)	UKAS	910	70.2	TP02 0.20m	N
Chromium (VI)	(mg/kg)	U	6	<0.04	All	N
Copper	(mg/kg)	MCERTS	2400	45.9	TP02 0.20m	N
Lead	(mg/kg)	MCERTS	200	22.5	TP01 0.30m	N
Mercury	(mg/kg)	UKAS	1.2	<0.7	All	N
Nickel	(mg/kg)	MCERTS	180	43.8	TPp03 0.60m	N
Zinc	(mg/kg)	MCERTS	3700	93.5	TP02 0.20m	N
Selenium	(mg/kg)	MCERTS	250	<3	All	N
Total Phenols	(mg/kg)	MCERTS	280	<0.5	All	N
pH	pH units	MCERTS	-	7.1-7.8	TP03-TP02	-
Asbestos	-	-	-	NAD	All Tested	N

9.3.2 NON-METALS - RESIDENTIAL WITH PLANT UPTAKE (1% SOM):

Determinant	Units	Accreditation	S4UL (mg/kg)	Highest Value(s) (mg/kg)	Location of Highest value	Exceedance? Y/N
Naphthalene	(mg/kg)	MCERTS	2.3	0.15	TP02 0.20m	N
Acenaphthylene	(mg/kg)	UKAS	170	0.27	TP02 0.20m	N
Acenaphthene	(mg/kg)	UKAS	210	1.26	TP02 0.20m	N
Fluorene	(mg/kg)	MCERTS	170	0.80	TP02 0.20m	N
Phenanthrene	(mg/kg)	MCERTS	95	5.42	TP02 0.20m	N
Anthracene	(mg/kg)	MCERTS	2400	2.10	TP02 0.20m	N
Fluoranthene	(mg/kg)	MCERTS	280	15.42	TP02 0.20m	N

Pyrene	(mg/kg)	MCERTS	620	14.49	TP02 0.20m	N
Benzo(a)anthracene	(mg/kg)	MCERTS	7.2	6.05	TP02 0.20m	N
Chrysene	(mg/kg)	MCERTS	15	6.12	TP02 0.20m	N
Benzo(b)fluoranthene	(mg/kg)	MCERTS	2.6	7.25, 11.19	TP01 0.30m & TP02 0.20m	Y
Benzo(k)fluoranthene	(mg/kg)	MCERTS	77	3.54	TP02 0.20m	N
Benzo(a)pyrene	(mg/kg)	MCERTS	2.2	7.83, 10.47	TP01 0.30m & TP02 0.20m	Y
Indeno(1, 2, 3,- cd)pyrene	(mg/kg)	MCERTS	27	10.26	TP02 0.20m	N
Dibenzo(a,h)anthracene	(mg/kg)	MCERTS	0.24	1.42, 1.72	TP01 0.30m & TP02 0.20m	Y
Benzo(g, h, i)perylene	(mg/kg)	MCERTS	320	9.62	TP02 0.20m	N
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	NC	98.9	TP02 0.20m	-

9.3.3 HYDROCARBON ALI-ARO SPLIT - RESIDENTIAL PLANT UPTAKE (1% SOM):

Determinant	S4UL (mg/kg)	Highest Value (mg/kg)	Location of Highest value	Exceedance? Y/N
Aliphatic				
EC 5-6	42	<0.1	All	N
EC >6-8	100	<0.1	All	N
EC >8-10	27	<0.1	All	N
EC >10-12	130	<10	All	N
EC >12-16	1100	6	TP01 0.30m	N
EC >16-35	65000	155	TP03 0.20m	N
EC >35-44	65000	57	TP03 0.20m	N
Aromatic				
EC 5-7 (Benzene)	70	<0.01	All	N
EC >7-8 (Toluene)	130	<0.01	All	N
EC >8-10	34	<0.01	All	N
EC >10-12	74	29	TP01 0.30m	N
EC >12-16	140	68	TP01 0.30m	N
EC >16-21	260	93	TP02 0.20m	N
EC >21-35	1100	1282	TP02 0.20m	Y
EC >35-44	1100	855	TP03 0.20m	N

