GEO-LOGIC

[redacted] 57 NIBLETTS HILL, BRISTOL

DOCUMENT CONTROL

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Client: Mr David Iles

Project: 57 Nibletts Hill, Bristol

Report Ref: p46.0.1

Title: Phase 2 Land Contamination Assessment

Status: Final

Date: 01/09/2023

Production Record

	Name	Signature
Prepared	Alexandra Flint, CGeol	[redacted]
Reviewed	David Hornibrook, CGeol	[redacted]

Revision Record

Issue Number	Date	Revision Details
0	28/07/2023	Original Issue
1	01/09/2023	Minor amendment to text

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1 INTRODUCTION

1.1 Terms of Reference

Geo-Logic Site Investigations Limited (Geo-Logic) has been appointed by Mr David Iles to undertake a Phase 2 Land Contamination Assessment for a proposed new residential development at 57 Nibletts Hill, Bristol.

All works were undertaken in accordance with our proposal letter dated 27th June 2023 and referenced t27.

1.2 Background

The site is located on the corner of Nibletts Hill and Nevalan Drive, St. George, in the east of Bristol, BS5 8TP, at approximate National Grid Reference 363236 172826 (Figure 1).

The proposed development is understood to comprise demolition of the existing side extension and detached garage, and construction of two residential apartments with associated driveway and gardens adjacent to the existing property of No.57 (Figure 2).

A Phase 1 Ground Contamination Desk Study Report has previously been prepared for the site by Earth Environmental and Geotechnical (Southern) Ltd (EEGSL), referenced B2483/22/DTS and dated October 2022. In addition, a Coal Mining Risk Assessment (CMRA) has previously been produced for the site by GRM Development Solutions Ltd, referenced P8162-CMRA-1.

The aim of these works is to further assess the potential pollutant linkages outlined within the EEGSL desk study report, to determine the land contamination risk at the site with regards to the proposed development.

This assessment relates to the side extension, garage and surrounding landscaping located adjacent to No.57 Nibletts Hill, referred to as the proposed development within this report.

1.3 Scope of Work

The following scope of work has been carried out:

- Review of previous reports for the site, including EEGSL desk study and GRM CMRA;
- Exploratory ground investigation to allow assessment of ground conditions and collection of representative soil samples for laboratory chemical testing;
- Completion of a generic quantitative risk assessment (GQRA) of potential contaminants to establish the sites suitability for use under the current planning regime;
- Refinement of the conceptual site model to identify plausible pollutant pathways; and
- Identification of any remediation/ mitigation measures required to ensure the site is suitable for the proposed residential end use.

2 PREVIOUS REPORTS SUMMARY

A Phase 1 Ground Contamination Desk Study Report was prepared by Earth Environmental and Geotechnical (Southern) Ltd (EEGSL) in October 2022, referenced B2483/22/DTS. In addition, a Coal Mining Risk Assessment (CMRA) was produced for the site by GRM Development Solutions Ltd, referenced P8162-CMRA-1.

A summary of the findings of these reports is provided below. Reference should be made to the original reports for full details.

Table 2.1: Previous Reports Summary

EEGSL Desk Study Report Summary (October 2022)	
Site History	Earliest available historical mapping shows buildings on the southeast boundary of the site. No significant changes are reported until 1964 OS mapping, when residential properties as per the present day layout are shown.
Geology	The site is reported to be underlain by the Downend Member, recorded by the BGS to comprise sandstone with some conglomerate and pebbly sandstone and sporadic fissile mudstone beds. Some workable coal seams are also present. There is one recorded pit working, located 203m southwest of the site, and referring to a ceased mineral working for sandstone. The property is not in a radon Affected Area, with less than 1% of properties above the Action Level and therefore radon protection measures are not required.
Hydrogeology and Hydrology	The Downend Member is classified as a Secondary A Aquifer by the Environment Agency and the on site soils are classified as having high leaching potential. The site is not located with a Source Protection Zone (SPZ) and there are no recorded groundwater or surface water abstractions within 250m of the site. There are no recorded surface water features within 250m of the site, the nearest is the River Avon located 452m west. The site is not reported to be within a flood risk area.
Waste/ Landfills	There are no historical landfill or waste sites recorded within 250m of the site.
Current and Historical Industrial Land Use	The nearest historical industrial land use is a nursery recorded 3m north of the site on 1955 mapping. An electricity substation and a transformer are shown on historical maps between 1969-1974 and 1992, located 31m west of the site. A recent electricity substation is recorded 34m west (topographically downgradient).
Sensitive Land Uses	A local nature reserve is located 246m northwest. No further significant environmentally sensitive sites are recorded within 250m of the site.
Preliminary Conceptual Model	The preliminary conceptual model produced by EEGSL for the site identified the following potential moderate to low risk pollutant linkages; • Risk to current and future site users via direct exposure to contaminants in soils in areas of soft landscaping within the proposed development; and • Risk to construction workers via direct exposure to contaminants in soils (reduced to low where correct protective measures such as PPE are put in place). All remaining pollutant linkages were assessed as being of low risk.
Conclusions and Recommendations	EEGSL report that the site appears to have been used for residential purposes, which is unlikely to be a source of contamination, and no records of pollution or potential sources of contamination were identified on or immediately adjacent the site. The site was therefore considered to have an overall risk rating of low.

