



Site Investigation Report

Chalford Vale Recreation Ground, Stroud



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CONTENTS

1.0	Introduction	1
1.1	Context.....	1
1.2	Proposed Use	1
1.3	Legislation and Regulatory Setting	1
2.0	Project Details	3
2.1	Site Location	3
2.2	Site Description	3
2.3	Surrounding Area	3
2.4	Site Context	4
2.4.1	Site History	4
2.4.2	Surrounding Area Use History.....	4
2.5	Published Geology	5
2.6	Hydrogeology.....	5
2.7	Hydrology.....	6
2.8	Sensitive Environmental Receptors	6
2.9	Previous Investigations Summary.....	6
3.0	Site Investigation	8
3.1	Works Completed	8
3.2	Sampling Strategy	8
3.3	Independent Air Monitoring.....	9
3.4	Analytical Strategy - Environmental	9
3.5	Additional Sampling	10
4.0	Ground Conditions	12
4.1	Encountered Geology	12
4.2	Field Observations	12
4.3	Groundwater	13
5.0	Human Health Risk Assessment	14
5.1	Asbestos	14
5.1.1	Generic Assessment	14
5.1.2	Detailed Assessment of Positive Asbestos Results	16
5.1.3	Dustiness Testing process.....	18
5.2	Updated Risk assessment following dustiness assessment	23
5.2.1	Asbestos type and friability.....	23
5.2.2	Condition and state of the materials.....	23
5.2.3	Concentration (represented as a weight %)	23
5.2.4	Depth within soils profile	24
5.2.5	Soils type.....	24
5.2.6	Soil's moisture content.....	24
5.3	Detailed Quantitative Assessment on Cumulative exposures	24
5.3.1	Factors of uncertainty and discussed levels of conservatism:.....	27
5.4	Chemical (non-Asbestos) Soil Analysis and Assessment	29
6.0	Controlled Waters Risk Assessment	33

6.1	Groundwater	33
6.2	Surface Water	35
7.0	Conceptual Site Model	39
7.1	Contaminant Sources	39
7.2	Contaminant Pathways	39
7.3	Contaminant Receptors	39
7.4	Conceptual Site Model	39
8.0	Summary and Conclusion	41
9.0	References	43
Appendix A	Drawings	A
Appendix B	Trial Pit Logs	B
Appendix C	Photographic Record	C
Appendix D	Environmental Laboratory Soil Analysis	D
Appendix E	Environmental Laboratory Water Analysis	E
Appendix F	Analysis Summary Tables	F
Appendix G	Asbestos Dustiness Technical Note	G
Appendix H	Envirocheck Report	H
Appendix I	Life Environmental Air Quality Monitoring	I

TABLES

Table 4-1: Strata Encountered During Investigation Works	12
Table 5-1: Summary of visually identified pACMSs asbestos analysis for Human Health Risk Assessment	14
Table 5-2: Summary of asbestos analysis within soil matrices, for Human Health Risk Assessment	15
Table 5-3: Dustiness Classification Summary	19

Table 5-4: Asbestos Dustiness Results – STP11	20
Table 5-5: Asbestos Dustiness Results – STP17	20
Table 5-6 - Dustiness Modelling assumptions and input values.....	21
Table 5-7 Soil Dustiness results.....	22
Table 5-8 Selected Soils Data for DQRA	25
Table 5-9 - Cumulative estimated exposure levels	25
Table 5-10 - Mesothelioma lifetime age adjusted risk rates per 100,000 - Crocidolite Scenario - Model 1	26
Table 5-11 - Mesothelioma lifetime age adjusted risk rates per 100,000 - Chrysotile Scenario - Model 2.....	26
Table 5-12 - Combined Mesothelioma lifetime risk rates per 100,000 (both Models)	26
Table 5-13 - lung cancer – lifetime risk per 100,000 exposed (both Models)	26
Table 5-14 - Overall excess lifetime cancer risk (combined Mesothelioma and Lung cancer risk). 27	
Table 5-: Assessment Summary of Soil Chemical Analysis – Human Health.....	30
Table 6-1: Assessment Summary of Soil Sample Chemical Analysis – Controlled Waters	34
Table 6-2: Assessment Summary of Surface Water Sample Chemical Analysis – Controlled Waters	36
Table 7-1: Conceptual Site Model	40

1.0 Introduction

1.1 Context

Sanctus Ltd was commissioned by both Stroud District Council and Chalford Parish Council (the Clients), to undertake a Phase 1 Desk Study and a Phase 2 Intrusive Investigation for a site located within the Chalford Vale Recreation Ground, Stroud. The site is situated to the south of Chalford High Street, Chalford, near Stroud and can be found at the National Grid Reference 390452E 202571N.

