Groundfirst

Reliable ground quality advice

Phase 2 land quality assessment: Penstrowed Quarry, Caersws, Powys

Prepared for: GF Grigg Construction Ltd
Penstrowed Quarry
Caersws
Powys

Report reference: 4316R1

Date of reporting: 12th July 2023

Report status: Final report

Prepared by
Ground First Ltd

26 Victoria Street, Castlefields, Shrewsbury, SY1 2HS
Tel: 07484 542827
email: info@groundfirst.com
Registered in England and Wales, number 10418394

Groundfirst

Reliable ground quality advice

Phase 2 land quality assessment: Penstrowed Quarry, Caersws, Powys

Revision record:

Issue	Date	Status	Comment	Author	Recipient
1	12th July 2023	Final		AJS	GF Grigg Construction Ltd

Prepared by
Ground First Ltd

26 Victoria Street, Castlefields, Shrewsbury, SY1 2HS
Tel: 07484 542827
email: info@groundfirst.com
Registered in England and Wales, number 10418394

Glossary and Abbreviations

This glossary includes definition of key technical terms and abbreviations that may be used within the report text.

ACM	Asbestos containing material
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BOD	Biological oxygen demand
BTEX	Benzene, toluene, ethylbenzene, xylene
C4SL	Category 4 Screening Level
DRO	Diesel range organics
EA	Environment Agency
EPH	Extractable petroleum hydrocarbons
GRO	Gasoline range organics
GAC	Generic assessment criterion
LOD	Limit of detection
MTBE	Methyl tertiary butyl ether
NGR	National Grid Reference
PAH	Polycyclic aromatic hydrocarbons
S4UL	Suitable for Use Level
SGV	Soil Guideline Value
SOM	Soil organic matter
SVOC	Semi-volatile organic compound
TPH	Total petroleum hydrocarbons
VOC	Volatile organic compound

CONTENTS

FIGURES

TABLES

APPENDICES

1 INTRODUCTION

1.1 Background

It is understood that a planning application is currently being prepared for the construction of a caravan holiday park within the boundaries of Penstrowed Quarry near Caersws in Powys (herein referred to as the 'Site'). The Site location is shown on Figure 1.1.

The c. 7 ha Site was used as a hard rock quarry from before the 1880s until the mid 1980s. The quarrying activity and subsequent reprofiling activities have created three main benches / levels (herein referred to as the 'lower', 'middle' and 'upper' benches; see Figure 1.2).

The current Site owner erected several light industrial units on concrete foundations across the lower bench, during the early 2000s. The units are predominantly used for the storage and maintenance of heavy plant and vehicles.

Since 2012, the Client has operated an Environmental Permit for waste storage and treatment activities. This includes the screening and recycling of selected waste materials for use off-Site. It is understood that some imported inert wastes have been placed within the Site boundaries.

The Client is currently intending to redevelop the entire quarry Site for use as a caravan / holiday park. The indicative development plan is shown on Figure 1.3.

The Client submitted a planning application to Powys County Council (PCC) in 2022 for the development of a holiday park at the study Site, comprising of c. 97 caravans with no communal structures (planning application ref: 22/1966/FUL). In order to facilitate the proposed development plan, the existing ground levels across the middle and lower quarry benches would need to be raised (in order to stabilise the sheer quarry faces). Note: planning permission was granted by PCC in 2014 to raise ground levels across certain areas of the quarry, to enhance the stability of the two main quarry faces. It is understood that the Client is considering applying for an additional Environmental Permit (to deposit imported waste as a recovery activity) to facilitate the land raising.

A limited ground investigation was performed at the Site by GroundSolve Ltd. in 2021; this work involved the excavation of nine trial pits, focussed on the upper bench level. The purpose of the investigation was 'to address any potential contamination issues and advise on the safe development of the holiday park'. The GroundSolve report was submitted in support of the 2022 planning application.

Comments provided in February 2023 by PCC, concerning the 2022 planning application, made reference to the inadequacy of the GroundSolve site investigation. The consultation response provided by NRW also stated that further assessment of groundwater and surface water pollution risks will be required in support of a planning application.

The 2022 planning application was recently withdrawn, although the Client is seeking to resubmit the application in the near future, including additional land quality information. To this end, GeoSmart Information Ltd, prepared a Phase 1 contaminated land report for the Site in April 2023.

The Phase 1 report identified a 'low / moderate to moderate' contamination risk and made the following recommendation: *'given the nature of the historical land use and therefore the potential for contamination to be present at the Site, it is recommended that a proportionate programme of site investigation and monitoring works be undertaken in order to establish the presence or absence of contamination and to enable a quantitative assessment of the associated environmental risks'.*

In response to the findings of the Phase 1 report, Ground First has been commissioned to undertake a proportionate site investigation in order to quantify potential environmental risks associated with the prevailing land quality at the Site.

1.2 Instruction

Ground First Ltd was instructed by GF Grigg Construction Ltd (the Client) in May 2023 to undertake a Phase 2 contaminated land assessment as outlined in proposal reference 4316P1, dated 5th May 2023.

1.3 Objectives

The objective of the commissioned work was to undertake a proportionate programme of data collation, site investigation and environmental risk assessment in order to clarify prevailing ground conditions and associated contaminated land risks in support of a revised planning application.

1.4 This report

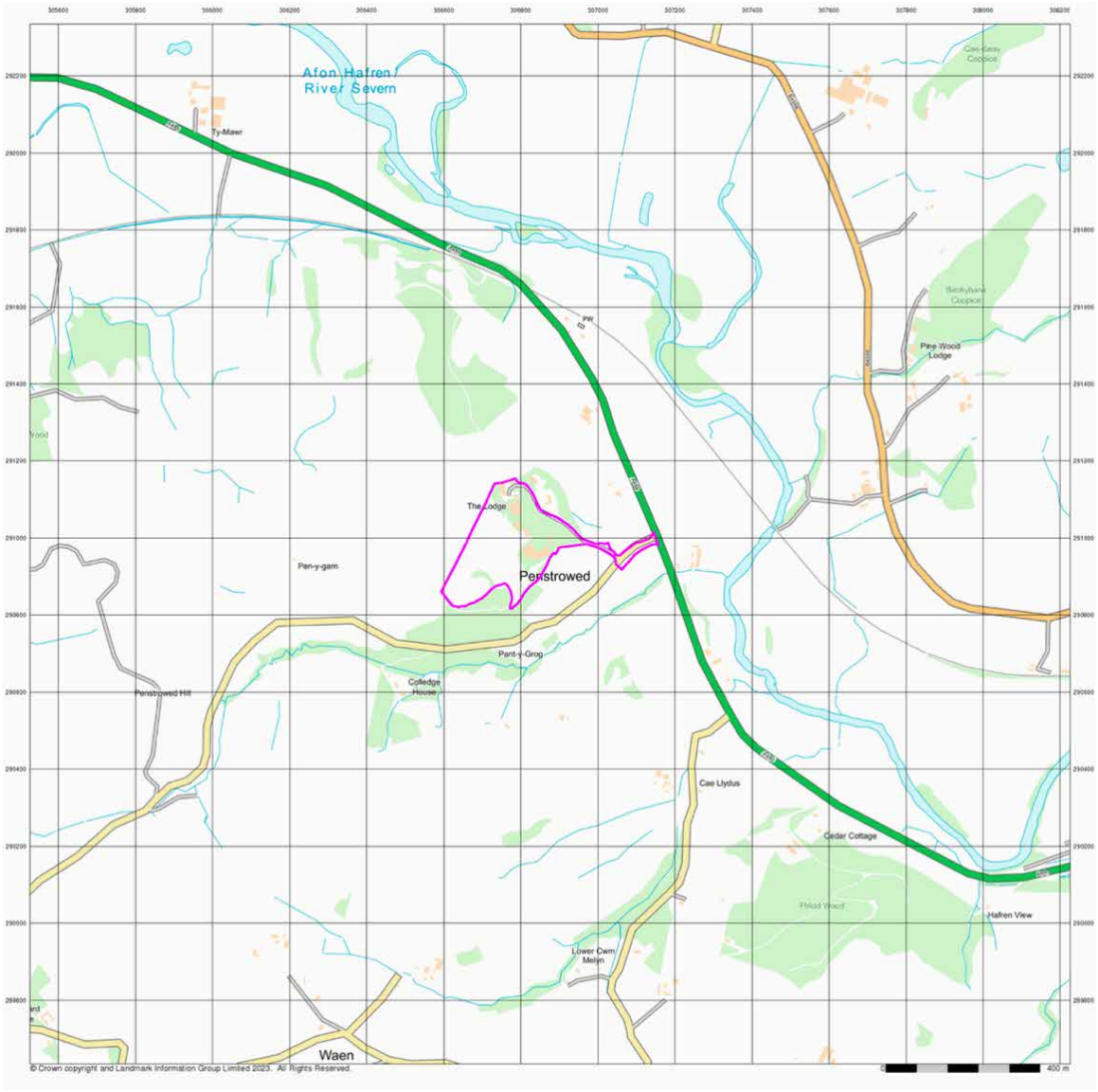
This report provides information derived from relevant data sources, factual records of all fieldwork observations, plus site measurements and analytical test results; it also presents a conceptual site model alongside the findings of appropriate risk assessments relating to relevant contaminant linkages.

1.5 Exclusions

It is noted that the findings presented in this report are in part based on information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity.

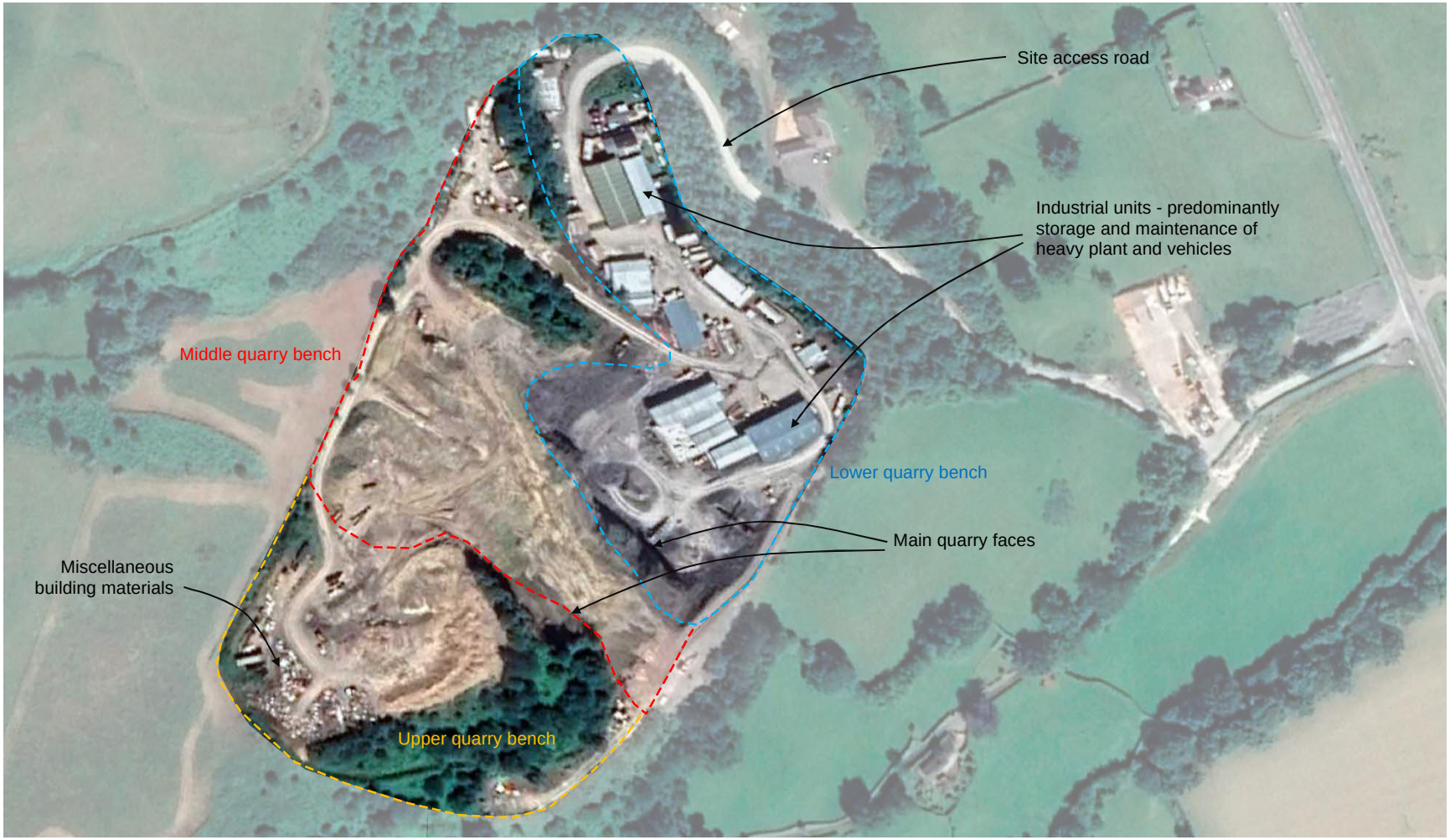
This report excludes consideration of potential hazards arising from any activities at the Site other than normal use of the proposed development. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Figure 1.1 Site location



Site location	July 2023	Drawn: AJS
	4316R1	Rev 1

Figure 1.2 Current Site layout



Site layout	**July 2023**	**Drawn: AJS**
	4316R1	**Rev 1**

Report Reference: **4316R1**
Report Status: **Final report**

Figure 1.3 Development plan

Development plan – proposed caravan / holiday park	**July 2023**	**Drawn: AJS**
	4316R1	**Rev 1**

2 SITE SETTING AND HISTORY

The following section provides a summary of the Site setting and land use history.

2.1 Basic site information

Information relating to the Site location is summarised in Table 2.1.

Table 2.1 Site details

Site Address	Penstrowed Quarry, Caersws, Newtown, SY17 5SG
Site area	c. 6.7 ha
NGR	306860, 290970
Topography	The topography local to the study Site typically slopes down towards the east, in the direction of the River Severn. The Site topography itself is highly variable, reflecting the legacy of historical mining activity. The upper quarry bench (in the south-west of the Site) slopes gradually down to the north-east from an elevation of c. 250 mAOD to around 235 mAOD. The middle bench typically occupies an elevation of around 230 mAOD. The lower bench slopes very gradually towards the north from c. 215 mAOD to c. 210 mAOD.
General setting and Ground coverage	The Site is located c. 4 km to the west of Newtown within a rural land use setting. There are no built structures on the middle and upper quarry benches, which comprise of undulating compacted ground with limited vegetation cover. Assorted building materials are present in the south-western part of the Site (on the upper quarry bench). Access roads connecting the quarry benches are comprised of both compacted gravel and some concreted sections. Multiple commerical units are located on the lower quarry bench; these are used for plant maintenance and repair, machinery storage and miscellaneous light industrial work. The majority of the units are constructed on concrete slab foundations with metal frames and metal sheet cladding. The main Site office is located in the north-west of the Site. The western part of the lower bench is covered by weathered concrete surfacing. The eastern half of the lower bench is largely surfaced in compacted gravel. The land bordering the Site comprises either grassed fields or wooded areas. Photographs of the current Site condition are included in Appendix C.

2.2 Site history

Salient aspects of the Site's historical land use are shown in

Table 2.2, as derived from historical land use mapping presented in the Phase 1 report (GeoSmart Information, 2023).

Table 2.2 Site land use history

Date	Land use
1884	Penstrowed Quarry mapped in the north of the Site; the southern half of the Site is undeveloped pasture. The surrounding land area is predominantly agricultural land / open ground. Penstrowed Hall is mapped c. 75 m to the east of the Site entrance (c. 350 m from the proposed development area). A well is mapped at the Birches property c. 125 m south of the Site.
1885	No significant land use changes are evident in and around the Site. A spring is mapped c. 30 m to the south.
1902 - 1903	An 'incline' (suspected rail line) is mapped in the east of the Site. The quarried area remains limited to the northern half of the Site. Several small structures are evident within the quarried area.
1938	No significant land use changes are evident in and around the Site.
1953 - 1963	No significant land use changes are evident in and around the Site.
1975	The former 'incline' is no longer mapped in the east of the Site.
1983	The quarried area appears to have extended across the central-southern part of the Site. No contour lines are shown across the southern Site area; potentially indicating some quarrying activity. A network of access tracks is mapped in the northern half of the quarry; the main Site access (as per the present day) has been constructed along the north-eastern Site boundary.
1994	No significant land use changes are evident in and around the Site.
2000	No significant land use changes are evident in and around the Site. An issue is mapped at the head of the stream located c. 20 m to the east of the Site.
2006 Aerial imagery	Aerial photography shows that multiple buildings have been constructed across the north-eastern part of the Site (lower quarry bench). Concrete hard standing is evident around the buildings located in the north of the Site. Multiple vehicles are present across the Site. Various vehicles and some plant are present across the middle quarry bench; various stone / material stockpiles are evident across this area. The upper quarry bench (in the south-west of the Site) is vegetated with some suspected access tracks evident. A residential property has been constructed directly to the east of the Site.
2009 Aerial imagery	Aerial photography shows material processing / screening is ongoing on both the lower bench (adjacent to the main quarry face) and the middle bench. Multiple storage containers and vehicles are shown on the middle bench. Some shallow excavations appear to have taken place at the western edge of the Site (on the upper bench).
2011 Aerial imagery	Aerial photography suggest that the lower and middle benches remain largely unchanged. Quarrying activity has been extended across the entire upper bench, including new access tracks and assorted material stockpiles.
2020 Aerial imagery	Aerial photography shows no significant changes on the lower bench area. The middle and upper benches have been cleared of all former storage containers, plant and vehicles (although some miscellaneous storage is evident in the south-west corner of the Site); the landform across the middle and upper bench areas appears to have been reprofiled.
2022 Aerial imagery	Aerial photography shows that further reprofiling has occurred across the middle and upper benches.

Date	Land use
Additional information	The contaminated land report prepared for the Site in 2021 by GroundSolve contains the following information: - The quarry was worked by the 'Local Council' prior to 1946 for the extraction of 'hard sandstone layers for use as building and road stone'. The quarry was purchased by a private firm in 1946. - A short rail link connecting the quarry to the main Shrewsbury – Aberystwyth railway was closed in 1937. - The quarry was abandoned in c. 1984. - GF Grigg Construction Ltd purchased the Site in March 2001. An Environmental Permit (EPR/GB3632AS) was issued to G.F. Grigg Ltd in September 2012 for the storage and treatment of waste material (including the sorting, separation, screening, crushing and blending to produce soil, soil substitutes or aggregates). Further details of the Permit requirements are included in Table 2.3.

Historical mapping indicates that the northern half of the Site was a hard rock quarry from before 1884; the main quarried area was serviced by a rail line from the late 1800s / early 1900s; this was disbanded in around 1937. The quarried area was extended across the southern half of the Site during the 1970s and early 1980s. Quarrying activity ceased in 1984. The lower quarry bench area was developed in the early 2000s, including the erection of multiple commerical units which have been predominantly used for the storage and maintenance of plant and machinery. The lower and middle benches have been used for screening imported waste materials during the last 11 years. The landform evident across the middle and upper benches has been sequentially reprofiled during the last 10 to 15 years.

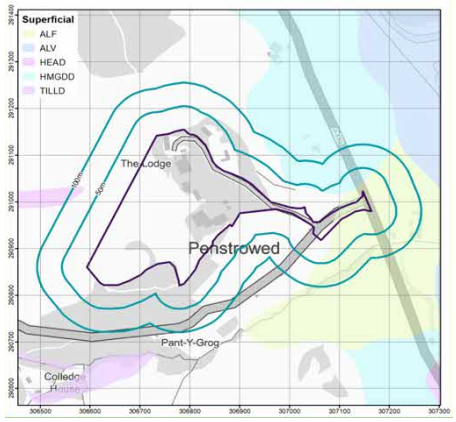
No significant developments have been identified within the area surrounding the Site.

The following consultation response was provided by PCC as part of the Phase 1 reporting: *'the subject site shown in your submission to us is identified as potential contaminated land in accordance with the Authority's Contaminated Land Strategy. This is due to its former use as quarrying, transport manufacture and mineral railway. There are no current plans to inspect the land however, it is possible that potential contamination may be investigated at a future date in accordance with the Authority's Contaminated Land Strategy'.*

2.3 Environmental setting

Information relating to the environmental Site setting is summarised in Table 2.3, as obtained from the existing Phase 1 report (GeoSmart Information, 2023) plus supporting web-based information.

Table 2.3 Environmental Site setting

Topic	Description
Geology and groundwater	 British Geological Survey (BGS) mapping indicates the absence of any superficial deposits across the vast majority of the Site and immediate surroundings (see inset plan). BGS mapping indicates that the bedrock geology beneath the entire Site consists of the Penstrowed Grits Formation, which comprises of sandstone and mudstone and is classified as a Secondary B Aquifer. The Penstrowed Grits encountered within the quarry comprise *'of a rhythmic alternating sequence of cream coloured greywacke sandstones and dark grey siltstones and shaley mudstones'* (Ground Solve, 2021). Made Ground is anticipated across the upper and middle benches as a result of both the regrading of existing overburden and natural scree material plus the placement of screened imported soils. There are no BGS borehole records within 100 m of the Site with which to verify the local geology. The Site does not lie within a groundwater Source Protection Zone (SPZ). The following groundwater abstraction licences are held within 1 km of the Site: - Mr. R. H. Jones; general farming and domestic abstraction located c. 120 m to the south. - Messrs. G. R. & D. Christmas; general farming and domestic abstraction located c. 400 m to the east. The Phase 1 report indicates that the risk of groundwater flooding at the Site is 'negligible'. The Site does not reside within a coal mining reporting area. According to information supplied by PCC (see Appendix A) there are three private water supplies (domestic use) within a 500 m radius of the Site: - The Brynhyfryd property (deep spring) located c. 230 m to the north-east of the Site. - College House (well) located c. 125 m south-west of the Site. - Hollybush (deep spring) located c. 260 m south of the Site. A further spring is known to be present c. 40 m to the south of the Site; the spring flow is piped to a water tank associated with The Birches property (see Figure 3.3 and also Photograph 81 in Appendix C). It is noted that The Birches address is connected to mains water; the spring feed is understood to be used for irrigation / providing water for horses. An additional spring is present c. 70 m to the east of the Site (see Figure 3.3 and also Photograph 79 in Appendix C). The spring discharges into the adjacent stream which flows towards the east.

Topic	Description
Surface water and flooding	The nearest water feature is an ephemeral drainage channel which is located along the western edge of the Site. A stream is mapped c. 135 m to the south-east of the Site. The local surface water drainage is directed towards the east, in the direction of the River Severn (positioned c. 450 m to the east of the Site). There are no licensed surface water abstractions within 1 km of the Site. The Phase 1 report indicates that the Site lies in Flood Zone 1.
Landfill / waste management	There are no recorded active, recent or historical landfills located within 500 m of the Site. It is noted that treated waste materials have been locally placed within the quarried area over the last c.10 years. Waste materials have been imported onto Site in line with Environmental Permit EPR/GB3632AS, which was issued to G.F. Grigg Ltd in September 2012 for the following waste activities: - Storage of waste pending recycling / reclamation. - Recycling / reclamation (treatment consisting only of sorting, separation, screening, crushing and blending to produce soil, soil substitutes or aggregates). Permitted waste types include: - Wastes from mineral extraction. - Wastes from physical and chemical processing of non-metalliferous minerals. - Wastes from manufacture of ceramic goods, bricks, tiles and construction products. - Wastes from manufacture of cement, lime and plaster and articles and products made from them. - Concrete, bricks, tiles and ceramics. - Bitumous mixtures, coal tar and tarred products. - Soil, stones and dredging spoil. - Gypsum-based construction material. - Other construction and demolition wastes. - Wastes from the mechanical treatment of waste. - Wastes from soil and groundwater remediation. - Garden and park waste. No hazardous waste will be accepted. No emission limits or associated monitoring are specified. Emissions of substances not controlled by emission limits shall not cause pollution. No reporting requirements are specified. The maximum permitted waste quantity is 92,000 tonnes / year. The permitted area is restricted to the middle quarry bench. Example waste returns provided by the Client (see Appendix B) include reference to the following waste types received on-Site: - Soil and stones (EWC code: 170504) - Concrete (EWC code: 170101) - Soil (EWC code: 170503) - River gravel (EWC code: 170506) - Rubble (EWC code: 170107) - Stone and tarmac (EWC code: 170302)
Radon	According to UK Health Security Agency data the Site lies in an area where between 3% to 5% of homes are at or above the UK radon action level.
Pollution incidents	No pollution incidents have been recorded by the Environment Agency / Natural Resources Wales within a 250 m radius of the Site.

