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James and Clare Duckett

Phase II Factual and Interpretative Geo-environmental and Geotechnical Investigation Report

DUNSDEN FARM,
DITCHFORD ROAD,
TODENHAM,
MORETON-IN-MARSH
GL56 9NX

Report No: 21-03-03

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EXECUTIVE SUMMARY

Site Location	Dunsden Farm, Ditchford Road, Todenham, Moreton-in-Marsh
OS Grid Reference	SP 23760 35993
Development Proposals	It is proposed that the Dutch barn on the site will be removed and replaced with a residential dwelling in its footprint, with the addition of soft landscaping.
Published Geology	Paxford Gravel overlying Charmouth Mudstone Formation
Topography	The site is generally flat lying, with a slope beyond the eastern boundary from west to east.
Site History	The site is within woodlands and open fields from at least 1884. At this time, a sand pit is located in the north west corner and is removed by 1902/1903. The first barn is built on site by 1950-1955, and further development of buildings on site continues during the 1970s.
Ground Conditions Encountered	Made Ground was encountered in all locations, except HA C, and was encountered in several forms from a minimum depth of ground level to a maximum depth of 1.60m bgl. Paxford Gravel was encountered in the majority of the exploratory holes from a minimum depth of 0.40m bgl to a maximum depth of 4.00m bgl and generally consisted of a soft to stiff, sandy gravelly clay with gravels of quartz, or loose to medium dense, orange brown to dark brown, gravelly, fine to coarse sand with gravels of quartz. Charmouth Mudstone Formation was encountered in three of the four CT boreholes from a minimum depth of 3.25m bgl to a maximum depth of 4.00m bgl where the boreholes were terminated. This was generally encountered as a stiff orange brown/brown/dark grey/blueish grey silty clay.
Groundwater Encountered	Groundwater was encountered in all CT boreholes at depths ranging from 2.0m bgl to 2.6m bgl.
Gas Protection	No gas protection measures needed and no radon protection required.
Geotechnical Comments	• The natural soils within the proposed location of the residential dwelling are classed as granular from PSD testing, and are therefore non-shrinkable. • A Design Sulphate Class of DS-1 and a site Aggressive Chemical Environment Classification (ACEC) Class of AC-1 can be used. • An allowable bearing pressure of 170kPa can be assumed for the natural soils for conventional shallow foundations not exceeding 1.0m in width. • Stepped foundations will be needed due to the varying depths of Made Ground.
Chemical Analysis	Four soil samples were taken from the soils and screened as part of this investigation against the relevant GAC for a 'Residential with the consumption of home-grown produce' land use scenario and only arsenic slightly exceeded the levels at HA D. Asbestos in the form of chrysotile was identified at HA B.
Recommendations	We recommend that a cover layer or hardstanding will be required in the areas of HA B and HA D. We recommend a watching brief should be undertaken during the construction phase, and if during development any previously undiscovered contamination (including visual or olfactory evidence) is found then site management should be immediately informed and inspection by a suitably qualified person should be undertaken.

This executive summary must be read in conjunction with this report.

PHASE II FACTUAL AND INTERPRETATIVE GEO-ENVIRONMENTAL AND GEOTECHNICAL INVESTIGATION REPORT

1 FACTUAL

1.1 INTRODUCTION

Geo-Integrity Ltd were commissioned by Taw Fitzwilliam, on behalf of the Clients (James and Clare Duckett), via email on the 3rd of March 2021 to undertake a site investigation at Dunsden Farm, Ditchford Road, Todenham, Moreton-in-Marsh, GL56 9NX. This Phase II intrusive investigation has been completed to gather geo-environmental and geotechnical data.

This report describes previous investigations, geological information, the fieldwork and laboratory testing undertaken and provides an interpretative section of the geo-environmental and geotechnical data from this investigation to inform the proposed development. This report should be read in conjunction with the previous Phase I Desk Study undertaken by Geo-Integrity with the reference 21-01-05, dated February 2021.

The site is located at OS Reference SP 23760 35993.

This report will be reviewed by the Local Planning Authority and once the development is completed, and as a minimum, the land must not be capable of being determined as 'contaminated land' under the terms of Part IIA of the Environmental Protection Act 1990. However, it also states that "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner." As such the previous desk study undertaken by Geo-Integrity ref. 21-01-05 constitutes the first stage in investigating whether the site is likely to be considered "contaminated", in accordance with clause 179 and should be read in conjunction with this Phase II interpretive report.

The objectives of this Phase II interpretative report are:-

- Briefly summarise the site development proposals and site setting.
- To describe and report the fieldwork undertaken at the site.
- To describe and report the chemical and geotechnical laboratory work undertaken on selected samples.
- To provide an interpretation of the results of this investigation with regards to the geo-environmental and geotechnical implications for the site.

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The investigation was performed in accordance with the general requirements of BS 5930:2015, BS EN ISO 22475-1 (2006) and other relevant related standards. The fieldwork took place on the 19th of March 2021.

1.2 SOURCES OF INFORMATION

The following sources of information have been used to compile this report:-

- Phase I Desk Study Report (ref. 21-01-05), undertaken by Geo-Integrity, dated February 2021
- The British Geological Survey (BGS) and Environment Agency (EA) websites.
- A site reconnaissance visit undertaken on 20th January 2021.
- Information from various internet sites on site history and environmental setting.

1.3 DEVELOPMENT PROPOSALS

It is proposed to remove the existing Dutch barn on the site and replace it with a residential dwelling in its footprint. There will be some addition of soft landscaping.

2 PHASE II INTRUSIVE INVESTIGATION

2.1 SITE WORK AND SAMPLING STRATEGY

The fieldwork was undertaken in accordance with BS 5930:2015, BS EN 1997-2 (2007) and BS EN ISO 22475-1 (2006), with the exploratory locations being selected by Geo-Integrity following information from the development plans and the findings from the previous Phase I desk study (Ref. 21-01-05). The table below explains the strategy behind the placement of the exploratory holes. The exploratory hole locations can be seen in the Appendices.

The fieldwork was undertaken on the 19th of March 2021 and consisted of four continuous tube boreholes targeting the proposed development area, and five hand-dug holes targeting the proposed garden areas. One standpipe was installed down to 4.0m bgl in CT 1.

Disturbed samples were taken at selected depths down to the base of the continuous tube exploratory holes and hand-dug holes for subsequent laboratory testing and inspection.

Exploratory Hole	Location Reasoning
CT 1	Within footprint of proposed development to establish ground conditions, identify any deeper Made Ground from sand pit identified in previous desk study, and test for any possible contamination from long human history of the site. Standpipe installed to 4.0m bgl to assess potential pollutant linkage from ground gas created from historic sand pit identified during the previous desk study.
CT 2	Within footprint of proposed development to establish ground conditions and test for any possible contamination from long human history of the site.
CT 3	Within footprint of proposed development to establish ground conditions and test for any possible contamination from long human history of the site.
CT 4	Within footprint of proposed development to establish ground conditions and test for any possible contamination from long human history of the site.
HA A	Within footprint of proposed gardens to test for any possible contamination from long human history of the site.
HA B	Within footprint of proposed gardens to test for any possible contamination from long human history of the site.
HA C	Within footprint of proposed gardens to test for any possible contamination from long human history of the site.
HA D	Within footprint of proposed gardens to test for any possible contamination from long human history of the site.
HA E	Within footprint of proposed gardens to test for any possible contamination from long human history of the site.

2.2 GROUND CONDITIONS

2.2.1 Summary

The site and laboratory test work revealed that the general succession of strata can be represented by Topsoil/Made Ground, overlying Paxford Gravel and Charmouth Mudstone Formation. Descriptions of the strata encountered are given on the exploratory hole records, and are summarised below. Further information is provided on the exploratory hole logs within the appendices.

2.2.2 Topsoil/Made Ground

Made Ground was encountered in several forms in all of the exploratory holes, except HA C, and were recorded as follows.

In CT 3 and CT 4, a layer of concrete from GL to 0.15m bgl was encountered.

Dense light brown, sandy, fine to coarse angular gravel and cobbles of limestone was encountered in CT 1, CT 3 and CT 4 from a minimum depth of GL to a maximum depth of 0.40m bgl.

Loose dark brown, slightly sandy, slightly gravelly slightly clayey topsoil with fine to coarse gravel of limestone was encountered in CT 1 from 0.20m bgl to 0.40m bgl.

Loose dark brown, sandy, gravelly topsoil with frequent brick cobbles, and fine to coarse, angular to sub-rounded gravels of brick was encountered in CT 2 from GL to 0.50m bgl.

Loose dark brown sandy gravelly topsoil with frequent brick cobbles, and fine to coarse angular gravels of limestone was encountered in CT 3 at 0.15m bgl to 0.40m bgl. Beneath this at 0.40m bgl to 1.60m bgl was a layer of firm dark brown, very sandy gravelly clay, with fine to angular gravels of quartz with occasional brick and ash.

Loose dark brown slightly clayey very gravelly fine to medium sand, with fine to coarse angular to sub rounded gravel of quartz and limestone was encountered in CT 4 from 0.40m bgl to 1.10m bgl.

In HA A, soft dark brown slightly sandy slightly clayey gravelly topsoil with fine to coarse gravels of brick and occasional brick cobbles was encountered from GL to 0.60m bgl.

In HA B, soft dark brown slightly sandy slightly clayey slightly gravelly topsoil with fine to coarse gravels of quartz and occasional tile fragments was encountered from GL to 0.70m bgl.

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Two forms of Made Ground were encountered in HA D. From GL to 0.30m bgl, soft dark brown slightly gravelly clayey topsoil with fine to coarse quartz and limestone gravels was encountered. Beneath this to a depth of 0.80m bgl was soft dark brown very gravelly clay with fine to coarse gravels of brick with frequent cobbles of brick and slate.

In HA E, soft dark brown slightly sandy slightly gravelly slightly clayey topsoil with fine to medium gravels of quartz, limestone and brick was encountered from ground level to a depth of 1.0m bgl.

