Dice Environmental

The Tudor
Phase 2 Contamination Assessment

October 2024

Ref: 101610

Version 1.0

Site	The Tudor, High Street, Fenstanton, Huntingdon PE28 9JZ
Client	Twenty Nine Architecture
Date	18 October 2024
Project Reference	101610

Drafted by:	[redacted]	[redacted]BSc FGS Geo-Environmental Consultant
Date	4th October 2024	
Completed & reviewed by:	[redacted]	[redacted]BSc AMIEnvSc Geo-Environmental Consultant
Date	9th October 2024	
Authorised by:	[redacted]	[redacted]BSc MSc CEnv Director
Date	18th October 2024	

Executive Summary	
Site Description	The site currently comprises a single large building formerly a hotel, however, the structure is mostly disused. There is a region of hardstanding around the south and west of the main site building which is in use as car parking spaces and an area of soft landscaping garden is present to the north and west of the main building. A temporary office building is present in the north-east of the site and an open shed storage yard is present in the landscaping to the east of the main building. Beyond the presence of made ground, no significant visual or olfactory evidence of contamination is observed on-site.
Proposed Development	The proposed site development comprises the demolition of the existing building and the construction of 6No. residential dwellings with hardstanding or car parking and soft landscaped garden areas.
Ground Conditions	Made ground was identified in regions of the site in the form of hardstanding with gravel surfacing, however, no made ground was identified in areas of landscaping where the pits were excavated. HP01 was advanced down the side of hardstanding to determine if made ground underlaid the hardstanding, however only natural soils were encountered. Superficial geology generally comprised dark brown/ brown clayey sandy gravelly topsoil overlying brown/ greyish brown slightly clayey gravelly sand with fine to coarse gravels of quartz and flint becoming hard to dig from a shallow depth. Geological maps record superficial geology as River Terrace Deposits. Solid geology was not encountered during this site investigation. However, geological maps record bedrock geology as Oxford Clay.
Hydrogeology	The underlying superficial geology is classified as a Secondary A Aquifer, comprising 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. The underlying bedrock geology is classified as an Unproductive Aquifer, comprising deposits with low permeability that have negligible significance for water supply or river base flow. The site lies within a total catchment Source Protection Zone (SPZ).
Hydrology	The nearest surface water feature is a pond located approximately 50m north of the site.

Risk to Controlled Waters	No significant levels of contaminants of concern have been identified with respect to controlled waters. Therefore, no specific remediation is considered to be required.
Human Health Risk Assessment	No contaminant exceedances with respect to the proposed end use were identified across the site during this site investigation. No significant potential source of ground gas was identified. However, the Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within a intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level. Therefore, basic radon protection measures will be required.
Conclusions / Recommendations	A Phase 2 contamination assessment was undertaken with soil materials from across the site being sampled and sent for analysis at a UKAS/MCERTS accredited laboratory for identified general and specific potential contaminants of concern. Hand-excavated pits were advanced to attain the aforementioned samples, as well as to describe and characterize underlying made ground/soil materials. Recommendations: - No elevated levels of contamination have been identified across the site with respect to a Residential with Produce end use. Therefore, no remedial measures are considered necessary at this time. - The Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within an intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level. Therefore, basic radon protective measures are considered necessary in the construction of new dwellings or extensions. - Should any unexpected signs of contamination be identified during building / groundwork activities, works should be stopped, the local authority notified, and a suitably qualified environmental consultant engaged to assess the risk posed and propose remedial measures where necessary. This report should be submitted to your local planning authority for approval.

Contents

Executive Summary 3
1. Introduction 6
1.1. Client Brief 6
1.2. Report Objectives 6
1.3. References 6
1.4. Limitations 7
2. Site Information 8
2.1. Site Location 8
2.2. Site Description 8
2.3. General Area Context 8
3. Phase 1 Conceptual Site Model 9
4. Phase II Investigation 10
4.1. Overview of Works 10
5. Ground Conditions 11
5.1. Made Ground 11
5.2. Superficial Strata 11
5.3. Solid Strata 11
5.4. Groundwater 11
5.5. Field Observations 11
6. Contamination Assessment 12
6.1. Inorganics & Organics 12
6.2. Asbestos 13
6.3. Ground Gas 13
6.4. Controlled Waters 14
7. Phase II Conceptual Site Model 15
8. Risk Management & Remediation 16
8.1. Remediation to Protect End Users 16
8.2. Ground Gas Protection Measures 16
8.3. Remediation to Protect Controlled Waters 16
8.4. Remediation to Protect Construction Workers 16
9. Conclusions and Recommendations 17

Appendix A – Figures
Appendix B – Hand pit logs
Appendix C – Laboratory Results
Appendix D – GACs

1. Introduction

1.1. Client Brief

Twenty Nine Architecture instructed Dice Environmental to undertake a Phase II Contamination Assessment for the site known as The Tudor Hotel, Fenstanton, Huntingdon PE28 9JZ, following the Phase 1 Desk Study undertaken by Sequoia Environmental in November 2023 (SE-2023-201).

The proposed site development comprises the demolition of the existing building and the construction of 6No. residential dwellings with hardstanding or car parking and soft landscaped garden areas.

The site location plan and proposed development are included within Appendix A.

1.2. Report Objectives

This Phase II Contamination Assessment includes:

- The provision and execution of a Phase II Contamination Assessment strategy, to investigate the potential sources of contamination identified within the aforementioned Phase I Report.
- The development of a Phase II Conceptual Model.
- Conclusions and recommendations to facilitate responsible development of the site, in relation to the intended end use.

1.3. References

Assessment guidance and site-specific information has been sought from the following locations:

- EA/DEFRA (2020) LCRM: Land contamination Risk Management (Supersedes (2004), CLR11: Model Procedures for the Assessment of Land Contamination).
- BS 5930:2015+A1:2020: Code of practice for ground investigations.
- Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.
- DEFRA (2014). Category 4 Screening Levels (C4SL) – SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination.
- CIRIA. (2001). *Contaminated land risk assessment A guide to good practice.*

- DoE (1995), Industry profiles.
- Environment Agency. (2008). *R&D Publication 66. Guidance for the Safe Development of Housing on Land Affected by Contamination.*
- Environment Agency. (March 2017). *New Groundwater Vulnerability Mapping Methodology in England and Wales. Reference SC040016/R. Environment Agency.*
- BS 8485:2015+A1:2019 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.
- BRE (2004), BR465: Cover systems for land regeneration.
- CIRIA (2014), C733 Asbestos in soil and made ground: a guide to understanding and managing risks.

1.4. Limitations

The recommendations and opinions expressed in this report are based on information obtained as part of the desk study or provided by others. Information provided from other sources is taken in good faith and Dice Environmental cannot guarantee its accuracy. By the very nature of a ground investigation, information gained through intrusive investigation is from specific point locations. Ground conditions have the potential to vary significant across any site, and the ultimate decision with regards to foundation design or other technical specifications lies with the developer and/or structural engineer.

This report does not include specific investigation for the presence of either Potential Asbestos Containing Material (PACM) or Japanese Knotweed at the subject site however, if obvious evidence of either is observed during EPS site walkover, details will be provided in this report. Specialist contractors should be commissioned to make detailed assessments and recommendations if these materials are suspected.

The information contained in this report is intended for the use of Twenty Nine Architecture. and Dice Environmental can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2. Site Information

2.1. Site Location

The site is located adjacent north-west from the intersection between High Street and Swan Road in Fenstanon. The national grid reference (NGR) for the approximate centre of the site is TL317683.

A site plan is presented in Appendix A.

2.2. Site Description

The site currently comprises a single large building formerly a hotel, however, the structure is mostly disused. There is a region of hardstanding around the south and west of the main site building which is in use as car parking spaces and an area of soft landscaping garden is present to the north and west of the main building.

A temporary office building is present in the north-east of the site and an open shed storage yard is present in the landscaping to the east of the main building.

Beyond the presence of made ground, no significant visual or olfactory evidence of contamination is observed on-site.

2.3. General Area Context

North: To the immediate north is the garden of a residential property and a private lake.

East: To the east of the site is Sawn Road followed by residential properties and associated gardens.

South: To the south of the site is High Street followed by residential properties and associated gardens.

West: To the immediate west of the site is a residential property and a nursery. These are then followed by additional residential properties.