9.4 ANALYSIS OF RESULTS

Laboratory analysis has identified exceedances of:

- Benzo(b)fluoranthene GAC of 2.6mg/kg by readings of 7.25mg/kg and 11.19mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Benzo(a)pyrene GAC of 2.2mg/kg by readings of 7.83mg/kg and 10.47mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Dibenzo(a,h,)anthracene GAC of 0.24mg/kg by readings of 1.42mg/kg and 1.72mg/kg at the locations of TP01 at 0.30m depth and TP02 at 0.20m depth, respectively;
- Aromatic C21-C35 (1282mg/kg) exceeds the TAC of 1100mg/kg.

No further exceedances of metals, metalloids, PAH's nor TPH CWG have been identified and no elevated phenol nor asbestos has been detected with all SVOC testing below laboratory detection limits (LOD).

TABLE 1 SUMMARY OF SIGNIFICANT POLLUTION LINKAGES

Contaminant	Pathway	Receptor	Probability of Pollutant Linkage	Conseq.	Risk	Possible Mitigation
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Direct Ingestion & Direct Contact	Site Workers (<i>during site works, excavations, eating and drinking</i>)	Lw	Md	M/L	Site workers to wear appropriate PPE for health and safety reasons, suitable usage and adherence to relevant HSE guidance during site works (and provision of an asbestos survey, if required) considered sufficient to mitigate hazards to LOW.
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Inhalation of Dust, Dry Arisings	Site Workers (<i>during site works, excavations, eating and drinking</i>)	Lw	Md	M/L	
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Crop Uptake & Direct Ingestion, Direct Contact	End Users (<i>residents / tenants, children, visitors, service personnel</i>)	Lw	Md	M/L	Environmental sampling carried out on site has identified relatively high exceedances of PAH's alongside a single exceedance of TPH CWG / Aromatic C21-C35 at TP01 and TP02 within hydrocarbon impacted made ground. As such, it is recommended that all areas of proposed soft-landscaping are remediated by way of excavation and replacement and that a hydrocarbon resistant membrane is installed within the proposed development, inline with BS8485:2015:A1-2019. It is recommended that a Phase 3 Remediation Strategy and Verification Report is produced for the site, to outline the remediation actions required. Additionally, relatively significant risks remain to any new potable piping that may be laid on site, as such, contact should be made with the local water supplier regarding barrier piping specification.
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Inhalation of Dust, Dry Arisings	End Users (<i>residents / tenants, children, visitors, service personnel</i>)	Lw	Md	M/L	
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Crop Uptake & Direct Ingestion, Direct Contact	Flora and Fauna (<i>on and offsite</i>)	UI	Md	L	
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Vertical and lateral migration (<i>no superficial, bedrock geology predominantly low in permeability</i>)	Controlled Waters (<i>Secondary Undifferentiated and B Aquifers, watercourse 75m SE</i>)	UI	Md	L	
Contaminated Soils (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Direct contact (<i>pipe degradation and leaching</i>)	Services (<i>impacted new potable supply piping</i>)	Lw	Md	M/L	
Ground Gases (Methane and CO ₂) (<i>infilled ponds remain persistent and unspecified pit discounted as potential source</i>)	Vertical and lateral migration (<i>no superficial, bedrock geology predominantly low in permeability</i>)	Site Workers & Excavations, End Users & Building Envelope (<i>ingress and build-up</i>)	UI	Md	L	Limited, potential sources of hazardous ground gas generation discounted as significant hazards – see Section 8.1.2.
Volatile and Semi-volatile Organic Compounds (<i>exceedances of PAH's & Aromatic C21-C35 at TP01 and TP02 – hydrocarbon impacted made ground</i>)	Vertical and lateral migration (<i>no superficial, bedrock geology predominantly low in permeability</i>)	Site Workers & Excavations, End Users & Building Envelope (<i>ingress and build-up</i>)	Lw	Md	M/L	The presence of hydrocarbons has been identified within the subbase (where accessible) and within made ground deposits on site, and as such, it is considered prudent to install a ground gas vapour membrane within the development, inline with BS8485:2015:A1-2019.
Radon	Vertical and lateral migration	End Users & Building Envelope	UI	Md	L	Site is not located in a Radon Affected Area.