HA C was the only exploratory hole where Made Ground was not encountered. A layer of soft dark brown slightly sandy slightly clayey gravelly topsoil with fine to coarse gravels of quartz and limestone was encountered from GL to 0.90m bgl.

2.2.3 Paxford Gravel

Encountered in the majority of exploratory holes from beneath the topsoil/Made Ground and was encountered in several forms in the exploratory holes.

In CT 1, stiff orangish brown and occasional dark brown sandy clay was encountered from 0.40m bgl to 0.70m bgl.

Loose orangish brown and dark brown gravelly fine sand with roots, with gravels of fine to coarse rounded quartz was encountered in CT 2 from 0.50m bgl to 1.00m bgl.

Medium dense orangish brown silty slightly gravelly fine to medium sand, with gravels of fine to medium angular to sub-rounded quartz was encountered in CT 1 from 0.7m bgl to 2.60m bgl, CT 2 from 1.00m bgl to 2.80m bgl and in CT 3 from 1.60m bgl to 4.00m bgl with cobbles of quartz also.

Loose brown and dark brown silty gravelly fine to medium sand, with fine to medium angular to sub rounded gravel of quartz was encountered in CT 4 from 1.10m bgl to 1.80m bgl. This was underlain by medium dense brown and orangish brown silty gravelly fine sand, with fine to coarse angular to sub-rounded gravel of quartz from 1.80m bgl to 2.60m bgl. Beneath this was medium dense brown and dark brown silty fine to medium sand and gravel, with gravel of fine to coarse angular to rounded quartz from 2.60m bgl to 3.250m bgl.

Medium dense brown and orangish brown silty very gravelly coarse sand, with fine to coarse angular to sub-rounded gravel of quartz was encountered in CT 1 from 2.60m bgl to 3.00m bgl; the same material was encountered in CT 2 from 2.80m bgl to 3.30m bgl although the sand was fine.

SPT “N” values within the Paxford Gravel Formation ranged between 14 and 32.

PSD tests were undertaken in samples taken at varying depths in the CT boreholes between 1.10m bgl and 4.0m bgl. The results of these showed percentages of silt between 9% and 23%, percentages of sand between 38% and 77%, and gravel between 1% and 52%. Therefore these soils are granular and non-shrinkable material.

In HA A, light brown dense slightly clayey slightly gravelly fine sand, with fine to medium gravels of quartz and limestone was encountered from 0.6m bgl to 0.8m bgl.

In HA B, orange brown medium dense slightly gravelly sand, with fine to medium gravel of quartz was encountered from 0.70m bgl to 0.80m bgl.

In HA C soft light brown slightly sandy slightly gravelly clay, with fine to medium gravel of quartz and limestone was encountered from 0.90m bgl to 1.00m bgl.

In HA E soft orange brown slightly sandy slightly gravelly clay, with fine to medium gravel of quartz was encountered from 1.00m bgl to 1.10m bgl.

2.2.4 Charmouth Mudstone

Charmouth Mudstone Formation was encountered within three of the four CT boreholes and the findings are summarised below.

In CT 1 from 3.70m bgl to 4.00m bgl stiff grey, orange brown and brown silty clay was encountered.

In CT 2 from 3.30m bgl to 4.0m bgl stiff dark grey silty clay was encountered.

In CT 4 from 3.25m bgl to 4.0m bgl stiff blueish grey silty clay was encountered.

2.2.5 Groundwater

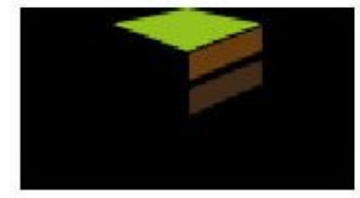
Groundwater was encountered in all four of the CT boreholes and water strike depths are as follows: CT 1 at 2.60m bgl; CT 2 at 2.30m bgl; CT 3 at 2.0m bgl; CT 4 at 2.10m bgl.

2.2.6 Evidence of Contamination

The only contamination identified within the soils during the field work was the gravels of brick, ash and occasionally tiles within the Made Ground, previously mentioned in section 2.2.2.

2.2.7 Ground Gas

Four monitoring visits were undertaken within CT 1 between 23/03/2021 to 26/04/2021 to establish the ground water depth at the site, and to establish the gas regime at the site. Methane was



recorded below detection limits in all visits; carbon dioxide was recorded between 0.8% to 2% with oxygen between 16.3% and 19.5%. Peak flow was recorded at -0.1l/h, and atmospheric pressure was recorded between 1006mb to 1015mb.

2.3 GEO-ENVIRONMENTAL TESTING

Geo-environmental laboratory testing was scheduled by Geo-Integrity on four soil samples recovered during the fieldwork. The testing was carried out at a MCERTS and UKAS accredited laboratory. The results are presented in the Appendices.

Eight soil samples were tested for a varied suite containing the following:

- Metals and Inorganic Substances
- Speciated Polyaromatic Hydrocarbons (PAH)
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX)
- Total Petroleum Hydrocarbons (TPH), with eight band split
- Asbestos Identification and Quantification

3 GEOTECHNICAL INTERPRETATIVE SECTION

3.1 GENERAL GROUND CONDITIONS INTERPRETATION

The ground conditions encountered reflected Made Ground in all locations (except HA C) from ground level to a maximum depth of 1.60m bgl.

The Made Ground was encountered in several forms and these are briefly summarised as follows.

In CT 3 and CT 4, a layer of concrete from GL to 0.15m bgl was encountered.

Dense light brown, sandy, fine to coarse angular gravel and cobbles of limestone was encountered in CT 1, CT 3 and CT 4 from a minimum depth of GL to a maximum depth of 0.40m bgl.

In all exploratory holes, except HA C, a layer of Made Ground was encountered from a minimum depth of GL to a maximum depth of 1.00m bgl which consisted of a soft/loose brown clayey, sandy, gravelly topsoil with gravels of limestone/quartz/brick/tile fragments.

In CT 3, at 0.40m bgl to 1.60m bgl, a layer of firm dark brown, very sandy gravelly clay, with fine to angular gravels of quartz with occasional brick and ash was encountered.

In HA D from 0.30m bgl to a depth of 0.80m bgl was soft dark brown very gravelly clay with fine to coarse gravels of brick with frequent cobbles of brick and slate.

Therefore there was not evidence of the old sand pit which was seen in the desk study.

Paxford Gravel Formation was encountered beneath the Made Ground/Topsoil and was encountered in several forms.

In CT 1, HA C and HA E this was encountered as a clay and is summarised as follows. In CT 1, stiff orangish brown and occasional dark brown sandy clay was encountered from 0.40m bgl to 0.70m bgl. In HA C soft light brown slightly sandy slightly gravelly clay, with fine to medium gravel of quartz and limestone was encountered from 0.90m bgl to 1.00m bgl. In HA E soft orange brown slightly sandy slightly gravelly clay, with fine to medium gravel of quartz was encountered from 1.00m bgl to 1.10m bgl.

For the rest of the exploratory holes, where the formation was encountered, this was generally as a loose to medium dense, orange brown to dark brown, gravelly, fine to coarse sand with gravels of quartz. The density of the sand generally increased over depths, and this material was encountered from a minimum depth of 0.40m bgl to a maximum depth of 4.00m bgl.

The SPT "N" values for the Paxford Gravel Formation ranged from 14 to 32.

PSD tests were undertaken in samples taken at varying depths in the CT boreholes between 1.10m bgl and 4.0m bgl. The results of these showed percentages of silt between 9% and 23%, percentages of sand between 38% and 77%, and gravel between 1% and 52%. Therefore these soils are granular and non-shrinkable material.

Charmouth Mudstone Formation was encountered in three of the four CT boreholes and is summarised as follows.

In CT 1 from 3.70m bgl to 4.00m bgl stiff grey, orange brown and brown silty clay was encountered. In CT 2 from 3.30m bgl to 4.0m bgl stiff dark grey silty clay was encountered. In CT 4 from 3.25m bgl to 4.0m bgl stiff blueish grey silty clay was encountered.

Groundwater was encountered in all four of the CT boreholes and water strike depths are as follows: CT 1 at 2.60m bgl; CT 2 at 2.30m bgl; CT 3 at 2.0m bgl; CT 4 at 2.10m bgl.

The full exploratory hole logs can be seen in the Appendix.

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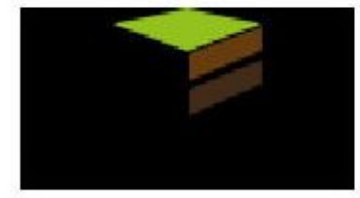

3.2 EXCAVATIONS

Conventional plant should be sufficient for the excavation of the underlying soils at the site.

3.3 FOUNDATIONS

3.3.1 Strip Foundations

The granular strata of the Paxford Gravel Formation, present across the site of the proposed residential dwelling development, are considered suitable bearing strata for conventional spread footings not exceeding 1.0m in width. Stepped foundations will be necessary due to the varying depths of Made Ground beneath the site which cannot be found on. The strip foundation should be created following the guidance of the NHBC Standards chapter 4.3.8.

At a depth of 0.75m bgl or 0.20m into the Paxford Gravel stratum, whichever is the deeper, a net allowable bearing pressure of 170kN/m^2 can be adopted. This allows for a factor of safety of three against shear failure, and for settlements generally not to exceed 25mm taking place by the end of construction.

3.4 FLOOR SLAB DESIGN

Assuming all the Topsoil/Subsoil/Made Ground is stripped off; ground bearing floor slabs could be constructed and placed on a layer of good quality, free draining, well compacted granular fill placed prior to the construction of the floor slab in order to make up the level. However, the advice of the NHBC Standards should be followed.

3.5 CONCRETE SULPHATE ATTACK

Four soil samples from this investigation were scheduled for the measurement of water soluble sulphate, acid soluble sulphate, total sulphur and pH to give an indication of the aggressivity of the ground in relation to buried concrete, as set out in the Building Research Establishment (BRE) Special Digest 1 (2005) Concrete in Aggressive Ground, Part 1: Assessing the aggressive chemical environment. The samples were recovered from depths ranging from 0.40m bgl to 1.0m bgl, and were sourced from the Natural Soils.