3. Phase 1 Conceptual Site Model

The Phase 1 Desk Study, undertaken by Sequoia Environmental in November 2023 (SE-2023-201), identified sources, pathways and receptors. Contaminant linkages that were considered plausible are summarised in the following table.

Source	Pathway	Receptor	Risk Rating
Contaminated soil	Dermal contact and ingestion	Site users and construction workers	High
	Inhalation of airborne soil and soil dust	Site users and construction workers	High
	On-site migration and volatilisation of organic compounds in soil	Site users and construction workers	High
	Uptake and adherence of contaminated soil to vegetation and ingestion	Site users	Moderate
	Ingress/diffusion into potable water supply pipework	Site users	Moderate/Low
	Root and leaf uptake	Plants	Moderate/Low

A number of contaminant linkages were identified which, whilst theoretically possible, were not considered to be 'plausible', given the context of the site and surrounding area. Justification for exclusion of these linkages from the Conceptual Site Model is made within the table below:

Source & Receptor	Risk Rating	Justification
Risks to groundwater from site derived contaminants	No plausible linkage	Although the site is used for some car parking, the vehicles are located on hardstanding. The on-site historic borehole log report the underlying river terrace deposits to be limited in thickness and therefore any groundwater present is likely to have limited resource potential.
On-site migration of PCBs	No plausible linkage	Two electricity substations are located nearby. Most modern transformer insulation oils do not contain PCBs and these substations lie at a significant distance from the site. This source is therefore not considered to pose a risk to future site users.
On-site migration of ground gas	No plausible linkage	An historic landfill site is present approximately 800m to the east. However, given the distance of this site and the limited permeability of the underlying clay geology, a plausible contaminant linkage has not been identified associated with the on-site migration of landfill gas.

4. Phase II Investigation

4.1. Overview of Works

The Phase II intrusive investigation was undertaken on the 16th of September 2024 under the supervision of a suitably qualified engineer and in general accordance with the Code of Practice for Site Investigations BS 5930:2015+A1:2020.

The Phase II investigation incorporated the following:

- The advancement of 6No. Hand pits to a maximum depth of 0.60m for shallow soil sampling.

- The analysis of 6No. soil samples at a UKAS/MCERTS accredited laboratory for general and site-specific chemical determinands. This included:

    - 8No. soil samples being analysed for a standard 'CLEA' screening suite of heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn), PAHs (USEPA 16 & Total) and asbestos.

    - 4No. soil samples being analysed for hydrocarbons (TPH CWG ali/aro split).

Hand pit logs are contained in Appendix B.
Hand pit and sample locations are contained within Appendix A.

5. Ground Conditions

5.1. Made Ground

Made ground was identified in regions of the site in the form of hardstanding with gravel surfacing, however, no made ground was identified in areas of landscaping where the pits were excavated. HP01 was advanced down the side of hardstanding to determine if made ground underlaid the hardstanding, however only natural soils were encountered.

5.2. Superficial Strata

Superficial geology generally comprised dark brown/ brown clayey sandy gravelly topsoil overlying brown/ greyish brown slightly clayey gravelly sand with fine to coarse gravels of quartz and flint becoming hard to dig from a shallow depth.

5.3. Solid Strata

Bedrock geology was not encountered during this site investigation.

5.4. Groundwater

Groundwater was not encountered during this site investigation.

5.5. Field Observations

Beyond the presence of made ground as described above in section 4.1, no significant visual or olfactory evidence of contamination was noted within soils across the site.

6. Contamination Assessment

The guidance detailed in section 1.3 has been followed to ensure that the risk posed to identified receptors, is reported according to accepted compliance criteria.

A Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL ("Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3829. All rights reserved") and DEFRAs C4SLs within Appendix D.

6.1. Inorganics & Organics

Determinand	Greatest recorded value across all samples (mg/kg)	Residential with Produce end use (mg/kg)	Pass/Fail	Samples with exceedances
Arsenic (total)	24.6	37	Pass	N/A
Cadmium (total)	<1.6	11	Pass	N/A
Chromium (total)	94.4	910	Pass	N/A
Chromium (VI)	<0.04	6	Pass	N/A
Copper (total)	15.7	2400	Pass	N/A
Lead (total)	120.3	200	Pass	N/A
Mercury (total)	<0.7	1.2	Pass	N/A
Nickel (total)	21.5	180	Pass	N/A
Selenium (total)	<3	250	Pass	N/A
Vanadium (total)	45.9	410	Pass	N/A
Zinc (total)	83	3700	Pass	N/A
PAHs				
Naphthalene	0.15	13	Pass	N/A
Acenaphthylene	0.03	920	Pass	N/A
Acenaphthene	<0.02	1100	Pass	N/A
Fluorene	<0.02	860	Pass	N/A
Phenanthrene	0.26	440	Pass	N/A
Anthracene	0.05	11000	Pass	N/A
Fluoranthene	0.64	890	Pass	N/A
Pyrene	0.51	2000	Pass	N/A
Benzo(a)anthracene	0.36	13	Pass	N/A
Chrysene	0.39	27	Pass	N/A
Benzo(b)fluoranthene	0.55	3.7	Pass	N/A
Benzo(k)fluoranthene	0.20	100	Pass	N/A
Benzo(a)pyrene	0.39	3	Pass	N/A
Indeno(123cd)pyrene	0.51	41	Pass	N/A

Dibenz(ah)anthracene	0.11	0.3	Pass	N/A
Benzo(ghi)perylene	0.49	350	Pass	N/A
TPH				
VPH Aromatic (>EC5-EC7)	<0.01	300	Pass	N/A
VPH Aromatic (>EC7-EC8)	<0.01	660	Pass	N/A
VPH Aromatic (>EC8-EC10)	<0.01	190	Pass	N/A
EPH Aromatic (>EC10-EC12)	3	380	Pass	N/A
EPH Aromatic (>EC12-EC16)	12	660	Pass	N/A
EPH Aromatic (>EC16-EC21)	26	930	Pass	N/A
EPH Aromatic (>EC21-EC35)	203	1700	Pass	N/A
EPH Aromatic (>EC35-EC44)	74	1700	Pass	N/A
VPH Aliphatic (>C5-C6)	<0.1	160	Pass	N/A
VPH Aliphatic (>C6-C8)	<0.1	530	Pass	N/A
VPH Aliphatic (>C8-C10)	0.15	150	Pass	N/A
EPH Aliphatic (>C10-C12)	<1	760	Pass	N/A
EPH Aliphatic (>C12-C16)	2	4300	Pass	N/A
EPH Aliphatic (>C16-C35)	44	110000	Pass	N/A
EPH Aliphatic (>C35-C44)	5	110000	Pass	N/A

a. Based on sandy loam soil as defined in SR3 (Environment Agency, 2009c) and 6% soil organic matter (SOM)
b. Figures are rounded to two significant figures
c. In applying the rules for non-soil background to the S4ULs, the background ADE is limited to being no larger that the contribution from the relevant soil ADE
d. Based on comparison of inhalation exposure with inhalation ID
e. Based on comparison of oral and dermal exposure with oral TDI

Based on published LQM/CIEH S4ULs & DEFRAs C4SLs, no exceedances were identified with respect to a Residential with produce end use.

The full laboratory results are available within Appendix C.

6.2. Asbestos

No asbestos was identified within any of the soil samples taken from across the site.

6.3. Ground Gas

No significant potential source of ground gas was identified. However, the Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within a intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level. Therefore, basic radon protection measures will be required.

6.4. Controlled Waters

No significant levels of contaminants of concern were identified with respect to controlled waters.

Therefore, the risk posed to controlled waters is considered to be negligible.

7. Phase II Conceptual Site Model

Human Receptors			
Source	**Pathway**	**Receptor**	**Solution**
No elevated levels of contaminants have been identified in shallow soils across the site with respect to the proposed end use.	Direct dermal contact, ingestion of soils, or inhalation of dust/fibres (i.e. human interaction with surface and subsurface materials).	Site workers during the redevelopment of the site.	Basic PPE and hygiene facilities should be provided for site workers.
		The intended end users of the site (residents).	No specific remediation is required for this development.
The Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within a intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level. No significant potential sources of ground gas have been identified for this site.	The migration and accumulation of ground gases through permeable sub-surface materials and/ or preferential pathways.	Intended end users of the site (residents).	Therefore, basic radon protective measures are considered necessary in the construction of new dwellings or extensions.
Environmental Receptors (Controlled Waters)			
No significant levels of contaminants of concern have been identified with respect to controlled waters.	Lateral and vertical migration of groundwater through permeable sub-surface materials and/ or preferential pathways.	Secondary A Aquifer within the superficial strata. Unproductive Aquifer within the bedrock strata.	No specific remediation is considered to be necessary for this receptor.