It is understood that, historically, soil was deposited at the site, increasing the ground level and establishing the current relatively level parkland now present. Chalford Parish Council (CPC) recently identified suspected asbestos-containing materials at the surface, following pedoturbation linked to mole activity. This investigation has been designed to determine the risk to site users and support both the District and Parish councils in the decision for the land use and site management going forward.

Following initial investigation, undertaken in August 2025, additional sampling was instructed and undertaken on the 2nd October 2025. All findings are included in this report.

1.2 Proposed Use

The site is a recreational ground with no development planned at this time.

This report is designed to assist the Clients in the site's future use and suitability as a public recreational ground.

1.3 Legislation and Regulatory Setting

This report considers a series of legislation, regulations, guidance and industry best practice, these are multifaceted to cover environmental requirements, such as the Environmental Protection Act (EPA) 1990 and its subsequent additions (1), for potential contamination.

The primary regime for the management of contaminated land in the UK is Part 2A of the Environmental Protection Act 1990. This regime is primarily concerned with identifying and dealing with the most significantly contaminated sites. 'Contaminated Land' is defined as land which appears to be in such a condition by reason of substances in, on or under the land that:

- Significant harm is being caused or there is a significant possibility of such harm being caused; or
- Significant pollution of controlled waters is being caused, or there is significant possibility of such pollution likely being caused.

This report has also been prepared in accordance with the over-arching framework guidance for the management of land contamination in the United Kingdom given in LCRM guidance (2) as well as other technical guidance and best practice documents including but not limited to BS10175 Investigation of potentially contaminated sites – code of practice (3), Construction Industry Research and Information Association (CIRIA) C552 Contaminated land risk assessment – a guide to good practice (4), and the Environment Agency's Groundwater Protection Collection (GWPC (5)).

Asbestos regulations have also been considered for the site, principally the Control of Asbestos Regulations 2012 (6) and supporting documents such as CIRIA C733 Asbestos in Soil and Made Ground: a guide to understanding managing risks (7), Control of Asbestos Regulations 2012 Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance (CAR-SOIL (8)).

2.0 Project Details

Sanctus have reviewed publicly available historic, environmental and other site-specific information provided in an Envirocheck Report [9], purchased for the Phase 1 Desk Study report [10]. The pertinent findings are summarised through the following section for ease of reference to provide context for the Sanctus intrusive investigation.

2.1 Site Location

The site is accessed off the High Street over a pedestrian footpath and the access primarily used during this investigation. The site can be located using post code GL6 8DX.

The approximate National Grid Reference coordinates for the centre of the site are 390452E 202571N.

2.2 Site Description

The site covers approximately 0.30Ha, and site topography is generally flat. This topography appears to be consistent throughout the entirety of the site. Currently, within the site, there is an extensive cover of mown grass across the majority of the site, with limited areas that have been hard covered for recreational use and installation of playground facilities in the west of the site.

2.3 Surrounding Area

The land's immediate surroundings are surfaced with bituminous material including the site entrance and around to the north, with surface water features to the south, the River Frome, and the surface water drainage ditch adjacent to the road.

To the east, the majority of the site is surrounded by woodland with well-established vegetated undergrowth coverage as well as an active water course, the River Frome, and the Thames and Severn Canal.

Beyond the woodland to the south of site, there is an actively used railway line. The south of site is also cut off by the River Frome with a drainage ditch situated to the full extent of the north of the site alongside the access road.

Other nearby land uses include a residential area to the west of the site and a large area of rural land to the east.

2.4 Site Context

2.4.1 Site History

The site history was compiled using historical maps from the Envirocheck report (9) and publicly available information accessible through Google Maps (11). The Envirocheck historical maps are included within Appendix H.

By the earliest publicly available historic maps, 1883, the site was mapped as marshy ground, with the drainage ditch located in the north of the site. The site has remained undeveloped throughout the historic map coverage, labelled as a playing field since circa 1974 until present day. The first mapping showing recreational facilities is from 1999 with little variation to the site layout noted from this time onward.

2.4.2 Surrounding Area Use History

From historical maps (9), the area surrounding the site has undergone limited changes from the initial 1883 mapping and 2025. The Valley Saw Mill was present from prior to the earliest map edition, 1883, until circa 1922 when it was no longer labelled. It has since been repurposed for residential use. The adjacent fields to the north and east of site were for agricultural use and rural land with the only variation being a residential property that now sits to the northwest of the site and railway and Severn Canal located to the south of site in place from prior to 1883 until present day. To the north of the site, the well noted across the road adjacent to the site entrance has also been present since prior to 1883.

