

Supplementary Phase 2 Ground Investigation

**FORMER GREENSIDE MILLS
SKELMANTHORPE**

for

Lovell Partnerships Limited

Report Number 4496

September 2025



Michael D Joyce Associates LLP

Geotechnical and Geoenvironmental Consultants

531 Denby Dale Road West, Calder Grove, Wakefield, West Yorkshire, WF4 3ND
T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Supplementary Phase 2 Ground Investigation

FORMER GREENSIDE MILLS, SKELMANTHORPE

Contents

1. Introduction
2. Existing Information
3. Supplementary Investigation
4. Strata Profile
5. Supplementary Laboratory Contamination Testing
6. Revised Conceptual Model
Procedure Notes

Figures

- Figure 1 Development Proposals
Figure 2 Site Plan with Exploratory Borehole and Sampling Positions
Figure 3 Conceptual Site Model

Appendices

- Appendix 1 Window Sampling Records
Appendix 2 Contamination Laboratory Test Results
Appendix 3 Comparison of Ground Levels (Drawing No. 21374-DCE-XX-XX-D-C-159 Rev. SK01)
Standard Appendices A and B

1 INTRODUCTION

- 1.1 Lovell Partnerships Limited is currently in the process of redeveloping the former Greenside Mills at Skelmanthorpe. At the request of Lovell Partnerships Limited, this report is intended to address two outstanding planning conditions 6 and 7, and concerns raised by Kirklees Environmental Health, namely;

The site was identified as potentially contaminated by Environmental Health (our reference 139/17). An intrusive investigation conducted by Sirius Group has confirmed contamination. On 17th April 2024, during a meeting with Sirius Group regarding the discharge of condition applications (2022/93965 and 2023/93622), Environmental Health raised concerns about demolition and clearance activities carried out by third-party contractors in the Summer of 2023.

In April 2024, Environmental Health was informed of significant alterations to the site's topography, compared to that described in the Sirius reports reviewed to date. There is potential mixing and disturbing of materials due to uncontrolled stockpiling and material management of demolition wastes, which could present risks and introduce new sources of contamination. Several soil stockpiles were identified across different areas of the site. This included black-stained soils stockpiled in an area to the east of the site. We question whether this black-stained soils is from the pond which was identified in the pond in, flagged by Sirius Group and Environmental Health as needing additional ground investigation work.

For Environmental Health to recommend the discharge of contaminated land conditions, we must be satisfied, at all the relevant stages, that satisfactory reports have been submitted to demonstrate that the development is suitable for use. We

acknowledge a verification report received in support of the current application, despite pre-commencement conditions not being discharged for this site. We will not consider a validation report until a suitable Phase 2 and where necessary a suitable remediation strategy has been received and approved. The site must be fully characterised in its current state.

Under the National Planning Policy Framework, it is the developer's responsibility to confirm that the site is safe and suitable for its intended use. Moving forward, in the first instance, we expect a detailed risk assessment and thorough investigation of the site in its current condition to confirm there is no risk to the end-users. Any reports must be authored by a competent person and adhere to legislation and good practice guidance. This information must be submitted to the Local Planning Authority for approval in writing. The Planning Officer will re-consult Environmental Health when new reports are authored.

- 1.2 Michael D Joyce Associates LLP first became involved with this development project in January 2025, by which time construction had begun. The brief was therefore to address the abovementioned concerns of Kirklees Council, in order that Conditions 6 and 7 are complied with.

- 1.3 In order to do so, Michael D Joyce Associates LLP Report No. 4493, "Contaminated Land Review" included full consideration of the works to date and subsequent investigations of findings of the original investigation and the original remediation strategy for the site. The current stage of development was summarised, together with photographs showing the site as of 15th August 2025.

- 1.4 The original remediation strategy outlined a number of remedial measures necessary. Some of these have been carried out, and verification reports were issued. These were included in the Contaminated Land Review report, as they demonstrate the satisfactory remediation carried out following the initial site clearance/preparatory works.
- 1.5 Based upon the preceding work, this latest supplementary investigation includes an up-to-date risk assessment and Conceptual Site Model. An updated and revised Remediation Strategy necessary for the safe completion of the residential development has also been issued.
- 1.6 Overall, Lovell Partnerships Limited is to adopt a precautionary approach, namely clean cover to all garden and landscaped areas, and basic gas protection measures to be incorporated in all properties. The Contaminated Land Review provided proposals for further investigation, sampling and testing. These are to define the site in its present state. The intention is to use this additional information in order to further refine the risk assessment and Conceptual Site Model, and provide any amendments necessary to the Remediation Strategy.
- 1.7 Additional intrusive investigation has therefore been carried out in order to fully characterise the nature of the site, following the initial ground preparatory works. This has comprised window sampling boreholes at the locations shown on figure 1. The boreholes extended to natural ground with sampling and testing predominantly of near surface Made Ground materials. Any other areas of contamination were also sampled and tested as necessary.

1.8 The purpose of this supplementary investigation is to determine if the initial site preparatory works have modified the site, such that the changes are required to the risk assessment and Conceptual Site Model. As such, it includes a revised risk assessment and Conceptual Site Model. An up-to-date Remediation Strategy has also been issued separately.

1.9 The original Sirius Remediation Strategy required a separate Remediation Strategy for Ground Gases. This has been issued as a separate document, namely;

- *“Remediation and Verification Strategy for Ground Gases - Former Greenside Mills, Skelmanthorpe”, on behalf of Lovell Partnerships Limited - Michael D Joyce Associates LLP Report No. 4494, dated August 2025.*

2 EXISTING INFORMATION

2.1 The site has been considered in detail in previous reports, as follows. It should be noted that these were provided prior to commencement of construction.

- *Geo-environmental Phase 1 Desk Study report dated May 2016 by Adeptus Consulting (report ref: 163-11).*
- *Preliminary Remediation Strategy, Land at Greenside Mill, Skelmanthorpe (Ref: 4319/1), dated February 2022 by Lithos Consulting Limited.*
- *Geo-environmental Appraisal of Land at Greenside Mills, Skelmanthorpe (Ref. C7340) dated December 2020.*
- *Gas Risk Assessment Letter Report (Ref. C7340/GH/9548) dated April 2021.*
- *Supplementary Site Investigation Letter Report (Ref. C7340/RC/9607) dated June 2021.*
- *Supplementary Contamination Appraisal Letter Report (Ref. C9297/AEC/10326) dated November 2023.*
- *Strategy for Remedial and Preparatory Works - Former Greenside Mills, Skelmanthorpe (Ref. C9297/RS) dated November 2023 by Sirius Geotechnical Limited.*

2.2 The Remediation Strategy by Sirius was submitted to Kirklees Council on 7th December 2023 via its planning portal. It provides a useful executive as follows;

Site Description

The overall site comprises an irregularly shaped parcel of land covering an area of approximate 2 hectares, located to the north of Saville Road and west of Marsden Street in the village of Skelmanthorpe. In general, the site slopes downward from northwest to southeast/east, with levels of approximately 156.5 mAOD adjacent to the northwestern site boundary, and 138 mAOD to the eastern site boundary, and is formed by approximately four development plateaus.

The western and central site areas formerly comprised a number of mill buildings and associated structures, with areas of asphalt hardstanding and roughly overgrown areas of landscaping. The site has recently undergone demolition and clearance leaving concrete slabs and crushed demolition hard-surfaced ground/remnant asphalt hardstand elsewhere. Steep vegetated slopes are present along the western site boundary retaining the off site adjacent highway (Saville Road), with level changes of c. 6m within the northwest and c. 2m within the southwest, sloping down towards the east/southeast. An approximately 3m high concrete retaining wall is located to the north of the slope, orientated approximately east-west. Land along the northern perimeter of the site slopes down to an overgrown ditch c. 1.0m to 3.0m below site levels, with wire mesh and concrete post fencing currently separating it from the main site area.

The eastern area of the site comprises a former mill pond (which has recently undergone infilling with crushed demolition materials) and an unlined reservoir/pond feature to the east with water levels at 137.5 mAOD. The reservoir/pond feature is largely filled with sediment and vegetation, with an unnamed stream recorded to run from south to north, within the locality of the pond. An overgrown stockpile of soils

arisings (c. 1m to 2m high and covering an area of c. 0.06 hectares) is present within the northwest of the eastern site area. Overhead cables run northwest-southeast across the site area, with associated wooden pylons located within the stockpile. Newly constructed overhead electricity cables and an associated temporary wooden pole is located within the southeast of the site, orientated approximately southwest-northeast. A former above-ground storage tank (AST) was present in the southeast of the site. An open surface water culvert is located within the southeast, fed by on and off site surface water drains.

Site History

The site has been known as "Green Side Mills" since the late 1800s and appears to have remained in use as a cloth/textile mill throughout its history with associated mill ponds. Demolition of the site has recently been undertaken (2023), with all above-ground structures demolished and cleared.

Ground Conditions

Reinforced concrete hardstand is located across the former building footprints to depths of up to 0.30 bgl. Black bund asphalt was also encountered at ground surface in the external investigation locations during the pre-demolition site investigations.

Made Ground was generally encountered to maximum depths of c. 1.0m to 1.5m bgl across the western and central site areas (locally deeper to c.2 – 3m bgl), typically including yellow-red-brown slightly clayey sandy gravels of sandstone, limestone and brick with occasional concrete obstructions. In the eastern area, Made Ground was encountered to proven depths of up to 2.6m bgl comprising grey-brown-black-yellow

clayey gravel/gravelly clays, with low to moderate cobble and boulder content, and fragments of ash, glass, plastic, brick, concrete, sandstone, rebar, timbers and clothing/carpet fibres. In the reservoir/pond area, saturated very soft black silts with gravels and cobbles of brick, sandstone with fabrics, wood fragments and decomposing plant and leaf waste was recorded, the base of which was not proven. Made Ground within both the stockpile and the pond sediments are entrained with anthropogenic materials including potentially degradable woollen fabrics, brick, glass, plastic and ash, and may be considered as geotechnically unsuitable for re-use within the site in their current condition.

Softened natural clays comprising low strength grey-brown slightly sandy slightly gravelly silty (on occasion organic-rich), clays were locally encountered in the eastern site area between approximately 2.6m to 3.5m bgl. Residual/de-structured bedrock, comprising firm to stiff, medium to high strength slightly sandy slightly gravelly silty clay to sandy gravel was encountered from depths of between 0.2m and 3.5m bgl. Lower Coal Measures (LCM) Formation bedrock, generally comprising very weak sandstone and mudstone with localised coal bands was encountered from depths of between 0.45m and 3.90m bgl.

The site comprises three conjectured fault blocks, with evidence of shallow coal and associated mine workings within the central fault block. The possibility of encountering unrecorded mine entries within the site (including bell pits and crop workings), cannot be discounted.

Sub Surface Obstructions

A number of exploratory hole locations identified subsurface concrete and brick obstructions at depths of between 0.7m and 2.0 - 3.0m bgl. There is the potential for other unrecorded obstructions across the site associated with relict foundations and other substructures.

Groundwater

Perched water ingress was noted within Made Ground soils within a number of exploratory hole locations, at depths of between 0.2m and 2.0m bgl, with deeper groundwater recorded at depths of between 11m and 18m within LCM bedrock. Moderate to rapid groundwater ingress was noted within the eastern site area at an approximate depth of 2m bgl, at a similar level to the adjacent pond.

Ground Gas

In accordance with the ground gas risk assessment, the site is considered to fall within CS2 conditions, as defined in BS8485. Gas protection measures are therefore required for new buildings. No radon protective measures are required for the site.

Identified Contamination

Heavy metals and PAHs have been identified within Made Ground soils across the site. Localised asbestos fibres have also been identified within Made Ground soils in TP06, and within the stockpile and pond sediments in the east of the site.

Hydrocarbon odours and staining has been identified locally in the former AST and mill pond areas in TP218 and TP223, and within the locality of TP04/TP226. Any potential hydrocarbon sources were recommended to be identified, with appropriate remedial measures undertaken.

A significantly elevated concentration of naphthalene was recorded within a sample of pond sediment (obtained from the eastern most pond). It was recommended that additional testing of the pond sediment be undertaken as part of enabling works to confirm the characteristic naphthalene concentration of the soils. Subject to further assessment, consideration of the excavation and off-site removal of all impacted materials, or alternative remedial options to treat the impacted soils, such as biological or chemical remedial techniques, should be considered.

It was noted that the pond contains a substantial quantity of sediments which have been demonstrated to include elevated concentrations of heavy metals and PAHs. It has been strongly recommended that a suitable strategy for management of surface waters is developed for this area of the site to prevent harmful mobilisation and release of sediments into adjacent watercourses.

Whilst no evidence of hydrocarbon contamination has been noted within the surface water culvert sample, the presence of the black oily substance should be further

assessed, with appropriate remedial measures taken to avoid mobilisation to the adjacent surface water feature.

- 2.3 The original Geo-environmental Appraisal and Remediation Strategy by Sirius was included as Appendices 1 and 2 respectively in Michael D Joyce Associates LLP Report No. 4493 - "Contaminated Land Review."

3 SUPPLEMENTARY INVESTIGATION

- 3.1 The investigation was designed to provide additional information on ground and groundwater conditions on the site following the initial site clearance, together with identifying any previously undetected areas of contamination. Ultimately, this is intended to be used to review the current site conditions and to enable an up-to-date risk assessment of the site. The investigation was undertaken in accordance with the principles of BS5930: 2015 + A1: 2020 and BS10175: 2011 + A2: 2017 and under the full-time supervision of Michael D Joyce Associates LLP.
- 3.2 The ground investigation was carried out on 22nd August 2025, and comprised 16 No. window sampling boreholes. The exploratory borehole positions are shown on figure 1. In addition, sampling and testing was out in respect of validating the removal of three contamination hotspots, together with surface sampling of garden areas and POS. These findings are presented in Appendices 4 and 9 respectively of the Contaminated Land Review - Michael D Joyce Associates LLP Report No. 4493. These were both carried out post site clearance and are also relevant to this latest report in respect of defining current site conditions. As such, they should be read in conjunction with this report.
- 3.3 The latest window sampling consisted of driving a series of 1m long tubes into the ground using a dropping weight. On completion of each run, the tube was withdrawn. The next tube was then inserted and the process repeated to provide a continuous profile of the ground. On each run the tube diameter was reduced in order to assist in its recovery. On completion, the boreholes were backfilled with arisings.

- 3.4 All the boreholes were extended to natural ground. It was not considered necessary to extend the boreholes further as the strata of the natural ground has been well defined previously, and shown to be uncontaminated.

4 STRATA PROFILE

4.1 The full exploratory borehole records are presented in Appendix 1. These give full strata descriptions based on visual examination and are in accordance with the requirements of BS5930: 2015 + A1 2020 “Code of Practice for Ground Investigations” and BS EN ISO 14688-1:2018 “Geotechnical Investigation and Testing - Identification and Classification of Soil - Part 1” and BS EN ISO 14688-2:2018 “Geotechnical Investigation and Testing - Identification and Classification of Soil - Part 2”. BS EN ISO 14689-1:2018 “Geotechnical Investigation and Testing - Identification and Classification of Rock - Part 1” has been withdrawn.

Plots/Garden Areas

4.2 The investigation encountered a varying thickness of Made Ground across the site. In the northern part of the site it was relatively thin due to the topography. For example, borehole WS104 encountered only a thin covering of Made Ground. It could be seen along the northern boundary that ground level had been reduced, such that natural ground was evident along the northern boundary.

4.3 The thickness of Made Ground increased gradually in a southerly direction, such that boreholes WS105 and WS106 encountered 2.0m and 1.1m of Made Ground respectively.

4.4 In the southern part of the site boreholes WS112, WS113 and WS114 encountered a relatively thin layer of Made Ground reflecting the gradual change in topography in a southerly direction.

- 4.5 The thickness of Made Ground also increased in an easterly direction, such that boreholes WS107 and WS109 encountered 1.5m and 2.3m of Made Ground respectively. This again reflects the original topography, in that this area had been built up relative to the falling topography along the northern boundary in the eastern part of the site.
- 4.6 The Made Ground across all these areas is best described as reworked natural ground materials, in that it consists predominantly of natural clays, with varying amounts of brick and stone and occasional pieces of concrete. There was no visual evidence of contamination.

Public Open Space (POS)

- 4.7 The only area that differed was encountered in the three boreholes placed in the POS towards the centre of the site. These boreholes, WS101, WS102 and WS103 encountered between 0.4m and 0.7m of the Made Ground material described above. This overlay the former pond sediment that had been relocated under the supervision of LK Consult. Section 5 and Appendix 5 of the "Contaminated Land Review" discusses this relocation process in detail, and reference should be made to this.
- 4.8 The relocated sediment typically comprised a dark grey silty clay and clayey silt. It had a soft consistency and also contained varying amounts of organic material with roots and rootlets visible. This deposit extended to a depth of 3.6m in borehole WS102, with the borehole terminating on a probable concrete obstruction.

Access Roads

- 4.9 It should be noted that the main access roads have been constructed across the site. These still require the addition of the wearing course, which will be placed towards completion of the project.
- 4.10 The relevance of this is that the access roads and hardstanding provide a barrier against any contamination below. As such, the source-pathway-receptor linkage no longer exists, in that the pathway has been broken.

Inaccessible Areas

- 4.11 At the time of this latest investigation, the westernmost part of the site was inaccessible, primarily due to stockpiled excavation material, site cabins and parking. It should be noted however that this area remains 'undisturbed' in that it has not been subject to the original site clearance, which is primarily of concern to Kirklees Council. As such, this area will be remediated in due course in accordance with the revised Remediation Strategy for the site.

Comparison of Topographic Levels

- 4.12 Drawing No. 21374-DCE-XX-XX-D-C-158 (attached as Appendix 3) illustrates the finished site levels relative to the pre-demolition site levels. The green areas are where finished levels are in excess of 600mm above original ground level. In other words, prior to the addition of a 600mm clean cover, ground levels will need to be raised above original ground level. This illustrates the relative changes in site level.

5 SUPPLEMENTARY LABORATORY CONTAMINATION TESTING

- 5.1 The supplementary investigation and sampling was under the full time direction of a Chartered Engineer. All the recovered soil samples were screened on site for any visual or olfactory evidence of contamination including the presence of VOCs. Samples were selected from the window sample boreholes on the basis of those which were most likely to be contaminated and those which gave the most appropriate indication of the spread of any contaminants. The samples were stored in both glass and plastic containers and kept in cooled conditions. Testing was carried out by i2 Analytical Limited to UKAS accredited procedures and in accordance with MCERTS performance standards.
- 5.2 The aim of this is to make a detailed supplementary assessment of the level of any contamination on the site in order to determine if there was any significant risk associated with contaminants in respect of both human health and the environment, including controlled waters exist following the initial site clearance works.
- 5.3 Standard Appendix B attached to this report discusses the methodology for the assessment of contamination and should be read in conjunction with the comments overleaf.
- 5.4 The Land Contamination Risk Management (LCRM) series of documents have been produced by the Environment Agency. It is to provide guidance to identify and assess if there is an unacceptable risk, assess suitable remediation options, and carry out and verify the remediation.

5.5 DEFRA previously issued "Outcome of the Way Forward Exercise on Soil Guideline Values". This document was intended to provide guidance to determine if there is a Significant Possibility of Significant Harm (SPOSH) i.e. whether land meets the legal trigger of being contaminated land.

5.6 In the context of Part 2A, a risk assessor using an SGV would conclude the following (DEFRA, 2008).

- At a representative average soil concentration at or below an SGV, it is very unlikely that there will be a *significant possibility of significant harm (SPOSH)*.
- At a representative average soil concentration above an SGV, there *might* be a *significant possibility of significant harm* with the significance linked to the margin of exceedance, the duration and frequency of exposure, and other site-specific factors that the enforcing authority may wish to take into account. Further investigation and/or detailed evaluation will usually be required.

5.7 It should be stressed that where there is any uncertainty as to whether or not there is a SPOSH, it was the policy of this practice to adopt a conservative approach, particularly in the adoption of clean cover systems.

5.8 In April 2012, Defra published new Statutory Guidance which forms a major part of their contaminated land regimes under Part 2A of the Environment Protection Act 1990. The regime provides a means of dealing with contaminated land which poses a significant risk to human health or the environment where there is no alternative solution. It also works alongside planning rules and building regulations to help ensure that affected land is made suitable for use when it is redeveloped.

5.9 Since the regime was first introduced in 2000 there has been considerable uncertainty over how to decide when land is, and is not, contaminated land on grounds of the legal test of *significant possibility of significant harm to human health or the environment*.