8. Risk Management & Remediation

Previous sections have quantified the risk posed to identified receptors. The following section details measures and recommendations for dealing with risks associated with soil, gas, and groundwater contamination in respect to the proposed residential development.

8.1. Remediation to Protect End Users

No contaminant exceedances with respect to the proposed end use were identified across the site during this site investigation.

Therefore, no remediation is considered required at this time.

8.2. Ground Gas Protection Measures

The Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within a intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level.

Therefore, basic radon protective measures are considered necessary in the construction of new dwellings or extensions.

8.3. Remediation to Protect Controlled Waters

No significant levels of contaminants of concern have been identified with respect to controlled waters, and no specific remediation is considered to be required.

8.4. Remediation to Protect Construction Workers

Basic PPE and hygiene facilities should be sufficient for site workers.

9. Conclusions and Recommendations

A phase 2 intrusive investigation was carried out which successfully characterised made ground across the site, as well as its depth & extent. Representative soil samples were taken of these made ground materials and sent for analysis at a UKAS/MCERTS accredited laboratory for analysis of the identified contaminants of concern.

Recommendations:

- No elevated levels of contamination have been identified across the site with respect to a Residential with Produce end use. Therefore, no remedial measures are considered necessary at this time.

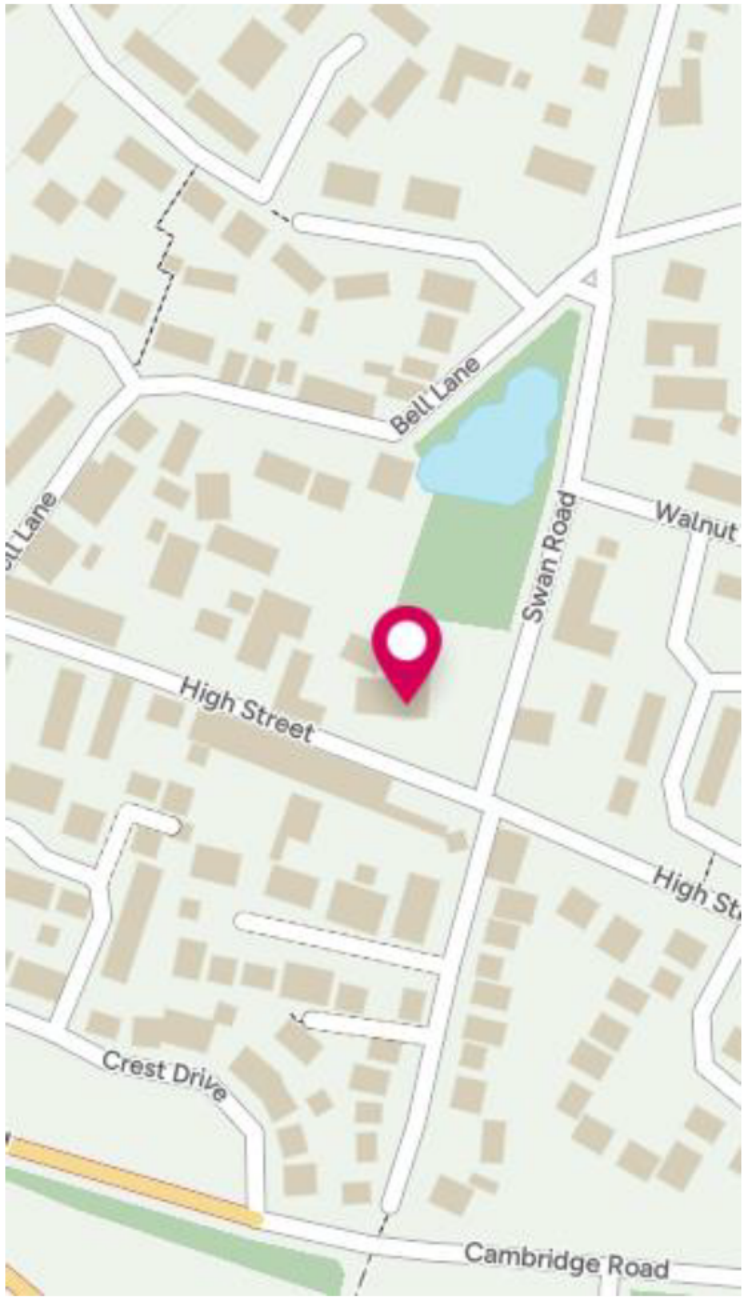
- The Phase 1 Desk Study by Sequoia Environmental (SE-2023-201) identifies that the site lies within a intermediate probability radon area, where between 3% and 5% of homes are estimated to be at or above the action level. Therefore, basic radon protective measures are considered necessary in the construction of new dwellings or extensions.

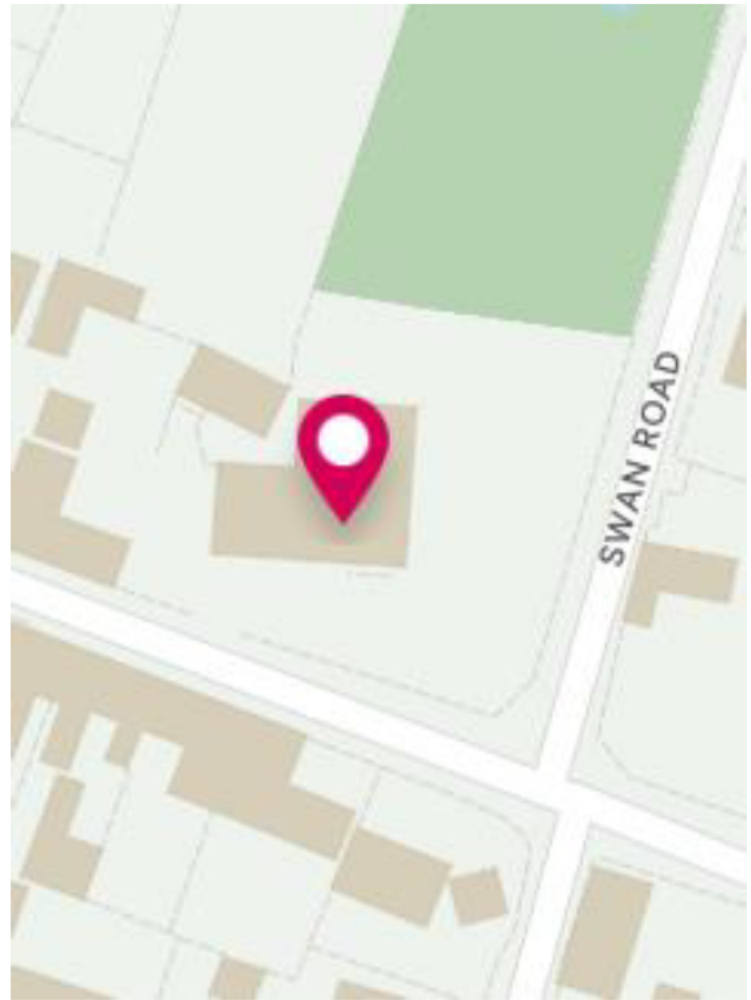
- Should any unexpected signs of contamination be identified during building / groundwork activities, works should be stopped, the local authority notified, and a suitably qualified environmental consultant engaged to assess the risk posed and propose remedial measures where necessary.

This report should be submitted to your local planning authority for approval.