Topic	Description
Environmental designations	Several areas of ancient woodland are located within 500 m of the Site, the closest of which is situated c. 120 m to the south. Sections of the Penstrowed Quarry (including the main quarry face) are classified as a Site of Special Scientific Interest (geological).
Additional information	An environmental information request (EIR) was submitted to PCC on 6th June 2023. A formal response was provided by the Council on 27th June 2023 (see Appendix A), including the following information: - The Council's contaminated land team has no records of any known or suspected pollution incidents associated with past or present Site activities. - The Site is identified as potential contaminated land in accordance with the Authority's Contaminated Land Strategy. This is due to its former use as quarrying, transport manufacture and mineral railway. - The only available details of previous site investigations relating to the Site or immediate surrounds are associated with previous planning application no: 22/1966/FUL. Note: these investigations relate to the work performed by GroundSolve in 2021 (see Section 2.4). - There are three private water supplies within 500 m of the Site (details provided above).

2.4 Previous site assessments

i) Stabilisation of Penstrowed Quarry (GroundSolve, 2013)

GroundSolve Ltd. prepared a report in 2013 providing details of the raised development platforms to be created on the middle and lower quarry benches in order to stabilise the existing quarry faces. The report proposes that the land raising is achieved by partial backfilling using material processed on-Site under an appropriate Environmental Permit.

GroundSolve's report includes a stability analysis of the quarry faces and describes the plans for stabilising the cliff faces, whilst also allowing continued access for interested parties.

ii) Penstrowed Quarry - contamination assessment (GroundSolve, 2021)

A limited ground investigation was performed at the Site by GroundSolve Ltd. during February 2021. The purpose of the investigation was 'to address any potential contamination issues and advise on the safe development of the holiday park'. The GroundSolve report was submitted in support of the 2022 planning application.

The investigation involved the excavation of nine trial pits to a maximum depth of 1.5 m bgl. The trial excavations were focussed on the upper bench level; see Figure 3.1.

The main findings of the 2021 GroundSolve investigation (see Appendix B) included the following:

- The encountered Made Ground was comprised of three general types:
    - General Made Ground, comprising of brown gravel with cobbles in a silt / sand / clay matrix with traces of plastic, metal, tarmac and concrete. Other material included light brown slightly gravelly clay; and red-brown slightly gravelly sandy clay.
    - Overburden materials, comprising of loose brown clayey gravel with cobbles and boulders.
    - Quarry fines, comprising of grey-brown silty clay to clayey silt with much sub angular to angular gravel.

- The weathered bedrock was described as firm to stiff brown gravelly silty clay / clayey silt; plus brown sandy mudstone gravel.
- The competent bedrock comprised of sandstone and very weak, highly weathered mudstone.
- Six soil samples were taken from the upper bench level at depths of between 0.2 m and 1.2 m bgl. Chemical analyses performed on these samples identified an absence of any significant soil contamination (when compared against Generic Assessment Criteria for a public open space land use). Note: no samples were collected from the middle or lower quarry benches.
- No evidence of asbestos was recorded in any of the samples.
- No significant source of ground gas was identified (albeit no gas measurements or related soil testing was performed).
- No significant risks to controlled waters were identified (although no water or leachability testing was performed).

3 SITE INVESTIGATION WORKS

3.1 Site investigation programme

A programme of intrusive site investigation was coordinated by Ground First on 7th and 8th June 2023. All intrusive works were performed by the Client.

A summary of the site investigation activities undertaken is presented in Table 3.1. Trial pit locations are shown on Figure 3.1 and Figure 3.2, with trial pit soil descriptions provided in Appendix D. A photographic record of the Site works is provided in Appendix C.

Table 3.1 Site investigation activities

Element of investigation	Details	Rationale
Trial pitting	41 trial pit locations (TP01 to TP41) were excavated at the study site using a tracked 13-tonne excavator. The pits were distributed across the Site working within the constraints of the prevailing landforms, buried services and existing structures. The trial pit locations are shown on Figure 3.1 and Figure 3.2. The trial pits were excavated to depths of between 0.1 m (refusal on bedrock) and 3.35 m bgl. All pits were backfilled on completion. The excavated spoil was replaced in broadly the same order as it was excavated. All excavated materials were logged by an experienced site supervisor.	To characterise existing ground conditions across accessible parts of the study area, based on the following rationale: - TP01 to TP24 were positioned across the upper and middle quarry benches. - TP24 to TP41 were positioned across the lower quarry bench. - TP27 and TP29 to TP32 were positioned around the main structures / industrial units on the lower bench. - TP33 and TP34 were situated within the terraced deposits of imported material located on the lower bench. - TP37 to TP39 were situated in and around areas of past and present bulk fuel storage. To assess the extent, thickness and composition of any Made Ground present across the study area. To make a visual assessment of any ground contamination. To clarify the nature of the underlying natural geology and to assess the presence of any shallow groundwater. To facilitate environmental soil sampling and chemical testing.
In situ testing / PID monitoring	A hand-held PID meter (10.6 eV lamp) was used during the site investigation works to provide an indication of the presence of any volatile organic compounds (VOCs) within the sub surface materials (i.e., through soil headspace testing). One or more soil samples were taken from selected trial pits. All samples were placed in a clean zip-lock plastic bag, agitated and left for a minimum of 30 minutes, after which the bag was pierced with the end of a PID meter and the peak and steady PID readings recorded.	To indicate the distribution and concentration of any VOCs within the sub surface.
Soil sampling	24 soil samples were taken from the trial pits at depths of between 0.1 m bgl and 2.5 m bgl. 16 of the samples were collected from the upper 0.5 m.	To provide appropriate samples for chemical laboratory analysis (analytical suite described below) in order to inform the environmental risk assessment.

Element of investigation	Details	Rationale
Groundwater sampling	A sample of perched groundwater was taken from trial pit TP03. Two water samples (FACE 1 and FACE 2) were collected from seepages observed at the base of the main quarry face. A sample was collected from a spring located c. 70 m to the east of the Site (SPRING 1). A further sample was collected from a spring-fed water tank located c. 40 m to the south of the Site (SPRING 2). The locations of all water samples are shown on Figure 3.3.	To provide appropriate samples for chemical laboratory analysis (analytical suite described below) in order to inform the environmental risk assessment.
Surface water sampling	Both the ephemeral drainage ditch located on the north-western Site boundary and also the stream channel c. 135 m to the south-east of the Site, were dry during the ground investigation; as such, no surface water samples were collected.	/
Chemical laboratory analysis	The soil and water samples collected during the site investigation were submitted to the UKAS and MCERTS accredited i2 Analytical for chemical analysis (see Section 3.2).	To allow assessment of potential land quality risks to identified receptors.

3.2 Chemical laboratory testing

Representative soil samples (24 samples in total) were obtained from 23 of the trial pits excavated at the Site. All soil samples were scheduled for analysis performed by i2 Analytical Ltd (i2 is an approved Ground First supplier). Where possible UKAS and MCERTS certified tests were used.

The soil samples were analysed for a range of the following soil determinands:

- Moisture content
- Fraction of organic carbon (foc)
- Soil organic matter (SOM)
- pH
- Total and water-soluble sulphate
- Sulphide
- Metals and metalloids (As, Be, B, Cd, Cr (III and VI), Cu, Hg, Ni, Pb, Se, Zn and V)
- Total and free cyanide
- Thiocyanate
- Speciated TPH
- Banded TPH (C6-C10; C10-C25; C25-C40)
- Speciated PAHs
- MTBE
- BTEX
- Total phenols

- Asbestos in soil screen

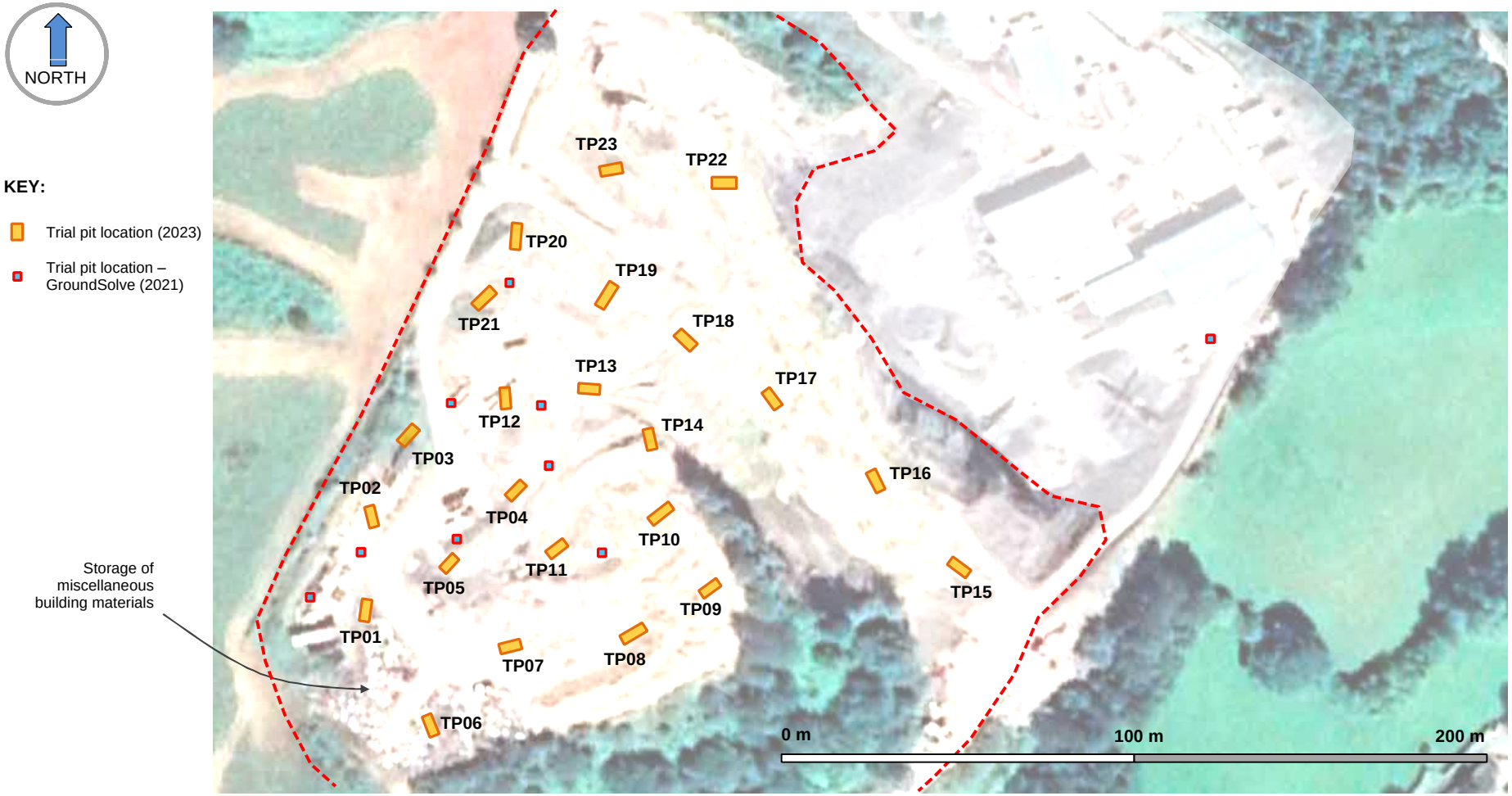
Ten of the soil samples were subjected to the following leachability analyses:

- pH
- Total and free cyanide
- Thiocyanate
- Sulphate
- Sulphide
- Metals and metalloids (As, B, Cd, Cr (III and VI), Cu, Hg, Ni, Pb, Se and Zn)
- Speciated PAHs
- Total PAHs
- Total phenols

The five water samples were analysed for the following suite of analyses:

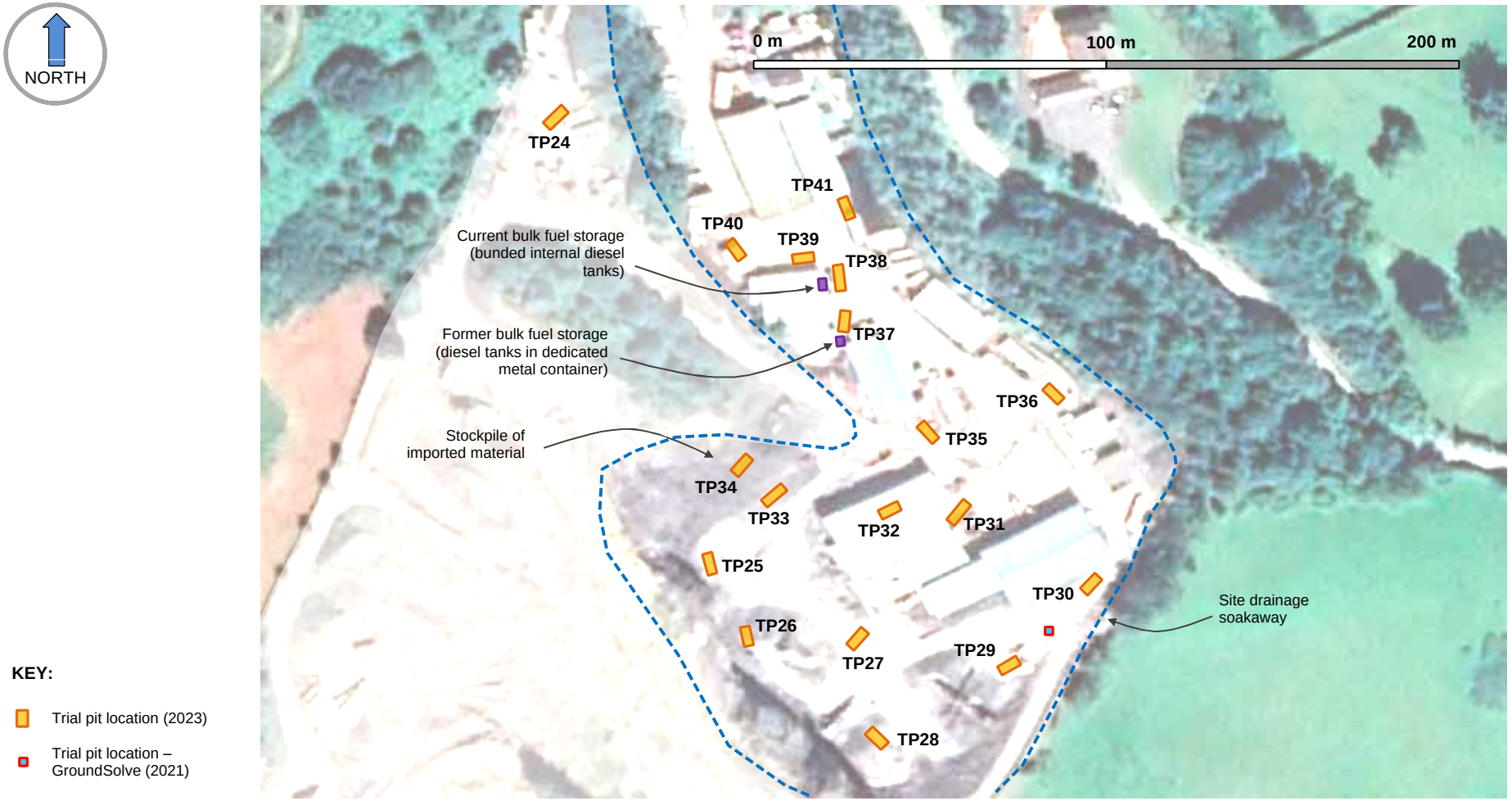
- pH
- Total cyanide
- Chloride
- Total sulphate
- Ammoniacal Nitrogen as N
- Ammoniacal Nitrogen as NH_3
- Dissolved organic carbon (DOC)
- Nitrate
- Nitrite
- Alkalinity
- Metals and metalloids (As, Ba, Be, B, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se and Zn)
- TPH CWG
- Speciated PAHs
- MTBE
- BTEX
- Total phenols

Figure 3.1 Site investigation location plan – upper and middle quarry benches



Site investigation locations	July 2023	Drawn: AJS
	4316R1	Rev 1

Figure 3.2 Site investigation location plan – lower quarry bench



Site investigation locations	July 2023	Drawn: AJS
	4316R1	Rev 1

Figure 3.3 Site investigation location plan – <u>water sample locations</u>

Site investigation locations – water samples	**July 2023**	**Drawn: AJS**
	4316R1	**Rev 1**

4 SITE INVESTIGATION RESULTS

4.1 Encountered ground conditions

The sequence of strata encountered within each of the trial pits is described in full within Appendix D and is summarised below.

Upper quarry bench (TP01 to TP11)

- Backfill material / Made Ground was encountered in all of the trial pits.
- The upper Made Ground, identified within all of the trial excavations, typically comprised of light brown to grey gravelly silt with sub angular to angular cobbles. This layer generally contained minimal man-made material, although occasional brick, tile and concrete remains were recorded. This material was typically of the order 0.5 m to 1.0 m thick.
- In trial pits TP01, TP02 and TP05 (all positioned towards the south-western part of the upper bench) the upper Made Ground was underlain by mid brown slightly sandy gravelly silt with frequent angular cobbles and boulders. These deposits contained minimal man-made material.
- In the remainder of the trial pits (i.e., beneath the central and eastern parts of the upper quarry bench) the upper Made Ground was underlain by more cohesive material including brown gravelly clayey silt, grey-brown clayey gravelly silt and soft brown silty gravelly clay. These deposits included occasional brick, concrete, tile, tarmac and wood remains.
- Consolidated bedrock was encountered at a depth of c. 0.7 m in TP01 (located in the south-western corner of the upper bench), with rockhead becoming progressively deeper towards the north-east. As such, the thickness of backfill material / Made Ground was in excess of 3.3 m at TP09.

Middle quarry bench (TP12 to TP24)

- As with the upper bench, backfill material / Made Ground was encountered in all of the trial pits.
- The upper Made Ground, identified within all of the trial excavations, typically comprised of light brown to grey gravelly silt with sub angular to angular cobbles. This layer generally contained minimal man-made material, although occasional brick, concrete, tarmac and plastic remains were recorded. This material was typically of the order 0.3 m to 1.0 m thick (although was locally in excess of 2.4 m thick (TP21)).
- In trial pits TP12, TP13, TP15 and TP16 the upper Made Ground was underlain by grey to brown and orange-brown slightly sandy gravelly silt with frequent angular cobbles and boulders. These deposits contained limited amounts of man-made material including occasional brick, concrete, clay tile, tarmac, plastic sheeting and hard plastic remains.
- In the remainder of the trial pits (i.e., beneath the central and north-western parts of the middle quarry bench) the upper Made Ground was underlain by more cohesive material including grey-brown gravelly clayey silt and grey-brown slightly sandy gravelly clayey silt. These deposits included occasional brick, concrete, clay tile, tarmac, metal and wood.
- Rock head was not proven at any of the trial pit locations. As such, the backfill material / Made Ground was shown to be locally in excess of 3.35 m thick.

Lower quarry bench (TP25 to TP41)

- Reworked natural material and weathered bedrock were encountered from ground surface at trial pits TP25 to TP31 (positioned in the southern and south-eastern parts of the lower bench level). This material comprised of grey to grey-brown and dark-grey silty gravel with angular mudstone cobbles and boulders. Minimal man-made material was recorded. Competent bedrock was encountered within these trial pits at depths of between 0.1 m and 0.8 m bgl.
- A limited amount of fill material / Made Ground was encountered at trial pits TP32 and TP35 (located in the central area of the lower bench); this included grey silty gravel with occasional brick; dark grey to black silty sand and gravel including suspected road planings; and dark grey to brown slightly gravelly silt with occasional brick and tile remains. The fill layer was c. 0.6 m thick and was underlain by natural reworked material (grey to grey-brown silty gravel with frequent sub angular to angular mudstone cobbles and boulders).
- The imported waste materials present at ground surface in and around TP33 and TP34 comprised of grey to brown gravelly silt, silty gravel and clayey gravelly silt with occasional brick and tarmac remains. This material was in excess of 2.3 m thick.
- More extensive fill / Made Ground was observed at trial pits TP36 to TP39 (located in the north and north-east of the lower bench level).
    - A 2.4 m thickness of Made Ground was encountered at TP36, comprising grey to brown gravelly silt to silty gravel including some road planings; dark grey to black sandy gravel including road planings; and brown to grey-brown slightly clayey gravelly silt including occasional brick and tile remains plus some hard plastics and wood. The fill layer was underlain by natural reworked material.
    - The Made Ground recorded at TP37 to TP39 was in excess of 2.6 m thick and included grey to grey-brown slightly gravelly silt to silty gravel including some brick, slate and tile plus some plastic bags, metal wire and wood.
- In contrast, less than 0.5 m of fill was observed at trial pits TP40 and TP41, positioned at the northern edge of the study area.

4.2 Groundwater

No shallow groundwater was encountered (to a maximum excavation depth of 3.35 m bgl) during the recent ground investigations, although localised perched water was observed towards the base of trial pit TP03, at a depth of c. 1.4 m bgl (see Photograph 18 in Appendix C).

4.3 Visual and olfactory evidence of contamination

The following site observations were recorded in relation to potential ground contamination:

- Fill material / Made Ground was identified within the majority of the site investigation locations. However, the Made Ground typically contained only limited amounts of man-made material including occasional brick, concrete, clay tile, tarmac, road planings, slate and metal plus some hard plastics, plastic sheeting and wood fragments.
- No obvious asbestos containing materials were observed at ground surface or within the Made Ground encountered at any of the excavated trial pits.
- No significant staining or odours were recorded in any of the trial pits.

4.4 PID headspace testing

Headspace testing was performed on soil samples taken from selected trial pits (most notably those positioned adjacent to areas of past or present bulk fuel storage). Soil samples were placed in zip-lock plastic bags, agitated and left for c. 30 minutes. Each bag was then pierced by a PID meter and the peak and steady state VOC readings recorded (see Photographs 110 and 111 in Appendix C).

Details of the PID headspace test results are presented in Table 4.1; this shows that all PID readings were below 1 ppm, suggesting the absence of any significant vapour phase contamination within the soil samples.

Table 4.1 PID headspace results

Trial Pit	Sample depth: m bgl	Peak PID reading: ppm	Steady state PID reading: ppm
TP04	0.8	0.1	0.0
TP07	0.2	0.4	0.0
TP08	2.5	0.0	0.0
TP15	2.0	0.1	0.0
TP22	1.0	0.0	0.0
TP26	0.5	0.0	0.0
TP34	1.5	0.2	0.0
TP37	0.3	0.0	0.0
TP37	1.0	0.0	0.0
TP38	1.0	0.0	0.0
TP39	0.3	0.1	0.0

4.5 Chemical testing results

Full laboratory certificates of all soil and water test results are presented in Appendix E.1.

Key observations relating to the 2023 laboratory soil test results (see Appendix E.2) include:

- All total and free cyanide, thiocyanate, cadmium, chromium, mercury, selenium, total phenol, BTEX, MTBE and petroleum range organics (>C5 – C10) concentrations were below the limits of laboratory detection.
- Asbestos material was identified within one of the soil samples (recovered from TP20) comprising of amosite loose fibrous debris.
- The sampled soils contained an average Soil Organic Matter (SOM) content of around 2%.

It is noted that the recent soil test results are very similar to the data derived from GroundSolve's 2021 sampling activities.