The predominant use of the surrounding area today is for housing; however, there are also some commercial/industrial uses within 1km of the site. According to the Envirocheck (9), there are 13 areas for manufacturing and production, although only one is located within 500 m of the site, with the nearest being approximately 220m from the site. Contemporary Trade Directory entries within 500 m of the site are limited to an inactive greeting card publishers and wholesalers and an active bathroom fixtures manufacturer.

Between 1945 and 1974, industrial presence in the surrounding area decreased with historical maps indicating a greater establishment of residential housing from 1974 onwards.

2.5 Published Geology

From the Envirocheck report [9], the bedrock geology is understood to comprise the Bridport Sand Formation. The BGS Geo-Index website [12] describes the Bridport Sand Formation as "grey, weathered yellow or brown, micaceous silt, very fine-grained sand and fine-grained sand, locally with calcite-cemented sandstone beds and lenses, variably sandy clay/mudstone at base, including Downcliff Clay (Member) of type area".

The site's superficial geology is described as clay, silt, sand and gravel Alluvium deposits. According to the BGX lexicon, it is the unconsolidated detrital material deposited by a river, stream or other body of running water as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta, or as a cone or fan at the base of a mountain slope.

The site is not located within a coal mining area and the Envirocheck does not record any mineral sites within 500 m of the site.

2.6 Hydrogeology

Published geology indicates that the site is located upon a bedrock Principal Aquifer, namely the Bridport Sand Formation. The Principal Aquifer is overlain by a Secondary A Aquifer in the superficial Alluvium deposits.

The site lies within a Source Protection Zone II (SPZ2). This designation relates to an area around a supply source within which all groundwater is within 400 days travel time to the abstraction point. The bedrock Principal Aquifer is noted as having a high vulnerability. The site is located within a Drinking Water Safeguard Zone.

According to the Envirocheck Report [9], the nearest licensed groundwater abstraction is located approximately 1.19 km southwest and is used for general agriculture: spray irrigation – storage. The nearest licensed surface water abstraction is located approximately 605 m west of the site with water abstracted for industrial/commercial/public services process water. The nearest potable abstraction is located 1.3 km west of the site at Chalford Pumping Station operated by Severn Trent Water Ltd which abstracts surface water.

More locally, a well is noted on historical mapping, approximately 10 m north of the site, from the earliest mapping to present day. A water works with reservoirs and an engine house is

also noted to have been present to the south of the River Frome from circa 1902 to circa 1980, likely abstracting from the adjacent River or Canal.

Available permitting information shows there has been two former discharge consents within 500 m of the site, but none within 250 m.

2.7 Hydrology

There are two surface water features on site, adjacent to the site's southern boundary and to the northern boundary, that runs the full extent of site. The drainage ditch along the north of the site discharges to the River Frome at the western end of the site. The Severn Canal runs parallel with the River Frome to the south. Its position is shown within Appendix A.

The section of the River Frome between source and Ebley Mill is classified by Defra (13) as having moderate ecological quality in 2022 and failing chemical quality in 2019 (not tested in 2022).

No pollution incidents to controlled waters have been reported in the Envirocheck Report as affecting the River Frome within 500 m of the site. The nearest recorded pollution incident to controlled waters was recorded approximately 450 m west to the Severn Canal, classified as a category 3 – minor incident involving inert suspended solids. No further details were provided regarding the nature of the suspended solids or the remedial works undertaken at the time,

2.8 Sensitive Environmental Receptors

A number of sensitive environmental receptors have been identified within a 1km radius of the site. 3no of these locations are categorised as Ancient and Semi-Natural Woodland with the closest being within the immediate vicinity of site (Pontins Farm Wood on site as well as Cowcombe wood approximately 300m south west and another unnamed ancient woodland approximately 440 m east of site respectively).

The site has also been classified as a being within a nitrate vulnerable zone and the Cotswolds Area of Outstanding Natural Beauty (AONB). A Site of Special Scientific Interest (SSSI), Strawberry Banks, is also located approximately 740m away from the site.

2.9 Previous Investigations Summary

There have been no previous investigations prior to Sanctus attendance on site.

As part of the Phase 1 Desk Study, an experienced Sanctus environmental engineer carried out a site reconnaissance on Monday 24th July 2025. This was undertaken to gain additional information on the site conditions and potential sources of contamination not identified within the reviewed desk-based information. A photographic log of the site walkover can be found within Appendix C.

3.0 Site Investigation

3.1 Works Completed

The investigation works were carried out in general accordance with BS10175:2011+A2:2017 and BS5930:2015+A1:2020. Initial investigation works were completed between the 4th and 6th August 2025, with follow up soil sampling on the 2nd October 2025.

Prior to excavation, Sanctus reviewed all available utilities plans and undertook a services avoidance exercise of all proposed excavation locations involving scanning for detectable utilities using a CAT and Genny.