	A Phase II intrusive investigation was recommended to assess ground conditions, including laboratory testing for a general suite of contaminants and updating of the site conceptual model.
GRM Development Solutions Ltd, CMRA	
Coal Mining Assessment and Conclusions	GRM reported the shallowest recorded worked seam in the area to be at an anticipated depth of around 23.5m beneath the site (Millgrit Vein). The rocks in this area of Hanham are recorded to be structurally disturbed and GRM reported it was likely uneconomical to work the less productive coals, including the Millgrit Vein, beneath the site. Even if it has been worked, research suggests there to be sufficient rock cover over the Millgrit Vein to maintain stability at the ground surface. Based on the research, GRM identified a negligible risk from recorded workings, unrecorded shallow workings, opencast workings, mine gas emissions and spontaneous combustion. A moderate risk was noted for the potential for unrecorded mine entries to be present on site, which could be mitigated to negligible by stripping the site to natural ground and inspecting for any anomalies.

3 GROUND INVESTIGATION

3.1 Background and Rationale

The ground investigation was designed to assess the potential pollutant linkages outlined within the EEGSL desk study report for the proposed development.

The investigation works were undertaken under the supervision of a suitably experienced chartered engineering geologist from Geo-Logic Site Investigations Limited. All site works were undertaken in general accordance with BS5930:2015+A1:2020 and BS10175+A2:2017.

3.2 Ground Investigation Methodology

A summary of the ground investigation works undertaken and the rationale for each location is provided in in Table 3.1, as follows:

Table 3.1: Summary of Ground Investigation Works

Investigation Method	Location	Date(s)	Location Rationale/ Purpose
Manually excavated trial pits	HDP2, HDP3 and–HDP5	12/07/2023	Positioned in areas of soft landscaping (where accessible) within the proposed development to provide spatial coverage across the site – note that HDP2 is located in an area of proposed hardstanding (driveway). To allow for characterisation of shallow ground conditions and collection of samples for geoenvironmental laboratory analysis.

Locations HDP1 and HDP4 are outside the proposed development area and therefore not included as part of this assessment. Exploratory hole locations are presented on Figure 2 and detailed descriptions of encountered ground conditions are shown on exploratory hole logs presented in Appendix B.

3.3 Field Testing

A summary of in situ field testing undertaken as part of these ground investigation works is provided in Table 3.2.

Table 3.2: Summary of Field Testing

Field Test	Purpose
Photo-ionisation detector (PID)	Indication of the presence of volatile organic compounds (VOCs)

3.4 Geoenvironmental Testing

Laboratory testing was scheduled on the basis of the previous desk study report and field observations. All samples were collected, stored and transported in accordance with BS10175:2011, for testing at Chemtech Environmental Ltd (a UKAS/MCERTS accredited laboratory).

Soil samples were collected and tested for a selection of the following suite of determinands;

- Heavy metals/ semi-metals;
- Total organic carbon/ soil organic matter;
- Total phenols
- Total cyanide
- Sulphates and pH;
- Speciated polycyclic aromatic hydrocarbons (PAH);
- Total petroleum hydrocarbons (TPH); and
- Asbestos screen

Geochemical laboratory certificates of analysis are presented in Appendix C.

3.5 Ground Conditions

The exploratory holes have established that, within the depth of investigation, the proposed development site is underlain by the following general sequence of strata (from ground level down).

Table 3.3: Encountered Ground Conditions

Strata	Locations Encountered	Depth to Top (m)	Depth to Bottom (m)	Thickness (m)
Made Ground	HDP2, HDP3 &– HDP5	0	0.25-0.65	0.25-0.65
Completely weathered Downend Member	HDP5	0.6	1.1	0.5
Highly weathered Downend Member	HDP2, HDP3 &– HDP5	0.25-0.65	>1.15	>0.35

Made Ground

A shallow thickness of made ground was encountered across the site, noted to be slightly thicker in the southern, downslope area of the site. The made ground was typically encountered as a topsoil type material of dark brown gravelly clayey silty sandy, with gravel of sandstone, occasional chert and rare fine red brick and tile. Frequent rootlets were recorded throughout the made ground.

Within HDP3, a band of light brown medium to coarse sand with gravel of fine red brick was recorded between 0.5m and 0.65m below ground level (bgl).

Downend Member

The Downend Member sandstone was encountered in all locations below the made ground. Within HDP5, an upper completely weathered deposit of orangish brown gravelly silt sand (gravel of sandstone) was encountered. Underlying this - and encountered below the made ground in all remaining locations - the Downend Member was recorded as weak to medium strong very thinly bedded, light grey and red or orange stained, fine to medium grained sandstone with some silty sand infill.

Groundwater

No groundwater was encountered during the intrusive works.

3.6 Contamination Observations

No visual or olfactory evidence of contamination was observed during the ground investigation. All soil samples were screened on site with a photo-ionisation detector (PID), with concentrations all recorded to be below the limit of detect of the instrument (i.e. 0ppm).

4 GENERIC QUANTITATIVE RISK ASSESSMENT

4.1 Background

Generic risk assessments have been undertaken in accordance with the Environment Agency land contamination management (LCRM) guidance (2023).

4.2 Human Health Risk Assessment

Methodology

The soil chemical test results have been compared to generic assessment criteria (GAC) that are considered appropriate for the proposed site end use, in order to provide an initial assessment of the potential risk to human health.

Generic Assessment Criteria (GAC) used within this assessment have been adopted from the following publications;

- Category 4 Screening Levels (C4SLs) issued by Defra in 2013;
- Soil Guideline Values (SGVs) issued by the Environment Agency in 2009;
- Suitable 4 Use Levels (S4ULs) issued by the Chartered Institute of Environmental Health (CIEH)/Land Quality Management in 2014; and
- Dutch Intervention Value (DIV) for total cyanide in the absence of a UK published value or guidance.

