Brown 2 Green

Geotechnical and Geo-environmental Consultants

GEO-ENVIRONMENTAL SITE INVESTIGATION REPORT

FORMER FIVE BELLS INN
BURES ROAD
GREAT CORNARD
CO10 0HU

Reference Number 3035/Rpt 4v1
July 2023

Prepared for

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EXECUTIVE SUMMARY

This report describes the findings of a geo-environmental site investigation of the former Five Bells Inn, Bures Road, Great Cornard, CO10 0HU. It is proposed to redevelop the site for residential usage.

At the time of the walk-over the site was occupied by a building formerly a public house which was being used as a storage accommodation area for the construction site located at the rear of the former pub car park. The site walk-over identified the made ground as a source of potential contamination.

The conceptual model prepared for the site did identify potentially active pollution linkages between the historical land use of the site and the future use as residential.

The investigation consisted of the excavation of trial pits. During the excavation, soil samples were obtained and submitted for chemical analysis.

The following conclusions were made:

The Tier I Human Health Risk Assessment has determined that the presence of individual PAHs within the underlying made ground and natural soils present in the west-central and south-central parts of the site would pose an unacceptable risk to human health of future site occupants and users.

The Tier I Controlled Water Risk Assessment has determined that there are no concentrations of potential contaminants within the underlying soils that would pose an unacceptable risk to controlled waters.

The risk assessment for bio-genic ground gas concluded that there are no concentrations at levels that would pose an unacceptable risk to human health and the proposed development.

The risk assessment in respect to the future planting and towards sensitive ecological receptors identified that the determinants at the site are at levels that would not pose an unacceptable level of risk to future planting and sensitive ecological receptors.

The risk assessment in respect to water supply infrastructure identified that the determinants at the site would not pose an unacceptable level of risk to the integrity of PE or PVC pipework.

Recommendations for remediation were made.

1 INTRODUCTION

Brown 2 Green Associates Ltd have been commissioned by DCP Developments Ltd to undertake a Geo-environmental Site Investigation of former Five Bells Inn, Bures Road, Great Cornard, CO10 0HU. The site is located at National Grid Reference 588350, 240300. The site location is presented in Figure 1.

A Phase 1 desk study was previously completed by Brown 2 Green Associates. The findings of the desk study are presented in the report titled:

- Phase I Geo-Environmental Desk Study and Preliminary Risk Assessment of Five Bells Inn, Bures Road, Great Cornard, CO10 0HU, dated January 2023, Ref: 3035/Rpt 2v1.

The report recommended that a Phase 2 intrusive site investigation should be undertaken. This report presents the findings of the Phase 2 intrusive site investigation.

A letter detailing the site investigation strategy (ref: 3035/Rpt 3v1) has been submitted for planning application DC/23/00559.

This report should be read in conjunction with the Phase 1 desk study and the site investigation strategy.

1.1 Proposed Development

The work was commissioned to provide information for a planning application to convert the existing former public house building and an outbuilding to residential usage. Each property will have a private garden. The proposed development is shown on drawing number D011.002.01 prepared by 20 Gainsborough Ltd. The proposed development layout is presented in Appendix II.

1.2 Objectives

The objectives of the work are to provide an Environmental Risk Assessment to inform about potential re-development of the site, address the requirements of the National Planning Policy Framework[1] and Planning Practice Guidance. These objectives are achieved by:

- Investigation of any identified pollution linkages to determine any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors; and,

- Provide a factual and interpretive report and recommendations on any potential development issues.

The investigation has been completed using the initial Conceptual Site Model (CSM) developed as part of the desk study. This CSM examines potential Source-Pathway-Receptor contaminant linkages in relation to identified or potential contamination issues at the site and vicinity, incorporating them into a Preliminary Risk Assessment. This report has been completed in accordance with Environment Agency Contaminated Land Risk Management.

The Preliminary Risk Assessment seeks to establish firstly whether unacceptable risk as defined in Part 2A of the Environmental Protection Act 1990 is present and secondly whether a possibility of

[1] National Planning Policy Framework, Department for Communities and Local Government, July 2021.

harm to controlled waters, human health or property is present and further investigation is therefore needed to better inform about risk assessment.

Consideration of geotechnical/engineering aspects of the proposed development falls outside the scope of this assessment.

1.3 Sources of Information

Background information relating to the site was acquired and referenced from the following sources:

- Phase I Geo-Environmental Desk Study and Preliminary Risk Assessment of Five Bells Inn, Bures Road, Great Cornard, CO10 0HU, dated January 2023, Ref: 3035/Rpt 2v1.

2 SITE LOCATION AND SETTING

This section presents a summary of the site location and setting. A detailed description can be found in the previous report. Where changes have been identified, these have been noted.

2.1 Site Location

The site is located in a residential area on the eastern side of Bures Road. The site location is presented in Figure 1.

The site layout is presented in Figure 2.

At the time of the site walk-over the western side of the site was occupied by the former Five Bells Inn building and fronts onto Bures Road. The building is two-storey with a slate roof. The building has been stripped of all internal fittings. The former public house including the surrounding area were being used as a construction compound for the development of the houses at the rear of the former car park.

Along the southern boundary there the two derelict buildings, one being an open fronted cart lodge and the other an outbuilding (Shed 1) for the public house. The buildings were being used for the storage of construction materials. Immediately west there is the footprint of three sheds (Shed 2, 3 and 4) that have been demolished.

The remainder of the site was the former car park that is paved with asphalt and the access driveway to the car park. The site that is currently under development was the former pub garden.

The topography of the site is flat.

2.2 Historic Land Use

The desk study identified that the Five Bells Public House has been developed sometime between 1885 and 1887. The desk study identified that the general quality of the made ground imported for the development of the site may adversely impact the proposed future use of the site.

2.3 Geology and Hydrogeology

The British Geological Survey mapping indicates that the site is underlain by the following geology:

Drift/Solid	Geological Unit	Description	Aquifer Classification
Drift/Superficial	River Terrace Deposits (2 and 3 Terrace)	Sand and gravel	Secondary (A) Aquifer
Solid	White Chalk Subgroup Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation (Undifferentiated)	Chalk	Unproductive

There are two licenced groundwater abstraction points within 500m radius of the site. The site is in a Zone 2 Source Protection Zone.

2.4 Hydrology

The Ordnance Survey Water Network Lines indicates the nearest surface water feature is the river Stour located 120m to the west.

There are no licensed surface water abstraction points within 500m radius of the site.

The database indicates that the site does not lie in a fluvial or tidal floodplain. Flood risk rating from flooding from rivers and the sea (RoFRaS) is Very Low.

2.5 Industrial Setting

The desk study did not identify any potentially contaminative industrial sites that would present a risk to the subject site.

3 INITIAL CONCEPTUAL MODEL

Brown 2 Green Associates Ltd has developed a conceptual model to identify potential sources, migration pathways and receptors within the study area. Assuming there is an active pollution pathway linkage between the source and receptor an assessment has been made of the level of risk. The level of risk is a consideration of both:

- the likelihood of an event (probability) [takes into account both the presence of the hazard and receptor and the integrity of the pathway]; and
- the severity of the potential consequence [takes into account both the potential severity of the hazard and the sensitivity of the receptor].

The classifications of the probability of an event occurring based on C552 CIRIA, 2001[2] are presented below:

Probability		Definition
High Likelihood	> 90% of hazard receptor linkage	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor that there is harm or contamination
Likely	45-90% of hazard receptor linkage	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term
Low likelihood	10-50% of hazard receptor linkage	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	10% of hazard receptor linkage	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

The classification of the severity of an event is presented below:

Severity	Category	Definition	Examples
Severe: It is likely that the hazard source could cause harm to a designated receptor and harm would be significant.	Humans	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Water	Short term risk of pollution of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to building or property	Explosion causing building to collapse.
	Ecological systems	A short term risk to a particular ecosystem, or organism forming part of such an ecosystem.	Loss of ecosystem.
Medium: It is possible that the hazard source could cause harm to a designated receptor, but it is unlikely that the harm would be significant	Humans	Chronic damage to human health ("significant harm" as defined in the DETR, 2000).	Concentrations of a contaminant from site exceeds the generic, or site specific assessment criteria
	Controlled Water	Pollution of sensitive water resources.	Leaching of contaminants from a site to a Principal Aquifer.
	Ecological systems	A significant change in a particular ecosystem, or organism forming part of such an ecosystem.	Death of a species within a designated nature reserve.