Sanctus completed 20no hand excavated trial pits (STP01-20) to approximately 0.60m below ground level (bgl), using insulated hand tools, to facilitate sampling of near-surface soils for soil and leachate analysis. Hand excavated trial pits were selected to be terminated at a depth of approximately 0.60m bgl as this is the conservative thickness to investigate a potential suitable soil capping layer (typically 0-0.15 m for direct contact and inhalation) within a public open space as well as a further depth to cover the depth of the mole activity and near-shallow material likely to be brought to the surface. This depth would also aid in defining potential contaminant exposure risk between site users and any soil contaminants. This aids the assessment of a human health risk assessment and could potentially be used to inform a remediation strategy should it be required.

Sanctus also obtained surface water samples from the River Frome at 4no points by immersion of sample containers at accessible points to assess surface water quality and identify potential contaminants.

Trial pit and surface water sampling locations are identified on Drawing D3565/002 included in Appendix A.

3.2 Sampling Strategy

Sampling was undertaken to provide a broad coverage of the site as well as focusing on the reported potential asbestos-containing materials.

Sampling locations and analytical suites/determinants are detailed below:

- Sanctus Soils Suite 1: 10no @ STP02, STP04, STP06, STP07, STP08, STP09, STP10, STP12, STP15 and STP20;

- Sanctus Leachate Suite: 5no @ STP01, STP05, STP11, STP14 and STP19;
- Soil Asbestos Screen and Quantification: 20no @ all trial pit locations;
- Soil Asbestos Dustiness: 2no @ STP11 and STP17; and
- Sanctus Waters Suite: 4no @ SW01, SW02, SW03 and SW04.

In addition to the above, 10no bulk samples of potential asbestos were submitted for identification.

All environmental soil sampling was carried out in general accordance with BS EN ISO 22475-1:2021. A Sanctus Environmental Engineer collected samples for chemical analysis. All samples were stored in containers suitable for the intended analysis.

Samples were stored out of direct sunlight and kept at a cool temperature between 5°C ($\pm$ 3°C) during storage and transit to the laboratory. All samples were recorded on chain of custody forms which were then scheduled for their required analysis which was undertaken by an independent laboratory with MCERTS and UKAS accreditations.

3.3 Independent Air Monitoring

During the ground investigation works independent air monitoring was completed on the 4th August 2025 by Life Environmental Services. 4no pumps were deployed across the site to complete 'background' air monitoring and produce an Airborne Fibre Concentration Report. The report is included in Appendix I.

3.4 Analytical Strategy - Environmental

The sampling undertaken was designed to provide a comprehensive analysis in forming a human health risk assessment and controlled waters risk assessment.

As part of the sampling strategy, 10no soil samples collected were scheduled for the following environmental chemical analysis:

- pH;
- Speciated petroleum hydrocarbons (TPH) and BTEX;
- Speciated polycyclic aromatic hydrocarbons (PAH);
- Total phenols;
- A range of metals, metalloids and inorganics;
- Organic matter; and

- An asbestos screen and quantification where identified.

Asbestos screening of all locations provided asbestos identification and quantification of free fibres or debris/fragments in soils, if any were identified. Asbestos dustiness sample analysis was used to assess the friability of asbestos-containing site materials and assist in the formation of the human health risk assessment.

5no soil samples were also scheduled for leachate analysis to allow for controlled waters risk assessment. The analysis suite included:

- Speciated petroleum hydrocarbons (TPH);
- Speciated polycyclic aromatic hydrocarbons; and
- Metals and metalloids.

The locations chosen for leachate analysis were distributed across the site to provide general coverage.

Additionally, 4no surface samples were scheduled for the following chemical analysis:

- pH;
- Speciated petroleum hydrocarbons (TPH) and BTEX;
- Speciated polycyclic aromatic hydrocarbons (PAH);
- A range of metals, metalloids and inorganics; and
- Speciated phenols.

Copies of all the soil chemical analysis results and asbestos results can be found in Appendix D and water chemical analysis results are included in Appendix E.

3.5 Additional Sampling

Sanctus Limited were instructed to undertake additional sampling to delineate and obtain further information in relation to identified speciated polycyclic aromatic hydrocarbons (PAHs) within shallow surface soils (to depths of 0.15 m bgl) following the initial investigation.

10no shallow hand-excavated trail pits were undertaken (STP201-210), as shown on Sanctus drawing D3565/002 included in 0.

Samples were taken from the arisings, collected in appropriate containers and stored in chilled cool boxes for transportation to a UKAS-accredited laboratory. The samples were analysed for speciated PAHs.