5.10 To help address this, one of the main changes set out in the new Statutory Guidance, is the introduction of a new four category test to help decide when land is, and is not, contaminated land on grounds of *significant possibility of significant harm to human health*. Under the new four category test:

- Category 1 describes land that is clearly contaminated land, for example because similar land is known to have caused significant harm in the past.
- Categories 2 and 3 cover less straightforward land where more detailed consideration is needed before the regulator can decide either: (a) that there is a strong case for regulatory action, in which case the land would be in Category 2 and be classified as contaminated land under Part 2A; or (b) that such a case does not exist, in which case the land would be in Category 3 and not be classified as contaminated land under Part 2A.
- Category 4 describes land that is clearly not contaminated land, as discussed below.

5.11 One of the main purposes of including the Categories in the Statutory Guidance is to provide a legal framework against which new technical tools can be developed by the land contamination sector to describe the Categories in more detail with regard to specific substances and/or situations.

5.12 The new Category 4 test is particularly important in terms of reducing uncertainty over when land is definitely not caught by the regime.

5.13 The new Statutory Guidance makes clear what land should be placed into Category 4, for example:

- (a) Land where no relevant contaminant linkage has been established.
- (b) Land where there are only normal levels of contaminants in soil (as explained in Section 3 of the guidance), unless there is a particular reason to consider otherwise. In other words land with normal background concentrations in the soil.
- (c) Land that has been excluded from the need for further inspection and assessment under Part 2A because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of the guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of the guidance, e.g. Category 4 Screening Levels.
- (d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed to in the normal course of their lives).

5.14 The guidance clarifies how generic assessment criteria should and should not be used. It states that:

3.27 *It is common practice in contaminated land risk assessment to use “generic assessment criteria” (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work may be warranted.*

3.28 *Local authorities may use GACs and other technical tools to inform certain decisions under the Part 2A regime, provided: (i) they understand how they*

were derived and how they can be used appropriately; (ii) they have been produced in an objective, scientifically robust and expert manner by reputable organisations; and (iii) they are only used in a manner that is in accordance with Part 2A and this Guidance.

3.29 *GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regard to such GACs:*

- (a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.
- (b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.
- (c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risks to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.

(d) They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.

(e) They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.

5.15 The way in which the new four category system is intended to operate and the place of the C4SLs within that system, was explained in detail in the Impact Assessment which accompanied the Statutory Guidance. Please note that although the detail of the Impact Assessment is included here to provide clarity on the job expected of C4SLs, the Statutory Guidance, itself, sets out the regime that needs to be delivered under Part 2A.

5.16 The C4SLs are intended as “*relevant technical tools*” provides to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

5.17 The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land”.

5.18 C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

5.19 In 2014 CL:AIRE (Contaminated Land: Application in Real Environments) published “Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination”. In it a series of C4SLs were proposed as follows. Where C4SLs are not available, the LQM/CIEH “Generic Assessment Criteria for Human Health Risk” have been used.

Analyte	Residential (with home grown produce) (mg/kg)	Residential (without home grown produce) (mg/kg)	Allotments (mg/kg)	Commercial (mg/kg)	POS (mg/kg)
Arsenic	37	40	49	640	79
Benzene	0.87	3.3	0.18	98	140
Benzo(a)Pyrene	5.0	5.3	5.7	77	10
Cadmium	22	150	3.9	410	880
Chromium (vi)	21	21	170	49	21
Lead	200	310	80	2300	630

Results

5.20 The following range of results was obtained and the full results are presented in Appendix 2.

Table 1: Chemical testing thresholds and results for soils

	Contaminant	Threshold (mg/kg)			Range of Results
Metals	Arsenic	37			5 - 16
	Cadmium	11			<0.2 - 4.5
	Chromium (total)	910			23 - 290
	Chromium VI	6			<1.8
	Copper	2,400			23 - 290
	Lead	200			26 - 110
	Mercury	1.2			<0.3
	Nickel	130			11 - 35
	Selenium	250			<1.0 - 1.5
	Zinc	3,700			66 - 170
	Soil Organic Matter (SOM)	1%	2.5%	6%	
PAH USEPA 16	Naphthalene	2.3	5.6	13	<0.05 - 0.43
	Acenaphthylene	170	420	920	<0.05 - 0.25
	Acenaphthene	210	510	1,100	<0.05 - 0.58
	Fluorene	170	400	860	<0.05 - 0.80
	Phenanthrene	95	220	440	<0.05 - 4.20
	Anthracene	2,400	5,400	11,000	<0.05 - 1.70
	Fluoranthene	280	560	890	<0.05 - 9.70
	Pyrene	620	1,200	2,000	<0.05 - 8.50
	Benzo(a) anthracene	7.2	11	13	<0.05 - 4.40
	Chrysene	15	22	27	<0.05 - 4.30
	Benzo(b) fluoranthene	2.6	3.3	3.7	<0.05 - 5.70
	Benzo(k) fluoranthene	77	93	100	<0.05 - 2.80
	Benzo(a) pyrene	2.2	2.7	3.0	<0.05 - 4.90
	Indeno (123-cd) pyrene	27	36	41	<0.05 - 2.60
	Dibenzo(a,h) anthracene	0.24	0.28	0.30	<0.05 - 0.53
	Benzo(g,h,i) perylene	320	340	350	<0.05 - 2.60
Asbestos	None			None	

(1) C4SL published 2014.

(2) Suitable for Use Values (S4UL) derived by LQM/CIH "Generic Assessment Criteria for Human Health Risk Assessment" 2009. For organics a SOM of 1.0% assumed.

- 5.21 The vast majority of results fell within the thresholds for garden areas.
- 5.22 Four of the samples tested contained slightly elevated levels of Dibenzo (a,h) anthracene and Benzo (b) fluoranthene. Two of these were from the area of POS (boreholes WS102 and WS103) with the others taken from boreholes WS106 and WS110. All of the results fell within the C4SL for Benzo (a) pyrene.
- 5.23 None of the samples tested were found to contain asbestos materials or asbestos fibres.
- 5.24 In conclusion, the results indicate low levels of contamination in places. They are commensurate with the previous surface sampling which recorded the following. The full report is presented in Appendix 9 of the Contaminated Land Review.
- 5.25 All the results for the metals fell within their Maximum Permitted Concentrations (thresholds) for a residential end-use (with home-grown vegetables).
- 5.26 One result for Benzo (b) fluoranthene marginally exceeded the threshold for garden areas. It recorded 3.34 mg/kg. However, the sample (POS2) was of future Public Open Space, and fell within the threshold for Residential POS of 7.1 mg/kg.
- 5.27 Two results for Dibenz (a,h) anthracene marginally exceeded the threshold for a residential end-use. However, these were also from POS. Only one result exceeded the threshold for Residential POS of 0.57 mg/kg, recording 0.91 mg/kg.

5.28 Loose Asbestos fibres of Chrysotile were recorded in three of the samples. The asbestos contents as a percentage of the sample as a whole were therefore determined. These recorded <0.001%, 0.002% and 0.026%.

5.29 In addition, one of the samples contained insulation board. The asbestos content comprised Chrysotile and Amosite and represented 0.001% of the total mass.

6 REVISED CONCEPTUAL SITE MODEL

- 6.1 Based upon the original Ground Investigation, Remediation Strategy, Contaminated Land Review and subsequent intrusive investigation described in Section 4, a revised quantitative health and environmental risk assessment has been carried out. The process of risk assessment is set out in Contaminated Land Report 11 (2014) "Model Procedures for the Management of Land Contamination" and in Part IIA of the Environment Protection Act 1990 and amended in part by The Water Act 2003. This defines contaminated land as *"any land which appears to the local authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that there is a significant possibility of significant harm being caused, or that significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused"*.
- 6.2 The Act introduces the concept of a pollution linkage. This linkage consists of a pollution (contaminative) source or hazard and a receptor, together with an established pathway between the two. For land to be contaminated, a pollution linkage (hazard-pathway-receptor) must exist. This forms a so-called 'Conceptual Model' (CSM) of the site.

6.3 **Human Health (Pathways 1-5, Receptors A – C)**

Uptake of contaminants by food plants grown in contaminated soil - Uptake will depend on the concentration of a contaminant in soil, its chemical form, soil pH, plant species and prominence in diet.

Ingestion and inhalation - Substances may be ingested directly by young children playing on contaminated soil, or by eating plants which have absorbed metals or are contaminated with soil or dust. Ingestion may also occur via contaminated water supplies. Metals and some organic material substances may be inhaled from dusts and soils. Land gas, radon and volatile organic compounds can be inhaled directly.

Skin contact - Soil containing tars, oils and corrosive substances may cause irritation to the skin through direct contact. Some substances (e.g. phenols) may be absorbed into the body through the skin or through cuts and abrasions.

Irradiation - As well as being inhaled and absorbed through the skin, radioactive materials emitting gamma rays can cause a radiation response.

Fire and explosion - Materials such as coal, coke particles, oil, tar, pitch, rubber, plastic and domestic waste are all combustible. Both underground fires and biodegradation of organic materials may produce toxic or flammable gases. Methane and other gases may explode if allowed to accumulate in confined spaces.

6.4 **Buildings (Pathways 7 and 8)**

Fire and explosion - Underground fires may cause ground subsidence and cause structural damage. Accumulations of flammable gases in confined space leads to a risk of explosion. Underground fires may damage services.

Chemical attack on building materials and services - Sulphates may attack concrete structures. Acids, oils and tarry substances may accelerate corrosion of metals or attack plastics, rubber and other polymeric materials used in pipework and service conduits or as jointing seals and protective coatings to concrete and metals.

Physical - Blast-furnace and steel-making slag (and some natural materials) may expand. Degradation of fills may cause settlement and voids in buried tanks and drums may collapse as corrosion occurs or under loading.

6.5 **Natural Environment (Pathway 6, Receptors D - E)**

Phytotoxicity (prevention/inhibition of plant growth) - Some metals essential for plant growth at low levels are phytotoxic at higher concentrations. Methane and other gases may give rise to phytotoxic effects.

Contamination of water resources - Soil has a limited capacity to absorb, degrade or attenuate the effects of pollutants. When this is exceeded, polluting substances may enter into surface and groundwaters.

Ecotoxicological effects - Contaminants in soil may affect microbial, animal and plant populations. Ecosystems or individual species on the site, in surface waters or areas affected by migration from the site may be affected.

- 6.6 For any contaminant source identified, judgement is used regarding the probability of a pollution linkage occurring and the potential consequences of that linkage. Based on the probability and likely consequences, the overall risk (significance) can be established. The definitions that have been used for this purpose are given in Standard Appendix B. The probability of a hazard, combined with its consequences, can be used to assess risk. This forms the so-called Conceptual Site Model (CSM).

Revised Contaminant Risk Assessment

- 6.7 In total, a total of 28 No. soil samples have been tested for the site following the initial site clearance. 15 No. samples from this supplementary investigation and 13 No. samples from the surface sampling risk assessment of April 2025. In addition, concentrated sampling and testing was also carried out as part of the verification of 'hotspot' removal.

In respect of the asbestos, reference is made to the HSE publication "Asbestos: The Analytes' Guide", published in 2001. It states;

The extent of airborne fibres released from soils and Made Ground will depend on several factors including the:

- *Nature of the asbestos material (e.g. bound or unbound or a combination);*
- *Percentage of asbestos in soil (w/w);*

- *Type of soil and the nature of any disturbance (e.g. mechanical excavation);*
- *Condition of the soil (e.g. moisture content).*

Air monitoring has shown that airborne fibre concentrations rarely exceed the LOQ and are unlikely to exceed the control limit unless the works is disturbing relatively high percentages (>1%) of unbound asbestos in dry soil. Where there is mostly bound asbestos in soils, below a mass concentration of 0.1% w/w, airborne fibre concentrations are unlikely to exceed the LOQ for personal sampling. When the soil is damp or wet, airborne emissions of asbestos will be suppressed and wind dilution and dispersion of any emissions will also reduce worker and bystander exposures.

There is significant evidence indicating that most worker fibre exposure from soil remediation and removal work will be below the LOQ (i.e. <0.010 f/ml) when carried out under controlled conditions (i.e. wetting) and using mechanical equipment. This sampling information will be useful for many risk assessments and confirms the need for continued control. This does not mean that soil remediation activities will always give rise to low exposure. More energetic processes (e.g. crushing, power screening and grading of demolition waste and made land/soil) may give rise to elevated fibre levels, especially if dry. There may also be situations where direct handling of dry ACM's may occur (e.g. conveyor belt screening, picking out debris or picking up material) which may give rise to measurable personal exposures when handling significant quantities. Where significant fine unbound asbestos fibres are present, action should be taken to control any work-related release to air by keeping the soil damp.

Based on the latest HSE guidance, it is reasonable to assume that the recorded levels of asbestos are acceptable in respect of groundworkers. In accordance with the

principles of As Low as Reasonably Practicable (ALARP), and soils being excavated should be kept damp and dust generation on the site kept to a minimum with spraying.

Nevertheless, the recommendations made in the Remediation Strategy continue to apply, namely;

For the Control of Asbestos Regulations 2012 (CAR), the overall purpose of the survey and site assessment is to protect workers from the asbestos hazard. The site survey data should be used to identify asbestos hotspots and the surrounding areas which have lower amounts of asbestos (i.e. spread from the hotspot). This can be in the form of approximate contours of the amount of asbestos found and/or colour coded as a red, amber or green zone. These zoned areas are used to communicate the appropriate management and control procedures that should be used by workers on the site to reduce their exposure to airborne asbestos to As Low as Reasonably Practicable (ALARP).

Where necessary, excavation, movement stockpiling and placement of asbestos-contaminated soils/aggregates should be undertaken in accordance with a site-specific method statement and the Control of Asbestos Regulations 2012.

An exclusion zone should be set out at the location of the impacted soils to be excavated, with access restricted for all site personnel except those specifically undertaking the works.

Where any visible fragments of ACM are identified, a hand-picking exercise should be undertaken during earthworks, where practicable, using Category B non-licensed

asbestos work qualified personnel. All identified visible ACM's should be carefully picked, double bagged and placed into a lockable skip for subsequent off-site disposal.

Following the above, picking, any remaining soils containing residual asbestos (i.e. no visible ACM's and asbestos soil matrix concentration of <0.1% may be carefully excavated and placed outside the footprint of proposed roads and drainage infrastructure at an appropriate depth to allow for the placement of hard surfacing or clean cover soils as necessary. These works should be supervised by Category B trained personnel, with the location and depths of placed impacted soils being accurately surveyed/recorded and marked on a constraints plan.

Any excavated soils containing visible ACM's, and/or asbestos fibres in concentrations >0.1% that are excavated must be removed from site as hazardous waste.

During all operations, the risk of dust release should be continuously assessed, and appropriate mitigation measures put in place. This is typically a bowser with hose attachment to wet down working areas and suppress dust, although other alternative techniques will be considered as necessary. Potential dust emissions from stockpiled soils should be mitigated by the application of water or stabilising agents and/or by covering with tarpaulin sheeting or other appropriate cover material.

Excavated 'residual' soils should be carefully placed within the deposition area and carefully compacted to minimise the risk of dust emissions.

All site personnel undertaking the remedial works should be suitably trained for the task being undertaken and should wear the appropriate personal protective equipment/respiratory protective equipment (PPE/RPE), taking into account the

weather conditions at the time of the works. Advice should be sought from a qualified and experienced asbestos surveyor/analyst if necessary. PPE/RPE may include:

- *Cat 3 Type 5 coveralls.*
- *RPE (typically Sundstrom ½ mask fitted with P3 filter or equivalent).*
- *Boots that are easily cleanable.*
- *Disposable gloves.*

Personal decontamination should be carried out in accordance with, and as applicable to, the HSE's Asbestos Essentials EM8 document. All disposable PPE/RPE should be treated as contaminated waste and disposed of appropriately.

The excavation and handling of asbestos-contaminated soils on the site may comprise non-licensed work. If this applies, the Health and Safety Executive (HSE) should be notified. Reference should be made to the CL:AIRE CAR-SOIL guidance to determine whether the work is notifiable.

Residential End-Users

- 6.8 The Sirius Remediation Strategy requires that for garden areas, where asbestos impacted Made Ground is present within 1m of finished ground levels (as is the case here), an additional 150mm granular hard-dig layer or geotextile separator is provided below the 600mm topsoil and sub-soil clean cover. As there is no clear pattern as to the spread of asbestos across the plots and POS areas tested, it is recommended that these precautions are provided to all the garden areas (both front and back) and the POS.

6.9 The original Sirius CSM identified the following residual contamination linkages, with the model, which are illustrated on figure 2. These have been reviewed in regard to the latest findings.

- *Inhalation and ingestion of, and dermal contact with, Made Ground in which elevated concentrations of arsenic and benzo (a) pyrene are present. These linkages are assessed as posing a **Moderate** risk to future site users and construction workers unless the impacted soils are placed below hardstanding or clean cover soils. Based upon subsequent investigation, this is considered to remain **Moderate**.*
- *Inhalation of localised asbestos fibres/ACMs, posing a Moderate to High risk to future residential end-users, adjacent site users and construction workers unless the impacted soils are below hardstanding or clean cover soils. **This is considered to remain as Moderate to High.***
- *Ingestion, inhalation and dermal contact of locally elevated concentrations of naphthalene and TPH detected within Made Ground and shallow natural soils posing a Moderate risk to future residential end-users, adjacent site users and construction workers. **This is considered to remain as Moderate.***
- *Migration of metals and ammonia within groundwater posing a Low to Moderate risk to controlled waters (including underlying Secondary A Aquifer and on-site surface water features). **This is considered to be Low now that the pond and identified hydrocarbon hotspots have been remediated.***
- ***The risk from ground gases is considered to remain as Moderate.** It should be noted that additional gas monitoring was not considered necessary. The supplementary investigation has not identified any additional sources of ground*

*gas. Further, the site clearance works will have liberated any near surface gases. It has also been confirmed that there are no shallow mineworkings. **The gas protection measures are therefore considered appropriate and suitable.***

- 6.10 Whilst some changes to the site topography have occurred following the initial site clearance/preparatory works, these have not changed the environment risk to any significant degree.

Conclusions

- 6.11 **In conclusion, the original Sirius Remediation Strategy remains broadly applicable and suitable. Given that the concerns regarding the initial site works, Lovell Partnerships Limited shall adopt a precautionary approach in that the clean cover, described in Section 8 of the Sirius Remediation Strategy, is to be applied to all garden and soft landscaped areas. Basic gas protection measures are to be applied to all properties, with the membrane affording protection against methane, carbon dioxide, VOCs (including BTEX) and radon.**
- 6.12 **To ensure a clear and consistent approach, going forward the Remediation Strategies for Soil Contamination and Ground Gases have been revised and are presented in;**
- ***“Remediation and Verification Strategy for Ground Gases - Former Greenside Mills, Skelmanthorpe”, on behalf of Lovell Partnerships Limited - Michael D Joyce Associates LLP Report No. 4494, dated August 2025.***

- ***“Remediation and Verification Strategy for Soil Contamination - Former Greenside Mills, Skelmanthorpe”, on behalf of Lovell Partnerships Limited - Michael D Joyce Associates LLP Report No. 4499, dated September 2025.***

A D Joyce

BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC SQP

September 2025

This report is subject to the provisions of the Copyright Acts and is for the sole benefit of Lovell Partnerships Limited in respect of a supplementary assessment of geotechnical and contamination conditions on the site. It does not purport to provide specialist legal advice in respect of environmental issues. The report cannot be assigned to, or relied on, by any other party without prior permission.

Procedure Notes

The desk study and/or ground investigation have been carried out using reasonable skill and care in accordance with the principles of Ground Investigation and Testing”, BS5930: 2015 + A1: 2020 and BS10175: 2011 + A2: 2017, and the terms of the client’s brief. The report has been prepared for the specific purposes notified at the time of the initial enquiry. It is not fully compliant with Eurocode 7 (EC7) and the report does not constitute a Ground Investigation Report or Geotechnical Design Report as defined by Eurocode 7.

By its very nature any ground investigation only encounters and samples a small percentage of the ground. Consequently changes in ground conditions, soil properties and contamination can occur between any two exploratory points, for example local features such as soft ground, pockets of contamination and faults. This is also true of the exploration of mineworkings and such features can extend beneath parts of the site not investigated. Unrecorded bell pits and shafts can also exist between exploratory points. The ground investigation is designed to minimize such risks with budgetary constraints. Conclusions and recommendations are based on the information presented in this report, but unforeseen features may exist. No liability can be accepted for ground conditions not revealed by the exploratory holes or for contamination not sampled or tested for. Therefore, actual ground conditions should be noted during construction and further advice sought if they differ from those predicted. Michael D. Joyce Associates LLP reserves the right to amend the conclusions and recommendations in the light of further information. Actual methods of construction or alternative designs should be notified to Michael D. Joyce Associates LLP, such that the recommendations made can be reconsidered in the light of any changes.