The results indicate a Design Sulphate Class of DS-1 and a site Aggressive Chemical Environment Classification (ACEC) Class AC-1. As groundwater was encountered in all of the CT boreholes, the more conservative condition of mobile groundwater was used to draw the conclusion of the ACEC.

The recommendations given in the above digest, with respect to suitable concrete design and other associated precautions against sulphate attack, should be followed for all below ground level concrete.

3.6 GAS PROTECTION

The risk of ground gases impacting the site was assessed by reference to the paper "A pragmatic approach to ground gas risk assessment for the 21st Century" Card and Wilson, 2011 and determined that there could be a possible risk of ground gases from the historic sand pit and possible infilled ground in this area.

Four confirmatory monitoring visits were undertaken at the site between 23/03/21 and 26/04/21 which recorded no carbon dioxide levels above 5% and no methane gas above detectable limits. A peak flow rate of -0.1l/h was recorded.

Based on the conditions measured during the monitoring visits carried out to date, In accordance with BS8485:2015 and CIRIA C665, 2007 the site is currently classified as a Characteristic Situation 1 (CS1). Therefore it is currently considered that no gas protection is necessary with regard to methane or carbon dioxide gas.

In addition, the site lies within an area where less than 1% of homes exceed the action level of 200Bq/m^3 for radon gas. Therefore, no radon protection measures are necessary in the construction of new dwellings or extensions, on this site.

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4 GEO-ENVIRONMENTAL INTERPRETATION

4.1 RISKS TO HUMAN HEALTH

4.1.1 Introduction

Environment Agency guidance LCRM, *Land Contamination: Risk Management*, (EA, 2019), states that human health risk assessment should be undertaken by a tiered approach using the source-pathway-receptor principle. A desk study constitutes the first tier and this has been previously undertaken by Geo-Integrity, dated February 2021, ref. 21-01-05. The conclusions of this phase were that:-

"Reference to the desk study and walkover survey indicates that the site has been a working farm for the majority of its history, with the first buildings on the farm being developed in the 1950s. Before this, the site was within woodlands, although there was a sand pit shown in the northwestern corner of the site on maps from 1884. It is considered that the location of the sand pit could have been infilled and this could lead to asbestos being present in any Made Ground along with a possible source of ground gas; asbestos could also be present from the structures on site, and structures surrounding the site, due to their age. The use and storage of machinery on site could lead to the presence of hydrocarbons and heavy metals within the ground from potential historic fuel spills. Pesticides are another possible contamination risk as these may have been stored on site, or used on the surrounding land, due to the agricultural use."

The possible contaminative sources at the site or surrounding area are listed below.

Potential onsite sources:

- Possible spilled fuels associated with the storage/use of farm machinery
- Asbestos within possible infilled/Made Ground of sand pit
- Ground gas from possible infilled/Made Ground of sand pit
- Possible pesticides in ground from storage/use on site

Potential offsite sources:

- Possible pesticides in ground from storage/use on surrounding land/farms

Therefore it was considered that potential source/pathway/receptors are present at and around the site, and as part of this investigation a sampling strategy, outlined in section 2.1, was used to undertake confirmatory chemical testing at the site.

Therefore, four soil samples were tested for chemical suites that were also analysed under the second tier, known as a Generic Quantitative Risk Assessment (GQRA), which uses generic guideline values to compare site chemical data against. The next and final tier would be a Detailed Quantitative Risk Assessment (DQRA), which uses data derived from the ground investigation to assess risks to identified receptors.

The assessment included in this report comprises a GQRA, which is undertaken by comparing soil contaminant concentrations from this investigation with conservative Generic Assessment Criteria (GAC). GAC for various land use and exposure scenarios have been selected from the following sources:

- CL:AIRE Category 4 Screening Levels (C4SL);
- LQM Suitable for Use Levels (S4UL);
- CL:AIRE/EIC/AGS GAC

The GAC have been derived using the Environment Agency Contaminated Land Exposure Assessment (CLEA) model, for a range of land uses and exposure scenarios, including:

- Residential with the consumption of home-grown produce
- Residential without the consumption of home-grown produce
- Commercial
- Allotments
- Public Open Space near residential housing (POS_{resi})
- Public Open Space public park scenario (POS_{park})

Given the proposed development is to be a residential dwelling with soft landscaping, we have used the scenario of "Residential with the consumption of home-grown produce" for this assessment.

4.1.2 Results of Chemical Testing

Four samples were tested from the soils across the whole site. Of all soil samples screened against the relevant GAC for a "Residential with the consumption of home-grown produce" land use scenario as described above, only arsenic slightly exceeded the relevant GACs in HA D at 0.60m bgl.

One sample from HA B at 0.40m bgl identified Asbestos Containing Material (ACM) as cement.

4.1.3 Asbestos

Screening for the presence of asbestos was conducted on four samples. One sample from HA B at 0.40m bgl identified asbestos in the form of chrysotile. This was later quantified using two methods: asbestos by gravimetry and total asbestos. Asbestos by gravimetry found asbestos at 2.6% and total asbestos gave the same result.

4.2 RISK TO END USERS

Given the results of the desk study, intrusive investigation and laboratory testing, a source-pathway-receptor linkage has been identified at the site from arsenic and Asbestos Containing Materials (ACM) via inhalation/ingestion of soil dust. It is recommended that remedial measures are undertaken to remove this potential contact.

To break the pollutant linkage, Made Ground material needs to be excluded from the end users, and special control measures need to be in place to protect the surrounding residents and construction workers.

These conclusions should be confirmed by the relevant Regulatory Authority as soon as possible prior to development.

4.3 REMEDIAL WORK OR FURTHER WORK REQUIRED

The laboratory testing of the Made Ground at the site identified that one sample contained arsenic and one sample contained Asbestos, and it has been established that this will provide a risk to end users of the site (should a pathway be available) and to construction workers during the groundworks.

4.3.1 Reducing Risk to End Users

It is considered that the exposure pathway between the ACM impacted Made Ground and site/end users needs to be broken. With the JIWG Decision support tool identifying a negligible risk to receptors once remediation has occurred.

To break the pathway between the arsenic and ACM and end users a cover system could be engineered in the areas of soft-landscaping. Such a cover system would require a 600mm layer of clean cover, consisting of at least 150mm of topsoil and a “deter to dig” layer at the base comprising of either a geotextile or granular layer. This cover system is not required in areas of

hardstanding (car parks, patios and under the building), where this will break the pathway between contaminated soils and site users.

During the development it is recommended that this process of placing the cover layer is tightly monitored and recorded (soil tests, photographs, depth measurements etc) as it is likely that a verification report will be required to prove its existence to Local Authorities or financing organisations (mortgage companies etc).

It is recommended that further testing is carried out on the site in order to delineate and understand the size of the area which is impacted by arsenic and ACM.

4.3.2 Reducing the Risk to Construction Workers

For the construction workers, remedial measures would not be in place when they undertake the site work and therefore different measures should be taken to reduce the risk of coming into contact with the soil and break the pollutant linkage with these receptors.

To reduce the risk to as low as reasonably practicable for the construction workers it is recommended that, high standards of personal hygiene should be maintained amongst the site personnel at all times. All personnel coming into contact with the soil, ground workers in particular, should be instructed to use gloves when on site to avoid dermal contact and restrict inadvertent hand-to-mouth ingestion. Washing facilities should be provided for the site staff to use, and should be used prior to eating or smoking. Reference should be made to the HSE Document, "Protection of Workers and the General Public during Development of Contaminated Land".

Additionally the initial works risk assessment has been undertaken using the JIWG Decision Support Tool CAR2012 to establish the probable licensing status of the works under CAR2012 and any precautionary procedures required. The worksheets are included in the Appendices and indicate that given the type of asbestos encountered and its distribution, the works are likely to be Non-Licensed Works, however further recommendations on RPE, dust suppression and hygiene/decontamination are also included, and these should be referred to in the first instance.

These include the wetting down (or equivalent methods) to suppress the dust, the wearing of EN149 FFP3 disposable masks when dealing with Made Ground and the provision of basic welfare facilities, as described above.

It is also recommended that a watching brief for undiscovered contamination is included in the Works Method Statement. Given the long human history of the surrounding area, it is always

possible that some previous undiscovered contamination maybe encountered. If this is the case, the area should be isolated and contact be made to a suitably qualified professional for further advice. This is particularly important if the contamination is possibly ACM or liquid based.

4.4 RISK TO CONTROLLED WATERS

None of the metal and inorganic contaminants tested for within the total soil chemical tests recorded significantly elevated values and no free-phase hydrocarbon contamination was encountered. Therefore it is considered that there is no elevated risk of Controlled Waters pollution from this site.

The Environment Agency is the regulatory body charged with protection of controlled waters and may be a consultee in the planning process. We recommend that the conclusions of this report are agreed with the relevant Local Authority at the earliest stage, to reduce any potential delays.

4.5 GEO-ENVIRONMENTAL CONCLUSION

Given the findings of the desk study, fieldwork and laboratory testing is it considered that elevated risk to Human Health exists on this site. This is in the form of arsenic within the Made Ground of HA D at 0.60m bgl and ACM within the Made Ground at HA B at 0.40m bgl, and we recommend that the aforementioned remedial measures should be carried out.

5 RECOMMENDATIONS

We recommend that a clean cover layer will be needed in the area impacted by arsenic and ACM.

We recommend a watching brief should be undertaken during the construction phase, and if during development any previously undiscovered contamination (including visual or olfactory evidence) is found then site management should be immediately informed and inspection by a suitably qualified person should be undertaken.

