GEOENVIRO

SOLUTIONS LIMITED

REMEDIATION STRATEGY

FOR

BRITANNIA ROAD, GOLCAR

FOR

CHERRY TREE DEVELOPMENTS LIMITED

Report Reference: 5026-24 RS

GeoEnviro Solutions Ltd
4A Haggwood Stone Quarry
Woodhead Road
Honley
West Yorkshire
HD9 6PW

www: geoenvirosolutions.com

QUALITY ASSURANCE

	Name	Position	Date
Prepared by:	Andrew Dickinson	Associate Director	October 2024
Reviewed by:	Rob Lewis	Director	October 2024
Approved by:	Rob Lewis	Director	October 2024

ISSUE STATUS

Version	Date	Description	Prepared	Reviewed	Approved
1	October 2024	First Issue	-	-	-

LIST OF CONTENTS

APPENDICES

Appendix	Information
1	Drawings and Plans
2	Photographs
3	Chemical Testing Results
4	Chemical Screening Criteria
5	Gas and Groundwater Monitoring Results
6	Risk Assessment Matrix

LIST OF ACRONYMS

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DoE	Department of Environment
DP	Dynamic Probe
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HA	Hand Auger
HP	Hand Pit
LPA	Local Planning Authority
LQM	Land Quality Management
mbgl	Metres Below Ground Level
MP	Mackintosh Probe
NGR	National Grid Reference
NPPF	National Planning Policy Framework
OS	Ordnance Survey
SGV	Soil Guideline Value
SPOSH	Significant Possibility of Significant Harm
SPT	Standard Penetration Test
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SSV	Soil Screening Value
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample
WSV	Water Screening Value

1. INTRODUCTION

1.1 BACKGROUND AND INSTRUCTION

A ground investigation has been undertaken by Your Environment, in 2021. This is discussed in Section 3 below. Additionally, remediation has been undertaken with respect of Japanese Knotweed and was reported by Eco Control Solutions in an undated letter, this is also discussed in Section 3 below.

Kirklees MBC have expressed concerns with respect to these reports and the work undertaken and have requested an appropriate CSM be formulated, and a suitable Remediation Strategy be prepared.

GeoEnviro Solutions Ltd (GES) have therefore been instructed by Cherry Tree Developments Ltd (the Client) to prepare a Remediation Strategy, including an independent risk assessment based on the previous site investigation at the site.

A site location plan is presented as drawing 5026-24/01 in **Appendix 1**.

1.2 PROPOSED DEVELOPMENT

We understand current plans for the development of the site include:

Nine residential properties presented as four pairs of semi-detached and a single detached house, complete with gardens and driveways.

An outline development plan, as drawn by Alan Robinson, Chartered Architect, referenced SP1 rev A and dated November 2022 for the site can be reviewed within **Appendix 1**.

The risk assessment undertaken, and subsequent Remediation Strategy proposed in this report is therefore based on the proposed development as outlined here. Any variation from this may require a re-assessment and the Conceptual Site Model updating accordingly.

1.3 PARTIES TO THE PROPOSED WORKS

The principal parties to the remediation and engineering works include:

- Client.
- Developer of the site.
- Contractor for the remedial and preparatory works.
- Council: Local Planning Authority.

1.4 PLANNING CONDITION

Planning permission (ref: 2024/62/92062) has been granted for the above site. This report may make reference to conditions outlined in the planning permission.

1.5 PREVIOUS INVESTIGATIONS

Previous assessments conducted at the site comprise the following:

- Phase II Site Investigation Report, by Your Environment referenced YEX1601 and dated March 2021.
- Land Remediation at Britianna Road, by Eco Control Solutions, undated and unreferenced.

However, Kirklees MBC made the following comments with regards to these reports.

KC Environmental Health (Pollution & Noise Control)

The reports include geo-technical information, which is outside the remit of Environmental Health, this consultation response therefore only relates to the land contamination aspects of the reports. Environmental Health have already reviewed this document as part of our comments for previous permission 2021/92062. We raised several points in our response dated 18th August 2021, that require clarification. We understand that works have commenced onsite. We require clarification on these points raised in our response dated 18th August 2021, and a statement that confirms the status of the site, before we can further consider the application to discharge Conditions 6, 7, and 9 on previous permission 2021/92062. For these reasons, Conditions 6, 7 and 9 must remain until further notice.

KC Environmental Health (Pollution & Noise Control) response letter dated 18th august 2021)

Having read the (YOUR ENVIRONMENT) report, we have identified a few points requiring clarification:

1. In the updated Conceptual Site Model (Section 10), made ground is referred to in several parts of the table. However, in Section 5 of the report where the ground conditions are described there is no reference to made ground. This appears contradictory and does not correspond to the borehole logs presented in the Appendix. We require clarification as to whether made ground was present. If this is not the case, CSM should be updated appropriately.

2. In the updated Conceptual Site Model (Section 10), made ground soils on site containing hydrocarbons are referred to. The table refers to vapour intrusion. However, the report details in Section 8.3 that no exceedances in organic determinants were identified. It remains unclear why a risk from vapour intrusion is identified. Again, it is also unclear why made ground is referred to when these samples were reportedly from topsoil horizons. Clarification is necessary.

3. We acknowledge the ground gas data provided, however in Section 6 of the report it is detailed that groundwater was encountered in every monitoring round. However, no commentary has been provided in relation to the impact of water ingress in the response zones of the monitoring wells. As such, we consider the ground gas regime characterisation incomplete until further information is received.

We also note that no revised remediation strategy has been provided since our last consultation response dated 14th July 2021. It remains that we do not consider the report 'Land Remediation statement from Eco Control Solutions' to be a robust remediation strategy.

We consider a robust remediation strategy to be a report that indicates how the proposed remediation measures will be implemented and remove any unacceptable risks identified from the Phase 1 and Phase 2 investigation. The requirements for a robust remediation strategy are indicated in the Land Contamination Risk Management (LCRM) guidance. Additionally, the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) have produced technical guidance for the development on contaminated land. Their document, Development on Land Affected by Contamination: Technical Guidance for Developers, Landowners and Consultants (dated June 2020, version 11.2) should also be consulted.

As such these reports are discussed in more detail in Section 3.

2. SITE SETTING

2.1 SITE INFORMATION

Location

The site is located at land off Britannia Road, Golcar, at approximate National Grid Reference NGR: 410853, 415817 (centre of the site).

Site Description

A site visit was undertaken by a representative of GES on 18th September 2024, at which time the weather was dry but slightly overcast.

The site is an irregular shaped piece of land with an approximate area of 0.40 Ha.

The site slopes steeply downwards from north to south with a slope angle of approximately 10%.

At the time of the visit the site was heavily overgrown and access into the central area of the site was limited. Although the site was heavily overgrown there is still visible evidence of the original remediation work, showing that the site wasn't levelled after that work and remains clearly visible, even allowing for the amount of foliage present.

A series of photos from the site visit are provided in **Appendix 2**.

2.2 RECORDED GEOLOGY

The relevant British Geological Survey (BGS) online mapping information indicates that the site is devoid of superficial ground deposits. The bedrock geology is composed of the Millstone Grit.

2.3 HYDROLOGY AND HYDROGEOLOGY

The bedrock aquifer is designated as being a Secondary (A) Aquifer. These are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

There are no active groundwater abstraction licences within 900 m and the site is not located within a Source Protection Zone.

The closest surface water feature is 100 m south, being the Huddersfield canal, adjacent to the river Colne.

3. PREVIOUS INVESTIGATIONS

3.1 YOUR ENVIRONMENT SITE INVESTIGATION REPORT NUMBER: YEX1601, DATED MARCH 2021.

Ground Investigation

The following SI works were completed on November 27th, 2020, the investigation included:

- Five windowless sampler boreholes were completed to a maximum depth of 5.00 mbgl.
- Soil samples were removed from shallow sub surface locations, with further samples taken at depth every 1.00 mbgl or when the underlying stratum changed.
- Three boreholes (WS01, WS04 and WS05) were installed with a standpipe comprising of 50 mm pipework to a maximum depth of 5.00 mbgl to enable future gas and groundwater monitoring to be undertaken.

The positions of exploratory holes in relation to the existing site layout can be reviewed on the Your Environment drawing within **Appendix 1**.

Proven Ground Conditions

The following ground conditions were encountered during the SI; Topsoil – in all positions to a maximum depth of 0.35 mbgl.

Head Deposits – potential head deposits were encountered from depths of 0.30 mbgl to a maximum depth of 5.45 mbgl. This stratum generally comprised a firm orange dark brown very sandy gravelly CLAY. Gravel is fine to coarse angular to subangular of mudstone and sandstone.

Chemical Results

A total of ten samples have been analysed by Chemtech Environmental Ltd in their UKAS and MCERTS accredited laboratory-testing facility in accordance with laboratory protocol.

The testing completed comprised of a focused suite of heavy metals, speciated Total Petroleum Hydrocarbons (TPH CWG Aromatic/aliphatic split) and speciated Polycyclic Aromatic Hydrocarbons (PAH) including the more carcinogenic benzo(a)pyrene (BaP) and naphthalene, asbestos, soil organic matter (SOM) content, pesticides, MTBE & BTEX, cyanide, pH and sulphates.

All chemical testing results are presented in **Appendix 3.**

A worst-case scenario of 1% SOM has been used where appropriate in the chemical assessment.

All chemical results have subsequently been compared against screening criteria for a “Residential with homegrown produce” end use by GES.

Only detectable concentrations of contaminants reported above the screening criteria are presented in **Error! Reference source not found.**Table 3.2, overleaf.

Table 3.2: Summary of Soil Chemical Testing Results

Analyte	No of samples analysed	Screening value (mg/kg) (where applicable)	Analyte concentration range (mg/kg)	No of Samples exceeding screening value	Location of Exceedances
Summary of Soil Results					
Arsenic	10	37	4.5 - 62	5	WS01 @ 0.25 mbgl; WS02 @ 0.20 mbgl; WS03 @ 0.30 mbgl; WS04 @ 0.20 mbgl; WS05 @ 0.15 mbgl.
Lead	10	200	23 - 791	1	WS02 @ 0.20 mbgl
Zinc	10	3700	56 - 3880	1	WS02 @ 0.20 mbgl

Ten samples were analysed for asbestos screen. No fibres were detected in any of the samples.

A list of the screening criteria used for soils is presented in **Appendix 4.**

Hazardous Ground Gases

Peak concentrations recorded during the ground gas monitoring undertaken on six occasions between the 11th December 2020 and the 16th February 2021 by Your Environment and calculated gas screening values (GSV), as part of the intrusive investigation are summarised in Table 3.3, below.

Table 3.3: Calculated GSV's

Peak Flow Rate (l/hr)	Worst Case CO_2	CO_2 GSV	Worst Case CH_4	CH_4 GSV
0.03	0.9%	0.00 l/hr	0.2%	0.00 l/hr

(Worst case CO_2 and CH_4 concentration / 100) x worst case flow rate = GSV

Based on the calculated GSV, the whole site has been classified as Characteristic Situation 1 (CS1); very low.

Furthermore, the site would be classified as "Green" under the NHBC traffic light system.

The results of the ground gas monitoring are provided in **Appendix 5**.

As identified by Kirklees MBC there are discrepancies in the data provided within the YE report. These are:

- Contradictory reports of the presence of Made Ground.
- Contradictory reports regarding the presence of hydrocarbon vapours.
- Clarification required regarding the impacts of groundwater on gas monitoring data.

These are discussed further in Section 4.