Further investigation can be carried out to reduce uncertainty further and risk but ultimately these risks cannot be eliminated. Similarly a desk study normally only considers readily available information and further information could be held by other sources. In commissioning further research or investigation the cost/benefit of doing so must be considered.

It is assumed that groundlevels will not change significantly from those at present. The groundwater conditions are based on observations made at the time of the investigation, unless stated otherwise. It should be noted that the observations are subject to the method of the boring or excavation and that groundwater levels will vary due to seasonal or other effects.

Where buildings are present on a site, structural and asbestos surveys have not been carried out, unless specifically stated. An Unexploded Ordnance Survey has not been carried out unless specifically stated. In relevant situations it would be prudent to commission such surveys.

Where information has been obtained from Third Parties, no liability can be accepted for the accuracy or completeness of this information. Where anecdotal evidence or speculations are presented, they must be treated as such and cannot be relied upon.



Greenside Mills, Skelmanthorpe
Development Proposals

Michael D Joyce Associates LLP
Geotechnical and Geoenvironmental Consultants

Reproduced from the
Ordnance Survey Map with
the permission of the
controller of Her Majesty's
Stationery Office. Crown
copyright reserved.
Licence No. AL 100004970



Scale: NTS

Figure: 1



- WS Borehole
- Near surface sample

Greenside Mills, Skelmanthorpe
Borehole and Sampling Locations

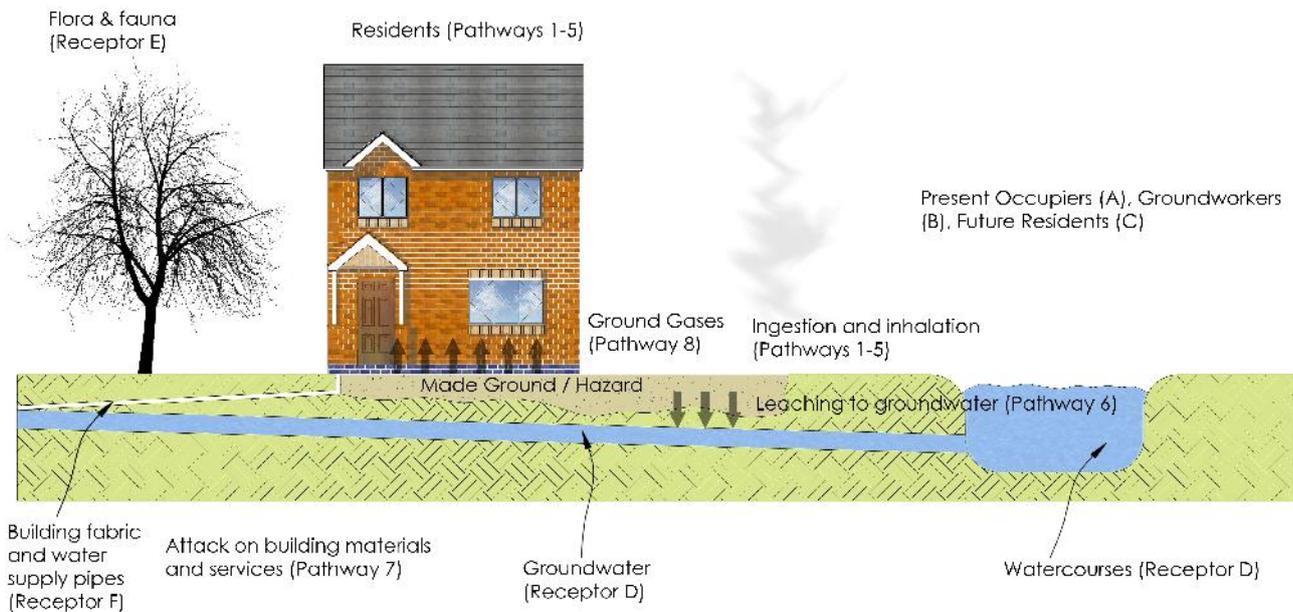
Michael D Joyce Associates LLP
Geotechnical and Geoenvironmental Consultants

Reproduced from the
Ordnance Survey Map with
the permission of the
controller of Her Majesty's
Stationery Office. Crown
copyright reserved.
Licence No. AL 100004970



Scale: NTS

Figure: 1



Pathways

1. Ingestion of contaminated soil/dust
2. Ingestion of contaminated food
3. Ingestion of contaminated water
4. Inhalation of contaminated vapours
5. Dermal contact with contaminated soil/dust or water
6. Pollution of controlled water and off site migration
7. Attack on building materials and services
8. Migration of landfill gases and radon

Receptors

- A. Present site occupiers
- B. Site development personnel
- C. Future residents
- D. Controlled waters
- E. Flora and fauna
- F. Building and services

Schematic Representation of Conceptual Site Model

Schematic Representation of Conceptual Site Model

Michael D Joyce Associates LLP
 Geotechnical and Geoenvironmental Consultants

Figure: 3

APPENDIX 1

Window Sampling Records

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

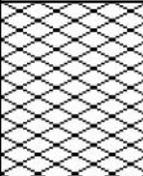
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS101

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
				0	0	Ground Surface	
						MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-0.7			
						MADE GROUND: Dark grey and black clayey silt with organic material including rootlets.	
				-1	1	End of Borehole	
					2		
					3		
					4		
					5		

General:

Groundwater: Dry on completion.

Remarks: Abandoned at 1m due to collapse of BH.

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

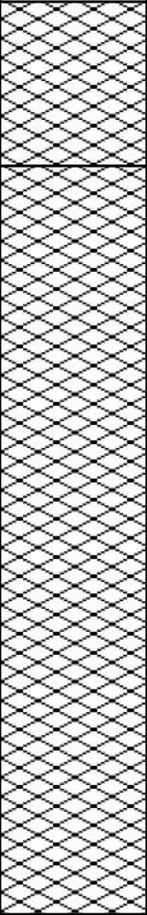
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS102

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
1.00 - 1.20	D			0	0	Ground Surface	
						MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-0.65	1	MADE GROUND: Dark grey and black clayey silt with organic material including rootlets.	
				-3.6	3.6	End of Borehole	

General:
Groundwater: Dry on completion.
Remarks: Refusal at 3.6m on concrete obstruction

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

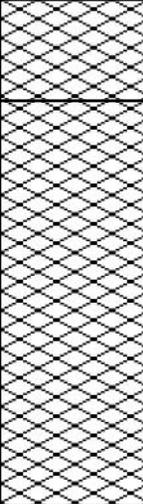
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS103

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.60 - 0.80	D			0	0	Ground Surface	
				-0.4		MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
						MADE GROUND: Dark grey and black clayey silt with organic material including rootlets.	
				-2	2	End of Borehole	
					3		
					4		
					5		

General:

Groundwater: Dry on completion.

Remarks: Abandoned at 1m due to collapse of BH.

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

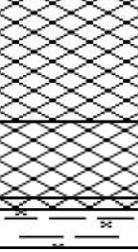
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS104

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.50 - 0.70	D			0	0	Ground Surface	
						MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-0.5		MADE GROUND: Brown and grey clay.	
				-0.8		MADE GROUND: Brick and ash.	
				-1	1	Firm brown and grey mottled silty CLAY	
					End of Borehole		
					2		
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

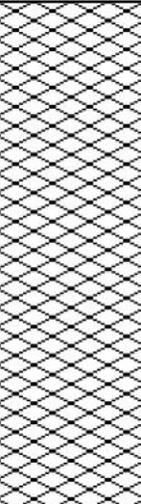
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS105

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend	
0.40 - 0.60	D			0	0	Ground Surface MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.		
				-2	2	Firm brown and grey mottled silty CLAY.		
				-2.4		Dark grey moderately weathered shaly MUDSTONE.		
				-3	3	End of Borehole		
					4			
					5			

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

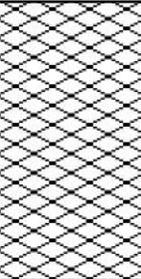
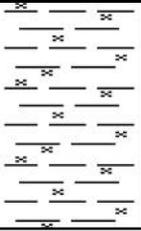
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS106

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.30 - 0.50	D			0	0	Ground Surface MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-1.1	1	Firm brown and grey mottled silty CLAY.	
				-2	2	End of Borehole	
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

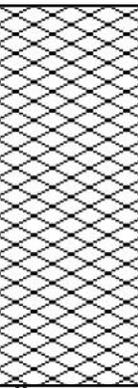
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS107

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.20 - 0.40	D			0	0	Ground Surface MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-1.5	1		
				-2	2	Stiff brown and grey mottled silty CLAY becoming highly weathered mudstone.	
					2	End of Borehole	
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

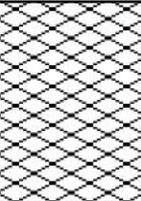
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS108

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.30 - 0.50	D			0	0	Ground Surface	
						MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-0.8	1	Firm brown and grey mottled silty CLAY.	
				-2	2	End of Borehole	
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

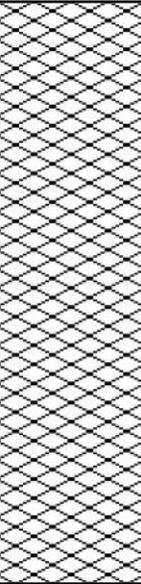
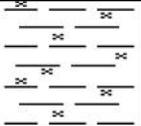
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS109

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend	
0.20 - 0.40	D			0	0	Ground Surface MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.		
				-2.3		Firm brown and grey mottled silty CLAY.		
				-2.8		End of Borehole		
					1			
					2			
					3			
					4			
					5			

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

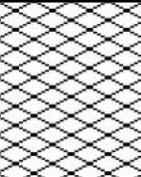
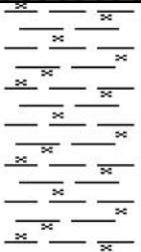
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS110

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.30 - 0.50	D			0	0	Ground Surface	
				-0.3		MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-1		MADE GROUND: Dark grey and brown clay (soft consistency) with occasional gravel sized fragments of concrete.	
				-2	1	Grey silty CLAY with rare brick fragments.	
				-2.2	2	MADE GROUND: Weak concrete.	
						End of Borehole	
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks: Unable to progress below 2.2m.

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

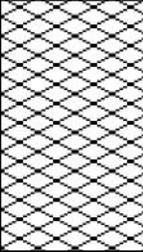
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS111

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
				0	0	Ground Surface MADE GROUND: Brown sandy clay with much stone.	
				-1	1	End of Borehole	
					2		
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks: Borehole collapsed at 1.0m.

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS112

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.30 - 0.50	D			0	0	Ground Surface	
				-0.3		Topsoil.	
						MADE GROUND: Brown and grey clay with much stone and brick.	
				-1.2	1	Firm brown and grey mottled silty CLAY.	
				-2	2	End of Borehole	
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

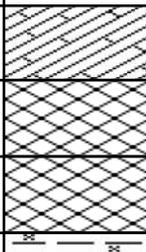
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS113

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.30 - 0.50	D			0	0	Ground Surface	
				-0.3		Topsoil.	
				-0.6		MADE GROUND: Brown and grey clay with occasional gravels of stone.	
				-0.9		MADE GROUND: Brown and grey silty clay with gravel sized brick and stone fragments.	
				-1	1	Firm brown and grey mottled silty CLAY.	
					1	End of Borehole	
					2		
					3		
					4		
					5		

General:
 Groundwater: Dry on completion.
 Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

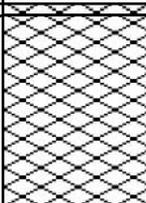
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS114

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.10 - 0.30	D			0	0	Ground Surface	
						MADE GROUND: Limestone gravel. MADE GROUND: Broken concrete.	
				-0.8		End of Borehole	
					1		
					2		
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks: Refusal at 0.80m on concrete.

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

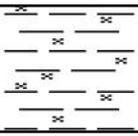
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS115

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
GL - 0.20	D			0	0	Ground Surface	
				-0.5		Firm brown and grey mottled silty CLAY.	
						End of Borehole	
					1		
					2		
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

Site: FORMER GREENSIDE MILLS (4496)

Location: SKELMANTHORPE

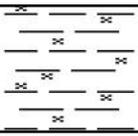
Method: Terrier Rig

Date: 22nd August 2025

Client: Lovell Partnerships Ltd

Window Sampling No: WS116

Michael D Joyce Associates LLP

Depth (m)	Samples	Water Depth (m)	Field Records	Reduced Level (m)	Depth (m)	Description	Legend
0.10 - 0.30	D			0	0	Ground Surface	
				-0.5		Firm brown and grey mottled silty CLAY.	
						End of Borehole	
					1		
					2		
					3		
					4		
					5		

General:
Groundwater: Dry on completion.
Remarks:

APPENDIX 2

Contamination Laboratory Test Results



Michael D Joyce Associates LLP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: mdja@geoenvironmental.co.uk

Analytical Report Number : 25-045409

Project / Site name:	Greenside Mills, Skelmanthorpe	Samples received on:	26/08/2025
Your job number:		Samples instructed on/ Analysis started on:	26/08/2025
Your order number:		Analysis completed by:	03/09/2025
Report Issue Number:	1	Report issued on:	03/09/2025
Samples Analysed:	12 soil samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-045409
Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number	659862	659863	659864	659865	659866
Sample Reference	WS102	WS103	WS104	WS105	WS106
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	1.00-1.20	0.60-0.80	0.50-0.70	0.40-0.60	0.30-0.50
Date Sampled	22/08/2025	22/08/2025	22/08/2025	22/08/2025	22/08/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	24	18	19	12	10
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.6	0.6	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	OGR	OGR	OGR	OGR	OGR
Analysis completed	N/A	N/A	N/A	02/09/2025	02/09/2025	02/09/2025	02/09/2025	02/09/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.9	8.2	7.9	9.2	10
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	1300	1200	370	690	1400
Water Soluble SO ₄ 16hr extraction (2:1) Leachate Equivalent	mg/l	1.25	MCERTS	674	615	183	344	690

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.43	0.2	0.09	0.11	0.12
Acenaphthylene	mg/kg	0.05	MCERTS	0.25	0.14	< 0.05	0.08	0.06
Acenaphthene	mg/kg	0.05	MCERTS	0.45	0.56	< 0.05	0.08	0.06
Fluorene	mg/kg	0.05	MCERTS	0.8	0.57	< 0.05	0.13	0.07
Phenanthrene	mg/kg	0.05	MCERTS	4.2	3.9	0.31	1.1	0.71
Anthracene	mg/kg	0.05	MCERTS	1.7	1.5	< 0.05	0.38	0.27
Fluoranthene	mg/kg	0.05	MCERTS	9.7	9.2	0.42	2.2	2.2
Pyrene	mg/kg	0.05	MCERTS	8.5	7.9	0.41	2	2.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.4	4	0.22	1.2	1.2
Chrysene	mg/kg	0.05	MCERTS	4.3	3.8	0.3	1.1	1.2
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	5.7	5.5	0.36	1.4	1.5
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.8	1.8	0.15	0.63	0.68
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.9	4	0.26	1.2	1.3
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.6	2	0.15	0.61	0.68
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.44	0.49	< 0.05	0.15	0.15
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.8	2.2	0.17	0.65	0.7

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	54.1	47.6	2.84	13	13
-----------------------------	-------	-----	-----------	------	------	------	----	----

Analytical Report Number: 25-045409
 Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number	659862				659863	659864	659865	659866
Sample Reference	WS102				WS103	WS104	WS105	WS106
Sample Number	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A				N/A	N/A	N/A	N/A
Depth (m)	1.00-1.20				0.60-0.80	0.50-0.70	0.40-0.60	0.30-0.50
Date Sampled	22/08/2025				22/08/2025	22/08/2025	22/08/2025	22/08/2025
Time Taken	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	11	16	9.8	9.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	0.4	< 0.2	0.2	0.4
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (VI) by IC	mg/kg	1.8	NONE	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	70	61	26	37	33
Copper (aqua regia extractable)	mg/kg	1	MCERTS	79	72	40	38	40
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	93	98	72	67
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	30	27	21	21	19
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	150	90	110	110

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-045409
Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number	659867	659868	659869	659870	659871			
Sample Reference	WS107	WS108	WS109	WS110	WS111			
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Water Matrix	N/A	N/A	N/A	N/A	N/A			
Depth (m)	0.20-0.40	0.30-0.50	0.20-0.40	0.30-0.50	0.40-0.60			
Date Sampled	22/08/2025	22/08/2025	22/08/2025	22/08/2025	22/08/2025			
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Stone Content	%	0.1	NONE	< 0.1	23.9	< 0.1	< 0.1	38.9
Moisture Content	%	0.01	NONE	17	12	14	16	9.1
Total mass of sample received	kg	0.1	NONE	0.6	0.6	0.6	0.6	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	OGR	OGR	OGR	OGR	OGR
Analysis completed	N/A	N/A	N/A	02/09/2025	02/09/2025	02/09/2025	02/09/2025	02/09/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	6.7	11.3	8.1	8.2	9.7
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	230	550	510	1500	1100
Water Soluble SO ₄ 16hr extraction (2:1) Leachate Equivalent	mg/l	1.25	MCERTS	117	274	254	733	561

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.14	0.29	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	0.05	0.11	0.14	0.09
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	0.06	0.58	0.33	0.08
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.07	0.43	0.42	0.08
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.66	5.1	2.5	1.1
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.18	1.6	0.96	0.54
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.3	7.3	7.4	5.6
Pyrene	mg/kg	0.05	MCERTS	< 0.05	1.2	6.3	6.7	5.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.65	3.2	3.5	3.1
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.76	3.1	3.8	2.8
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.84	3.3	4.9	3.2
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.41	1.6	2.2	1.5
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.71	2.9	3.9	2.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.36	1.4	2.2	1.3
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.11	0.34	0.53	0.3
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.42	1.5	2.6	1.3

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	7.81	38.9	42.2	28.9
-----------------------------	-------	-----	-----------	--------	------	------	------	------

Analytical Report Number: 25-045409

Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number	659867				659868	659869	659870	659871
Sample Reference	WS107				WS108	WS109	WS110	WS111
Sample Number	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A				N/A	N/A	N/A	N/A
Depth (m)	0.20-0.40				0.30-0.50	0.20-0.40	0.30-0.50	0.40-0.60
Date Sampled	22/08/2025				22/08/2025	22/08/2025	22/08/2025	22/08/2025
Time Taken	None Supplied				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.7	11	16	12	8.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.2	0.2	0.6	0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (VI) by IC	mg/kg	1.8	NONE	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	32	290	67	57
Copper (aqua regia extractable)	mg/kg	1	MCERTS	32	32	77	96	48
Lead (aqua regia extractable)	mg/kg	1	MCERTS	26	48	82	110	43
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	20	28	29	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	96	170	170	150

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-045409
Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number				659872	659873
Sample Reference				WS112	WS113
Sample Number				None Supplied	None Supplied
Water Matrix				N/A	N/A
Depth (m)				0.30-0.50	0.30-0.50
Date Sampled				22/08/2025	22/08/2025
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	47.7
Moisture Content	%	0.01	NONE	19	8.1
Total mass of sample received	kg	0.1	NONE	0.6	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	OGR	OGR
Analysis completed	N/A	N/A	N/A	02/09/2025	02/09/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.9	8.7
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	300	610
Water Soluble SO ₄ 16hr extraction (2:1) Leachate Equivalent	mg/l	1.25	MCERTS	152	305

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.07	0.09
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.14	0.06
Fluorene	mg/kg	0.05	MCERTS	0.1	0.06
Phenanthrene	mg/kg	0.05	MCERTS	1	0.72
Anthracene	mg/kg	0.05	MCERTS	0.23	0.24
Fluoranthene	mg/kg	0.05	MCERTS	1.6	1.9
Pyrene	mg/kg	0.05	MCERTS	1.5	1.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.78	1.1
Chrysene	mg/kg	0.05	MCERTS	0.87	1.1
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.1	1.4
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.4	0.49
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.84	1.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.42	0.54
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.1	0.14
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.5	0.64

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	9.7	11.6
-----------------------------	-------	-----	-----------	-----	------

Analytical Report Number: 25-045409
 Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number				659872	659873
Sample Reference				WS112	WS113
Sample Number				None Supplied	None Supplied
Water Matrix				N/A	N/A
Depth (m)				0.30-0.50	0.30-0.50
Date Sampled				22/08/2025	22/08/2025
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	9.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	4.5	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	U/S ^{*U/S} g	< 1.8
Chromium (VI) by IC	mg/kg	1.8	NONE	< 1.80	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	29	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	54	40
Lead (aqua regia extractable)	mg/kg	1	MCERTS	55	78
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	22
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.5	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	110

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-045409

Project / Site name: Greenside Mills, Skelmanthorpe

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
659862	WS102	None Supplied	1.00-1.20	Brown loam and clay with gravel and vegetation
659863	WS103	None Supplied	0.60-0.80	Brown loam and clay with gravel and vegetation
659864	WS104	None Supplied	0.50-0.70	Brown loam and clay with gravel
659865	WS105	None Supplied	0.40-0.60	Brown clay and sand with gravel
659866	WS106	None Supplied	0.30-0.50	Brown clay and sand with gravel
659867	WS107	None Supplied	0.20-0.40	Brown clay and sand with gravel
659868	WS108	None Supplied	0.30-0.50	Brown clay and sand with gravel and stones
659869	WS109	None Supplied	0.20-0.40	Brown clay and sand with gravel
659870	WS110	None Supplied	0.30-0.50	Brown clay and sand with gravel
659871	WS111	None Supplied	0.40-0.60	Brown loam and clay with gravel and stones
659872	WS112	None Supplied	0.30-0.50	Brown loam and clay with gravel
659873	WS113	None Supplied	0.30-0.50	Brown clay and sand with gravel and stones

Analytical Report Number : 25-045409

Project / Site name: Greenside Mills, Skelmanthorpe

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE
Cr(VI) in soils by Ion chromatography	Determination of hexavalent chromium in alkaline soil extract by use of ion chromatography with spectrophotometric detection	In-house method	L130B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

*U/S g- Unsuitable for analysis due to high colour intensity.