6 REFERENCES

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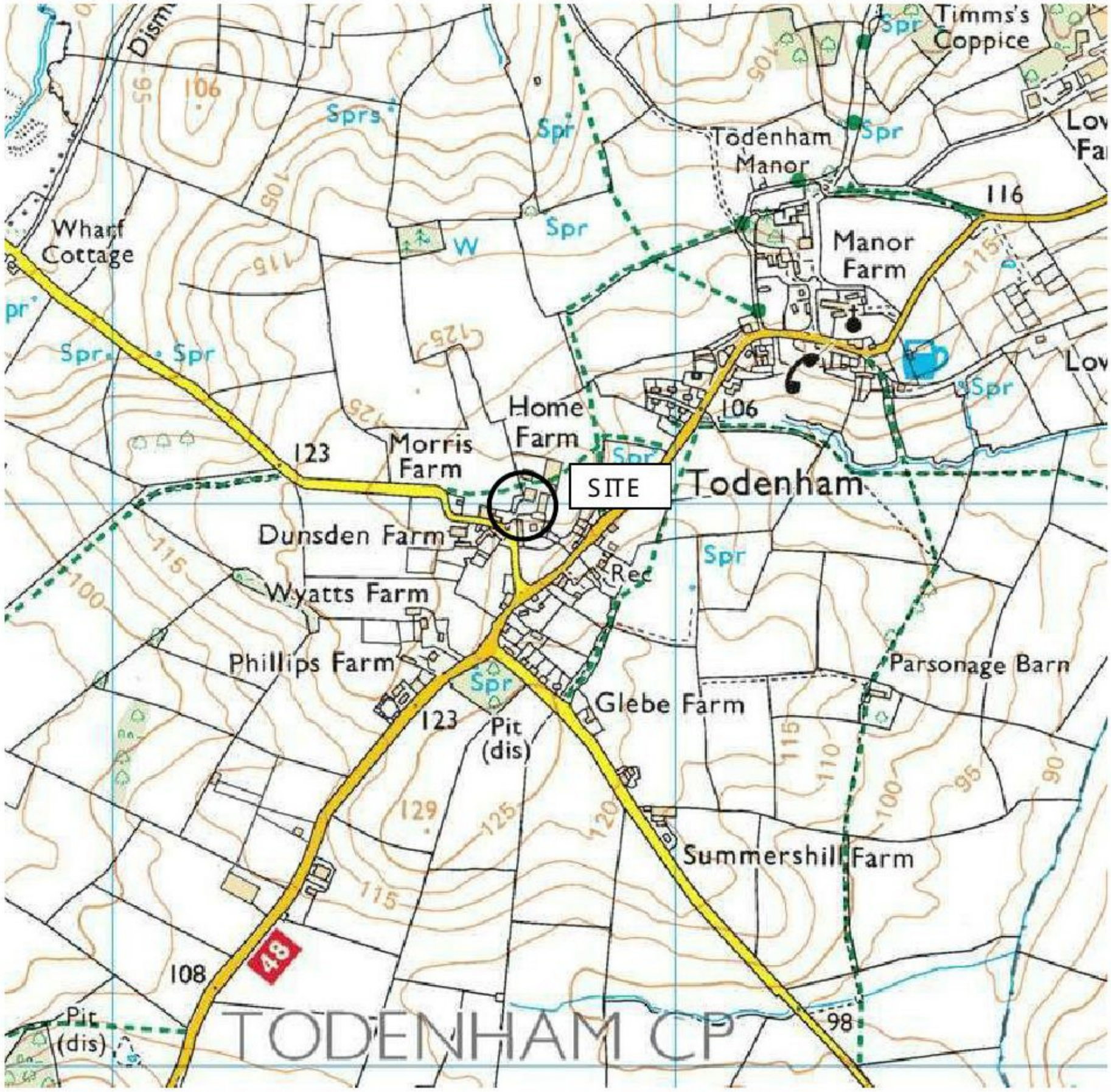
APPENDIX A

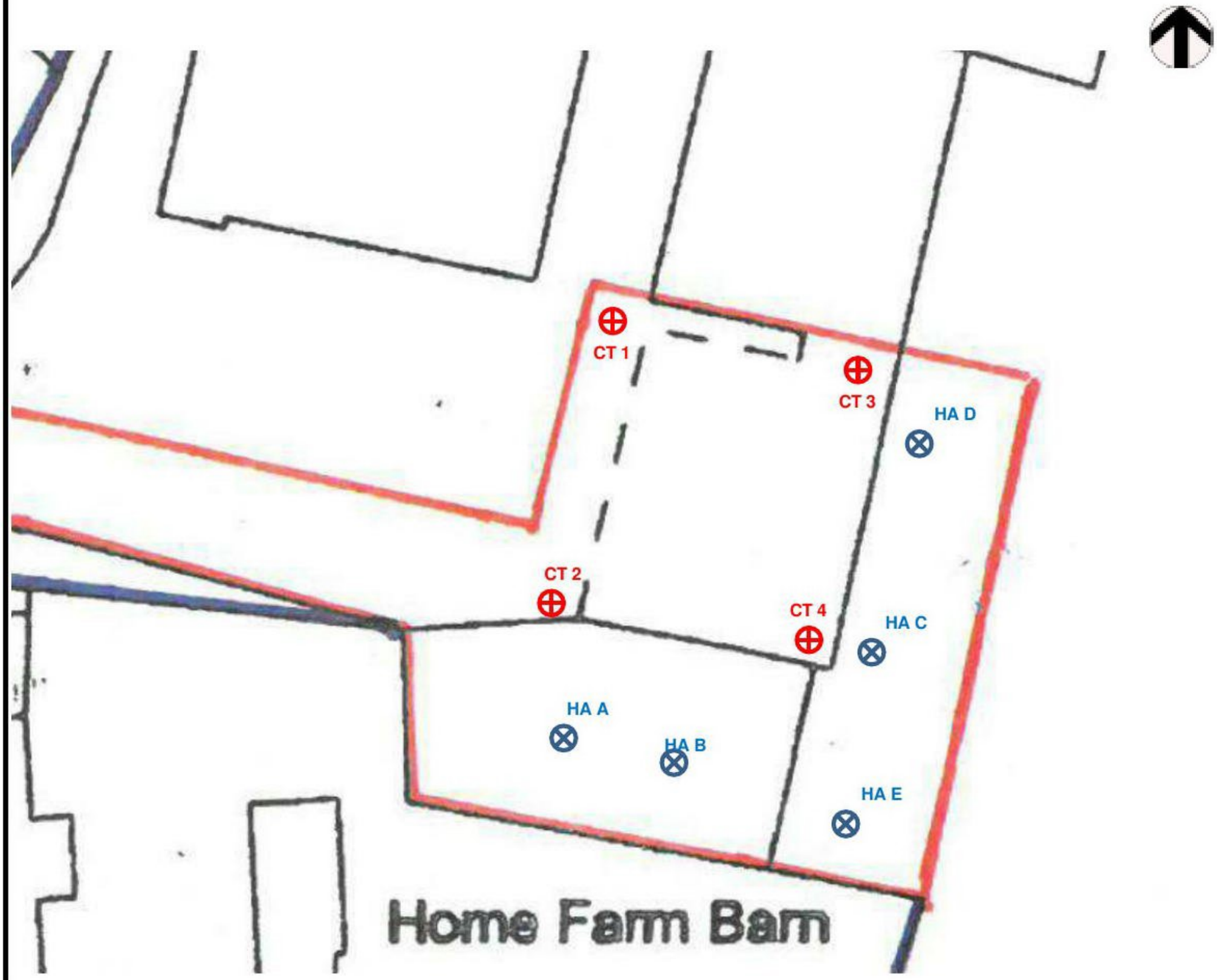
Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

Site Plan



March 2021 SITE LOCATION PLAN Report No:- 21-03-03

Geo-Integrity, - 07858 367 125 Email:- murraybateman@geo-integrity.co.uk



Key

Continuous Tube Borehole Locations

Hand Auger Locations

GEO INTEGRITY

4 Church Street
Maids Moreton
MK18 1QE

Tel:- 01280 816409
Mob:- 07858 367 125
www. geo-integrity.co.uk

Exploratory Hole Location Plan

SITE:- Dunsden Farm, Todenham

JOB NO.:- 21-03-03

CLIENT:- James and Clare Duckett

Drawn	Checked
SB	MB

Scale: Not To Scale, for indicative purposes only

APPENDIX B

Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

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Site: Dunsden Farm, Todenham			Number: CT 1
Machine : Window Sample Rig Method : Drive-in Windowless Sampler	Dimensions: 87mm to 2.0m, 77mm to 3.0m, 67mm to 4.0m	Ground Level (mOD)	Client: James and Clare Duckett
	Location	Dates: 19/03/2021	Project Contractor: Geo-Integrity
			Job Number: 21-03-03 Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	MADE GROUND Dense light brown sandy fine to coarse angular GRAVEL and COBBLES of limestone		
0.20	D				0.20			
					(0.20)	MADE GROUND Loose dark brown slightly sandy slightly gravelly slightly clayey TOPSOIL. Gravel is fine to coarse angular to sub-rounded		
0.40	D				0.40			
					(0.30)			
0.70	D				0.70	PAXFORD GRAVEL Stiff orangish brown and occasional dark brown sandy CLAY.		
1.00-1.45 1.00	SPT N=17 D		3,2/3,4,4,6			PAXFORD GRAVEL Medium dense orangish brown silty slightly gravelly fine to medium SAND. Gravel is fine to medium angular to sub-rounded of quartz		
1.50	D				(1.90)			
2.00-2.45 2.00	SPT N=26 D		4,3/4,6,7,9					
2.60	D		Water strike(1) at 2.60m.		2.60	PAXFORD GRAVEL Medium dense brown and orangish brown silty very gravelly coarse SAND. Gravel is fine to coarse angular to sub-rounded of quartz		▽1
					(0.40)			
3.00-3.45 3.00	SPT N=23 D		5,5/5,6,6,6		3.00	PAXFORD GRAVEL Medium dense brown silty slightly gravelly fine medium SAND. Gravel is fine to medium angular to sub-rounded of quartz		
					(0.70)			
3.70	D				3.70	CHARMOUTH MUDSTONE Stiff grey, orange brown and brown silty CLAY		
					(0.30)			
4.00	D				4.00	Complete at 4.00m		