3.2 LAND REMEDIATION AT BRITIANNA ROAD, BY ECO CONTROL SOLUTIONS.

Eco Control Solutions reported that they carried out remediation on Britannia Road was in line with the phase 2 site investigation reference YEX1601. All materials within the proposed garden areas were stripped and removed to at least a depth of at least 50 cm.

Eco Control Solutions then remediated the Japanese Knotweed (JKW) on site which led to the majority of the site being excavated to a depth of 2-3 mbgl.

They further report that:

- No other contaminants were found during these works.
- No materials are due to be imported onto site until development works commence.
- The works were carried out between 01/03/21 and 15/04/21.

These comments were supported by three photographs (not included).

However, Kirklees MBC has expressed concern regarding the scope and extent of this report, and it does not represent a suitably robust Remediation Strategy.

4. RISK ASSESSMENT AND TARGET CONCENTRATIONS

4.1 CONTAMINATED SOIL

Following a review of the original data provided within the YE report contamination on site is identified by GES as:

- Concentrations above guideline values of Arsenic at near surface depths across the site.
- Concentrations of Lead and Zinc in WS02 recorded at 0.20 mbgl.

As site investigations are undertaken using a point specific approach there is always the potential to encounter further, as yet unidentified but localised 'hot-spots' of contamination.

As such an indicative contamination profile is provided on drawing 5026-24 / 02 in **Appendix 1**.

Contaminated soils aren't considered suitable for treatment on-site. However, it may be necessary to export some contaminated materials to landfill, particularly any which is grossly contaminated.

4.2 HAZARDOUS GROUND GASES

YE identified the site as being designated as CS1. For CS1 conditions gas protection measures are not required. Should the land use or proposed building type(s) change from those assumed herein, then re-evaluation of the conclusions and recommendations will be required.

Radon protection measures are not required for the site.

4.3 DISCUSSION AND COMMENTS

As indicated in Section 3, Kirklees identified the following three elements of the YE report requiring further clarification:

- Contradictory reports of the presence of Made Ground.

There are no references to Made Ground throughout the body of the report, specifically Section 5.0 Geology and Ground Conditions, where it was reported that Topsoil with Head Deposits (comprising of clay) encountered directly below the topsoil to depths of 5.45 mbgl. This is supported by the borehole logs presented in Appendix B. However, there is a further discrepancy in that WS02 reports sandstone at 3.70 mbgl to a depth of 3.96 mbgl and WS05 reports sandstone at 2.50 mbgl to a depth of 2.88 mbgl.

The anticipated geology identifies that no superficial deposits are expected, and the bedrock is Millstone Grit. It should be noted that Millstone Grit is a coarse sandstone. The logs therefore suggest that a superficial Stratum of Head Deposits (clay) are present on site, overly Millstone Git (sandstone), contrary to Section 5. GES are of the opinion that the logs, having been prepared to BS5930/Eurocode 7 represent the most accurate reporting of the geological strata encountered, and are therefore reported on Table 4.1 overleaf.

Table 4.1: Summary of Ground Conditions

Geology / Strata	Depth (mbgl)				Thickness (m)		Locations encountered
	Top		Base		Min	Max	
	Min	Max	Min	Max			
Topsoil	0.00	-	0.30	0.35	-	0.35	All locations
Head Deposits	0.30	0.35	3.70	5.45	3.40	5.25	All locations
Millstone Grit	2.50	3.70	2.88	3.96	0.26	0.38	WS02 and WS05

Therefore, the reference to Made Ground is considered a carry over from a template and not representative of actual conditions encountered.

- Contradictory reports regarding the presence of hydrocarbon vapours.

Section 7 of the YE report states that no visual and/or olfactory evidence of potential contamination was noted during the fieldwork. Vapours (VOCs and SVOCs) would be predominantly in the olfactory range of organic contaminants and would therefore be reported at this point. Additionally, the chemical test results, as reported in Section 8.3 did not show any elevated small ring organics, those most likely to be volatile in nature.

Therefore, GES are also of the opinion that this is a carry over from a badly amended template.

- Clarification required regarding the impacts of groundwater on gas monitoring data.

Gas monitoring did not identify any elevated hazardous ground gases during any of the monitoring visits, even during the visit where a very low atmospheric pressure (972 mbar) was prevalent. The borehole logs did not encounter any groundwater during the advancement and standpipe installation phase.

GES have considered the following:

- Gas monitoring was undertaken during the winter of 2020/21, as such the presence of rainwater within the soil matrix, especially clay, is likely to be higher than during the rest of the year.

- The presence of standpipes provides an artificial collection point for water held within the soil matrix, especially during rainy periods, and encountering water at near surface depths within clayey soil would not be uncommon.

- Given the relative azimuth heights of the three standpipes, the water encountered would appear to be relatively stable across the site, suggesting it is held by an aquitard.

- The local superficial geology is Head Deposits, comprising of clay. Clay does not offer a homogeneous medium for groundwater movement and as such the water encountered could be localised perched rainwater as opposed to a continuous body.

- The Millstone Grit (designated a Secondary (A) aquifer) lies at a depth of approximately 2.50 mbgl in WS05, whilst the groundwater was encountered at a depth of 0.81 mbgl, within the Head Deposits, and as such is unlikely to be associated with the Millstone Grit.

- The local topology of the area falls sharply (10% over the site), then drops dramatically on the opposite side of Britannia Road to the neighbouring industrial estate (at a level approximately 2 to 3 m below Britannia Road) and falls further to the river. If this groundwater was constant, then the neighbouring industrial unit would be permanently flooded.

- The gas monitoring data does not suggest significant volumes of gas present in the underlying Head Deposits and with no significant sources within influencing distance it is unlikely to allow for the build-up of ground gases within the soil matrix.

- No basements are proposed within the development, as such there will be minimal confined spaces within the properties.

When considering all the above, GES are of the opinion that the minimal level of ground gases encountered will not be significantly impacted or be further influenced by variable water levels within the soil matrix.

4.4 REVISED CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

The Conceptual Site Model has been re-formulated based upon the results from the site investigation in accordance with BS10175: 2015. It aims to provide information regarding the sources of contamination and the pathways in which contamination can migrate to a vulnerable receptor, all of which need to be present for there to be a risk. This is in relation to the proposed end use being classified as 'residential with homegrown produce'. The following linkages have been identified and are presented in Table 4.2, overleaf.

A summary of the risk assessment protocols, and subsequent risk assessment matrix is provided in **Appendix 6**.

Table 4.2: Revised Conceptual Site Model.

Contaminant Source	Pathways	Receptor	Pollutant Linkage	Probability of Risk	Classification of Consequence	Level of Risk	Justification
On-site: Made Ground soils on site possibly containing elevated metals.	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Considered potentially active	High Likelihood	Mild	Moderate ●	A moderate risk rating has been assessed due to the presence of arsenic and lead on site.
		Construction Workers	Considered potentially active	High Likelihood	Medium	High ●	Groundworkers are at an elevated risk due to their extended exposure to contaminated soils.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Considered potentially active	Low Likelihood	Minor	Very Low ●	A very low risk rating has been assessed due to the presence of no contaminative sources on site and the potential presence of an aquitard underlying the site.
	Permeation of water pipes	Construction materials, future end users and site visitors	Considered inactive	-	-	Very Low ●	Returned samples indicated no hydrocarbon concentrations from tested soils. However, final decision lies with the water supply company.
	Uptake	Plant and Wildlife	Considered potentially active	Likely	Minor	Low ●	Zinc was reported at WS02. However, this was only marginally above the screening value.
On-site: Asbestos at/near ground surface in	Inhalation of fibres in airborne dust	Future end users and site visitors	Considered inactive	-	-	Very Low ●	A very low risk rating has been assessed due to the asbestos screening returning a negative result for the presence of fibrous material from all samples analysed.

Contaminant Source	Pathways	Receptor	Pollutant Linkage	Probability of Risk	Classification of Consequence	Level of Risk	Justification
Made Ground soils.		Construction Workers	Considered inactive	-	-	Very Low ●	A very low risk rating has been assessed due to the asbestos screening returning a negative result for the presence of fibrous material from all samples analysed.
On-site: Ground Gases (CH_4, CO_2, H_2S and CO)	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	Considered inactive	-	-	Very Low ●	No Made Ground reported on site.
Offsite: Ground Gases (CH_4, CO_2, H_2S) from off-site historical landfilling activities.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	Considered potentially active	Low Likelihood	Minor	Very Low ●	The monitoring undertaken suggests the risk from ground gas is very low with the site characterised as CS1.

5. REMEDIATION STRATEGY (GENERAL)

The objectives of this remediation strategy are:

- Resolve any identified and potential contamination issues in order to protect environmental receptors and render the site suitable for the proposed development with respect to the National Planning Policy Framework (NPPF).
- To satisfy the Local Planning Authority (LPA), principally the Environmental Health and Highways Departments, and the National House Building Council (NHBC) that the remedial works provide a site suitable for the proposed development
- Render the site as unlikely to be defined as Contaminated Land as defined under Part 2A of the EPA.
- To minimise the impact to the environment and human health whilst undertaking the works.
- To discharge the relevant planning condition relating to contaminated land.
- In the interests of sustainability, to reduce requirements for excavation, offsite disposal and promote the use of existing site-won materials, providing they are suitable for the proposed end use.
- Outline the proposed verification strategy for agreement by the Local Planning Authority (LPA).

The remediation may be required to be undertaken under a CL:AIRE Development Industry Code of Practice Materials Management Plan (MMP); the MMP must be declared to CL:AIRE prior to commencement of earthworks.

6. OPTIONS APPRAISAL

From the above discussion metals and metalloids within the site soils are considered to pose a risk and as such site-specific remedial action aimed directly at these contaminants is required.

However, any remediation approach recommended must also be practicable within the timeframe and cost/benefit analysis of the Client. In this instance the Client requires as short a timeframe as possible due to the need to commence construction as the earliest opportunity.

As the primary source of contamination is considered to be in the site soils, two solutions are considered viable:

- Solidification.
- Removal to landfill.

Solidification has the added benefit of stabilising the site in geotechnical terms, however, although a formal geotechnical assessment has not been carried out, reviewing the geotechnical data in the logs provided within the YE report suggests that standard strip footings would be suitable for this site, as such remedial geotechnical action is not required.

Whilst this option could be considered further, it is probable that removal to landfill will prove to offer the best cost vs time benefit in this instance.

Removal to landfill will remove the primary source of any on-site contamination.

Therefore, the option that offers the quickest remediation is removal to landfill of the impacted soils where they pose a risk to potential end users.

However, the Eco Control Solutions report indicated that the site was stripped to a depth of between 2.00 and 3.00 mbgl in order to remediate for the presence of JKW. This would, by inference, also remediate the contaminated soils at a shallow depth. Unfortunately, Eco Control Solutions did not undertake, or did not report undertaking, a validation exercise on the site.

7. PRE-REMEDIATION WORK

As there is the potential for remediation to have been undertaken in a somewhat ad hoc manner, it would be prudent to confirm that this is the case.

As such it is proposed that the following scope work is undertaken prior to completing any formal remediation work as details in Section 8, below:

- Considering the state of the site during the walkover, it is recommended that the site is surveyed by an invasive plant surveyor to confirm that there is no JKW present on site.

- Should JKW be identified a further round of soil stripping should be undertaken under the guidance of a suitably qualified consultant to remove any JKW identified on site.

- The resultant void should be tested for the contaminants of concern to confirm that they have also been remediation during the JKW removal process.