Michael D Joyce Associates LLP

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: mdja@geoenvironmental.co.uk

Analytical Report Number : 25-046143

Project / Site name:	Greenside Mills, Skelmanthorpe	Samples received on:	26/08/2025
Your job number:		Samples instructed on/ Analysis started on:	29/08/2025
Your order number:		Analysis completed by:	05/09/2025
Report Issue Number:	1	Report issued on:	05/09/2025
Samples Analysed:	3 soil samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

Excel copies of reports are only valid when accompanied by this PDF certificate.

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-046143
Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number	663350	663351	663352
Sample Reference	WS114	WS115	WS116
Sample Number	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A
Depth (m)	0.10-0.30	0.00-0.20	0.10-0.30
Date Sampled	22/08/2025	22/08/2025	22/08/2025
Time Taken	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	9.1	7.3	8.9
Total mass of sample received	kg	0.1	NONE	0.7	0.7	0.7

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MBI	MBI	MBI
Analysis completed	N/A	N/A	N/A	05/09/2025	05/09/2025	05/09/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	10.1	8.6	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	560	300	330
Water Soluble SO ₄ 16hr extraction (2:1) Leachate Equivalent	mg/l	1.25	MCERTS	278	152	163

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.61	0.25	0.33
Anthracene	mg/kg	0.05	MCERTS	0.13	0.07	0.09
Fluoranthene	mg/kg	0.05	MCERTS	0.89	0.66	0.79
Pyrene	mg/kg	0.05	MCERTS	0.79	0.62	0.73
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.39	0.37	0.46
Chrysene	mg/kg	0.05	MCERTS	0.44	0.41	0.48
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.42	0.51	0.6
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.23	0.2	0.23
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.34	0.37	0.46
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.18	0.23	0.24
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.21	0.22	0.28

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	4.76	3.92	4.76
-----------------------------	-------	-----	-----------	------	------	------

Analytical Report Number: 25-046143
 Project / Site name: Greenside Mills, Skelmanthorpe

Lab Sample Number		663350	663351	663352
Sample Reference		WS114	WS115	WS116
Sample Number		None Supplied	None Supplied	None Supplied
Water Matrix		N/A	N/A	N/A
Depth (m)		0.10-0.30	0.00-0.20	0.10-0.30
Date Sampled		22/08/2025	22/08/2025	22/08/2025
Time Taken		None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.1	8.6	7.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	31	35
Copper (aqua regia extractable)	mg/kg	1	MCERTS	23	38	29
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29	29	40
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	35	27
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	66	96	89

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-046143

Project / Site name: Greenside Mills, Skelmanthorpe

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
663350	WS114	None Supplied	0.10-0.30	Brown clay and sand with gravel
663351	WS115	None Supplied	0.00-0.20	Brown clay and sand with gravel
663352	WS116	None Supplied	0.10-0.30	Brown loam and clay with gravel and vegetation

Analytical Report Number : 25-046143
Project / Site name: Greenside Mills, Skelmanthorpe

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)
Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080-PL	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.
The result for sum should be interpreted with caution

Your ref:

Our ref: ADJ/DJM/11466

Date: 8th April 2025

Mr. M. Killip
Lovell Partnerships Limited
Unit 3 Turnberry Park
Gildersome
Leeds
LS27 7LE

By Email Only

Dear Matt

Greenside Mills, Skelmanthorpe Risk Assessment and Validation Report No. 4458

Michael D Joyce Associates LLP was commissioned by Lovell Partnerships Limited to carry out additional testing and reporting to address concerns regarding remediation on the above named site.

Kirklees Council raised uncertainty regarding the groundworks to date and possible cross-contamination as follows;

The site was identified as potentially contaminated by Environmental Health (our reference 139/17). An intrusive investigation conducted by Sirius Group has confirmed contamination. On 17th April 2024, during a meeting with Sirius Group regarding the discharge of condition applications (2022/93965 & 2023/93622), Environmental Health raised concerns about demolition and clearance activities carried out by third-party contractors in the Summer of 2023.

In April 2024, Environmental Health was informed of significant alterations to the site's topography, compared to that described in the Sirius reports reviewed to date. There is potential mixing and disturbing of materials due to uncontrolled stockpiling and material management of demolition wastes, which could present risks and introduce new sources of contamination. Several soil stockpiles were identified across different areas of the site. This included black-stained soils stockpiled in an area to the east of the site. We question whether this black-stained soil is from the pond which was identified in the pond in, flagged by Sirius Group and Environmental Health as needing additional ground investigation work.

For Environmental Health to recommend the discharge of contaminated land conditions, we must be satisfied, at all the relevant stages, that satisfactory reports have been submitted to demonstrate that the development is suitable for use. We acknowledge a verification report received in support of the current application, despite pre-commencement conditions not being discharged for this site. We will not consider a validation report until a suitable Phase 2 and where necessary a suitable remediation strategy has been received and approved. The site must be fully characterised in its current state.

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

Under the National Planning Policy Framework, it is the developer's responsibility to confirm that the site is safe and suitable for its intended use. Moving forward, in the first instance, we expect a detailed risk assessment and thorough investigation of the site in its current condition to confirm there is no risk to the end-users. Any reports must be authored by a competent person and adhere to legislation and good practice guidance. This information must be submitted to the Local Planning Authority for approval in writing. The Planning Officer will reconsult Environmental Health when new reports are authored.

At this stage our recommendation was therefore to carry out surface sampling across the site (excluding the remediated pond) now that the site has been reduced to anticipated final level.

The sampling locations were specifically chosen from the rear gardens of plots that are accessible at present, namely Plots 1, 3, 7, 8, 17, 20, 23, 24, 28, 38 and three samples of Public Open Space (POS). All were from the near surface. As such, these areas constitute the greatest risk to future residents. These are shown on figure 1.

The western part of the site is presently inaccessible due to spoil and materials being stockpiled, and also concrete hardstanding which has yet to be removed. Further testing is proposed for this area in due course.

Reporting

The purpose of this documentation is to provide transparent reasoning as to why the remediation was required, a methodology about how it was to be undertaken and proof that the specified works have been undertaken so as to provide confirmation that the site is 'suitable for its intended use'.

The document is utilised not only to satisfy conditions of planning permissions but also is to be kept on record by the Local Authority should queries be raised during the lifetime of the development and to confirm to future purchasers that the site is suitable for use. The report should be carried out by Michael D Joyce Associates LLP.

Where hardstanding is proposed, the link between the potential contaminants in the soil and the end users will no longer exist. As such, no special precautions are necessary.

General Rational

The inspection and sampling was under the direction a Chartered Engineer. The recovered soil samples were screened on site for any visual or olfactory evidence of contamination including the presence of VOCs. Samples were selected on the basis of those which were most likely to be contaminated and those which gave the most appropriate indication of the remediation of any contaminants. The samples were stored in both glass and plastic containers and kept in cooled conditions. Testing was carried out by Envirolab Limited to UKAS accredited procedures in accordance with MCERTS performance standards.

The aim of this was to make a preliminary assessment of the level of any contamination on the site in order to determine if there was any remaining risk in respect of both human health and the environment.

Standard Appendix B attached to this report discusses the methodology for the assessment of contamination and should be read in conjunction with the comments overleaf.

The Contaminated Land Report (CLR) series of documents have been produced by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency, to provide regulators with "relevant, appropriate, authoritative and scientifically based information and advice on the assessment of risk from contamination in soils".

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

The Environment Agency has issued a number of Soil Guideline Values (SGVs) which, whilst non-binding, may be used as guidance in the assessment of land and in setting remediation targets. They should only be applied to human health assessments.

The SGVs have been derived using the Contaminated Land Exposure Assessment Model (CLEA) and are based on assumptions relating to soil conditions, pollutant type and behaviour, land use patterns and the availability of receptors. SGVs are also subject to statistical assessment. The CLR documentation requires that the results of laboratory testing are subject to statistical analysis to remove uncertainty over a so-called 'averaging area'.

To date selective SGVs have been issued for the following land-uses as follows;

- Residential with and without plant uptake (SGVres)
- Allotments
- Commercial/Industrial (SGVcomm)

DEFRA previously issued "Outcome of the Way Forward Exercise on Soil Guideline Values". This document was intended to provide guidance to determine if there is a Significant Possibility of Significant Harm (SPOSH) i.e. whether land meets the legal trigger of being contaminated land.

In the context of Part 2A, a risk assessor using an SGV would conclude the following (DEFRA, 2008).

- At a representative average soil concentration at or below an SGV, it is very unlikely that there will be a *significant possibility of significant harm (SPOSH)*.
- At a representative average soil concentration above an SGV, there *might* be a *significant possibility of significant harm* with the significance linked to the margin of exceedance, the duration and frequency of exposure, and other site-specific factors that the enforcing authority may wish to take into account. Further investigation and/or detailed evaluation will usually be required.

It should be stressed that where there is any uncertainty as to whether or not there is a SPOSH, it was the policy of this practice to adopt a conservative approach, particularly in the adoption of clean cover systems.

In April 2012, Defra published new Statutory Guidance which forms a major part of their contaminated land regimes under Part 2A of the Environment Protection Act 1990. The regime provides a means of dealing with contaminated land which poses a significant risk to human health or the environment where there is no alternative solution. It also works alongside planning rules and building regulations to help ensure that affected land is made suitable for use when it is redeveloped.

Since the regime was first introduced in 2000 there has been considerable uncertainty over how to decide when land is, and is not, contaminated land on grounds of the legal test of *significant possibility of significant harm to human health or the environment*.

To help address this, one of the main changes set out in the new Statutory Guidance, is the introduction of a new four category test to help decide when land is, and is not, contaminated land on grounds of *significant possibility of significant harm to human health*. Under the new four category test:

- Category 1 describes land that is clearly contaminated land, for example because similar land is known to have caused significant harm in the past.

Contin....



- Categories 2 and 3 cover less straightforward land where more detailed consideration is needed before the regulator can decide either: (a) that there is a strong case for regulatory action, in which case the land would be in Category 2 and be classified as contaminated land under Part 2A; or (b) that such a case does not exist, in which case the land would be in Category 3 and not be classified as contaminated land under Part 2A.
- Category 4 describes land that is clearly not contaminated land, as discussed below.

One of the main purposes of including the Categories in the Statutory Guidance is to provide a legal framework against which new technical tools can be developed by the land contamination sector to describe the Categories in more detail with regard to specific substances and/or situations.

The new Category 4 test is particularly important in terms of reducing uncertainty over when land is definitely not caught by the regime.

The new Statutory Guidance makes clear what land should be placed into Category 4, for example:

- (a) Land where no relevant contaminant linkage has been established.
- (b) Land where there are only normal levels of contaminants in soil (as explained in Section 3 of the guidance), unless there is a particular reason to consider otherwise. In other words land with normal background concentrations in the soil.
- (c) Land that has been excluded from the need for further inspection and assessment under Part 2A because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of the guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of the guidance, e.g. Category 4 Screening Levels.
- (d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed to in the normal course of their lives).

The guidance clarifies how generic assessment criteria (including the currently available SGVs/GACs) should and should not be used. It states that:

3.27 It is common practice in contaminated land risk assessment to use “generic assessment criteria” (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work may be warranted.

3.28 Local authorities may use GACs and other technical tools to inform certain decisions under the Part 2A regime, provided: (i) they understand how they were derived and how they can be used appropriately; (ii) they have been produced in an objective, scientifically robust and expert manner by reputable organisations; and (iii) they are only used in a manner that is in accordance with Part 2A and this Guidance.

3.29 GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regard to such GACs:



Contin....

Ref: ADJ/DJM/11466

8th April 2025

Page 5 of 11

- (a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.
- (b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.
- (c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risks to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.
- (d) They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.
- (e) They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.

The way in which the new four category system is intended to operate and the place of the C4SLs within that system, was explained in detail in the Impact Assessment which accompanied the Statutory Guidance. Please note that although the detail of the Impact Assessment is included here to provide clarity on the job expected of C4SLs, the Statutory Guidance, itself, sets out the regime that needs to be delivered under Part 2A.

The C4SLs are intended as “*relevant technical tools*” (in relation to Paragraph 4.2.1(c)) provides to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land”.

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

“SGVs are guidelines on the level of long-term human exposure to individual chemicals in soils that, unless stated otherwise, are tolerable or pose a minimal risk to human health”.

C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

Contin...



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

In 2014 CL:AIRE (Contaminated Land: Application in Real Environments) published "*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*". In it a series of C4SLs were proposed as follows;

Results

C4SLs, therefore, should not be viewed as "SPOSH levels" and they should not be used as a legal trigger for the determination of land under Part 2A.

In 2014 CL:AIRE (Contaminated Land: Application in Real Environments) published "*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*". In it a series of C4SLs were proposed as follows;

The Sirius Remediation Strategy provides threshold concentrations for Total Petroleum Hydrocarbons (TPH). However, no hydrocarbon odours were encountered during the sampling, and as such Polyaromatic Hydrocarbon (PAH) testing was considered more relevant. The threshold values chosen for these are those of the LQM/CIEH with a 1% Soil Organic Matter content.

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

Table 1: Results of Topsoil and Subsoil Testing

Analyte	Concentration Range (mg/kg)	Maximum Permitted Concentrations for Gardens (mg/kg)
Arsenic (total)	<1 - 18	37
Cadmium (total)	<0.5 - 1.0	11
Chromium (total)	18 - 78	910
Copper (total)	19 - 75	910
Lead (total)	14 - 101	200
Mercury (total)	<0.17	40
Nickel (total)	15 - 24	130
Selenium (total)	<1	250
Zinc (total)	56 - 145	450
Phenols (total)	<0.2	110
Naphthalene	<0.03 - 0.23	2.3
Acenaphthylene	<0.01 - 0.16	170
Acenaphthene	<0.01 - 0.22	210
Fluorene	<0.01 - 0.31	170
Phenanthrene	<0.03 - 1.95	95
Anthracene	<0.02 - 0.61	2400
Fluoranthene	<0.08 - 4.67	280
Pyrene	<0.07 - 4.26	620
Benzo (a) anthracene	<0.04 - 2.49	7.2
Chrysene	<0.06 - 3.14	15
Benzo (b) fluoranthene	<0.05 - 3.34	2.6
Benzo (k) fluoranthene	<0.07 - 1.30	77
Benzo (a) pyrene	<0.04 - 3.17	5.0
Indeno (1,2,3 cd) pyrene	<0.03 - 3.81	27
Dibenz (a,h) anthracene	<0.04 - 0.91	0.24
Benzo (g,h,i) perylene	<0.05 - 3.66	320
Asbestos	Identified	None

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 E mdja@geoenvironmental.co.uk W www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

Discussion of the Results

Metals

All the results for the metals fell within their Maximum Permitted Concentrations (thresholds) for a residential end-use (with home-grown vegetables).

Polyaromatic Hydrocarbons (PAH)

One result for Benzo (b) fluoranthene marginally exceeded the threshold for garden areas. It recorded 3.34 mg/kg. However, the sample (POS2) was of future Public Open Space, and fell within the threshold for Residential POS of 7.1 mg/kg.

Two results for Dibenz (a,h) anthracene marginally exceeded the threshold for a residential end-use. However, these were also from POS. Only one result exceeded the threshold for Residential POS of 0.57 mg/kg, recording 0.91 mg/kg.

Asbestos

Loose Asbestos fibres of Chrysotile were recorded in three of the samples. The asbestos contents as a percentage of the sample as a whole were therefore determined. These recorded <0.001%, 0.002% and 0.026%.

In addition, one of the samples contained insulation board. The asbestos content comprised Chrysotile and Amosite and represented 0.001% of the total mass.

Contaminant Risk Assessment

None of the results recorded excess metal concentrations, and only one sample exceeded its threshold for a Residential POS.

In respect of the asbestos, reference is made to the HSE publication "Asbestos: The Analytes' Guide", published in 2001. It states;

The extent of airborne fibres released from soils and Made Ground will depend on several factors including the:

- *Nature of the asbestos material (e.g. bound or unbound or a combination);*
- *Percentage of asbestos in soil (w/w);*
- *Type of soil and the nature of any disturbance (e.g. mechanical excavation);*
- *Condition of the soil (e.g. moisture content).*

Air monitoring has shown that airborne fibre concentrations rarely exceed the LOQ and are unlikely to exceed the control limit unless the works is disturbing relatively high percentages (>1%) of unbound asbestos in dry soil. Where there is mostly bound asbestos in soils, below a mass concentration of 0.1% w/w, airborne fibre concentrations are unlikely to exceed the LOQ for personal sampling. When the soil is damp or wet, airborne emissions of asbestos will be suppressed and wind dilution and dispersion of any emissions will also reduce worker and bystander exposures.

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

There is significant evidence indicating that most worker fibre exposure from soil remediation and removal work will be below the LOQ (i.e. <0.010 f/ml) when carried out under controlled conditions (i.e. wetting) and using mechanical equipment. This sampling information will be useful for many risk assessments and confirms the need for continued control. This does not mean that soil remediation activities will always give rise to low exposure. More energetic processes (e.g. crushing, power screening and grading of demolition waste and made land/soil) may give rise to elevated fibre levels, especially if dry. There may also be situations where direct handling of dry ACM's may occur (e.g. conveyor belt screening, picking out debris or picking up material) which may give rise to measurable personal exposures when handling significant quantities. Where significant fine unbound asbestos fibres are present, action should be taken to control any work-related release to air by keeping the soil damp.

Based on the latest HSE guidance, it is reasonable to assume that the recorded levels of asbestos are acceptable in respect of groundworkers. In accordance with the principles of As Low as Reasonably Practicable (ALARP), and soils being excavated should be kept damp and dust generation on the site kept to a minimum with spraying.

Nevertheless, the recommendations made in the Remediation Strategy continue to apply, namely;

For the Control of Asbestos Regulations 2012 (CAR), the overall purpose of the survey and site assessment is to protect workers from the asbestos hazard. The site survey data should be used to identify asbestos hotspots and the surrounding areas which have lower amounts of asbestos (i.e. spread from the hotspot). This can be in the form of approximate contours of the amount of asbestos found and/or colour coded as a red, amber or green zone. These zoned areas are used to communicate the appropriate management and control procedures that should be used by workers on the site to reduce their exposure to airborne asbestos to As Low as Reasonably Practicable (ALARP).

Where necessary, excavation, movement stockpiling and placement of asbestos-contaminated soils/aggregates should be undertaken in accordance with a site-specific method statement and the Control of Asbestos Regulations 2012.

An exclusion zone should be set out at the location of the impacted soils to be excavated, with access restricted for all site personnel except those specifically undertaking the works.

Where any visible fragments of ACM are identified, a hand-picking exercise should be undertaken during earthworks, where practicable, using Category B non-licensed asbestos work qualified personnel. All identified visible ACM's should be carefully picked, double bagged and placed into a lockable skip for subsequent off-site disposal.