Remarks

Scale (approx)	Logged By
1:40	FW

Figure No. 21-03-03.CT 1

AGS

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Site: Dunsden Farm, Todenham			Number: CT 2
Machine : Window Sample Rig Method : Drive-in Windowless Sampler	Dimensions: 87mm to 1.0m, 77mm to 2.0m, 67mm to 3.0m, 57mm to 4.0m	Ground Level (mOD)	Client: James and Clare Duckett
	Location	Dates: 19/03/2021	Project Contractor: Geo-Integrity
			Job Number: 21-03-03
			Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	D				(0.50)	MADE GROUND Loose dark brown sandy gravelly TOPSOIL with frequent brick cobbles. Gravel is fine to coarse angular to sub-rounded of brick		
0.50	D				0.50 (0.50)	PAXFORD GRAVEL Loose orangish brown and dark brown gravelly fine SAND with roots. Gravel is fine to coarse angular to rounded of quartz		
1.00-1.45 1.00	SPT N=17 D		3,3/3,4,4,6		1.00	PAXFORD GRAVEL Medium dense orangish brown silty slightly gravelly fine to medium SAND. Gravel is fine to medium angular to sub-rounded of quartz		
1.50	D				(1.80)			
2.00-2.45 2.00	SPT N=17 D		3,2/4,4,4,5					▽1
			Water strike(1) at 2.30m.					
2.50	D							
2.80	D				2.80	PAXFORD GRAVEL Medium dense brown and orangish brown silty very gravelly fine SAND. Gravel is fine to coarse angular to sub-rounded of quartz		
3.00-3.45 3.00	SPT N=17 D		4,4/5,5,4,3		(0.50)			
			Borehole collapsed into 3.20m		3.30	CHARMOUTH MUDSTONE Stiff dark grey silty CLAY		
3.30	D				(0.70)			
4.00	D				4.00	Complete at 4.00m		

Remarks

Scale (approx)	Logged By
1:40	FW

Figure No. 21-03-03.CT 2

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Site: Dunsden Farm, Todenham			Number: CT 3
Machine : Window Sample Rig Method : Drive-in Windowless Sampler	Dimensions: 87mm to 1.0m, 77mm to 2.0m, 67mm to 3.0m, 57mm to 4.0m	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	CONCRETE		
0.15	D				0.15 (0.25)	MADE GROUND Dense light brown sandy fine to coarse angular GRAVEL and COBBLES of limestone		
0.40	D				0.40	MADE GROUND Loose dark brown sandy gravelly TOPSOIL. Gravel is fine to coarse angular of limestone		
1.00-1.45 1.00	SPT N=4 D		0,0/1,1,1,1		(1.20)	MADE GROUND Firm dark brown very sandy gravelly CLAY. Gravel is fine to angular of quartz with occasional brick and ash		
1.60	D				1.60	PAXFORD GRAVEL Medium dense brown and orangish brown silty gravelly fine SAND. Gravel is fine to coarse angular to sub-rounded of quartz ith occasional quartz cobbles		▽1
2.00 2.00-2.45	D SPT N=32		Water strike(1) at 2.00m. 5,4/7,8,8,9					
2.50	D		Borehole collapsed into 2.50m		(2.40)			
3.00-3.45 3.00	SPT N=17 D		4,4/5,5,4,3					
3.50	D							
4.00	D				4.00	Complete at 4.00m		

Remarks

Scale (approx)	Logged By
1:40	FW

Figure No. 21-03-03.CT 3

AGS

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Site: Dunsden Farm, Todenham			Number: CT 4
Machine : Window Sample Rig Method : Drive-in Windowless Sampler	Dimensions: 87mm to 1.0m, 77mm to 2.0m, 67mm to 3.0m, 57mm to 4.0m	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	CONCRETE		
0.15	D				(0.25) 0.40	MADE GROUND Dense light brown sandy fine to coarse angular GRAVEL and COBBLES of limestone		
0.40	D				(0.70) 1.10	MADE GROUND Loose dark brown slightly clayey very gravelly fine to medium SAND. Gravel is fine to coarse angular to sub-rounded of quartz and limestone		
1.00-1.45 1.10	SPT N=10 D		2,2/2,1,3,4		(0.70) 1.80	PAXFORD GRAVEL Loose brown and dark brown silty gravelly fine to medium SAND. Gravel is fine to medium angular to sub-rounded of quartz		
1.50	D				(0.80) 2.60	PAXFORD GRAVEL Medium dense brown and orangish brown silty gravelly fine SAND. Gravel is fine to coarse angular to sub-rounded of quartz		▽1
1.80	D				(0.65) 3.25	PAXFORD GRAVEL Medium dense brown and dark brown silty fine to medium SAND and GRAVEL. Gravel is fine to coarse angular to rounded of quartz		
2.00-2.45 2.00	SPT N=14 D		4,3/3,3,4,4 Water strike(1) at 2.10m.					
2.60	D				(0.75) 4.00	CHARMOUTH MUDSTONE Stiff bluish grey silty CLAY		
3.00	D		Borehole collapsed into 3m					
3.00-3.45 3.25	SPT N=13 D		4,3/7,2,2,2					
4.00	D					Complete at 4.00m		

Remarks

Scale (approx)	Logged By
1:40	FW

Figure No. 21-03-03.CT 4

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Site: Dunsden Farm, Todenham				Trial Pit Number: HA A
Machine : Hand Dug Method : Trial Pit	Dimensions	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location: 423743 E 235983 N	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D				(0.60)	MADE GROUND Soft dark brown slightly sandy slightly clayey gravelly TOPSOIL. Gravel is fine to coarse brick with occasional cobbles of brick		
0.70	D			0.60	(0.20)	PAXFORD GRAVEL Light brown dense slightly clayey slightly gravelly fine SAND. Gravel is fine to medium of quartz and limestone		
				0.80		Complete at 0.80m		

Plan

Remarks

AGS

Scale (approx)	Logged By	Figure No.
1:10	Fiona White	21-03-03.HA A

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Site: Dunsden Farm, Todenham				Trial Pit Number: HA B
Machine : Hand Dug Method : Trial Pit	Dimensions	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location: 423756 E 235980 N	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D				(0.70)	MADE GROUND Soft dark brown slightly sandy slightly clayey slightly gravelly TOPSOIL. Gravel is fine to coarse of quartz with occasional tile fragments		
0.75	D			0.70	(0.10)	PAXFORD GRAVEL Orange brown medium dense slightly gravelly SAND. Gravel is fine to medium of quartz		
				0.80		Complete at 0.80m		

Plan

Remarks

AGS

Scale (approx)	Logged By	Figure No.
1:10	Fiona White	21-03-03.HA B

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Site: Dunsden Farm, Todenham			Trial Pit Number: HA C
Machine : Hand Dug Method : Trial Pit	Dimensions	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location: 4237749 E 235988 N	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.90)	TOPSOIL Soft dark brown slightly sandy slightly clayey slightly gravelly TOPSOIL. Gravel is fine to coarse of quartz and limestone		
0.50	D				0.90			
0.95	D				(0.10)	PAXFORD GRAVEL Soft light brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium of quartz and limestone		
					1.00	Complete at 1.00m		

Plan

Remarks

AGS

Scale (approx)	Logged By	Figure No.
1:10	Fiona White	21-03-03.HA C

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Site: Dunsden Farm, Todenham			Trial Pit Number: HA D
Machine : Hand Dug Method : Trial Pit	Dimensions	Ground Level (mOD)	Client: James and Clare Duckett	Job Number: 21-03-03
	Location: 423773 E 236009 N	Dates: 19/03/2021	Project Contractor: Geo-Integrity	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	D				(0.30)	MADE GROUND Soft dark brown slightly gravelly clayey TOPSOIL. Gravel is fine to coarse of quartz and limestone		
0.60	D				0.30 (0.50)	MADE GROUND Soft dark brown very gravelly CLAY. Gravel is fine to coarse of brick with frequent cobbles of brick and slate		
					0.80	Complete at 0.80m		

Plan

Remarks

AGS

Scale (approx)	Logged By	Figure No.
1:10	Fiona White	21-03-03.HA D

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Machine : Hand Dug Method : Trial Pit	Dimensions	Ground Level (mOD)	Client James and Clare Duckett	Job Number 21-03-03
	Location 423775 E 239576 N	Dates 19/03/2021	Project Contractor Geo-Integrity	Sheet 1/1

Site: Dunsden Farm, Todenham

Trial Pit Number: HA E

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						MADE GROUND Soft dark brown slightly sandy slightly gravelly slightly clayey TOPSOIL. Gravel is fine to medium of quartz, limestone and brick		
0.40	D				(1.00)			
					1.00	PAXFORD GRAVEL Soft orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium of quartz		
1.05	D				(0.10)			
					1.10	Complete at 1.10m		

Plan

Remarks

AGS

Scale (approx)	Logged By	Figure No.
1:10	Fiona White	21-03-03.HA E

Date	Job No.	BH	CH4(%)	LEL(%)	CO2(%)	O2(%)	H2S (ppm)	CO (ppm)	Hex(%)	PIDCf()	PkFlw (lh)	AP (mbar)	GW (m bgl)	Pmp (s)	Bal(%)
23/03/21	21-03-03	CT 1	0	0	2	16.3	0	0	0.005	1	-0.1	1015	2.21	66	81.7
06/04/21	21-03-03	CT 1	0	0	1.5	18	0	0	0.002	1	0	1006	2.3	75	80.5
19/04/21	21-03-03	CT 1	0	0	1.6	18.3	0	0	0.003	1	-0.1	1011	2.7	61	80.1
26/04/21	21-03-03	CT 1	0	0	0.8	19.5	0	0	0.001	1	0	1009	2.39	65	79.7

APPENDIX C

Geo-Integrity, Mob.: - 07858 367 125 Email:- info@geo-integrity.co.uk

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

2183

Final Report

Report No.:	21-09659-1
Initial Date of Issue:	01-Apr-2021
Client	Geo Integrity
Client Address:	4 Church Street Maids Moreton Bucks MK18 1QE
Contact(s):	Fiona White
Project	21-03-03 Dunsden Farm, Todenham