- If no JKW is identified during the survey the site should then be stripped of any local foliage that has accumulated since the Eco Controls Solution work.

- As remediation is measured against the final, developed site level, the site should be reduced/brough up to the working level needed for the development of the site to take place.

- The site should then be subjected to a further round of chemical testing for the previously identified contaminants of concern.

If this action identified that the previously identified contaminants of concern are still present, then further remedial action is required as set out in Section 8 and should be validated in accordance with Section 10.

If this action identified that the previously identified contaminants of concern have been remediated, then no further action is required in terms of remediation and Section 8 becomes null and void. However, any imported material should be validated in accordance with Section 10.

8. REMEDIATION STRATEGY (DETAILED)

8.1 CONSTRUCTION ACTIVITIES

All site personnel shall undergo a site-specific health and safety induction prior to commencement of work on site.

Site cabins and welfare facilities are to be established at a location to be agreed with the Engineer. All welfare facilities must be established in accordance with the relevant health & safety statutory requirements. Provision shall be provided on site for car parking for all employees.

All visitors to site must enter and register at the main Site Office.

During the construction works, especially the groundworks, construction workers will be subject to an elevated level of risk.

As such, all personnel on site will comply with guidance provided in the Health and Safety Executive (HSE) document “Protection of Workers and the general public during the redevelopment of potentially Contaminated Land”. In summary, the following should be provided by the appointed contractor:

- All staff to be suitably trained and competent.
- Protective clothing, footwear, glasses, suitable dust masks and gloves. (Personnel should be instructed in why and how they are to be used).
- Hand washing, eye washing and boot washing facilities.
- Damp down all exposed soils on site.
- Smoking shall be limited to designated areas.

8.2 MANAGEMENT OF WATER

It is possible that perched waters may be encountered during the remediation earthworks; most commonly associated with redundant drains and buried structures.

Groundwater shall be controlled in accordance with CIRIA report 113 “Control of Groundwater for Temporary Works”.

Arrangements shall be made to prevent ponding in any excavation “hollows”; the Contractor shall ensure that ground levels are of sufficient gradient to enable the collection of surface water run-off in sumps or grips.

The Contractor will liaise with the Environment Agency and Yorkshire Water regarding water management at the site.

8.3 REMOVAL OF BELOW GROUND OBSTRUCTIONS

Obstructions in the form of relic foundations and infrastructure may be found on site during groundworks.

Where relict structures are found to retain fluid contaminants, they shall be drained and removed from site. The engineer should be notified to ensure that the appropriate action is taken, and records made for final validation.

Deep excavations for the removal of structures etc. will be unstable in the short term and side support may be necessary.

Suitable materials derived from the grubbing-up shall be stored in a location on site, to be agreed with the engineer, prior to crushing. Any unsuitable materials shall be removed to a suitable licensed landfill site as stipulated within the Materials Management Plan.

8.4 CONTAMINATED SOILS

We understand that the proposed development includes for nine residential properties presented as four pairs of semi-detached and a single detached house, complete with gardens and driveways.

In areas of the site where buildings and hardstanding are proposed the underlying material can be left insitu as the buildings and hardstanding areas will break the 'pollutant linkage' and remove the pathway for contamination and come in to contact with the end users.

However, remedial measures are required with respect to any intended landscaped areas associated with the new construction.

As the proposed development includes for areas of soft landscaping, then the contaminated materials should be removed from the site, as indicated on drawing 5026-24 / 03 in **Appendix 1**.

During removal, it is recommended that a watching brief is present on site to record and validate the removal of materials.

At this stage as a minimum, the impacted materials should be removed from site in accordance with BRE 465 (Cover systems for land regeneration) 2004. This document recommends that based on the soil testing results, up to 600 mm of made ground below proposed formation level should be removed from site and replaced with clean inert materials comprising of clean inert imported topsoil material in line with BS 3882: 2015 Specification for Topsoil.

As a limited number of locations have been tested with respect to the overall dimensions of the site it is recommended that the maximum guidance depth of 600 mm be removed. Some of these materials may require removal anyway as part of the construction process.

Excavations should not be left open for longer than necessary, should be safely battered back and should be securely cordoned-off using 2.00m high safety fencing, with appropriate warning signs whenever excavations works are suspended.

8.5 EXPORT TO LANDFILL

Excavation arisings that are unsuitable for retention and re-use on site shall, if they cannot be immediately removed from site, be placed in temporary stockpiles on hardstand or polythene sheeting and be suitably covered to minimise the potential for dust/odour nuisance and prevent surface water run-off.

Given the proximity of existing housing, and in order to avoid any potential odour nuisance, stockpiles of material shall be exported from site as soon as practically possible.

Any material exported from the site to landfill should be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991 and the Landfill (England and Wales) Regulations 2005.

A transfer note should be completed, signed and retained by the parties involved. The transfer note shall include the volume of waste, the nature of the material and a statement of its chemical composition, details of the source and destination sites, and details of the haulier.

All hazardous waste going for disposal at landfills must be classified according to the new European Waste Catalogue (EWC).

A Hazardous Waste Assessment may be required on any materials requiring removal and disposal from site. Waste Acceptance Criteria (WAC) testing may also be required, and the results of the Hazardous Waste Assessment and WAC testing (if appropriate) should be presented to the landfill operator for their confirmation of waste category.

In order to protect the general public from dust and vapour emissions, wagons that are to be used for the haulage of the contaminated material from the site must be sheeted. In addition, the Contractor must ensure that no fluids seep from the wagons.

8.6 DUST CONTROL

At all times during the excavation works, Best Practicable Means shall be employed to minimise dust and odour generation and their emission off site.

8.7 PREVIOUSLY UNIDENTIFIED CONTAMINANTS

Should any suspected contaminated materials other than those detailed in this, and previous reports be encountered during the re-development, then it should be excavated and stockpiled on an impermeable material and sampled and tested for an appropriate range of determinants.

Should any visual or olfactory evidence of limited contamination be identified during the removal of below ground obstructions and the turning over of made ground appropriate samples shall be taken by the Engineer for chemical analysis. The Engineer shall check the nature of materials excavated for visual and olfactory evidence of hydrocarbon contamination throughout the remedial works. Depending on the results, the excavated materials shall either be returned to the works beneath the proposed cover system or disposed of, off-site to a suitable licensed facility.

Should any visual or olfactory evidence of gross contamination be identified during the removal of below ground obstructions and the turning over of made ground works should be suspended, and the LPA advised. A decision will be made as to whether this can be delt with by a variation to this Remediation Strategy or a new or amended Remediation Strategy is required.

8.8 SERVICES INSTALLATION

It is recommended that statutory services are consulted at an early stage, with respect to the ground conditions within which they will lay services, in order to enable them to assess if any protection measures are required.

Underground services, comprising BT Lines, gas mains, combined and foul sewers, CCTV and possible fibre optic cables may all impact the site, and the design team and Client should familiarise themselves with their presence.

8.9 MATERIALS MANAGEMENT PLAN

The Materials Management Plan should allow for remediation of the site soils in the landscaped areas during the appropriate phase of the works.

The Materials Management Plan should also refer to this strategy in respect to:

- Materials arising from the encountering of previously unidentified contamination.
- Materials arising from the removal of below ground obstructions.
- Control of water.
- Contamination related Health and Safety issues, including dust control.

GES does not provide advice on Materials Management Plans, as such expert advice should be sought from a suitably experienced consultant.

9. GENERAL SITE REQUIREMENTS

The contractor shall comply at all times with this Strategy, the Conditions of Contract and all relevant health and safety requirements. Site works will be supervised by a suitably qualified person appointed by the Client.

The contractor shall prepare and submit a programme for the works to the Client prior to the commencement on site.

Site cabins, stores and welfare facilities shall be established at a convenient location to be agreed between the contractor and the Client.

Prior to commencement of works, the contractor shall establish the boundaries of the site and working areas and shall make adequate provision to secure the site boundary and prevent unauthorised access to the site during the works.

No fires shall be permitted on site, unless previously agreed with the Local Authority.

Details of all monitoring will be retained on site by the contractor and made available to the Local Authority Environmental Health Department on request.

9.1 SERVICES

The Client shall be responsible for obtaining all relevant service records for the site and undertake any consultation with the statutory undertakers in relation to identifying the location of live services, including those to any adjacent properties. The Client shall ensure the safe disconnection of all existing services entering the site, except for those which are to remain operational.

9.2 HEALTH AND SAFETY

The remediation shall be undertaken in accordance with all relevant legislation including, but not limited to:

- The Health and Safety at Work etc. Act, 1974.
- The most current Construction (Design and Management) Regulations (The CDM
- Regulations).
- The Control of Substances Hazardous to Health Regulations, 2002, and
- The Control of Asbestos at Work Regulations, 2012.

Contaminated materials are locally present on the site. During the remediation and construction, it will be necessary to protect the health and safety of site personnel. General guidance on these matters is given in the Health and Safety Executive (HSE) document 'Protection of Workers and the General Public during the Redevelopment of Contaminated Land' (HS(G)66).

In summary, the following measures are suggested to provide a minimum level of protection where potential for exposure to contaminated materials exists:

- All ground workers should be issued with safety glasses, protective footwear and impermeable heavy-duty gloves. Personnel should be instructed in their correct use.
- Hand washing and boot cleaning facilities shall be provided.
- No smoking on site other than in designated areas if any are present on site; and,
- Good practices relating to personal hygiene shall be adopted.

Before site operations are commenced, the necessary COSHH Assessment, Method Statements and Health and Safety Plans should be completed and issued by the contractor in accordance with The CDM Regulations 2015.

All site personnel shall undergo a site-specific health and safety induction prior to commencement of work on site.

The contractor shall provide details of emergency procedures. Emergency Services shall be informed of the site operations prior to commencement.

If an excavation meets the definition of a 'confined space' within the Confined Space Regulations 1997, entry must be undertaken in accordance with the requirements of the HSE's Safe Work in Confined Spaces - Confined Spaces Regulations 1997: Approved Code of Practice and Guidance (Third Edition, 2014).

9.3 OFF-SITE DISPOSAL

Materials for off-site disposal shall be sampled and analysed by the contractor at a frequency sufficient to allow the material to be adequately categorised.

Removal of any materials from the site should be undertaken in accordance with current Duty of Care requirements and EA Technical Guidance Document WM3, Guidance on the Classification and Assessment of Waste, 1st Edition, 2015. The waste may also be subject to Waste Acceptance Criteria (WAC) testing. It is recommended that discussion with landfill operators takes place at an early stage. A transfer note shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement of its chemical composition. The waste transfer notes shall be kept by the contractor for a period of at least two years.

10. VALIDATION TESTING AND REPORT

10.1 SOIL VALIDATION

Validation chemical testing should be provided by the supplier of any capping material to be imported to confirm its suitability for use on site. All soil imported should be certified prior to import to be suitable for use as BS2883:2015 compliant for topsoil. Any soil test certificate much be 'in date' as approved by the LPA.

Irrespective of the above, all materials to be used within soft landscaping areas, irrespective of its source, should be independently tested for its chemical composition in terms of soil contamination.

GES has adopted the approach as identified in the YALPAG Verification Requirements for Cover Systems: Technical Guidance for Developers, Landowners and Consultants: Version 4.1 – June 2021 in its verification process. The minimum analysis to be undertaken on materials for use within the cover system is detailed in Table 9.1: below.