The GAC used within this assessment have been conservatively selected based on a residential site end use (with homegrown produce) and a 1% soil organic matter (SOM).

No visual or olfactory evidence of contamination was encountered during the intrusive site works. Therefore, 5no. soil samples were collected from the shallow made ground that end users may come into contact with via the dermal contact, ingestion and inhalation pathways, to assess the potential chronic human health risks. As the site investigation methodology involved targeted sampling, and based on the number of samples collected, statistical analysis has not been undertaken and the results have been directly compared to the GAC.

Summary of Results

Laboratory test certificates for the soil chemical analysis are presented in Appendix C. The full human health generic quantitative risk assessment is presented in Appendix D. A summary of the measured contaminant concentrations recorded to exceed the associated GAC is provided in Table 4.1.

Table 4.1: Results Exceeding Human Health GAC

Strata	Contaminant	GAC (mg/kg)	Sample	Concentration (mg/kg)
Made ground	Arsenic	37	HDP2 0.1 – 0.2m	43.5
	Lead	200	HDP2 0.1 – 0.2m	629

It is noted that the exceedances of arsenic and lead have been recorded in a sample of the made ground (HDP2 at 0.1 – 0.2m) that will be located within an area of hardstanding (driveway) as part of the proposed development. This has been taken into consideration within the risk assessment for the site although the result has not been disregarded given the number of samples and as the made ground encountered in this location was not distinct from that encountered across the remaining site area.

Concentrations of all organic contaminants were recorded to be below the GAC. No asbestos fibres were detected in any of the soil samples tested.

4.3 Phytotoxicity

Substances with phytotoxic potential can have an effect on the establishment and healthy growth of planting introduced to areas of gardens and landscaping. Potentially phytotoxic substances can include metals such as copper, nickel and zinc, however there are a range of other soil contaminants and ground conditions that should be considered. Reference should be made to British Standard publications BS3882:2015 (Specification for topsoil) and BS8601:2013 (Specification for subsoil and requirements for use), when considering planting for the development.

4.4 Controlled Waters Risk Assessment

No groundwater was encountered as part of these works. Leachate analysis has not been undertaken on the sampled soils given the limited thickness of made ground present at the site and the total soil chemical results. The site is not located with a Source Protection Zone (SPZ) and there are no recorded groundwater or surface water abstractions within 250m of the site. The risk to controlled waters is therefore low based on the desk study and ground investigation works and no further assessment is considered to be required.

4.5 Ground Gas Risk Assessment

In accordance with BS8485:2019 and CL:AIRE RB17, a qualitative assessment of the risk posed by ground gases at the site has been undertaken based on the previous desk study report, the site investigation works and the conceptual side model. The following site-specific information has been considered as part of the assessment:

- There are no landfill or waste sites recorded within 250m of the site;
- The CMRA prepared for the site by GRM identified a negligible risk from coal mining recorded workings, unrecorded shallow workings and mine gas emissions. The shallowest coal seam was anticipated to be at some 23m depth, and the geology in the area was reported to be structurally disturbed. It was therefore considered by GRM that coal workings beneath the site would likely have been uneconomical. No evidence of unrecorded workings or mine entries was noted during these intrusive works;
- Ground conditions were recorded to comprise a shallow thickness of made ground only, typically of topsoil type material, underlain by natural sandstone deposits; and
- The property is not in a radon Affected Area, with less than 1% of properties above the Action Level and therefore radon protection measures are not required.

Based on the above, no further ground gas monitoring or assessment and no specific ground gas remedial measures are considered to be required in relation to the proposed development at this stage.

4.6 Updated Conceptual Site Model

The findings of the site investigation and the GQRA present above have been used to update the conceptual site model (previously presented within the EEGSL desk study report), to identify relevant pollutant linkages associated with the proposed development.

Identified Contaminant Sources

Sources of contaminants identified within this assessment are summarised in Table 4.2 below.

Table 4.2: Contaminant Sources

Potential Source	Rationale
Made ground – heavy metals	Concentrations of arsenic and lead within the sampled made ground have been recorded to exceed GAC for the proposed residential site end use.

Identified Receptors

Receptors identified by this assessment are summarised in Table 4.3 below.

Table 4.3: Receptors

Potential Receptor	Description
Human health	Current and future site end users and adjacent site users

It should be noted that health and safety risks to site contractors and maintenance workers have not been assessed as part of these works and will need to be considered separately within appropriate construction risk assessments/ method statements.

Pollutant Linkages

The updated conceptual model for the identified pollutant linkages is shown below in Table 4.4.

References to risk estimations are made in accordance with the methodology presented in CIRIA publication C552 (2001) titled 'Contaminated Land Risk Assessment: A Guide to Good Practice', as summarised in Appendix E.

Table 4.4: Updated Conceptual Site Model

Source	Associated Contaminants	Receptor	Pathway	Consequence	Discussion of Potential Pollutant Linkages	Likelihood	Risk
Heavy metals – on site made ground	Arsenic and lead	Human health – current and future site end users	Ingestion, inhalation and dermal contact	Medium	Future site users may come into contact with made ground in areas of proposed gardens/ soft landscaping. Exceedances of the GAC have been recorded for arsenic and lead within the sampled made ground, although these have currently only been recorded within an area of proposed hardstanding.	Likely	Moderate/ Low
		Adjacent site users	Inhalation of fugitive dust	Medium	Contaminated soil dust could reach neighbouring properties during construction in dry weather, although given the scale of the development, the concentrations of contaminants recorded within the shallow soils and the limited thickness of made ground encountered, the likelihood of significant dust generation and release of contaminants is considered to be low. Good practices during construction would mitigate any remaining risk.	Unlikely	Low

5 REMEDIATION AND RISK MANAGEMENT RECOMMENDATIONS

5.1 Background

The assessment has identified pollutant linkages at the site, which require either additional testing or mitigation to ensure the site is suitable for the proposed residential end use.