Key observations relating to the 2023 laboratory soil leachability test results (see Appendix E.3) include:

- All total and free cyanide, sulphide, cadmium, chromium, mercury, total phenol and speciated PAH concentrations were below the limits of laboratory detection.
- Those analytes which were measured above the limits of laboratory detection were observed at similar concentrations within all of the eluate samples.

Key observations relating to the 2023 laboratory water test results (see Appendix E.4) include:

- All total cyanide, beryllium, lead, mercury, total phenol, speciated PAH, BTEX, MTBE and speciated TPH results were below the limits of laboratory detection.
- The perched water sample derived from TP03 displayed a slightly different inorganic chemistry to the other four samples, including higher sulphate, ammonia, nitrate and nitrite concentrations.

4.6 Other site observations

Salient observations made during the site investigation works included:

- A variety of commercial units were present in the eastern part of the lower bench level, including:
  - The main structure in the east of the lower bench comprised of a large sheet metal clad shed used for plant storage and servicing (see Photographs 63 to 65 in Appendix C). The flooring within this unit comprised of a concrete slab (see Photograph 67 in Appendix C). A former waste oil burner was positioned at the northern edge of the structure (see Photograph 66 in Appendix C).
  - An empty fuel storage tank was positioned adjacent to the main structure; located on an elevated metal platform (see Photograph 70 in Appendix C). The Client has indicated that the tank has never been used for fuel storage, rather it was placed in order to raise up a water tank (i.e., to provide a sufficient head of water to enable the tank to be used for vehicle washing).
  - An adjoining structure in the south-east of the lower bench was vacant (see Photographs 68 and 69 in Appendix C). This unit, which also included concrete flooring, is understood to have previously been used for paint spaying activities.
- A further collection of commercial units was present in the western part of the lower quarry bench, including:
  - A former fuel storage tank (situated within an integral metal storage container); see Photograph 73 in Appendix C.
  - A corrugated metal shed containing several above ground diesel storage tanks (all situated within concrete bunds); see Photograph 74 in Appendix C.
  - Several adjoining sheet metal clad units used for general storage plus a vehicle repair centre (see Photographs 75 to 78 in Appendix C).
- An open-sided structure was present in the central part of the lower bench (see Photograph 71 in Appendix C); this was used for vehicle parking.
- No obvious asbestos containing material was observed within any of the built structures.
- Two terraces of imported material were evident to the north-east of the main quarry face (see Photograph 62 in Appendix C); no appreciable man-made material was identified within these deposits.
- Assorted building supplies / materials were present on the upper quarry bench, including bricks, concrete ring sections, assorted plastic drainage pipework, miscellaneous metal and plastic materials, timber, etc. (see Photographs 5 to 11 in Appendix C).
- The ground surface across the upper and middle quarry benches largely comprised of compacted gravelly silt (see Photographs 3 and 4 in Appendix C).
- A stockpile of imported aggregate was observed on the middle quarry bench (see Photograph 33 in Appendix C); this material comprised largely of stone with occasional brick remains (see Photograph 34 in Appendix C).
- Two seepages were identified on the main quarry face; see Photographs 60 and 61 in Appendix C.
- The stream channel present along the western Site boundary was observed to be dry (see Photograph 52 in Appendix C).

- A spring chamber was observed c. 70 m to the east of the Site (see Photograph 79 in Appendix C); the associated flow discharged into a minor stream (see Photograph 80 in Appendix C).
- The Client has indicated that a second spring is located c. 40 m to the south of the Site; this is understood to be piped into a nearby sub-surface water tank (see Photograph 81 in Appendix C).
- The water course located c. 135 m to the south-east of the Site was observed to be dry (see Photograph 82 in Appendix C – this image shows the stream channel at a location c. 300 m from the Site boundary).

5 CONTAMINATION ASSESSMENT

The following section identifies potential contaminants of concern (COC) associated with encountered ground conditions beneath the Site. The outputs of this process will be used to refine the conceptual site model which will in turn provide the technical basis for an assessment of contamination risks in Section 6.

5.1 Planning context

The planning system adopts a risk-based approach to the management of soil contamination in which the Local Authority acts as the primary regulator. The requirements of the planning system, including those associated with the management of contaminated land, are described within Planning Policy Wales, Edition 11 (WAG, 2021). Relevant components of the Planning Policy Wales document include:

> **Section 3.55. Previously Developed Land**:
>
> *'Previously developed (also referred to as brown field) land should, wherever possible, be used in preference to green field sites where it is suitable for development'.*
>
> **Sections 6.9.16 to 6.9.21. Land Contamination**:
>
> (Section 6.9.17). *'…the onus will remain with the developer to ensure that the development of the site will remove any unacceptable risks and the planning authority in making development management decisions will need to ensure that the land is suitable for its proposed use and would not meet the legal definition of contaminated land under Part IIA'.*
>
> (Section 6.9.18). *'Planning authorities should take into account the nature, scale and extent of land contamination which may pose risks to health and the environment so as to ensure the site is capable of effective remediation and is suitable for its intended use. In doing so, development management decisions need to take into account:*
>
> > *the potential hazard that contamination presents to the development itself, its occupants and the local environment; and*
> >
> > *the results of a specialist investigation and assessment by the developer to determine the contamination of the ground and to identify any remedial measures required to deal with any contamination'*.
>
> (Section 6.9.19). '*Where land contamination issues arise, the planning authority will require evidence of a detailed investigation and risk assessment prior to the determination of the application to enable beneficial use of land.'*

5.2 Assessment of soil data (human health risks)

5.2.1 Contaminant screen (soil quality)

An initial soil screening exercise involved comparing observed soil quality data with a set of generic human health screening values (commonly referred to as Generic Assessment Criteria (GAC)). GACs have been compiled from various published sources based on the following hierarchy:

- Suitable for Use Levels (S4ULs) derived by a consortia of industry professionals and published by LQM and CIEH.
- Category 4 Screening Levels (C4SL) published by Defra.

The available soil quality data have initially been assessed against GACs representative of a typical residential land use with a sandy loam soil type and a SOM content of 2.5% (note: the average measured SOM, based on both observed SOM and foc results, was 2%). The

adopted GACs are listed in Appendix F. It is noted that the GACs relating to a standard residential land use are considered to be highly conservative in the context of the proposed holiday park.

Table 5.1 presents a summary of those soil quality determinands which exceed the adopted residential land use GACs, together with corresponding sample locations and depths. GAC exceedances are highlighted in bold.

Table 5.1 Soil quality screen (residential GACs)

Analyte	No. Samples	Minimum (mg/kg)	Average (mg/kg)	Maximum (mg/kg)	GAC (mg/kg)	Number of Samples exceeding GAC	Samples exceeding GAC (depth)
Benzo(b)-fluoranthene	23	<0.05	0.7	**4.2**	3.3 (S4UL)	1 (4%)	TP11 (0.5 m)
Benzo(a)-pyrene	23	<0.05	0.6	**3.7**	2.7 (S4UL)	1 (4%)	TP11 (0.5 m)
Dibenz(a,h) anthracene	23	<0.05	0.1	**0.44**	0.28 (S4UL)	2 (9%)	TP11 (0.5 m) TP16 (0.2 m)

Key observations taken from the initial soil screening exercise (applying residential land use GACs), include the following:

- The majority of analytes were measured at concentrations below the conservative adopted screening values, indicating that these substances are unlikely to pose any future health risks under the proposed development scenario.
- Three PAH species did record maximum concentrations in excess of the residential land use GACs; the average concentrations of all three species were however below their respective screening values.

Given that the proposed development does not include standard residential use (and as such, somewhat different contaminant exposure pathways, durations and frequencies will apply), the available soil quality data have also been assessed against S4ULs and C4SLs which are representative of a Public Open Space (POS) scenario for grassed areas adjacent to residential housing (POS_{resi}) with a sandy loam soil type and a SOM content of 2.5%. The key assumptions adopted in the derivation of POS_{resi} GACs include the following:

- The POS_{resi} land use is generally considered to be a predominantly grassed area of up to 500 m^2 (0.05 ha) and a considerable proportion of this (up to 50%) may be bare soil. Such areas are assumed to be in close proximity to residential housing and are regularly used by children for playing and may be used for informal sports activities such as a football 'kickabout'.
- The critical receptor is considered to be a female child (of lower body weight than a male and therefore more sensitive) and covers ages >3 years to <9 years old).
- Exposure modelling includes assessment of indoor exposure pathways as in the standard residential land-use scenario. Therefore, the relevant exposure pathways for the POS_{resi} land use are assumed to be:
  - Ingestion of soil and dust (outdoors and indoors).
  - Dermal contact with soil (outdoors); and soil-derived dust (indoors).
  - Inhalation of dust (outdoors and indoors).
  - Inhalation of vapours outdoors.

- The critical receptor is assumed to use the site on a regular basis (1 hour at a time and for 170 days per year).
- The consumption of homegrown produce is discounted since public open space is not anticipated to be used for the growing of fruit and vegetables.
- A slight reduced in the soil ingestion rate (compared to the standard residential land-use) of 75 mg/day is used for the POS_{resi} land use.

All of the measured soil quality results associated with the recent ground investigation (including all PAH concentrations) were below the adopted POS_{resi} GACs, indicating the likely absence of any corresponding health risks.

The risks posed by the available soil quality data are discussed further in Section 6.

5.2.2 Contaminant screen (asbestos)

23 soil samples were screened by i2 Analytical for the presence of asbestos containing materials (ACM). ACMs were identified within one of the samples:

- Amosite loose fibrous debris was recorded within a sample taken from TP20 at a depth of 0.1 m.
- Subsequent asbestos quantification testing performed on the TP20 soil sample indicated that the concentration of asbestos present was <0.001 % wt/wt.

CIRIA C733 (2014) provides guidance concerning the investigation, assessment and remediation of soils containing, or suspected of containing, free asbestos fibres or asbestos containing material (ACM).

C733 indicates that there are negligible health risks from the ingestion of ACMs; potentially significant health risks are constrained to the inhalation of airborne asbestos. As such, asbestos only poses a distinct health risk when it is airborne.

The number of fibres released into the air from asbestos containing soils is influenced by a range of site-specific factors (CIRIA, 2014); these factors are evaluated for the study Site in Table 5.2.

Table 5.2 Appraisal of asbestos fibre release factors (CIRIA, 2014)

Factor	Description / context	Site-specific conditions
Characteristics of the asbestos or ACM		
Concentration of asbestos in soil	The risk of exposure to ACMs is proportional to the concentration of any free fibres within the near surface soils.	One of the 23 samples recently screened for ACMs contained amosite loose fibrous debris (sample recovered from TP20). Asbestos quantification testing performed on the TP20 sample has indicated that the concentration of asbestos material was <0.001 % wt/wt (equivalent to trace levels).
Depth to asbestos in relation to (final) ground level	In the absence of significant physical disturbance, exposure to airborne asbestos fibres from soil will be from friable materials or asbestos fibres present at, or very close to, the soil surface (i.e., the soil-air interface). Consequently, soil risk assessments for buried asbestos primarily need to consider the likelihood that such materials may reach the surface due to the action of burrowing animals or human activities.	The asbestos detection was associated with a sample of Made Ground taken from trial pit TP20 at a depth of 0.1 m bgl. The Made Ground comprised of brown slightly sandy gravelly silt with occasional tarmac remains. Note: the complete soil quality data set (23 samples in total) included samples collected from depths of between 0.1 m and 2.5 m bgl. No ACMS were recorded within any of the other soil samples.

Factor	Description / context	Site-specific conditions
Volume or surface area of asbestos containing soils (ACS)	The larger the area of soil which could give rise to asbestos releases, the greater the associated exposure risks.	A single soil sample taken from the Made Ground encountered within the middle bench area (TP20 - see Figure 3.1) contained asbestos fibrous debris, indicating the localised presence of ACS. It is notable that the sample recovered from TP20 was the only Made Ground material to contain ACMs (i.e., less than 5% of screened samples contained any asbestos) No visible suspected asbestos remains were observed at ground surface or within any of the trial excavations during the recent site investigations. Based on the available information, the widespread presence of ACS is considered unlikely.
Type(s) of asbestos present / degree of heterogeneity	Chrysotile asbestos is less potent than amosite, which in turn is less potent than crocidolite. Chrysotile asbestos is largely considered to be both less toxic and to generate lower airborne concentrations than either amosite or crocidolite.	Amosite loose fibrous debris was identified in a single sample, recovered from TP20. No chrysotile or crocidolite asbestos was identified within any of the screened soil samples.
Type(s) and condition of ACMs	Asbestos cement (AC) typically contains less than 10% asbestos bound in a cohesive matrix; AC materials are also associated with far lower levels of fibre generation compared with other forms of ACM (i.e., textiles, insultation board, etc.).	The identified asbestos related to loose fibrous debris. As such, there is the potential for fibres to be present within the sub surface, although no loose fibres have been identified to date.
Extent of bonding/friability	Chrysotile is typically less friable than other forms of asbestos.	The condition of the identified asbestos is unknown; this in part reflects the minimal presence / distribution and very low concentrations of ACMs observed on-Site. No evidence of any ACMs was visually recorded during the Site works (i.e., only trace loose fibrous debris was identified through laboratory screening).
Weathering, degradation or physical deterioration	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 undisturbed.	
Fraction of free respirable fibres	Significant health risks are constrained to the inhalation of airborne asbestos fibres.	No explicit free / loose asbestos fibres have been identified within the in-situ Made Ground to date. Although there is potential for localised fibres to be present. Asbestos quantification testing performed on the TP20 sample has indicated that the concentration of asbestos material was <0.001 % wt/wt (equivalent to trace levels). Based on the available information, the widespread presence of asbestos free fibres is considered unlikely.
Characteristics of the soil		
Soil type including particle size distribution	Empirical experimentation has shown that the rate of release of airborne asbestos fibres is proportional to the soil particle size (i.e., lower rates of fibre release can be expected from clayey soils, as compared to more granular, sandy soils).	The Made Ground deposits encountered across the Site area included some granular material (which could give rise to fibre release under certain conditions) including gravelly silt.

Factor	Description / context	Site-specific conditions
Soil moisture content	The moisture content of the soil is one of the most important factors dictating the emission of airborne asbestos fibres from soil. Minor increases in moisture content significantly reduce the release of fibres. The addition of 5% moisture to dry soil reduced airborne fibre release (in laboratory tests) by 80% to 95%, and no airborne fibre were detected above 40% soil moisture content. In the UK, most soils, even after long dry periods, are likely to have about five per cent moisture apart from extreme or very localised situations.	The average Moisture Content Ratio (% of received sample) for the soil samples taken during the recent site investigation was 9.1%.
Presence of surface vegetation / (Micro) relief of soil surface	CIRIA C733 indicates that 'airborne fibres will predominantly be released only from exposed soil' and 'release will be strongly inhibited by vegetative cover'	The proposed development plans allow for large areas of soft standing / landscaping. The future landscaped areas are anticipated to be largely covered by grass.
Presence of hard landscaping or cover	Hard standing offers a pathway break to the release of any sub surface asbestos fibres.	
Weather influences		
Precipitation	Number of dry days can be used as an indicator of potential fibre release.	Rainfall data have not been collected as part of this assessment although rates of rainfall are assumed to be broadly consistent with the national average.
Temperature and ground freezing	Frozen ground conditions can inhibit the release of asbestos fibres from the near surface soils.	Frozen ground conditions are not commonly anticipated at the Site.
Wind speed and direction	Wind conditions will influence the potential for dust/fibre release from any exposed soils.	No site-specific data are available regarding wind conditions.
Land use/soil-disturbing activities		
Distance of receptor(s) from the source of asbestos	The distance separation between receptors and impacted soils will influence the exposure to any airborne asbestos.	Future Site users will be located on-Site and will have access to the proposed soft standing / landscaped areas, potentially including areas of exposed soil.
Type(s) of activities	The level of disturbance of the surficial and sub surface soils is an important factor in controlling asbestos exposure.	Based on the proposed development (caravan holiday park), the associated land use activities are unlikely to disturb in-situ soils and hence give rise to any airborne fibres. It is noted that potential exposure frequencies and durations will also be relatively low. Any landscaping / maintenance activities are likely to be undertaken by appointed maintenance workers / contractors.
Duration and frequency of activities	The degree of asbestos exposure is proportional to the duration and frequency of any activities which may disturb in-situ ground.	
May dust mitigation measures employed	Targeted control measures can reduce the extent of dust/fibre release and associated asbestos exposure.	As part of the development plans, backfilling of the middle and lower quarry benches is proposed (using clean imported material) in order to stabilise the existing quarry faces and create the necessary development platforms. Appropriate topsoil material will also be placed across the Site

Factor	Description / context	Site-specific conditions
		as part of the planned development. The combined effects of the backfilling and topsoil placement will provide a clean cover layer which will reduce potential human exposure to any localised ACS.

The risks posed by potential ACMs are discussed further in Section 6.

5.3 Assessment of soil leachability and groundwater quality data (controlled water risks)

Ten soil samples (derived from trial pits excavated across the Site) have been subjected to leachability testing. In addition, five 'groundwater' samples were collected during the recent ground investigation (recovered from quarry face seepages and also two nearby springs); see Figure 3.3 for sample locations.

A controlled waters risk screening exercise has been performed using both the soil leachability and groundwater quality data in line with the Environment Agency's Remedial Targets Methodology (EA, 2006).

i) Soil leachability data

The soil leachability screening assessment (or Level 1 Remedial Targets Methodology assessment) involves comparing the available soil eluate quality data with relevant target concentrations. This approach assumes that the 'compliance point' (i.e., the point at which target concentrations are not to be exceeded) is equivalent to the pore water within the soil matrix. As such, the Level 1 assessment does not allow for the effect of dilution within either the unsaturated or saturated zones or indeed any wider attenuation processes within the unsaturated zone. The screening results can therefore be considered to offer a conservative assessment of risks to controlled waters.

Given the presence of a Secondary B Aquifer beneath the Site, the adopted target concentrations are drinking water related, including both UK Drinking Water Standards (DWS) and also World Health Organisation (WHO) standards (including those for TPH fractions as per CL:AIRE, 2017). In the absence of DWS or WHO values, Environmental Quality Standards (EQS) have been applied. A listing of adopted target concentrations is presented in Appendix F.

Salient observations taken from the comparison of soil leachability results with the adopted target concentrations are as follows:

- All measured eluate concentrations were below the adopted target concentrations.
- Furthermore, all total and free cyanide, sulphide, cadmium, chromium, mercury, total phenol and speciated PAH concentrations were below the limits of laboratory detection.
- The consistency of the observed eluate quality data (across the 10 analysed samples) adds confidence to the risk assessment outcome.

In summary, the available soil leachability data indicate the likely absence of a significant dissolved phase contaminant source.

ii) Groundwater quality data

The groundwater screening assessment (or Level 2 Remedial Targets Methodology assessment) involves comparing the available groundwater quality data with relevant target concentrations. This approach assumes that the 'compliance point' (i.e., the point at which target concentrations are not to be exceeded) is equivalent to the bedrock groundwater surface directly beneath the Site.

The adopted target concentrations are the same as applied to the soil leachability screening assessment (see Appendix F).

Salient observations taken from the comparison of the available groundwater quality results with the adopted target concentrations are as follows:

- With the exception of a single sulphate result, all observed water quality results were below the adopted drinking water standards. Furthermore, all total cyanide, beryllium, lead, mercury, total phenol, speciated PAH, BTEX, MTBE and speciated TPH results were below the limits of laboratory detection.
- The one elevated sulphate concentration (1450 mg/l) was associated with a sample of perched water collected from trial pit TP03 (on the upper bench level). All other sulphate results (including the quarry face seepage samples and the two spring samples) were below the sulphate drinking water standard (250 mg/l). This suggests that the TP03 sample result is indicative of localised ground conditions, opposed to wider groundwater quality. It is noted that in general, the perched water encountered at TP03 displayed a different inorganic chemistry to the other four samples, including higher sulphate, ammonia, nitrate and nitrite concentrations.
- Two of the water samples contained ammonia concentrations in excess of the corresponding EQS, including the perched water sample from TP03 (0.6 mg/l) and to a lesser degree one of the quarry face samples (0.026 mg/l). It is noted that all measured ammonium concentrations were below the adopted drinking water standard.

On balance, as with the soil leachability data, the available groundwater quality data indicate the absence of any significant dissolved phase contaminants.

The risks posed by the observed water quality results are discussed further in Section 6.

5.4 Preliminary assessment of ground gases

In general, hazardous ground gases may pose a variety of risks to human health and built structures including acute affects such as asphyxiation and explosion, as well as on-going physiological effects (CIRIA, 2007).

The most common hazardous ground gases in the context of risks to built structures and Site occupants are methane and carbon dioxide, radon and hydrocarbon vapours.

Available soil quality data and field observations (including PID soil headspace test results) suggest an absence of an appreciable vapour source within the Made Ground.

UK Health Security Agency data indicates that the Site is located within an area where between 3% and 5% of homes are at or above the radon action level (200 Bq/m^3). Given the nature of the proposed development (raised static caravan units with temporary occupancy) no specific radon protection measures are likely to be required.

Methane and carbon dioxide are common gases generated through the degradation of organic material that can be present in both natural and Made Ground materials.

Whilst the recent site investigation has shown the presence of Made Ground across various parts of the study area (of variable thickness), this material is dominated by inert soils with an apparent absence of any significant quantity of putrescible material (which could give rise to the production of ground gases). This observation is consistent with the modest soil organic matter content of the Made Ground samples (average SOM: 2%). As such, the ground gas potential of the Made Ground encountered at the Site is considered to be low.

It is noted that the gas risks posed to the proposed development will also be a function of the construction / design of the caravan units. Hence, the proposed fabrication of a concrete slab beneath each of the static caravans and also the presence of a ventilation gap beneath the caravan accommodation, will by default provide protection from any localised ground gases.

In addition, based on a review of past and present land uses within the Site locality, no significant off-Site gas sources have been identified which could pose a risk to future Site occupants.

6 CONCEPTUAL SITE MODEL AND RISK ASSESSMENT

6.1 Conceptual model

The recent site investigation was designed to update the prevailing conceptual site model by providing more detailed information relating to the physical ground model and associated plausible contaminant linkages. The updated model is outlined below.

6.1.1 Sources

Potential contaminant sources are summarised as follows:

- Any localised inorganic or organic chemical contamination associated with the Made Ground identified beneath the Site. *Note: no such contamination was identified during the 2021 or 2023 ground investigations.*
- Localised asbestos containing materials (including amosite loose fibrous debris) present within the near surface Made Ground.
- Any localised ground gases associated with the on-Site Made Ground.
- Naturally occurring radon gas.

6.1.2 Pathways

The relevant potential contaminant pathways are summarised as follows:

Pathways relevant to human health

It is possible that future construction workers and/or Site users (visitors and employees) may be exposed to in-situ contaminants via one or more of the following exposure pathways:

- Dermal contact with in-situ soils.
- Accidental ingestion of in-situ soils.
- Inhalation/ingestion of soil dust.
- Ingress of any appreciable organic contamination into water supply pipework and subsequent ingestion.
- Potential disturbance of asbestos containing materials and subsequent inhalation of any airborne fibres.
- Possible ingress of any ground gases into the proposed caravans, potentially leading to toxic effects and/or asphyxiation and explosive risks.
- Inhalation of any radon gases which may enter into the proposed caravan units.

Pathways relevant to controlled waters

Potential contaminant migration pathways associated with local controlled waters receptors include the following:

- Dissolution of any contaminants present within the in-situ Made Ground and subsequent vertical migration of dissolved phase compounds into the underlying bedrock aquifer.
- Entrainment of any surface contaminants within rainfall runoff and subsequent discharge into local surface water features.
- Discharge of any contaminated groundwater into local surface water courses.

6.1.3 Receptors

Based on the prevailing conceptual site model, the following environmental receptors have been identified for further consideration:

- Future construction workers.
- Future Site users (visitors and employees).
- The bedrock Penstrowed Grits Formation (Secondary B Aquifer).
- Local springs and surface water features.

6.2 Risk assessment

A summary of the revised potential contaminant linkages associated with the Site is presented in Table 6.1, alongside a judgement of the risks posed by each linkage.