Table 9.1: Proposed Testing Frequency and Analysis

Soil Source	Testing Frequency	Minimum	Analysis suite
Site sourced soils	Between 1 sample per 50m^3 and 1 sample per 100m^3.	6	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.
Imported soils: brownfield source	Between 1 sample per 50m^3 and 1 sample per 100m^3.	6	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.
Imported soils: greenfield / manufactured soil source	Between 1 sample per 50m^3 and 1 sample per 250m^3	3	Heavy metals/metalloids, and inorganics, Speciated PAH, TPH CWG, asbestos screen.
Crushed Hardcore, Stone, Brick (excluding asphalt)	Minimum 1 per 500m^3	-	Standard metals/metalloids (as above), PAH (16 USEPA speciation), asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).
Virgin Quarried Material	1 or 2 depending on the type of stone utilised	-	Standard metals/metalloids (should include as a minimum As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn)

Where any material is deemed to be unsuitable for use in the capping layer, either by GES or the Local Authority/Environment Agency, the Contractor shall make provision for the costs of sampling, testing and removal of, said unacceptable materials from excavations and shall make provisions for delays associated with material testing and classification prior to disposal.

Depth validation of the capping system will be required within landscaped areas. The validation will comprise a hand dug pits, with photographic record and insitu testing of all soil will be undertaken as part of the verification. Samples should be taken from each validation pit for subsequent testing.

10.2 VALIDATION REPORT

The Validation Report should, where practicable, include the following:

- Remediation Strategy (including copies of confirmation from regulatory authorities agreeing criteria).
- Photographic evidence of the removal of material from site.
- Detailed drawings of the excavated areas showing the extent of the material removal operation.
- Details of the provenance of the subsoil and topsoil (to be provided by contractor).
- Copy of Consignment Notes relating to the movement of wastes to a licensed waste management facility.
- Laboratory analysis of validation soil samples and assessment of suitability for use.
- Logs indicating the thickness of cover soils within each trial pit excavated.
- A drawing indicating the location of cover thickness validation trial pits.
- Photographic evidence of the validation trial pits.
- Detailed drawings showing all sampling locations for chemical testing.
- Details of any variation from the adopted strategy due to unforeseen circumstances.
- Details of any previously unidentified contamination encountered.
- Details of any potentially contaminative activity occurrences that took place.
- Production of a Validation Report.

11. RELIANCE AND LIMITATIONS

This report has been prepared using published information and information provided by the Client and their professional advisers which has been made available to GES at the time of writing only. GES accepts no liability for any changes resulting from new information which has become available since this time.

This report is provided for the sole use of the client and their professional advisors and is confidential to them unless agreed otherwise in writing. This report may only be used and relied on once the work has been paid for in full. GES owes no duty of care and has no liability to any third party who is not authorised by GES to use this report. Any unauthorised third parties using information contained in this report do so at their own risk.

We are content that as a result of the site investigation works and subsequent soil testing undertaken, as outlined within this report, we have characterised the ground conditions and consequently the potential for contamination to exist on site. These works and ensuing assessment have been detailed in this report.

This assessment has been carried out to determine the potential risks posed to future end users, along with other key receptors, resulting from potential contamination at the site, based on the proposed development. Should any revisions in the development proposals result in a change any assessment parameters detailed in this report, a re-assessment of the risk should be carried out.

Whilst this report may reference observations made regarding the presence of features/ issues such as invasive species, ACM, site drainage and evidence of structural abnormalities, this report does not constitute specialist surveys on these matters. Should further specialist surveys be carried out in this regard, the findings of these should be reported to GES so that we may determine if this has any impact on the findings of this report.

The assessment and interpretation of the factual data obtained as part of this site investigation has been undertaken in accordance with standard consulting practise and with current national and international guidance.

This report presents the observations made during the site investigation and the factual data obtained. The conclusions and recommendations in this report are limited to those which can be made based on the findings of the survey and information provided by third parties. GES assumes all third party data to be true and correct. No responsibility can be accepted by GES for inaccuracies in the information provided by any other party.

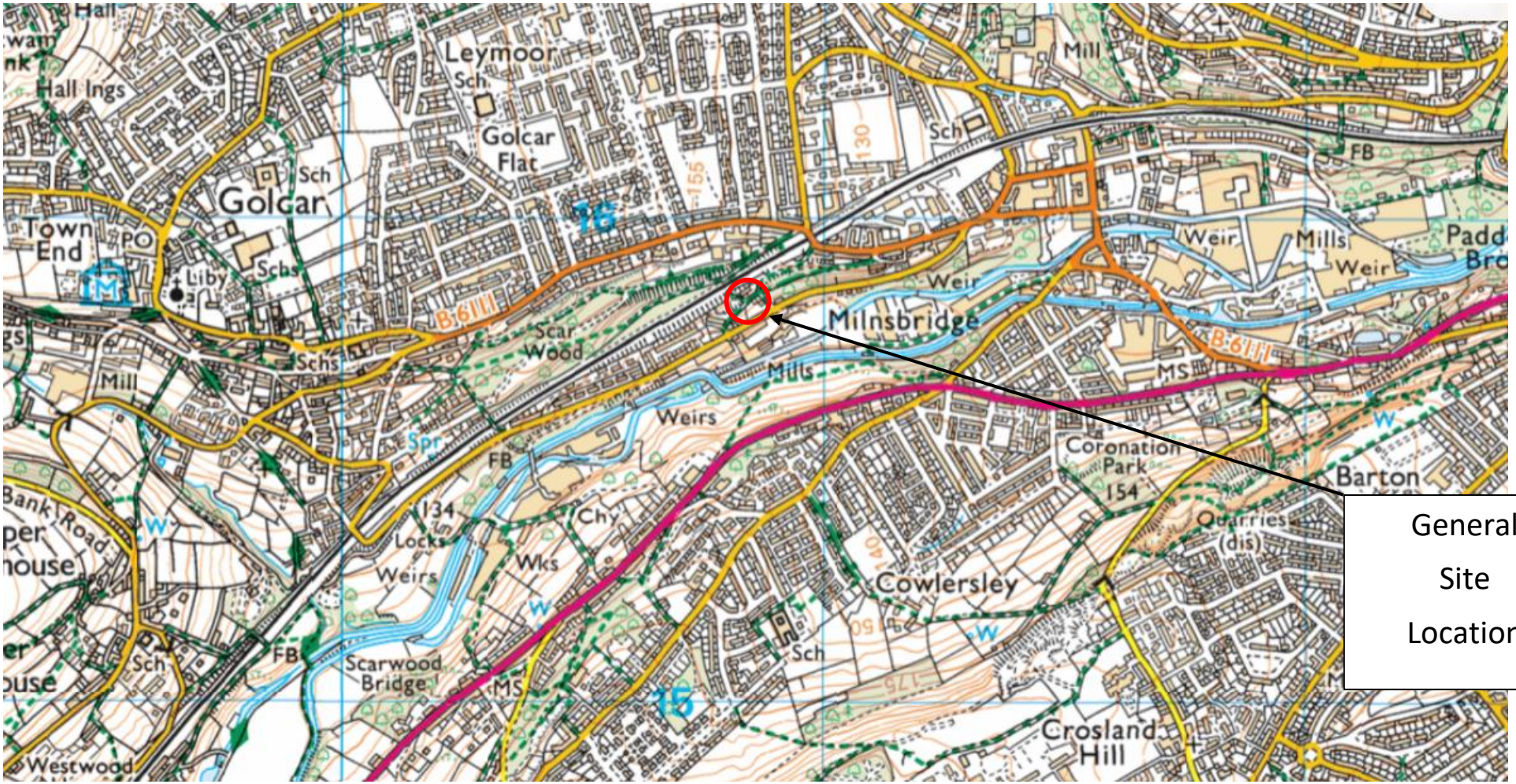
This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore, new information, improved practises, and changes in legislation may require the reinterpretation of the report in whole or in part after its original issue. GES reserve the right to alter their conclusions and recommendations in the light of further information that may become available.

Ground conditions can be variable and change rapidly, especially in areas of Made Ground, however it is assumed that the ground conditions encountered and observed are typical and representative of the site as a whole. Most specifically with regard to this limited investigation, the ground conditions have been determined from a limited number of exploratory holes formed across the site, therefore only a small percentage of the total area of the site has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced. Conclusions drawn from the ground investigation should be read in this context. GES cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.

In addition, subsurface conditions including contaminant concentrations and groundwater levels may vary spatially with time. This factor should be given due consideration in the event that the information contained within this report is used after any significant period of time has elapsed.

APPENDIX 1

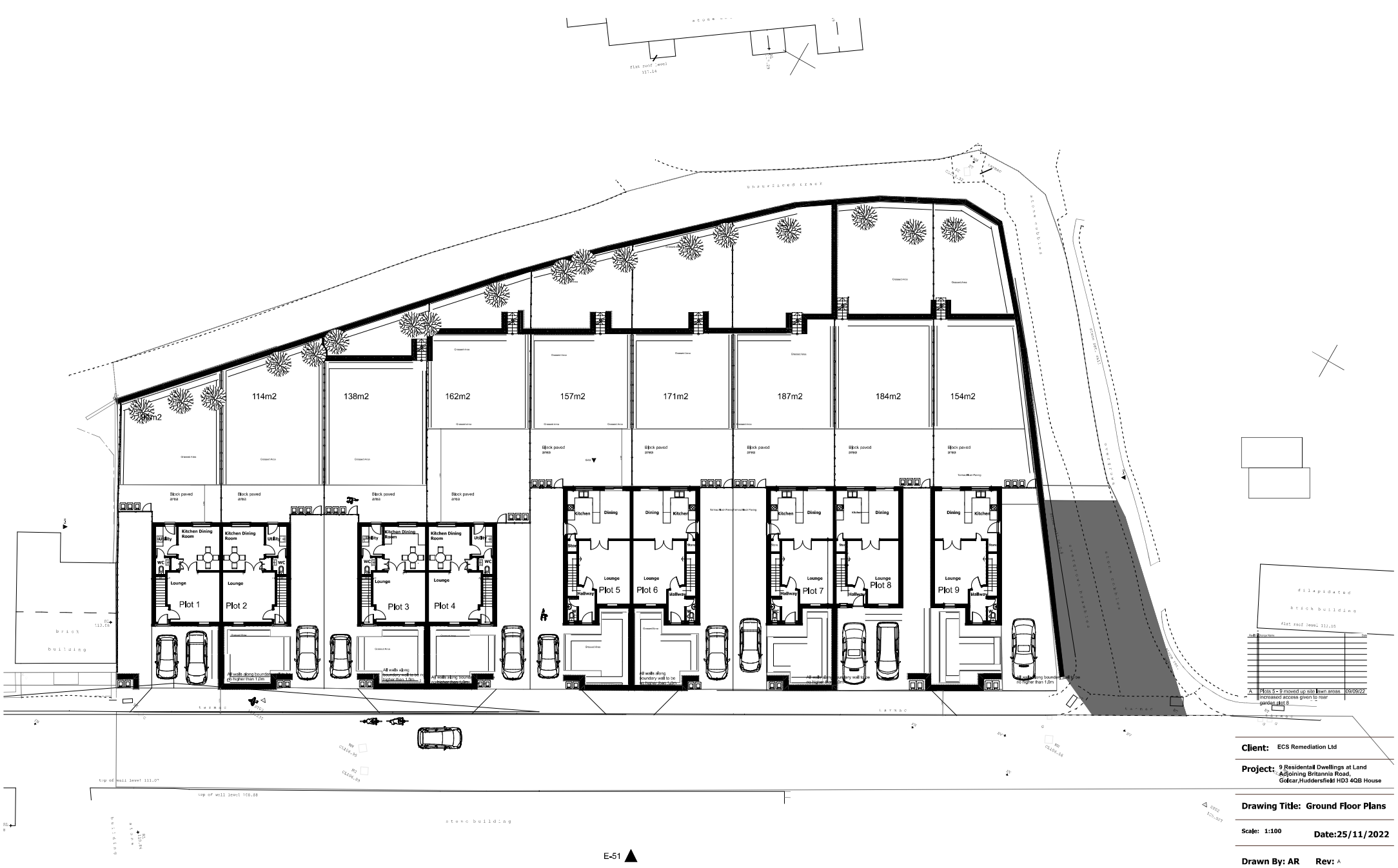
DRAWINGS AND PLANS



GeoEnviro Solutions Ltd
4A Haggwood Stone Quarry,
Woodhead Road, Honley,
HD9 6PW
Tel: 01484 986010
Email: info@geoenvirosolutions.com
Web: www.geoenvirosolutions.com