[2] Contaminated land risk assessment. A guide to good practice (C552), D J Rudland, R M Lancefield and P N Mayell.

Severity	Category	Definition	Examples
Mild: It is possible that the hazard source could cause significant harm to a designated receptor, however it is likely to be mild	Controlled Waters	Pollution of non-sensitive water resource.	Pollution of non-classified groundwater
	Property	Significant damage to buildings/structures and crops ("significant harm" as defined in the DETR, 2000). Damage to sensitive buildings/structures or the environment.	Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor: The potential hazard source cannot cause significant harm to the receptor.	Financial or project	Harm, although not necessarily significant harm, which may result in a financial loss, or an expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as Personal Protective Clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings/structures	The loss of plants in landscaping scheme. Discolouration of concrete.

The comparison of Likelihood against Severity is presented below:

		Severity			
		Severe	**Medium**	**Mild**	**Minor**
Likelihood	**High Likelihood**	**Very High Risk**	**High Risk**	**Moderate Risk**	**Moderate / Low Risk**
	Likely	**High Risk**	**Moderate Risk**	**Moderate / Low Risk**	**Low Risk**
	Low Likelihood	**Moderate Risk**	**Moderate / Low Risk**	**Low Risk**	**Very Low Risk**
	Unlikely	**Moderate / Low Risk**	**Low Risk**	**Very Low Risk**	**Very Low Risk**

The potential consequence of risk classifications is presented below:

Very High Risks	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 Risks	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 Risks	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that 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.
Moderate / Low Risks	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 medium to mild and professional judgement is required. Some remediation works may be required in the long term where high sensitivity receptors are involved.
Low Risks	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 Risks	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.

3.1 Potential Sources of Contamination

On-site Potential Sources

Based on the findings of the site walk-over and the desk study information review the following potential on-site sources of contaminants that may plausibly impact the site were identified:

- General quality of the made ground imported for the development of the site.

Off-site Potential Sources

No plausible off-site sources of ground contamination have been identified within a 250m radius of the subject site that may result in impact to the site that would result in an unacceptable level of risk.

3.2 Potential Pathways

Plausible pathways identified for each contaminant at are presented in the initial conceptual model detailed overleaf.

3.3 Potential Receptors

Brown 2 Green Associates Ltd has identified the following possible receptors:

- Human health - future users of the site (residential with private gardens).
- Human health - construction workers
- Controlled water (groundwater and surface water).
- Buildings and construction materials (concrete).
- Water supply pipework.

3.4 Discussion of Potential Pollutant Linkages

Potential pollution linkages identified are presented in the initial conceptual model detailed overleaf.

Initial Conceptual Model and Risk Assessment

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Probability of Risk***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
On-site Sources						
Made ground						
Metals (As, Cd, Cr, Pb, Hg, Se, Ni, V)	Ingestion of contaminated soil and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor).	Future site users	High likelihood	Medium	High	Potentially active in areas of soft landscaping and private gardens. Further assessment required.
	Ingestion of contaminated soils by direct contact. Inhalation of dust (indoor and outdoor).	Construction workers	Likely	Minor	Low	Potentially active but short-term exposure. General site practices and site PPE (gloves) will reduce exposure.
Metals (Cu, Ni, Zn)	Uptake by plants	Planting and soft landscape areas	Likely	Minor	Low	Potentially active in areas to be developed as soft landscaping and gardens. Further assessment required.
PAHs in ash and coal tar	Ingestion of contaminated soil and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor).	Future site users	Likely	Medium	Moderate	Potentially active in areas of soft landscaping and private gardens. Further assessment required.
	Ingestion of contaminated soil and dust by direct contact. Inhalation of dust (indoor and outdoor).	Construction workers	Likely	Minor	Low	Potentially active but short-term exposure. General site practices and site PPE (gloves) will reduce exposure.
	Downward and lateral migration.	Groundwater Surface Water	Low likelihood	Medium	Moderate/Low	Potentially active.
	Contact with contaminated soils.	Water supply infrastructure	Likely	Medium	Moderate	Potentially active.

Potential Contaminant	***Potential migration pathway***	***Potential Receptors***	***Probability of Risk***	***Severity***	***Risk Classification***	***Comments*** ***Active/Inactive***
Asbestos	Inhalation of fibres.	Future site users and construction workers	Likely	Severe	Moderate	Potentially active.
Ground gas	Through soil.	Future users and buildings	Unlikely	Medium	Low	Potentially active should made ground be identified at thickness greater than 2m and with high organic matter content to act as source.

4 SITE INVESTIGATION

4.1 Exploratory Fieldwork

Five trial pits (TP21 to TP25) were excavated using a 2t digger on 3rd July 2023 to a maximum depth of 1.3m below surface.

The sample locations were based on the site conceptual model to provide a general assessment of the quality beneath the soils beneath site and the potential source areas listed in the table below. The sampling locations are illustrated in Figure 3.

Sample Location	Rational/Potential Source Area
TP21	General assessment of the ground from the north-western part of the site and within the proposed garden of Unit 1.
TP22	General assessment of the ground from the western part of the site and within the proposed garden of Unit 2.
TP23	General assessment of the ground from the south-western part of the site and within the proposed garden of Unit 3.
TP24	General assessment of the ground from the south-central part of the site and within a proposed garden.
TP25	General assessment of the ground from the south-eastern part of the site and within a proposed garden.

Soil samples destined for chemical testing were collected in laboratory prepared jars. Samples for organic analysis were placed in amber glass jars, samples for volatile analysis in vials with septums and samples for inorganic analysis in plastic tubs. During the site works recovered soils were geologically logged by an experienced Geo-environmental Engineer. The geological logs are presented in Appendix VI.

4.2 Chemical Analysis

The soil samples were submitted to Eurofins/Chemtest Ltd of Newmarket, Suffolk. The chemical analysis was carried out under UKAS/MCERTS accreditation protocols. The chemical analysis was carried out in accordance with the findings of the Phase I Desk Study (Brown 2 Green Associates Report 3035/Rpt 2v1), the proposed investigation strategy (Rpt 3035/Rpt 3 v1) and the observations made during the site works. The chemical testing programme included.

- Metals Suite (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn, V);
- Speciated PAH (USEPA 16);
- TPH – CWG;
- Organic Matter;
- pH;
- Soluble Sulphate; and
- Asbestos fibres

5 RESULTS

5.1 Summary of Site Investigation Observations

Ground Conditions

The geological logs are presented in Appendix VI.

Made Ground

The trial pits indicate that the hardstanding is underlain by up to 1.0m of made ground. The made ground generally consists of clayey sand and gravel with frequent bricks. Carbonaceous materials were noted in the made ground from TP22 and TP24.

Natural Strata

The made ground is underlain by brown silty sand and gravel. Gravel is fine to coarse, angular to subrounded flints.

Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of contamination was noted.

Groundwater Conditions

During the investigation no groundwater strikes or seepages were recorded. All boreholes were dry on completion of drilling.

It should be noted that groundwater levels can fluctuate seasonally and therefore, may be encountered at higher or lower elevations than those recorded in this site investigation.

5.2 Laboratory Results

The chemical analysis of the soil samples was undertaken by Eurofins/Chemtest Ltd of Newmarket under MCERT and UKAS accreditation. The test certificates are included in Appendix IV.

6 RISK ASSESSMENT

6.1 Human Health

6.1.1 Approach

Brown 2 Green Associates Ltd has undertaken a Tier 1 Human Health Risk Assessment to determine if any potential contaminants within the underlying soil pose an unacceptable level of risk to the identified human health receptors.