4.0 Ground Conditions

4.1 Encountered Geology

Across the two phases of intrusive investigation undertaken, Sanctus completed 30no hand-excavated trial pits to depths of up to 0.60 m below ground level (bgl) across the site. The general ground conditions were logged by the environmental engineer onsite and the recorded lithologies are included on the trial pit logs attached as Appendix B.

A general summary of the strata encountered in the hand pits is presented below in Table 4-1: Strata Encountered During Investigation Works.

Table 4-1: Strata Encountered During Investigation Works

Depths (m bgl)	Description
0.00 – 0.05	Grass over dark brown silty sand with abundant rootlets.
0.05 – 0.50	Light brown to brown gravelly silty sand. Gravel is fine to medium, subangular to subrounded concrete, flint and sandstone. Occasional ceramic, glass, red brick and porcelain fragments present. (Made Ground).
0.05 – 0.60	Dark brown silty sand with frequent fine to coarse, subangular to subrounded concrete, sandstone and flint gravels. Rare to frequent cobbles of sandstone, yellow brick and red brick. Rare to occasional ceramic, porcelain and glass present. (Made Ground).
0.05 – 0.60	Grey brown or yellow brown gravelly sand with fine to coarse, subangular to subrounded gravel comprising sandstone, mudstone and flint. (Alluvium deposits).

4.2 Field Observations

It was observed by the attending engineer conducting the trial pit investigative works on 4th August 2025, that visible potential asbestos containing material could be seen on disturbed ground brought to the surface by moles. Bulk samples were obtained in and around the working area to be identified in a UKAS-accredited laboratory.

Potential asbestos-containing materials were encountered in 4no hand pit locations: STP03 at 0.40 m bgl, STP11 at 0.40 m bgl, STP16 at 0.30 m bgl, and STP17 at 0.10 m bgl, and also at surface in the vicinity of STP11. These locations are noted to be present in the centre of the playing field area.

During the further investigation work in October 2025, material fragments consistent in appearance as ACMs were observed within all 10 investigation locations (STP201-210). No laboratory analysis was conducted on these materials during this phase of investigation.

4.3 Groundwater

During the ground investigation, groundwater was encountered at 2no locations. These locations were STP07 and STP17. In both instances this groundwater was only observed after achieving the proposed 0.60 m depth and had slow groundwater ingress, from the base of the excavation.

5.0 Human Health Risk Assessment

5.1 Asbestos

5.1.1 Generic Assessment

Sanctus has undertaken screening for the presence of asbestos in all soil samples obtained from the trial pits. Where bulk fragments of potential asbestos containing materials (pACMs) were identified in the soils on site, selected bulk fragments were obtained and submitted for analysis.

The results of the analysis is summarised in Table 5-1: Summary of visually identified pACMs asbestos analysis for Human Health Risk Assessment, below.

Table 5-1: Summary of visually identified pACMs asbestos analysis for Human Health Risk Assessment

Asbestos Fragment - Bulk Sample Identification			
Hand Pit Location and Sample ID	Sample Depth (m bgl)	Asbestos Type	Quantification (w/w %)
STP03 pACM01	0.40	Chrysotile - Cement	N/A
STP03 pACM02	0.40	Chrysotile - Cement	N/A
STP11 pACM03	0.40	Chrysotile - Cement	N/A
STP16 pACM04	0.30	Chrysotile - Cement	N/A
STP17 pACM05	0.10	Chrysotile - Cement	N/A
STP11 pACM06	0.40	Chrysotile - Cement	N/A
STP11 pACM07	0.40	Chrysotile - Cement	N/A
STP11 pACM08	0.40	Chrysotile - Cement	N/A
STP11 pACM09	0.40	Chrysotile - Cement	N/A
pACM10	0.00	Chrysotile - Cement	N/A

Table 5-2: Summary of asbestos analysis within soil matrices, for Human Health Risk Assessment

Asbestos in Soils – Free Fibre Identification			
Hand Pit Location and Sample ID	Sample Depth (m bgl)	Asbestos Type	Quantification (w/w %)
STP02	0.05 – 0.50	Chrysotile – Loose Fibres	<0.10
STP03	0.05 – 0.60	Chrysotile – Loose Fibrous Debris, Asbestos Cement	0.26
STP04	0.05 – 0.20	Chrysotile – Sheeting/Board Debris, Asbestos Cement	9.801
STP04	0.20 – 0.60	Chrysotile – Loose Fibrous Debris, Sheeting/Board Debris	2.29
STP08	0.40 – 0.60	Chrysotile – Loose Fibres	<0.001
STP09	0.05 – 0.30	Chrysotile – Loose Fibres	<0.001
STP10	0.25 – 0.60	Chrysotile – Loose Fibres	<0.001
STP11	0.05 – 0.20	Chrysotile – Asbestos Cement, Loose Fibrous Debris	0.78
STP12	0.05 – 0.15	Chrysotile – Loose Fibrous Debris	0.002
STP12	0.15 – 0.60	Amosite, Crocidolite and Chrysotile – Loose Fibrous Debris	1.36
STP13	0.05 – 0.20	Chrysotile – Loose Fibres	<0.001
STP15	0.15 – 0.60	Chrysotile – Loose Fibrous Debris	0.102
STP16	0.05 – 0.20	Chrysotile – Loose Fibres	<0.001
STP17	0.40 – 0.60	Chrysotile – Loose Fibres	<0.001
STP19	0.05 – 0.60	Chrysotile – Loose Fibres	<0.001