Dice Environmental

APPENDIX A





Dice Environmental

Title
Site Location

Reference	Date
101610	27/09/2024

Site Address

The Tudor Hotel
30 High St,
Fenstanton, Huntingdon
PE28 9JZ

Legend

Approximate Site Centre

Scale	Drawn	Figure Number
NTS	MVD	Fig.1



Dice Environmental

Title
Site Layout

Reference
101610

Date
27/09/2024

Site Address

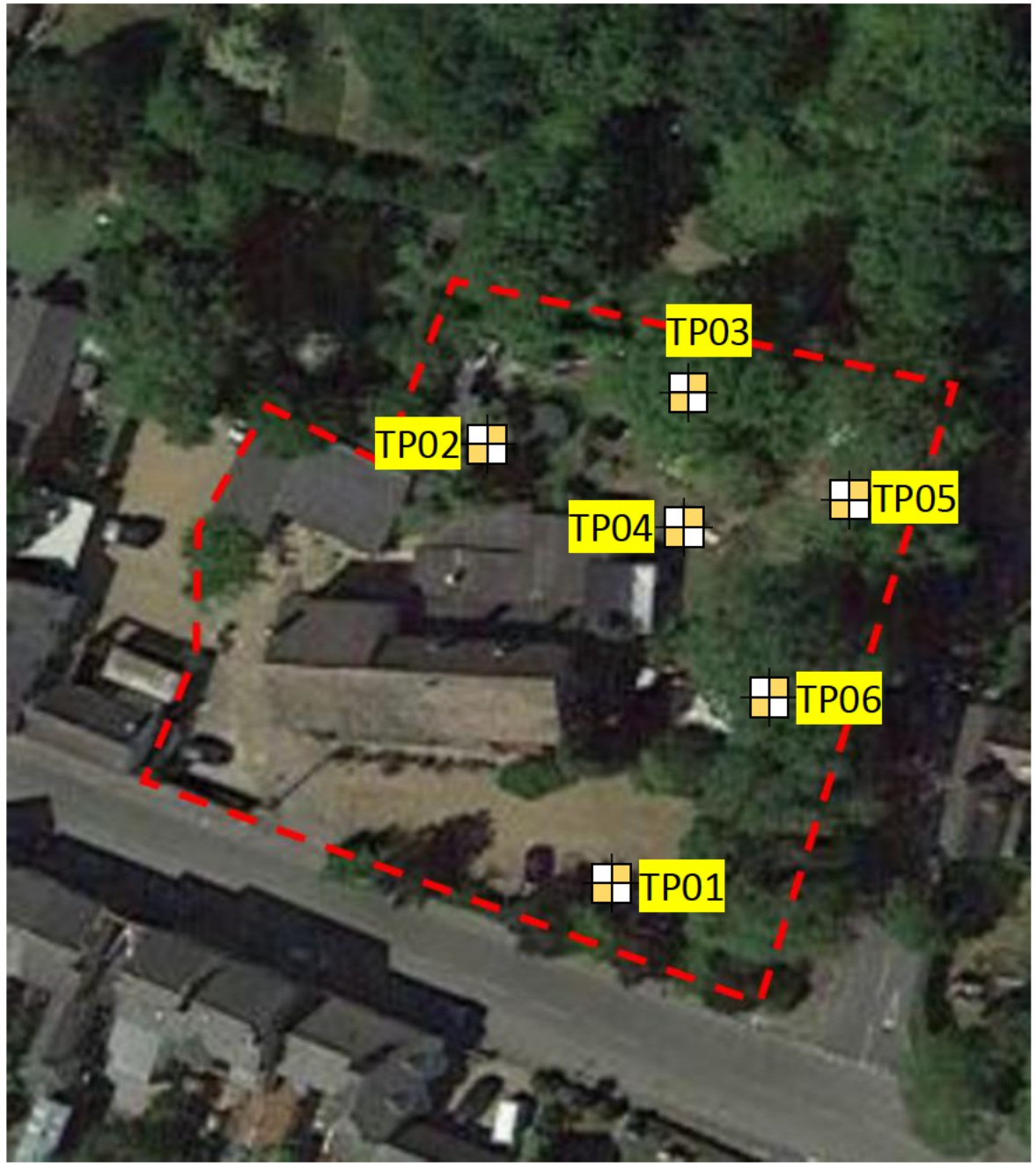
The Tudor Hotel
30 High St,
Fenstanton, Huntingdon
PE28 9JZ

Legend

Scale
NTS

Drawn
MVD

Figure Number
Fig.2



Dice Environmental

Title
SI Plan

Reference
101610

Date
27/09/2024

Site Address

The Tudor Hotel
30 High St,
Fenstanton, Huntingdon
PE28 9JZ

Legend

Scale
NTS

Drawn
MVD

Figure Number
Fig.3



general notes

© This drawing and all information it contains is copyright of Twenty-Nine Architecture and must not be copied or reproduced in whole or in part or used without express approval of the authors.

The drawing is to be read in conjunction with all other relevant drawings and specifications.

All dimensions to be checked on site prior to commencement of works and any discrepancies to be checked immediately.

Do not scale from this drawing.

Unless otherwise stated, all dimensions are in mm.

LEGEND

- SITE BOUNDARY
- OUTLINE OF APPROVED DWELLING UNDER REF: 19/02100/FUL UNDER CONSTRUCTION
- TO BE DEMOLISHED/ REMOVED
- 1.8m CLOSE BOARDED FENCE
- 1.8m 215mm WIDE BRICK WALL
- PROPOSED NEW TREES REFER TO SOFT LANDSCAPING SCHEME
- EXISTING TREES TO REMAIN REFER TO ARBORICULTURAL REPORT
- SOFT LANDSCAPING REFER TO SOFT LANDSCAPING SCHEME
- FLAG PAVING TO PATIOS AND PATHS
- PERMEABLE BLOCK PAVING TO DRIVEWAYS
- +24.40 EXISTING SITE LEVELS
- +24.40 PROPOSED SITE LEVELS

rev	P1	date April'24	drawn DSR
client			
project	The Tudor, 30 High Street, Fenstanton, Huntingdon		
drawing title	Proposed Site Plan		
drawing no	PL(90)01	checked DSR	
scale	1:200	original A2	
status	PLANNING		

address 25 Cromwell Road Cambridge Cambridgeshire CB1 3EB
telephone +44 (0)1223 212253
email info@29architecture.co.uk
website www.29architecture.co.uk

TWENTY NINE. ARCHITECTURE + PLANNING

Dice Environmental

Title
Development Proposal

Reference
101610

Date
27/09/2024

Site Address

The Tudor Hotel
30 High St,
Fenstanton, Huntingdon
PE28 9JZ

Legend

Scale
NTS

Drawn
MVD

Figure Number
Fig.4

Dice Environmental

APPENDIX B

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531788.00 N268379.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP01	TP		md	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.20	ES		0.15			Dark brown slightly clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
				0.30			Dark brown slightly clayey gravelly SAND. Gravel is fine to coarse angular quartz and flint.
							End of Borehole at 0.30m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531772.00 N268410.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP02	TP		MD	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.15	ES		0.25			Dark brown slightly clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
	0.40	ES		0.50			Greyish brown slightly clayey gravely SAND. Gravel is fine to coarse angular quartz and flint.
							End of Borehole at 0.50m

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531782.00 N268411.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP03	TP		MD	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.10	ES		0.30			Dark brown clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
							End of Borehole at 0.30m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531779.00 N268404.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP04	TP		MD	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.15	ES		0.15			Dark brown clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
	0.55	ES		0.60			Brown slightly clayey gravelly SAND. Gravel is fine to coarse angular quartz and flint.
							End of Borehole at 0.60m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531797.00 N268408.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP05	TP		MD	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.50	ES		0.15			Dark brown clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
				0.60			Brown slightly clayey gravelly SAND. Gravel is fine to coarse angular quartz and flint.
							End of Borehole at 0.60m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

Trial Pit Log

Project Name: The Tudor	Client: Twenty Nine Architecture	Date: 16/09/2024
Location: High St, Fenstanton, Huntingdon PE28 9JZ	Contractor:	Co-ords: E531795.00 N268396.00
Project No. : 101610	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
HP06	TP		MD	1:25	Sheet 1 of 1

Well	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth (m)	Type	Results				
	0.35	ES		0.10			Dark brown clayey sandy gravelly TOPSOIL. Gravel is fine to coarse angular quartz and flint.
							Brown slightly clayey gravelly SAND. Gravel is fine to coarse angular quartz and flint.
				0.40			*0.35m: Becoming hard to dig.*
							End of Borehole at 0.40m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

1. No visual or olfactory evidence of contamination was present. 2. Pit was backfilled with arisings upon completion.

AGS

Dice Environmental

APPENDIX C

ANALYTICAL TEST REPORT

Contract no: 136680

Contract name: The Tudor

Client reference: 101610

Clients name: Dice Environmental

Clients address: 167 Kennington Road
Nottingham
NG8 1QE

Samples received: 19 September 2024

Analysis started: 19 September 2024

Analysis completed: 26 September 2024

Report issued: 26 September 2024

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: [redacted]