KEY: Probability of pollutant linkage Hi = Highly likely, Li = Likely, Lw = Low Likelihood, UI = Unlikely
Consequence Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor,
Overall Risk VH = Very High, H = High, M = Moderate, M/L = Moderate/Low, L = Low, VL = Very Low

Based on the preliminary CSM for the site, an environmental risk assessment has been undertaken. A simple matrix can provide a consistent basis for decision making. It should be used with caution, recognising the over-simplification that it will normally represent. The probability and consequences are defined according to parameters relevant to the situation; the boundaries of risk acceptability (and tolerability, where relevant) indicated on the matrix provided in Table 2, can be tailored to the factors influencing the significance of the risk. Individual situations are mapped onto the matrix to provide a ready and consistent indication of their acceptability or tolerability.

TABLE 2 RISK CLASSIFICATION MATRIX

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High (Hi)	Very high risk	High risk	Moderate Risk	Moderate/ Low Risk
	Likely (Li)	High risk	Moderate Risk	Moderate/ Low Risk	Low Risk
	Low Likelihood (Lw)	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely (UI)	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

Source: CIRIA Report C552, Contaminated Land Risk Assessment. A Guide to Good Practice, 2001

These attributes are evaluated qualitatively against individual hazard assessments to determine the likelihood of a given hazard occurring. The risk evaluations for each plausible pollutant linkage are given in the last three columns of Table 1.

TABLE 3 CLASSIFICATION OF RISK

Very high risk (Vh)	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk (Hi)	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer term.
Moderate risk (Md)	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk (Lw)	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk (VI)	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Source: CIRIA Report C552, Contaminated Land Risk Assessment. A Guide to Good Practice, 2001

10.0 REVISED ENVIRONMENTAL RISK ASSESSMENT

Based on the information contained in this report, it is the opinion of Castledine Environmental that the site represents a **MODERATE** level of risk with respect to the proposed development.

It is recommended that remediation in-line with section 16.0 is planned and carried out on site.

This report should be submitted to your Local Planning Authority for agreement to allow the Phase 3 Remediation Strategy and Verification Plan to be written.

11.0 SUMMARY OF RISKS**12.0 HUMAN HEALTH****12.1.1 RESIDENTS / END-USERS**

The risks to end-users of the site are considered to remain at a low to moderate when assessed against the sensitive, residential end-usage of the site. The site is proposed to be almost entirely encapsulated beneath building footprint and hardstanding; however, areas of soft-landscaping are proposed and as such, these areas will required remediation, as should onsite soils be used to form said soft-landscaping, there exists credible pathways for contamination to impact end-users (inhalation of dusts, direct contact, direct and indirect ingestion, surface water run-off). Furthermore, limited vapour hazards to end-users via the building envelope are considered present, as elevated hydrocarbon presence has been identified in both made ground deposits and the subbase on site. Furthermore, there remains the potential for hydrocarbon impact from hydrocarbon impacted made ground deposits to new potable water supply piping.

12.1.2 SITE WORKERS

The risks to site workers during site works are considered to be low to moderate, due to the extent and depth of hydrocarbon impacted made ground on site. The provision for the considered usage of PPE and adherence to relevant HSE guidance would be sufficient to mitigate the risks to low.

13.0 CONTROLLED WATERS

The risks to controlled waters are considered to be low, due to the lack of superficial geological deposits in the local area, the largely impermeable bedrock geology in the area inhibiting significant offsite and vertical migration, the lack of productive aquifer beneath site, the lack of abstraction sites within 1000m of site and likely lack of significant contamination on site capable of impacting controlled waters.