N

PROJECT NAME Britannia Road, Golcar		**DRAWING NO.**	**SCALE**
PROJECT NUMBER 5026-24		5026-24/01	N.T.S
TITLE		**DATE**	**DRAWN BY**
Site Location Plan		September 2024	ADD



A	Plots 5 - 9 moved up site lawn areas increased access given to rear garden plot 8 — 09/09/22

Client: ECS Remediation Ltd

Project: 9 Residential Dwellings at Land Adjoining Britannia Road, Golcar,Huddersfield HD3 4QB House

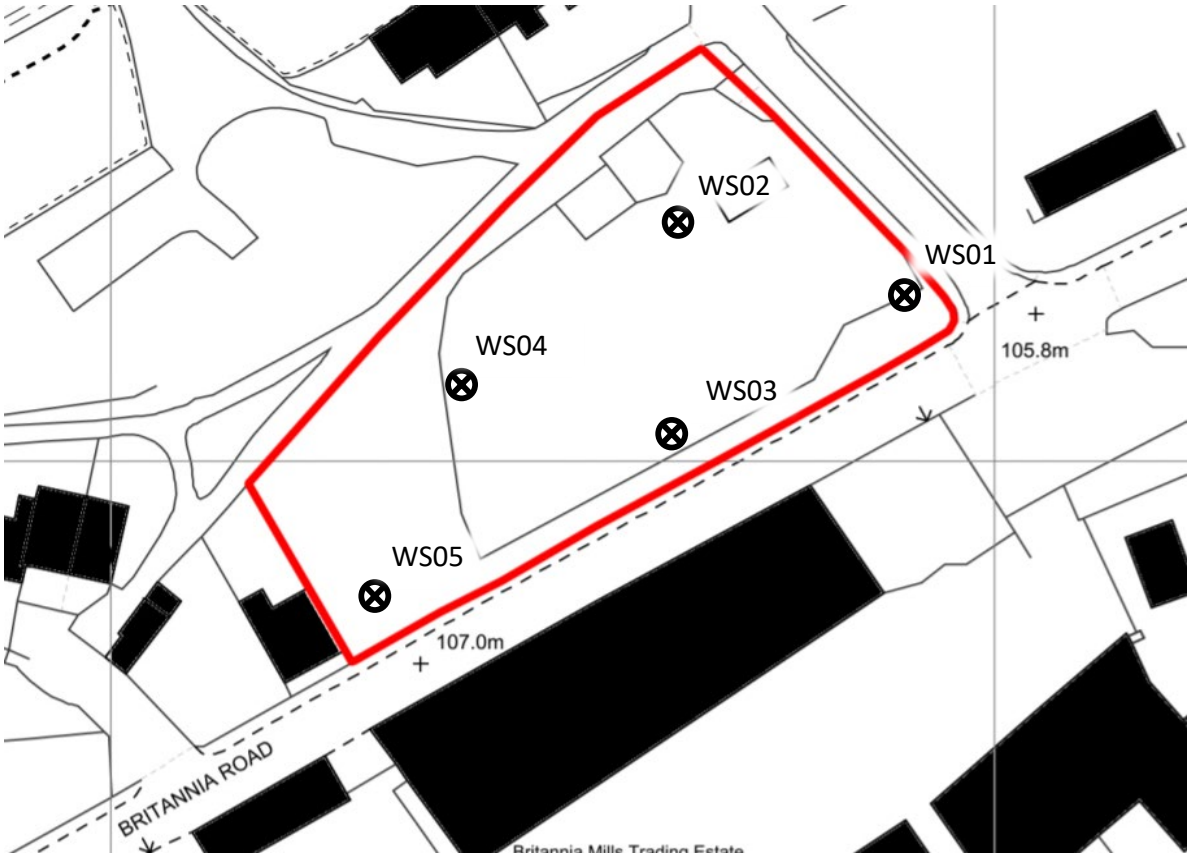
Drawing Title: Ground Floor Plans

Scale: 1:100 **Date:**25/11/2022

Drawn By: AR **Rev:** A

Drawing Nr: SP1

Alan Robinson
Chartered Architect BA Dip Arch RIBA BSc (Hons)
2 Gawber Road, Barnsley S75 2AF
Tel/Fax 01226 286066
Mob: 07947808933



Title: **Investigation Location Plan**

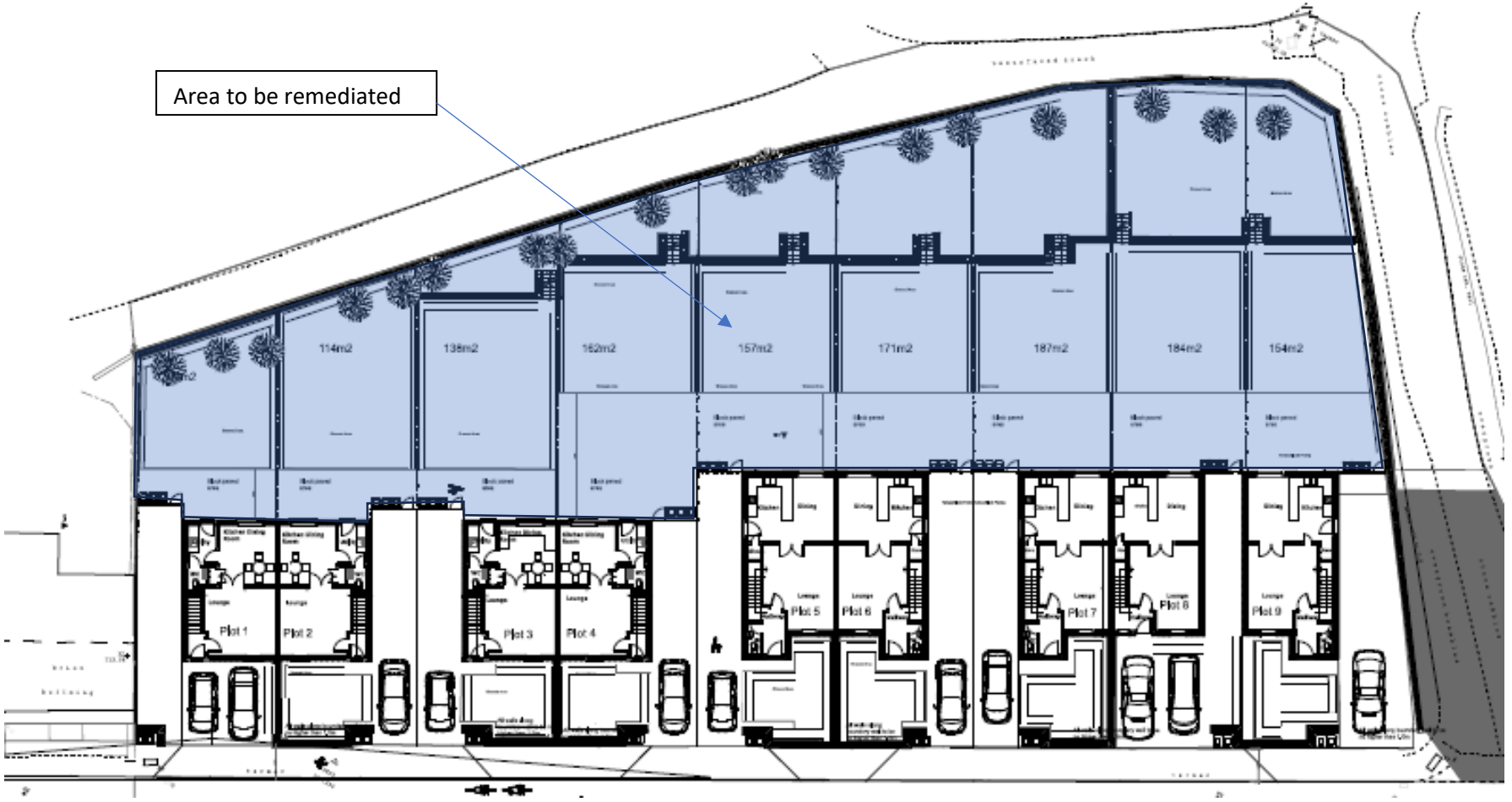
Your Environment	Site Name: **Britannia Road, Huddersfield**	Job No: **YEX1601**

GEOENVIRO SOLUTIONS LIMITED

GeoEnviro Solutions Ltd
4A Haggwood Stone Quarry,
Woodhead Road, Honley,
HD9 6PW
Tel: 01484 986010
Email: info@geoenvirosolutions.com
Web: www.geoenvirosolutions.com

N

PROJECT NAME Britannia Road, Golcar **PROJECT NUMBER** 5026-24	**DRAWING NO.** 5026-24/02	**SCALE** N.T.S
TITLE Contamination Profile	**DATE** September 2024	**DRAWN BY** ADD



GeoEnviro Solutions Ltd
4A Haggwood Stone Quarry,
Woodhead Road, Honley,
HD9 6PW
Tel: 01484 986010
Email: info@geoenvirosolutions.com
Web: www.geoenvirosolutions.com

N

PROJECT NAME Britannia Road, Golcar **PROJECT NUMBER** 5026-24		**DRAWING NO.** 5026-24/03	**SCALE** N.T.S
TITLE Remediation Profile		**DATE** October 2024	**DRAWN BY** ADD

APPENDIX 2

PHOTOGRAPHS

Site: Britannia Road, Golcar
Client: Cherry Tree Developments Ltd
Job Reference: 5026-24

GEOENVIRO
SOLUTIONS LIMITED

A.

B.

C.

D.

A. View eastwards along Britannia Road from site boundary.

B. A view into the site itself from the same vantage point.

C. A view from the north of the site, ‘downhill, southwards’, across the site.

D. A view from the northeastern corner, showing the extent of the void resultant from previous preparation work on site.

Site: Britannia Road, Golcar
Client: Cherry Tree Developments Ltd
Job Reference: 5026-24

E.

F.

G.