Senior Reporting Administrator

Unit 6 Parkhead, Greencroft Industrial Park, Stanley, County Durham, DH9 7YB
Tel 01207 528578 Email customerservices@chemtech-env.co.uk
Vat Reg No. 772 5703 18 Registered in England number 4284013

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
136680-1	HP01 ES1+O	0.20	Sand with Gravel & Roots	-	-	4.3
136680-2	HP02 ES1	0.15	Sand with Gravel & Roots	-	-	9.4
136680-3	HP02 ES2+O	0.40	Sand with Gravel & Roots	-	-	4.6
136680-4	HP03 ES1+O	0.10	Sand with Gravel & Roots	-	-	9
136680-5	HP04 ES1+O	0.15	Sand with Gravel & Roots	-	-	6.2
136680-6	HP04 ES2+O	0.55	Sand with Gravel & Roots	-	-	5.5
136680-7	HP05 ES1+O	0.50	Sand with Gravel & Roots	-	-	6.3
136680-8	HP06 ES1	0.35	Sand with Gravel & Roots	-	-	4.7

Chemtech Environmental Limited

SOILS

Lab number			136680-1	136680-2	136680-3	136680-4	136680-5	136680-6	136680-7	136680-8
Sample id			HP01 ES1+O	HP02 ES1	HP02 ES2+O	HP03 ES1+O	HP04 ES1+O	HP04 ES2+O	HP05 ES1+O	HP06 ES1
Depth (m)			0.20	0.15	0.40	0.10	0.15	0.55	0.50	0.35
Date sampled			16/09/2024	16/09/2024	16/09/2024	16/09/2024	16/09/2024	16/09/2024	16/09/2024	16/09/2024
Test	**Method**	**Units**								
Arsenic (total)	CE264^{U}	mg/kg As	<1.8	<1.8	24.6	20.1	19.9	23.9	23.6	23.6
Cadmium (total)	CE264^{M}	mg/kg Cd	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
Chromium (total)	CE264^{U}	mg/kg Cr	<2	<2	93.2	84.1	94.4	85.3	75.2	72.9
Chromium (VI)	CE263	mg/kg CrVI	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Copper (total)	CE264^{M}	mg/kg Cu	<1.6	<1.6	10.8	14.4	15.7	13.4	13.8	13.8
Lead (total)	CE264^{U}	mg/kg Pb	<2.3	<2.3	37.5	120.3	78.3	64.0	106.4	94.0
Mercury (total)	CE264^{U}	mg/kg Hg	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
Nickel (total)	CE264^{M}	mg/kg Ni	<2.1	<2.1	18.4	17.8	21.2	21.5	21.4	21.3
Selenium (total)	CE264	mg/kg Se	<3	<3	<3	<3	<3	<3	<3	<3
Vanadium (total)	CE264^{U}	mg/kg V	<1.8	<1.8	40.2	38.6	39.3	39.5	45.4	45.9
Zinc (total)	CE264^{M}	mg/kg Zn	<4	<4	60.3	82.3	83.0	72.7	80.7	80.4
pH	CE004 ^{M}	units	8.5	7.6	7.6	7.6	7.9	8.0	8.3	8.3
Sulphate (2:1 water soluble)	CE061 ^{U}	mg/l SO_4	73	27	21	23	13	11	14	<10
Sulphate (acid extractable)	CE062 ^{M}	mg/kg SO_4	359	435	248	504	354	296	361	269
Total Organic Carbon (TOC)	CE197	% w/w C	1.9	1.9	0.8	3.8	2.0	1.3	1.6	1.1
Estimate of OMC (calculated from TOC)	CE197	% w/w	3.3	3.3	1.3	6.5	3.5	2.3	2.7	1.9
PAH										
Naphthalene	CE087 ^{M}	mg/kg	<0.02	0.02	<0.02	0.02	0.02	<0.02	0.15	<0.02
Acenaphthylene	CE087 ^{M}	mg/kg	0.03	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 ^{M}	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 ^{U}	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 ^{M}	mg/kg	0.20	0.26	0.08	0.16	0.14	0.09	0.24	0.07
Anthracene	CE087 ^{U}	mg/kg	0.04	0.05	<0.02	0.04	0.03	<0.02	0.03	0.02
Fluoranthene	CE087 ^{M}	mg/kg	0.57	0.64	0.14	0.31	0.33	0.23	0.32	0.17
Pyrene	CE087 ^{M}	mg/kg	0.51	0.51	0.12	0.27	0.30	0.21	0.27	0.15
Benzo(a)anthracene	CE087 ^{U}	mg/kg	0.28	0.36	0.09	0.17	0.19	0.13	0.17	0.11
Chrysene	CE087 ^{M}	mg/kg	0.32	0.39	0.10	0.19	0.21	0.15	0.18	0.11
Benzo(b)fluoranthene	CE087 ^{M}	mg/kg	0.55	0.52	0.12	0.24	0.29	0.22	0.24	0.17
Benzo(k)fluoranthene	CE087 ^{M}	mg/kg	0.20	0.20	0.05	0.11	0.13	0.08	0.11	0.07
Benzo(a)pyrene	CE087 ^{U}	mg/kg	0.39	0.37	0.09	0.20	0.25	0.16	0.20	0.15
Indeno(123cd)pyrene	CE087 ^{M}	mg/kg	0.51	0.35	0.09	0.18	0.22	0.16	0.19	0.14
Dibenz(ah)anthracene	CE087 ^{M}	mg/kg	0.11	0.08	0.02	0.04	0.05	0.03	0.03	0.03
Benzo(ghi)perylene	CE087 ^{M}	mg/kg	0.49	0.29	0.07	0.15	0.19	0.14	0.17	0.11
PAH (total of USEPA 16)	CE087	mg/kg	4.21	4.08	0.97	2.08	2.36	1.60	2.29	1.31
TPH										
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)	CE250	mg/kg	3	-	1	-	-	1	1	-
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	12	-	3	-	-	4	5	-
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	26	-	4	-	-	6	6	-
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	203	-	31	-	-	31	36	-
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	74	-	8	-	-	8	11	-
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	0.15	-	<0.1	-	-	<0.1	<0.1	-
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<1	-	<1	-	-	<1	<1	-
EPH Aliphatic (>C12-C16)	CE250	mg/kg	1	-	<0.5	-	-	2	1	-
EPH Aliphatic (>C16-C35)	CE250	mg/kg	44	-	6	-	-	11	9	-
EPH Aliphatic (>C35-C44)	CE250	mg/kg	5	-	<0.5	-	-	<0.5	1	-
Subcontracted Analysis										
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE264	Arsenic (total)	Aqua Regia Extraction, ICPOES	Dry	U	1.8	mg/kg As
CE264	Cadmium (total)	Aqua Regia Extraction, ICPOES	Dry	M	1.6	mg/kg Cd
CE264	Chromium (total)	Aqua Regia Extraction, ICPOES	Dry	U	2	mg/kg Cr
CE263	Chromium (VI)	Discrete Analyser	Dry		0.04	mg/kg CrVI
CE264	Copper (total)	Aqua Regia Extraction, ICPOES	Dry	M	1.6	mg/kg Cu
CE264	Lead (total)	Aqua Regia Extraction, ICPOES	Dry	U	2.3	mg/kg Pb
CE264	Mercury (total)	Aqua Regia Extraction, ICPOES	Dry	U	0.7	mg/kg Hg
CE264	Nickel (total)	Aqua Regia Extraction, ICPOES	Dry	M	2.1	mg/kg Ni
CE264	Selenium (total)	Aqua Regia Extraction, ICPOES	Dry	U	3	mg/kg Se
CE264	Vanadium (total)	Aqua Regia Extraction, ICPOES	Dry	U	1.8	mg/kg V
CE264	Zinc (total)	Aqua Regia Extraction, ICPOES	Dry	M	4	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	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO_4
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	0.016	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.015	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.013	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.013	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.014	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.017	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.017	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.016	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.012	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.028	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	0.025	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.019	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.019	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.017	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.019	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.028	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		0.6	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		1.5	mg/kg
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		4.5	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		2	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

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		0.5	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		3	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		0.5	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)
136680-1	HP01 ES1+O	0.20	N	
136680-2	HP02 ES1	0.15	N	
136680-3	HP02 ES2+O	0.40	N	
136680-4	HP03 ES1+O	0.10	N	
136680-5	HP04 ES1+O	0.15	N	
136680-6	HP04 ES2+O	0.55	N	
136680-7	HP05 ES1+O	0.50	N	
136680-8	HP06 ES1	0.35	N	

Chemtech Environmental Limited

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.