5.2 Additional Testing

Given the localised nature of the recorded contaminants of potential concern within the shallow made ground - recorded within an area of proposed hardstanding only - additional testing may be undertaken at final site levels to confirm the requirement for remedial measures at the site.

5.3 Remedial Options

The following outline remedial approach is provided for guidance and will require approval from the Local Planning Authority. Where remedial works are carried out, a verification report will be required upon completion of all remedial works to demonstrate the risk has been reduced and that the remediation objectives and criteria have been met.

On the basis of the intrusive works and the updated conceptual site model, the following remediation is considered to be required.

Table 5.1: Recommended Remediation/ Mitigation

Pollutant Linkage	Remedial options
Dermal contact, ingestion and inhalation of heavy metals (lead and arsenic) in shallow made ground by future site users, from areas of proposed gardens and soft landscaping.	Capping with clean cover soils in gardens/ areas of soft landscaping. Recommended thickness of 600mm, or Removal of made ground in garden/ soft landscaped areas and provision of suitable subsoil and topsoil.
Inhalation of heavy metals in fugitive dust by neighbouring site users during construction works in dry weather	Good site practices during construction works including dampening down during excavation and handling of made ground materials on site.

5.4 Unforeseen Risks During Development

It is anticipated that similar ground conditions are present across the site to those encountered during these works. However, should evidence of former mine workings, significant thickness of made ground, or evidence of contamination be identified during the development works, further investigation and assessment will be required by a suitably qualified person.

5.5 Construction Health and Safety

It is recommended that construction workers at the site adopt appropriate personal hygiene precautions at the site and use personal protective equipment as required, particularly provision of washing facilities, wearing of gloves and avoidance of hand to mouth contact (e.g. eating or smoking), especially when dealing with made ground.

5.6 Water Supply Pipes

The water company should be contacted prior to installation of water supply pipes. Targeted testing and site specific assessment may be required along propped pipeline routes.

5.7 Waste

Waste testing and characterisation has not been undertaken as part of these works. Testing may be required to support off-site disposal of soils from site.

5.8 Phytotoxicity

Given the requirement for clean cover within garden areas, suitable topsoil and subsoil should be provided in order to establish healthy growth for any proposed planting. Reference should be made to British Standard publications BS3882:2015 (Specification for topsoil) and BS8601:2013 (Specification for subsoil and requirements for use), when considering planting for the development.

6 SUMMARY

The proposed development is understood to comprise construction of two residential apartments with associated driveway and gardens.

A Phase 1 Ground Contamination Desk Study Report and a Coal Mining Risk Assessment (CMRA) have previously been prepared for the site by Earth Environmental and Geotechnical (Southern) Ltd and GRM Development Solutions Ltd.

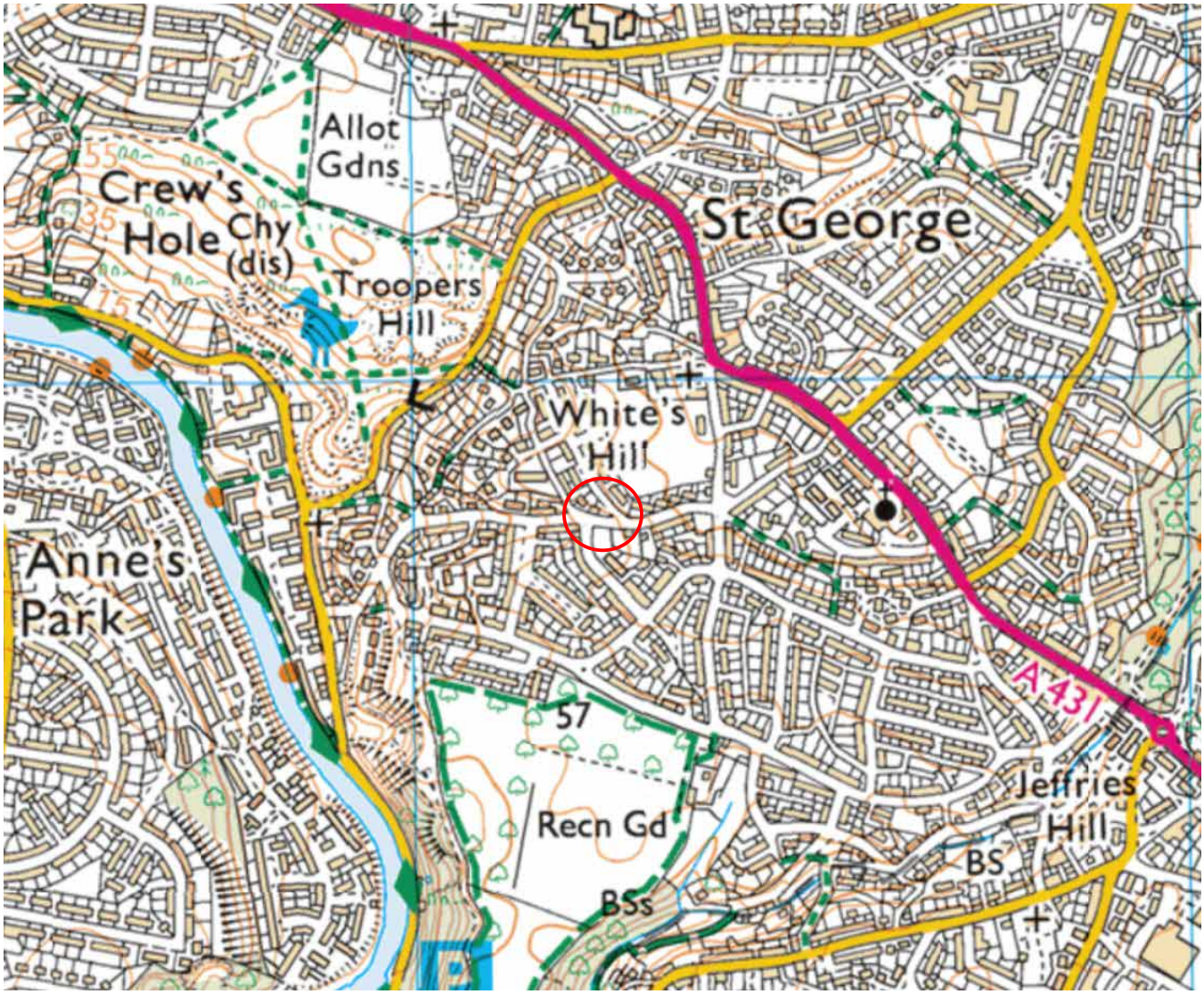
A site investigation has been carried out comprising manual excavation of 3no. trial pits across the proposed development area to assess ground conditions and obtain samples for geoenvironmental laboratory analysis.