14.0 STRUCTURES**14.1.1 GROUND GASES**

No significant potential sources of ground gas generation have been identified, with ponds in the local area remaining persistent until the present-day (allowing for vertical release of any ground gases) and an unspecified pit, being infilled by circa.1965/66 and located approximately 354m east of site being discounted as a potential hazard as no credible pathways are present (no superficial geological deposits and bedrock geology – Gunthorpe Member - is predominantly low in permeability) nor has any clear pressure gradient been identified nor topographical difference noted.

14.1.2 HAZARDOUS VAPOURS

Environmental sampling has identified hydrocarbon impacted made ground deposits and a subbase on site, which may also remain impacted beneath the main footprint of the structure on site. As such, the risk from hazardous vapours is considered to remain and it is recommended that a hydrocarbon resistant membrane is installed within the proposed development, inline with BS8485:2015:A1-2019.

14.1.3 POTABLE SUPPLY PIPING

Due to the identified hydrocarbon impacted made ground and subbase on site (PAH's and TPH CWG), it is recommended that the local water supplier be contacted regarding barrier piping specification – once service proposals are known.

15.0 RECOMMENDATIONS

At this stage, it is considered that allowance be made for the following:

- A suitable capping system in all soft areas of landscaping and private gardens (i.e. minimum 600mm pre-certified clean material imported to site to form soft-landscaping with prior deposits excavated and removed offsite);
- Upgraded water pipes / liaison with local water supplier;

- A vapour resistant membrane is installed within the proposed development, to guard against potential vapour ingress into the final-build.

A watching brief (as outlined in Appendix F) should be carried out by the site supervisor during the course of demolition, site clearance and construction works for any obvious contamination (e.g. oil spillage in ground, buried waste, possible asbestos containing material). Should previously unreported or undiscovered contamination be identified, then development should stop and Castledine Environmental should be contacted to determine if further assessment or changes to the remediation scheme are required.

16.0 REMEDIATION STRATEGY AND VERIFICATION PLAN

When this report has been agreed with your Local Planning Authority, a Phase 3 Remediation Strategy and Verification Plan would need to be produced.

17.0 REFERENCES**17.1 LEGISLATION AND REGULATIONS****17.1.1 ACTS**

- [1]. Environmental Protection Act 1990, Part IIA: inserted by Environment Act 1995, Section 57. See Environment Act 1995 for text of Part IIA.

17.1.2 PLANNING REGULATIONS

- [2]. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 SI1999/No.293
- [3]. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2000 SI2000/No.2867
- [4]. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) (Amendment) Regulations 2017 SI2017/No.571

17.1.3 CONTAMINATED LAND REGULATIONS

- [5]. The Contaminated Land (England) Regulations 2000. SI2000/No.227
- [6]. The Contaminated Land (England) (Amendment) Regulations 2001 SI2001/No.663
- [7]. The Contaminated Land (England) Regulations 2006 SI2006/No.1380

17.2 STATUTORY GUIDANCE

- [8]. Department of Environment, Food and Rural Affairs. 2012. *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*. Department of Environment, Food and Rural Affairs
- [9]. Communities and local Government, 2023: National Planning Policy Framework.

17.3 BRITISH STANDARDS

- [10]. BS 5930:2015+A1:2020 Code of practice for site investigations
- [11]. BS 10175:2011+A2:2017 Investigation of potentially contaminated sites - Code of practice
- [12]. BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings
- [13]. BS 8576:2013 Guidance on investigations for ground gas. Permanent gases and Volatile Organic Compounds (VOCs)
- [14]. BS 10176 Taking Soil Samples for Determination of Volatile Organic Compounds (VOCs)