The contaminant linkages have been assessed using the risk assessment methodology described in CIRIA C552 (2001). As such, risk is considered to be a function of both the probability (likelihood) of contamination occurring at the study site and also the potential severity (consequence) of the environmental impacts associated with any such contamination. The classification system used to define contaminant probability, consequence and risk is described in Appendix G.

Table 6.1 Risk assessment

	Sources	Pathways	Receptors	Consequence	Probability	Risk classification	Comment / *risk mitigation*
1	Potential for localised soil contamination associated with the **Made Ground** identified beneath the Site	Dermal contact, soil ingestion and dust ingestion / inhalation	Construction workers	**Mild**	**Unlikely**	**Very Low Risk**	Risk rating reflects the absence of any observed chemical contamination within the sub surface soils and also the limited duration of any soil exposure during the proposed construction works. *No risk mitigation considered necessary*
2		Dermal contact, soil ingestion, dust ingestion / inhalation	Future Site users and employees Maintenance workers	**Medium**	**Unlikely**	**Low Risk**	Risk ratings reflect the absence of any significant chemical contamination within the sub surface soils / Made Ground during the recent site investigations (i.e., all soil quality data were below corresponding 'public open space' GAC values); in addition, no significant soil vapours were identified as a result of PID soil headspace testing. The relatively consistent composition of the Made Ground encountered across the Site suggests that localised areas of ground contamination are less likely to be present. This position is further supported by the absence of any significant contamination observed during GroundSolve's 2021 site investigation. The risk ratings also reflect the relatively low duration and frequency of Site use by any one individual and the limited potential for both soil and drinking water exposure (i.e., consistent with the planned caravan park land use). The development plans allow for the import of clean material across the middle and lower bench areas (in order to raise ground levels and stabilise the exposed quarry faces). Appropriate topsoil material will also be placed across the Site prior to occupation. The import of these clean cover materials will substantially reduce potential human exposure to any localised contamination associated with the in-situ Made Ground. *No risk mitigation is considered necessary.*
3		Ingress of any localised organic contaminants to drinking water pipework and subsequent human ingestion		**Medium**	**Unlikely**	**Low Risk**	

	Sources	Pathways	Receptors	Consequence	Probability	Risk classification	Comment / *risk mitigation*
4	Potential **soluble contaminant sources** associated with the Made Ground	Vertical and lateral migration of any leachable contaminants towards the underlying bedrock aquifer	Penstrowed Grits Formation (Secondary B Aquifer) Including local springs (40 m to the south and 70 m to the east of the Site)	**Medium**	**Unlikely**	**Low Risk**	Risk rating reflects the apparent absence of a significant source of leachable contamination associated with the Made Ground, as indicated by the available soil quality, soil leachate quality and water quality data (including samples taken from the two down-gradient springs). This is consistent with the conditions of the existing Environmental Permit, which prohibits the storage / treatment of any hazardous substances. On balance, the loading of any dissolved phase contaminants to the underlying aquifer, following Site redevelopment, is anticipated to be low. The groundwater pollution risks are likely to be further constrained by the modest resource potential of the underlying bedrock aquifer, plus the absence of any nearby SPZs. It is however noted that there is one licenced groundwater abstraction and two private groundwater abstractions within a 250 m radius of the Site. *No risk mitigation is considered necessary.*
5		Contaminated surface water run-off discharging to local surface water features Discharge of any contaminated groundwater into local surface water courses (i.e., as baseflow)	Local surface water features (including an ephemeral drainage channel along the western edge of the Site plus a stream c. 135 m to the south-east of the Site)	**Medium**	**Unlikely**	**Low Risk**	Risk rating reflects the apparent absence of a significant source of dissolved phase contamination associated with the Site, as indicated by the available soil quality, soil leachate quality and water quality data. This is consistent with the conditions of the existing Environmental Permit, which prohibits the storage / treatment of any hazardous substances. Following Site development, a drainage management plan will be implemented, likely including the creation of an on-Site balancing pond; this will allow the control of all surface water run-off generated at the Site, post development. The surface water pollution risks are likely to be further constrained by the ephemeral nature of the two identified drainage and the absence of any licensed surface water abstractions within 1 km of the Site. *No risk mitigation is considered necessary.*
6	Localised **asbestos containing materials** (ACM) present within Made Ground, including	Potential disturbance of asbestos containing materials / loose fibres during the proposed construction works	Construction workers	**Medium**	**Low likelihood**	**Moderate / Low Risk**	Risk rating reflects the prevailing conceptual exposure model discussed in Table 5.2, including the following points: - A single sample (from a total of 23 samples) was found to contain ACMs; amosite loose fibrous debris was identified in the affected sample, which was taken from a depth of 0.1 m. - The concentration of asbestos material within the impacted sample was <0.001 % wt/wt (equivalent to trace levels). - No free / loose asbestos fibres were detected within any of the samples.

	Sources	Pathways	Receptors	Consequence	Probability	Risk classification	Comment / *risk mitigation*
	amosite loose fibrous debris	and subsequent inhalation of any airborne fibres					- No visible suspected ACMs were identified at ground surface or within any of the trial excavations during the recent site investigations. - Based on the available information, the widespread presence of ACS is considered unlikely. This is consistent with the conditions of the existing Environmental Permit, which prohibits the storage / treatment of any hazardous substances. - The Made Ground included some granular material which could give rise to fibre release under certain conditions. - The construction works will be of relatively limited duration (thus constraining possible asbestos exposures). Based on the prevailing conceptual site model it is considered that in-situ ACMs could pose a minor health risk to future construction workers, during the groundworks phase of development. It is acknowledged that the risks will be constrained by the apparent scarcity of ACMs and the low anticipated exposure frequencies and durations. *Suitable working methods and PPE will be required in order to manage the risks posed by localised asbestos containing soils during the groundworks phase of development.*
7	Localised **asbestos containing materials** (ACM) present within Made Ground, including amosite loose fibrous debris	Potential disturbance of asbestos containing materials / loose fibres during future recreational / maintenance activities giving rise to possible inhalation of any airborne fibres	Future Site users and employees Maintenance workers	**Medium**	**Unlikely**	**Low Risk**	Risk rating reflects the prevailing conceptual exposure model discussed in Table 5.2, including the following points: - A single sample (from a total of 23 samples) was found to contain ACMs; amosite loose fibrous debris was identified in the affected sample, which was taken from a depth of 0.1 m. - The concentration of asbestos material within the impacted sample was <0.001 % wt/wt (equivalent to trace levels). - No free / loose asbestos fibres were detected within any of the samples. - No visible suspected ACMs were identified at ground surface or within any of the trial excavations during the recent site investigations. - Based on the available information, the widespread presence of ACS is considered unlikely. This is consistent with the conditions of the existing Environmental Permit, which prohibits the storage / treatment of any hazardous substances. - The Made Ground included some granular material which could give rise to fibre release under certain conditions. - Future Site users will have access to areas of proposed soft standing, potentially including areas of exposed soil. However, based on the proposed development (caravan holiday park), the associated land use activities are unlikely to disturb in-situ Made Ground and hence give rise to airborne fibres. Potential exposure frequencies and durations will also be relatively low.

	Sources	Pathways	Receptors	Consequence	Probability	Risk classification	Comment / *risk mitigation*
							- The development plans also allow for the import of clean material across the middle and lower bench areas; this approach will offer protection from any localised contamination within the in-situ Made Ground. - Prior to occupation, appropriate topsoil material will also be placed across the Site; this will further reduce potential human exposure to any localised ACS. Based on the prevailing conceptual site model, future exposures to ACS are considered to be very unlikely. *No specific risk mitigation is considered necessary. Note: all imported materials (including topsoil) will require appropriate characterisation to ensure associated health risks are suitably controlled.*
8	Any localised **ground gases** associated with the Made Ground identified beneath the Site	Lateral and vertical gas migration through any permeable horizons or preferential pathways and potential ingress of methane and/or carbon dioxide into the proposed caravan lodges; resultant asphyxiation or explosion risk and/or toxic effects	Future Site users and employees Built structures (caravans)	**Medium**	**Unlikely**	**Low Risk**	Risk rating reflects the prevailing conceptual site model including the following lines of evidence: - The Made Ground observed across the majority of the Site was dominated by inert soils with an apparent absence of any significant quantity of putrescible material (this is consistent with the modest soil organic matter content recorded within the Made Ground samples). - The ground gas potential of the Made Ground is considered to be low. - The proposed caravan units will be effectively suspended above a concrete slab, further reducing the likelihood of any gas migration into the caravan structures. - Given the likely presence of widespread soft standing between the proposed caravans it is considered likely that any localised ground gases present within the subsurface will vent to atmosphere rather than penetrating the concrete slabs and entering the caravan structures. - The risk rating also reflects the relatively low duration and frequency of Site use by any one individual (i.e., reducing potential toxic exposures). *No specific risk mitigation is considered necessary.*
8	**Radon gas** (naturally occurring)	Migration of any radon gases into the proposed caravan units and subsequent inhalation	Future Site users	**Medium**	**Unlikely**	**Low Risk**	Risk rating reflects the anticipated background radon gas levels (3% to 5% of homes are estimated to be above the Action Level for radon) and also the proposed construction of the caravan units (effectively suspended above a concrete slab with associated high rates of ventilation) and the relatively low duration and frequency of Site use / occupation by any one individual. *No risk mitigation is considered necessary.*
					OVERALL **RISK RATING**	**Low to Moderate / Low Risk**	

7 RISK ASSESSMENT CONCLUSIONS AND RECOMMENDATIONS

7.1 Environmental conclusions

Historical mapping indicates that the northern half of the Site was a hard rock quarry from before 1884; the main quarried area was serviced by a rail line from the late 1800s / early 1900s; this was disbanded in around 1937. The quarried area was extended across the southern half of the Site during the 1970s / 1980s. The lower quarry bench area was developed in the early 2000s, including the erection of multiple commerical units which have been predominantly used for the storage and maintenance of plant and machinery. The lower and middle benches have been used for screening imported waste materials during the last 11 years. The landform evident across the middle and upper benches has been sequentially reprofiled during the last 10 to 15 years. No significant past or present developments have been identified within the area directly surrounding the Site.

Geological mapping indicates the absence of any superficial deposits across the proposed development area. The bedrock geology beneath the entire Site consists of the Penstrowed Grits Formation, which comprises of sandstone and mudstone and is classified as a Secondary B Aquifer.

The recent ground investigation has shown the presence of backfill materials / Made Ground across the upper and middle quarry benches. On the upper bench the Made Ground was observed at thicknesses of between 0.7 m and in excess of 3.3 m, whilst the base of the Made ground was not proven within any of the trial pits excavated on the middle bench (i.e., the Made Ground was locally in excess of 3.35 m thick). The upper 0.3 m to 1.0 m of Made Ground was typified by a light brown to grey gravelly silt with minimal man-made material. The lower-lying Made Ground comprised of mid brown slightly sandy gravelly silt; gravelly clayey silt; grey-brown clayey gravelly silt; and soft brown silty gravelly clay, with limited amounts of man-made material including occasional brick, concrete, clay tile, tarmac, plastic sheeting and hard plastic remains.

Made Ground was absent from the southern and south-eastern parts of the lower bench level, where the encountered material comprised of reworked natural deposits and weathered bedrock. Competent bedrock was encountered within these trial pits at depths of between 0.1 m and 0.8 m bgl.

More extensive fill / Made Ground was observed in the northern and north-eastern parts of the lower bench level. The encountered Made Ground was in excess of 2 m thick and included grey to brown gravelly silt to silty gravel; sandy gravel; and slightly clayey gravelly silt, with some road planings, brick, slate and tile plus some plastic bags, hard plastics, metal wire and wood.

The ground investigation showed the absence of any consistent groundwater within the trial pits (to a maximum excavation depth of 3.35 m bgl). Localised perched water was encountered in a single trial pit (positioned on the upper quarry bench). Two water seepages were observed within the main quarry face. Two known springs are also located beyond the Site boundaries (at lower elevations) to the south and east.

The Site does not lie within a groundwater Source Protection Zone. There are however two licensed groundwater abstractions within 1 km of the Site (including a general farming and domestic abstraction located c. 120 m to the south) and three private water supplies (domestic use) within a 500 m radius of the Site (the nearest of which is located c. 125 m south-west of the Site.

The nearest water feature is an ephemeral drainage channel which is located along the western edge of the Site. A stream is also mapped c. 135 m to the south-east of the Site. Both features were dry during the recent site investigation works. There are no licensed surface water abstractions within 1 km of the Site.

Several areas of ancient woodland are located within 500 m of the Site, the closest of which is situated c. 120 m to the south. It is noted that parts of the Penstrowed Quarry (including the main quarry face) are classified as a Site of Special Scientific Interest (geological classification).

There are no recorded active, recent or historical landfills located within 500 m of the Site. It is noted that treated waste materials have been locally placed within the quarried area over the last c.10 years. The waste materials have been imported onto Site in line with Environmental Permit EPR/GB3632AS, which was issued in September 2012 for the storage of waste pending recycling / reclamation. The Permit does not allow for the import of any hazardous materials. Waste returns provided by the Client include reference to the following waste types received on-Site: soil, soil and stones, concrete, river gravel, rubble, and stone and tarmac.

Laboratory chemical testing of the in-situ Made Ground suggests the absence of any significant soil or water contamination. Amosite loose fibrous debris was identified within one of the 23 samples screened for the presence of ACMs. Quantification testing has shown the asbestos concentration within the affected sample to be < 0.001% wt/wt.

Given the nature of the in-situ Made Ground, the associated ground gas and soil vapour potential is considered to be low.

UK Health Security Agency data indicate that the application Site is in an area where between 3% and 5% of homes are estimated to be at or above the radon Action Level. Based on the proposed development plans, no specific radon protective measures are likely to be necessary within the caravan units.

7.1.1 Risks to construction workers

The health risks posed to future construction workers by the chemical quality of the in-situ soils are considered to be very low, based on both the observed ground conditions and also the limited duration of any soil exposure during the proposed construction works.

The health risks posed by asbestos containing materials present within the Made Ground are considered to be moderate to low given the presence of localised loose fibrous debris. Appropriate mitigation measures / working methods will therefore be required in order to reduce possible inhalation exposure risks during the construction phase of development.

7.1.2 Risks to future Site users

The health risks posed to future Site users from in-situ soil quality are considered to be low. It is noted that the risks posed by asbestos will be constrained by the localised nature of the observed ACMs and the proposed import of both inert cover material and a topsoil layer across the lower and middle quarry benches.

No significant gas risks have been identified in the context of the predominantly inert Made Ground and also the nature of the proposed development, which comprises of raised static caravans situated over dedicated concrete slabs / plinths.

7.1.3 Risks to the water environment

The pollution risks posed to the underlying bedrock aquifer are considered to be low based on the observed soil and water quality data.

7.2 Recommendations

Based on observed ground conditions and the prevailing environmental risk assessments described in this report the following actions are recommended:

- In order to manage the risks posed by localised asbestos in soil, suitable PPE and working methods should be adopted by all construction workers to minimise soil exposure during future development activities (especially across the middle quarry bench where the majority of waste storage and treatment activity has occurred during

the last c. 10 years). In particular, the development Contractor must carefully consider the manner in which all excavation / groundworks are carried out, such that any dust generation / possible fibre release is minimised and associated inhalation exposures are appropriately controlled. The approved working methods should include careful consideration of the sequencing of future groundworks; the choice of excavation techniques; Site security and access; appropriate material management; plus suitable dust / fibre control measures.

- All imported material used to backfill the middle and lower quarry bench levels must be 'clean' and free from contamination. The import of material must be consistent with the requirements of the prevailing environmental permit. Once the imported materials have been placed and the final development platforms created, the exposed Made Ground should be sampled and tested to further demonstrate that these materials are fit for use.
- All imported topsoil should be sourced from a legitimate supplier with supporting evidence demonstrating its physical and chemical suitability. Sampling and testing of the imported soil will be required prior to final placement on-Site.
- A watching brief should be maintained during all future groundworks activities (most notably during / following clearance of the commerical units on the lower bench level) in order to identify any further signs of ground contamination. If any further unexpected contamination is identified, development must be halted on the impacted part of the Site and advice sought from a suitably qualified contaminated land specialist. The Local Planning Authority should also be kept informed of any notable Site observations.
- Subject to the watching brief observations, a further phase of ground investigation may be required following the demolition of the existing commerical structures occupying the lower quarry bench (note: many of these areas were inaccessible during the recent investigation works).

8 REFERENCES

British Standards Institute, 2017. Investigation of potentially contaminated sites – code of practice. BS10175: 2011+A2:2017.

British Standards Institute, 2020. Code of practice for site investigations. BS5930:2015+A1:2020.

CIRIA, 2001. Contaminated land risk assessment. A guide to good practice. C552. CIRIA London. ISBN 0-86017-552 9.

CIRIA, 2007. Assessing risks posed by hazardous ground gases to buildings. C665. CIRIA London. ISBN: 978-0-86017-665-7.

CIRIA, 2014. Asbestos is soil and Made Ground: a guide to understanding and managing the risks. C733. ISBN: 978-0-86017-737-1.

CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies.

Environment Agency, 2006. Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination.

GeoSmart Information, 2023. EnviroSmart Plus. Phase 1 Contaminated Land Assessment. Penstrowed Quarry, Penstrowed, Caersws, SY17 5SG. Report ref: 79011R1.

GroundSolve, 2013. Stabilisation of Penstrowed Quarry, Newtown by Partial Backfilling. Job number 1436.

GroundSolve, 2021. Penstrowed Quarry, Newtown. Proposed Holiday Park. Contamination Assessment. Job number 2402.

LQM/CIEH, 2015. The LQM/CIEH S4ULs for Human Health Risk.

APPENDICES

APPENDIX A

Information supplied by PCC

Gwilym Davies
Pennaeth Eiddo, Cynllunio a Gwarchod y Cyhoedd
Head of Property, Planning & Public Protection

Gwasanaeth Iechyd yr Amgylchedd/
Environmental Health Service
Cyngor Sir Powys County Council
Y Gwalia/ The Gwalia,
Ffordd Ieithon/ Ithon Road,
Llandrindod/ Llandrindod Wells,
Powys LD1 6AA
Ffôn / Tel : 01597 827645
Ffacs / Fax :
E-bost / E-mail : david.jones1@powys.gov.uk
Eich cyf / Your ref :
Ein cyf / Our ref : DJ/WK202305114
Dyddiad / Date : 27th June 2023
Os yn galw gofynnwch am /
If calling please ask for : David Jones

Andy Singleton

Groundfirst Ltd

Email only

Ref: Information request - Penstrowed Quarry, SY17 5SG

You have made the following request for information:

To inform the assessment I would be grateful if you are able to provide any of the following information:

> *Details of any known or suspected pollution incidents associated with past or present site activities.*
> *Any known or suspected contaminated land issues at (or directly adjacent to) the site.*
> *Details of any previous site investigations relating to the site or immediate surrounds.*
> *The presence of any private groundwater abstractions within a 500 m radius of the site.*

Response
There are no current plans to inspect the land however, it is possible that potential contamination may be investigated at a future date in accordance with the Authority's Contaminated Land Strategy.

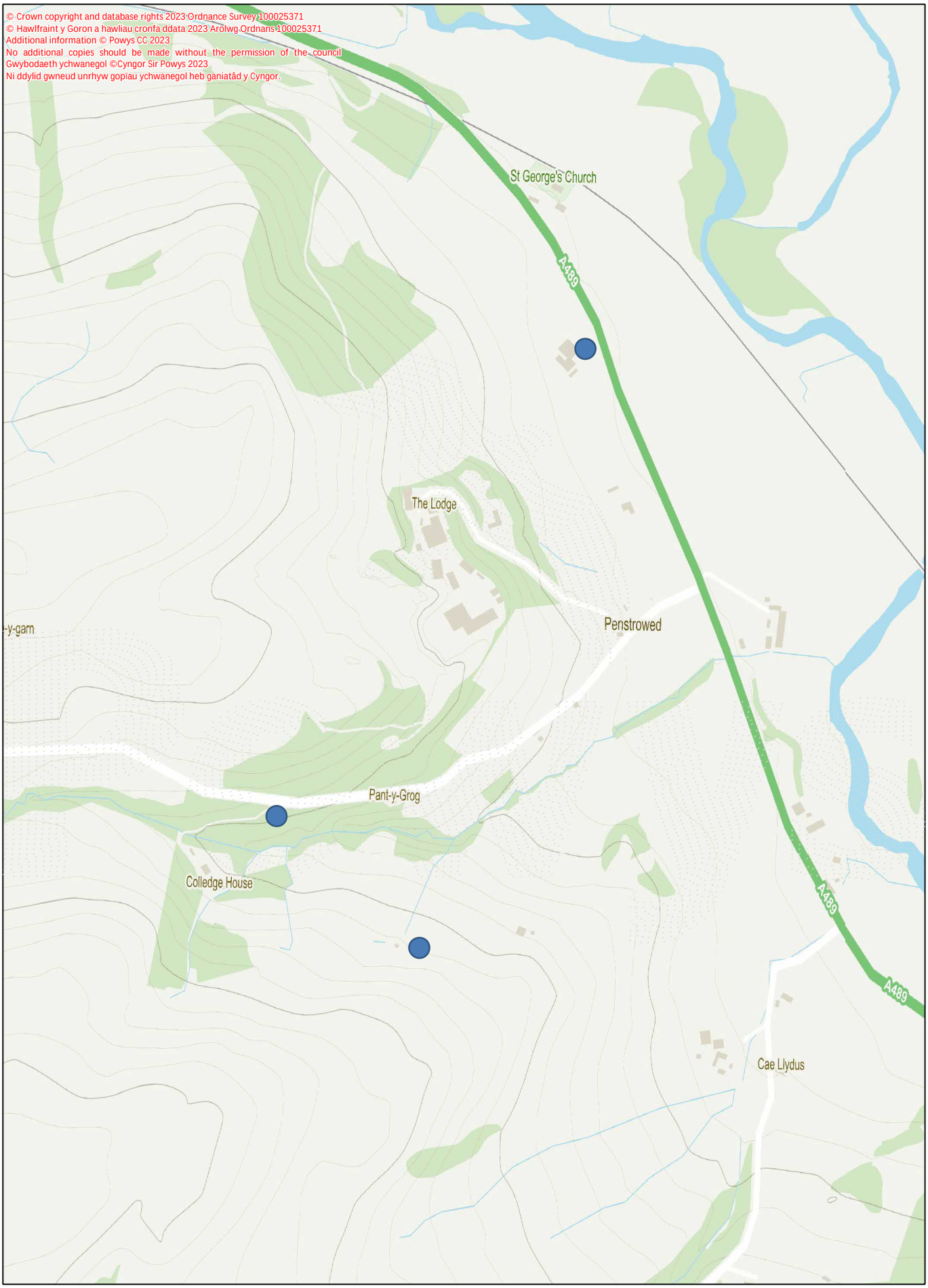
> *Details of any known or suspected pollution incidents associated with past or present site activities.* **The Contaminated Land team has no records of such incidents;**
>
> *Any known or suspected contaminated land issues at (or directly adjacent to) the site.*
> **Response: The subject site shown in your submission to us is identified as potential contaminated land in accordance with the Authority's Contaminated Land Strategy. This is due to its former use as quarrying, transport manufacture and mineral railway;**
>
> *Details of any previous site investigations relating to the site or immediate surrounds.*
> **Response: please see the Powys Planning Portal application no: 22/1966/FUL;**
>
> The presence of any private groundwater abstractions within a 500 m radius of the site.
> **Response: provided on separate page**

The Contaminated Land Team does not hold further information, however It is recommended that you consult our planning department and/or the planning portal to ascertain whether reports exist.

This information is sourced from a third party and has not yet been verified by this Authority. However, it is possible that potential contamination may be investigated at a future date in accordance with the Authority's Contaminated Land Strategy.