Quotation No.:	Q16-07998	**Date Received:**	26-Mar-2021
Order No.:		**Date Instructed:**	26-Mar-2021
No. of Samples:	7		
Turnaround (Wkdays):	5	**Results Due:**	01-Apr-2021
Date Approved:	01-Apr-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

Project: 21-03-03 Dunsden Farm, Todenham

Client: Geo Integrity					**Chemtest Job No.:**	21-09659	21-09659	21-09659	21-09659	21-09659	21-09659
Quotation No.: Q16-07998					**Chemtest Sample ID.:**	1167267	1167268	1167269	1167270	1167271	1167272	1167273
					Sample Location:	HA B	HA D	HA E	CT 3	CT 1	CT 2	CT 4
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.40	0.60	0.40	0.40	0.70	0.50	0.40
					Bottom Depth (m):				1.00	1.00	1.00	1.10
					Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021
					Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
ACM Type	U	2192		N/A		Cement	-	-	-			
Asbestos Identification	U	2192		N/A		Chrysotile	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected			
ACM Detection Stage	U	2192		N/A		Screen Visible by Eye	-	-	-			
Asbestos by Gravimetry	U	2192	%	0.001		2.6						
Total Asbestos	U	2192	%	0.001		2.6						
Moisture	N	2030	%	0.020		26	18	18	21	8.7	12	9.0
pH	U	2010		4.0					8.0	8.1	8.4	7.8
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010					0.049	0.017	< 0.010	0.016
Arsenic	U	2450	mg/kg	1.0		21	42	16	17			
Cadmium	U	2450	mg/kg	0.10		0.15	0.27	0.18	0.13			
Chromium	U	2450	mg/kg	1.0		26	65	24	36			
Copper	U	2450	mg/kg	0.50		28	35	37	20			
Mercury	U	2450	mg/kg	0.10		< 0.10	0.16	< 0.10	< 0.10			
Nickel	U	2450	mg/kg	0.50		23	50	19	28			
Lead	U	2450	mg/kg	0.50		31	65	30	17			
Selenium	U	2450	mg/kg	0.20		0.51	< 0.20	0.39	0.76			
Zinc	U	2450	mg/kg	0.50		100	170	110	93			
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50			
TPH >C5-C6	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C6-C7	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C7-C8	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C8-C10	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C10-C12	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C12-C16	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C16-C21	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
TPH >C21-C35	N	2670	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
Total TPH >C5-C35	N	2670	mg/kg	10		< 10	< 10	< 10	< 10			
Naphthalene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Acenaphthylene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Acenaphthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Fluorene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Phenanthrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[a]anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			

Results - Soil

Project: 21-03-03 Dunsden Farm, Todenham

Client: Geo Integrity					**Chemtest Job No.:**	21-09659	21-09659	21-09659	21-09659	21-09659	21-09659
Quotation No.: Q16-07998					**Chemtest Sample ID.:**	1167267	1167268	1167269	1167270	1167271	1167272	1167273
					Sample Location:	HA B	HA D	HA E	CT 3	CT 1	CT 2	CT 4
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.40	0.60	0.40	0.40	0.70	0.50	0.40
					Bottom Depth (m):				1.00	1.00	1.00	1.10
					Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021	19-Mar-2021
					Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM			
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Chrysene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[b]fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[k]fluoranthene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[a]pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10			
Total Of 16 PAH's	U	2700	mg/kg	2.0		< 2.0	< 2.0	< 2.0	< 2.0			
Benzene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
Toluene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
Ethylbenzene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
m & p-Xylene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			
o-Xylene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0			

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

GroundTech Laboratories

Geotechnical Testing Facility
Slapton Hill Barn, Blakesley Road, Slapton, Towcester, Northants. NN12 8QD
Telephone:- 01327 860947/860060 Fax:- 01327 860430 Email: groundtech@listersgeotechnics.co.uk

PROJECT INFORMATION		SAMPLE INFORMATION		
Site Location:-	Dunsden Farm Todenham	**Laboratory Tests Undertaken:-**		
		TEST TYPE	**TEST METHOD**	**TESTED**
		Natural Water Contents (WC%)	(BS 1377:Part 2:1990 Clause 3.2)	
		Liquid Limits (%)	(BS 1377:Part 2:1990 Clause 4.3)	
		Plastic Limits (%)	(BS 1377:Part 2:1990 Clause 5.3)	
		Plasticity Index (%)	(BS 1377:Part 2:1990 Clause 5.4)	
		Linear Shrinkage (%)	(BS 1377:Part 2:1990 Clause 6.5)	
		PSD - Wet Sieving	(BS 1377:Part 2:1990 Clause 9.2)	✓
Client Reference:-	-	Engineering Sample Descriptions	(BS 5930 : Section 6)	
		Passing 425/63 (μm)	-	
		Hydrometer	(BS 1377:Part 2:1990 Clause 9.5)	
Date Samples Received:-	26th March 2021	Loss on Ignition (%)	-	
Date Testing Completed:-	8th April 2021	Soil Suctions (kPa)	BRE Digest IP 4/93, 1993	
		Bulk Density (Mg/m^3)	(BS 1377:Part 2:1990 Clause 7.2)	
		Strength Tests	(BS 1377:Part 7:1990 Clause 8 & 9)	
		Soluble Sulphate Content (SO_4g/l)	(BS 1377:Part 3:1990 Clause 5.3)	
		pH value	(BS 1377:Part 3:1990 Clause 9.4)	
		California Bearing Ratios (CBR)	(BS 1377:Part 4:1990 Clause 7)	
		Compaction Tests	(BS 1377:Part 4:1990 Clauses 3.0-3.6)	
The results relate only to the samples tested				

Laboratory testing in accord with BS EN ISO/IEC 17025-2000 and Quality Management in accord with ISO 9001

Signed on behalf of GroundTech Laboratories:-_____ **Technical Signatory**

Quality Assured to ISO 9001

GEOTECHNICAL LABORATORY TEST RESULTS

Report No: 21.03.039

GroundTech Laboratories

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Quality Assured to ISO 9001

SAMPLES				CLASSIFICATION TESTS							CLASSIFICATION TESTS							STRENGTH TESTS					CHEMICAL TESTS	
Test Location	Sample Type	Sample Depth -m	Test Type	WC %	LL %	PL %	PI %	Passing 425 µm %	Modified PI %	Class	Passing 63 µm %	WC/ LL	PL+ 2%	Liquidity Index	Loss on Ignition %	Soil Suction kPa	Bulk Density Mg/m³	Test Type	Cell Pressure kN/m²	Deviator Stress kN/m²	Apparent Cohesion kN/m²	ϕ	pH Value	Soluble Sulphate Content SO4 g/l
CT 01	D	1.50	PSD																					
CT 02	D	2.00	PSD																					
CT 03	D	3.00	PSD																					
CT 04	D	1.10	PSD																					

Symbols:

U	Undisturbed Sample	R	Remoulded	PI	Plasticity Index	T	Triaxial Undrained	L	100mm specimen
D	Disturbed Sample	63	Passing 63µm	F	Filter Paper Suction Tests	M	Multistage Triaxial	S	38mm specimen
B	Bulk Sample	H	Hydrometer	CC	Continuous Core	HP	Hand Penetrometer		
W	Water Sample	PSD	Wet Sieving			V	Vane Test		

LABORATORY TEST RESULTS

Project Reference
21.03.039

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Quality Assured ISO 9001

Site: Dunsden Farm, Todenham

Test Location: CT 01

Sample Depth: 1.50m -2.00m

Sample Description:

Hydrometer No.:

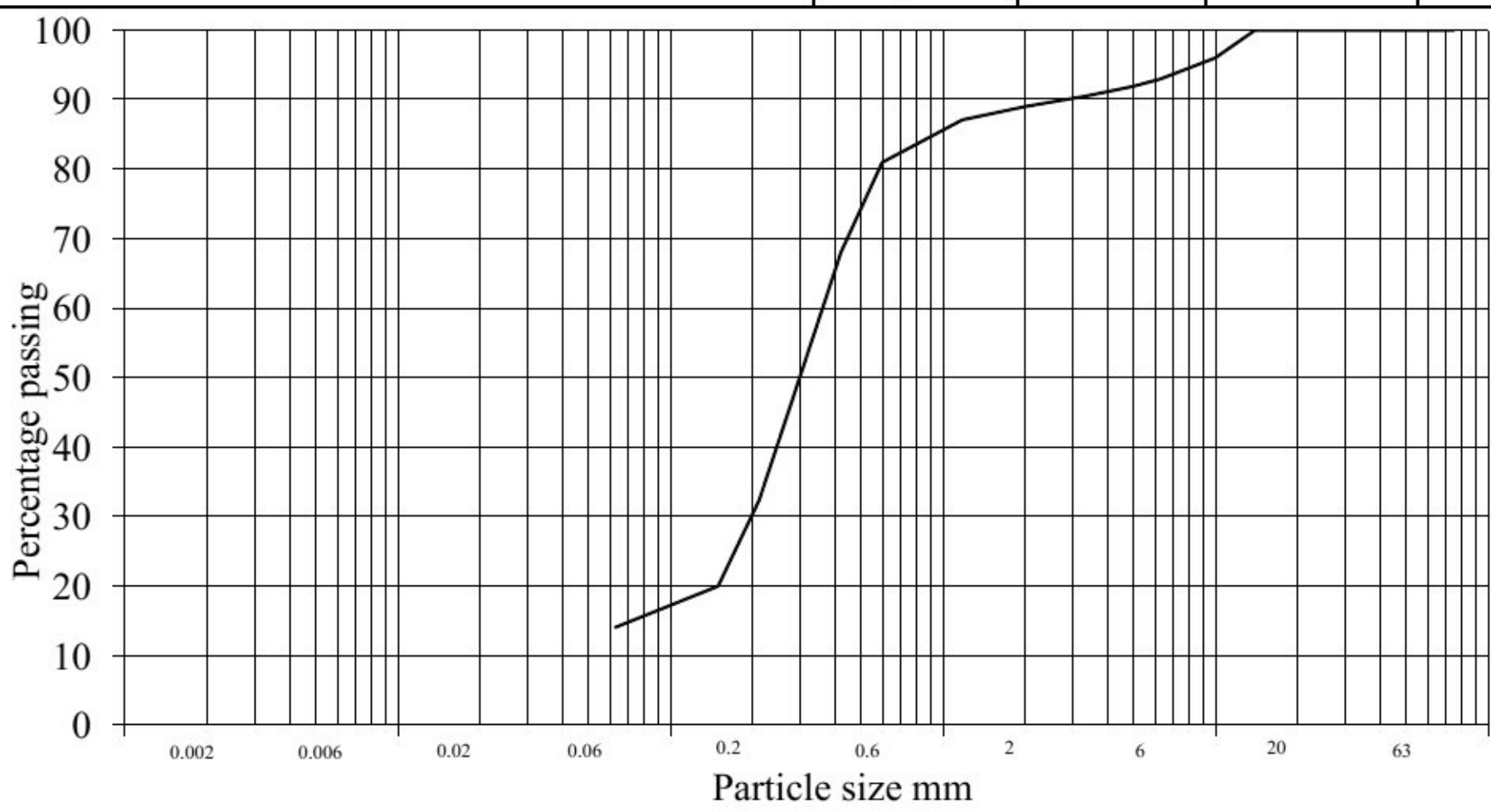
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	96.00		
6.3mm	93.00		
5mm	91.90		
3.5mm	90.50		
2mm	89.00		
1.18mm	87.10		
600µm	81.00		
425µm	68.10		
300µm	50.20		
212µm	32.40		
150µm	20.00		
63µm	14.10		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
14%				75%			11%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.039