E. Additional photo of the previous removal works undertaken on site.

F. View from the southeast corner of the site, looking northwest towards Britannia Road.

G. View from within the site, looking north.

APPENDIX 3

CHEMICAL TESTING RESULTS

2531

ANALYTICAL TEST REPORT

Contract no: 91545

Contract name: Britannia Road, Huddersfield

Client reference: YEX1601

Clients name: YourEnvironment

Clients address: Unit 2 Woodhorn Business Centre
Chichester
West Sussex
PO20 2BX

Samples received: 01 December 2020

Analysis started: 01 December 2020

Analysis completed: 08 December 2020

Report issued: 08 December 2020

Notes:

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.
BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

Key:

U UKAS accredited test
M MCERTS & UKAS accredited test
$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

K Campbell

Karan Campbell
Director

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
91545-1	WS01	0.25	Loam with Gravel & Roots	-	-	25.9
91545-2	WS01	1.00	Sandy Clay with Gravel	-	-	28.7
91545-3	WS02	0.20	Loam with Gravel & Roots	-	-	27.5
91545-4	WS02	0.60	Sandy Clay with Gravel	-	-	23.6
91545-5	WS03	0.30	Loam with Gravel & Roots	-	-	27.8
91545-6	WS03	0.90	Sandy Clay with Gravel	-	-	16.0
91545-7	WS04	0.20	Loam with Gravel & Roots	-	-	23.2
91545-8	WS04	1.20	Loam with Gravel & Roots	-	-	12.6
91545-9	WS05	0.15	Sandy Clay with Gravel & Roots	-	-	26.8
91545-10	WS05	0.80	Sandy Clay with Gravel	-	-	21.5

Chemtech Environmental Limited

SOILS

Lab number			91545-1	91545-2	91545-3	91545-4	91545-5	91545-6
Sample id			WS01	WS01	WS02	WS02	WS03	WS03
Depth (m)			0.25	1.00	0.20	0.60	0.30	0.90
Date sampled			27/11/2020	27/11/2020	27/11/2020	27/11/2020	27/11/2020	27/11/2020
Test	**Method**	**Units**						
Arsenic (total)	CE127	mg/kg As	43	8.5	44	4.5	62	17
Cadmium (total)	CE127	mg/kg Cd	0.3	<0.2	0.8	<0.2	0.2	<0.2
Chromium (total)	CE127	mg/kg Cr	124	102	80	97	99	123
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127	mg/kg Cu	53	17	103	11	71	40
Lead (total)	CE127	mg/kg Pb	123	26	791	41	124	43
Mercury (total)	CE127	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127	mg/kg Ni	13	15	13	6.6	15	35
Selenium (total)	CE127	mg/kg Se	2.2	1.4	1.5	0.9	2.4	1.8
Zinc (total)	CE127	mg/kg Zn	115	85	3880	222	70	96
pH	CE004 M	units	5.6	5.1	7.3	6.8	5.0	5.8
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	105	41	38	55	21	21
Cyanide (total)	CE077	mg/kg CN	<1	<1	1.0	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	0.8	<0.5	1.7	<0.5
Organic matter content (OMC)	CE005	% w/w	11.4	6.0	16.2	4.9	13.3	5.1
Estimate of TOC (calculated from OMC)	CE005	% w/w C	6.6	3.5	9.4	2.8	7.7	3.0
PAH								
Naphthalene	CE087 M	mg/kg	0.05	<0.02	0.07	<0.02	0.04	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	0.05	<0.02	<0.02	<0.02	0.05	<0.02
Fluorene	CE087 U	mg/kg	0.03	<0.02	<0.02	<0.02	0.03	<0.02
Phenanthrene	CE087 M	mg/kg	0.51	<0.02	0.21	<0.02	0.46	<0.02
Anthracene	CE087 U	mg/kg	0.10	<0.02	0.04	<0.02	0.10	<0.02
Fluoranthene	CE087 M	mg/kg	1.01	<0.02	0.34	<0.02	0.93	<0.02
Pyrene	CE087 M	mg/kg	0.91	<0.02	0.33	<0.02	0.82	<0.02
Benzo(a)anthracene	CE087 U	mg/kg	0.44	<0.02	0.19	<0.02	0.40	<0.02
Chrysene	CE087 M	mg/kg	0.51	<0.03	0.22	<0.03	0.45	<0.03
Benzo(b)fluoranthene	CE087 M	mg/kg	0.62	<0.02	0.28	<0.02	0.51	<0.02
Benzo(k)fluoranthene	CE087 M	mg/kg	0.20	<0.03	0.12	<0.03	0.25	<0.03
Benzo(a)pyrene	CE087 U	mg/kg	0.53	<0.02	0.21	<0.02	0.40	<0.02
Indeno(123cd)pyrene	CE087 M	mg/kg	0.49	<0.02	0.22	<0.02	0.36	<0.02
Dibenz(ah)anthracene	CE087 M	mg/kg	0.05	<0.02	<0.02	<0.02	0.04	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	0.28	<0.02	0.08	<0.02	0.18	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	5.79	<0.34	2.30	<0.34	5.00	<0.34
BTEX & TPH								
MTBE	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Chemtech Environmental Limited

SOILS

Lab number			91545-1	91545-2	91545-3	91545-4	91545-5	91545-6
Sample id			WS01	WS01	WS02	WS02	WS03	WS03
Depth (m)			0.25	1.00	0.20	0.60	0.30	0.90
Date sampled			27/11/2020	27/11/2020	27/11/2020	27/11/2020	27/11/2020	27/11/2020
Test	**Method**	**Units**						
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	4	<1	<1	<1	3	<1
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	4	<1	2	<1	3	<1
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	<1	<1	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
EPH Aliphatic (>C10-C12)	CE068	mg/kg	<4	<4	<4	<4	<4	<4
EPH Aliphatic (>C12-C16)	CE068	mg/kg	<4	<4	<4	<4	<4	<4
EPH Aliphatic (>C16-C35)	CE068	mg/kg	97	12	<4	6	8	<4
EPH Aliphatic (>C35-C44)	CE068	mg/kg	47	20	<10	<10	<10	<10
Subcontracted analysis								
Asbestos (qualitative)	$	-	NAD	-	NAD	-	NAD	-

Chemtech Environmental Limited

SOILS

Lab number			91545-7	91545-8	91545-9	91545-10
Sample id			WS04	WS04	WS05	WS05
Depth (m)			0.20	1.20	0.15	0.80
Date sampled			27/11/2020	27/11/2020	27/11/2020	27/11/2020
Test	**Method**	**Units**				
Arsenic (total)	CE127	mg/kg As	39	9.3	45	10
Cadmium (total)	CE127	mg/kg Cd	0.5	<0.2	0.2	<0.2
Chromium (total)	CE127	mg/kg Cr	103	135	92	82
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1
Copper (total)	CE127	mg/kg Cu	64	25	77	18
Lead (total)	CE127	mg/kg Pb	115	23	119	24
Mercury (total)	CE127	mg/kg Hg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127	mg/kg Ni	19	23	19	25
Selenium (total)	CE127	mg/kg Se	2.1	1.5	2.3	1.4
Zinc (total)	CE127	mg/kg Zn	81	56	67	77
pH	CE004 M	units	6.1	5.0	5.1	5.8
Sulphate (2:1 water soluble)	CE061 M	mg/l SO_4	65	59	97	60
Cyanide (total)	CE077	mg/kg CN	<1	<1	1.2	<1
Phenols (total)	CE078	mg/kg PhOH	0.6	<0.5	2.1	<0.5
Organic matter content (OMC)	CE005	% w/w	13.9	3.4	16.2	5.4
Estimate of TOC (calculated from OMC)	CE005	% w/w C	8.1	2.0	9.4	3.1
PAH						
Naphthalene	CE087 M	mg/kg	0.06	<0.02	0.21	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	0.02	<0.02
Acenaphthene	CE087 M	mg/kg	0.02	<0.02	0.11	<0.02
Fluorene	CE087 U	mg/kg	<0.02	<0.02	0.09	<0.02
Phenanthrene	CE087 M	mg/kg	0.25	<0.02	1.10	<0.02
Anthracene	CE087 U	mg/kg	0.05	<0.02	0.21	<0.02
Fluoranthene	CE087 M	mg/kg	0.41	<0.02	1.35	<0.02
Pyrene	CE087 M	mg/kg	0.39	<0.02	1.27	<0.02
Benzo(a)anthracene	CE087 U	mg/kg	0.19	<0.02	0.60	<0.02
Chrysene	CE087 M	mg/kg	0.24	<0.03	0.70	<0.03
Benzo(b)fluoranthene	CE087 M	mg/kg	0.27	<0.02	0.74	<0.02
Benzo(k)fluoranthene	CE087 M	mg/kg	0.09	<0.03	0.30	<0.03
Benzo(a)pyrene	CE087 U	mg/kg	0.24	<0.02	0.62	<0.02
Indeno(123cd)pyrene	CE087 M	mg/kg	0.21	<0.02	0.47	<0.02
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	<0.02	0.07	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	0.08	<0.02	0.31	<0.02
PAH (total of USEPA 16)	CE087	mg/kg	2.50	<0.34	8.16	<0.34
BTEX & TPH						
MTBE	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01

Chemtech Environmental Limited

SOILS

Lab number			91545-7	91545-8	91545-9	91545-10
Sample id			WS04	WS04	WS05	WS05
Depth (m)			0.20	1.20	0.15	0.80
Date sampled			27/11/2020	27/11/2020	27/11/2020	27/11/2020
Test	**Method**	**Units**				
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	<1	<1	<1	<1
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	<1	<1	<1	<1
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	2	<1	5	<1
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	2	<1	5	<1
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE068	mg/kg	<4	<4	<4	<4
EPH Aliphatic (>C12-C16)	CE068	mg/kg	<4	<4	6	<4
EPH Aliphatic (>C16-C35)	CE068	mg/kg	34	<4	45	<4
EPH Aliphatic (>C35-C44)	CE068	mg/kg	18	<10	11	<10
Subcontracted analysis						
Asbestos (qualitative)	$	-	NAD	-	NAD	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO_4
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE005	Organic matter content (OMC)	Based on BS 1377, Colorimetry	Dry		0.1	% w/w
CE005	Estimate of TOC (calculated from OMC)	Calculation from Organic Matter Content	Dry		0.1	% w/w C
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE192	MTBE	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE068	EPH Aromatic (>EC10-EC12)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC12-EC16)	Solvent extraction, GC-FID	As received		1	mg/kg

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE068	EPH Aromatic (>EC16-EC21)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC21-EC35)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC35-EC44)	Solvent extraction, GC-FID	As received		1	mg/kg
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE068	EPH Aliphatic (>C10-C12)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C12-C16)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C16-C35)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C35-C44)	Solvent extraction, GC-FID	As received		10	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
91545-1	WS01	0.25	N	
91545-2	WS01	1.00	N	
91545-3	WS02	0.20	N	
91545-4	WS02	0.60	N	
91545-5	WS03	0.30	N	
91545-6	WS03	0.90	N	
91545-7	WS04	0.20	N	
91545-8	WS04	1.20	N	
91545-9	WS05	0.15	N	
91545-10	WS05	0.80	N	