Yours sincerely

David Jones
Senior Contaminated Land Officer – Environmental Health



Cyngor Sir Powys County Council

Printed by: dianew5 Date: 23/6/2023

Penstrowed Quarry

PWS within 500m of boundary

According to our records there are 3 private water supplies within 500m of the site boundary as detailed below (see also map attached):-

SUPPLY_REFERENCE	PROPERTY	LOCALITY_1	LOCALITY_2	POSTTOWN	COUNTY	POSTCODE	SOURCE_TYPE	SUPPLYDESC	CLSUPPDESC	SUPPLY_CLASSIFICATION
PW/000003023	Brynhyfryd	Penstrowed	Caersws	Newtown	Powys	SY17 5SG	Ground - Deep Spring	Domestic	Single Supply	Regulation 10
PW/000004397	College House	Penstrowed	Caersws	Newtown	Powys	SY17 5SG	Ground - Well	Domestic	Single Supply	Regulation 10
PW/000004398	Hollybush	Penstrowed	Caersws	Newtown	Powys	SY16 4LB	Ground - Deep Spring	Domestic	Single Supply	Regulation 10

It should be noted that the exact location of the source of the PWS are not known and may be situated some distance away from the properties identified.
*Please note this information is true to the best of our knowledge but may not be conclusive.

APPENDIX B

GroundSolve ground investigation report (2021)

Report Reference: **4316R1**
Report Status: **Final report**

APPENDIX C

Site photographs

Photograph 1

Description: View of upper bench
Date: 07/06/2023
Location: South-western edge of the Site – looking to the north-east

Photograph 2

Description: Exposed bedrock (weathered mudstone)
Date: 07/06/2023
Location: South-western edge of the Site

Photograph 3

Description: Typical ground surface across upper bench level
Date: 07/06/2023
Location: South-western part of the Site

Photograph 4

Description: Ground surface across upper bench level (incl. some metal remains)
Date: 07/06/2023
Location: South-western part of the Site

Photograph 5

Description: Storage of building materials on upper bench
Date: 07/06/2023
Location: South-western edge of the Site – looking to the north-east

Photograph 6

Description: Storage of building materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the north-east

Photograph 7

Description: Storage of building materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the north

Photograph 8

Description: Storage of building materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the east

Photograph 9

Description: Storage of building materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the south-east

Photograph 10

Description: Storage of materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the south-west

Photograph 11 Description: Storage of miscellaneous materials on upper bench
Date: 07/06/2023
Location: South-western part of the Site – looking to the north-west

Photograph 12 Description: Trial pit TP01
Date: 07/06/2023
Location: Upper quarry bench

Photograph 13 Description: Upper soil recovered from trial pit TP01
Date: 07/06/2023
Location: Upper quarry bench

Photograph 14 Description: Lower soil recovered from trial pit TP01
Date: 07/06/2023
Location: Upper quarry bench

Photograph 15 Description: Trial pit TP02
Date: 07/06/2023
Location: Upper quarry bench

Photograph 16 Description: Upper spoil recovered from trial pit TP02
Date: 07/06/2023
Location: Upper quarry bench

Photograph 17 Description: Lower spoil recovered from trial pit TP02
Date: 07/06/2023
Location: Upper quarry bench

Photograph 18 Description: Trial pit TP03 (including perched water)
Date: 07/06/2023
Location: Upper quarry bench

Photograph 19 Description: Trial pit TP04
Date: 07/06/2023
Location: Upper quarry bench

Photograph 20 Description: Trial pit TP05
Date: 07/06/2023
Location: Upper quarry bench

Photograph 21 Description: Trial pit TP06
Date: 07/06/2023
Location: Upper quarry bench

Photograph 22 Description: Trial pit TP07
Date: 07/06/2023
Location: Upper quarry bench

Photograph 23 Description: Trial pit TP08
Date: 07/06/2023
Location: Upper quarry bench

Photograph 24 Description: Trial pit TP09
Date: 07/06/2023
Location: Upper quarry bench

Photograph 25 Description: Spoil recovered from trial pit TP09
Date: 07/06/2023
Location: Upper quarry bench

Photograph 26 Description: Trial pit TP10
Date: 07/06/2023
Location: Upper quarry bench

Photograph 27 Description: Trial pit TP11
Date: 07/06/2023
Location: Upper quarry bench

Photograph 28 Description: Upper spoil recovered from trial pit TP11
Date: 07/06/2023
Location: Upper quarry bench

Photograph 29

Description: View across middle bench
Date: 07/06/2023
Location: Top of quarry face – looking to the north-east

Photograph 30

Description: Area between upper and middle benches
Date: 07/06/2023
Location: Western part of the Site – looking to the east

Photograph 31

Description: North-western end of middle bench
Date: 07/06/2023
Location: Western part of the Site – looking to the south-east

Photograph 32

Description: North-western part of middle bench
Date: 07/06/2023
Location: Western part of the Site – looking to the north

Photograph 33 Description: Central part of middle bench (incl. stockpile of imported material)
Date: 07/06/2023
Location: Central-southern part of the Site – looking to the north-east

Photograph 34 Description: Stockpiled inert material on middle bench
Date: 07/06/2023
Location: Central part of middle bench

Photograph 35 Description: View along middle bench
Date: 07/06/2023
Location: South-eastern end of the bench – looking to the north-west

Photograph 36 Description: Access track along western Site boundary
Date: 07/06/2023
Location: North-western edge of the Site – looking to the south-west

Photograph 37 Description: Trial pit TP12
Date: 07/06/2023
Location: Land between upper and middle quarry benches

Photograph 38 Description: Upper spoil recovered from trial pit TP12
Date: 07/06/2023
Location: Land between upper and middle quarry benches

Photograph 39 Description: Lower spoil recovered from trial pit TP12
Date: 07/06/2023
Location: Land between upper and middle quarry benches

Photograph 40 Description: Trial pit TP13
Date: 07/06/2023
Location: Land between upper and middle quarry benches

Photograph 41 Description: Trial pit TP15
Date: 07/06/2023
Location: Middle quarry bench

Photograph 42 Description: Trial pit TP16
Date: 07/06/2023
Location: Middle quarry bench

Photograph 43 Description: Trial pit TP17
Date: 07/06/2023
Location: Middle quarry bench

Photograph 44 Description: Trial pit TP18
Date: 07/06/2023
Location: Middle quarry bench

Photograph 45 Description: Trial pit TP19
Date: 07/06/2023
Location: Middle quarry bench

Photograph 46 Description: Trial pit TP20
Date: 07/06/2023
Location: Middle quarry bench

Photograph 47 Description: Trial pit TP21
Date: 07/06/2023
Location: Middle quarry bench

Photograph 48 Description: Upper spoil recovered from trial pit TP21
Date: 07/06/2023
Location: Middle quarry bench

Photograph 49 Description: Lower spoil recovered from trial pit TP21
Date: 07/06/2023
Location: Middle quarry bench

Photograph 50 Description: Trial pit TP22
Date: 07/06/2023
Location: Middle quarry bench

Photograph 51 Description: Trial pit TP23
Date: 07/06/2023
Location: Middle quarry bench

Photograph 52 Description: Ephemeral drainage channel (dry)
Date: 07/06/2023
Location: Western Site boundary

Photograph 53 Description: Lay down area (between lower and middle quarry benches)
Date: 07/06/2023
Location: North-western part of the Site – looking to the north

Photograph 54 Description: Trial pit TP24
Date: 07/06/2023
Location: Lay down area in the north-western part of the Site

Photograph 55

Description: Upper Made Ground encountered in trial pit TP24
Date: 07/06/2023
Location: Lay down area in the north-western part of the Site

Photograph 56

Description: Spoil encountered towards base of trial pit TP24
Date: 07/06/2023
Location: Lay down area in the north-western part of the Site

Photograph 57

Description: View across lower quarry bench
Date: 08/06/2023
Location: Eastern edge of the Site – looking to the north-west

Photograph 58

Description: Southern end of main quarry face
Date: 08/06/2023
Location: North-eastern part of the Site – looking to the south

Photograph 59 Description: Main quarry face
Date: 08/06/2023
Location: Lower quarry bench – looking to the north-west

Photograph 60 Description: Seepage from main quarry face (FACE 1 sample location)
Date: 08/06/2023
Location: Western part of quarry face – looking to the west

Photograph 61 Description: Seepage from main quarry face (FACE 2 sample location)
Date: 08/06/2023
Location: Central part of quarry face – looking to the south

Photograph 62 Description: Terraced imported material
Date: 08/06/2023
Location: South-western part of the lower quarry bench

Photograph 63

Description: Commerical unit on lower bench - plant storage and repairs
Date: 08/06/2023
Location: Eastern end of the lower bench

Photograph 64

Description: Commerical unit on lower bench - plant storage and repairs
Date: 08/06/2023
Location: Eastern end of the lower bench

Photograph 65 Description: Commerical unit on lower bench - plant storage and repairs
Date: 08/06/2023
Location: Eastern end of the lower bench

Photograph 66 Description: Commerical unit on lower bench – waste oil burner
Date: 08/06/2023
Location: Eastern end of the lower bench

Photograph 67

Description: Concrete surfacing within commerical unit on lower bench
Date: 08/06/2023
Location: Eastern end of the lower bench

Photograph 68

Description: Vehicle / plant storage and commerical units on lower bench
Date: 08/06/2023
Location: Eastern part of the lower bench

Photograph 69 Description: Vacant commerical unit on lower bench
Date: 08/06/2023
Location: Eastern part of the lower bench

Photograph 70 Description: Empty fuel storage tank and water-filled IBC
Date: 08/06/2023
Location: Eastern part of the lower bench

Photograph 71

Description: Open-sided vehicle store
Date: 08/06/2023
Location: Central part of the lower bench

Photograph 72

Description: Concrete surfaced parking bay
Date: 08/06/2023
Location: Northern edge of the lower bench

Photograph 73 Description: Former diesel storage (integrated within storage container)
Date: 08/06/2023
Location: Central-western part of the lower bench

Photograph 74 Description: Unit containing bunded diesel storage tanks
Date: 08/06/2023
Location: Central-western part of the lower bench

Photograph 75

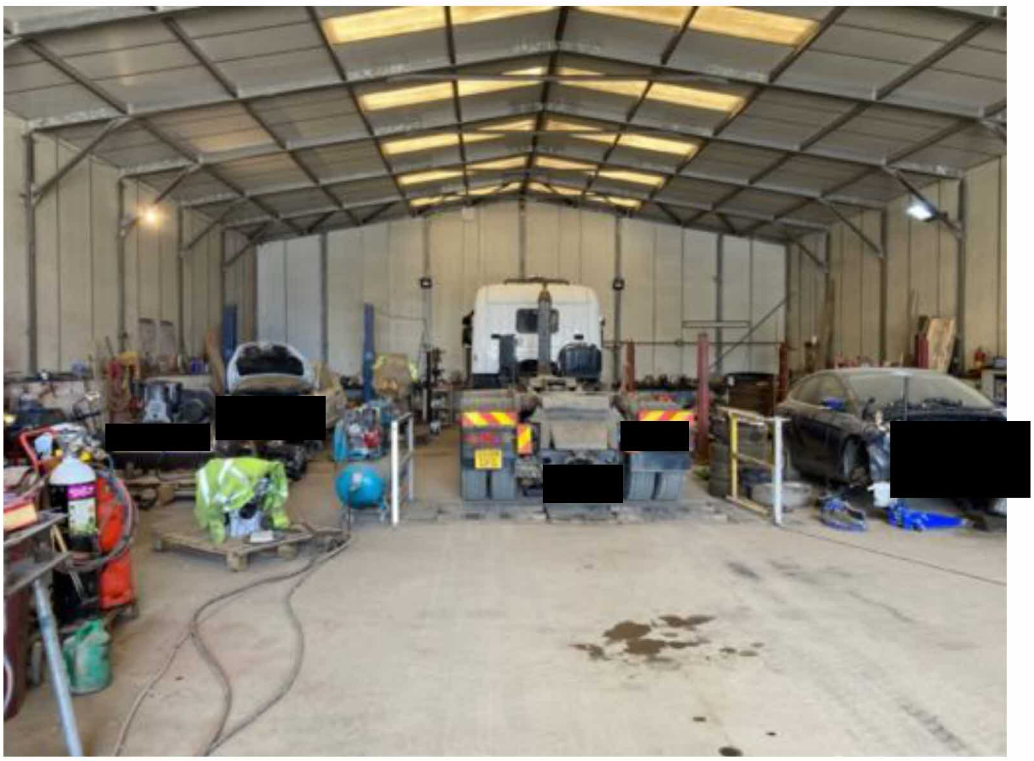
Description: Commerical units
Date: 08/06/2023
Location: Western part of the lower bench

Photograph 76

Description: General storage
Date: 08/06/2023
Location: Western part of the lower bench

Photograph 77

Description: General vehicle and material storage
Date: 08/06/2023
Location: Western part of the lower bench



Photograph 78

Description: Vehicle servicing and repair unit
Date: 08/06/2023
Location: Western part of the lower bench

Photograph 79 Description: Spring chamber
Date: 08/06/2023
Location: Wooed area c. 70 m to the east of the Site

Photograph 80 Description: Drainage channel receiving spring discharge
Date: 08/06/2023
Location: Grassed field c. 100 m to the east of the Site

Photograph 81 Description: Water tank receiving spring discharge
Date: 08/06/2023
Location: Private land c. 40 m to the south of the Site

Photograph 82 Description: Dry river channel
Date: 08/06/2023
Location: Stream channel c. 300 m to the east of the Site

Photograph 83 Description: Trial pit TP25
Date: 08/06/2023
Location: Lower quarry bench

Photograph 84 Description: Natural material recovered from trial pit TP25
Date: 08/06/2023
Location: Lower quarry bench

Photograph 85 Description: Trial pit TP26
Date: 08/06/2023
Location: Lower quarry bench

Photograph 86 Description: Trial pit TP27
Date: 08/06/2023
Location: Lower quarry bench

Photograph 87 Description: Trial pit TP28
Date: 08/06/2023
Location: Lower quarry bench

Photograph 88 Description: Trial pit TP29
Date: 08/06/2023
Location: Lower quarry bench

Photograph 89 Description: Trial pit TP30
Date: 08/06/2023
Location: Lower quarry bench

Photograph 90 Description: Trial pit TP31
Date: 08/06/2023
Location: Lower quarry bench

Photograph 91 Description: Trial pit TP32
Date: 08/06/2023
Location: Lower quarry bench

Photograph 92 Description: Spoil encountered in trial pit TP32
Date: 08/06/2023
Location: Lower quarry bench

Photograph 93 Description: Trial pit TP33
Date: 08/06/2023
Location: Terrace of imported material on lower quarry bench

Photograph 94 Description: Upper imported spoil encountered in trial pit TP33
Date: 08/06/2023
Location: Terrace of imported material on lower quarry bench

Photograph 95 Description: Lower imported spoil encountered in trial pit TP33
Date: 08/06/2023
Location: Terrace of imported material on lower quarry bench

Photograph 96 Description: Trial pit TP34
Date: 08/06/2023
Location: Terrace of imported material on lower quarry bench

Photograph 97 Description: Trial pit TP35
Date: 08/06/2023
Location: Lower quarry bench

Photograph 98 Description: Trial pit TP36
Date: 08/06/2023
Location: Lower quarry bench

Photograph 99 Description: Spoil encountered in trial pit TP36
Date: 08/06/2023
Location: Lower quarry bench

Photograph 100 Description: Trial pit TP37
Date: 08/06/2023
Location: Lower quarry bench – adjacent to former fuel storage unit

Photograph 101 Description: Spoil recovered from trial pit TP37
Date: 08/06/2023
Location: Lower quarry bench – adjacent to former fuel storage unit

Photograph 102 Description: Trial pit TP38
Date: 08/06/2023
Location: Lower quarry bench – adjacent to current fuel storage unit

Photograph 103 Description: Upper spoil recovered from trial pit TP38
Date: 08/06/2023
Location: Lower quarry bench – adjacent to current fuel storage unit

Photograph 104 Description: Lower spoil recovered from trial pit TP38
Date: 08/06/2023
Location: Lower quarry bench – adjacent to current fuel storage unit

Photograph 105 Description: Trial pit TP39
Date: 08/06/2023
Location: Lower quarry bench – adjacent to current fuel storage unit

Photograph 106 Description: Trial pit TP40
Date: 08/06/2023
Location: Lower quarry bench

Photograph 107 Description: Sandy clayey silt encountered at the base of trial pit TP40
Date: 08/06/2023
Location: Lower quarry bench

Photograph 108 Description: Trial pit TP41
Date: 08/06/2023
Location: Lower quarry bench

Photograph 109 Description: Spoil encountered in trial pit TP41
Date: 08/06/2023
Location: Lower quarry bench

Photograph 110 Description: Example of PID headspace testing
Date: 08/06/2023

Photograph 111 Description: Example of PID headspace testing
Date: 08/06/2023

APPENDIX D

Trial pit soil descriptions

TRIAL PIT : TP01

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 0.7 m

NGR: 306626, 290870
SURFACE ELEVATION: c. 250 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1	No PID readings	ENV 0.3 m		Light brown gravelly silt. Gravel is fine to coarse and sub angular to angular. Some sub angular to angular cobbles.	Refusal on rock head. No groundwater encountered. No obvious man-made material.
0.2				Grey gravelly silt. Gravel is fine to coarse and sub angular to angular mudstone.	
0.3					
0.4				Mid brown slightly sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent angular cobbles and boulders.	
0.5					
0.6					
0.7				Termination Depth at: 0.7 m	
0.8					
0.9					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP02

PROJECT NUMBER: 4316	**DATE:** 07/06/2023	**NGR:** 306629, 290895
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 248 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 1.75 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1	No PID readings	ENV 0.2 m		Light brown gravelly silt. Gravel is fine to coarse and sub angular to angular. Some sub angular to angular cobbles.	Refusal on rock head. No groundwater encountered. No obvious man-made material.
0.2					
0.3				Grey gravelly silt. Gravel is fine to coarse and sub angular to angular mudstone.	
0.4					
0.5					
0.6				Mid brown slightly sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent angular cobbles and boulders.	
0.7					
0.8					
0.9					
1					
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8				Termination Depth at: 1.75 m	
1.9					

Disclaimer This log is intended for environmental not geotechnical purposes.

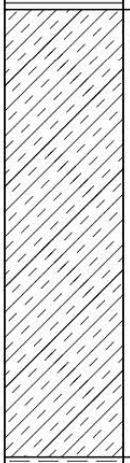
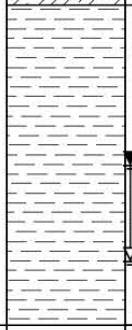
TRIAL PIT : TP03

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 1.7 m

NGR: 306641, 290913
SURFACE ELEVATION: c. 243 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	WATER 0.3 m		Light brown to grey slightly sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Some sub angular to angular cobbles and boulders.	Refusal on rock head. Water seepage during excavation. Rest water level at c. 1.45 m bgl after 60 mins. Minimal man-made material.
0.5 – 1.2				Grey-brown clayey gravelly silt with occasional organic matter. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders	
1.2 – 1.7				Soft brown silty gravelly clay. Gravel is fine to coarse and sub angular to angular. Sub rounded to sub angular cobbles and boulders.	
1.7 – 1.9				Termination Depth at: 1.7 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

Report Reference: **4316R1**
Report Status: **Final report**

TRIAL PIT : TP04

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.3 m

NGR: 306665, 290902
SURFACE ELEVATION: c. 248 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.8	Peak: 0.1 ppm	No samples		Light brown to grey slightly sandy gravelly silt. Gravel is fine to coarse and sub rounded to sub angular including very occasional brick, tile and concrete. Some sub angular to angular cobbles and boulders. Metal bar at 0.8 m.	Refusal on rock head. No groundwater encountered. Very limited man-made material.
1 – 2.3				Soft dark grey to dark brown gravelly silty clay. Gravel is fine to coarse and sub angular to angular. Frequent sub rounded to sub angular cobbles and boulders.	
2.3 – 2.9				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

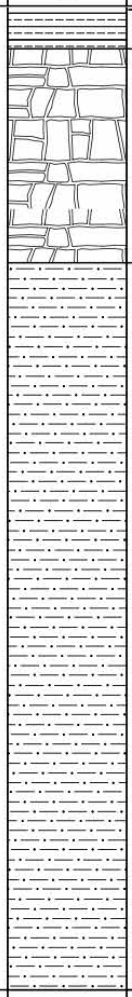
TRIAL PIT : TP05

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.3 m

NGR: 306649, 290880
SURFACE ELEVATION: c. 248 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 2.3	No PID readings	No samples		Light brown gravelly silt. Gravel is fine to coarse and sub angular to angular. Some sub angular to angular cobbles. Grey sub angular to angular mudstone cobbles.	Refusal on rock head. No groundwater encountered. No obvious man-made material.
0.6 – 2.3				Brown slightly sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders.	
2.3				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP06

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.1 m

NGR: 306642, 290845
SURFACE ELEVATION: c. 249 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	No samples		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	Refusal on rock head. No groundwater encountered. Minimal man-made material.
0.5 – 2.1				Brown gravelly clayey silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular cobbles and boulders. Some wood remains.	
2.1				Termination Depth at: 2.1 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP07

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.3 m

NGR: 306667, 290858
SURFACE ELEVATION: c. 250 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1	Peak: 0.4 ppm	ENV 0.15 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular including occasional brick. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material.
0.6				Brown gravelly clayey silt. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and tile. Frequent sub angular cobbles and boulders. Some wood remains and occasional plastics.	
2.3				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP08

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd
DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.9 m
NGR: 306696, 290858
SURFACE ELEVATION: c. 248 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4		No samples		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Very limited man-made material.
0.4 – 0.7				Grey-brown gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	
0.7 – 2.9	Peak: 0.0 ppm			Dark brown to dark grey gravelly clayey silt with some roots and organic matter. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and tarmac. Frequent rounded to sub angular cobbles and boulders.	
2.9 – 3.1				Termination Depth at: 2.9 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP09

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 3.3 m

NGR: 306713, 290870
SURFACE ELEVATION: c. 240 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4	No PID readings			Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Very limited man-made material.
0.4 – 3.3		ENV 0.5 m		Dark brown to dark grey gravelly clayey silt with some roots and organic matter. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent rounded to sub angular cobbles and boulders. Occasional plastic remains.	
3.3 – 3.4				Termination Depth at: 3.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP10

PROJECT NUMBER: 4316	**DATE:** 07/06/2023	**NGR:** 306694, 290886
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 240 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 2.3 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 1.8	No PID readings	No samples		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Very limited man-made material.
1.1 – 1.8				Grey-brown gravelly silt. Gravel is fine to coarse and sub angular. Frequent rounded to sub angular cobbles and boulders.	
1.8 – 2.3				Grey fine to coarse angular mudstone gravel and angular mudstone cobbles.	
2.3				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP11

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.3 m

NGR: 306675, 290882
SURFACE ELEVATION: c. 243 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	ENV 0.5 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered.
0.5 – 1.1				Grey-brown gravelly silt. Gravel is fine to coarse and sub angular including occasional brick and some concrete. Frequent rounded to sub angular cobbles and boulders including frequent reinforced concrete slab remains.	
1.1 – 2.3				Dark brown to dark grey gravelly clayey silt with some roots and organic matter. Gravel is fine to coarse and sub angular to angular including occasional brick and tarmac. Frequent rounded to sub angular cobbles and boulders. Occasional wood remains.	
2.3				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP12

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 3.35 m

NGR: 306668, 290933
SURFACE ELEVATION: c. 237 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	ENV 0.2 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material.
0.5 – 1				Grey sandy gravelly silt. Gravel is fine to coarse and sub angular including occasional brick. Frequent rounded to sub angular cobbles and boulders.	
1 – 3.3				Brown-grey sandy gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and tarmac. Frequent rounded to sub angular cobbles and boulders. Some electrical cable and wire remains.	
3.4				Termination Depth at: 3.35 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP13

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.6 m

NGR: 306684, 290925
SURFACE ELEVATION: c. 236 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