Following the above, picking, any remaining soils containing residual asbestos (i.e. no visible ACM's and asbestos soil matrix concentration of <0.1% may be carefully excavated and placed outside the footprint of proposed roads and drainage infrastructure at an appropriate depth to allow for the placement of hard surfacing or clan cover soils as necessary. These works should be supervised by Category B trained personnel, with the location and depths of placed impacted soils being accurately surveyed/recorded and marked on a constraints plan.

Any excavated soils containing visible ACM's, and/or asbestos fibres in concentrations >0.1% that are excavated must be removed from site as hazardous waste.

During all operations, the risk of dust release should be continuously assessed, and appropriate mitigation measures put in place. This is typically a bowser with hose attachment to wet down working areas and suppress dust, although other alternative techniques will be considered as necessary. Potential dust emissions from stockpiled soils should be mitigated by the application of water or stabilising agents and/or by covering with tarpaulin sheeting or other appropriate cover material.



Contin....

Ref: ADJ/DJM/11466

8th April 2025

Page 10 of 11

Excavated 'residual' soils should be carefully placed within the deposition area and carefully compacted to minimise the risk of dust emissions.

All site personnel undertaking the remedial works should be suitably trained for the task being undertaken and should wear the appropriate personal protective equipment/respiratory protective equipment (PPE/RPE), taking into account the weather conditions at the time of the works. Advice should be sought from a qualified and experienced asbestos surveyor/analyst if necessary. PPE/RPE may include:

- *Cat 3 Type 5 coveralls.*
- *RPE (typically Sundstrom ½ mask fitted with P3 filter or equivalent).*
- *Boots that are easily cleanable.*
- *Disposable gloves.*

Personal decontamination should be carried out in accordance with, and as applicable to, the HSE's Asbestos Essentials EM8 document. All disposable PPE/RPE should be treated as contaminated waste and disposed of appropriately.

The excavation and handling of asbestos-contaminated soils on the site may comprise non-licensed work. If this applies, the Health and Safety Executive (HSE) should be notified. Reference should be made to the CL:AIRE CAR-SOIL guidance to determine whether the work is notifiable.

Residential End-Users

The Sirius Remediation Strategy requires that for garden areas, where asbestos impacted Made Ground is present within 1m of finished ground levels (as is the case here), an additional 150mm granular hard-dig layer or geotextile separator is provided below the 600mm topsoil and sub-soil clean cover.

As there is no clear pattern as to the spread of asbestos across the plots and POS areas tested, it is recommended that the above precautions are provided to the garden areas (both front and back).

In conclusion, the existing Remediation Strategy continues to be adopted.

Waste Soils

The Waste Classification Technical Guidance WM3, states that waste containing asbestos should be classified as "hazardous" where;

- Soil or waste is hazardous if there are free and dispersed fibres that represent $\geq 0.1\%$ of the waste as a whole.
- Or if identifiable fragments of asbestos are present and the concentrations of asbestos with those fragments is greater than 0.1%.

It is therefore recommended that the existing and future stockpiles are tested to determine if any identifiable fragments of Asbestos Containing Materials (ACM's) are present. It is very unlikely that the concentrations of free fibres will exceed 0.1% of the waste as a whole.

Contin....



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)

Ref: ADJ/DJM/11466

8th April 2025

Page 11 of 11

To minimise future costs, it is recommended that Made Ground is stockpiled separately from clean excavated soils, as the latter are very unlikely to be contaminated by ACM's.

Yours sincerely

A D Joyce



Registered Office: 531 Denby Dale Road West, Calder Grove, Wakefield, WF4 3ND UK (Reg No. OC 302905)

T +44(0)1924 360458 **E** mdja@geoenvironmental.co.uk **W** www.geoenvironmental.co.uk

Partners: Anthony D Joyce BSc MSc ARSM CEng CGeol CEnv MICE FGS SiLC

Lucie A M Joyce BSc (Hons) Edward L H Joyce BSc (Hons)



Greenside Mills, Skelmanthorpe
 Sampling Locations

Michael D Joyce Associates LLP
 Geotechnical and Geoenvironmental Consultants

Reproduced from the
 Ordnance Survey Map with
 the permission of the
 controller of Her Majesty's
 Stationery Office. Crown
 copyright reserved.
 Licence No. AL 100004970



Scale: NTS

Figure: 1

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 25/03242
Issue Number: 1 **Date:** 04 April, 2025

Client: Michael D Joyce Associates LLP
Charnock Court
6 South Parade
Wakefield
WF1 1LR

Project Manager: Mr Anthony Joyce
Project Name: Greenside Mills, Skelmanthorpe
Project Ref: N/A
Order No: N/A
Date Samples Received: 27/03/25
Date Instructions Received: 28/03/25
Date Analysis Completed: 04/04/25

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/1	25/03242/2	25/03242/3	25/03242/4	25/03242/5	25/03242/6	25/03242/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 1	Plot 3	Plot 7	Plot 8	Plot 17	Plot 20	Plot 23			
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05	0.05			
Depth To Bottom										
Date Sampled	26-Mar-25									
Sample Type	SOIL									
Sample Matrix Code	5A	5A	6A	6A	6A	5A	6A			
% Stones >10mm _A	<0.1	28.8	7.9	<0.1	2.2	4.9	<0.1	% w/w	0.1	A-T-044
Phenol _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	3.45	1.86	2.44	2.33	6.10	2.62	6.79	% w/w	0.14	A-T-032s
Arsenic _D ^{M#}	3	5	4	7	18	8	7	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	<0.5	<0.5	1.0	0.6	0.6	<0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	35	30	26	75	65	24	29	mg/kg	1	A-T-024s
Chromium _D ^{M#}	18	78	25	47	73	29	29	mg/kg	1	A-T-024s
Lead _D ^{M#}	36	31	29	50	79	41	40	mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	24	20	19	29	21	21	20	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	79	56	75	136	81	79	74	mg/kg	1	A-T-024s

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/1	25/03242/2	25/03242/3	25/03242/4	25/03242/5	25/03242/6	25/03242/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 1	Plot 3	Plot 7	Plot 8	Plot 17	Plot 20	Plot 23			
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05	0.05			
Depth To Bottom										
Date Sampled	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25			
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL			
Sample Matrix Code	5A	5A	6A	6A	6A	5A	6A			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	Chrysotile & Amosite	NAD	NAD	Chrysotile	NAD	NAD	Chrysotile			A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	Insulation	-	-	Loose Fibres	-	-	Loose Fibres			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	0.001	-	-	0.026	-	-	<0.001	% w/w	0.001	A-T-054

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/1	25/03242/2	25/03242/3	25/03242/4	25/03242/5	25/03242/6	25/03242/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 1	Plot 3	Plot 7	Plot 8	Plot 17	Plot 20	Plot 23			
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05	0.05			
Depth To Bottom										
Date Sampled	26-Mar-25									
Sample Type	SOIL									
Sample Matrix Code	5A	5A	6A	6A	6A	5A	6A			
PAH-16MS										
Acenaphthene _A ^{M#}	0.06	<0.01	<0.01	0.06	<0.01	<0.01	0.02	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.05	<0.01	<0.01	0.05	0.02	<0.01	0.01	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.28	0.03	<0.02	0.24	0.04	0.07	0.09	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	1.19	0.15	<0.04	0.72	0.17	0.11	0.33	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	1.06	0.15	<0.04	0.69	0.16	0.10	0.27	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	1.13	0.15	<0.05	0.70	0.19	0.10	0.33	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.59	0.08	<0.05	0.38	0.10	<0.05	0.15	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.47	<0.07	<0.07	0.30	<0.07	<0.07	0.15	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	1.21	0.18	<0.06	0.79	0.21	0.12	0.38	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.15	<0.04	<0.04	0.09	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	2.48	0.32	<0.08	1.62	0.22	0.22	0.69	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.05	<0.01	<0.01	0.07	<0.01	<0.01	0.04	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.63	0.08	<0.03	0.38	0.10	0.06	0.15	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.06	<0.03	<0.03	0.08	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.69	0.16	0.10	0.72	0.13	0.09	0.41	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	2.25	0.28	<0.07	1.38	0.19	0.18	0.65	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	12.3	1.58	0.10	8.27	1.53	1.05	3.67	mg/kg	0.01	A-T-019s

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/8	25/03242/9	25/03242/10	25/03242/11	25/03242/12	25/03242/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 24	Plot 28	Pos. 1	Pos. 2	Pos. 3	Plot 39				
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05				
Depth To Bottom										
Date Sampled	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25				
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL				
Sample Matrix Code	6A	6A	6AE	6A	6AE	6AE				
% Stones >10mm _A	6.6	<0.1	1.6	5.1	9.5	38.1				
Phenol _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	4.83	0.55	5.54	8.64	6.72	3.99		% w/w	0.14	A-T-032s
Arsenic _D ^{M#}	6	<1	7	7	8	6		mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	<0.5	0.6	0.8	0.6	<0.5		mg/kg	0.5	A-T-024s
Copper _D ^{M#}	24	19	59	74	62	28		mg/kg	1	A-T-024s
Chromium _D ^{M#}	20	19	44	50	45	38		mg/kg	1	A-T-024s
Lead _D ^{M#}	32	14	82	101	76	37		mg/kg	1	A-T-024s
Mercury _D	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17		mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	20	21	22	23	22	15		mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1		mg/kg	1	A-T-024s
Zinc _D ^{M#}	75	58	119	145	115	69		mg/kg	1	A-T-024s

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/8	25/03242/9	25/03242/10	25/03242/11	25/03242/12	25/03242/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 24	Plot 28	Pos. 1	Pos. 2	Pos. 3	Plot 39				
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05				
Depth To Bottom										
Date Sampled	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25				
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL				
Sample Matrix Code	6A	6A	6AE	6A	6AE	6AE				
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	Chrysotile	NAD	NAD	NAD				A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-				A-T-045
Asbestos Matrix (microscope) _D	-	-	Loose Fibres	-	-	-				A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A				A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	-	-	0.002	-	-	-		% w/w	0.001	A-T-054

Envirolab Job Number: 25/03242

Client Project Name: Greenside Mills, Skelmanthorpe

Client Project Ref: N/A

Lab Sample ID	25/03242/8	25/03242/9	25/03242/10	25/03242/11	25/03242/12	25/03242/13		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	Plot 24	Plot 28	Pos. 1	Pos. 2	Pos. 3	Plot 39				
Depth to Top	0.05	0.05	0.05	0.05	0.05	0.05				
Depth To Bottom										
Date Sampled	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25	26-Mar-25				
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL				
Sample Matrix Code	6A	6A	6AE	6A	6AE	6AE				
PAH-16MS										
Acenaphthene _A ^{M#}	0.01	<0.01	0.17	0.22	0.13	0.18		mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	0.16	0.12	<0.10	0.04		mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.03	<0.02	0.49	0.61	0.41	0.47		mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.17	<0.04	1.75	2.49	1.25	0.65		mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.16	<0.04	2.23	3.17	1.41	0.51		mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.18	<0.05	2.48	3.34	1.38	0.53		mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.07	<0.05	1.48	3.66	1.18	0.26		mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	1.02	1.30	<0.70	0.22		mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.19	<0.06	2.10	3.14	1.44	0.67		mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	0.36	0.91	<0.40	0.07		mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.29	<0.08	3.74	4.67	2.42	1.78		mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.01	<0.01	0.23	0.31	0.16	0.16		mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.08	<0.03	1.45	3.81	1.19	0.26		mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	0.23	<0.30	<0.30	0.04		mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	0.15	<0.03	1.51	1.95	1.37	1.25		mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.26	<0.07	3.22	4.26	2.06	1.45		mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	1.60	<0.08	22.6	34	14.4	8.54		mg/kg	0.01	A-T-019s

APPENDIX 3

Comparison of Ground Levels
(Drawing No. 21374-DCE-XX-XX-D-C-159 Rev. SK01)

Standard Appendices

A and B

NOTES ON SITE INVESTIGATION PROCEDURE (Dec 2023)

1. **GENERAL.** The ground investigation has been carried out in accordance with the requirements of BS5930: 2015 and A1: 2020 and BS10175: 2011+A1: 2017. By its very nature, any ground investigation only samples a small percentage of the ground. Consequently, changes in ground conditions and soil properties can occur between any two exploratory points, for example local features such as soft ground, pockets of contamination and faults. This is also true of the exploration of mineworkings and such features can extend beneath parts of the site not investigated. Unrecorded bell pits and shafts can also exist between exploratory points. The ground investigation is designed to minimise such risks but they cannot be eliminated.

2. **GROUND INVESTIGATION.**
 - 2.1 **BOREHOLE AND TRIAL PIT RECORDS.** These illustrate the ground conditions only at the location of the particular borehole or trial pit. Correlation between boreholes is for guidance only and its accuracy cannot be guaranteed.
 - 2.2 **SHELL AND AUGER BORING.** This technique uses a tripod winch and an essentially percussive action using a variety of tools. Disturbed and undisturbed samples can be taken. This is the most suitable method for soft ground investigation, enabling the maximum amount of information to be obtained. However, minor changes in lithology may be overlooked unless continuous undisturbed sampling is used.
 - 2.3 **GROUNDWATER.** Groundwater levels vary seasonally and the details given on the borehole logs relate only to the dates and the conditions described in the borehole records. The rate of boring may not have allowed an equilibrium water level to be established and the use of casing may seal off certain seepages.
 - 2.4 **SAMPLING.** Disturbed samples of soils are taken for identification and classification purposes. In cohesive soils 'undisturbed' samples 100mm in diameter are taken by open drive sampler for laboratory testing of strength, permeability and consolidation characteristics.
 - 2.5 **STANDARD PENETRATION TESTS.** S.P.T tests are used in granular and cohesive materials and in soft or weathered rocks. Difficulties in obtaining true 'N' values mean they must only be used as a guide and not as an absolute value in foundation design.
 - 2.6 **ROTARY DRILLING.** Two main types of rotary drilling are carried out in rock. Rock coring using diamond or tungsten carbide tipped core bits provides samples and information on rock types, fissuring and weathering. Openhole drilling only produces small particles for identification purposes and the information gained is therefore limited. The latter is, however, useful as a quick method for detecting major strata changes and for the location of coal seams and old workings. Water, air, foam or drilling muds may be used as the flushing medium in either case.
 - 2.7 **PERMEABILITY TESTS.** These can be carried out in boreholes or trial pits and gives a good indication of in-situ permeability.
 - 2.8 **TRIAL PITTING.** This enables soil conditions to be closely examined at any specific point and samples taken. It also gives useful information on the stability of excavations and ingress of water.
 - 2.9 **WINDOW SAMPLING.** Window sampling consists of driving a series of 1m-long tubes into the ground using a dropping weight. On completion of each 1m run, the tube is withdrawn. The next tube is then inserted and the process repeated to provide a continuous profile of the ground. On each run the tube diameter is reduced in order to assist in its recovery.
 - 2.10 **GAS MONITORING.** This is routinely carried out in trial pits or probe holes to check for elevated levels of methane and carbon dioxide or oxygen deficiency, particularly since risks can exist from natural gases, landfill sites and rising groundwater levels in mine workings below ground. Longer term monitoring is carried out with gas monitoring standpipes.

3. **SOIL DESCRIPTION.** Samples from borings or trial pits are described as specified in the standard procedure outlined in the British Standards. The description includes colour, consistency, structure, weathering, lithological type, inclusions and origin. All descriptions are based on visual and manual identification.

Fire Soils (Cohesive Soils)

The following field terms are used:

Soil Type	Description
Very soft	Exudes between fingers
Soft	Moulded by light finger pressure
Firm	Cannot be moulded by the fingers but can be rolled in hand to 3mm threads.
Stiff	Crumbles and breaks when rolled to 3mm threads but can be remoulded to a lump.
Very stiff	No longer moulded but crumbles under pressure. Can be indented with thumbs.

The following terms are used in accordance with the results of laboratory and field tests.

Description	Undrained Shear Strength C_u (kPa)
Extremely Low	<10
Very Low	10 - 20
Low	20 - 40
Medium	40 - 75
High	75 - 150
Very High	150 - 300

Fine soils can also be classified according to their sensitivity, which is the ratio between undisturbed and remoulded undrained shear strength.

Sensitivity	Ratio
Low	8
Medium	8 - 30
High	>30
Quick	>50

Granular Soils (Non-Cohesive)

The following descriptions are used for granular soils.

Description	Normalised Blow Count (N_1) 60
Very Loose	0 - 4
Loose	4 - 10
Medium	10 - 30
Dense	30 - 50
Very Dense	>50

- NATURAL OR IN-SITU MOISTURE CONTENT.** The natural or in-situ moisture content of a soil is defined as the weight of water contained in the pore space, expressed as a percentage of the dry weight of solid matter present in the soil. Soil properties are greatly affected by the moisture content and the test can help to give an indication of likely engineering behaviour.
- LIQUID AND PLASTIC LIMITS.** Two simple classification tests are known as the liquid and plastic limits. If a cohesive soil is remoulded with increasing amounts of water, a point will be reached at which it ceases to behave as a plastic material and becomes essentially a viscous fluid. The moisture content corresponding to this change is arbitrarily determined by the liquid limit test. 'Fat' clays, which have high contents of colloidal particles, have high liquid limits; 'lean' clays, having low colloidal particle contents have correspondingly low liquid limits. An increase in the organic content of a clay is reflected by an increase in the liquid and plastic limits.

If a cohesive soil is allowed to dry progressively, a point is reached at which it ceases to behave as a plastic material, which can be moulded in the fingers, and it becomes friable. The moisture content of the soil at this point is known as the 'plastic limit' of the soil.

The range of water content over which a cohesive soil behaves plastically, i.e. the range lying between the liquid and plastic limits, is defined as the plasticity index.

A cohesive soil with a natural water content towards its liquid limit will, in general, be an extremely soft material whereas a cohesive soil with a natural water content below its plastic limit will tend to be a stiff material.

- PARTICLE-SIZE DISTRIBUTION.** A knowledge of particle-size distribution is used to classify soils and to indicate likely engineering behaviour. British Standards define soils in relation to their particle-size as shown below:-

Boulders	>200mm	Coarse Sand	2.0	to	0.63mm
Cobbles	200 to 63mm	Medium Sand	0.63	to	0.2mm
		Fine Sand	0.2	to	0.063mm
Coarse Gravel	63 to 20mm	Coarse Silt	0.063	to	0.02mm
Medium Gravel	20 to 6.3mm	Medium Silt	0.02	to	0.0063mm
Fine Gravel	6.3 to 2mm	Fine Silt	0.0063	to	0.002mm
		Clay	<0.002mm		

- BULK DENSITY.** The bulk density of a material is the weight of that material per unit volume and includes the effects of voids whether filled with air or water. The 'dry density' of a soil is defined as the weight of solids contained in a unit volume of the soil.

8. **PERMEABILITY.** The permeability of a material is defined as the rate at which water flows through it per unit area of soil under unit hydraulic gradient.
9. **CONSOLIDATION CHARACTERISTICS.** When subjected to pressure, a soil tends to consolidate as the air or water in the pore space is forced out and the grains assume a denser state of packing. The decrease in volume per unit of pressure is defined as the 'compressibility' of the soil, and a measure of the rate at which consolidation proceeds is given by the 'coefficient of consolidation' of the soil. These two characteristics M_v and C_v are determined in the consolidation test and the results are used to determine settlement of structures or earthworks.
10. **STRENGTH CHARACTERISTICS.** The strength of geological materials is generally expressed as the maximum resistance that they offer to deformation or fracture by applied shear or compressive stress. The strength characteristics of geological materials depend to an important degree on their previous history and on the conditions under which they will be stressed in practice. Consequently, it is necessary to simulate in the laboratory tests the conditions under which the material will be stressed in the field.

In general, the only test carried out on hard rocks is the determination of their compressive strength but consideration must be given to fissuring, jointing and bedding planes.

The tests at present in use for soils and soft rocks fall into two main categories. Firstly, those in which the material is stressed under conditions of no moisture content change, and secondly those in which full opportunity is permitted for moisture content changes under the applied stresses. Tests in the first category are known as undrained (immediate or quick) tests, while those in the second category are known as drained (slow or equilibrium) tests. The tests are normally carried out in the triaxial compression apparatus but granular materials may be tested in the shear box apparatus.

The undrained triaxial test gives the apparent cohesion C_u and the angle of shearing resistance ϕ_u . In dry sands, $C_u = 0$ and ϕ_u is equal to the angle of internal friction whereas with saturated non-fissured clays ϕ_u tends to 0 and the apparent cohesion C_u is equal to one-half the unconfined compression strength q_u . On site the vane test gives an approximate measure of shear strength.