The investigation recorded a shallow thickness of made ground across the site (to depths between 0.25m and 0.6m), underlain by natural ground comprising sandstone of the Downend Member. No groundwater was encountered.

Laboratory analysis of the made ground has recorded elevated concentrations of heavy metals (arsenic and lead) in relation to generic assessment criteria (GAC) for a residential site end use.

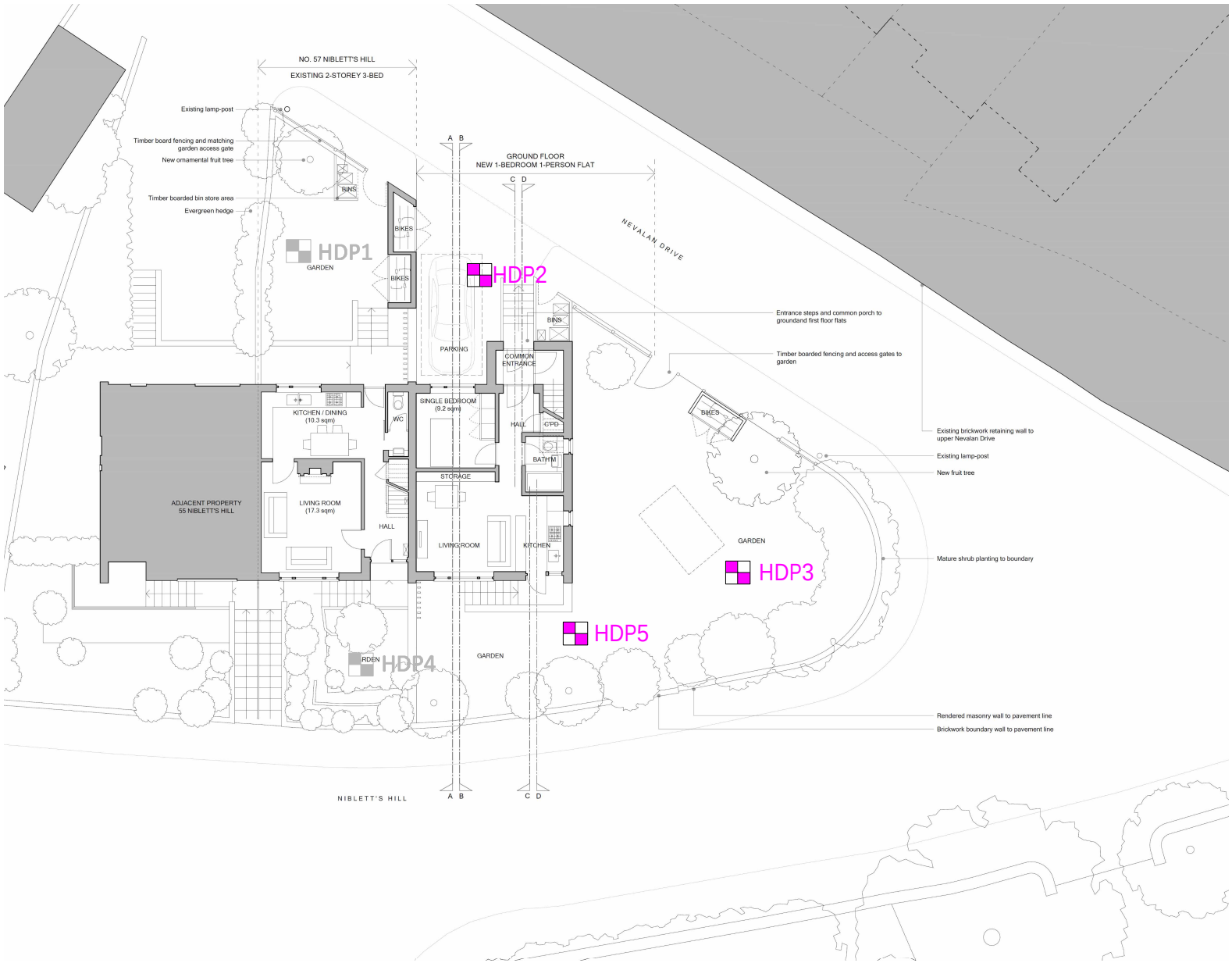
Additional testing may be undertaken within proposed areas of garden/ soft landscaping at final levels to further assess the requirement for remedial measures. Alternatively, remedial measures should be provided within the development comprising either removal of made ground and replacement with suitable subsoil/ topsoil, or provision of 600mm thickness of clean cover, within proposed garden areas.