At a Tier 1 stage the long term (chronic) human health toxicity of the soil has been assessed with reference to Generic Assessment Criteria (GAC) detailed in Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham (Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3086). If no generic GAC (CIEH/LQM) is available, reference has been made to Category 4 Screening Values or GAC have been determined by Brown 2 Green Associates Ltd using CLEA 1.06 with adjustments based on input data used in the calculation of Category 4 Screening Values.

For the assessment of risk to human health from groundwater a qualitative risk assessment has been undertaken. Within this section we have only considered the risk to users of the site. An assessment of risk to human health beyond the boundaries of the site is considered as part of the risk to controlled waters.

6.1.2 Risk from Soil

Risk to Future Site Users

For the purposes of the Tier 1 assessment Brown 2 Green Associates Ltd have initially compared the laboratory test data directly to the relevant Brown 2 Green Associates Ltd Tier 1 human health screening criteria for residential with plant uptake end use with a soil organic matter content of 1%. The results of this direct comparison are presented below:

Determinant	Units	GAC	n	Max Conc.	Locations above GAC	Path-way	Assessment
Arsenic	mg/kg	37	10	27	-	1	No Further Action
Cadmium	mg/kg	11	10	0.2	-	5	No Further Action
Chromium (III)	mg/kg	910	10	29	-	4	No Further Action
Copper	mg/kg	2400	10	91	-	5	No Further Action
Mercury (Inorganic)	mg/kg	40	10	0.3	-	1	No Further Action
Nickel	mg/kg	130	10	32	-	1	No Further Action
Lead *	mg/kg	200	10	170	-	1, 4	No Further Action
Selenium	mg/kg	250	10	0.7	-	1	No Further Action
Vanadium	mg/kg	410	10	64	-	5	No Further Action
Zinc	mg/kg	3700	10	77	-	5	No Further Action
Naphthalene	mg/kg	2.3	10	0.41	-	5, 2	No Further Action
Acenaphthylene	mg/kg	170	10	0.17	-	5	No Further Action
Acenaphthene	mg/kg	210	10	0.25	-	5	No Further Action
Fluorene	mg/kg	170	10	0.11	-	1, 5	No Further Action
Phenanthrene	mg/kg	95	10	0.94	-	5	No Further Action
Anthracene	mg/kg	2400	10	0.32	-	5	No Further Action
Fluoranthene	mg/kg	280	10	3.3	-	5	No Further Action

Determinant	Units	GAC	n	Max Conc.	Locations above GAC	Path-way	Assessment
Pyrene	mg/kg	620	10	3.3	-	1, 5	No Further Action
Benzo(a)anthracene	mg/kg	7.2	10	2.0	-	1	No Further Action
Chrysene	mg/kg	15	10	2.5	-	1	No Further Action
Benzo(b)fluoranthene	mg/kg	2.6	10	3.7 3.4 4.2	**TP22** (0.1-0.6m); **TP22** (0.6-0.7m); **TP24** (0.15-0.5m).	1	Further Assessment (see below)
Benzo(k)fluoranthene	mg/kg	77	10	1.5	-	1	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	10	3.5 3.3 3.2	**TP22** (0.1-0.6m); **TP22** (0.6-0.7m); **TP24** (0.15-0.5m).	1	Further Assessment (see below)
Indeno(123-cd)pyrene	mg/kg	27	10	3.4	-	1	No Further Action
Dibenz(ah)anthracene	mg/kg	0.24	10	0.66 0.72 0.42	**TP22** (0.1-0.6m); **TP22** (0.6-0.7m); **TP24** (0.15-0.5m).	1	Further Assessment (see below)
Benzo(ghi)perylene	mg/kg	320	10	3.10	-	1	No Further Action
TPH C_5-C_6 (aliphatic)	mg/kg	42	10	<0.05	-	2	No Further Action
TPH C_6-C_8 (aliphatic)	mg/kg	100	10	<0.10	-	2	No Further Action
TPH C_8-C_{10} (aliphatic)	mg/kg	27	10	<0.05	-	2	No Further Action
TPH C_{10}-C_{12} (aliphatic)	mg/kg	130	10	2.3	-	2	No Further Action
TPH C_{12}-C_{16} (aliphatic)	mg/kg	1100	10	3.9	-	1	No Further Action
TPH C_{16}-C_{35} (aliphatic)	mg/kg	65,000	10	4.7	-	1	No Further Action
TPH C_{35}-C_{44} (aliphatic)	mg/kg	65,000	10	<10	-	1	No Further Action
TPH C_5-C_7 (aromatic)	mg/kg	70	10	<0.05	-	2	No Further Action
TPH C_7-C_8 (aromatic)	mg/kg	130	10	<0.05	-	2	No Further Action
TPH C_8-C_{10} (aromatic)	mg/kg	34	10	<0.05	-	2	No Further Action
TPH C_{10}-C_{12} (aromatic)	mg/kg	74	10	<1.0	-	2	No Further Action
TPH C_{12}-C_{16} (aromatic)	mg/kg	140	10	<1.0	-	1	No Further Action
TPH C_{16}-C_{21} (aromatic)	mg/kg	260	10	4.1	-	1	No Further Action
TPH C_{21}-C_{35} (aromatic)	mg/kg	1100	10	58	-	1	No Further Action
TPH C_{35}-C_{44} (aromatic)	mg/kg	1100	10	8.7	-	1	No Further Action

Notes
Main Exposure Pathways: 1 = Soil and dust Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact, 4 = Dust Inhalation, 5 = consumption of home grown produce.

Abbreviations: GAC = General Assessment Criteria, n = number of samples.

Tier 1 GAC are based on Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

* - Category 4 Screening Level.
** - EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment January 2010.
*** - Brown 2 Green HH-GSV using CLEA V 1.06 and tox data from DEFRA/Environment Agency SGV.

Asbestos was not identified in any of the soil samples submitted for screening analysis.

Due to the limited number of samples, it is considered that a statistical assessment is not relevant in this scenario.

Within the made ground identified within TP22 (0.1-0.6m), TP22 (0.6-0.7m) and TP24 (0.15-0.5m) concentrations of benzo(b)fluoranthene (maximum concentration 4.2mg/kg), benzo(a)pyrene (maximum concentration 3.5 mg/kg) and dibenzo(a,h)anthracene (maximum concentration 0.72 mg/kg) exceed the relevant GAC of 2.6mg/kg for benzo(b)fluoranthene, 2.2mg/kg for benzo(a)pyrene and 0.24 mg/kg for dibenzo(a,h)anthracene. Carbonaceous materials were noted within the made ground of TP22 and TP24. At the concentrations present it is considered the individual PAH's will present an unacceptable level of risk to human health in areas proposed to be developed as private gardens as active pollution pathways will be created.

To further determine the source of the polycyclic aromatic hydrocarbon compounds, an assessment based upon a source signature double ratio plot has been derived using four polycyclic aromatic hydrocarbon compounds (benzo(a)anthracene, chrysene, fluoranthene and pyrene). This has determined whether the high concentrations of polycyclic aromatic hydrocarbons are anticipated to be petroleum, combustion, or coal derived. It is possible to differentiate petroleum based hydrocarbon concentrations from natural organic units by determining the rates of combustion and the relative losses of polycyclic aromatic hydrocarbon compounds within samples analysed. Forensic environmental scientists, have investigated the relationships between many combinations of polycyclic aromatic hydrocarbon compounds and it is generally considered the four compounds mentioned above have a suitable and representative correlation for this assessment.

The method of assessment has been derived from Jones Environmental Forensics' extensive knowledge with regards to PAH signatures as well as the extensive work completed by Environmental Forensic scientists such as H J Costa and T C Sauer. Jones Environmental Forensics Ltd have been using this method for tracing hydrocarbon sources for many years and have pooled their extensive database of material type traces for their graphic representation.

The results of the double ratio plot indicate that the source of the polycyclic aromatic hydrocarbons is a coal derived product. A copy of the chart is presented in Appendix V.