APPENDIX 4

CHEMICAL SCREENING VALUES

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Metals/metalloids																			
Arsenic	37			40			43			640			79			170			LQM (2014)
Beryllium	1.7			1.7			35			12			2.2			63			LQM (2014)
Boron	290			11000			45			240000			21000			46000			LQM (2014)
Cadmium	11			85			1.9			190			120			532			LQM (2014)
Chromium III	910			910			18000			8600			1500			33000			LQM (2014)
Chromium VI	6			6			1.8			33			7.7			220			LQM (2014)
Copper	2400			7100			520			68000			12000			44000			LQM (2014)
Lead	200			310			80			2330			630			1300			C4SL
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			LQM (2014)
Mercury (Inorganic)	40			56			19			1100			120			240			LQM (2014)
Methylmercury	11			15			6			320			40			68			LQM (2014)
Nickel	180			180			230			980			230			3400			LQM (2014)
Selenium	250			430			88			12000			1100			1800			LQM (2014)
Vanadium	410			1200			91			9000			2000			5000			LQM (2014)
Zinc	3700			40000			620			730000			81000			170000			LQM (2014)
Other																			
Total Sulphate	2,400			2,400			2,400			2,400			2,400			2,400			BRE (2005)
Water Soluble Sulphate (g/l)	0.5			0.5			0.5			0.5			0.5			0.5			BRE (2005)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
PAHs																			
Acenaphthene	210	510	1100	3000 (57)	4700(141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	8300 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM (2014)
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	LQM (2014)
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	LQM (2014)
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.1	7.1	13	15	16	LQM (2014)
Benzo(g,h,i)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	LQM (2014)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	LQM (2014)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	LQM (2014)
Dibenz(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.61	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM (2014)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	63	6300	6400	LQM (2014)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	63000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	LQM (2014)
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	LQM (2014)
Phenanthrene	95	220	440	1300 (36)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM (2014)
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM (2014)
Coal Tar (BaP as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	LQM (2014)
BTEX and TPH																			
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	LQM (2014)
Toluene	130	290	660	880 vap (869)	1900	3900	22	51	120	56000 vap (869)	110000 vap (1920)	180000 vap (4360)	56000	56000	56000	87000 vap (869)	95000 vap (1920)	100000 vap (4360)	LQM (2014)
Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 vap (518)	13000 vap (1220)	27000 vap (2840)	24000	24000	25000	17000 vap (518)	22000 vap (1220)	27000 vap (2840)	LQM (2014)
Xylene - o	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	42000	43000	17000 (478)	24000 (1120)	33000 (2620)	LQM (2014)
Xylene - m	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	41000	42000	43000	17000 (625)	24000 (1470)	32000 (3460)	LQM (2014)
Xylene - p	56	130	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	41000	42000	43000	17000 (576)	23000 (1350)	31000 (3170)	LQM (2014)
Aliphatic EC 5-6	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	600000	95000 (304)	130000 (558)	180000 (1150)	LQM (2014)
Aliphatic EC >6-8	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	620000	150000 (144)	220000 (322)	320000 (736)	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	LQM (2014)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000(283)	LQM (2014)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4300 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	25000 (24)	25000 (59)	26000 (142)	LQM (2014)
Aliphatic EC >16-35	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	110000	65000 (8.48)	92000 (21)	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	LQM (2014)
Aromatic EC 5-7	70	140	300	370	690	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (1220)	84000 (2260)	92000 (4710)	LQM (2014)
Aromatic EC >7-8	130	290	660	860	1800	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	LQM (2014)
Aromatic EC >8-10	34	83	190	47	110	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	LQM (2014)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	LQM (2014)
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	23	27	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	LQM (2014)
Aromatic EC >16-21	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM (2014)
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >44-75	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
VOCs																			
1,2-dichloroethane (1,2-DCA)	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	LQM (2014)
1,1,1-trichloroethane	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000 (1425)	76000 (2915)	100000 (6392)	LQM (2014)
1,1,2,2,tetrachloroethane	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	LQM (2014)
tetrachloroethene	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	45	95	1400	1400	1400	810 (424)	1100 (951)	1500	LQM (2014)
tetrachloromethane (Carbon tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	LQM (2014)
Trichloroethene	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	LQM (2014)
Trichloromethane (chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	LQM (2014)
Chloroethene (Vinyl chloride)	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM (2014)
2,4,6 Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	LQM (2014)
HMX	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	LQM (2014)
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	LQM (2014)
Dieldrin	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	LQM (2014)
Atrazine	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	LQM (2014)
Dichlovos	0.032	0.066	0.014	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	LQM (2014)
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.8	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2500	LQM (2014)
alpha-Hexachlorocyclohexane	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	LQM (2014)
beta-hexachlorocyclohexanes	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	LQM (2014)
gamma-hexachlorocyclohexanes	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	LQM (2014)
Chlorobenzene	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	LQM (2014)
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	LQM (2014)
1,3-Dichlorobenzene	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	LQM (2014)
VOCs Continued																			
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	LQM (2014)
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	LQM (2014)
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	LQM (2014)
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	LQM (2014)
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49 (39.4)	120 (98.1)	240 (235)	78	79	79	110 (39)	120	130	LQM (2014)
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	LQM (2014)
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7	640 (43)	770 (107)	830	100	100	100	190	190	190	LQM (2014)
Hexachlorobenzene	1.8 (0.2)	3.3 (0.5)	4.9	4.1 (0.2)	5.7 (0.5)	6.7 (1.2)	0.47	1.1	2.5	110 (0.2)	120	120	16	16	16	30	30	30	LQM (2014)
Phenol	280	550	1100	750	1300	2300	66	140	280	760 $_{dir}$ (31000)	1500 $_{dir}$ (35000)	3200 $_{dir}$ (37000)	760 $_{dir}$ (31000)	1500 $_{dir}$ (35000)	3200 $_{dir}$ (37000)	760 $_{dir}$ (31000)	1500 $_{dir}$ (35000)	3200 $_{dir}$ (37000)	LQM (2014)

Parameter	Residential with homegrown produce (mg/kg, unless otherwise stated)			Residential without homegrown produce (mg/kg, unless otherwise stated)			Allotment (mg/kg, unless otherwise stated)			Commercial / Industrial (mg/kg, unless otherwise stated)			Public Open Space near Residential (mg/kg, unless otherwise stated)			Public Open Space - Park (mg/kg, unless otherwise stated)			Source
SOM	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	**1%**	**2.50%**	**6%**	
Chlorophenols (excluding pentachlorophenol)	0.87 (g)	2	4.5	94	150	210	0.13 (g)	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	LQM (2014)
Pentachlorophenol	0.22	0.52	1.2	27 (16.4)	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	LQM (2014)
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	LQM (2014)
Hexachlorobutadiene	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	LQM (2014)

(g) derived based on 2,3,4,6-tetrachlorophenol; dir - based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only); (vap) calculated for vapour phase only. SOM – Soil Organic Matter; (4.5) solubility.

APPENDIX 5

GAS AND GROUNDWATER MONITORING RESULTS

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: ECS Remediation Ltd **Job No:** YEX1601
Site: Britannia Road, Huddersfield **Visit No:** 1 **of** 6
Date: 11/12/2020 **Operator:** JR **Project Manager:** JR

Monitoring Point	GAS CONCENTRATIONS: Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		VOLATILES: PID Peak (ppm)	Product thickness (mm)	FLOW DATA: Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Worst-credible GSVs: Methane (l/hr)	CO2 (l/hr)	WELL AND WATER DATA: Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	Comments
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.2	0.2	0.0	0.0	0.6	0.6	3.0	0.0	0.0	0.0	20.3	20.4			0.0	0.0			0	0	4.81	5.20			1.0-5.2	
WS04	0.1	0.1	0.0	0.0	0.6	0.4	2.0	0.0	0.0	0.0	20.4	20.5			0.0	0.0			0	0	1..35	4.88			1.0-5.0	
WS05	0.1	0.1	0.0	0.0	0.8	0.5	3.0	0.0	0.0	0.0	20.2	20.5			0.0	0.0			0	0	0.81	2.66			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	0.2	0.2	0.0	0.0	0.8	0.6	3	0	0	0	20.4	20.5	ND	ND	0.0	0.0	ND	NA	0.0000	0.0000	4.81	5.20	NR	NR		
Min	**0.1**	**0.1**	**0.0**	**0.0**	**0.6**	**0.4**	**2**	**0**	**0**	**0**	**20.2**	**20.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.81**	**2.66**	**0.00**	**0.00**		

Worst-possible GSVs

Methane	CO2
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:		Dry		Moist	X	Wet		Snow		Frozen
Wind:	X	Calm		Light		Moderate		Strong		
Cloud cover:		None		Slight		Cloudy	X	Overcast		
Precipitation:		None		Slight	X	Moderate		Heavy		
Time monitoring performed:			14:00	Start			14:45	End		
Barometric pressure (mbar):			972	Start			972	End		
Pressure trend (Daily):				Falling			X	Rising		
Source:										
Air Temperature (Deg. C):			4	Before			4	After		

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GA5000
Gas Range: **CH_4** 0 - 100% **CO_2** 0 - 100% **O_2** 0 - 25%
Gas Flow range: +/-
Differential Pressure: +/- 500mbar
Date of last calibration:
Date of next calibration:

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client:	ECS Remediation Ltd	**Job No:**	YEX1601				
Site:	Britannia Road, Huddersfield	**Visit No:**	2	**of**	6		
Date:	22/12/2020	**Operator:**	JR			**Project Manager:**	JR

	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.1	0.1	0.0	0.0	0.5	0.3	0.0	0.0	0.0	0.0	20.1	20.3			0.0	0.0			0	0	4.75	5.20			1.0-5.2	
WS04	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	20.2	20.5			0.0	0.0			0	0	1.23	4.88			1.0-5.0	
WS05	0.1	0.1	0.0	0.0	0.7	0.4	0.0	0.0	0.0	0.0	20.1	20.3			0.0	0.0			0	0	0.85	2.66			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.1**	**0.1**	**0.0**	**0.0**	**0.7**	**0.4**	**0**	**0**	**0**	**0**	**20.2**	**20.5**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**4.75**	**5.20**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**0.4**	**0.3**	**0**	**0**	**0**	**0**	**20.1**	**20.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.85**	**2.66**	**0.00**	**0.00**		

Worst-possible GSVs

Methane	CO2
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:		Dry	x	Moist		Wet		Snow		Frozen
Wind:	x	Calm		Light		Moderate		Strong		
Cloud cover:		None	x	Slight		Cloudy		Overcast		
Precipitation:	x	None		Slight		Moderate		Heavy		
Time monitoring performed:			08:00				08:30	End		
Barometric pressure (mbar):			1008	Start			1008	End		
Pressure trend (Daily):				Falling		Steady	x	Rising		
Source:										
Air Temperature (Deg. C):			6				6	After		

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GA5000
Gas Range: **CH_4** 0 - 100% **CO_2** 0 - 100% **O_2** 0 - 25%
Gas Flow range: +/-
Differential Pressure: +/- 500mbar
Date of last calibration:
Date of next calibration:

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client:	ECS Remediation Ltd	**Job No:**	YEX1601		
Site:	Britannia Road, Huddersfield	**Visit No:**	3 6		
Date:	06/01/2021	**Operator:**	JR	**Project Manager:**	JR

Monitoring Point	GAS CONCENTRATIONS: Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		VOLATILES: PID Peak (ppm)	Product thickness (mm)	FLOW DATA: Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Worst-credible GSVs: Methane (l/hr)	CO2 (l/hr)	WELL AND WATER DATA: Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	Comments
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.2	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	21.3	21.3			0.0	0.0			0	0	4.36	5.20			1.0-5.2	
WS04	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	21.7	21.7			0.0	0.0			0	0	1.48	4.88			1.0-5.0	
WS05	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	21.6	21.9			0.0	0.0			0	0	0.83	2.66			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	0.2	0.1	0.0	0.0	0.1	0.1	0	0	0	0	21.7	21.9	ND	ND	0.0	0.0	ND	NA	0.0000	0.0000	4.36	5.20	NR	NR		
Min	**0.1**	**0.1**	**0.0**	**0.0**	**0.1**	**0.1**	**0**	**0**	**0**	**0**	**21.3**	**21.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.83**	**2.66**	**0.00**	**0.00**		