FIGURES



Ordnance Survey PMCL: LAN1001933

Approximate Site Location:



Extract of Kove Architects, 57 Nibletts Hill, Floor Plans - As Proposed, Drawing No. 364-7(PL-P) 1.02, May 2021

NORTH (approx)

Key:

Hand dug pit location

Hand dug pit location outside proposed development area

Notes

*

Site:
57 Nibletts Hill, Bristol

Client:
Mr. David Iles

Reference No:	Scale:
P46	NTS

Filename:
P46.figures.dwg

FIGURE 1

Exploratory Hole Location Plan - Proposed Site Layout

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Geo-Logic Site Investigations Ltd
Unit 3 Beckery Old Road
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APPENDIX A

Site photographs

Plate 1	

Facing north towards site from Nibletts Hill.

Plate 2	

Facing west towards garage and extension.

Plate 3	

Facing west across paved and garden areas in the south of the site (location of HDP5 (foreground)). Properties along Nibletts Hill beyond.

Plate 4	

Encountered ground conditions in HDP2.

Plate 5	

Encountered ground conditions in HDP3.

Plate 6	

Encountered ground conditions in HDP5.

APPENDIX B

Hand dug pit exploratory hole records

GEO-LOGIC

HAND DUG PIT: HDP2

PROJECT NUMBER P46	**EXCAVATION METHOD** Hand digging tools	**LOGGED BY** A Flint
PROJECT NAME 57 Nibletts Hill, Bristol	**TOTAL DEPTH** 0.6m	**CHECKED BY** D Hornibrook
CLIENT Mr David Iles	**DATE** 12/07/2023	

COMMENTS

Depth	Level	Type	Legend	Stratum Description	Additional Observations
	0.0	ES 0.1 - 0.2m		MADE GROUND Dark brown gravelly clayey silty sand. Gravel of fine to coarse angular to subangular sandstone and rare fine brick. Frequent rootlets.	
0.5	0.0	ES 0.4 - 0.5m		DOWNEND MEMBER Weak to medium strong very thinly bedded light grey and orange stained fine to medium grained SANDSTONE with silty sand infill.	
1 1.5				Terminated on medium strong sandstone at 0.6m.	

GEO-LOGIC

HAND DUG PIT: HDP3

PROJECT NUMBER P46	**EXCAVATION METHOD** Hand digging tools	**LOGGED BY** A Flint
PROJECT NAME 57 Nibletts Hill, Bristol	**TOTAL DEPTH** 1.0m	**CHECKED BY** D Hornibrook
CLIENT Mr David Iles	**DATE** 12/07/2023	

COMMENTS

Depth	Water	Sample	Graphic	Stratum Description	Additional Observations
	0.0	ES 0.4 - 0.5m		MADE GROUND Dark brown slightly gravelly silty sand. Gravel of chert, sandstone and rare fine red tile. Frequent rootlets.	
0.5	0.0			MADE GROUND Light brown medium to coarse sand with rare gravel of fine to medium red brick.	
				DOWNEND MEMBER Weak to medium strong very thinly bedded light grey and red stained fine to medium grained SANDSTONE with silty sand infill.	
1				Terminated on medium strong sandstone at 1.0m.	
1.5					

HAND DUG PIT: HDP5

PROJECT NUMBER P46	**EXCAVATION METHOD** Hand digging tools	**LOGGED BY** A Flint
PROJECT NAME 57 Nibletts Hill, Bristol	**TOTAL DEPTH** 1.15m	**CHECKED BY** D Hornibrook
CLIENT Mr David Iles	**DATE** 12/07/2023	

COMMENTS

Depth (m)	Level (m)	Sample / Test	Graphic	Stratum Description	Additional Observations
	0.0			MADE GROUND Dark brown slightly gravelly silty sand. Gravel of chert, sandstone and rare fine red tile. Frequent rootlets.	
0.5	0.0	ES 0.5 - 0.6m			
				DOWNEND MEMBER Orangish brown and light brown gravelly silty SAND. Gravel of weak fine to coarse angular to subangular sandstone.	
1				DOWNEND MEMBER Weak to medium strong very thinly bedded light grey fine to medium grained SANDSTONE with silty sand infill.	
				Terminated on medium strong sandstone at 1.15m.	
1.5					

APPENDIX C

Geochemical laboratory analytical certificates

ANALYTICAL TEST REPORT

Contract no: 124778

Contract name: Nibletts Hill, Bristol

Client reference: P46

Clients name: Geo-Logic SI

Clients address: Unit 3 Beckery Old Road
Glastonbury
Somerset
BA6 9QT

Samples received: 14 July 2023

Analysis started: 14 July 2023

Analysis completed: 24 July 2023

Report issued: 24 July 2023

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

Approved by: [redacted]

Ellis McCulloch
Senior Reporting Administrator

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.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
124778-1	HDP1	0.20-0.30	Sandy Loam with Gravel & Roots	-	-	18.2
124778-2	HDP2	0.10-0.20	Sandy Loam with Gravel & Roots	-	-	18.1
124778-3	HDP3	0.40-0.50	Sandy Loam with Gravel & Roots	-	-	17.7
124778-4	HDP4	0.20-0.30	Sandy Loam with Gravel & Roots	-	-	20.6
124778-5	HDP5	0.50-0.60	Sandy Loam with Gravel & Roots	-	-	11.7