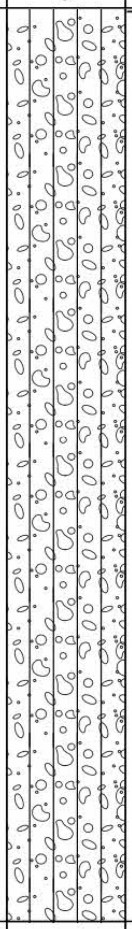
Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	ENV 0.6 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders.	Very small amount of water in base of trial pit after 90 mins. Limited man-made material.
0.5 – 2.6				Brown-grey sandy gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick and concrete plus some whole bricks. Frequent rounded to sub angular cobbles and boulders. Some plastic sheeting.	
2.6				Termination Depth at: 2.6 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP14

PROJECT NUMBER: 4316	**DATE:** 07/06/2023	**NGR:** 306702, 290911
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 236 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 1.0 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1	No PID readings	No samples		Brown silty sand and gravel. sand is fine. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders. One fragment of concrete slab with rebar.	Trial pit excavated into the slope between the upper and lower quarry benches. No groundwater encountered. Limited man-made material.
1.1 1.2 1.3				Termination Depth at: 1.0 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP15

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 3.1 m

NGR: 306786, 290876
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.3				Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material.
0.4		ENV 0.4 m		Brown slightly sandy gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick and tarmac. Frequent rounded to angular cobbles and boulders. Occasional plastic sheeting.	
0.5 – 2	Peak: 0.1 ppm				
2.1 – 3					
3.1				Termination Depth at: 3.1 m	
3.2 – 3.4					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP16

PROJECT NUMBER: 4316	**DATE:** 07/06/2023	**NGR:** 306756, 290903
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 230 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 3.1 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4	No PID readings	ENV 0.2 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material.
0.4 – 3.1		ENV 2.5 m		Brown to orange-brown slightly sandy gravelly silt with some organic remains. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete, tarmac and clay tile. Frequent rounded to angular cobbles and boulders. Occasional plastic pipe remains.	
3.1				Termination Depth at: 3.1 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

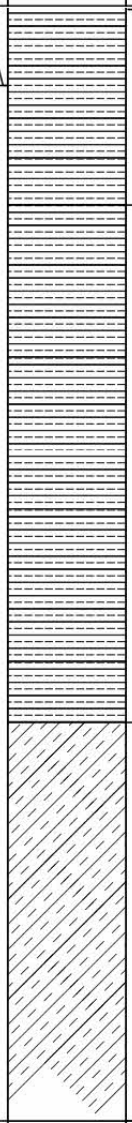
TRIAL PIT : TP17

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.8 m

NGR: 306731, 290930
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 2.7	No PID readings	ENV 0.2 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub rounded to sub angular cobbles and boulders.	No groundwater encountered. Minimal man-made material.
				Brown slightly gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular. Frequent rounded to angular cobbles and boulders.	
				Grey-brown gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick and clay tile. Frequent sub rounded to angular cobbles and boulders. Occasional timber.	
2.8 – 3.1				Termination Depth at: 2.8 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP18

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.9 m

NGR: 306713, 290948
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.3	No PID readings	ENV 0.3 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub rounded to sub angular cobbles and boulders.	No groundwater encountered. Limited man-made material.
0.4 – 0.8				Brown slightly gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular. Frequent rounded to angular cobbles and boulders.	
0.9 – 2.8				Grey-brown gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick and concrete. Frequent sub rounded to angular cobbles and boulders.	
2.9 – 3.1				Termination Depth at: 2.9 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP19

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.6 m

NGR: 306690, 290959
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings	ENV 1.5 m		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional concrete. Frequent sub rounded to sub angular cobbles and boulders. Occasional hard plastic remains.	No groundwater encountered.
0.5 – 2.6				Grey-brown gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and tarmac. Frequent sub rounded to angular cobbles and boulders. Some wood and metal wire.	
2.6				Termination Depth at: 2.6 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP20

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd
DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.7 m
NGR: 306690, 290959
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.6	No PID readings	ENV 0.1 m		Brown slightly sandy gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional tarmac. Frequent sub rounded to sub angular cobbles and boulders.	No groundwater encountered. Limited man made material.
0.6 – 2.7				Grey-brown gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional concrete and tarmac. Frequent sub rounded to angular cobbles and boulders.	
2.7 – 3.1				Termination Depth at: 2.7 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

Report Reference: **4316R1**
Report Status: **Final report**

TRIAL PIT : TP21

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.4 m

NGR: 306659, 290954
SURFACE ELEVATION: c. 230 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4	No PID readings	No samples		Light brown to grey gravelly silt. Gravel is fine to coarse and sub angular to angular including very occasional brick. Frequent sub rounded to sub angular cobbles and boulders. Occasional hard plastic remains.	No groundwater encountered.
0.4 – 2.4				Grey-brown gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and tarmac. Frequent sub rounded to angular cobbles and boulders. Some wood and metal wire.	
2.4				Termination Depth at: 2.4 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

Groundfirst

Reliable ground quality advice

TRIAL PIT : TP22

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.2 m

NGR: 306721, 290998
SURFACE ELEVATION: c. 228 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4				Light brown slightly sandy gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular. Frequent sub rounded to angular cobbles and boulders.	Refusal on rock head. No groundwater encountered.
0.5		ENV 0.5 m			
0.5 – 2.2	Peak: 0.0 ppm			Grey-brown slightly sandy gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick, concrete and slate. Frequent sub rounded to angular cobbles and boulders. Occasional wood and metal remains.	
2.2				Termination Depth at: 2.2 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

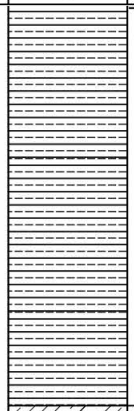
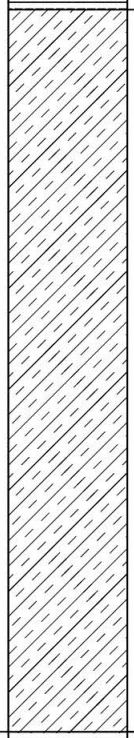
TRIAL PIT : TP23

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 07/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.8 m

NGR: 306687, 290998
SURFACE ELEVATION: c. 228 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.9	No PID readings	No samples		Light brown slightly sandy gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent sub rounded to sub angular cobbles and boulders.	No groundwater encountered. Limited man made material.
1 – 2.8				Grey-brown slightly sandy gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including occasional concrete (incl rebar) and brick. Frequent sub rounded to angular cobbles and boulders.	
2.8 – 3.1				Termination Depth at: 2.8 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP24

PROJECT NUMBER: 4316	**DATE:** 07/06/2023	**NGR:** 306724, 291086
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 220 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 2.2 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.3	No PID readings	No samples		Light brown to grey silty gravel. Gravel is fine to coarse and sub angular to angular (HARDCORE).	No groundwater encountered. Minimal man-made material.
0.3 – 1.1				Brown slightly sandy slightly gravelly silt. Sand is fine. Gravel is fine to coarse and sub angular to angular. Frequent rounded to angular cobbles and boulders.	
1.1 – 2.2				Brown gravelly clayey silt. Sand is fine. Gravel is fine to coarse and sub angular to angular including very occasional brick and concrete. Frequent sub rounded to angular cobbles and boulders.	
2.2 – 2.5				Termination Depth at: 2.2 m	

Groundfirst

Reliable ground quality advice

TRIAL PIT : TP25

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306784, 290971
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 215 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.8 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

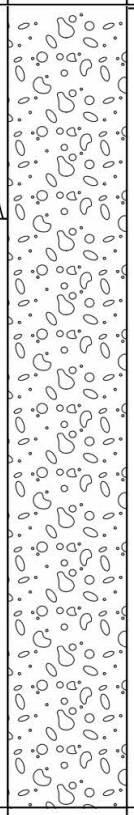
Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8	No PID readings	No samples		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. No man-made material encountered.
0.9 1 1.1				Termination Depth at: 0.8 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP26

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306788, 290949
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 215 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.75 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1	Peak: 0.0 ppm	ENV 0.2		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular including very occasional brick close to ground surface. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. Minimal man-made material encountered.
0.2					
0.3					
0.4					
0.5					
0.6					
0.7					
0.8				Termination Depth at: 0.75 m	
0.9					
1					
1.1					

Disclaimer This log is intended for environmental not geotechnical purposes.

Groundfirst

Reliable ground quality advice

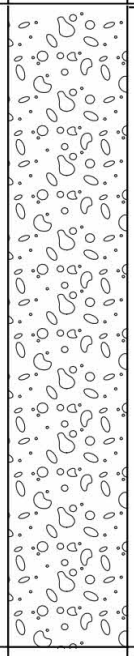
TRIAL PIT : TP27

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 0.4 m

NGR: 306817, 290934
SURFACE ELEVATION: c. 215 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3 0.4	No PID readings	No samples		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular including very occasional brick close to ground surface. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. Minimal man-made material encountered.
0.5 0.6 0.7				Termination Depth at: 0.4 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

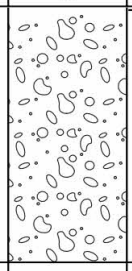
Groundfirst

Reliable ground quality advice

TRIAL PIT : TP28

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306824, 290908
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 215 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.1 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

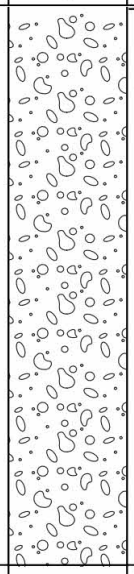
Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
	No PID readings	No samples		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. No man-made material encountered.
0.1				Termination Depth at: 0.1 m	
0.2					
0.3					
0.4					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP29

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306854, 290930
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 214 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.35 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

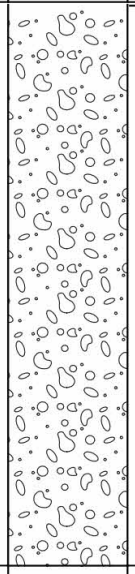
Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3	No PID readings	No samples		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular including very occasional brick and clay tile remains close to ground surface. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. Minimal man-made material encountered.
0.4 0.5 0.6 0.7				Termination Depth at: 0.35 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP30

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306872, 290961
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 214 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.35 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3	No PID readings	No samples		Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. No man-made material encountered.
0.4 0.5 0.6 0.7				Termination Depth at: 0.35 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

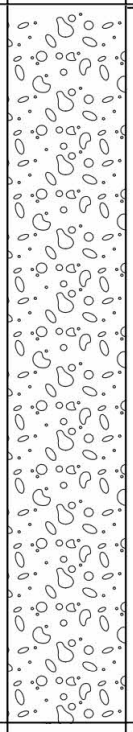
TRIAL PIT : TP31

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 0.45 m

NGR: 306839, 290973
SURFACE ELEVATION: c. 214 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 0.2 0.3 0.4	No PID readings	No samples		Grey to dark grey silty gravel. Gravel is fine to coarse and sub angular to angular. Abundant sub angular to angular mudstone cobbles and boulders.	Refusal on bedrock. No groundwater encountered. No man-made material encountered.
0.5 0.6 0.7				Termination Depth at: 0.45 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP32

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306815, 290977
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 214 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 1.0 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1	No PID readings	ENV 0.4 m		Dark grey to black silty sand and gravel. Sand is fine. Gravel is fine to coarse and sub angular to angular including suspected road planings.	Refusal on bedrock. No groundwater encountered. Limited man-made material encountered.
0.3				Dark grey to brown slightly gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick and tile remains. Some sub angular to angular cobbles and boulders.	
0.6				Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
1				Termination Depth at: 1.0 m	
1.1					

Disclaimer This log is intended for environmental not geotechnical purposes.

Groundfirst

Reliable ground quality advice

TRIAL PIT : TP33

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 1.3 m

NGR: 306799, 290986
SURFACE ELEVATION: c. 217 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.8	No PID readings	ENV 0.8 m		Grey to brown gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent sub angular to angular cobbles and boulders.	Refusal on bedrock. Slight water seepage towards base of trial pit. Limited man-made material encountered.
1 – 1.3				Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
1.3 – 1.4				Termination Depth at: 1.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP34

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.3 m

NGR: 306786, 290995
SURFACE ELEVATION: c. 218 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

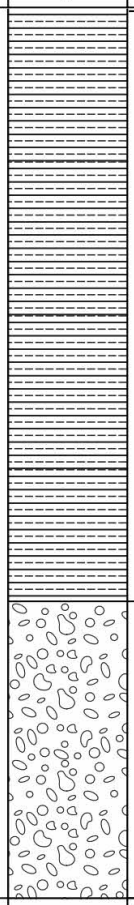
Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.8				Light brown gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional hard plastics. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material encountered.
0.8 – 2.3	Max: 0.2 ppm	ENV 1.5 m		Brown slightly clayey gravelly silt with organic remains. Gravel is fine to coarse and sub angular to angular including occasional tarmac. Frequent sub angular to angular cobbles and boulders.	
2.3 – 2.4				Termination Depth at: 2.3 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP35

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306839, 291000
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 214 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 0.9 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.9	No PID readings	No samples		Grey silty gravel. Gravel is fine to coarse and sub angular to angular including very occasional brick. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material encountered.
0.6 – 0.9				Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
0.9 – 1.2				Termination Depth at: 0.9 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP36

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.5 m

NGR: 306859, 291012
SURFACE ELEVATION: c. 213 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.5	No PID readings			Grey to brown gravelly silt to silty gravel. Gravel is fine to coarse and sub angular to angular including some road planings. Some sub angular to angular cobbles and boulders.	No groundwater encountered.
0.5 – 0.6				Dark grey to black sandy gravel. Gravel is fine to medium and sub angular including road planings.	
0.6 – 2.4		ENV 2.3 m		Brown to grey-brown slightly clayey gravelly silt. Gravel is fine to coarse and sub angular to angular including occasional brick and tile remains. some sub angular to angular cobbles and boulders. Occasional plastic sheeting, hard plastics and wood.	
2.4 – 2.5				Grey to grey-brown silty gravel. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
2.5				Termination Depth at: 2.5 m	

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP37

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.55 m

NGR: 306805, 291031
SURFACE ELEVATION: c. 213 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1				Concrete.	No groundwater encountered.
0.2				Grey to grey-brown slightly gravelly silt to silty gravel. Gravel is fine to coarse and sub angular to angular including some brick, slate and tile. Frequent sub angular to angular mudstone cobbles and boulders. Some plastic bags, metal wire and wood.	
0.3	Peak: 0.0 ppm				
0.4					
0.5					
0.6					
0.7					
0.8					
0.9					
1	Peak: 0.0 ppm				
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2		ENV 2.0 m			
2.1					
2.2					
2.3					
2.4					
2.5					
2.6				Termination Depth at: 2.55 m	
2.7					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP38

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 2.6 m

NGR: 306802, 291043
SURFACE ELEVATION: c. 213 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1				Concrete.	No groundwater encountered.
0.2				Grey sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	Limited man-made material.
0.3					
0.4					
0.5					
0.6					
0.7				Grey to dark brown slightly gravelly silt to silty gravel. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent sub angular to angular mudstone cobbles and boulders. Some plastic and wood.	
0.8					
0.9					
1	Peak: 0.0 ppm	ENV 1.0 m			
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2					
2.1					
2.2					
2.3					
2.4					
2.5					
2.6				Termination Depth at: 2.6 m	
2.7					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP39

PROJECT NUMBER: 4316
PROJECT NAME: Penstrowed Quarry
CLIENT: GF Grigg Construction Ltd

DATE: 08/06/2023
CONTRACTOR: GF Grigg Construction Ltd
EQUIPMENT: 13 tonne excavator
DEPTH: 1.0 m

NGR: 306792, 291048
SURFACE ELEVATION: c. 213 m
LOGGED BY: AJS

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0				Concrete.	No groundwater encountered. Limited man-made material.
0.1 – 0.5	Peak: 0.1 ppm	ENV 0.3 m		Grey sandy gravelly silt. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
0.5 – 1				Grey to dark brown slightly gravelly silt to silty gravel. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent sub angular to angular mudstone cobbles and boulders.	
1				Termination Depth at: 1.0 m	
1.1 – 1.4					

Disclaimer This log is intended for environmental not geotechnical purposes.

Report Reference: **4316R1**
Report Status: **Final report**

TRIAL PIT : TP40

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306777, 291050
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 213 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 1.2 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.4	No PID readings	No samples		Grey-brown sandy silt and gravel. Gravel is fine to coarse and sub angular to angular including occasional brick. Frequent sub angular to angular cobbles and boulders.	No groundwater encountered. Limited man-made material encountered.
0.5 – 1.2				Orange-brown sandy gravelly clayey silt. Gravel is fine to coarse and sub angular to angular. Some sub angular to angular cobbles and boulders.	
1.2				Termination Depth at: 1.2 m	
1.3 – 1.4					

Disclaimer This log is intended for environmental not geotechnical purposes.

TRIAL PIT : TP41

PROJECT NUMBER: 4316	**DATE:** 08/06/2023	**NGR:** 306801, 291063
PROJECT NAME: Penstrowed Quarry	**CONTRACTOR:** GF Grigg Construction Ltd	**SURFACE ELEVATION:** c. 213 m
CLIENT: GF Grigg Construction Ltd	**EQUIPMENT:** 13 tonne excavator	**LOGGED BY:** AJS
	DEPTH: 1.2 m	

COMMENTS: Trial pitting performed in support of a planning application for the construction of a caravan park

Depth (m)	PID	Samples	Graphic Log	Material Description	Additional Observations
0.1 – 0.3	No PID readings	ENV 0.4 m		Dark grey to black silty sand and gravel. Sand is fine. Gravel is fine to coarse and sub angular to angular including suspected road planings.	No groundwater encountered.
0.4 – 1.1				Dark grey sandy silty gravel. Gravel is fine to coarse and sub angular to angular. Frequent sub angular to angular mudstone cobbles and boulders.	
1.2				Termination Depth at: 1.2 m	
1.3 – 1.4					

Disclaimer This log is intended for environmental not geotechnical purposes.

APPENDIX E

Laboratory results

Appendix E.1: Laboratory test certificates

Andy Singleton
Ground first
26 Victoria Street
Castlefields
Shrewsbury
Shropshire
SY1 2HS

e: andy@groundfirst.com

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

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

Analytical Report Number : 23-38567

Replaces Analytical Report Number: 23-38567, issue no. 1
Additional analysis undertaken.
Asbestos Screen added to 2708847, 2708851 & 2708852 as per client's request

Project / Site name:	Penstrowed Quarry	**Samples received on:**	12/06/2023
Your job number:	4316	**Samples instructed on/ Analysis started on:**	12/06/2023
Your order number:		**Analysis completed by:**	27/06/2023
Report Issue Number:	2	**Report issued on:**	04/07/2023
Samples Analysed:	3 leachate samples - 8 soil samples		

Signed [redacted]

Dominika Warjan
Reporting Specialist
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

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

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: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708847	2708848	2708849	2708850	2708851
Sample Reference				TP01	TP02	TP07	TP09	TP11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.20	0.15	0.50	0.50
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023
Time Taken				0950	0940	1030	1115	1230
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	4.2	7.2	13	14	7.4
Total mass of sample received	kg	0.001	NONE	1	0.9	0.9	0.9	1

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JBH	SFS	SFS	SFS	JBH

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.1	6.3	7	7.3	8.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	< 5.0	-	-	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	5800	-	-	-	810
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.9	-	-	-	0.12
Sulphide	mg/kg	1	MCERTS	2.8	-	-	-	1.4
Organic Matter (automated)	%	0.1	MCERTS	0.8	-	-	-	1.9
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	-	0.006	0.03	0.011	-

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	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.09	< 0.05	0.51
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.06	< 0.05	0.31
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.5	0.12	4.1
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.16	< 0.05	1.6
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.5	0.41	9.4
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.4	0.4	8.2
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.71	0.24	3.6
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.78	0.27	3.5
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	1	0.39	4.2
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	0.44	0.16	1.7
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.91	0.32	3.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.51	0.19	1.9
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.12	< 0.05	0.44
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.59	0.21	2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	8.74	2.71	45.3

Analytical Report Number: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708847	2708848	2708849	2708850	2708851
Sample Reference				TP01	TP02	TP07	TP09	TP11
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.20	0.15	0.50	0.50
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023
Time Taken				0950	0940	1030	1115	1230
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	26	18	11	12	11
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.2	0.79	0.94	-
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.8	0.5	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	-	29	30	32	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	29	30	33	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	44	43	35	99	63
Lead (aqua regia extractable)	mg/kg	1	MCERTS	23	30	38	31	34
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	39	43	36	41	35
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	31	34	35	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	59	84	120	110	120
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-
Toluene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-
o-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	-	< 0.1	< 0.1	< 0.1	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	11	< 10	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	86	< 10	-

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

Analytical Report Number: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708852	2708853	2708854
Sample Reference				TP12	TP13	TP15
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.60	0.40
Date Sampled				07/06/2023	07/06/2023	07/06/2023
Time Taken				1305	1400	1430
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content	%	0.1	NONE	< 0.1	31	< 0.1
Moisture Content	%	0.01	NONE	8.9	9.1	11
Total mass of sample received	kg	0.001	NONE	1	0.9	0.9

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	JBH	SFS	SFS

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.7	7.8	7.7
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	< 5.0	-	-
Total Sulphate as SO4	mg/kg	50	MCERTS	580	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.14	-	-
Sulphide	mg/kg	1	MCERTS	1	-	-
Organic Matter (automated)	%	0.1	MCERTS	1	-	-
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	-	0.0091	0.0069

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	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.18	0.19
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.07
Fluoranthene	mg/kg	0.05	MCERTS	0.07	0.28	0.41
Pyrene	mg/kg	0.05	MCERTS	0.07	0.26	0.37
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.15	0.21
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.15	0.21
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.18	0.25
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.08	0.15
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.15	0.22
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.09	0.12
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.09	0.14

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	1.61	2.34

Analytical Report Number: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708852	2708853	2708854
Sample Reference				TP12	TP13	TP15
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.60	0.40
Date Sampled				07/06/2023	07/06/2023	07/06/2023
Time Taken				1305	1400	1430
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	21	12
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.89	0.93
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.4	< 0.2
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 (III)	mg/kg	1	NONE	-	24	29
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	25	29
Copper (aqua regia extractable)	mg/kg	1	MCERTS	36	74	38
Lead (aqua regia extractable)	mg/kg	1	MCERTS	30	38	27
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	47	33	42
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	25	28
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	110	120	95
Monoaromatics & Oxygenates						
Benzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0
Petroleum Hydrocarbons						
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	-	< 0.1	< 0.1
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	< 10
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	< 10

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

Analytical Report Number: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708855	2708856	2708857
Sample Reference				TP07	TP09	TP13
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				0.15	0.50	0.60
Date Sampled				07/06/2023	07/06/2023	07/06/2023
Time Taken				1030	1115	1400
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status			
General Inorganics						
pH (automated)	pH Units	N/A	ISO 17025	7.1	7	7.1
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10
Thiocyanate as SCN	µg/l	200	ISO 17025	< 200	< 200	< 200
Sulphate as SO_4	µg/l	100	ISO 17025	6910	10100	4770
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0
Total Phenols						
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10
Speciated PAHs						
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01
Total PAH						
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2
Heavy Metals / Metalloids						
Arsenic (dissolved)	µg/l	1	ISO 17025	3.9	< 1.0	< 1.0
Boron (dissolved)	µg/l	10	ISO 17025	11	< 10	11
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.1	< 0.4	1.7
Copper (dissolved)	µg/l	0.7	ISO 17025	24	13	21
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	1.6
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.3	0.5	1.8
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	15	8.6	15

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

Analytical Report Number : 23-38567
Project / Site name: Penstrowed Quarry

* 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 *
2708847	TP01	None Supplied	0.3	Brown sand with gravel.
2708848	TP02	None Supplied	0.2	Brown sand with gravel.
2708849	TP07	None Supplied	0.15	Brown sand with gravel.
2708850	TP09	None Supplied	0.5	Brown clay with vegetation.
2708851	TP11	None Supplied	0.5	Brown sand with gravel.
2708852	TP12	None Supplied	0.2	Brown sand with gravel.
2708853	TP13	None Supplied	0.6	Brown clay with gravel and stones.
2708854	TP15	None Supplied	0.4	Brown clay with gravel.