At present, there is no widely accepted Generic Assessment Criteria (GAC) for asbestos presence in soil to inform risk assessment. As such, Sanctus adopt the presence of asbestos as the preliminary screening tool, whether free-fibres/non-visible debris, or visible fragments of asbestos containing materials (ACM) are identified, asbestos presence poses a potential risk to human health.

Detected asbestos is considered to represent a risk to current and future site users as well as nearby residents if present within its natural form; however, this requires detailed assessment against the current site form and onsite soil conditions, as discussed within the Sanctus Technical Note included within Appendix G.

Following review of data obtained from asbestos screening and quantification of soils and confirmation that asbestos was present within bound fragments identified, the results are included above in Table 5.1 and Table 5.2. The sampling locations where asbestos was confirmed are indicated on drawing D3565/003 within Appendix B.

A further two soil samples from STP11 and STP17 were analysed for asbestos dustiness. The results of this are discussed in Section 5.1.2, below, and in a separate Sanctus Technical Note included as Appendix G.

Background air monitoring was completed by Life Environmental during the investigation (and whilst soils containing asbestos were being disturbed) primarily to ensure that fibre levels in the surrounding area during the investigation works did not exceed exposure levels (with controls in place) in accordance with the Control of Asbestos Regulation 2012.

There were no exceedances noted above the clearance indicator of $<0.010 \text{ f/cm}^3$ level during the investigation works. The results of the air quality monitoring is included in Appendix I.

Asbestos-containing materials (ACMs) have been identified primarily in the eastern part of the site, particularly within the playing field, where asbestos was found in 10 out of 13 locations excavated. In contrast, fewer locations in the western part of the site (specifically the play area) indicated asbestos contamination, only 3 out of 7 locations were affected.

Based on these results, it is considered that there is a potential risk to human health due to the presence of both ACM fragments and free asbestos fibres in the soils. Due to its presence in surface and subsurface soils, a direct exposure pathway via inhalation exists to site users and potentially nearby residents. If inhaled, these asbestos fibres could lead to health conditions like asbestosis and mesothelioma.

The ongoing pedoturbation caused by mole activity could bring further soils impacted with asbestos fragments and fibres to the surface, increasing the likelihood that future site users will come into contact with these ACM's via direct exposure or tracking of the soils offsite. Without appropriate mitigation measures, this contamination issue may pose risk to human health.

5.1.2 Detailed Assessment of Positive Asbestos Results

The investigation has identified widespread asbestos within the soils in the form of asbestos cement materials, as well as non-visible asbestos fibre and debris within the soil's matrix.

There are a number of factors which can affect the likely exposure, these include:

- Asbestos type and friability;

- Condition and state of the materials;
- Concentration (represented as a weight %);
- Depth identified within the surrounding soils profile;
- Soil type; and
- Soil moisture content.

In the park scenario, the existing soil moisture content has the greatest impact on the likely exposure of historic, current and future site users.

The asbestos materials identified were all confirmed as chrysotile cement bound materials, however amosite and crocidolite free fibre and debris (non-visible) has been identified within a single location at STP12 (0.15-0.60m bgl).

The Control Limit for asbestos is a 0.1 fibres per cubic centimetre (f/cm³) of air averaged over a continuous period of 4 hours. This is the concentration of asbestos in the atmosphere when measured in accordance with the 1997 World Health Organisation (WHO) recommended method, or by a method giving equivalent results to that method approved by the Health and Safety Executive (HSE).

The Clearance Indicator for asbestos 'airborne fibres' is a level recorded below <0.010 f/ml (the Limit of Quantification LOQ). When this level is achieved, the location or area is judged to be 'safe for reoccupation', however the airborne clearance indicator is not an acceptable permanent environmental level. It is merely a transient indicator of site cleanliness (normally used during asbestos removal, demolition or remediation operations) and does not demonstrate the location to be 'asbestos free'.

5.1.3 Dustiness Testing process

As included, within Appendix G, the following dustiness risk assessment has been undertaken to further refine the risk assessment for the site utilising evidence based risk levels.