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Quality Assured ISO 9001

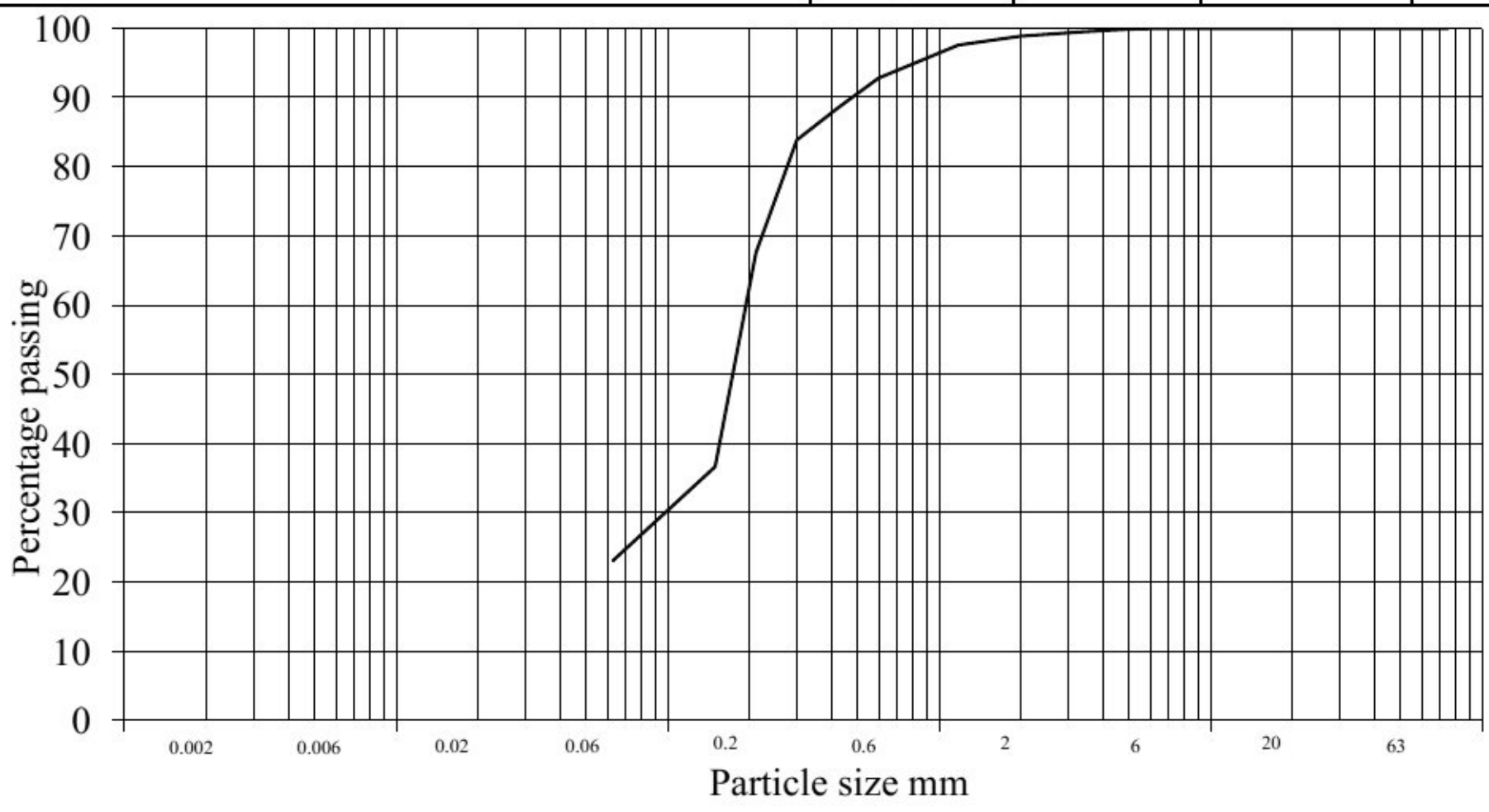
Site: Dunsden Farm, Todenham

Test Location: CT 02
Sample Depth: 2.00m -2.50m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	100.00		
5mm	99.90		
3.5mm	99.50		
2mm	98.90		
1.18mm	97.60		
600µm	92.80		
425µm	88.50		
300µm	83.90		
212µm	67.60		
150µm	36.70		
63µm	23.10		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
23%				76%			1%			0%

PARTICLE SIZE DISTRIBUTION

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Quality Assured ISO 9001

Site: Dunsden Farm, Todenham

Test Location: CT 03

Sample Depth: 3.00m -4.00m

Sample Description:

Hydrometer No.:

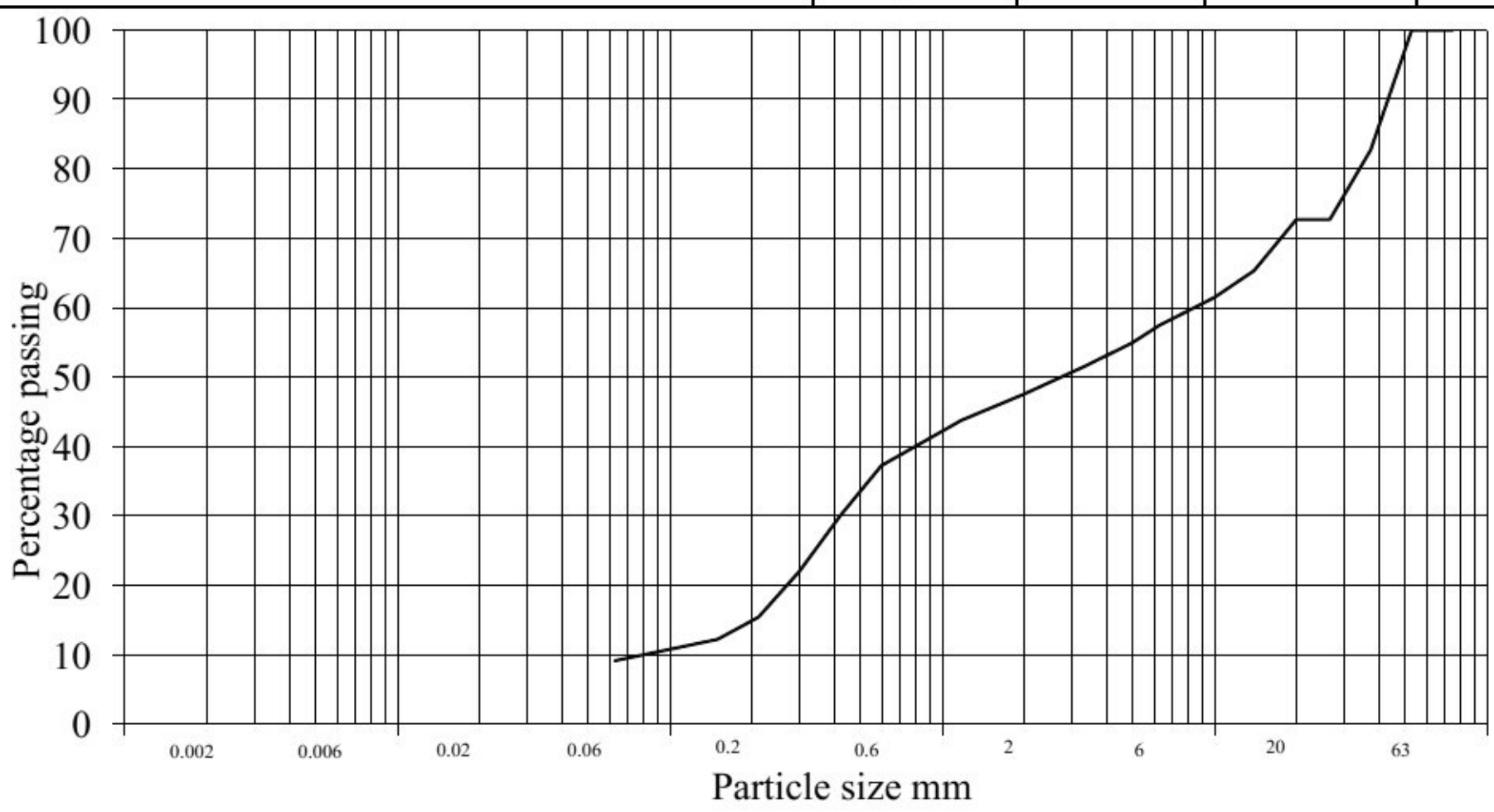
SG Gs:

Water Visc. (N):

Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	82.80		
26.5mm	72.70		
20mm	72.70		
14mm	65.40		
10mm	61.50		
6.3mm	57.50		
5mm	55.00		
3.5mm	51.60		
2mm	47.60		
1.18mm	43.80		
600µm	37.30		
425µm	30.10		
300µm	22.10		
212µm	15.50		
150µm	12.30		
63µm	9.20		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
9%				38%			52%			0%

PARTICLE SIZE DISTRIBUTION

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Quality Assured ISO 9001

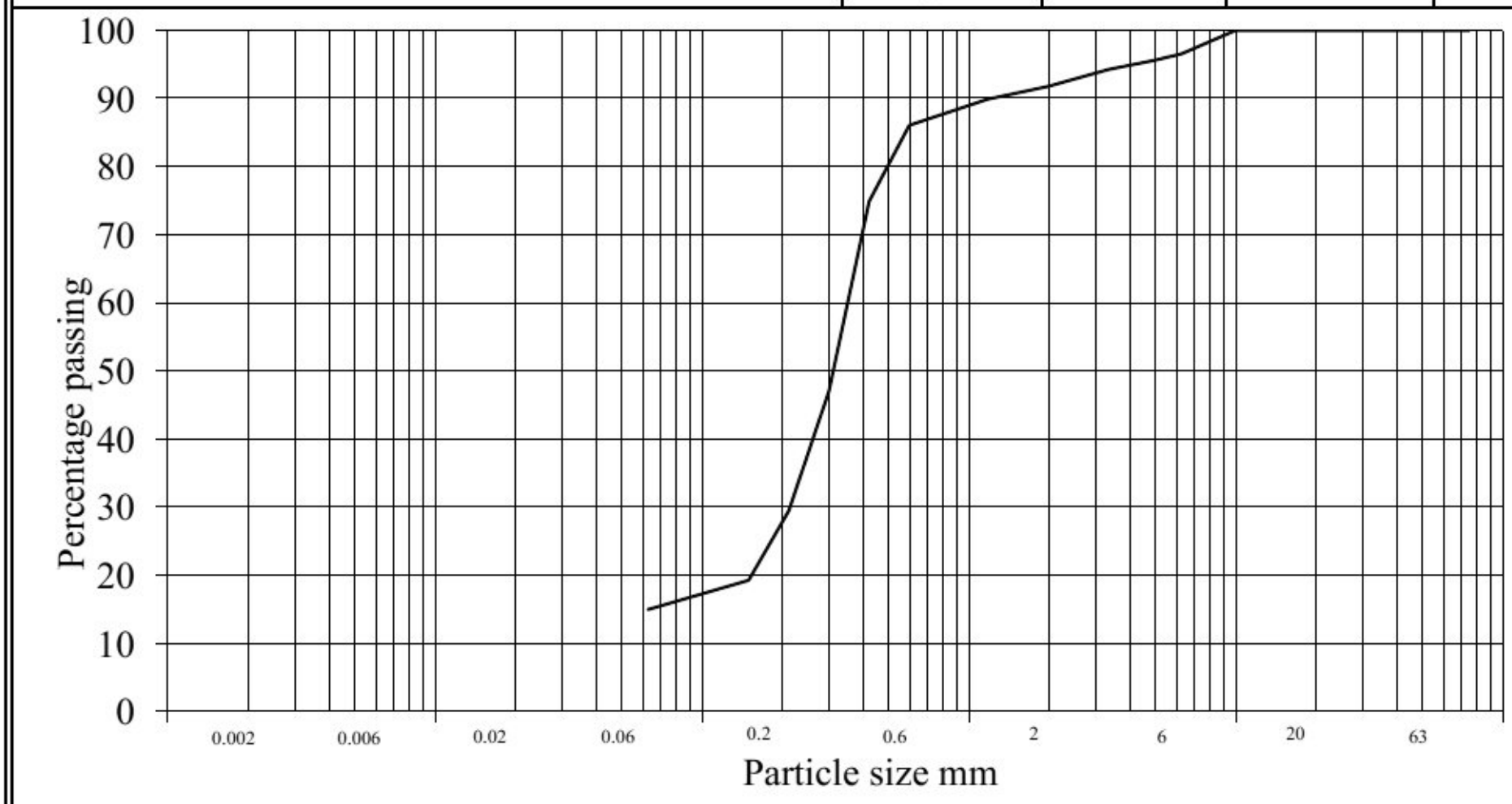
Site: Dunsden Farm, Todenham

Test Location: CT 04
Sample Depth: 1.10m -1.50m
Sample Description:

Hydrometer No.:
SG Gs:
Water Visc. (N):
Dry Mass of Soil after pretreatment (g):

Test Method: BS 1377 : Part 2 : 1990 : 9.2

BS test sieve	Cumulative Passing - %	Hydrometer Particle Diameter	Cumulative Passing - %
75mm	100.00		
63mm	100.00		
50mm	100.00		
37.5mm	100.00		
26.5mm	100.00		
20mm	100.00		
14mm	100.00		
10mm	100.00		
6.3mm	96.60		
5mm	95.60		
3.5mm	94.30		
2mm	91.80		
1.18mm	89.90		
600µm	86.10		
425µm	74.90		
300µm	47.10		
212µm	29.50		
150µm	19.30		
63µm	15.00		



CLAY	SILT			SAND			GRAVEL			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	
15%				77%			8%			0%

PARTICLE SIZE DISTRIBUTION

Project Reference
21.03.039

JIWG

Joint Industry Working Group

Asbestos in Soil and Construction & Demolition Materials

Project Reference	21-03-03
Site Name	Dunsden Farm, Todenham
Client	James and Clare Duckett
Run by	Fiona White
Date	22-Apr-21
Scenario details	

Decision Support Tool for CAR2012 Work Categories

Stage 1

Hazard Factors

		Score
Select ACM type (run model for each type to generate 'Worst Case' output)	Bonded ACMs: cement, vinyl, composites, textured decorative coatings, bitumen products	1
Extent of degradation of ACMs at outset of work	Weathered (Slight degradation in ACM; material still retains its basic integrity)	2
Friability and degree of bonding by matrix (ACM matrix, not ground materials)	Non-friable ACM or ACM with fibres firmly linked in a matrix	0
Distribution of Visible Asbestos Across Affected Area	Sporadic/random occurrences of visible contamination by ACMs	2
Amount of asbestos fibre in selected ACM/fibre type as % of host material	Large quantities - >0.1 %wt/wt	4
Sub-total		**9**

Note: the asbestos licensing regime is unaffected by the type of asbestos fibre present in ACMs

Hazard ranking Low

JIWG

Joint Industry Working Group

Asbestos in Soil and Construction & Demolition Materials

Stage 2

Exposure Factors

		Score
Anticipated airborne fibre concentration - Control Limit or SALI?	<0.001 fibres/ml	0
Anticipated duration of exposure to asbestos	> 2 hours in a 7 day period and Up to 10 hours in a day (e.g. full time occupational exposure)	4
Activity type and effect on deterioration of ACMs during work	Maintenance tasks, significant deterioration expected	2
Best description of primary host material matrix (soil/made ground)	Fine Silt and/or Clay	1
Respirable fibre index for ACM - RIVM report 711701034 (2003)	Very low	1
Sub-total		**8**
Exposure ranking		Low
Combined hazard and exposure ranking	**17**	Low

Stage 3

Risk Assessment Outputs

Probable Licensing Status	Non-Licensed Work
RPE*	EN149 type FFP3 disposable
Dust Suppression**	Manual/localised dust suppression
Hygiene/Decontamination***	Localised and basic personal decontamination facilities

*Where RPE has to be worn continuously for long periods (e.g. more than 1-hour), then powered RPE may be necessary.
**Reduction in control measures possible if natural mitigation factors are present (e.g. raining, wet ground)
***Guide only; suitability of selected personal hygiene measures may be reviewed on a site/contamination-specific basis

JIWG

Joint Industry Working Group

Asbestos in Soil and Construction & Demolition Materials

Decision Support Tool for Receptor Risk Ranking

Stage 1

Hazard Identification		Score
Select ACM type (run model for each type to generate 'Worst Case' output)	Bonded ACMs: cement, vinyl, composites, textured decorative coatings, bitumen products	0
Extent of degradation of ACMs	Weathered (Slight degradation in ACM; material still retains its basic integrity)	2
Friability and degree of bonding by matrix (ACM matrix, not ground materials)	Non-friable ACM or ACM with fibres firmly linked in a matrix	0
Distribution of Visible Asbestos Across Affected Area	No visible ACMs/fibre bundles	0
Asbestos fibre type	Chrysotile alone	0
Sub-total		**2**
Hazard ranking		**Very Low**

Version 2, February 2017

Stage 2

Emission Factors		Score
Amount of asbestos fibre in selected ACM/fibre type as % of host material	Large quantities - ≥0.1 %wt/wt	4
Respirable fibre index for ACM - RIVM report 711701034 (2003)	Very low	1
Activity type and effect on deterioration of ACMs	High disturbance, significant deterioration expected	4
Best description of primary host material matrix	Fine Silt and/or Clay	1
Sub-total		10
Exposure ranking		Medium

Stage 3

Pathway and Receptor Sensitivity		Score	
Receptor category	Residential	No score required	
Age of Receptor	Infant (under 5)	4	
Duration of exposure/site occupancy	< 1 hour in any single day (e.g. frequent but short exposure event)	1	
Receptor ranking		**5**	**Medium**
Combined hazard, exposure and receptor ranking			**Low**
Pathway: Distance of Receptor from Source	In or within 10m of area of disturbance	4	
Pathway: Depth to impacted material	Material buried at depth, unlikely to be disturbed except for deeper construction related excavation	B	
Pathway ranking		4B	**Very Low**
Overall ranking			**Negligible**

Project Reference	21-03-03

Site Name	Dunsden Farm, Todenham
Client	James and Clare Duckett

Run by	Fiona White
Date	22-Apr-21
Reviewed by	Murray Bateman

Characterisation of scenario being evaluated	On-going risk to end users AFTER 600mm cover layer is included in areas of soft landscaping.
Interpretation of scenario ranking by DST	