Risk to Construction Workers

In respect to the risk to construction workers, this report and the generic assessment criteria (GAC) consider long term and chronic risk to humans based on defined exposure scenarios set out in the CLEA model. In some cases, contaminants may also pose acute hazards to workers at a site, or a worker's exposure scenario may differ from the scenarios considered when deriving the GAC. As exposure times for construction workers are generally short term, risks from site contamination are generally addressed through the use of appropriate working procedures and the use of personal protective equipment (PPE) in line with the Management of Health and Safety at Work Regulations (1999), Construction (Design) Management Regulations (2007) for some sites and the Control of Substances Hazardous to Health Regulations (2002).

6.1.3 Risk from Groundwater

As no pollution linkages have been identified, it is considered contamination in the groundwater beneath the site will not pose an unacceptable level of risk to human health.

6.2 Ground Gas

From the results of the site investigation, no sources of ground gas that would result in the generation of volumes of biogenic gas that would pose an unacceptable level of risk to human health and the proposed development have been identified. The Conceptual Site Model prepared for the Preliminary Risk Assessment did not identify any off-site sources. From the assessment it is

considered that ground gas will not pose a significant risk to human health and the development.

6.3 Risk to Controlled Water

To assess risk to controlled waters from the leaching of determinants from soil, a Qualitative Risk Assessment has been made based on the concentrations identified within the soil samples and site conditions. From the results it is considered that concentrations will not be mobilised at concentrations that would pose an unacceptable level of risk to controlled waters.

6.4 Risk to Planting

An assessment of risk to from potentially phytotoxic metal compounds has been completed. In the absence of published assessment criteria specifically for contaminated land, GAC have been obtained from legislation (UK and European) and guidance related to the use of sewage sludge on agricultural fields.

For the assessment values defined in The Sludge (use in Agriculture) Regulations 1989 (Public Health England, Wales and Scotland), as amended in 1990 and The Sludge (use in Agriculture) Regulations (Northern Ireland) SR No, 245, 1990 have been adopted. In addition, the Department of Environment (DoE) produced a Code of Practice (CoP) (Updated 2nd Edition) in 2006 which provided guidance on the application of sewage sludge on agricultural land. The specified limits of concentrations of selected elements in soil are presented in the 2nd Edition of the DoE Code of Practice and are designed to protect plant growth.

As all concentrations are below their respective assessment criteria, it is considered that the concentrations of phytotoxic metals are not at levels that would pose an unacceptable level of risk to planting.

6.5 Risk to Construction Materials

The assessment of the risk to concrete from the concentrations of sulphate and the pH in the soil has been made using BRE guidance Special Digest 1:2005 Concrete in Aggressive Ground.

Sulphate concentrations of between <10mg/l and 200mg/l and pH values of 8.0 to 8.8 were recorded in the soils. The site has been assessed as brownfield due to the presence of previous developments and made ground of unknown origin and a static groundwater regime apportioned in view of the findings of the boreholes.

Following the guidance set out in the Digest the characteristic sulphate content is 200mg/l and the characteristic pH is 8.0 in the soil; the Design Sulphate class for the site is DS-1 and the Aggressive Environment for Concrete Class is AC-1. Based on the results of the assessment it is considered that the made ground beneath the site will not pose an unacceptable level of risk to concrete through acid attack.

This recommendation is based on samples taken in the near surface materials on site. If deeper foundations are required additional testing should be undertaken and the conclusions of this section should be re-assessed in light of the additional test results available.

6.6 Risk to Water Supply Pipe

The assessment of risk to pipe work used in the potable water supply has been made using UK Water Industry Research (UKWIR) "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21)" January 2011 and supplement "Contaminated Land

Assessment Guidance" dated January 2014. The results from samples of made ground (through which any new water supply pipes are likely to pass) have been compared with the threshold values listed in the UKWIR guidance. It should be noted that the threshold values are for use by designers in the selection of appropriate pipe materials. Exceedance of a threshold value indicates only that there could be a 'water quality issue'. Threshold values are generally protective of taste and odour quality of water in plastic water pipes and only threshold values for benzene and MTBE are protective of human health.

Beneath the site the results indicate that concentrations are at levels that enable PE/PVC pipe work to be adopted. It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

6.7 Risk to Sensitive Ecological Receptors

As no receptors were identified, it is considered that contamination will not pose an unacceptable risk to ecological receptors.

6.8 Risk to Historical Structures and Monuments

As no receptors were identified, it is considered that contamination will not pose an unacceptable risk to historical structures and monuments or sites of historical interest.

7 REVISED CONCEPTUAL MODEL

In the light of the results of the site investigation, results of the chemical analysis and the risk screening assessment presented in the previous sections the conceptual model developed has been updated. The conceptual model is presented below:

Source	***Potential migration pathway***	***Potential Receptors***	***Discussion, Remedial or Precautionary Measures and Mitigating Factors***
PAHs	Soil and dust ingestion	Residents and construction workers	Clean capping in private gardens is required.

8 GEO-ENVIRONMENTAL CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

The Tier I Human Health Risk Assessment has determined that the presence of individual PAHs within the underlying made ground and natural soils present in the areas to be developed as private gardens would pose an unacceptable risk to human health of future site occupants and users.

The Tier I Controlled Water Risk Assessment has determined that there are no concentrations of potential contaminants within the underlying soils that would pose an unacceptable risk to controlled waters.

The risk assessment for bio-genic ground gas concluded that there are no concentrations at levels that would pose an unacceptable risk to human health and the proposed development.

The risk assessment in respect to the future planting and towards sensitive ecological receptors identified that the determinants at the site are at levels that would not pose an unacceptable level of risk to future planting and sensitive ecological receptors.

The risk assessment in respect to water supply infrastructure identified that the determinants at the site would not pose an unacceptable level of risk to the integrity of PE or PVC pipework.

8.2 Recommendations

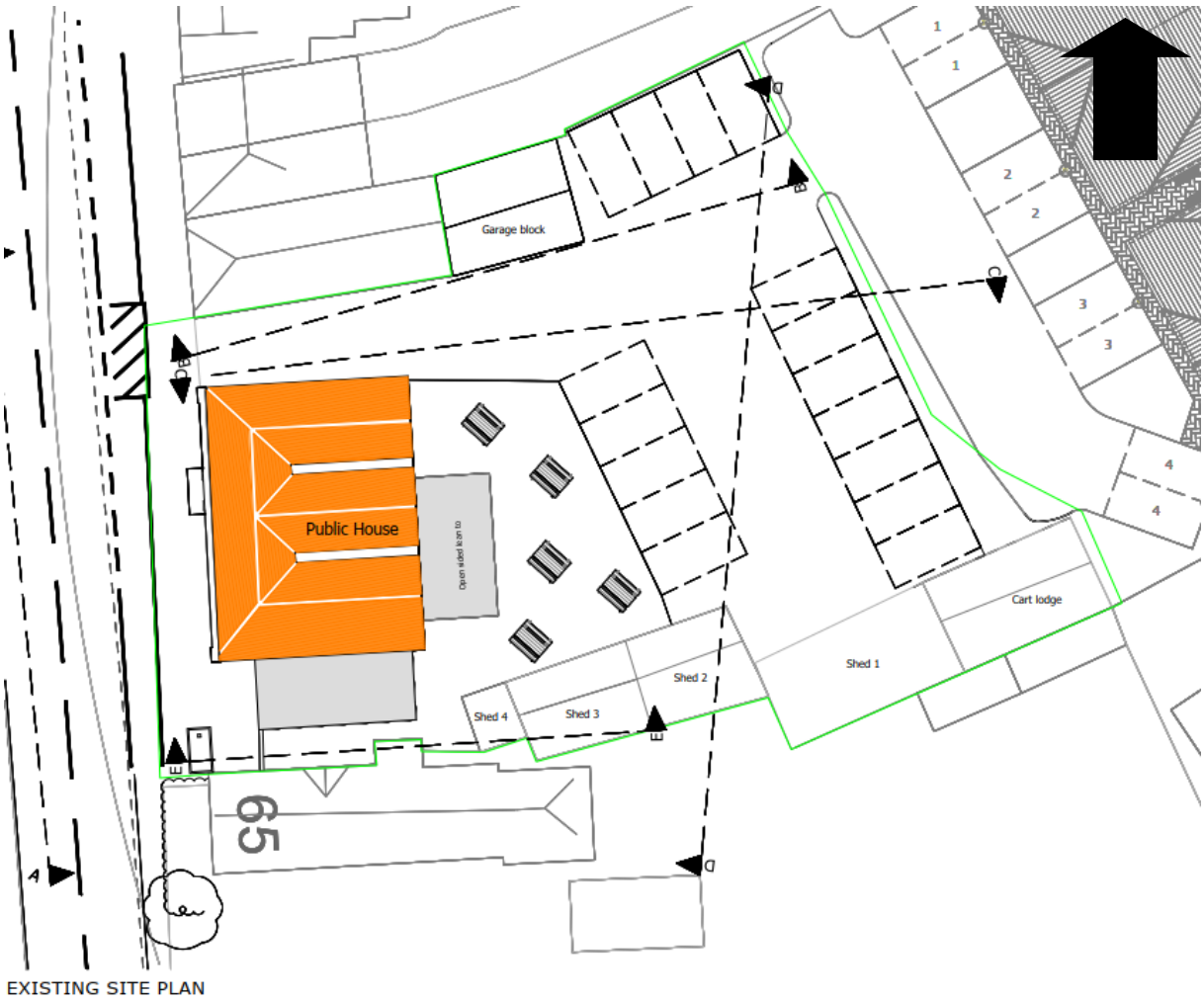
In garden areas, soils should be removed from the made ground to an estimated depth of 0.6mbgl and replaced with clean, validated, imported soils. Where the site levels are to be raised a soil barrier of 0.6m should be maintained between the surface and current site levels.