Analytical Report Number : 23-38567
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
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	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
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 (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	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

Analytical Report Number : 23-38567
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Thiocyanate in leachate	Determination of thiocyanate in water by discreet analyser (colorimetry).	In house method based on SMWW 4500-CN-M.	L082-PL	W	ISO 17025
Thiocyanate in soil	Determination of thiocyanate in soil by extraction in water followed by acidification followed by addition of ferric nitrate followed by discrete analyser (spectrophotometer).	In-house method	L082-PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
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.	L019-UK/PL	D	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
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 (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS

Analytical Report Number : 23-38567
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS

Analytical Report Number : 23-38567
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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

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 30oC.
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.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Andy Singleton
Ground first
26 Victoria Street
Castlefields
Shrewsbury
Shropshire
SY1 2HS

e: andy@groundfirst.com

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

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

Analytical Report Number : 23-38597

Replaces Analytical Report Number: 23-38597, issue no. 1
Additional analysis undertaken.
Asbestos Screen added to samples 2709108, 2709111 & 2709113 and Asbestos Quantification added to sample 2709112 as per client's request

Project / Site name:	Penstrowed Quarry	**Samples received on:**	12/06/2023
Your job number:	4316	**Samples instructed on/ Analysis started on:**	12/06/2023
Your order number:		**Analysis completed by:**	27/06/2023
Report Issue Number:	2	**Report issued on:**	05/07/2023
Samples Analysed:	2 leachate samples - 7 soil samples		

Signe [redacted]
Dominika Warjan
Reporting Specialist
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

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

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: 23-38597
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709107	2709108	2709109	2709110	2709111
Sample Reference				TP16	TP16	TP17	TP18	TP19
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	2.50	0.20	0.30	1.50
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023
Time Taken				1500	1510	1550	1615	1645
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	32	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	4.9	12	8	6.7	14
Total mass of sample received	kg	0.001	NONE	0.9	1	0.9	0.9	1
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	ASE	ASE	ASE	ASE	ASE
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.2	8.4	7.5	7.9	7.9
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0	-	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	-	< 5.0	-	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	840	-	-	420
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.19	-	-	0.05
Sulphide	mg/kg	1	MCERTS	-	4.9	-	-	1.5
Organic Matter (automated)	%	0.1	MCERTS	-	1	-	-	2.1
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.015	-	0.0037	0.0074	-
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	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.11	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.4	0.25	< 0.05	< 0.05	0.32
Anthracene	mg/kg	0.05	MCERTS	0.53	0.11	< 0.05	< 0.05	0.12
Fluoranthene	mg/kg	0.05	MCERTS	4.3	0.5	< 0.05	0.2	0.75
Pyrene	mg/kg	0.05	MCERTS	4.1	0.44	< 0.05	0.19	0.75
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2	0.19	< 0.05	0.1	0.33
Chrysene	mg/kg	0.05	MCERTS	2.3	0.22	< 0.05	0.15	0.43
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	3.2	0.26	< 0.05	0.16	0.56
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.2	0.13	< 0.05	0.11	0.25
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.5	0.23	< 0.05	0.17	0.42
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.3	0.11	< 0.05	0.09	0.22
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.37	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.6	0.14	< 0.05	0.11	0.27
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	25	2.58	< 0.80	1.28	4.42

Analytical Report Number: 23-38597
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709107	2709108	2709109	2709110	2709111
Sample Reference				TP16	TP16	TP17	TP18	TP19
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	2.50	0.20	0.30	1.50
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023
Time Taken				1500	1510	1550	1615	1645
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	12	12	12	14
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.93	-	1.1	0.94	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	< 0.2	< 0.2	< 0.2	0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	32	-	35	31	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	31	35	31	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	42	42	41	43	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	57	30	34	30	40
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	37	47	54	45	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	39	-	32	30	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	140	130	120	120	120
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	MCERTS	< 5.0	-	< 5.0	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	-	< 5.0	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	< 5.0	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	< 5.0	-	< 5.0	< 5.0	-
o-xylene	µg/kg	5	MCERTS	< 5.0	-	< 5.0	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-	< 5.0	< 5.0	-
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	-	< 0.1	< 0.1	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	11	-	< 10	< 10	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	43	-	< 10	< 10	-

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

Analytical Report Number: 23-38597
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709112	2709113
Sample Reference				TP20	TP26
Sample Number				None Supplied	None Supplied
Depth (m)				0.10	0.20
Date Sampled				07/06/2023	08/06/2023
Time Taken				1715	1000
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	38	50
Moisture Content	%	0.01	NONE	4.3	1.3
Total mass of sample received	kg	0.001	NONE	0.9	1

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Amosite	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	< 0.001	-
Asbestos Quantification Total	%	0.001	ISO 17025	< 0.001	-
Asbestos Analyst ID	N/A	N/A	N/A	ASE	ASE

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	8.3
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	1800
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.61
Sulphide	mg/kg	1	MCERTS	-	19
Organic Matter (automated)	%	0.1	MCERTS	-	1.4
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.01	-

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.22	0.31
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.15
Fluoranthene	mg/kg	0.05	MCERTS	0.68	0.56
Pyrene	mg/kg	0.05	MCERTS	0.63	0.57
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.32	0.31
Chrysene	mg/kg	0.05	MCERTS	0.39	0.37
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.47	0.4
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.27	0.19
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.42	0.28
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.13
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.18

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	3.4	3.45

Analytical Report Number: 23-38597
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709112	2709113
Sample Reference				TP20	TP26
Sample Number				None Supplied	None Supplied
Depth (m)				0.10	0.20
Date Sampled				07/06/2023	08/06/2023
Time Taken				1715	1000
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Heavy Metals / Metalloids					
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	14
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.66	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	22	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	59	35
Lead (aqua regia extractable)	mg/kg	1	MCERTS	25	18
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	39
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	23	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	100	68
Monoaromatics & Oxygenates					
Benzene	µg/kg	5	MCERTS	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	< 5.0	-
o-xylene	µg/kg	5	MCERTS	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-
Petroleum Hydrocarbons					
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	-

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

Analytical Report Number: 23-38597
Project / Site name: Penstrowed Quarry
Your Order No:

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2709112	TP20	0.10	160	Loose Fibrous Debris	Amosite	< 0.001	< 0.001

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number: 23-38597
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709114	2709115
Sample Reference				TP16	TP19
Sample Number				None Supplied	None Supplied
Depth (m)				2.50	1.50
Date Sampled				07/06/2023	07/06/2023
Time Taken				1510	1645
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status		
General Inorganics					
pH (automated)	pH Units	N/A	ISO 17025	7.4	7.6
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10	< 10
Thiocyanate as SCN	µg/l	200	ISO 17025	< 200	< 200
Sulphate as SO_4	µg/l	100	ISO 17025	11300	7230
Sulphide	µg/l	5	NONE	< 5.0	< 5.0
Total Phenols					
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10
Speciated PAHs					
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01
Total PAH					
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2
Heavy Metals / Metalloids					
Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0	3.3
Boron (dissolved)	µg/l	10	ISO 17025	< 10	12
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	2.5	1.7
Copper (dissolved)	µg/l	0.7	ISO 17025	14	22
Lead (dissolved)	µg/l	1	ISO 17025	3.4	1.9
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2	2.8
Selenium (dissolved)	µg/l	4	ISO 17025	5.7	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	18	21

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

Analytical Report Number : 23-38597
Project / Site name: Penstrowed Quarry

* 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 *
2709107	TP16	None Supplied	0.2	Brown sand with stones.
2709108	TP16	None Supplied	2.5	Brown clay with gravel.
2709109	TP17	None Supplied	0.2	Brown sand with gravel.
2709110	TP18	None Supplied	0.3	Brown sand with gravel.
2709111	TP19	None Supplied	1.5	Brown clay.
2709112	TP20	None Supplied	0.1	Brown sand with stones.
2709113	TP26	None Supplied	0.2	Brown sand with stones.

Analytical Report Number : 23-38597
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
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.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
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	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
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 (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	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

Analytical Report Number : 23-38597
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Thiocyanate in leachate	Determination of thiocyanate in water by discreet analyser (colorimetry).	In house method based on SMWW 4500-CN-M.	L082-PL	W	ISO 17025
Thiocyanate in soil	Determination of thiocyanate in soil by extraction in water followed by acidification followed by addition of ferric nitrate followed by discrete analyser (spectrophotometer).	In-house method	L082-PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
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.	L019-UK/PL	D	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
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 (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025

Analytical Report Number : 23-38597
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	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

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 30oC.
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.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

4041

Andy Singleton
Ground first☐
26 Victoria Street
Castlefields
Shrewsbury
Shropshire
SY1 2HS

e: andy@groundfirst.com

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

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

Analytical Report Number : 23-40820

Project / Site name:	Penstrowed Quarry	**Samples received on:**	12/06/2023
Your job number:	4316	**Samples instructed on/ Analysis started on:**	23/06/2023
Your order number:		**Analysis completed by:**	28/06/2023
Report Issue Number:	1	**Report issued on:**	05/07/2023
Samples Analysed:	1 soil sample		

Signe[redacted]
Izabela Wojcik
Reporting Specialist
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

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

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: 23-40820
Project / Site name: Penstrowed Quarry

Lab Sample Number				2723197
Sample Reference				TP22
Sample Number				None Supplied
Depth (m)				0.50
Date Sampled				07/06/2023
Time Taken				1745
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	PDO

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

Analytical Report Number : 23-40820
Project / Site name: Penstrowed Quarry

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (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	A001-PL	D	ISO 17025

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 30oC.
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.

Andy Singleton
Ground first
26 Victoria Street
Castlefields
Shrewsbury
Shropshire
SY1 2HS

e: andy@groundfirst.com

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

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

Analytical Report Number : 23-38563

Replaces Analytical Report Number: 23-38563, issue no. 1
Additional analysis undertaken.
Asbestos Screen added to samples 2708825, 2708826 & 2708828 as per client's request

Project / Site name:	Penstrowed Quarry	**Samples received on:**	12/06/2023
Your job number:	4316	**Samples instructed on/ Analysis started on:**	12/06/2023
Your order number:		**Analysis completed by:**	26/06/2023
Report Issue Number:	2	**Report issued on:**	04/07/2023
Samples Analysed:	5 leachate samples - 8 soil samples		

[redacted]

Signed:

Dominika Warjan
Reporting Specialist
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

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

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: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708824	2708825	2708826	2708827	2708828
Sample Reference				TP32	TP34	TP33	TP36	TP37
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.50	0.80	2.30	2.00
Date Sampled				08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1100	1250	1230	1350	1445
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	54	< 0.1	88	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	3.8	17	6.3	5.8	8.3
Total mass of sample received	kg	0.001	NONE	0.9	1	1	0.9	1
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	KWB	IZJ	IZJ	KWB	IZJ

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.9	6.4	8	8.3	8
Total Cyanide	mg/kg	1	MCERTS	-	< 1.0	< 1.0	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	-	< 5.0	< 5.0	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	550	1300	-	1600
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.03	0.5	-	0.32
Sulphide	mg/kg	1	MCERTS	-	9	44	-	6.7
Organic Matter (automated)	%	0.1	MCERTS	-	2.6	1.9	-	0.8
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.021	-	-	0.02	-

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	0.14	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.06	< 0.05	0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.19	< 0.05	0.3	0.16	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.1	< 0.05	0.1	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.57	< 0.05	0.61	0.4	0.06
Pyrene	mg/kg	0.05	MCERTS	1.1	< 0.05	0.6	0.53	0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.31	< 0.05	0.3	0.21	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.39	< 0.05	0.31	0.37	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.1	< 0.05	0.52	0.69	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.38	< 0.05	0.18	0.25	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.1	< 0.05	0.41	0.58	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.28	< 0.05	0.2	0.36	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.1	< 0.05	0.07	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.4	< 0.05	0.24	0.38	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	6.37	< 0.80	3.89	3.93	< 0.80

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708824	2708825	2708826	2708827	2708828
Sample Reference				TP32	TP34	TP33	TP36	TP37
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.50	0.80	2.30	2.00
Date Sampled				08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1100	1250	1230	1350	1445
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	13	14	11	24
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.89	-	-	0.91	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3	0.3	0.6	0.3	1.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	23	-	-	29	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	27	32	29	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	77	26	46	39	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	41	19	22	26	38
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	33	28	40	37	44
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	-	-	43	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	72	100	93	120
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	MCERTS	< 5.0	-	-	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	-	-	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	-	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	< 5.0	-	-	< 5.0	-
o-xylene	µg/kg	5	MCERTS	< 5.0	-	-	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-	-	< 5.0	-

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708824	2708825	2708826	2708827	2708828
Sample Reference				TP32	TP34	TP33	TP36	TP37
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	1.50	0.80	2.30	2.00
Date Sampled				08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1100	1250	1230	1350	1445
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Petroleum Hydrocarbons								
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	< 0.1	-	-	< 0.1	-
TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	-	-	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	68	-	-	88	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	450	-	-	610	-

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

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708829	2708830	2708831
Sample Reference				TP38	TP39	TP41
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	0.40
Date Sampled				08/06/2023	08/06/2023	08/06/2023
Time Taken				1520	1600	1640
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content	%	0.1	NONE	58	97	36
Moisture Content	%	0.01	NONE	18	20	3.1
Total mass of sample received	kg	0.001	NONE	0.9	0.9	1

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	KWB	KWB	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	8.2	8.1
Total Cyanide	mg/kg	1	MCERTS	-	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	-	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	-	-	680
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.27	0.1	0.3
Sulphide	mg/kg	1	MCERTS	-	-	78
Organic Matter (automated)	%	0.1	MCERTS	-	-	1
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.04	0.0062	-

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	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.6	0.46	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.21	0.15	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	2.5	0.82	0.08
Pyrene	mg/kg	0.05	MCERTS	2.4	0.71	0.07
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.3	0.29	0.05
Chrysene	mg/kg	0.05	MCERTS	1.4	0.35	0.07
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	2.1	0.37	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.8	0.16	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	0.29	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	0.16	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.28	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.3	0.17	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	15.7	3.93	< 0.80

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708829	2708830	2708831
Sample Reference				TP38	TP39	TP41
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	0.40
Date Sampled				08/06/2023	08/06/2023	08/06/2023
Time Taken				1520	1600	1640
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	19	17
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.9	1.2	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.9	0.6
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 (III)	mg/kg	1	NONE	21	24	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	22	24	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	36	30	30
Lead (aqua regia extractable)	mg/kg	1	MCERTS	32	36	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29	36	34
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	30	25	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	88	78	44
Monoaromatics & Oxygenates						
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	-
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0	-

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708829	2708830	2708831
Sample Reference				TP38	TP39	TP41
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				1.00	0.30	0.40
Date Sampled				08/06/2023	08/06/2023	08/06/2023
Time Taken				1520	1600	1640
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Petroleum Hydrocarbons						
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	-	-	-
TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	41	< 8.0	-
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	24	< 8.4	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	41	< 10	-
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	65	< 10	-
TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	< 10	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	74	< 10	-
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	52	< 8.4	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	83	11	-
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	130	11	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	-	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	-	-

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

Analytical Report Number: 23-38563
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708832	2708833	2708834	2708835	2708836
Sample Reference				TP34	TP33	TP36	TP37	TP38
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.50	0.80	2.30	2.00	1.00
Date Sampled				08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1250	1230	1350	1445	1520
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status					
General Inorganics								
pH (automated)	pH Units	N/A	ISO 17025	6.9	7.4	7.3	7.2	6.9
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Thiocyanate as SCN	µg/l	200	ISO 17025	220	< 200	< 200	< 200	< 200
Sulphate as SO_4	µg/l	100	ISO 17025	2760	47600	5030	21900	26900
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Heavy Metals / Metalloids								
Arsenic (dissolved)	µg/l	1	ISO 17025	1.4	< 1.0	2	< 1.0	< 1.0
Boron (dissolved)	µg/l	10	ISO 17025	13	< 10	< 10	58	27
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4	1	1.1	0.7	0.5
Copper (dissolved)	µg/l	0.7	ISO 17025	10	12	12	5	20
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	2.6	1.3	2.3
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	< 0.3	1.1	0.7	< 0.3	1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	3.7	14	11	9.7	18

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

Analytical Report Number : 23-38563
Project / Site name: Penstrowed Quarry

* 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 *
2708824	TP32	None Supplied	0.4	Brown sand with rubble and stones.
2708825	TP34	None Supplied	1.5	Brown clay.
2708826	TP33	None Supplied	0.8	Brown clay with stones.
2708827	TP36	None Supplied	2.3	Brown clay with gravel.
2708828	TP37	None Supplied	2	Brown clay with gravel.
2708829	TP38	None Supplied	1	Brown clay with gravel and stones.
2708830	TP39	None Supplied	0.3	Brown clay with stones.
2708831	TP41	None Supplied	0.4	Brown clay with gravel and stones.

Analytical Report Number : 23-38563
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
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	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
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 (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	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

Analytical Report Number : 23-38563
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
PRO (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	NONE
Sulphide in leachate	Determination of sulphide in leachate by ion selective electrode.	In-house method	L010-PL	W	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Thiocyanate in leachate	Determination of thiocyanate in water by discreet analyser (colorimetry).	In house method based on SMWW 4500-CN-M.	L082-PL	W	ISO 17025
Thiocyanate in soil	Determination of thiocyanate in soil by extraction in water followed by acidification followed by addition of ferric nitrate followed by discrete analyser (spectrophotometer).	In-house method	L082-PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
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.	L019-UK/PL	D	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
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 (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073B-PL	W	MCERTS
TPH Oils (Soils)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
DRO (Soil)	Determination of extractable hydrocarbons in soil by GC-MS/FID.	In-house method with silica gel split/clean up.	L076-PL	D	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

Analytical Report Number : 23-38563
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	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

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 30oC.
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.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

4041

Andy Singleton
Ground first
26 Victoria Street
Castlefields
Shrewsbury
Shropshire
SY1 2HS

e: andy@groundfirst.com

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

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

Analytical Report Number : 23-38600

Project / Site name:	Penstrowed Quarry	**Samples received on:**	12/06/2023
Your job number:	4316	**Samples instructed on/ Analysis started on:**	12/06/2023
Your order number:		**Analysis completed by:**	19/06/2023
Report Issue Number:	1	**Report issued on:**	19/06/2023
Samples Analysed:	5 water samples		

Signe[redacted]

Dominika Warjan
Reporting Specialist
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

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

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: 23-38600
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709126	2709127	2709128	2709129	2709130
Sample Reference				TP03	FACE 1	FACE 2	SPRING 1	SPRING 2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.45	0.00	0.00	0.00	0.00
Date Sampled				07/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1105	1100	1130	1600	1630
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					
General Inorganics								
pH (L005B)	pH Units	N/A	ISO 17025	6.7	8.2	8.3	8	6.3
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO4	mg/l	0.045	ISO 17025	1450	110	97.8	74.8	7.25
Chloride	mg/l	0.15	ISO 17025	17	44	18	19	13
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	490	22	< 15	< 15	< 15
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	600	26	< 15	16	< 15
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	5.79	2.53	1.79	1.43	0.93
Nitrate as N	mg/l	0.01	ISO 17025	6.25	0.52	0.15	1.19	1.55
Nitrite as N	µg/l	1	ISO 17025	40	1.1	< 1.0	< 1.0	< 1.0
Alkalinity as CaCO3	mg/l	3	ISO 17025	160	220	200	110	49
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
Heavy Metals / Metalloids								
Boron (dissolved)	µg/l	10	ISO 17025	33	81	33	21	< 10
Antimony (dissolved)	µg/l	0.4	ISO 17025	0.6	1.5	1.2	0.6	0.5
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.42	1.35	0.53	0.27	0.85
Barium (dissolved)	µg/l	0.06	ISO 17025	38	38	25	11	7.8
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.14	< 0.02	< 0.02	< 0.02	0.07
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.2	0.6	0.4	0.4
Copper (dissolved)	µg/l	0.5	ISO 17025	3	6.4	3	2.1	13
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum (dissolved)	µg/l	0.05	ISO 17025	0.7	2.4	4.9	0.77	7.8
Nickel (dissolved)	µg/l	0.5	ISO 17025	17	1.4	1	< 0.5	0.8
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.3	0.7	0.9	< 0.6	< 0.6

Analytical Report Number: 23-38600
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709126	2709127	2709128	2709129	2709130
Sample Reference				TP03	FACE 1	FACE 2	SPRING 1	SPRING 2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.45	0.00	0.00	0.00	0.00
Date Sampled				07/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1105	1100	1130	1600	1630
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					
Zinc (dissolved)	µg/l	0.5	ISO 17025	4.2	2.8	2.3	7.2	31
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6# $_{HS\_1D\_AL}$	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8# $_{HS\_1D\_AL}$	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10# $_{HS\_1D\_AL}$	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 $_{EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) $_{HS+EH\_1D\_AL\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 $_{HS\_1D\_AR}$	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 $_{EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) $_{HS+EH\_1D\_AR\_MS}$	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

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

Analytical Report Number : 23-38600
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved inorganic carbon in water by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Ammonia as NH3 in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW, FSE, LL.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Ammoniacal Nitrogen as N in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW, FSE, LL.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025
Chloride in water	Determination of Chloride (diissolved) colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025

Analytical Report Number : 23-38600
Project / Site name: Penstrowed Quarry

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Alkalinity in Water (by discreet analyser)	Determination of Alkalinity by discreet analyser (colorimetry). Accredited matrices: SW, PW, GW.	In house method based on MEWAM & USEPA Method 310.2.	L082-PL	W	ISO 17025

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 30oC.
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.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

#Data reported unaccredited due to quality control parameter failure associated with this result; other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and therefore may be compromised.