17.4 NON-STATUTORY TECHNICAL GUIDANCE**17.4.1 ENVIRONMENT AGENCY**

- [15]. Land Contamination Risk Management (LCRM) 2020, updated 2023

17.4.2 CIRIA PUBLICATIONS

- [16]. Wilson, S., Oliver, S., Mallett, H., Hutchings, H., and Card, G.. 2007, *C 665 Assessing risks posed by hazardous ground gases to buildings* London: Construction Industry Research and Information Association
- [17]. Mallett, H., Cox, L., Wilson, S. and Corban, M... 2014, *C 735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* London: Construction Industry Research and Information Association

17.4.3 CL:AIRE

- [18]. Card G, Wilson S, Mortimer S. 2012. *A Pragmatic Approach to Ground Gas Risk Assessment. CL:AIRE Research Bulletin RB17.* CL:AIRE, London, UK. ISSN 2047- 6450 (Online)

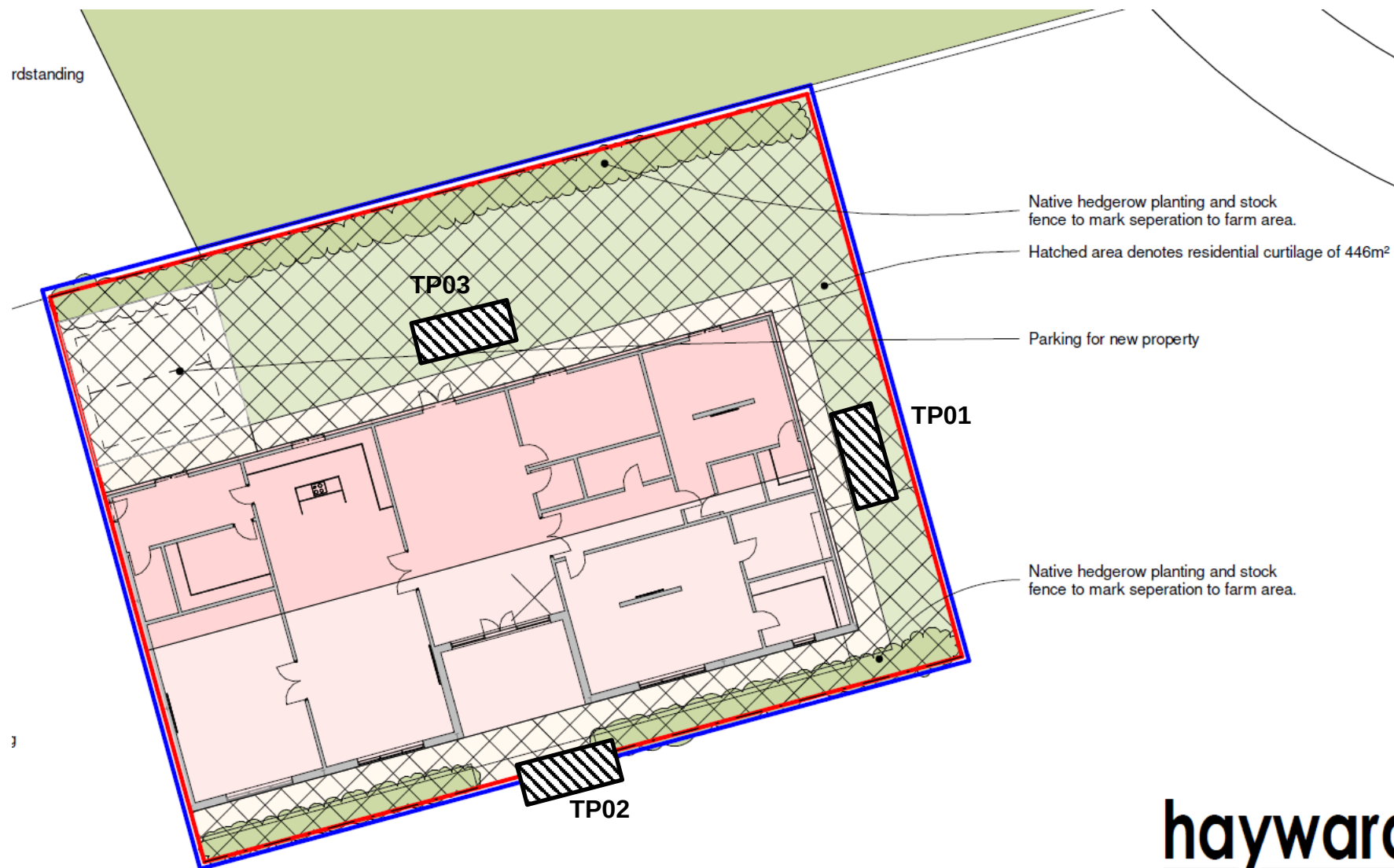
18.0 APPENDICES

APPENDIX A PHASE 1 REPORT

- Found as separate PDF(s)

APPENDIX B

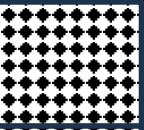
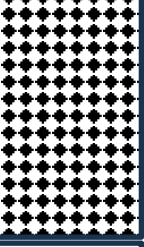
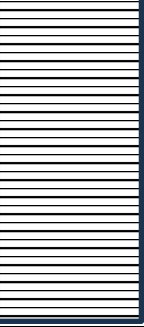
SITE PLAN INCLUDING TRIAL PIT LOCATIONS



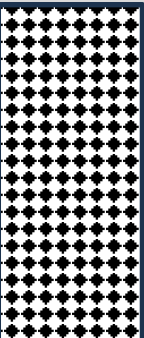
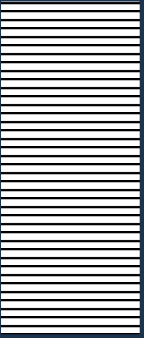
APPENDIX C

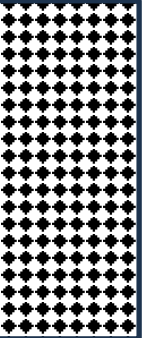
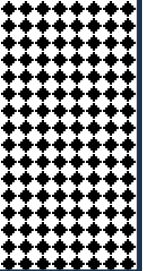
TRIAL PIT LOGS

Project.	Ratcliffe House Farm, Culey, Atherstone		Trial Pit	
			TP01	
Client.	Ms. Garland		Date	
			16/09/24	
Method.			Project Reference.	