The concentration of airborne fibres released is influenced by many factors including asbestos type, ACM type and condition and state, depth, distribution and concentration in soil, soil type, and soil moisture content. There is limited data on the release of airborne fibres from soils in real world environments, however soil moisture content has a particularly significant impact.

Increasing amounts of fibres are likely to be released over time as ACMs deteriorate. Friable ACMs (e.g., lagging and asbestos insulating board) release fibres much more easily, and are likely to deteriorate faster, than firmly bound materials (e.g. asbestos cement), which may take a very long time to degrade, if left undisturbed. Even low-level fibre concentrations have been demonstrated to give rise to significant fibre concentrations under certain conditions.

Results are presented in Appendix G for the Asbestos Dustiness Test undertaken on the 'worst case' sample retrieved from the Chalford Vale Recreational Centre.

Dustiness testing was undertaken on dried soils, prepared within a UKAS- and MCERTS-approved laboratory, using an ISO-accredited in house method. The samples were dried to remove all moisture from the soils to provide a conservative, worst-case dust generation. The testing has been undertaken to detail the generation of respirable fibres within dried soils present on site. The analytical results were then compared to industry accepted dustiness categories. The results are summarised within Table 5-4: Asbestos Dustiness Results – STP11 and Table 5-5: Asbestos Dustiness Results – STP17, overleaf.

The reported dustiness mass fraction was then compared to the classification scheme, summarised below.

Table 5-3: Dustiness Classification Summary

Category of Dustiness	Respirable Dustiness Mass Fraction (mg/kg)
Very Low	< 10
Low	10 to 60
Moderate	> 60 to 210
High	> 210

Table 5-4: Asbestos Dustiness Results – STP11

Sample ID		STP11				General Sample Description				N/A	
Other ID		DRIED								N/A	
Depth		0.2				Moisture content of 'As received' sample					
Run no.	Volume (L)	Respirable fibres counted	Graticules counted	LOQ Fibre concentration in drum (f/ml)	Fibre concentration in drum (f/ml)	LOQ Dust in drum (mg/m³)	Dust in drum (mg/m³)	Respirable dustiness mass fraction (mg/kg)	Mean of Respirable dustiness mass fraction (mg/kg)	RSD of Respirable dustiness mass fraction (%)	
1	4	3	200	9	<9.00	20	2747	68	60	30	
2	4	4	200	9	<9.00	20	3270	40			
3	4	2.5	200	9	<9.00	20	3053	73			
Comments											

Table 5-5: Asbestos Dustiness Results – STP17

Sample ID		STP17				General Sample Description				N/A	
Other ID		DRIED								N/A	
Depth		0.1				Moisture content of 'As received' sample					
Run no.	Volume (L)	Respirable fibres counted	Graticules counted	LOQ Fibre concentration in drum (f/ml)	Fibre concentration in drum (f/ml)	LOQ Dust in drum (mg/m3)	Dust in drum (mg/m3)	Respirable dustiness mass fraction (mg/kg)	Mean of Respirable dustiness mass fraction (mg/kg)	RSD of Respirable dustiness mass fraction (%)	
1	4	0	200	9	<9.00	20	872	31	49	38	
2	4	1	200	9	<9.00	20	1335	48			
3	4	2	200	9	<9.00	20	2317	69			
Comments											

For the purpose of assessment and the exposure scenario, the future use of the site is assumed to be:

- Public Open Space (Park)

Maintenance – cutting grass and general upkeep of football pitch and landscaped areas.

For ease and sensitivity of the receptor comparisons to the activities by children have been considered. These children are assumed to be between the ages typically associated with a school child.

Table 5-6 - Dustiness Modelling assumptions and input values

Model Parameter	Input Value
Critical receptor	Visiting children, as most likely to have a greater exposure frequency (weekly)
The age at which exposure started	1 years old
The age at which exposure will finish	18 years old
Total exposure years (Yi)	17 years
Exposure duration (Ti)	2 hours
Exposure frequency (Fi)	52 visits per year (reduced to 14.56 visits assuming 28% dry day visits per year)
Estimated airborne concentrations (Ci)	0.02 (Addison Et al 1988 Sandy Soil) f/ml
Realistic observed airborne concentrations (Ci2) Dustiness testing	9.00 f/ml (limit of quantification from the i2 laboratory testing equipment) – reduced to 0.001 f/ml from the worst case actual fibre count concentration during dustiness test.

Estimated airborne fibre concentration 0.02 fibres/ml (Ci) in the using conservative estimated (Addison et al 1988).