Soil/Solid samples will be disposed of 4 weeks from initial receipt unless otherwise agreed.

Waters and leachate samples will be disposed of 2 weeks from report issue unless otherwise agreed.

DEFRA Licence for the introduction and movement within England of prohibited soil for chemical and physical analysis Licence No: 132693/469907-0

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

Dice Environmental

APPENDIX D

Dice Environmental

Rational and full list of General Assessment Criteria used by Dice Environmental.

Copyright Land Quality Management ltd reproduced with permission; Publication number S4UL3829. All rights reserved.

Determinand	Allotment	R_WHP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Metals						
Arsenic (**Inorganic**) [a, b, c]	43	37	40	640	79	170
Beryllium [a, b, d, e]	35	1.7	1.7	12	2.2	63
Boron [a, b, d]	45	290	11000	240000	21000	46000
Cadmium (**pH6-8**) [a, b, d, f]	1.9	11	85	190	120	560
Chromium (trivalent) [a, b, d, g]	18000	910	910	8600	1500	33000
Chromium (hexavalent) [a, b, c]	1.8[h]	6[i]	6[i]	33[i]	7.7[i]	220[i]
Copper [a, b, c]	520	2400	7100	68000	12000	44000
Mercury (elemental) [a, b, c, j]	21	1.2	1.2	58[vap] (25.8)	16	30[vap] (25.8)
Mercury (inorganic) [a, b, c]	19	40	56	1100	120	240
Methylmercury [a, b, c]	6	11	15	320	40	68
Nickel [a, b, c]	230[k]	180[e]	180[e]	980[e]	230[e]	3400[k]
Selenium [a, b, c]	88	250	430	12000	1100	1800
Vanadium [a, b, c, i, j]	91	410	1200	9000	2000	5000
Zinc [a, b, c]	620	3700	40000	730000	81000	170000
BTEX Compounds (SOM 1%/ 2.5%/ 6%)						
Benzene [a, b, l, m]	0.017/0.034/ 0.075	0.087/0.17/ 0.37	0.38/0.7/1.4	27 / 47 / 90	72 / 72 / 73	90 / 100 / 110
Toluene [a, b, l, m]	22 / 51 / 120	130 / 290 / 660	800[vap] (869) /1900/3900	56000[vap] (869) / 110000[vap] 1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869)/ 95000[vap](1920)/ 100000[vap](4360)
Ethylbenzene [a, b, l, m]	16 / 39 / 91	47 / 110 / 260	83 / 190 / 440	5700[vap] (518) / 13000[vap] (1220) / 27000[vap] (2840)	24000 / 24000 / 25000	17000[vap] (518) / 22000[vap](1220) / 27000[vap] (2840)
O – Xylene [a, b, l, m, n]	28 / 67 / 160	60 / 140 / 330	88 / 210 / 480	6600[sol] (478) / 15000[sol] (1120) / 33000[sol] (2620)	41000 / 42000 / 43000	17000[sol] (478) / 24000[sol] (1120) / 33000[sol] (2620)
M – Xylene [a, b, l, m, n]	31 / 74 / 170	59 / 140 / 320	82 / 190 / 450	6200[vap] (625) / 14000[vap] (1470) / 31000[vap] (3460)	41000 / 42000 / 43000	17000[vap] (625) / 24000[vap](1470) / 32000[vap] (3460)
P – Xylene [a, b, l, m, n]	29 / 69 / 160	56 / 130 / 310	79 / 180 / 430	5900[sol] (576) / 14000[sol] (1350) / 30000[sol] (3170)	41000 / 42000 / 43000	17000[sol] (576) / 23000[sol] (1350) / 31000[sol] (3170)
Polycyclic Aromatic Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Acenaphthene	34 / 85 / 200	210 / 510 / 1100	3000[sol](57.0)/ 4700[sol](141)/ 6000[sol](336)	84000[sol] (57.0)/ 97000[sol] (141)/ 100000	15000 / 15000 / 15000	29000/ 30000/ 30000
Acenaphthylene	28 / 69 / 160	170 / 420 / 920	2900[sol](86.1)/ 4600[sol](212)/ 6000[sol](506)	83000[sol] (86.1)/ 97000[sol] (212)/ 100000	15000 / 15000 / 15000	29000 / 30000 / 30000
Anthracene	380 / 950 / 2200	2400 / 5400 / 11000	31000[sol](1.17 /35000/ 37000	520000/ 540000/ 540000	74000 / 74000 / 74000	150000 / 150000 / 150000
Benz(a)anthracene	2.9 / 6.5 / 13	7.2 / 11 / 13	11 / 14 / 15	170 / 170 / 180	29 / 29 / 29	49 / 56 / 62
Benzo(a)pyrene (Bap)	0.97 / 2.0 / 3.5	2.2 / 2.7 / 3.0	3.2 / 3.2 / 3.2	35 / 35 / 36	5.7/ 5.7/5.7	11 / 12 / 13
Benzo(b)fluoranthene	0.99 / 2.1 / 3.9	2.6 / 3.3 / 3.7	3.9 / 4.0 / 4.0	44 / 44 / 45	7.1/7.2/7.2	13 / 15 / 16
Benzo(g,h,i)perylene	290 / 470 / 640	320 / 340 / 350	360/360 / 360	3900/4000/ 4000	640/640/640	1400/1500/ 1600
Benzo(k)fluoranthene	37 / 75 / 130	77 / 93 / 100	110/ 110 / 110	1200/ 1200/1200	190/190/190	370 / 410 / 440
Chrysene	4.1 / 9.4 / 19	15 / 22 / 27	30 / 31 / 32	350 / 350 / 350	57 / 57 / 57	93 / 110 / 120
Dibenzo(ah)anthracene	0.14 / 0.27 / 0.43	0.24 / 0.28 / 0.3	0.31/0.32/ 0.32	3.5 / 3.6 / 3.6	0.57/0.57/0.58	1.1 / 1.3 / 1.4
Fluoranthene	52 / 130 / 290	280 / 560 / 890	1500/1600/ 1600	23000/23000/ 23000	3100/3100/ 3100	6300 / 6300 / 6400
Fluorene	27 / 67 / 160	170 / 400 / 860	2800[sol](30.9) /3800[sol](76.5) /4500[sol](183)	63000[sol] (30.9) / 68000 / 71000	9900 / 9900 / 9900	20000 / 20000 / 20000
Indeno(1,2,3-cd)pyrene	9.5 / 21 / 39	27 / 36 / 41	45 / 46 / 46	500 / 510 / 510	82 / 82 / 82	150 / 170 / 180
Naphthalene [q]	4.1 / 10 / 24	2.3 / 5.6 / 13	2.3 / 5.6 / 13	190[sol](76.4) / 460[sol] (183) / 1100[sol] (432)	4900/ 4900/ 4900	1200[sol](76.4) / 1900[sol] (183) / 3000
Phenanthrene	15 / 38 / 90	95 / 220 / 440	1300[sol](36.0)/ 1500/1500	22000 / 22000 / 23000	3100 / 3100 / 3100	6200 / 6200 / 6300
Pyrene	110 / 270 / 620	620 / 1200 / 2000	3700 / 3800 / 3800	54000 / 54000 / 54000	7400 / 7400 / 7400	15000 / 15000 / 15000
Coal Tar (Bap as surrogate marker)	0.32 / 0.67 / 1.2	0.79 / 0.98 / 1.1	1.2 / 1.2 / 1.2	15 / 15 / 15	2.2 / 2.2 / 2.2	4.4 / 4.7 / 4.8
Explosives [a, b, l, p]						
2, 4, 6 Trinitrotoluene	0.24 / 0.58 / 1.40	1.6 / 3.7 / 8.0	65 / 66 / 66	1000/1000/1000	130/130 / 130	260 / 270 / 270
RDX (Royal Demolition Explosive $C_3H_6N_6O_6$)	17 / 38 / 85	120 / 250 / 540	13000 / 13000 / 13000	210000 / 210000 / 210000	26000/26000/ 27000	49000[sol] (18.7) / 51000 / 53000
HMX (High Melting Explosive $C_4H_8N_8O_8$)	0.86 / 1.9 / 3.9	5.7 / 13 / 26	6700 / 6700 / 6700	110000 / 110000 / 110000	13000 / 13000 / 13000	23000[vap] (0.35) /23000[vap] (0.39) /24000[vap] (0.48)