For some stability problems use is made of a variant of the undrained triaxial test in which the specimen is allowed to consolidate fully under the hydrostatic pressure and is then tested to failure under conditions of no moisture content change. This is known as the consolidated undrained triaxial test. Pore water pressures may be measured during this test or a fully drained test may be carried out. In either case the effective shear strength parameters C' and ϕ' can be obtained which can be used to calculate shear strength at any given pore water pressure.

11. **COMPACTION.** The density at which any soil can be placed in an earth dam, embankment or road depends on its moisture content and on the amount of work which is used in compaction. The influence of these two factors can be studied in compaction tests, which can determine the maximum dry density (MDD) achievable at a certain optimum moisture content (OMC).
12. **CALIFORNIA BEARING RATIO TEST.** In flexible pavement design a knowledge of the bearing capacity of the subgrade is necessary to enable the thickness of pavement for any particular combination of traffic and site conditions to be determined. The quality of the subgrade can be assessed by means of the California Bearing Ratio Test or approximately by the MEXE cone penetrometer.
13. **ROCK DESCRIPTION.** This is based on;
- (i) Strength

Term	Field Identification	Unconfined Compressive Strength (MPa)
Extremely Weak ^a	Indented by thumbnail.	Less than 1
Very Weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1 to 5
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5 to 25
Medium Strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer.	25 to 50
Strong	Specimen required more than one blow of geological hammer to fracture it.	50 to 100
Very Strong	Specimen requires many blows of geological hammer to fracture it.	100 to 250
Extremely Strong	Specimen can only be chipped with geological hammer.	Greater than 250

^a Some extremely weak rocks will behave as soils and should be described as soils.

- (ii) Structure

Thickness Term	Spacing Term	Thickness or spacing
Very thickly	Extremely wide	>6m
Very thickly	Very wide	2m – 6m
Thickly	Wide	600mm – 2m
Medium	Medium	200mm – 600mm
Thinly	Close	60mm – 200mm
Very thinly	Very close	20mm – 60mm
Thickly laminated (Sedimentary)		
Narrowly (Metamorphic and Igneous)	Extremely close	6mm – 20mm
Thinly laminated (Sedimentary)		
Very narrowly (Metamorphic and Igneous)	Extremely close	<6mm

- (iii) Colour
- (iv) Texture
- (v) Grain size

Description	Predominate Grain Size (mm)
Conglomerate	>2
Coarse - grained	2 - 0.63
Medium - grained	0.63 - 0.20
Fine - grained	0.20 - 0.063
Siltstone	0.063 - 0.002
Mudstone	<0.002

- (vi) Rock Name
- (vii) Stability
- (viii) Weathering

Term	Description	Grades
Fresh/unweathered	No visible sign of rock material weathering; perhaps slight discolouration on major discontinuity surfaces.	0
Slightly weathered	Slight discolouration indicates weathering of rock material and discontinuity surfaces.	1
Moderately weathered/Distinctly weathered	Less than half of the rock material is decomposed or disintegrated. Fresh or discoloured rock is present either as a continuous framework or as core stones.	2
Highly weathered/ Destroyed	More than half of the rock material is decomposed or disintegrated. Fresh or discoloured rock is present either as a continuous framework or as core stones.	3
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still apparent.	4
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soils has not been significantly transported.	5

- (ix) Discontinuities
- (x) Weathered of Rock Mass

14. **CHEMICAL TESTS.** A knowledge of water soluble sulphate content and pH of soils and groundwater is important in determining the protection required for concrete or steel in contact with the ground. Other specialist tests may be carried out on sites suspected of being contaminated (see standard appendix B).

15. **REFERENCES**

BS5930: 2015+A1:2020 British Standard Code of Practice for Site Investigations
 BS10175: 2011+A1:2017 British Standard Code of Practice for the Investigation of Potentially Contaminated Sites
 BS EN ISO 14688-1: 2018 Geotechnical Investigation and Testing: Identification and Classification of Soil
 BS EN ISO 14688-2: 2018 Geotechnical Investigation and Testing: Identification and Classification of Soil

1. **GENERAL.** The desk study and/or intrusive ground investigation is typically carried out in accordance with the Environment Agency's "Land Contamination Risk Management (LCRM) documents and the requirements of BS5930: 2015 and BS10175: 2011+A1: 2020. In relation to contamination the desk study is referred to as the preliminary investigation in BS10175 and the intrusive ground investigation is referred to as the Exploratory Investigation. This appendix briefly describes the nature of the work carried out and explains the standards against which contamination data has been assessed. The nature of any contamination investigation is such that only a small percentage of the ground, and therefore potential contamination, is sampled. Consequently variations in both ground conditions and contaminant levels can occur between any two sampling positions. The contamination investigation is designed to minimise such risks, but they cannot be eliminated.

2. **REVIEW OF CONTAMINATION ISSUES** – The National Planning Policy Framework (NPPF) and Part 2A of the Environmental Protection Act 1990 create a new regime for the identification and remediation of contaminated land. It introduced a definition of contaminated land described in Section 78A(2) of the Act of:

"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused:

Both Part 2A and the planning regime embrace the "suitable for use" approach. In the context of Part IIA, action is necessary only where there are unacceptable risks to health or to the environment, taking into account the current use of the land and its environmental setting.

For humans, significant harm is defined as "death, disease, serious injury". Specifically, disease is taken to mean an unhealthy condition of the body or part of it. "Significant possibility of significant harm" is described as health effects arising from the intake of a contaminant or other direct bodily contact with the contaminant where the intake or exposure is unacceptable. The assessment should also take into account the total intake from all sources, the relative contribution of the pollutant linkage in question, and the duration of intake or exposure. The various statutory definitions are given overleaf.

The presence of unnatural substances does not automatically constitute a risk unless there is a link or pathway between the contamination (the hazard) and the receptor (the target) be it humans, the environment or property. Therefore the assessment needs to determine whether a hazard is present and whether the necessary pathway exists the so-called "pollution linkage" or "conceptual site model".

The effect of any hazard on a site depends primarily on the site use and groundwater conditions since these determine who and what may be at risk and the routes by which they may be exposed to the hazard. Site uses can include allotments, domestic gardens on residential developments, amenity and recreational areas, public open space and industrial and commercial buildings. On any site, the potential contaminants have to be identified together with the potential receptors. The pathway for that contaminant to reach its target has then to be considered.

3. **PRELIMINARY INVESTIGATION.** The preliminary Phase I Geoenvironmental Assessment (desk study) report normally considers the following key sections:

Introduction	
The Site	Contaminated Land
Site History	Radon
Geology and Mining	Geoenvironmental Risk Assessment
Hydrogeology	Geotechnical Assessment
Groundsure Geo-Insight and Enviro-Insight	Ground Investigation (Recommendations)

The report will summarise the findings and also relate our opinions to the potential for a site to be geoenvironmentally impaired, at levels likely to warrant mitigation or further consideration appropriate to the current or future use. Findings are based on information obtained and described during the desk study and site inspection without intrusive ground investigation. It is possible that further information exists. The absence of indicators of impairment does not mean that such impairment does not exist. Additional investigation including intrusive methods can reduce the risks but cannot eliminate them and may not be cost effective. We can advise on the additional research opportunities, their cost and their possible impact on mitigating risk. Recommendations are normally given based on the redevelopment proposals for the site.

Type of Receptor	Description of harm that is to be regarded as significant harm	Conditions For There Being A Significant Possibility Of Significant Harm
1. Human beings	<p>Death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.</p>	<p>If the amount of the pollutant in the pollutant linkage represents an unacceptable intake or direct bodily contact, assessed on the basis of relevant information on the toxicological properties of that pollutant.</p> <p>Such an assessment should take into account:</p> <ul style="list-style-type: none"> • the likely total intake of, or exposure to, the substance or substances which form the pollutant, from all sources including that from the pollutant linkage in question; • the relative contribution of the pollutant linkage in question to the likely aggregate intake of, or exposure to, the relevant substance or substances; and • the duration of intake or exposure resulting from the pollutant linkage in question. <p>The question of whether an intake or exposure is unacceptable is independent of the number of people who might experience or be affected by that intake or exposure.</p> <p>Toxicological properties should be taken to include carcinogenic, mutagenic, teratogenic, pathogenic, endocrine-disrupting and other similar properties.</p>
2. All other human health effects (particularly by way of explosion or fire)		<p>If the probability, or frequency, of significant harm of that description is unacceptable. The pollutant linkage might cause "significant harm which"</p> <ul style="list-style-type: none"> • would be irreversible or incapable of being treated; • would affect a substantial number of people; • would result from a single incident such as a fire or an explosion; or • would be likely to result from a short-term (less than 24-hour) exposure to the pollutant.
3. Any ecological system, or living organism forming part of such a system, within a location which is protected.	<p>For any protected location:</p> <ul style="list-style-type: none"> • harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or • harm which affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. 	<p>If either:</p> <ul style="list-style-type: none"> • significant harm of that description is more likely than not to result from the pollutant linkage; or • there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration.
4. Property in the form of: <ul style="list-style-type: none"> • crops, including timber; • produce grown domestically, or on allotments, for consumption; • livestock; • other owned or domesticated animals; • wild animals which are the subject of shooting or fishing rights. 	<p>For crops, a substantial diminution in yield or other substantial loss in the value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p>	<p>If significant harm of that description is more likely than not to result from the pollutant linkage in question.</p>
5. Property in the form of buildings.	<p>Structural failure, substantial damage or substantial interference with any right of occupation.</p>	<p>If significant harm of that description is more likely than not to result from the pollutant linkage in question during the expected economic life of the building.</p>
6. Controlled waters.		

4. **INTRUSIVE INVESTIGATION.** BS10175 describes this as an exploratory investigation. Intrusive ground investigation is described in Standard Appendix A. During the investigation representative or indicative samples are obtained for testing by an accredited laboratory. The aim is to determine (with a degree of confidence appropriate to the objectives), the presence, concentration and distribution of contaminants in respect of those points investigated. The extent of any necessary intrusive investigation will depend on the size of the site and any hazards, either known or suspected.
5. **ASSESSMENT OF CONTAMINATION.** The assessment of contaminated land under the terms of Part II A of the Environmental Protection Act 1990 is based upon pollution linkage (source - pathway - receptor model) and the principles of the Environment Agency's "Contamination Land Risk Management" documentation.

DEFRA previously issued "Outcome of the Way Forward Exercise on Soil Guideline Values". This document was intended to provide guidance to determine if there is a Significant Possibility of Significant Harm (SPOSH) i.e. whether land meets the legal trigger of being contaminated land.

In the context of Part 2A, a risk assessor using an SGV would conclude the following (DEFRA, 2008).

- At a representative average soil concentration at or below an SGV, it is very unlikely that there will be a *significant possibility of significant harm (SPOSH)*.
- At a representative average soil concentration above an SGV, there *might* be a *significant possibility of significant harm* with the significance linked to the margin of exceedance, the duration and frequency of exposure, and other site-specific factors that the enforcing authority may wish to take into account. Further investigation and/or detailed evaluation will usually be required.

It should be stressed that where there is any uncertainty as to whether or not there is a SPOSH, it was the policy of this practice to adopt a conservative approach, particularly in the adoption of clean cover systems.

In April 2012, Defra both published new Statutory Guidance which forms a major part of their contaminated land regimes under Part 2A of the Environment Protection Act 1990. The regime provides a means of dealing with contaminated land which poses a significant risk to human health or the environment where there is no alternative solution. It also works alongside planning rules and building regulations to help ensure that affected land is made suitable for use when it is redeveloped.

Since the regime was introduced in 2000 there has been considerable uncertainty over how to decide when land is, and is not contaminated land on grounds of the legal test of *significant possibility of significant harm to human health or the environment*.

To help address this, one of the main changes set out in the new Statutory Guidance, is the introduction of a new four category test to help decide when land is, and is not, contaminated land on grounds of *significant possibility of significant harm to human health*. Under the new four category test:

- Category 1 describes land that is clearly contaminated land, for example because similar land is known to have caused significant harm in the past.
- Categories 2 and 3 cover less straightforward land where more detailed consideration is needed before the regulator can decide either: (a) that there is a strong case for regulatory action, in which case the land would be in Category 2 and be classified as contaminated land under Part 2A; or (b) that such a case does not exist, in which case the land would be in Category 3 and not be classified as contaminated land under Part 2A.
- Category 4 describes land that is clearly not contaminated land, as discussed below.

One of the main purposes of including the Categories in the Statutory Guidance is to provide a legal framework against which new technical tools can be developed by the land contamination sector to describe the Categories in more detail with regard to specific substances and/or situations.

The new Category 4 test is particularly important in terms of reducing uncertainty over when land is definitely not caught by the regime.

The new Statutory Guidance makes clear what land should be placed into Category 4, for example:

- (a) Land where no relevant contaminant linkage has been established.
- (b) Land where there are only normal levels of contaminants in soil (as explained in Section 3 of the guidance), unless there is a particular reason to consider otherwise. In other words land with normal background concentrations in the soil.

- (c) Land that has been excluded from the need for further inspection and assessment under Part 2A because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of the guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of the guidance, e.g. Category 4 Screening Levels.
- (d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed to in the normal course of their lives).

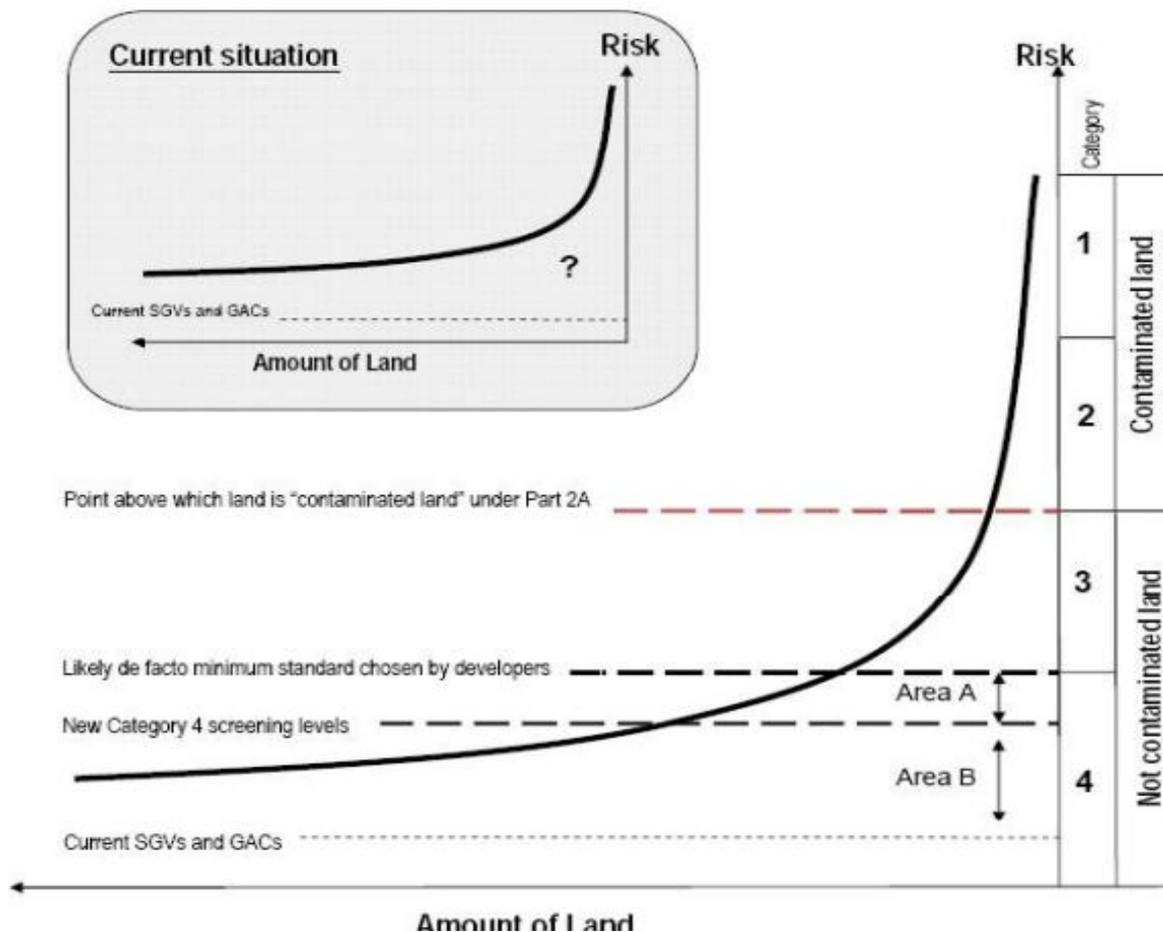
The guidance clarifies how generic assessment criteria (including the currently available SGVs/GACs) should and should not be used. It states that:

- 3.27 *It is common practice in contaminated land risk assessment to use “generic assessment criteria” (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work may be warranted.*
- 3.28 *Local authorities may use GACs and other technical tools to inform certain decisions under the Part 2A regime, provided: (i) they understand how they were derived and how they can be used appropriately; (ii) they have been produced in an objective, scientifically robust and expert manner by reputable organizations; and (iii) they are only used in a manner that is in accordance with Part 2A and this Guidance.*
- 3.29 *GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regard to such GACs:*
 - (a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.
 - (b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.
 - (c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risks to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.
 - (d) They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.
 - (e) They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.

The way in which the new four category system is intended to operate and the place of the C4SLs within that system, was explained in detail in the Impact Assessment which accompanied the Statutory Guidance. Please note that although the detail of the Impact Assessment is included here to provide clarity on the job expected of C4SLs, the Statutory Guidance, itself, sets out the regime that needs to be delivered under Part 2A.

Paragraph 47 of the Impact Assessment describes the diagram in detail. Of particular relevance to this project is the description of the overall diagram (sub-paragraph a), description of category 4 (sub-paragraphs c (part iv) and h) and the description of how the monetised benefits of the new system will be realised (sub-paragraph h). These sub-paragraphs are reproduced below.

Diagram showing the new Category 1-4 system (compared to current situation)



The diagram above seeks to illustrate, in a simplified manner, broadly what the changes to the statutory guidance on significant possibility of significant harm to human health are intended to achieve. To explain:

- (a) The curved line and axes illustrate the spectrum of risk presented by land contamination. The idea is to show that a very large amount of land is low risk, and only a small amount of land would pose sufficient risk to be contaminated land in the legal sense. The axes and lines in the diagrams are not to scale, and they have been compressed for the purposes of illustration (in reality the risks on Category 1 land would probably be orders of magnitude above Category 4 risks, and vastly more land would be in Category 4 compared to the other Categories).
- (b) The smaller diagram summarizes the current situation. In the area below the SGV/GACs there is near certainty that land is not contaminated land, however, above the line there is increasing uncertainty. As explained above, currently remediation usually occurs to just below the SGV/GAC level because they are perceived as offering the only cast-iron guarantee of when land is definitely not contaminated land. Sometimes consultants are employed to justify remediating to levels above the SGV/GACs, however the further they go away from the SGV/GACs the more legal risk they and their clients are exposed to.
- (c) The new statutory guidance will end the current situation, and it would not be legally possible e.g. for individual regulators to ignore the changes being made. For example, as explained above, the new statutory guidance will specifically say:
 - (i) that Part 2A cannot be used to force remediation to below a point where it ceases to be contaminated land in the legal sense i.e. the Category 2/3 border in terms of the diagram), although responsible parties can choose to go further;
 - (ii) that SGV/GACs cannot be used as one size fits all remediation thresholds under either Part 2A of the planning system;
 - (iii) that normal background levels of contamination are not caught by Part 2A; and
 - (iv) that SGV/GACs are well into Category 4, sometimes by only a few times and sometimes by orders of magnitude. These changes and others also provide the legal backing for the development e.g. of Category 4 screening levels, as discussed below.
- (d) The new Category 1-4 system divides the spectrum of risk posed by contaminated land into four different categories, and the statutory guidance will explain how to decide when land falls into each Category. This is more sophisticated than the current statutory guidance, which in effect has only two categories (contaminated land or not) and does not explain how to decide which category land falls into. The new Category 1-4 system

reflects what assessors find when they investigate real sites i.e. some are clearly contaminated land (Category 1); some clearly are not (Category 4) and some are less-straightforward and need some level of detailed assessment before a decision can be taken as to whether or not they are contaminated land (Categories 2 and 3).