Chemtech Environmental Limited

SOILS

Lab number			124778-2	124778-3	124778-5
Sample id			HDP2	HDP3	HDP5
Depth (m)			0.10-0.20	0.40-0.50	0.50-0.60
Date sampled			12/07/2023	12/07/2023	12/07/2023
Test	Method	Units			
Boron (water soluble)	CE063 U	mg/kg B	0.7	1.2	<0.5
Arsenic	$ M	mg/kg	43.5	30.2	26.6
Cadmium	$ M	mg/kg	1.2	1.4	0.7
Chromium	$ M	mg/kg	35.0	35.2	38.2
Copper	$ M	mg/kg	76.6	67.5	48.5
Lead	$ M	mg/kg	629	200	125
Mercury	$ M	mg/kg	0.5	0.3	0.3
Nickel	$ M	mg/kg	27.7	29.5	26.8
Selenium	$ M	mg/kg	< 1.0	< 1.0	< 1.0
Zinc	$ M	mg/kg	410	416	204
pH	CE004 M	units	7.5	7.7	7.9
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	152	32	13
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	1362	969	426
Sulphur (total)	CE119	mg/kg S	735	558	412
Total Potential Sulphate	CE223	mg/kg SO_4	2204	1674	1237
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	11.1	12.5	5.6
Estimate of OMC (calculated from TOC)	CE197	% w/w	19.1	21.5	9.7
PAH					
Naphthalene	CE087 M	mg/kg	0.10	0.08	0.25
Acenaphthylene	CE087 M	mg/kg	0.03	0.05	<0.02
Acenaphthene	CE087 M	mg/kg	0.08	<0.02	0.05
Fluorene	CE087 U	mg/kg	0.09	0.04	0.05
Phenanthrene	CE087 M	mg/kg	1.81	0.69	0.72
Anthracene	CE087 U	mg/kg	0.39	0.27	0.14
Fluoranthene	CE087 M	mg/kg	2.85	1.67	0.98
Pyrene	CE087 M	mg/kg	2.28	1.46	0.87
Benzo(a)anthracene	CE087 U	mg/kg	1.35	1.16	0.50
Chrysene	CE087 M	mg/kg	1.69	1.33	0.61
Benzo(b)fluoranthene	CE087 M	mg/kg	1.71	1.18	0.69
Benzo(k)fluoranthene	CE087 M	mg/kg	0.57	0.37	0.24
Benzo(a)pyrene	CE087 U	mg/kg	1.17	0.84	0.45
Indeno(123cd)pyrene	CE087 M	mg/kg	0.91	0.62	0.40
Dibenz(ah)anthracene	CE087 M	mg/kg	0.22	0.14	0.09
Benzo(ghi)perylene	CE087 M	mg/kg	0.81	0.50	0.39
PAH (total of USEPA 16)	CE087	mg/kg	16.1	10.4	6.43
TPH					
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	<0.01	<0.01

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SOILS

Lab number			124778-2	124778-3	124778-5
Sample id			HDP2	HDP3	HDP5
Depth (m)			0.10-0.20	0.40-0.50	0.50-0.60
Date sampled			12/07/2023	12/07/2023	12/07/2023
Test	Method	Units			
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	-	<10	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	-	<10	<10
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	-	<1	<1
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	-	<1	<1
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	-	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	-	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	-	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	-	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	-	<10	<10
Subcontracted Analysis					
Asbestos (qualitative)	$	-	NAD	NAD	NAD

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
$^{M}	Arsenic	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg
$^{M}	Cadmium	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg
$^{M}	Chromium	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^{M}	Copper	Aqua regia digest, ICP-MS	Dry	M	4	mg/kg
$^{M}	Lead	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^{M}	Mercury	Aqua regia digest, ICP-MS	Dry	M	0.1	mg/kg
$^{M}	Nickel	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^{M}	Selenium	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg
$^{M}	Zinc	Aqua regia digest, ICP-MS	Dry	M	4.5	mg/kg
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO_4
CE119	Sulphur (total)	Aqua regia digest, ICP-OES	Dry		100	mg/kg S
CE223	Total Potential Sulphate	Calculation: S (total) x (MW SO_4 / MW S)	Dry		300	mg/kg 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
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
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
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
CE250	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		1	mg/kg

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
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
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		15	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		10	mg/kg

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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)
124778-1	HDP1	0.20-0.30	N	
124778-2	HDP2	0.10-0.20	N	
124778-3	HDP3	0.40-0.50	N	
124778-4	HDP4	0.20-0.30	N	
124778-5	HDP5	0.50-0.60	N	

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ADDITIONAL INFORMATION

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 4 weeks from initial receipt unless otherwise instructed.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