Determinand	Allotment	R_WHP	R_{WO}HP	Commercial/ Industrial	POSresi	POSpark
Petroleum Hydrocarbons (SOM 1%/ 2.5%/ 6%) [a, b, l, m]						
Aliphatic EC 5-6	730 / 1700 / 3900	42 / 78 / 160	42 / 78 / 160	3200[sol] (304) / 5900[sol] (558) / 12000[sol] (1150)	570000[sol](304 590000 / 600000	95000[sol] (304) / 130000[sol] (558)/ 180000[sol](1150)
Aliphatic EC >6-8	2300 / 5600 / 13000	100 / 230 / 530	100 / 230 / 530	7800[sol] (144) / 17000[sol] (322) / 40000[sol] (736)	600000 / 610000 / 620000	150000[sol] (144) 220000[sol] (322)/ 320000[sol] (736)
Aliphatic EC >8-10	320 / 770 / 1700	27 / 65 / 150	27 / 65 / 150	2000[sol] (78) / 4800[vap] (190) / 11000[vap] (451)	13000 / 13000 / 13000	14000[sol] (78) / 18000[vap] (190) / 21000[vap] (451)
Aliphatic EC >10-12	2200 / 4400 / 7300	130v[ap] (48) / 330[vap] (118) / 760[vap] (283)	130v[ap] (48) / 330[vap] (118) / 770[vap] (283)	9700[sol] (48) / 23000[vap] (118) / 47000[vap] (283)	13000 / 13000 / 13000	21000[sol] (48) / 23000[vap] (118) / 24000[vap] (283)
Aliphatic EC >12-16	11000 / 13000 / 13000	1100[sol] (24) / 2400[sol] (59) / 4300[sol] (142)	1100[sol] (24) / 2400[sol] (59) / 4400[sol] (142)	59000[sol] (24) / 82000[sol] (59) / 90000[sol] (142)	13000 / 13000 / 13000	25000[sol] (24) / 25000[sol] (59) / 26000[sol] (142)
Aliphatic EC >16-35 °	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aliphatic EC >35-44 °	260000 / 270000 / 270000	65000[sol](8.48 92000[sol] (21) / 110000	65000[sol](8.48 92000[sol] (21) 110000	1600000 / 1700000 / 1800000	250000 / 250000 / 250000	450000 / 480000 / 490000
Aromatic EC 5-7 (benzene)	13 / 27 / 57	70 / 140 / 300	370 / 690 / 1400	260000[sol] (1220) / 46000[sol] (2260) / 86000[sol] (4710)	56000 / 56000 / 56000	76000[sol] (1220) /84000[sol](2260)/ 92000[sol] (4710)
Aromatic EC >7-8 (toluene)	22 / 51 / 120	130 / 290 / 660	860 / 1800 / 3900	56000[vap] (869)/ 110000[sol] (1920)/ 180000[vap] (4360)	56000 / 56000 / 56000	87000[vap](869) / 95000[sol] (1920)/ 100000[vap](4360)
Aromatic EC >8-10	8.6 / 21 / 51	34 / 83 / 190	47 / 110 / 270	3500[vap] (613) / 8100[vap] (1500) / 17000[vap] (3580)	5000 / 5000 / 5000	7200[vap](613) / 8500[vap] (1500) / 9300[vap] (3580)
Aromatic EC >10-12	13 / 31 / 74	74 / 180 / 380	250 / 590 / 1200	16000[sol] (364) / 28000[sol] (899) / 34000[sol] (2150)	5000 / 5000 / 5000	9200[sol] (364) / 97000[sol] (899) / 10000
Aromatic EC >12-16	23 / 57 / 130	140 / 330 / 660	1800 / 2300[sol] (419) / 2500	36000[sol] (169) / 37000 / 38000	5100 / 5100 / 5000	10000 / 10000 / 10000
Aromatic EC >16-21 °	46 / 110 / 260	260 / 540 / 930	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7600 / 7700 / 7800
Aromatic EC >21-35 °	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aromatic EC >35-44 °	370 / 820 / 1600	1100 / 1500 / 1700	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Aliphatic+Aromatic EC >44-70 °	1200 / 2100 / 3000	1600 / 1800 / 1900	1900 / 1900 / 1900	28000 / 28000 / 28000	3800 / 3800 / 3800	7800 / 7800 / 7900
Chloroalkanes & Chloroalkenes (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
1,2-Dichloroethane	0.0046 / 0.0083 / 0.016	0.0071 / 0.011 / 0.019	0.092 / 0.013 / 0.023	0.67 / 0.97 / 1.7	29 / 29 / 29	21 / 24 / 28
1,1,1 Trichloroethane (TCA)	48 / 110 / 240	8.8 / 18 / 39	9.0 / 18 / 40	660 / 1300 / 3000	140000 / 140000 / 140000	57000[vap](1425) 76000[vap](2915)/ 100000[vap](6392
1,1,1,2 Tetrachloroethane	0.79 / 1.9 / 4.4	1.2 / 2.8 / 6.4	1.5 / 3.5 / 8.2	110 / 250 / 560	1400 / 1400 / 1400	1500 / 1800 / 2100
1,1,2,2 Tetrachloroethane	0.41 / 0.89 / 2.0	1.6 / 3.4 / 7.5	3.9 / 8.0 / 17	270 / 550 / 1100	1400 / 1400 / 1400	1800 / 2100 / 2300
Tetrachloroethene (PCE)	0.65 / 1.5 / 3.6	0.18 / 0.39 / 0.90	0.18 / 0.4 / 0.92	19 / 42 / 95	1400 / 1400 / 1400	810[sol](424)/1100 [sol] (951)/1500
Tetrachloromethane (Carbon Tetrachloride)	0.45 / 1.0 / 2.4	0.026 / 0.056 / 0.13	0.026 / 0.056 / 0.13	2.9 / 6.3 / 14	890 / 920 / 950	190 / 270 / 400
Trichloroethene (TCE)	0.041 / 0.091 / 0.21	0.016 / 0.034 / 0.075	0.017 / 0.036 / 0.080	1.2 / 2.6 / 5.7	120 / 120 / 120	70 / 91 / 120
Trichloromethane (Chloroform)	0.42 / 0.83 / 1.7	0.91 / 1.7 / 3.4	1.2 / 2.1 / 4.2	99 / 170 / 350	2500 / 2500 / 2500	2600 / 2800 / 3100
Chloroethene (Vinyl Chloride)	0.00055/ 0.001/ 0.0018	0.00064 / 0.00087/ 0.0014	0.00077 / 0.001 / 0.0015	0.059 / 0.077 / 0.12	3.5 / 3.5 / 3.5	4.8 / 5.0 / 5.4
Phenol & Chlorophenols [a, b, l, p]						
Phenol	23 /42 / 83	120 / 200/380	440/690 /1200	440[dir] (26000) / 690[dir] (30000) / 1300[dir] (34000)	440[dir] (10000)/ 690[dir](10000) 1300[dir](10000)	440[dir] (7600) / 690[dir] (8300) / 1300[dir] (93000)
Chlorophenols (excluding PCP) [r]	0.13[s] / 0.3 / 0.7	0.87[s] / 2.0 / 4.5	94 / 150 / 210	3500 / 4000 / 4300	620/ 620 / 620	1100/1100/ 1100
Pentachlorophenol (PCP)	0.03 / 0.08 / 0.19	0.22/ 0.52 / 1.2	27[vap] (16.4) / 29 / 31	400 / 400 / 400	60 / 60 / 60	110 / 120 / 120
Other [a, b, l, p]						
Carbon Disulphide	4.8 / 10 / 23	0.14/0.29 /0.62	0.14/0.29 /0.62	11 / 22 / 47	11000 / 11000 / 12000	1300 / 1900 / 2700
Hexachlorobutadiene (HCBD)	0.25/0.61/1.4	0.29/0.7/1.6	0.32/0.78/1.8	31 / 66 / 120	25 / 25 / 25	48 / 50 / 51