A Remediation Method Statement (RMS) to implement the above measures should be drafted in accordance with the local Environmental Health Department and the Environment Agency. This should be undertaken by a competent person. On completion of the remediation, verification should be undertaken to ensure suitable and sufficient works have been undertaken. Verification should consist of the checking of the depth of excavation or thickness of the capping layer, confirmation of suitability of the imported capping materials and if made ground is excavated, the PAH concentration is at a level below the Tier 1 Screening Values.

If any suspected contamination, underground storage tanks or chambers not previously identified is revealed during the course of construction contact should be made with an Environmental Consultant to determine suitable action to be undertaken.

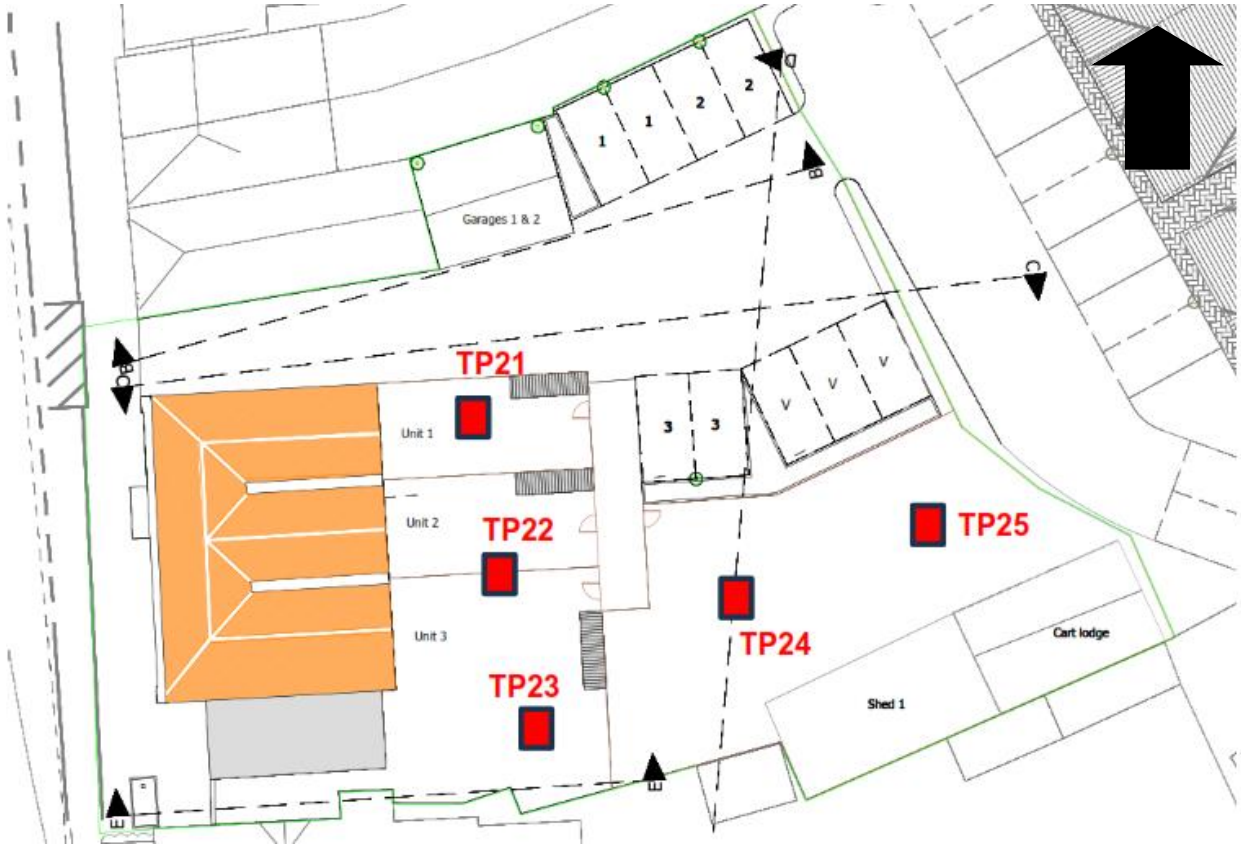
FIGURES

Project Number: 3035	Project: Five Bells Inn, Bures Road, Great Cornard	Scale: NTS
Figure 1	**Site Location Plan**	Brown 2 Green



EXISTING SITE PLAN

Project Number: 3035	Project: Five Bells Inn, Bures Road, Great Cornard	Scale: NTS
Figure 2	**Site Layout Plan**	Brown 2 Green



Project Number: 3035	Project: Five Bells Inn, Bures Road, Great Cornard	Scale: NTS
Figure 3	**Exploratory Hole Location Plan**	Brown 2 Green

APPENDIX I

LIMITATIONS AND CONSTRAINTS

Brown 2 Green Associates Limited has prepared this report in accordance with our standard Terms and Conditions solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.

Brown 2 Green Associates Ltd cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The client cannot place reliance on the report until full payment has been made. The copyright in this report and other plans and documents prepared by Brown 2 Green Associates Ltd is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of the report may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Brown 2 Green Associates Ltd in this connection without their explicit written agreement thereto by Brown 2 Green Associates Ltd.

For the work, reliance has been placed on publicly available data obtained from the sources identified and data supplied by other parties. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information. Brown 2 Green Associates Ltd does not warrant work / data undertaken / provided by others.

Due to the short timescales associated with these projects responses may not have been received from all parties. Brown 2 Green Associates Limited cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.

This report has been produced in accordance with UK policy and legislative requirements for land and groundwater contamination at the time the report was commissioned. Should changes in legislation or policy occur the report findings may need revisiting once the development layout is confirmed.

During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walk-over no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown or the location of the area has not been made known, or where access has not been permitted.

Access considerations, the presence of services and the activities being carried out on the site limited the positions where sampling locations could be installed and the techniques that could be used.

This report presents an interpretation of the geo-environmental information established by excavation, observation and testing. It should be noted that when investigating, or developing land it is important to recognise that sub-surface conditions may vary spatially and also with time. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.

The scope of any investigation was basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.