Worst-possible GSVs

Methane	CO2
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:	X	Dry		Moist		Wet		Snow		Frozen
Wind:	X	Calm		Light		Moderate		Strong		
Cloud cover:		None		Slight	X	Cloudy		Overcast		
Precipitation:	X	None		Slight		Moderate		Heavy		
Time monitoring performed:			08:30	Start			09:00	End		
Barometric pressure (mbar):			1021	Start			1021	End		
Pressure trend (Daily):			X	Falling		Steady		Rising		
Source:										
Air Temperature (Deg. C):			2	Before			2	After		

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GA5000
Gas Range: **CH_4** 0 - 100% **CO_2** 0 - 100% **O_2** 0 - 25%
Gas Flow range: +/-
Differential Pressure: +/- 500mbar
Date of last calibration:
Date of next calibration:

Ground Gas and Groundwater Monitoring Record Sheet

sirius

JOB DETAILS:

Client:	ECS Remediation Ltd	**Job No:**	YEX1601		
Site:	Britannia Road, Huddersfield	**Visit No:**	4 **of** 6		
Date:	19/01/2021	**Operator:**	JR	**Project Manager:**	JR

Monitoring Point	GAS CONCENTRATIONS: Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		VOLATILES: PID Peak (ppm)	Product thickness (mm)	FLOW DATA: Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Worst-credible GSVs: Methane (l/hr)	CO2 (l/hr)	WELL AND WATER DATA: Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	Comments
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.1	0.1	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	21.0	21.0			0.0	0.0			0	0	4.45	5.20			1.0-5.2	
WS04	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	21.3	21.5			0.0	0.0			0	0	1.88	4.88			1.0-5.0	
WS05	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	21.7	21.7			0.0	0.0			0	0	0.98	2.66			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.1**	**0.1**	**0.0**	**0.0**	**0.3**	**0.2**	**0**	**0**	**0**	**0**	**21.7**	**21.7**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**4.45**	**5.20**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0**	**0**	**0**	**0**	**21.0**	**21.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.98**	**2.66**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:	[ ] Dry	[ ] Moist	[x] Wet	[ ] Snow	[ ] Frozen
Wind:	[ ] Calm	[x] Light	[ ] Moderate	[ ] Strong	
Cloud cover:	[ ] None	[ ] Slight	[x] Cloudy	[ ] Overcast	
Precipitation:	[ ] None	[x] Slight	[ ] Moderate	[ ] Heavy	
Time monitoring performed:		12:15 Start		12:45 End	
Barometric pressure (mbar):		998 Start		998 End	
Pressure trend (Daily):		[x] Falling	[ ] Steady	[ ] Rising	
Source:					
Air Temperature (Deg. C):		7 Before		7 After	

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:

Gas Range: **CH_4** **CO_2** **O_2**

Gas Flow range:

Differential Pressure:

Date of last calibration:

Date of next calibration:

Ambient air check: **CH_4** [ ] **CO_2** [ ] **O_2** [ ]

PID:

Calibrated range:

Calibration gas:

Response time:

Accuracy:

Date of last calibration:

Date of next calibration:

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client:	ECS Remediation Ltd	**Job No:**	YEX1601		
Site:	Britannia Road, Huddersfield	**Visit No:**	5 **of** 6		
Date:	04/02/2021	**Operator:**	JR	**Project Manager:**	JR

	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA					Comments
Monitoring Point	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.0	0.0	0.0	0.0	0.6	0.5	0.0	0.0	0.0	0.0	21.9	21.9			0.0	0.0			0	0	3.87	5.20			1.0-5.2	
WS04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	21.7			0.0	0.0			0	0	1.35	4.88			1.0-5.0	
WS05	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	21.9	21.8			0.0	0.0			0	0	0.92	2.66			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**0.5**	**0**	**0**	**0**	**0**	**21.9**	**21.9**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**3.87**	**5.20**	**NR**	**NR**		
Min	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0**	**0**	**0**	**21.7**	**21.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.92**	**2.66**	**0.00**	**0.00**		

Worst-possible GSVs	
0	**0**

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:		Dry		Moist	X	Wet		Snow		Frozen
Wind:	X	Calm		Light		Moderate		Strong		
Cloud cover:		None		Slight	X	Cloudy		Overcast		
Precipitation:	X	None		Slight		Moderate		Heavy		
Time monitoring performed:			16:00	Start			16:30	End		
Barometric pressure (mbar):			982	Start			982	End		
Pressure trend (Daily):				Falling	X	Steady		Rising		
Source:										
Air Temperature (Deg. C):			5	Before			5	After		

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:

Gas Range: **CH_4** **CO_2** **O_2**

Gas Flow range:

Differential Pressure:

Date of last calibration:

Date of next calibration:

Ambient air check: **CH_4** [ ] **CO_2** [ ] **O_2** [ ]

PID:

Calibrated range:

Calibration gas:

Response time:

Accuracy:

Date of last calibration:

Date of next calibration:

Ground Gas and Groundwater Monitoring Record Sheet

JOB DETAILS:

Client: ECS Remediation Ltd **Job No:** YEX1601
Site: Britannia Road, Huddersfield **Visit No:** 6 **of** 6
Date: 16/02/2021 **Operator:** JR **Project Manager:** JR

Monitoring Point	GAS CONCENTRATIONS: Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		VOLATILES: PID Peak (ppm)	Product thickness (mm)	FLOW DATA: Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Worst-credible GSVs: Methane (l/hr)	CO2 (l/hr)	WELL AND WATER DATA: Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone	Comments
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady										
WS01	0.2	0.1	0.0	0.0	0.5	0.5	0.0	0.0	0.0	0.0	20.5	20.5			0.0	0.0			0	0	3.74	5.00			1.0-5.2	
WS04	0.1	0.1	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	20.6	21.3			0.0	0.0			0	0	1.06	4.88			1.0-5.0	
WS05	0.1	0.1	0.0	0.0	0.9	0.1	0.0	0.0	0.0	0.0	20.8	21.4			0.0	0.0			0	0	0.64	2.60			0.5-2.7	
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
																			0	0						
Max	**0.2**	**0.1**	**0.0**	**0.0**	**0.9**	**0.5**	**0**	**0**	**0**	**0**	**20.8**	**21.4**	**ND**	**ND**	**0.0**	**0.0**	**ND**	**NA**	**0.0000**	**0.0000**	**3.74**	**5.00**	**NR**	**NR**		
Min	**0.1**	**0.1**	**0.0**	**0.0**	**0.5**	**0.1**	**0**	**0**	**0**	**0**	**20.5**	**20.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0.0000**	**0.0000**	**0.64**	**2.60**	**0.00**	**0.00**		

Worst-possible GSVs	
0	0

ND - Not detected
NR - Not recorded
NA - Non applicable

MG - Made ground
NAT - Natural
C - Cohesive
G - Granular

NB: Where no flow (ND) recorded, GSVs are calculated using equiment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION: (Select correct box with X or enter data, as applicable)

State of ground:	[ ] Dry	[X] Moist	[ ] Wet	[ ] Snow	[ ] Frozen
Wind:	[ ] Calm	[X] Light	[ ] Moderate	[ ] Strong	
Cloud cover:	[ ] None	[ ] Slight	[X] Cloudy	[ ] Overcast	
Precipitation:	[X] None	[ ] Slight	[ ] Moderate	[ ] Heavy	
Time monitoring performed:		08:30 Start		09:15 End	
Barometric pressure (mbar):		1000 Start		1000 End	
Pressure trend (Daily):		[X] Falling	[ ] Steady	[ ] Rising	
Source:					
Air Temperature (Deg. C):		9 Before		9 After	

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter:
Gas Range: **CH_4** **CO_2** **O_2**
Gas Flow range:
Differential Pressure:
Date of last calibration:
Date of next calibration:

Ambient air check: **CH_4** [ ] **CO_2** [ ] **O_2** [ ]

PID:
Calibrated range:
Calibration gas:
Response time:
Accuracy:
Date of last calibration:
Date of next calibration:

APPENDIX 6

RISK ASSESSMENT MATRIX

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008) sets out a methodology for the estimation of risk.

At Phase I the risk estimation will take the form of a qualitative risk assessment, which will be entirely based on the conceptual model for each potential end-use of the site. Comments on level of uncertainty will also need to be included for each source-pathway-target linkage to allow the confidence in the assessed risks to be understood. The results of the qualitative risk assessment will allow the risk evaluation to be concisely described in the following chapters.

The methodology for risk evaluation is a qualitative method for interpreting the output for the risk estimation stage of the assessment. It involves the classification of the:

The magnitude of probability (i.e. likelihood).
[takes into account both the presence of the hazard and receptor and the integrity of the pathway]

The magnitude of the potential consequence (i.e. severity).
[takes into account both the potential severity of the hazard and the sensitivity of the receptor]

Classification of Probability

Classification	Definition	Examples
High likelihood (Hi)	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor of harm or pollution.	*A) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.* *B) Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50 years*
Likely (Li)	There is a pollutant 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.	*A) Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.* *B) Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.*
Low likelihood (Lw)	There is a pollutant 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 short term.	*A) Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.* *B) Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.*
Unlikely (Ul)	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.	*A) Elevated concentrations of toxic contaminants are present below hardstanding.* *B) Light industrial unit <10 yrs old containing a double skinned UST with annual integrity testing results available.*

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

Classification of Consequence

	Definition	Examples
Severe (Sv)	Highly elevated concentrations likely to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. A Category 1: Human Health risk is present. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long - term maintenance of the population. Catastrophic damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Major fish kill in surface water from large spillage of contaminants from site.* *Highly elevated concentrations of List I and substances present in groundwater close to small potable abstraction (high sensitivity).* *Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).*
Medium (Md)	Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. A Category 2: Human Health risk is present. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	*Significant harm to humans is defined in circular 01/2006 as death, disease* serious injury, genetic mutation, birth defects or the impairment of reproductive functions.* *Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability.* *Ingress of contaminants through plastic potable water pipes.*
Mild (Ml)	Exposure to human health unlikely to lead to "significant harm". A Category 3 Human Health risk is present. Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population Minor damage to crops, buildings or property.	*Exposure could lead to slight short - term effects (e.g. mild skin rash).* *Surface spalling of concrete.*
Minor (Mr)	No measurable effect on humans.A Category 4: Human Health risk is present. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	*The presence of contaminants at such concentrations that protective equipment is required during site works.* *The loss of plants in a landscaping scheme.* *Discoloration of concrete.*

* For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.

The classification of consequence does not take into account the probability of the consequence being realized. Therefore, there may be more than one consequence for a particular pollutant linkage. Both a severe and medium classification can result in death. Severe relates to short term (acute) risk while medium relates to long

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

term (chronic) risk. Mild relates to significant harm but to less sensitive receptors. Minor classification relates to harm which is not significant but could have a financial cost.

The classification gives a guide as to the severity and consequence of identified risk when compared with other risk presented on the site. It should be noted that if a risk is identified it cannot be classified as “no risk” but as “very low risk”. Differing stakeholders may have a different view on the acceptability of a risk.

Risk Evaluation Matrix

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High likelihood (Hi)	Very high risk (VH)	High Risk (H)	Moderate Risk (M)	Mod/low risk (M/L)
	Likely (Li)	High risk (H)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)
	Low likelihood (Lw)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)
	Unlikely (Ul)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)	Very low risk (VL)

Risk Categorizations

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

Reference

Rudland, D J, Lancefield, R M, Mayell, P N; 2001; Contaminated land Risk Assessment. A guide to Good Practice; CIRIA Report C552.

The NHBC (National House-Building Council) the Environment Agency and the Chartered Institute of Environmental Health, 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66.