Dustiness testing on a sample has produced 6No. fibre concentrations below the limit of quantification within the dustiness drum equipment. As such, for a conservative equivalent, this limit of detection yielded an equivalent of 9.00 f/ml. From the actual fibre count during the dustiness test, over the required 4 litres of air, a maximum fibre count of 4 fibres were counted on the 2nd run of STP17. This would create an actual fibre count of 0.001 fibres/ml. This fibre count is also a conservative estimate of asbestos fibres, as no discrimination can be made during the count between asbestos and non-asbestos fibres which achieve the size ratios used to determine a respirable fibre count, hence the actual number of asbestos fibres may actually be lower.

For conservatism assumptions have been made that the soil will be dry and dusty on 100 days per year (28% of the time), from figures provided by the Met Office.

It is also assumed that this assessment is for repeated exposure to an area with average concentration of free fibre asbestos (0.002%) with 50% of the surface disturbed or partially vegetated.

The table below shows a conservative estimate based on literature and that of a measured dustiness test.

Table 5-7 Soil Dustiness results

A1: Event Number	B1: Estimated Concentration (Ci) (f/ml)	B2: Assumed fibres can be released from 50% of site	C1: Frequency (Fi) (per year)	D1: Time Period (Ti) (hours)	E1: Ei (Output) F/ml.hrs	Years	Total fm.hr (cumulative)	Potential Exposure Fml.hr to yrs
1 - Soil	0.02	0.01	14.56	2	0.2912	17	4.9504	0.002475
2 - Dustiness (conservative)	9.00	4.5	52	2	468	17	7956	3.978
3 - Dustiness (refined)	0.001	0.0005	14.56	2	0.01456	17	0.24752	0.000124

5.2 Updated Risk assessment following dustiness assessment

As discussed within section 5.1, fibre release is influenced by the following factors:

- Asbestos type and friability;
- Condition/state of the materials;
- Concentration (represented as a weight %);
- Depth within soils profile;
- Soils type; and
- Soils moisture content.

5.2.1 Asbestos type and friability

Of the 15No positive soil matrix samples for asbestos, only one sample presented asbestos types other than just Chrysotile – within STP12, at a depth of 0.15 – 0.60m, showing Amosite, Crocidolite and Chrysotile – Loose Fibrous Debris, at a concentration of 1.36% w/w. From within Addison et al (1988) (14), for a given soil type, crocidolite was released more readily than amosite which, in turn, was released more readily than chrysotile.

5.2.2 Condition and state of the materials

The visually identified pACMs were in the condition of broken fragments, showing moderate weathering on the cement sections.

5.2.3 Concentration (represented as a weight %)

Loose asbestos fibres were identified within the made ground of the site. 20no. sample locations were analysed for loose fibres. Out of these 20no. locations, 13no. locations provided a positive result for the presence of loose fibres/loose fibrous material as indicated by the table above.

The concentration of these fibres came back between <0.001 and 9.801% for values of asbestos % by hand picking/weighing and <0.10 and 2.29% from asbestos quantification [SemiQ - 0.1%].

Sanctus have not assessed the concentrations or material types to calculate the risk of overall excess lifetime risk, due to the level of assumptions already made to provide a conservative respirable dustiness mass fraction.

5.2.4 Depth within soils profile

The visually identified pACMs were detected on the surface and within the near-surface vegetation as well as at maximum depths of 0.4 m below the surface.

5.2.5 Soils type

From the soil samples which tested positive, the soils were described as a brown loamy soil, containing sand and gravels with frequent rootlets. From Addison Et al [14], this predominantly sandy soil is known to release more asbestos fibres when compared to an intermediate clay. Due to the presence of a maintained vegetative cover in summertime (>95% of the witnessed park surface areas), these typical conditions are likely to reduce the potential for airborne fibre generation, when compared to bare soil or sparse vegetation cover.

5.2.6 Soil's moisture content

The comparison of the onsite results vs the industry accepted dustiness risk profile, showed that a conservative, worst case scenario with no soil moisture present, the site would be categorised as Low Risk.

However, given the presence of site vegetation cover (>95% of the park's surface during the summer's investigation period) and mean average soils concentrations of 23%, and a maximum of 45%, obtained during the summer when soils are likely to be their driest, at a surface level which was close to the adjacent river's levels – therefore this categorisation could be reduced to Very Low.

5.3 Detailed Quantitative Assessment on Cumulative exposures

A quantitative human health risk assessment has been undertaken in accordance with CIRIA C733 [7]. The risks associated with asbestos containing soils are a function of the potential for the release of asbestos fibres. Site investigation data has therefore been used, in conjunction with published soil-to-air relationships, as well as the previously calculated cumulative exposure levels in Fibres/ml.years, as seen in Table 5-6 Soil Dustiness results.

Maximum concentrations of asbestos were identified in hand pits STP04 and STP12. Overall excess lifetime cancer risks for current site users have been estimated using data from these two exploratory holes, in accordance with the methodology presented in CIRIA C733 [7].