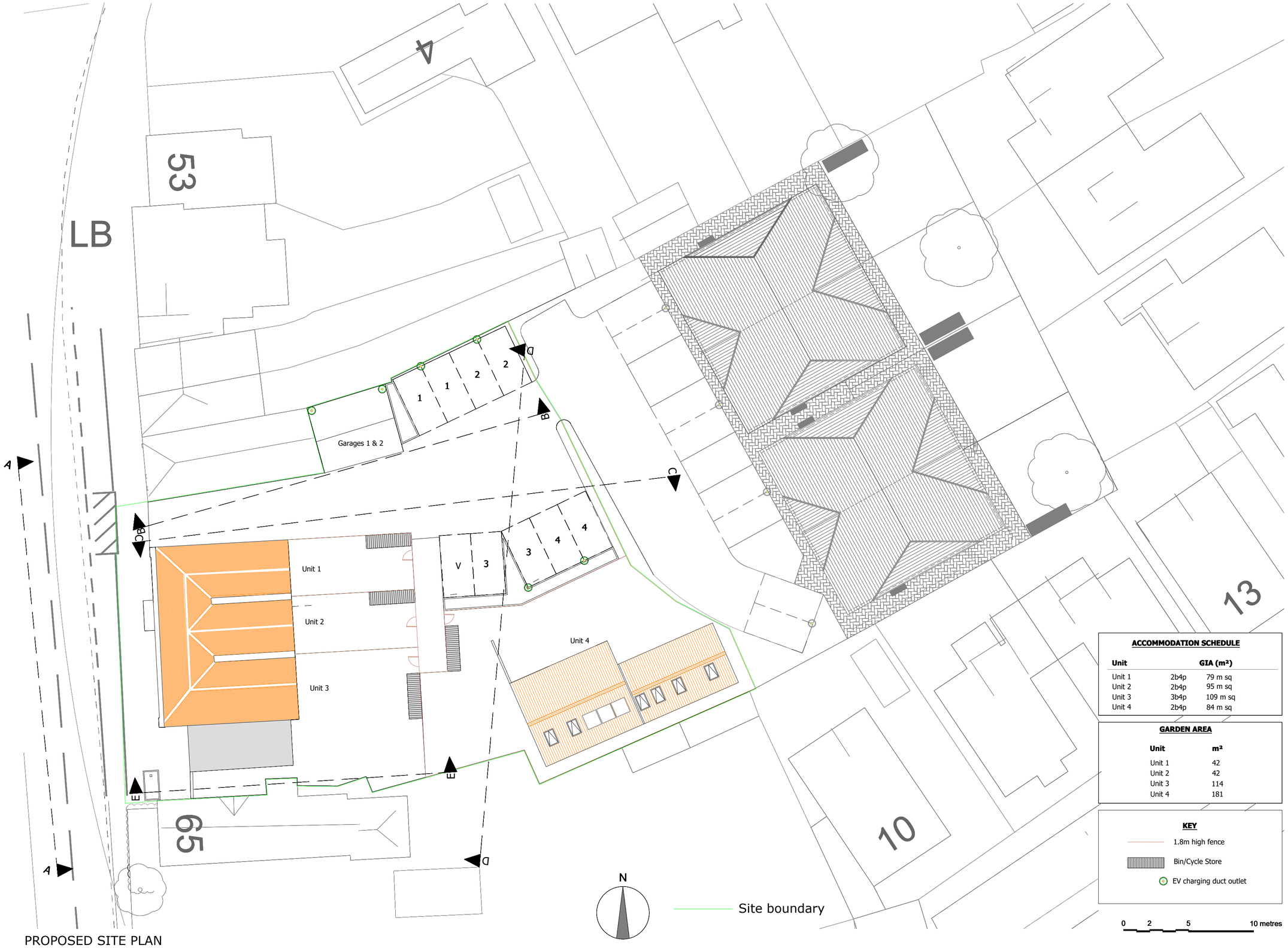
Rather, this investigation has been undertaken to provide a characterisation of the existing sub-surface geo-environmental characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

During any development programme Brown 2 Green Associates Limited should be consulted if alternative ground conditions are encountered. It assumes during any site works that the contractor will use their best endeavours to manage and control groundwater and other unforeseen ground conditions. Brown 2 Green Associates Limited will not be liable for actions taken prior to consultation.

Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and does not constitute or replace full and proper surveys.

APPENDIX II

PROPOSED DEVELOPMENT LAYOUT



PROPOSED SITE PLAN

ACCOMMODATION SCHEDULE

Unit		GIA (m²)
Unit 1	2b4p	79 m sq
Unit 2	2b4p	95 m sq
Unit 3	3b4p	109 m sq
Unit 4	2b4p	84 m sq

GARDEN AREA

Unit	m²
Unit 1	42
Unit 2	42
Unit 3	114
Unit 4	181

KEY

1.8m high fence

Bin/Cycle Store

EV charging duct outlet

Notes:

1. DO NOT SCALE FROM DRAWINGS.
2. WHERE APPLICABLE, CHECK ALL DIMENSIONS ON SITE PRIOR TO COMMENCING CONSTRUCTION
3. REPORT ALL CONFLICTS OF INFORMATION AND/OR DESIGN ISSUES TO 20 GAINSBOROUGH LTD
4. IF IN DOUBT CONTACT 20 GAINSBOROUGH LTD

REV: DATE: DESCRIPTION: BY:

20 Gainsborough Ltd
3 Warners Mill
Silks Way
Braintree
CM7 3GB

Client:
20 Gainsborough Ltd

Project:
Five Bells
Bures Road Great Cornard Sudbury Suffolk
CO10 0HU

Title:
5 Bells public house
Proposed site plan

JOB No:	SCALE:	SHEET SIZE:
G011.22	1:200 @ A2	

Level:	Drawing No:	REV:	STATUS:
	D011.002.01	1	I

Drawn By:	Date:	Checked By:	Date:
DW	16.11.22		

APPENDIX III

GEOLOGICAL LOGS

GEOLOGICAL LOG

Project:	Five Bells Inn	**Trial Pit Number:**	TP21
Location:	Bures Road Great Cornard CO10 0HU	**Date of Excavation:**	03-Jul-23
Project No:	3035	**Type of Machine**	2t Excavator
Client	DCP Developments Ltd	**Co-ordinates**	N/A
Logged By:	RMI	**Ground Level (m AOD):**	N/A

Sample/Test							
Sample / Test	Result	Sample range	Description	Log	Depth (m)	Thickness (m)	Ground Water (m)
			MADE GROUND - Asphalt.		0.1	0.1	
T,J,V		0.1-0.6	MADE GROUND - Dark greyish brown clayey SAND and GRAVEL with frequent bricks and rare concrete. Gravel of fine to coarse, angular to subrounded flint.		0.8	0.7	
T,J,V		0.8-1.0	MADE GROUND - Brown clayey SAND and GRAVEL with occasional ceramic tiles. Gravel of fine to coarse, angular to subrounded flint.		1.0	0.2	
			Brown silty SAND and GRAVEL. Gravel of fine to coarse, angular to subrounded flint.	o . o . o o . o o o o	1.3	>0.3	
			End of pit.		2.0		
					3.0		
					4.0		
					5.0		
					6.0		
					7.0		

Remarks: Dry on completion.

Dimensions and Orientation: L=1.5m; w=0.45m. N-S

Stability: Stable.

Keys J - 250 or 500ml Jar, T - Tub, V - Vial or 60ml jar, D - Small Disturbed, B - Large bulk sample, W - Water sample, HSV - hand shear vane

GEOLOGICAL LOG

Project:	Five Bells Inn	**Trial Pit Number:**	TP22
Location:	Bures Road		
	Great Cornard		
	CO10 0HU	**Date of Excavation:**	03-Jul-23
Project No:	3035	**Type of Machine**	2t Excavator
Client	DCP Developments Ltd	**Co-ordinates**	N/A
Logged By:	RMI	**Ground Level (m AOD):**	N/A

Sample/Test			Description	Log	Depth (m)	Thickness (m)	Ground Water (m)
Sample / Test	Result	Sample range					
			MADE GROUND - Asphalt.		0.1	0.1	
			MADE GROUND - Dark greyish brown clayey SAND and GRAVEL with frequent yellow and red bricks and concrete and carbonaceous materials. Gravel of fine to coarse, angular to subrounded flint.				
T,J,V		0.1-0.6			0.6	0.5	
T,J,V		0.6-0.7	Brown silty SAND and GRAVEL. Gravel of fine to coarse, angular to subrounded flint.	o . o . o	0.7	>0.1	
			End of pit.		1.0		
					2.0		
					3.0		
					4.0		
					5.0		
					6.0		
					7.0		

Remarks: Dry on completion.