Machine-excavated			3799D	

Groundwater	Depth (m)	Description of Strata	Legend	Samples		
				Type	Depth (m)	
					From	To
No GW encountered	0.15	Brown very gravelly MADE GROUND with gravel sized fragments of rounded, fine to medium of pea gravels				
	0.35	Black very gravelly, slightly clayey, sandy MADE GROUND with gravel sized fragments of angular to subrounded, fine to coarse and occasionally cobbly of tarmac, road planing, sandstone, mudstone, rare brick and concrete.		ES01	0.30	0.35
	0.80	Dark grey sandy CLAY .		ES02	0.40	0.45

Remarks	Key			 Castledine Environmental LAND CONTAMINATION SURVEYS
	Logged By	Scale	Sheet	
	DW	Not to Scale	1 of 1	

Project.	Ratcliffe House Farm, Culey, Atherstone		Trial Pit				
			TP02				
Client.	Ms. Garland		Date				
			16/09/24				
Method.			Project Reference.				
Machine-excavated			3799D				
Groundwater	Depth (m)	Description of Strata	Legend	Samples			
				Type	Depth (m)		
					From	To	
No GW encountered	0.50	Dark brown to black very gravelly, sandy, slightly clayey MADE GROUND with gravel and cobble sized fragments of road planings, tarmac, building stone, brick, concrete, mudstone, rounded mixed natural lithologies and rare ceramic, metal and plastic.		ES01	0.20	0.25	
	1.00	Dark grey sandy CLAY .		ES02	0.60	0.65	
Remarks		Key		 Castledine Environmental LAND CONTAMINATION SURVEYS			
		Logged By	Scale				Sheet
		DW	Not to Scale				1 of 1