Moisture Content Calculated on a Wet Weight basis

APPENDIX D

Generic quantitative risk assessment: human health

Table 1 - Estimation of Chronic Human Health Risks for Standard Residential Land Use with Plant Uptake (1 % SOM)						
Contaminant		Units	GAC	HDP2	HDP3	HDP5
				0.10-0.20m	0.40-0.50m	0.50-0.60m
pH value		-	-	7.5	7.7	7.9
Soil Organic Matter		%	-	19.1	21.5	9.7
Asbestos screen		-	-	NAD	NAD	NAD
Metals and inorganics	Arsenic	mg/kg	37	43.5	30.2	26.6
	Boron	mg/kg	290	0.7	1.2	<0.5
	Cadmium	mg/kg	11	1.2	1.4	0.7
	Chromium	mg/kg	910	35.0	35.2	38.2
	Copper	mg/kg	2400	76.6	67.5	48.5
	Lead	mg/kg	200[C4SL]	629.0	200.0	125.0
	Inorganic Mercury	mg/kg	40	0.5	0.3	0.3
	Nickel	mg/kg	130	27.7	29.5	26.8
	Selenium	mg/kg	250	< 1.0	< 1.0	< 1.0
	Zinc	mg/kg	3700	410.0	416.0	204.0
	Cyanide	mg/kg	41[DIV]	<1	<1	<1
Organics	Phenols	mg/kg	120	0.5	<0.5	<0.5
PAHs	Naphthalene	mg/kg	2.3	0.10	0.08	0.25
	Acenaphthylene	mg/kg	170	0.03	0.05	<0.02
	Acenaphthene	mg/kg	210	0.08	<0.02	0.05
	Fluorene	mg/kg	170	0.09	0.04	0.05
	Phenanthrene	mg/kg	95	1.81	0.69	0.72
	Anthracene	mg/kg	2400	0.39	0.27	0.14
	Fluoranthene	mg/kg	280	2.85	1.67	0.98
	Pyrene	mg/kg	620	2.28	1.46	0.87
	Benzo(a)anthracene	mg/kg	7.2	1.35	1.16	0.50
	Chrysene	mg/kg	15	1.69	1.33	0.61
	Benzo(b)fluoranthene	mg/kg	2.6	1.71	1.18	0.69
	Benzo(k)fluoranthene	mg/kg	77	0.57	0.37	0.24
	Benzo(a)pyrene	mg/kg	2.2	1.17	0.84	0.45
	Indeno(1,2,3-c,d)pyrene	mg/kg	27	0.91	0.62	0.40
	Dibenzo(ah)anthracene	mg/kg	0.24	0.22	0.14	0.09
	Benzo(g,h,i)perylene	mg/kg	320	0.81	0.50	0.39
TPHs (Aromatics)	Aromatic (>EC5-EC7)	mg/kg	70	-	<0.01	<0.01
	Aromatic (>EC7-EC8)	mg/kg	130	-	<0.01	<0.01
	Aromatic (>EC8-EC10)	mg/kg	34	-	<0.01	<0.01
	Aromatic (>EC10-EC12)	mg/kg	74	-	<10	<10
	Aromatic (>EC12-EC16)	mg/kg	140	-	<10	<10
	Aromatic (>EC16-EC21)	mg/kg	260	-	<1	<1
	Aromatic (>EC21-EC35)	mg/kg	1100	-	<1	<1
	Aromatic (>EC35-EC44)	mg/kg	1100	-	<1	<1
TPHs (Aliphatics)	Aliphatic (>C5-C6)	mg/kg	42	-	<0.1	<0.1
	Aliphatic (>C6-C8)	mg/kg	100	-	<0.1	<0.1
	Aliphatic (>C8-C10)	mg/kg	27	-	<0.1	<0.1
	Aliphatic (>C10-C12)	mg/kg	130	-	<6	<6
	Aliphatic (>C12-C16)	mg/kg	1100	-	<6	<6
	Aliphatic (>C16-C35)	mg/kg	65000	-	<15	<15
	Aliphatic (>C35-C44)	mg/kg	65000	-	<10	<10

Notes

GAC	Generic Assessment Criteria. All GAC are S4ULs published by CIEH/LQM in 2014, unless otherwise stated.
C4SL	Catergory 4 Screening Level published by DEFRA in 2013.
DIV	Dutch Intervention Value (VROM 2000)
NAD	No asbestos detected
Value	Shaded cells indicate samples in which GAC is exceeded.

APPENDIX E

Risk evaluation

The contaminated land risk assessment methodology within this report is based on CIRIA C552 (2001) Contaminated Land Risk Assessment – A Guide to Good Practice, in order to quantify potential risk via risk estimation and risk evaluation, which can be adopted at the Phase I stage. The methodology requires the classification of:

- the magnitude of the consequence (severity) of a risk occurring, and
- the magnitude of the probability (likelihood) of a risk occurring.

The potential consequences of contamination risks occurring at this site are classified in accordance with the tables below, as extracted from CIRIA C552.

Table 1: Classification of Consequence

Classification	Definition of Consequence
Severe	Short-term (acute) risks to human health likely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such an ecosystem.
Medium	Chronic damage to Human Health (significant harm as defined in DEFRA, 2012). Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such an ecosystem.
Mild	Pollution of non-sensitive water resources. Significant damage to plants/ crops, buildings, structures and services ("significant harm" as defined in the DEFRA, 2012). Damage to sensitive buildings/structures/services or the environment.
Minor	Harm, though not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.). Easily repairable effects of damage to buildings, structures and services.

Table 2: Classification of Probability

Classification	Definition of Probability
High likelihood	There is a pollutant linkage and an event that appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term
Low likelihood	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 an event would take place, and is less likely in the shorter term.
Unlikely	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

For each possible contaminant linkage (source-pathway-receptor) identified, the potential risk is evaluated based upon the following probability and consequence matrix shown overleaf in Table 3.

Table 3: Contamination Risk Matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/ low risk
	Likely	High risk	Moderate risk	Moderate/ low risk	low Risk
	Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Based upon this, CIRIA C552 present definitions of the risk categories, together with the investigatory and remedial actions that are likely to be necessary in each case, as in Table V-4. These risk categories apply to each contaminant linkage.

Table 4: Definition of Risk Categories/ Action Required

Classification	Definition and Likely Action Required
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, if [it] is 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	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised would at worst be relatively mild.
Very Low	There is a low possibility that harm could rise to a receptor. In the event of such harm being realised it is not likely to be severe.