Dimensions and Orientation: L=1.2m; w=0.45m. N-S

Stability: Stable.

Keys J - 250 or 500ml Jar, T - Tub, V - Vial or 60ml jar, D - Small Disturbed, B - Large bulk sample, W - Water sample, HSV - hand shear vane

GEOLOGICAL LOG

Project:	Five Bells Inn	**Trial Pit Number:**	TP23
Location:	Bures Road Great Cornard CO10 0HU	**Date of Excavation:**	03-Jul-23
		Type of Machine	2t Excavator
Project No:	3035	**Co-ordinates**	N/A
Client	DCP Developments Ltd	**Ground Level (m AOD):**	N/A
Logged By:	RMI		

Sample/Test			Description	Log	Depth (m)	Thickness (m)	Ground Water (m)
Sample / Test	Result	Sample range					
			MADE GROUND - Concrete over a thin layer of chalk.		0.1	0.1	
			MADE GROUND - Dark greyish brown clayey SAND and GRAVEL with frequent bricks and rare concrete. Gravel of fine to coarse, angular to subrounded flint.				
T,J,V		0.1-0.6			0.6	0.5	
			Brown silty SAND and GRAVEL.	o . o . o o . o o o o o . o			
T,J,V		0.6-0.8	Gravel of fine to coarse, angular to subrounded flint.		1.0	>0.4	
			End of pit.				
					2.0		
					3.0		
					4.0		
					5.0		
					6.0		
					7.0		

Remarks: Dry on completion.

Dimensions and Orientation: L=1.5m; w=0.45m. N-S

Stability: Stable.

Keys J - 250 or 500ml Jar, T - Tub, V - Vial or 60ml jar, D - Small Disturbed, B - Large bulk sample, W - Water sample, HSV - hand shear vane

GEOLOGICAL LOG

Project:	Five Bells Inn	**Trial Pit Number:**	TP24
Location:	Bures Road Great Cornard CO10 0HU	**Date of Excavation:**	03-Jul-23
		Type of Machine	2t Excavator
Project No:	3035	**Co-ordinates**	N/A
Client	DCP Developments Ltd	**Ground Level (m AOD):**	N/A
Logged By:	RMI		

Sample/Test			Description	Log	Depth (m)	Thickness (m)	Ground Water (m)
Sample / Test	Result	Sample range					
			MADE GROUND - Concrete.		0.15	0.15	
			MADE GROUND - Dark greyish brown clayey SAND and GRAVEL with frequent bricks and rare concrete and carbonaceous materials. Gravel of fine to coarse, angular to subrounded flint.				
T,J,V		0.15-0.5			0.5	0.35	
			Orangish brown gravelly SAND.	… O …o			
T,J,V		0.5-0.7	Gravel of fine to coarse, angular to subrounded flint.	o. . .o .			
				… O …o			
				o. . .o .			
				… O …o	1.0	>0.5	
			End of pit.				

2.0

3.0

4.0

5.0

6.0

7.0

Remarks: Dry on completion.

Dimensions and Orientation: L=1.5m; w=0.45m. E-W.

Stability: Stable.

Keys J - 250 or 500ml Jar, T - Tub, V - Vial or 60ml jar, D - Small Disturbed, B - Large bulk sample, W - Water sample, HSV - hand shear vane

GEOLOGICAL LOG

Project:	Five Bells Inn	**Trial Pit Number:**	TP25
Location:	Bures Road		
	Great Cornard		
	CO10 0HU	**Date of Excavation:**	03-Jul-23
Project No:	3035	**Type of Machine**	2t Excavator
Client	DCP Developments Ltd	**Co-ordinates**	N/A
Logged By:	RMI	**Ground Level (m AOD):**	N/A

Sample/Test			Description	Log	Depth (m)	Thickness (m)	Ground Water (m)
Sample / Test	Result	Sample range					
T,J,V		0.0-0.4	MADE GROUND - Dark greyish brown clayey SAND and GRAVEL with frequent bricks and rare concrete fragments. Gravel of fine to coarse, angular to subrounded flint.		0.4	0.4	
T,J,V		0.4-0.6	Orangish brown gravelly SAND. Gravel of fine to coarse, angular to subrounded flint.	… O …o o. . .o . … O …o o. . .o . … O …o o. . .o .	1.0	>0.6	
			End of pit.		2.0		
					3.0		
					4.0		
					5.0		
					6.0		
					7.0		

Remarks: Dry on completion.

Dimensions and Orientation: L=1.5m; w=0.45m. E-W.

Stability: Stable.

Keys J - 250 or 500ml Jar, T - Tub, V - Vial or 60ml jar, D - Small Disturbed, B - Large bulk sample, W - Water sample, HSV - hand shear vane

APPENDIX IV

CHEMICAL ANALYSIS REPORTS

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

Amended Report

Report No.:	23-22779-2		
Initial Date of Issue:	11-Jul-2023	**Date of Re-Issue:**	17-Jul-2023
Re-Issue Details:	This report has been revised and directly supersedes 23-22779-1 in its entirety		
Client	Brown 2 Green Associates		
Client Address:	Suite 1, Wenden Court Station Road Wendens Ambo Nr. Saffron Walden Essex CB11 4LB		
Contact(s):	Philip Miles Radu Mihai Ilie		
Project	3035 Five Bells Public House Great Cornard		
Quotation No.:		**Date Received:**	05-Jul-2023
Order No.:		**Date Instructed:**	05-Jul-2023
No. of Samples:	10		
Turnaround (Wkdays):	11	**Results Due:**	19-Jul-2023
Date Approved:	17-Jul-2023		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - Soil

Project: 3035 Five Bells Public House Great Cornard

Client: Brown 2 Green Associates		**Chemtest Job No.:**			23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779
Quotation No.:		**Chemtest Sample ID.:**			1669143	1669144	1669145	1669146	1669147	1669148	1669149	1669150	1669151
		Sample Location:			TP21	TP21	TP22	TP22	TP23	TP23	TP24	TP24	TP25
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.1	0.8	0.1	0.6	0.1	0.6	0.15	0.5	0
		Bottom Depth (m):			0.6	1	0.6	0.7	0.6	0.8	0.5	0.7	0.4
		Date Sampled:			03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023
		Asbestos Lab:			DURHAM		DURHAM		DURHAM		DURHAM		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
ACM Type	U	2192		N/A	-		-		-		-		-
Asbestos Identification	U	2192		N/A	No Asbestos Detected		No Asbestos Detected		No Asbestos Detected		No Asbestos Detected		No Asbestos Detected
Moisture	N	2030	%	0.020	16	6.7	8.4	8.4	11	6.3	9.7	8.7	10
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Black	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and plastic	Stones	Stones	Stones	Stones and Roots	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Loam	Sand	Loam	Loam	Loam	Loam	Loam	Sand	Loam
pH	M	2010		4.0	8.8	8.6	8.4	8.5	8.0	8.4	8.3	8.2	8.4
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.077	0.013	0.025	< 0.010	0.20	0.038	0.028	0.023	< 0.010
Arsenic	M	2455	mg/kg	0.5	20	16	18	23	14	13	17	14	14
Cadmium	M	2455	mg/kg	0.10	0.15	< 0.10	0.14	0.17	0.15	< 0.10	0.24	< 0.10	0.18
Chromium	M	2455	mg/kg	0.5	12	20	17	20	18	17	21	19	15
Copper	M	2455	mg/kg	0.50	91	19	29	34	59	12	35	12	25
Mercury	M	2455	mg/kg	0.05	0.17	0.06	0.15	0.22	0.20	0.05	0.27	0.05	0.19
Nickel	M	2455	mg/kg	0.50	16	20	21	25	18	19	23	20	17
Lead	M	2455	mg/kg	0.50	83	27	66	95	100	25	170	16	54
Selenium	M	2455	mg/kg	0.25	0.45	0.28	0.42	0.50	0.43	0.25	0.59	0.29	0.39
Vanadium	U	2455	mg/kg	0.5	31	37	35	40	35	35	41	35	33
Zinc	M	2455	mg/kg	0.50	68	40	56	63	77	37	75	37	76
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	< 2.0	2.3	< 2.0	2.0	2.2	< 2.0
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic EPH >C12-C16	M	2690	mg/kg	1.00	3.2	2.9	2.9	3.1	3.9	3.2	2.8	3.0	2.6
Aliphatic EPH >C16-C21	M	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C21-C35	M	2690	mg/kg	3.00	4.7	< 3.0	< 3.0	< 3.0	3.1	< 3.0	< 3.0	< 3.0	< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Total Aliphatic EPH >C10-C35	M	2690	mg/kg	5.00	11	5.1	< 5.0	5.4	9.7	5.2	6.8	5.8	6.1
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00	11	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: 3035 Five Bells Public House Great Cornard