- (e) In the case of Category 2 and 3 sites, the regulator will have flexibility to take decisions within the parameters set by the new Guidance. There would be less flexibility for Category 2 and 3 sites that clearly pose either a high or low risk. However, the regulator will have considerable flexibility for sites closer to the Category 2/3 border to judge which side of the border a site would fall (e.g. taking account of their understanding of the risks, uncertainties and the interests of the local community). These are often complex decisions which need to be taken case-by-case given the many factors involved.
- (f) In the case of Categories 1 and 4 the regulator will have far less flexibility. For example, if a regulator claimed that a site matching the Category 1 description was not contaminated land, or that a site matching the Category 4 description was contaminated land, they would be acting directly against the statutory guidance which the Act requires that they follow, and decisions could be challenged (e.g. in a law court) with a high chance that the challenge would be successful. Among other things, the intention of doing this is to create far more legal certainty around when land is definitely not contaminated land in the legal sense. With the specific wording of the new statutory guidance, and the supporting tools such as the new Category 4 screening levels, it would be very difficult for a regulator e.g. to threaten landowners with the Part 2A regime, and if they tried to determine land as contaminated land they would be operating in direct opposition to the statutory guidance.
- (g) In the many consultation meetings held in developing the Category 1-4 system, all the developers, landowners and consultants we spoke to were strongly of the view that they would want to ensure their land is safely within Category 4 (even though in theory they could remediate to a level within Category 3 and still satisfy Part 2A and planning rules). They would do this for various reasons, including the fact that the flexibility granted to regulators in Categories 2 and 3 means that the further into Category 3 a site gets, the greater the risk that the regulator might decide it is in Category 2. Also they would want to be in Category 4 for reasons of marketability, future proofing etc. So developers and others would have a strong incentive to seek the regulatory certainty of being safely within Category 4. Thus, as far as development taking place under the planning system is concerned, Category 3 would, in effect, normally be a buffer which provides added reassurance that development falling within Category 4 will not be caught by the Part 2A regime.
- (h) The new statutory guidance will bring about a situation where the current SGV/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land. Above the C4SLs, in Area A on the diagram, there will be much stronger legal backing for experts to use their judgement to make sensible and precautionary decisions on when land should be considered to be towards the top end of Category 4, without fear that land may be caught as contaminated land. This recognizes that the generic C4SLs will not be able to describe the Category 3/4 border itself because they are generic and would therefore have to err on the side of caution whilst a detailed site specific assessment would be able to push further by looking at specific circumstances relating to a specific site.
- (i) The very large majority of the monetized benefits of the changes to the regime discussed in this Impact Assessment manifest themselves in Category 4, and in particular in Areas A and B on the diagram. The main effects of moving to the new system would include Low risk land falling within Area B (pre-development) on the diagram would no longer have to be remediated because it would fall below the new C4SLs. Similarly land which is in Area A pre-development would no longer need to be remediated if justified by a detailed site-specific assessment. For these sites the cost of remediation would be removed altogether. The cost of remediating land which is initially in Categories 3, 2 or 1 would fall because it would be remediated to the new C4SL levels (or somewhere within Area A if there has been a detailed assessment) rather than the SGV/GAC level. This will have the overall effect of reducing the cost of remediation, with the effect varying according to specific site circumstances, the type of remediation etc. Generally the cost of remediation would fall for many affected brownfield land sites. This would have the general effect of making such land more economically viable for development. It would also mean that some land that is not currently economically viable to develop becomes reduce pressure to develop Greenfield land in some cases. The C4SLs will also speed up regulatory decisions on the reuse of brownfield land by providing a simple remediation standard.

The C4SLs are intended as “*relevant technical tools*” (in relation to Paragraph 4.2.1(c)) provides to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land”.

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

“SGVs are guidelines on the level of long-term human exposure to individual chemicals in soils that, unless stated otherwise, are tolerable or pose a minimal risk to human health”.

C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

CL:AIRE (Contaminated Land: Application in Real Environments) has published “*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*”. In it a series of C4SLs were proposed as follows;

Analyte	Residential (with home grown produce) (mg/kg)	Residential (without home grown produce) (mg/kg)	Allotments (mg/kg)	Commercial (mg/kg)	POS (mg/kg)
Arsenic	37	40	49	640	79
Benzene	0.87	3.3	0.18	98	140
Benzo(a)Pyrene	5	5.3	5.7	77	10
Cadmium	22	150	3.9	410	880
Chromium (vi)	21	21	170	49	21
Lead	200	310	80	2300	630

Where C4SL’s are not available, Generic Assessment Criteria have been used as follows;

Generic Assessment Criteria for Human Health Risk Assessment Comparison

METALS/CYANIDE

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and based on 6% soil organic matter (SOM)

Values are expressed in mg/kg

	S4UL						C4SL						EA SGV			EIC/AGS/CL:AIRE or *ATRISKSOIL		
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential without consumption of homegrown produce	Allotment	Commercial
Antimony ¹																550	ND	7500
Arsenic (6% SOM)	37	40	43	640	79	170	37	40	49	640	79	170	32	43	640			
Barium ¹																1300	ND	22000
Beryllium (6% SOM)	1.7	1.7	35	12	2.2	63												
Boron (6% SOM)	290	11000	45	240000	21000	46000												
Cadmium (6% SOM)	11	85	1.9	190	120	560	22	150	3.9	410	220	880	10	1.8	230			
Chromium (III) (6% SOM)	910	910	18000	8600	1500	33000												
Chromium (VI) (6% SOM)	6	6	1.8	33	7.7	220	21	21	170	49	21	250						
Copper (6% SOM)	2400	7100	520	68000	12000	44000												
Cyanide (AtriskSoil)																34*	34*	34*
Lead (6% SOM)							200	310	80	2300	630	1300						
Nickel (6%SOM)	130	180	53	980	230	800												
Mercury (Elemental) (6% SOM)	1.2	1.2	21	58	16	30							1.0	26	26			
Mercury (Inorganic) (6% SOM)	40	56	19	1100	120	240							170	80	3600			
Mercury (Methyl) (6% SOM)	11	15	6	320	40	68							11	8	410			
Molybdenum ¹																670	ND	17000
Selenium (6% SOM)	250	430	88	12000	1100	1800							350	120	13000			
Vanadium (6% SOM)	410	1200	91	9000	2000	5000												
Zinc (6% SOM)	3700	40000	620	730000	81000	170000												

Additional notes for EIC/AGS/CL:AIRE GAC

¹ Due to the limitations in time and scope of the EIC/AGS/CL:AIRE project, plant uptake factors were not derived for metals and therefore the metals GAC have only been produced for residential without consumption of homegrown produce and commercial land-uses. Note that the derived GAC are not dependent on SOM.

Compound	S4UL		C4SL				EA SGV				EIC/AGS/CL:AIRE								
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Benzene (1% SOM)	0.087	0.38	0.017	27	72	90													
Benzene (2.5% SOM)	0.17	0.7	0.034	47	72	100													
Benzene (6% SOM)	0.37	1.4	0.075	90	73	110	0.87	3.3	0.18	98	140	230	0.33	0.07	95				
Toluene (1% SOM)	130	880 (869)	22	56000 (869)	56000	87000 (869)													
Toluene (2.5% SOM)	290	1900	51	110000 (1920)	56000	95000 (1920)													
Toluene (6% SOM)	660	3900	120	180000 (4360)	56000	100000 (4360)							610	120	4.4x10 ³				
Ethyl benzene (1% SOM)	47	83	16	5700 (518)	24000	17000 (518)													
Ethyl benzene (2.5% SOM)	110	190	39	13000 (1220)	24000	22000 (1220)													
Ethyl benzene (6% SOM)	260	440	91	27000 (2840)	25000	27000 (2840)							350	90	2.8x10 ³				
o-xylene (1% SOM)	60	88	28	6600 (478)	41000	17000 (478)													
o-xylene (2.5% SOM)	140	210	67	15000 (1120)	42000	24000 (1120)													
o-xylene (6% SOM)	330	480	160	33000 (2620)	43000	33000 (2620)							250	160	2.6x10 ³				
m-xylene (1% SOM)	59	82	31	6200 (625)	41000	17000 (625)													
m-xylene (2.5% SOM)	140	190	74	14000 (1470)	42000	24000 (1470)													
m-xylene (6% SOM)	320	450	170	31000 (3460)	43000	32000 (3469)							240	180	3.5x10 ³				
p-xylene (1% SOM)	56	79	29	5900 (576)	41000	17000 (478)													
p-xylene (2.5% SOM)	130	180	69	14000 (1350)	42000	23000 (1350)													
p-xylene (6% SOM)	310	430	160	30000 (3170)	43000	31000 (3170)							230	160	3.2x10 ³				
Methyl tert-butyl ether (1% SOM)																49	73	23	7900
Methyl tert-butyl ether (2.5% SOM)																84	120	44	13000
Methyl tert-butyl ether (6% SOM)																160	220	90	24000

Additional Notes for LQM/CIEH Generic Assessment Criteria

- For residential land use the inhalation of vapours indoors exposure pathway is the most significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12). The ingestion of soil and indoor dust and consumption of homegrown produce exposure pathways are the most significant for the higher end fractions (aliphatics EC>16-35 and EC>35-44; aromatics EC>12-16, EC16-21, EC>21-35, EC>35-44 and EC44-70).
- For the allotment land use the consumption of homegrown produce exposure pathway is the most significant for the aromatic and lighter end aliphatic fractions. The ingestion of soil and indoor dust is the most significant exposure pathway for the higher end aliphatics EC>12-16, EC>16-35 and EC35-44.
- For the commercial land use the indoor inhalation of vapour exposure pathway is a significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12).
- Background exposure represents a significant proportion of the total exposure for all fractions expect aromatic fractions EC>5-7 and EC>7-8 in all land uses.

Notes for SGVs

- Based on a sandy loam as defined in Environment Agency (2009b) and 6% SOM. At a lower SOM, SGVs may not be sufficient protective.
- Generic assessment criteria will vary according to SOM for all land uses.
- SGVs assume that free phase contamination is not present.
- SGVs based on a sub-surface soil to indoor air correction air correction factor of 10.
- SGV presented for Toluene Commercial based on the vapour saturation limit.
- SGV presented for Ethylbenzene Allotment and Xylene Allotment - in applying the rules for non-soil background, the inhalation background ADE is limited to being no larger than the contribution of the inhalation soil ADE.
- Exposure of all isomers of xylene should be considered together, because the HCV applied is based on intake of total xylene and not an individual isomer in isolation.

Notes for EIC/AGS/CL:AIRE Generic Assessment Criteria

- GAC have been derived for 4 generic land uses; residential with consumption of homegrown produce, residential without consumption of homegrown produce, allotments and commercial land-use.

POLYAROMATIC HYDROCARBONS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria for Polycyclic Aromatic Hydrocarbons will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	LQM/CIEH						C4SL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
Acenaphthene (1% SOM)	210	3000 (57)	34	84000 (57)	15000	29000						
Acenaphthene (2.5% SOM)	510	4700 (141)	85	97000 (141)	15000	30000						
Acenaphthene (6% SOM)	1100	6000 (336)	200	100000	15000	30000						
Acenaphthylene (1% SOM)	170	2900 (86.1)	28	83000 (86.1)	15000	29000						
Acenaphthylene (2.5% SOM)	420	4600 (212)	69	97000 (212)	15000	30000						
Acenaphthylene (6% SOM)	920	6000 (506)	160	100000	15000	30000						
Anthracene (1% SOM)	2400	31000 (1.17)	380	520000	74000	150000						
Anthracene (2.5% SOM)	5400	35000	950	540000	74000	150000						
Anthracene (6% SOM)	11000	37000	2200	540000	74000	150000						
Benz(a)anthracene (1% SOM)	7.2	11	2.9	170	29	49						
Benz(a)anthracene (2.5% SOM)	11	14	6.5	170	29	56						
Benz(a)anthracene (6% SOM)	13	15	13	180	29	62						
Benzo(a)pyrene (1% SOM)	2.2	3.2	0.97	35	5.7	11						
Benzo(a)pyrene (2.5% SOM)	2.7	3.2	2.0	35	5.7	12						
Benzo(a)pyrene (6% SOM)	3.0	3.2	3.5	36	5.7	13	5.0	5.3	5.7	77	10	21
Benzo(b)fluoranthene (1% SOM)	2.6	3.9	0.99	44	7.1	13						
Benzo(b)fluoranthene (2.5% SOM)	3.3	4.0	2.1	44	7.2	15						
Benzo(b)fluoranthene (6% SOM)	3.7	4.0	3.9	45	7.2	16						
Benzo(ghi)perylene (1% SOM)	320	360	290	3900	640	1400						
Benzo(ghi)perylene (2.5% SOM)	340	360	470	4000	640	1500						
Benzo(ghi)perylene (6% SOM)	350	360	640	4000	640	1600						
Benzo(k)fluoranthene (1% SOM)	77	110	37	1200	190	370						
Benzo(k)fluoranthene (2.5% SOM)	93	110	75	1200	190	410						
Benzo(k)fluoranthene (6% SOM)	100	110	130	1200	190	440						
Chrysene (1% SOM)	15	30	4.1	350	57	93						
Chrysene (2.5% SOM)	22	31	9.4	350	57	110						
Chrysene (6% SOM)	27	32	19	350	57	120						
Dibenzo(ah)anthracene (1% SOM)	0.24	0.31	0.14	3.5	0.57	1.1						
Dibenzo(ah)anthracene (2.5% SOM)	0.28	0.32	0.27	3.6	0.57	1.3						
Dibenzo(ah)anthracene (6% SOM)	0.3	0.32	0.43	3.6	0.58	1.4						
Fluoranthene (1% SOM)	280	1500	52	23000	3100	6300						
Fluoranthene (2.5% SOM)	560	1600	130	23000	3100	6300						
Fluoranthene (6% SOM)	890	1600	290	23000	3100	6400						
Fluorene (1% SOM)	170	2800 (30.9)	27	63000 (30.9)	9900	20000						
Fluorene (2.5% SOM)	400	3800 (76.5)	67	68000	9900	20000						
Fluorene (6% SOM)	860	4500 (183)	160	71000	9900	20000						
Indeno(123cd)pyrene (1% SOM)	27	45	9.5	500	82	150						
Indeno(123cd)pyrene (2.5% SOM)	36	46	21	510	82	170						
Indeno(123cd)pyrene (6% SOM)	41	46	39	510	82	180						
Naphthalene (1% SOM)	2.3	2.3	4.1	190 (76.4)	4900	1200 (76.4)						
Naphthalene (2.5% SOM)	5.6	5.6	10	460 (183)	4900	1900 (183)						
Naphthalene (6% SOM)	13	13	24	1100 (432)	4900	3000						
Phenanthrene (1% SOM)	95	1300 (36)	15	22000	3100	6200						
Phenanthrene (2.5% SOM)	220	1500	38	22000	3100	6200						
Phenanthrene (6% SOM)	440	1500	90	22000	3100	6300						
Pyrene (1% SOM)	620	3700	110	54000	7400	15000						
Pyrene (2.5% SOM)	1200	3800	270	54000	7400	15000						
Pyrene (6% SOM)	2000	3800	620	54000	7400	15000						
Coal Tar (BaP as surrogate marl)	0.79	1.2	0.32	15	2.2	4.4						
Coal Tar (BaP as surrogate marl)	0.98	1.2	0.67	15	2.2	4.7						
Coal Tar (BaP as surrogate marl)	1.1	1.2	1.2	15	2.2	4.9						

CHLOROALCANES AND ALKANES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
1,1-Dichloroethane (1% SOM)							2.4	2.5	9.2	280
1,1-Dichloroethane (2.5% SOM)							3.9	4.1	17	450
1,1-Dichloroethane (6% SOM)							7.4	7.7	35	850
1,2-Dichloroethane (1% SOM)	0.0071	0.0092	0.0046	0.67	29	21				
1,2-Dichloroethane (2.5% SOM)	0.011	0.013	0.0083	0.97	29	24				
1,2-Dichloroethane (6% SOM)	0.019	0.023	0.016	1.7	29	28				
1,1,1-Trichloroethane (1% SOM)	8.8	9	48	660	140000	57000 (1425)				
1,1,1-Trichloroethane (2.5% SOM)	18	18	110	1300	140000	76000 (2915)				
1,1,1-Trichloroethane (6% SOM)	39	40	240	3000	140000	100000 (6392)				
1,1,2-Trichloroethane (1% SOM)							0.6	0.88	0.28	94
1,1,2-Trichloroethane (2.5% SOM)							1.2	1.8	0.61	190
1,1,2-Trichloroethane (6% SOM)							2.7	3.9	1.4	400
1,1,1,2-Tetrachloroethane (1% SOM)	1.2	1.5	0.79	110	1400	1500				
1,1,1,2-Tetrachloroethane (2.5% SOM)	2.8	3.5	1.9	250	1400	1800				
1,1,1,2-Tetrachloroethane (6% SOM)	6.4	8.2	4.4	560	1400	2100				
1,1,2,2-Tetrachloroethane (1% SOM)	1.6	3.9	0.41	270	1400	1800				
1,1,2,2-Tetrachloroethane (2.5% SOM)	3.4	8.0	0.89	550	1400	2100				
1,1,2,2-Tetrachloroethane (6% SOM)	7.5	17	2.0	1100	1400	2300				
1,1-Dichloroethene (1% SOM)							0.23	0.23	2.8	26
1,1-Dichloroethene (2.5% SOM)							0.40	0.41	5.6	46
1,1-Dichloroethene (6% SOM)							0.82	0.82	12	92
Tetrachloroethene (1% SOM)	0.18	0.18	0.65	19	1400	810 (424)				
Tetrachloroethene (2.5% SOM)	0.39	0.40	1.5	42	1400	1100 (951)				
Tetrachloroethene (6% SOM)	0.9	0.92	3.6	95	1400	1500				
Tetrachloromethane (1% SOM)	0.026	0.026	0.45	2.9	890	190				
Tetrachloromethane (2.5% SOM)	0.056	0.056	1.0	6.3	920	270				
Tetrachloromethane (6% SOM)	0.13	0.13	2.4	14	950	400				
Trichloroethene (1% SOM)	0.016	0.017	0.041	1.2	120	70				
Trichloroethene (2.5% SOM)	0.034	0.036	0.091	2.6	120	91				
Trichloroethene (6% SOM)	0.075	0.080	0.21	5.7	120	120				
Trichloromethane (1% SOM)	0.91	1.2	0.42	99	2500	2600				
Trichloromethane (2.5% SOM)	1.7	2.1	0.83	170	2500	2800				
Trichloromethane (6% SOM)	3.4	4.3	1.7	350	2500	3100				
Vinyl Chloride (1% SOM)	0.00064	0.00077	0.00055	0.059	3.5	4.8				
Vinyl Chloride (2.5% SOM)	0.00087	0.0010	0.0010	0.077	3.5	5.0				
Vinyl Chloride (6% SOM)	0.0014	0.0015	0.0018	0.12	3.5	5.4				
Chloroethane (1% SOM)							8.3	8.4	110	960
Chloroethane (2.5% SOM)							11	11	200	1300
Chloroethane (6% SOM)							18	18	380	2100
1,2-Dichloropropane (1% SOM)							0.024	0.024	0.62	3.3
1,2-Dichloropropane (2.5% SOM)							0.042	0.042	1.2	5.9
1,2-Dichloropropane (6% SOM)							0.084	0.085	2.6	12
2-Chloronaphthalene (1% SOM)							3.7	3.8	40	390
2-Chloronaphthalene (2.5% SOM)							9.2	9.3	98	960
2-Chloronaphthalene (6% SOM)							22	22	230	2200
Bromodichloromethane (1% SOM)							0.016	0.019	0.016	2.1
Bromodichloromethane (2.5% SOM)							0.030	0.034	0.032	3.7
Bromodichloromethane (6% SOM)							0.061	0.07	0.068	7.6
Chloromethane (1% SOM)							0.0083	0.0085	0.066	1
Chloromethane (2.5% SOM)							0.0098	0.0099	0.13	1.2
Chloromethane (6% SOM)							18	18	380	2100

Compound	S4UL				EIC/AGS/CL:AIRE					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
<i>cis</i> -1,2 Dichloroethene (2.5% SOM)							0.19	0.20	0.50	24
<i>cis</i> -1,2 Dichloroethene (6% SOM)							0.37	0.39	1.0	47
<i>trans</i> -1,2 Dichloroethene (1% SOM)							0.19	0.19	0.93	22
<i>trans</i> -1,2 Dichloroethene (2.5% SOM)							0.34	0.35	1.9	40
<i>trans</i> -1,2 Dichloroethene (6% SOM)							0.70	0.71	4.0	81
Dichloromethane (1% SOM)							0.58	2.1	0.1	270
Dichloromethane (2.5% SOM)							0.98	2.8	0.19	360
Dichloromethane (6% SOM)							1.7	4.5	0.34	560
Hexachloroethane (1% SOM)							0.2	0.22	0.27	22
Hexachloroethane (2.5% SOM)							0.48	0.54	0.67	53
Hexachloroethane (6% SOM)							1.1	1.3	1.6	120

Notes for EIC/AGS/CL:AIRE Generic Assessment Criteria

1 GAC have been derived for 4 generic land uses; residential with consumption of homegrown produce, residential without consumption of homegrown produce, allotments and commercial land-use.