Project.	Ratcliffe House Farm, Culey, Atherstone		Trial Pit				
			TP03				
Client.	Ms. Garland		Date				
			16/09/24				
Method.			Project Reference.				
Machine-excavated			3799D				
Groundwater	Depth (m)	Description of Strata	Legend	Samples			
				Type	Depth (m)		
					From	To	
No GW encountered	0.50	Black very gravelly, sandy MADE GROUND with gravel and cobble sized fragments of road planings, tarmac, full, half brick, brick fragments, rare ceramic and metal with fabric membrane at base.		ES01	0.20	0.25	
	0.90	Brown clayey, very sandy MADE GROUND BACKFILL (service strike at 0.80m depth)		ES02	0.60	0.65	
Remarks		Key		 Castledine Environmental LAND CONTAMINATION SURVEYS			
Service strike at 0.80m (water), undamaged		Logged By	Scale				Sheet
		DW	Not to Scale				1 of 1

APPENDIX D

TRIAL PIT PHOTOGRAPHS



Trial Pit Photographs

Photo No.1: TP01 located outside the eastern face of the barn proposed to be converted to a residential usage



Address: Ratcliffe House Farm Ratcliffe, Culey, Atherstone
Client: Ms. V. Garland

Photo No.2: TP01 pit sides and base (excavated adjacent to existing concrete base) showing made ground atop clays





Trial Pit Photographs

Photo No.3: TP02 located on the southern face of the barn proposed to be converted to a residential usage



Address: Ratcliffe House Farm Ratcliffe, Culey, Atherstone
Client: Ms. V. Garland

Photo No.4: TP02 pit sides and base (excavated adjacent to existing concrete base) showing made ground atop clays





Trial Pit Photographs

Photo No.5: TP03 located outside the northern face of the barn proposed to be converted to a residential usage



Address: Ratcliffe House Farm Ratcliffe, Culey, Atherstone
Client: Ms. V. Garland

Photo No.6: TP03 pit sides and base showing made ground atop made ground sand infill (service strike at 0.80m – water)



APPENDIX E

TEST RESULTS

- Found as separate PDF(s)

APPENDIX F**WATCHING BRIEF**

It remains possible that previously unexpected soil conditions may be encountered during the construction process. Examples may include oily pockets within the soil, potential for asbestos containing materials, black ashy materials, soils exhibiting strong odours, brightly coloured materials, and former demolition materials.

Should previously undiscovered contamination be encountered during the demolition/construction of the new buildings the following course of action should be adhered to:

1. The ground workers should report any suspected contamination immediately to the Client's site supervisor. The supervisor should contact the Client or their appointed agent who will in turn contact Castledine Environmental to request an engineer to visit the site to assess the extent of the 'contamination'.
2. Castledine Environmental shall make records of their inspection, and pass details of these to the Local Authority.
3. Where the conditions revealed differ from those previously anticipated, the Castledine Environmental shall take samples as deemed appropriate to be dispatched for appropriate chemical testing.
4. Depending on the results of the testing either:
 - a. no further work will be required;
 - b. a further detailed risk assessment will be required; and/or
 - c. Localised specific remedial measures will be necessary.Appraisal criteria will vary depending on the nature of the assessment.
5. The results of any such testing will be sent to the Local Authority Pollution Control Section, Local Authority development control section, and the appointed building inspector. If remediation is required, the LA/Building inspector will be informed of the date and time of the proposed works.

6. Remediation will be undertaken in accordance with a method statement submitted for approval. The works shall be supervised where necessary by Castledine Environmental who shall provide a Verification Report for the Local Authorities.
7. A copy of the discovery strategy should be lodged on site and provisions made to ensure that all workers are made aware of their responsibility to observe, report and act on any potentially suspicious or contaminated materials they may encounter.