Client: Brown 2 Green Associates			**Chemtest Job No.:**		23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779	23-22779
Quotation No.:			**Chemtest Sample ID.:**		1669143	1669144	1669145	1669146	1669147	1669148	1669149	1669150	1669151
			Sample Location:		TP21	TP21	TP22	TP22	TP23	TP23	TP24	TP24	TP25
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0.8	0.1	0.6	0.1	0.6	0.15	0.5	0
			Bottom Depth (m):		0.6	1	0.6	0.7	0.6	0.8	0.5	0.7	0.4
			Date Sampled:		03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023	03-Jul-2023
			Asbestos Lab:		DURHAM		DURHAM		DURHAM		DURHAM		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21	U	2690	mg/kg	2.00	2.2	2.6	3.0	4.1	4.1	2.6	2.5	2.1	2.8
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00	58	2.4	5.4	18	6.3	< 2.0	< 2.0	< 2.0	2.5
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	8.7	1.2	1.7	4.4	2.2	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00	60	< 5.0	8.3	22	10	< 5.0	< 5.0	< 5.0	5.3
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00	69	< 10	10	27	13	< 10	< 10	< 10	< 10
Total VPH >C5-C10	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00	71	10	13	28	20	< 10	11	< 10	11
Total EPH >C10-C40	N	2690	mg/kg	10.00	79	11	15	32	22	< 10	11	< 10	11
Organic Matter	M	2625	%	0.40	4.5	< 0.40	2.0	2.6	2.1	0.54	1.7	< 0.40	1.4
Naphthalene	M	2800	mg/kg	0.10	0.23	< 0.10	0.22	0.41	0.20	0.10	0.23	< 0.10	0.18
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.17	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.25	0.20	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	0.15	< 0.10	0.86	0.94	0.48	< 0.10	0.83	0.21	0.26
Anthracene	M	2800	mg/kg	0.10	0.13	< 0.10	0.30	0.27	0.15	< 0.10	0.32	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.37	0.18	1.6	1.5	1.1	0.18	3.3	0.42	0.96
Pyrene	M	2800	mg/kg	0.10	0.38	0.24	1.4	1.4	0.97	0.17	3.3	0.33	0.88
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.29	< 0.10	1.6	1.5	0.49	< 0.10	2.0	< 0.10	0.50
Chrysene	M	2800	mg/kg	0.10	0.22	< 0.10	1.4	1.4	0.59	< 0.10	2.5	< 0.10	0.51
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.48	< 0.10	3.7	3.4	0.61	< 0.10	4.2	< 0.10	0.94
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.13	< 0.10	1.5	1.5	0.26	< 0.10	1.5	< 0.10	0.33
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.44	< 0.10	3.5	3.3	0.42	< 0.10	3.2	< 0.10	0.63
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.35	< 0.10	2.9	3.4	0.40	< 0.10	2.8	< 0.10	0.69
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.66	0.72	< 0.10	< 0.10	0.42	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.48	< 0.10	3.0	3.1	0.36	< 0.10	2.8	< 0.10	0.66
Total Of 16 PAH's	N	2800	mg/kg	2.0	3.7	< 2.0	23	23	6.0	< 2.0	28	< 2.0	6.5

Results - Soil

Project: 3035 Five Bells Public House Great Cornard

Client: Brown 2 Green Associates			**Chemtest Job No.:**		23-22779
Quotation No.:			**Chemtest Sample ID.:**		1669152
			Sample Location:		TP25
			Sample Type:		SOIL
			Top Depth (m):		0.4
			Bottom Depth (m):		0.6
			Date Sampled:		03-Jul-2023
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	
Asbestos Identification	U	2192		N/A	
Moisture	N	2030	%	0.020	5.2
Soil Colour	N	2040		N/A	Brown
Other Material	N	2040		N/A	Stones
Soil Texture	N	2040		N/A	Sand
pH	M	2010		4.0	8.3
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010
Arsenic	M	2455	mg/kg	0.5	27
Cadmium	M	2455	mg/kg	0.10	0.13
Chromium	M	2455	mg/kg	0.5	29
Copper	M	2455	mg/kg	0.50	16
Mercury	M	2455	mg/kg	0.05	0.06
Nickel	M	2455	mg/kg	0.50	32
Lead	M	2455	mg/kg	0.50	17
Selenium	M	2455	mg/kg	0.25	0.73
Vanadium	U	2455	mg/kg	0.5	64
Zinc	M	2455	mg/kg	0.50	52
Aliphatic VPH >C5-C6	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C7	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	N	2780	mg/kg	0.10	< 0.10
Total Aliphatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25
Aliphatic EPH >C10-C12	M	2690	mg/kg	2.00	< 2.0
Aliphatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05
Aliphatic EPH >C12-C16	M	2690	mg/kg	1.00	2.9
Aliphatic EPH >C16-C21	M	2690	mg/kg	2.00	< 2.0
Aliphatic EPH >C21-C35	M	2690	mg/kg	3.00	< 3.0
Aliphatic EPH >C35-C40	N	2690	mg/kg	10.00	< 10
Total Aliphatic EPH >C10-C35	M	2690	mg/kg	5.00	5.0
Total Aliphatic EPH >C10-C40	N	2690	mg/kg	10.00	< 10
Aromatic VPH >C5-C7	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C7-C8	U	2780	mg/kg	0.05	< 0.05
Aromatic VPH >C8-C10	U	2780	mg/kg	0.05	< 0.05
Total Aromatic VPH >C5-C10	U	2780	mg/kg	0.25	< 0.25
Aromatic EPH >C10-C12	U	2690	mg/kg	1.00	< 1.0

Results - Soil

Project: 3035 Five Bells Public House Great Cornard

Client: Brown 2 Green Associates			**Chemtest Job No.:**		23-22779
Quotation No.:			**Chemtest Sample ID.:**		1669152
			Sample Location:		TP25
			Sample Type:		SOIL
			Top Depth (m):		0.4
			Bottom Depth (m):		0.6
			Date Sampled:		03-Jul-2023
			Asbestos Lab:		
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Aromatic EPH >C12-C16	U	2690	mg/kg	1.00	< 1.0
Aromatic EPH >C16-C21	U	2690	mg/kg	2.00	2.2
Aromatic EPH >C21-C35	U	2690	mg/kg	2.00	< 2.0
Aromatic EPH >C35-C40	N	2690	mg/kg	1.00	< 1.0
Total Aromatic EPH >C10-C35	U	2690	mg/kg	5.00	< 5.0
Total Aromatic EPH >C10-C40	N	2690	mg/kg	10.00	< 10
Total VPH >C5-C10	U	2780	mg/kg	0.50	< 0.50
Total EPH >C10-C35	U	2690	mg/kg	10.00	< 10
Total EPH >C10-C40	N	2690	mg/kg	10.00	< 10
Organic Matter	M	2625	%	0.40	< 0.40
Naphthalene	M	2800	mg/kg	0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	0.15
Pyrene	M	2800	mg/kg	0.10	0.15
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0

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
2455	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.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection
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)
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	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-MS

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 30 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

APPENDIX V

DOUBLE RATIO PLOT

Polycyclic Aromatic Hydrocarbons Plotted on a Signature Double Plot