Determinand	Allotment	R_WHP	$R_{WO}HP$	Commercial/ Industrial	POSresi	POSpark
Pesticides (SOM 1%/ 2.5%/ 6%) [a, b, l, p]						
Aldrin	3.2 / 6.1 / 9.6	5.7/ 6.6 /7.1	7.3 / 7.4 / 7.5	170 / 170 / 170	18 / 18 / 18	30 / 31 / 31
Atrazine	0.5 / 1.2 / 2.7	3.3/7.6/17.4	610/ 620 / 620	9300 / 9400 / 9400	1200/1200 /1200	2300 / 2400 / 2400
Dichlorvos	0.0049/0.010/ 0.022	0.032/0.066/ 0.14	6.4 / 6.5 / 6.6	140 / 140 / 140	16 / 16 / 16	26 / 26 / 27
Dieldrin	0.17/0.41/0.96	0.97/ 2 / 3.5	7.0 / 7.3 / 7.4	170 / 170 / 170	18 / 18 / 18	30 / 30 / 31
Alpha - Endosulfan	1.2 / 2.9 / 6.8	7.4 / 18 / 41	160^{vap} (0.003)/ 280^{vap} (0.007)/ 410^{vap} (0.016)	5600^{vap} (0.003) / 7400^{vap} (0.007) / 8400^{vap} (0.016)	1200 / 1200 / 1200	2400 / 2400 / 2500
Beta - Endosulfan	1.1 / 2.7 / 6.4	7.0 / 17 / 39	190^{vap}(0.00007) /320^{vap}(0.0002) /440^{vap}(0.0004)	6300^{vap}(0.00007) /7800^{vap}(0.0002) / 8700	1200 / 1200 / 1200	2400 / 2400 / 2500
Alpha-Hexachlorocyclohexane	0.035/0.087/ 0.21	0.23/0.55 / 1.2	6.9 / 9.2 / 11	170 / 180 / 180	24 / 24 / 24	47 / 48 / 48
Beta - Hexachlorocyclohexane	0.013/0.032/ 0.077	0.085 / 0.2/ 0.46	3.7 / 3.8 / 3.8	65 / 65 / 65	8.1 / 8.1 / 8.1	15 / 15 / 16
Gamma – Hexachlorocyclohexane	0.0092 / 0.023 / 0.054	0.06/0.14/ 0.33	2.9 / 3.3 / 3.5	67 / 69 / 70	8.2 / 8.2 / 8.2	14 / 15 / 15
Chlorobenzenes [a, b, l, p]						
Chlorobenzene	5.9 / 14 / 32	0.46 / 1.0 / 2.4	0.46 / 1.0 / 2.4	56 / 130 / 290	11000 / 13000 / 14000	1300^{sol}(675)/ 2000^{sol}(1520)/ 2900
1,2-dichlorobenzene (1,2-DCB)	94 / 230 / 540	23 / 55 / 130	24 / 57 / 130	2000^{sol} (571) / 4800^{sol} (1370) / 11000^{sol} (3240)	90000 / 95000 / 98000	24000^{sol} (571) / 36000^{sol} (1370) /51000^{sol} (3240)
1,3-dichlorobenzene (1,3-DCB)	0.25 / 0.6 / 1.5	0.4 / 1.0 / 2.3	0.44/1.1 / 2.5	30 / 73 / 170	300/ 300 / 300	390 / 440 / 470
1-4-dichlorobenzene (1,4-DCB)	15^{i} / 37^{i} / 88 ^{i}	61^{q} / 150^{q} /350 ^{q}	61^{q}/150^{q}/350^{q}	4400^{vap,q} (224) / 10000^{vap,q} (540) / 25000^{vap,q} (1280)	17000^{i} / 17000^{i} / 17000^{i}	36000^{vap,i} (224) 36000^{vap,i}(540)/ 36000^{vap,i}(1280)
1,2,3-Trichlorobenzene	4.7 / 12 / 28	1.5 / 3.6 / 8.6	1.5 / 3.7 / 8.8	102 / 250 / 590	1800 / 1800 / 1800	770^{vap} (134) / 1100^{vap} (330) / 1600^{vap} (789)
1,2,4- Trichlorobenzene	55 / 140 / 320	2.6 / 6.4 / 15	2.6 / 6.4 / 15	220 / 530 / 1300	15000 / 17000 / 19000	1700^{vap} (318) / 2600^{vap} (786) / 4000^{vap} (1880)
1,3,5- Trichlorobenzene	4.7 / 12 / 28	0.33 / 0.81 / 1.9	0.33 / 0.81 / 1.9	23 / 55 / 130	1700 / 1700 / 1800	380^{vap} (36.7) / 580^{vap} (90.8) / 860^{vap} (217)
1,2,3,4-Tetrachlorobenzene	4.4 / 11 / 26	15 / 36 / 78	24 / 56 / 120	1700^{vap} (122) / 3080^{vap} (304) / 4400^{vap} (728)	830 / 830 / 830	1500^{vap} (122) / 1600 / 1600
1,2,3,5- Tetrachlorobenzene	0.38 / 0.90 / 2.2	0.66 / 1.6 / 3.7	0.75 / 1.9 / 4.3	49^{vap} (39.4) / 120^{vap} (98.1) / 240^{vap} (235)	78 / 79 / 79	110^{vap} (39) / 120 / 130
1,2,4,5- Tetrachlorobenzene	0.06 / 0.16 / 0.37	0.33 / 0.77 / 1.6	0.73 / 1.7 / 3.5	42^{sol} (19.7) / 72^{sol} (49.1) / 96	13 / 13 / 13	25 / 26 / 26
Pentachlorobenzene (P_ECB)	1.2 / 3.1 / 7.0	5.8 / 12 / 22	19 / 30 / 38	640^{sol} (43.0) / 770^{sol} (107) / 830	100 / 100 / 100	190 / 190 / 190
Hexachlorobenzene (HCB)	0.47 / 1.1 / 2.5	1.8^{vap} (0.20) / 3.3^{vap} (0.5) / 4.9	4.1^{vap} (0.20) / 5.7^{vap} (0.5) / 6.7^{vap} (1.2)	110^{vap} (0.20) / 120 / 120	16 / 16 / 16	30 / 30 / 30

R_WHP Residential with homegrown produce
$R_{WO}HP$ Residential without homegrown produce
POSresi public open spaces near residential housing
POSpark public open space for recreational use but not dedicated sports pitches
SOM Soil Organic Matter – ***the S4UL for all organic compounds will vary according to SOM***

a Based on a sandy loam soil as defined in SR3 (Environment Agency, 2009b) and 6% soil organic matter (SOM)
b Figures rounded to two significant figures
c Based only on a comparison of oral and dermal soil exposure with oral Index Dose
d The background ADE is limited to being no larger than the contribution from the relevant soil ADE
e Based on comparison of inhalation exposure with inhalation TDI only
f Based on a lifetime exposure via the oral, dermal and inhalation pathways
g Based on localised effects comparing inhalation exposure with inhalation ID only
h Based on comparison of inhalation exposure with inhalation ID
i Based on comparison of oral and dermal exposure with oral TDI
j Based on comparison of oral, dermal and inhalation exposure with inhalation TDI
k Based on comparison of all exposure pathways with oral TDI
l S4ULs assume that free phase contamination is not present
m S4ULs based on a sub-surface soil to indoor air correction factor of 10
n The HCV applied is based on the intake of total Xylene and therefore exposure should not consider an isomer in isolation
o Oral, dermal and inhalation exposure compared with oral HCV
p S4ULs based on a sub-surface soil to indoor air correction factor of 1
q Based on a comparison of inhalation exposure with the inhalation TDI for localised effects
r Based on 2,4-dichlorophenol unless otherwise stated
s Based on 2,3,4,6-tetrachlorophenol
vap S4UL presented exceeded the vapour saturation limit, which is presented in brackets
sol S4UL presented exceeds the solubility saturation limit, which is presented in brackets
dir S4ULs based on a threshold protective of direct skin contact, guideline in brackets based on the health effects following long term exposure provided for illustration only

Copyright Land Quality Management ltd reproduced with permission; Publication number S4UL3829. All rights reserved.

Category 4 Screening Levels (C4SL) – Table taken from SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document (Department for Environmental, Food and Rural Affairs December 2014).

	Residential (with home-grown produce)	Residential (without home-grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37	40	49	640	79	170
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5.0	5.3	5.7	77	10	21
Cadmium	22	150	3.9	410	220	880
Chromium VI	21	21	170	49	21	250
Lead	200	310	80	2300	630	1300

All in mg/kg
Public Open Space 1 – for grassed area adjacent to residential housing
Public Open Space 2 - Park Type Public Open Space Scenario