EXPLOSIVES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
RDX (1% SOM)	120	13000	17	210000	210000	210000
RDX (2.5% SOM)	250	13000	38	210000	26000	49000 (18.7)
RDX (6% SOM)	540	13000	85.0	210000	27000	53000
HMX (1% SOM)	5.7	6700	0.86	110000	13000	23000 (0.35)
HMX (2.5% SOM)	13	6700	1.9	110000	13000	23000 (0.39)
HMX (6% SOM)	26	6700	3.9	110000	13000	24000 (0.48)

PESTICIDES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
Aldrin (1% SOM)	5.7	7.3	3.2	170	18	30
Aldrin (2.5% SOM)	6.6	7.4	6.1	170	18	31
Aldrin (6% SOM)	7.1	7.5	9.6	170	18	31
Dieldrin (1% SOM)	0.97	7	0.17	170	18	30
Dieldrin (2.5% SOM)	2	7.3	0.41	170	18	30
Dieldrin (6% SOM)	3.5	7.4	0.96	170	18	31
Atrazine (1% SOM)	3.3	610	0.5	9300	1200	2300
Atrazine (2.5% SOM)	7.6	620	1.2	9400	1200	2400
Atrazine (6% SOM)	17.4	620	2.7	9400	1200	2400
Dichlorovos (1% SOM)	0.032	6.4	0.0049	140	16	26
Dichlorovos (2.5% SOM)	0.066	6.5	0.010	140	16	26
Dichlorovos (6% SOM)	0.14	6.6	0.022	140	16	27
Alpha-Endosulfan (1% SOM)	7.4	160 (0.003)	1.2	5600 (0.003)	1200	2400
Alpha-Endosulfan (2.5% SOM)	18	280 (0.007)	2.9	7400 (0.007)	1200	2400
Alpha-Endosulfan (6% SOM)	41	410 (0.016)	6.8	8400 (0.016)	1200	2500
Beta-Endosulfan (1% SOM)	7	190 (0.00007)	1.1	6300 (0.00007)	1200	2400
Beta-Endosulfan (2.5% SOM)	17	320 (0.0002)	2.7	7800 (0.0002)	1200	2400
Beta-Endosulfan (6% SOM)	39	440 (0.0004)	6.4	8700	1200	2500
Alpha-Hexachlorocyclohexanes (1)	0.23	6.9	0.035	170	24	47
Alpha-Hexachlorocyclohexanes (2)	0.55	9.2	0.087	180	24	48
Alpha-Hexachlorocyclohexanes (3)	1.2	11	0.21	180	24	48
Beta-Hexachlorocyclohexanes (1)	0.085	3.7	0.013	65	8.1	15
Beta-Hexachlorocyclohexanes (2)	0.2	3.8	0.032	65	8.1	15
Beta-Hexachlorocyclohexanes (3)	0.46	3.8	0.077	65	8.1	16
Gamma-Hexachlorocyclohexane	0.06	2.9	0.0092	67	8.2	14
Gamma-Hexachlorocyclohexane	0.14	3.3	0.023	69	8.2	15
Gamma-Hexachlorocyclohexane	0.33	3.5	0.054	70	8.2	15

CHLOROBENZENES & METHYLBENZENES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL				EIC/AGS/CL:AIRE					
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Chlorobenzene (1% SOM)	0.46	0.46	5.9	56	11000	1300 (675)				
Chlorobenzene (2.5% SOM)	1.0	1.0	14	130	13000	2000 (1520)				
Chlorobenzene (6% SOM)	2.4	2.4	32	290	14000	2900				
1,2-Dichlorobenzene (1% SOM)	23	24	94	2000 (571)	90000	24000 (571)				
1,2-Dichlorobenzene (2.5% SOM)	55	57	230	4800 (1370)	95000	36000 (1370)				
1,2-Dichlorobenzene (6% SOM)	130	130	540	11000 (3240)	98000	51000 (3270)				
1,3-Dichlorobenzene (1% SOM)	0.40	0.44	0.25	30	300	390				
1,3-Dichlorobenzene (2.5% SOM)	1.0	1.1	0.6	73	300	440				
1,3-Dichlorobenzene (6% SOM)	2.3	2.5	1.5	170	300	470				
1,4-Dichlorobenzene (1% SOM)	61	61	15	4400 (224)	17000	36000 (224)				
1,4-Dichlorobenzene (2.5% SOM)	150	150	37	10000 (540)	17000	36000 (540)				
1,4-Dichlorobenzene (6% SOM)	350	350	88	25000 (1280)	17000	36000 (1280)				
1,2,3-Trichlorobenzene (1% SOM)	1.5	1.5	4.7	102	1800	770 (134)				
1,2,3-Trichlorobenzene (2.5% SOM)	3.6	3.7	12	250	1800	110 (330)				
1,2,3-Trichlorobenzene (6% SOM)	8.6	8.8	28	590	1800	1600 (789)				
1,2,4-Trichlorobenzene (1% SOM)	2.6	2.6	55	220	15000	1700 (318)				
1,2,4-Trichlorobenzene (2.5% SOM)	6.4	6.4	140	530	17000	2600 (786)				
1,2,4-Trichlorobenzene (6% SOM)	15	15	320	1300	19000	400 (1880)				
1,3,5-Trichlorobenzene (1% SOM)	0.33	0.33	4.7	23	1700	380 (36.7)				
1,3,5-Trichlorobenzene (2.5% SOM)	0.81	0.81	12	55	1700	580 (90.8)				
1,3,5-Trichlorobenzene (6% SOM)	1.9	1.9	28	130	1800	860 (217)				
1,2,3,4-Tetrachlorobenzene (1% SOM)	15	24	4.4	1700 (122)	830	1500 (122)				
1,2,3,4-Tetrachlorobenzene (2.5% SOM)	36	56	11	3080 (304)	830	1600				
1,2,3,4-Tetrachlorobenzene (6% SOM)	78	120	26	4400 (728)	830	1600				
1,2,3,5-Tetrachlorobenzene (1% SOM)	0.66	0.75	0.38	49 (39.4)	78	110 (39)				
1,2,3,5-Tetrachlorobenzene (2.5% SOM)	1.6	1.9	0.90	120 (98.1)	79	120				
1,2,3,5-Tetrachlorobenzene (6% SOM)	3.7	4.3	2.2	240 (235)	79	130				
1,2,4,5-Tetrachlorobenzene (1% SOM)	0.33	0.73	0.06	42 (19.7)	13	25				
1,2,4,5-Tetrachlorobenzene (2.5% SOM)	0.77	1.7	0.16	72 (49.1)	13	26				
1,2,4,5-Tetrachlorobenzene (6% SOM)	1.6	3.5	0.37	96	13	26				
Pentachlorobenzene (1% SOM)	5.8	19	1.2	640 (43.0)	100	190				
Pentachlorobenzene (2.5% SOM)	12	30	3.1	770 (107)	100	190				
Pentachlorobenzene (6% SOM)	22	38	7.0	830	100	190				
Hexachlorobenzene (1% SOM)	1.8 (0.20)	4.1 (0.20)	0.47	110 (0.20)	16	30				
Hexachlorobenzene (2.5% SOM)	3.3 (0.50)	5.7 (0.50)	1.1	120	16	30				
Hexachlorobenzene (6% SOM)	4.9	6.7 (1.2)	2.5	120	16	30				
1,2,4-Trimethylbenzene (1% SOM)					0.35	0.41	0.38	42		
1,2,4-Trimethylbenzene (2.5% SOM)					0.85	0.99	0.93	99		
1,2,4-Trimethylbenzene (6% SOM)					2	2.3	2.2	220		
Isopropyl benzene (1% SOM)					11	12	32	1400		
Isopropyl benzene (2.5% SOM)					27	28	79	3300		
Isopropyl benzene (6% SOM)					64	67	190	7700		
Propylbenzene (1% SOM)					34	40	34	4100		
Propylbenzene (2.5% SOM)					82	97	83	9700		
Propylbenzene (6% SOM)					190	230	200	21000		
Styrene (1% SOM)					8.1	35	1.6	3300		
Styrene (2.5% SOM)					19	78	3.7	6500		
Styrene (6% SOM)					43	170	8.7	11000		

PHENOLS AND CHLOROPHENOLS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	LQM/CIEH			EA SGV			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	atm	Commercial
Phenol (1% SOM)	120	440 (460)	23	440 (26000)	440 (10000)	440 (7600)							
Phenol (2.5% SOM)	200	690	42	690 (30000)	690 (10000)	690 (8300)							
Phenol (6% SOM)	380	1200	83	1300 (34000)	1300 (10000)	1300 (9300)	420	280	3200 (38000)				
Chlorophenol (1% SOM)	0.87	94	0.13	3500	620	1100							
Chlorophenol (2.5% SOM)	2.0	150	0.30	4000	620	1100							
Chlorophenol (6% SOM)	4.5	210	0.70	4300	620	1100							
Pentachlorophenol (1% SOM)	0.22	27 (16.7)	0.03	400	60	110							
Pentachlorophenol (2.5% SOM)	0.52	29	0.08	400	60	120							
Pentachlorophenol (6% SOM)	1.2	31	0.19	400	60	120							
2,4-Dimethylphenol (1% SOM)										19	210	3	16000
2,4-Dimethylphenol (2.5% SOM)										43	410	7	24000
2,4-Dimethylphenol (6% SOM)										97	730	17	30000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (1% SOM)										80	3700	12	160000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (2.5% SOM)										180	5400	27	180000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (6% SOM)										400	6900	63	180000

PHTHALATES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	EIC/AGS/CL:AIRE			
	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Bis (2-ethylhexyl) phthalate (1%)	280	2700	47	85000
Bis (2-ethylhexyl) phthalate (2.5%)	610	2800	120	86000
Bis (2-ethylhexyl) phthalate (6%)	1100	2800	280	86000
Butyl benzyl phthalate (1% SOM)	1400	42000	220	940000
Butyl benzyl phthalate (2.5% SOM)	3300	44000	550	940000
Butyl benzyl phthalate (6% SOM)	7200	44000	1300	950000
Diethyl Phthalate (1% SOM)	120	1800	19	1500000
Diethyl Phthalate (2.5% SOM)	260	3500	41	2200000
Diethyl Phthalate (6% SOM)	570	6300	94	2900000
Di-n-butyl phthalate (1% SOM)	13	450	2	15000
Di-n-butyl phthalate (2.5% SOM)	31	450	5	15000
Di-n-butyl phthalate (6% SOM)	67	450	12	15000
Di-n-octyl phthalate (1% SOM)	2300	3400	940	89000
Di-n-octyl phthalate (2.5% SOM)	2800	3400	2100	89000
Di-n-octyl phthalate (6% SOM)	3100	3400	3900	89000

OTHER ORGANICS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Carbon disulphide (1% SOM)	0.14	0.14	4.8	11	11000	1300				
Carbon disulphide (2.5% SOM)	0.29	0.29	10	22	11000	1900				
Carbon disulphide (6% SOM)	0.62	0.62	23	47	12000	2700				
Hexachloro-1,3-butadiene (1% S)	0.29	0.32	0.25	31	25	48				
Hexachloro-1,3-butadiene (2.5%)	0.70	0.78	0.61	66	25	50				
Hexachloro-1,3-butadiene (6% S)	1.6	1.8	1.4	120	25	51				
Tributyl tin oxide (1% SOM)							0.25	1.4	0.042	130
Tributyl tin oxide (2.5% SOM)							0.59	3.1	0.1	180
Tributyl tin oxide (6% SOM)							1.3	5.7	0.24	200
Biphenyl (1% SOM)							66	220	14	18000
Biphenyl (2.5% SOM)							160	500	35	33000
Biphenyl (6% SOM)							360	980	83	48000
2,4-Dinitrotoluene (1% SOM)							1.5	170	0.22	3700
2,4-Dinitrotoluene (2.5% SOM)							3.2	170	0.49	3700
2,4-Dinitrotoluene (6% SOM)							7.2	170	1.1	3800
2,6-Dinitrotoluene (1% SOM)							0.78	78	0.12	1900
2,6-Dinitrotoluene (2.5% SOM)							1.7	84	0.27	1900
2,6-Dinitrotoluene (6% SOM)							3.9	87	0.61	1900
Bromoform (1% SOM)							2.8	5.2	0.95	760
Bromoform (2.5% SOM)							5.9	11	2.1	1500
Bromoform (6% SOM)							13	23	4.6	3100

6. GEOENVIRONMENTAL RISK ASSESSMENT

- 6.1 **Potential Hazard Sources.** Ground contamination can occur through several causes, particularly from historical use of the site and is often linked to the processes of waste disposal, underground storage, open storage, process pipework, leaks, spillages, tanks, site filling and various other reasons. The contamination can either arise from site sources or be the result of migration from other sources off site.
- 6.2 **Potential Migratory Pathways.** The primary pathways are considered to be laterally or vertically downward through underlying strata or upward to the ground surface. Such pathways also provide the potential for contaminants to migrate towards local watercourses and groundwater.
- 6.3 **Potential Targets At Risk.** Potential environmental liabilities related to current legislation associated with contaminated land with regard to existing ownership and redevelopment are summarised.

The probability of a hazard, linked with its consequences, can be used to assess risk in accordance with the tables below for use in decision making.

Consequence of Pollution Linkage

Severe	Damage to human health. Substantial pollution of controlled waters. Significant change in ecosystem population. Irreparable damage to property.
Moderate	Non-permanent damage to human health. Minor pollution of controlled waters. Change in ecosystem. Damage to property.
Mild	Short term health effects. Slight pollution of controlled waters. Slight effect on ecosystem. Minor repairable damage to property.
Near Zero	No noticeable effect on human health. No significant pollution to controlled waters. No measurable effect on ecosystem densities. Non-structural cosmetic damage to property.

Decision Making

Probability of a hazard and an associated linkage	Consequences of a pollution linkage (hazard-pathway-target)			
	Severe	Moderate	Mild	Near Zero
High	High	High	Medium/low	Negligible
Medium	High	Medium	Low	Negligible
Low	High/medium	Medium/low	Low	Negligible
Unlikely	High/medium/low	Medium/low	Low	Negligible

Final overall risk is based on an assessment of probability of a hazard and its consequences. Risk categories are shown shaded in the table above and defined below.

Risk	Description
High	Site probably or certainly unsuitable for present use or environmental setting. Contamination probably or certainly present and likely to have an unacceptable impact on key targets. Urgent action needed.
Medium/ Moderate	Site may not be suitable for present use or environmental setting. Contamination may be present, and likely to have unacceptable impact on key targets. Action may be needed on the medium term.
Low	Site considered suitable for present use and environmental setting. Contamination may be present but unlikely to have unacceptable impacts on key targets. Action unlikely to be needed in present use.
Negligible	Site considered suitable for present use and environmental setting. Contamination may be present but unlikely to have unacceptable impacts on key targets. No action needed while site remains in present use.

The review of the information from the exploratory investigation may be such that a decision is made that there is no need for further investigation. Alternatively, it may be necessary to carry out a further main investigation.

The Environment Agency has set out guidance as to the classification of waste arising from construction sites in its document "The Definition of Waste" dated April 2006. This document outlines how waste is to be handled

The following activities are not regarded as a waste management activity requiring licencing.

- 1) Construction activities carried out for the purpose of producing a suitably engineered soil e.g. lime stabilisation, vibro-replacement and piling.
- 2) Uncontaminated materials produced on site (including excavated soils and materials from demolition) which can be reused without further treatment. Examples include site regrading and footing excavations.

These must be done in accordance with the Planning Permission. Demolition material must be used in accordance with the quality protocols for the production of aggregates from inert waste, subject to appropriate testing and the lack of any harmful constituents. Uses include pipe bedding, backfill and sub-base.

- 3) Contaminated soils can be moved on-site providing they do not require treatment or containment. There should be no risk to the environment i.e. non-leachable and in accordance with Planning Permission. Relevant activities can include site regrading and use of materials below clean cover systems, capping, buildings and hardstanding.

Where contaminated materials have to be placed in an engineered cell to prevent pollution, then this would be classed as landfilling and require PPC permits. Any material taken off site is considered to be waste. However, this is under review. If material is waste, then there is a duty of care including ensuring material is transported by a registered carrier. The destination of material leaving the site should be regularly checked and Waste Transfer Notes kept.

Clean Cover Systems

According to the Environment Agency's Remediation Position Statements of May 2006, the placement of a cover system using "clean" material is not treatment of waste. Consequently, no licensing/permitting position statements are applicable to this type of remediation. If the cover system uses 'waste materials' in its construction, waste management licensing exemption paragraph 9A may be applicable to its installation. If the installation of the proposed cover system does not meet the criteria for registration of this exemption, the activity may be regulated through a waste management site license.

7. WASTE ACCEPTANCE CRITERIA (WAC)

The main objective of the Landfill Directive is to prevent or reduce as far as possible the negative effects of landfilling waste on the environment and on human health. It is intended to reduce the disposal of waste materials to landfills and to encourage more sustainable approaches to dealing with wastes. It bans the landfill of liquids and certain solid wastes, introduces requirements for the treatment of wastes prior to landfill and provides for the classification of landfills as sites for inert, hazardous or non-hazardous waste and prohibits co-disposal.

It sets out procedures for waste acceptance at landfills and the types of waste for each class of landfill as specified by Waste Acceptance Criteria (WAC). The WAC are predominantly lists of "limit values" for certain parameters obtained from standard leaching tests of wastes going to landfills. WAC are set out in the Landfill Directive itself. Full details can be found in the Environment Agency document "Waste Classification – Guidance on the classification and Assessment of Waste " Technical Guidance WM3 - 2015

8. MAIN REFERENCES

British Standards	BS3882: 2015 British Standard Specification for Topsoil BS5930: 2015+A1:2020 British Standard Code of Practice for Site Investigations BS8485: 2015 British Standard Code of Practice for the design and protective measures from methane and carbon dioxide ground gases for new buildings BS10175: 2011+A2:2017 British Standard Code of Practice for the Investigation of Potentially Contaminated Sites
BRE	Radon: Guidance on protective measures for new dwellings, BR211, 2015 Protective measures for housing on gas-contaminated land, BR414, 2015 Cover systems for land regeneration, 2004 Concrete in aggressive ground. Special Digest SD1, 3 rd Edition, 2005 Soakaway Design (DG365)
CIEH	The LQM / CIEH Generic Assessment Criteria for Human Health Risk Assessment (2 nd Edition)
CIRIA	Assessing risks posed by hazardous ground gases to buildings, CIRIA C665 Asbestos in Soil and Made Ground: a guide to understanding and managing risks, CIRIAC733, 2014 Good Practice on the testing and verification of protection systems for buildings against hazardous ground gases. C735:2014
CL:AIRE	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, SP1010, 2013
DEFRA	Contaminated Land Report CLR 11, 2002 (7-10 withdrawn) R & D Publications TOX 1 – 12, 14, 16 – 25 R & D Publications SGV 1, 3, 4, 5, 7, 8, 9, 10, 15 and 16 (withdrawn) Improvements to Contaminated Land Guidance - “Outcome of the “Way Forward”, 2008 Exercise on Soil Guideline Values. July 2008 Guidance on the Legal Definition of Contaminated Land. July 2008 Simplification of the Contaminated Land Regime Impact Assessment No: Defra 1133
DETR	Circular 02/2000. Contaminated Land, 2000 Guidelines for Environmental Risk Assessment and Management, 2000
Environment Agency	Guidance for the Safe Development of Housing on Land Affected by Contamination, 2000 Protective measures for housing on gas-contaminated land Remediation Position Statements, May 2006 Guidance and monitoring of landfill leachate, groundwater and surface water Human health toxicological assessment of contaminants in soil (Science Report SC050021/SR2) 2008 Updated technical background in the CLEA model (Science Report SC0520021/SR3) Waste Classification – Guidance on the classification and Assessment of Waste - Technical Guidance WM3 (2015) Contaminated Land Risk Management (2021)
HMSO	Part 2A of the Environmental Protection Act Part 2A Statutory Guidance – April 2012 Contaminated Land (England) Regulations 2006 The Contaminated Land (England) (Amendment) Regulations 2012 The Water Act 2003 (Commencement No. 11) Order 2012
Institution of Civil Engineers	Contaminated Land: Investigation, Assessment and Remediation, 2 nd Edition
NHBC	Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present, 2007

This list is not intended to be exhaustive.