Sample Deviation Report

Analytical Report Number : 23-38600
Project / Site name: Penstrowed Quarry

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
FACE 1	None Supplied	W	2709127	c	Ammonia as NH3 in water	L082-PL	c
FACE 1	None Supplied	W	2709127	c	Ammoniacal Nitrogen as N in water	L082-PL	c
FACE 1	None Supplied	W	2709127	c	pH at 20oC in water (automated)	L099-PL	c
FACE 2	None Supplied	W	2709128	c	Ammonia as NH3 in water	L082-PL	c
FACE 2	None Supplied	W	2709128	c	Ammoniacal Nitrogen as N in water	L082-PL	c
FACE 2	None Supplied	W	2709128	c	pH at 20oC in water (automated)	L099-PL	c
SPRING 1	None Supplied	W	2709129	c	Ammonia as NH3 in water	L082-PL	c
SPRING 1	None Supplied	W	2709129	c	Ammoniacal Nitrogen as N in water	L082-PL	c
SPRING 1	None Supplied	W	2709129	c	pH at 20oC in water (automated)	L099-PL	c
SPRING 2	None Supplied	W	2709130	c	Ammonia as NH3 in water	L082-PL	c
SPRING 2	None Supplied	W	2709130	c	Ammoniacal Nitrogen as N in water	L082-PL	c
SPRING 2	None Supplied	W	2709130	c	pH at 20oC in water (automated)	L099-PL	c
TP03	None Supplied	W	2709126	c	Ammonia as NH3 in water	L082-PL	c
TP03	None Supplied	W	2709126	c	Ammoniacal Nitrogen as N in water	L082-PL	c
TP03	None Supplied	W	2709126	c	pH at 20oC in water (automated)	L099-PL	c

Appendix E.2: Summary of soil test results

Project / Site name: Penstrowed Quarry

Lab Sample Number				2708847	2708848	2708849	2708850	2708851	2708852	2708853	2708854	2709107	2709108	2709109	2709110
Sample Reference				TP01	TP02	TP07	TP09	TP11	TP12	TP13	TP15	TP16	TP16	TP17	TP18
Depth (m)				0.30	0.20	0.15	0.50	0.50	0.20	0.60	0.40	0.20	2.50	0.20	0.30
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023
Time Taken				0950	0940	1030	1115	1230	1305	1400	1430	1500	1510	1550	1615
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status												
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	31	< 0.1	32	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	4.2	7.2	13	14	7.4	8.9	9.1	11	4.9	12	8	6.7
Total mass of sample received	kg	0.001	NONE	1	0.9	0.9	0.9	1	1	0.9	0.9	0.9	1	0.9	0.9
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-	-	-	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025												
Asbestos Quantification Total	%	0.001	ISO 17025												
Asbestos Analyst ID	N/A	N/A	N/A	JBH	SFS	SFS	SFS	JBH	JBH	SFS	SFS	ASE	ASE	ASE	ASE
General Inorganics															
pH - Automated	pH Units	N/A	MCERTS	7.1	6.3	7	7.3	8.3	7.7	7.8	7.7	8.2	8.4	7.5	7.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0	< 1.0	-	-	-	< 1.0	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	< 5.0	-	-	-	< 5.0	< 5.0	-	-	-	< 5.0	-	-
Total Sulphate as SO4	mg/kg	50	MCERTS	5800	-	-	-	810	580	-	-	-	840	-	-
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	1.9	-	-	-	0.12	0.14	-	-	-	0.19	-	-
Sulphide	mg/kg	1	MCERTS	2.8	-	-	-	1.4	1	-	-	-	4.9	-	-
Organic Matter (automated)	%	0.1	MCERTS	0.8	-	-	-	1.9	1	-	-	-	1	-	-
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	-	0.006	0.03	0.011	-	-	0.0091	0.0069	0.015	-	0.0037	0.0074
Total Phenols															
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs															
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.09	< 0.05	0.51	< 0.05	< 0.05	< 0.05	0.14	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.06	< 0.05	0.31	< 0.05	< 0.05	< 0.05	0.11	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.5	0.12	4.1	< 0.05	0.18	0.19	1.4	0.25	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.16	< 0.05	1.6	< 0.05	< 0.05	0.07	0.53	0.11	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.5	0.41	9.4	0.07	0.28	0.41	4.3	0.5	< 0.05	0.2
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	1.4	0.4	8.2	0.07	0.26	0.37	4.1	0.44	< 0.05	0.19
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.71	0.24	3.6	< 0.05	0.15	0.21	2	0.19	< 0.05	0.1
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.78	0.27	3.5	< 0.05	0.15	0.21	2.3	0.22	< 0.05	0.15
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	1	0.39	4.2	< 0.05	0.18	0.25	3.2	0.26	< 0.05	0.16
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	0.44	0.16	1.7	< 0.05	0.08	0.15	1.2	0.13	< 0.05	0.11
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.91	0.32	3.7	< 0.05	0.15	0.22	2.5	0.23	< 0.05	0.17
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.51	0.19	1.9	< 0.05	0.09	0.12	1.3	0.11	< 0.05	0.09
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.12	< 0.05	0.44	< 0.05	< 0.05	< 0.05	0.37	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.59	0.21	2	< 0.05	0.09	0.14	1.6	0.14	< 0.05	0.11
Total PAH															
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	8.74	2.71	45.3	< 0.80	1.61	2.34	25	2.58	< 0.80	1.28
Heavy Metals / Metalloids															
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	26	18	11	12	11	12	21	12	17	12	12	12
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	1.2	0.79	0.94	-	-	0.89	0.93	0.93	-	1.1	0.94
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.8	0.5	0.6	0.5	0.4	< 0.2	0.2	< 0.2	< 0.2	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	-	29	30	32	-	-	24	29	32	-	35	31
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	29	30	33	32	33	25	29	33	31	35	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	44	43	35	99	63	36	74	38	42	42	41	43
Lead (aqua regia extractable)	mg/kg	1	MCERTS	23	30	38	31	34	30	38	27	57	30	34	30
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	39	43	36	41	35	47	33	42	37	47	54	45
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	31	34	35	-	-	25	28	39	-	32	30
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	59	84	120	110	120	110	120	95	140	130	120	120
Monoaromatics & Oxygenates															
Benzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	< 5.0	< 5.0	-	-	< 5.0	< 5.0	< 5.0	-	< 5.0	< 5.0
Petroleum Hydrocarbons															
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1
TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CUHS_1D_AL	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC44) EH_CUHS_1D_AL	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	-	-	-	-	-	-	-	-	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CUHS_1D_AR	mg/kg	10	NONE												
TPH-CWG - Aromatic (EC5 - EC44) EH_CUHS_1D_AR	mg/kg	10	NONE												
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	11	< 10	-	-	< 10	< 10	11	-	< 10	< 10
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	86	< 10	-	-	< 10	< 10	43	-	< 10	< 10

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

Project / Site name: Penstrowed Quarry

Lab Sample Number				2709111	2709112	2723197	2709113	2708824	2708825	2708826	2708827	2708828	2708829	2708830	2708831
Sample Reference				TP19	TP20	TP22	TP26	TP32	TP34	TP33	TP36	TP37	TP38	TP39	TP41
Depth (m)				1.50	0.10	0.50	0.20	0.40	1.50	0.80	2.30	2.00	1.00	0.30	0.40
Date Sampled				07/06/2023	07/06/2023	07/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1645	1715	1745	1000	1100	1250	1230	1350	1445	1520	1600	1640
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status												
Stone Content	%	0.1	NONE	< 0.1	38	-	50	54	< 0.1	88	< 0.1	< 0.1	58	97	36
Moisture Content	%	0.01	NONE	14	4.3	-	1.3	3.8	17	6.3	5.8	8.3	18	20	3.1
Total mass of sample received	kg	0.001	NONE	1	0.9	-	1	0.9	1	1	0.9	1	0.9	0.9	1
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Amosite- Loose Fibrous Debris	-	-	-	-	-	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025		< 0.001										
Asbestos Quantification Total	%	0.001	ISO 17025		< 0.001										
Asbestos Analyst ID	N/A	N/A	N/A	ASE	ASE	PDO	ASE	KWB	IZJ	IZJ	KWB	IZJ	KWB	KWB	N/A
General Inorganics															
pH - Automated	pH Units	N/A	MCERTS	7.9	8	-	8.3	7.9	6.4	8	8.3	8	7.6	8.2	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	-	< 1.0	-	< 1.0	< 1.0	-	< 1.0	-	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Thiocyanate as SCN	mg/kg	5	NONE	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-	< 5.0	-	-	< 5.0
Total Sulphate as SO4	mg/kg	50	MCERTS	420	-	-	1800	-	550	1300	-	1600	-	-	680
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.05	-	-	0.61	-	0.03	0.5	-	0.32	0.27	0.1	0.3
Sulphide	mg/kg	1	MCERTS	1.5	-	-	19	-	9	44	-	6.7	-	-	78
Organic Matter (automated)	%	0.1	MCERTS	2.1	-	-	1.4	-	2.6	1.9	-	0.8	-	-	1
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	-	0.01	-	-	0.021	-	-	0.02	-	0.04	0.0062	-
Total Phenols															
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs															
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	0.14	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	0.06	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.32	0.22	-	0.31	0.19	< 0.05	0.3	0.16	< 0.05	0.6	0.46	< 0.05
Anthracene	mg/kg	0.05	MCERTS	0.12	< 0.05	-	0.15	0.1	< 0.05	0.1	< 0.05	< 0.05	0.21	0.15	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.75	0.68	-	0.56	0.57	< 0.05	0.61	0.4	0.06	2.5	0.82	0.08
Pyrene	mg/kg	0.05	MCERTS	0.75	0.63	-	0.57	1.1	< 0.05	0.6	0.53	0.05	2.4	0.71	0.07
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.33	0.32	-	0.31	0.31	< 0.05	0.3	0.21	< 0.05	1.3	0.29	0.05
Chrysene	mg/kg	0.05	MCERTS	0.43	0.39	-	0.37	0.39	< 0.05	0.31	0.37	< 0.05	1.4	0.35	0.07
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.56	0.47	-	0.4	1.1	< 0.05	0.52	0.69	< 0.05	2.1	0.37	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.25	0.27	-	0.19	0.38	< 0.05	0.18	0.25	< 0.05	0.8	0.16	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.42	0.42	-	0.28	1.1	< 0.05	0.41	0.58	< 0.05	1.8	0.29	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.22	< 0.05	-	0.13	0.28	< 0.05	0.2	0.36	< 0.05	1.1	0.16	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05	0.1	< 0.05	0.07	< 0.05	< 0.05	0.28	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.27	< 0.05	-	0.18	0.4	< 0.05	0.24	0.38	< 0.05	1.3	0.17	< 0.05
Total PAH															
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	4.42	3.4	-	3.45	6.37	< 0.80	3.89	3.93	< 0.80	15.7	3.93	< 0.80
Heavy Metals / Metalloids															
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	14	16	-	14	19	13	14	11	24	15	19	17
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	0.66	-	-	0.89	-	-	0.91	-	0.9	1.2	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.2	0.2	-	0.4	0.3	0.3	0.6	0.3	1.8	0.6	0.9	0.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	-	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	-	22	-	-	23	-	-	29	-	21	24	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	32	22	-	31	23	27	32	29	30	22	24	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	45	59	-	35	77	26	46	39	45	36	30	30
Lead (aqua regia extractable)	mg/kg	1	MCERTS	40	25	-	18	41	19	22	26	38	32	36	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	40	29	-	39	33	28	40	37	44	29	36	34
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	23	-	-	29	-	-	43	-	30	25	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120	100	-	68	180	72	100	93	120	88	78	44
Monoaromatics & Oxygenates															
Benzene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
Toluene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
Ethylbenzene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
p & m-xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
o-xylene	µg/kg	5	MCERTS	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	< 5.0	-	-	< 5.0	-	-	< 5.0	-	< 5.0	< 5.0	-
Petroleum Hydrocarbons															
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	0.1	NONE	-	< 0.1	-	-	< 0.1	-	-	< 0.1	-	-	-	-
TPH-CWG - Aliphatic >EC5 - EC6 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 HS_1D_AL	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 EH_CU_1D_AL	mg/kg	1	MCERTS	-	-	-	-	-	-	-	-	-	< 1.0	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	-	-	-	-	-	-	-	-	< 2.0	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-	-	-	-	-	< 8.0	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-	-	-	-	-	-	-	41	< 8.0	-
TPH-CWG - Aliphatic > EC35 - EC44 EH_CU_1D_AL	mg/kg	8.4	NONE	-	-	-	-	-	-	-	-	-	24	< 8.4	-
TPH-CWG - Aliphatic (EC5 - EC35) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	41	< 10	-
TPH-CWG - Aliphatic (EC5 - EC44) EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	65	< 10	-
TPH-CWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.001	NONE	-	-	-	-	-	-	-	-	-	< 0.001	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-	-	-	-	-	-	-	-	-	< 1.0	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	-	-	-	-	-	-	-	-	< 2.0	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-	-	-	-	-	< 10	< 10	-
TPH-CWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-	-	-	-	-	-	-	74	< 10	-
TPH-CWG - Aromatic > EC35 - EC44 EH_CU_1D_AR	mg/kg	8.4	NONE	-	-	-	-	-	-	-	-	-	52	< 8.4	-
TPH-CWG - Aromatic (EC5 - EC35) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	83	11	-
TPH-CWG - Aromatic (EC5 - EC44) EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	-	-	-	-	-	-	-	130	11	-
TPH (C10 - C25) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	-	-	68	-	-	88	-	-	-	-
TPH (C25 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	-	< 10	-	-	450	-	-	610	-	-	-	-

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

Appendix E.3: Summary of soil leachability test results

Analytical Report Number: 23-38567
Project / Site name: Penstrowed Quarry

Lab Sample Number				2708855	2708856	2708857	2709114	2709115	2708832	2708833	2708834	2708835	2708836
Sample Reference				TP07	TP09	TP13	TP16	TP19	TP34	TP33	TP36	TP37	TP38
Depth (m)				0.15	0.50	0.60	2.50	1.50	1.50	0.80	2.30	2.00	1.00
Date Sampled				07/06/2023	07/06/2023	07/06/2023	07/06/2023	07/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1030	1115	1400	1510	1645	1250	1230	1350	1445	1520
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status										
General Inorganics													
pH (automated)	pH Units	N/A	ISO 17025	7.1	7	7.1	7.4	7.6	6.9	7.4	7.3	7.2	6.9
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Thiocyanate as SCN	µg/l	200	ISO 17025	< 200	< 200	< 200	< 200	< 200	220	< 200	< 200	< 200	< 200
Sulphate as SO_4	µg/l	100	ISO 17025	6910	10100	4770	11300	7230	2760	47600	5030	21900	26900
Sulphide	µg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Phenols													
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Speciated PAHs													
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH													
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Heavy Metals / Metalloids													
Arsenic (dissolved)	µg/l	1	ISO 17025	3.9	< 1.0	< 1.0	< 1.0	3.3	1.4	< 1.0	2	< 1.0	< 1.0
Boron (dissolved)	µg/l	10	ISO 17025	11	< 10	11	< 10	12	13	< 10	< 10	58	27
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.1	< 0.4	1.7	2.5	1.7	< 0.4	1	1.1	0.7	0.5
Copper (dissolved)	µg/l	0.7	ISO 17025	24	13	21	14	22	10	12	12	5	20
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	1.6	3.4	1.9	< 1.0	< 1.0	2.6	1.3	2.3
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.3	0.5	1.8	2	2.8	< 0.3	1.1	0.7	< 0.3	1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	5.7	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	15	8.6	15	18	21	3.7	14	11	9.7	18

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

Appendix E.4: Summary of water test results

Analytical Report Number: 23-38600
Project / Site name: Penstrowed Quarry

Lab Sample Number				2709126	2709127	2709128	2709129	2709130
Sample Reference				TP03	FACE 1	FACE 2	SPRING 1	SPRING 2
Depth (m)				1.45	0.00	0.00	0.00	0.00
Date Sampled				07/06/2023	08/06/2023	08/06/2023	08/06/2023	08/06/2023
Time Taken				1105	1100	1130	1600	1630
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					
General Inorganics								
pH (L005B)	pH Units	N/A	ISO 17025	6.7	8.2	8.3	8	6.3
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO4	mg/l	0.045	ISO 17025	1450	110	97.8	74.8	7.25
Chloride	mg/l	0.15	ISO 17025	17	44	18	19	13
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	490	22	< 15	< 15	< 15
Ammoniacal Nitrogen as NH3	µg/l	15	ISO 17025	600	26	< 15	16	< 15
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	5.79	2.53	1.79	1.43	0.93
Nitrate as N	mg/l	0.01	ISO 17025	6.25	0.52	0.15	1.19	1.55
Nitrite as N	µg/l	1	ISO 17025	40	1.1	< 1.0	< 1.0	< 1.0
Alkalinity as CaCO3	mg/l	3	ISO 17025	160	220	200	110	49
Total Phenols								
Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Speciated PAHs								
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH								
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
Heavy Metals / Metalloids								
Boron (dissolved)	µg/l	10	ISO 17025	33	81	33	21	< 10
Antimony (dissolved)	µg/l	0.4	ISO 17025	0.6	1.5	1.2	0.6	0.5
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.42	1.35	0.53	0.27	0.85
Barium (dissolved)	µg/l	0.06	ISO 17025	38	38	25	11	7.8
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.14	< 0.02	< 0.02	< 0.02	0.07
Chromium (dissolved)	µg/l	0.2	ISO 17025	< 0.2	0.2	0.6	0.4	0.4
Copper (dissolved)	µg/l	0.5	ISO 17025	3	6.4	3	2.1	13
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum (dissolved)	µg/l	0.05	ISO 17025	0.7	2.4	4.9	0.77	7.8
Nickel (dissolved)	µg/l	0.5	ISO 17025	17	1.4	1	< 0.5	0.8
Selenium (dissolved)	µg/l	0.6	ISO 17025	1.3	0.7	0.9	< 0.6	< 0.6
Zinc (dissolved)	µg/l	0.5	ISO 17025	4.2	2.8	2.3	7.2	31
Monoaromatics & Oxygenates								
Benzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >C5 - C6# HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8# HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10# HS_1D_AL	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35 EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35) HS+EH_1D_AL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C8 - C10 HS_1D_AR	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35 EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35) HS+EH_1D_AR_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10

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

APPENDIX F

Soil and water screening values

Screening values adopted for the human health risk assessment (residential land use)

Parameter	Units	Screening value/GAC	Comment
Metals			
Arsenic	mg/kg	37	LQM (2015)
Barium	mg/kg	1300	CL:AIRE (2010)
Beryllium	mg/kg	1.7	LQM (2015)
Boron	mg/kg	290	LQM (2015)
Cadmium	mg/kg	11	LQM (2015)
Chromium VI	mg/kg	6	LQM (2015)
Chromium III	mg/kg	910	LQM (2015)
Copper	mg/kg	2400	LQM (2015)
Lead	mg/kg	200	Category 4 Screening Level incorporating vegetable consumption (DEFRA, 2014)
Mercury	mg/kg	11	LQM (2015) - methylmercury
Nickel	mg/kg	130	LQM (2015)
Selenium	mg/kg	250	LQM (2015)
Vanadium	mg/kg	410	LQM (2015)
Zinc	mg/kg	3700	LQM (2015)
Miscellaneous			
Phenols	mg/kg	200	LQM (2015); 2.5% SOM
Cyanide (free)	mg/kg	16.8	RIVM derived value[1] for free cyanide
PAHs			
Acenaphthene	mg/kg	510	LQM (2015); 2.5% SOM
Acenaphthylene	mg/kg	420	LQM (2015); 2.5% SOM
Anthracene	mg/kg	5400	LQM (2015); 2.5% SOM
Benzo[a]anthracene	mg/kg	11	LQM (2015); 2.5% SOM
Benzo[a]pyrene	mg/kg	2.7	LQM (2015); 2.5% SOM
Benzo[b]fluoranthene	mg/kg	3.3	LQM (2015); 2.5% SOM
Benzo[g,h,i]perylene	mg/kg	340	LQM (2015); 2.5% SOM
Benzo[k]fluoranthene	mg/kg	93	LQM (2015); 2.5% SOM
Chrysene	mg/kg	22	LQM (2015); 2.5% SOM
Dibenzo[a,h]anthracene	mg/kg	0.28	LQM (2015); 2.5% SOM
Fluoranthene	mg/kg	560	LQM (2015); 2.5% SOM
Fluorene	mg/kg	400	LQM (2015); 2.5% SOM
Indeno[1,2,3-cd]pyrene	mg/kg	36	LQM (2015); 2.5% SOM
Naphthalene	mg/kg	5.6	LQM (2015); 2.5% SOM
Phenanthrene	mg/kg	220	LQM (2015); 2.5% SOM
Pyrene	mg/kg	1200	LQM (2015); 2.5% SOM
BTEX and speciated TPH			
Benzene	mg/kg	0.17	LQM (2015); 2.5% SOM
Toluene	mg/kg	290	LQM (2015); 2.5% SOM
Ethylbenzene	mg/kg	110	LQM (2015); 2.5% SOM
m & p Xylene	mg/kg	130	LQM (2015); 2.5% SOM
o Xylene	mg/kg	140	LQM (2015); 2.5% SOM
Aliphatics C5-C6	mg/kg	78	LQM (2015); 2.5% SOM
Aliphatics >C6-C8	mg/kg	230	LQM (2015); 2.5% SOM
Aliphatics >C8-C10	mg/kg	65	LQM (2015); 2.5% SOM
Aliphatics >C10-C12	mg/kg	330 (118)^{vap}	LQM (2015). GAC exceeds theoretical soil saturation limit; 2.5% SOM
Aliphatics >C12-C16	mg/kg	2400 (59)^{sol}	LQM (2015). GAC exceeds theoretical soil saturation limit; 2.5% SOM

Parameter	Units	Screening value/GAC	Comment
Aliphatics >C16-C21	mg/kg	92,000	LQM (2015). Based on GAC for C16-C35 fraction; 2.5% SOM
Aliphatics >C21-C35	mg/kg	92,000	LQM (2015). Based on GAC for C16-C35 fraction; 2.5% SOM
Aromatics C6-C7	mg/kg	140	LQM (2015). Based on GAC for C5-C7 fraction; 2.5% SOM
Aromatics >C7-C8	mg/kg	290	LQM (2015); 2.5% SOM
Aromatics >EC8-EC10	mg/kg	83	LQM (2015); 2.5% SOM
Aromatics >EC10-EC12	mg/kg	180	LQM (2015); 2.5% SOM
Aromatics >EC12-EC16	mg/kg	330	LQM (2015); 2.5% SOM
Aromatics >EC16-EC21	mg/kg	540	LQM (2015); 2.5% SOM
Aromatics >EC21-EC35	mg/kg	1500	LQM (2015); 2.5% SOM
Aromatics >EC35-EC44	mg/kg	1500	LQM (2015); 2.5% SOM

DEFRA, 2014. SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination. Policy companion document.

LQM, 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment.

RIVM, 2001. Technical evaluation of the Intervention Values for Soil/sediment and Groundwater Human and ecotoxicological risk assessment and derivation of risk limits for soil, aquatic sediment and groundwater. RIVM report 711701 023.

Target concentrations adopted for the controlled waters risk screen

Parameter	Unit	Drinking Water Standards		Environmental Quality Standards		Comment
Metals						
Antimony	µg/l	5	DWS	-	-	
Arsenic	µg/l	10	DWS	50	AA	
Barium	µg/l	700	WHO	-	-	
Beryllium	µg/l	-	-	-	-	
Boron	µg/l	1000	DWS	2000	-	Protection of freshwater aquatic life
Cadmium	µg/l	5	DWS	0.25 (1.5)	AA (MAC)	Assuming hardness in excess of 200 mg CaCO3/l
Chromium (total)	µg/l	50	DWS	-	-	
Chromium VI	µg/l	-	-	3.4	AA	
Chromium III	µg/l	-	-	4.7 (32)	AA (95%ile)	
Copper	µg/l	2000	DWS	1	AA	EQS reflects bioavailable component
Lead	µg/l	10	DWS	1.2 (14)	AA (MAC)	
Mercury	µg/l	1	DWS	0.07	MAC	
Molybdenum	µg/l	-	-	-	-	
Nickel	µg/l	20	DWS	4 (34)	AA (MAC)	
Selenium	µg/l	10	DWS	-	-	
Vanadium	µg/l	-	-	60	AA	Former EQS for List II substances. Assuming hardness > 200 mg CaCO3/l
Zinc	µg/l	3000	SW	12.3	AA	
Others						
Ammoniacal Nitrogen as NH_4	mg/l	0.5	DWS	-	-	
Ammonia (ammonium (NH_3 as N))	mg/l	-	-	0.021	AA	
Chloride	mg/l	250	DWS	250	AA	
Nitrate as NO_3	mg/l	50	DWS	-	-	
Nitrite as NO_2	mg/l	0.5	DWS	-	-	
Phenol	µg/l	5800	RSL	7.7 (46)	AA (95%ile)	
Sulphate	mg/l	250	DWS	400	AA	
Sulphite	mg/l	-	-	-	-	
Total Cyanide	mg/l	0.05	DWS	0.001 (0.005)	AA (MAC)	
Petroleum hydrocarbons compounds						
Oils/hydrocarbons	µg/l	10	DWS	-	-	Former DWS
Methyl tertiary butyl ether (MTBE)	µg/l	-	-	-	-	No published standards

Parameter	Unit	Drinking Water Standards		Environmental Quality Standards		Comment
Benzene	µg/l	1	DWS	10 (50)	AA (MAC)	
Ethylbenzene	µg/l	300	WHO	20 (200)	AA (MAC)	Former EQS for List II substances
Toluene	µg/l	700	WHO	74 (380)	AA (95)	
o-Xylene	µg/l	500	WHO	30	AA	
p/m-Xylene	µg/l	500	WHO	30	AA	
Aliphatics EC5-EC6	µg/l	15000	WHO	-	-	
Aliphatics EC6-EC8	µg/l	15000	WHO	-	-	
Aliphatics EC8-EC10	µg/l	300	WHO	-	-	
Aliphatics EC10-EC12	µg/l	300	WHO	-	-	
Aliphatics EC12-EC16	µg/l	300	WHO	-	-	
Aromatics EC5-EC6	µg/l	10	WHO	-	-	
Aromatics EC6-EC8	µg/l	700	WHO	-	-	
Aromatics EC8-EC10	µg/l	300	WHO	-	-	
Aromatics EC10-EC12	µg/l	90	WHO	-	-	
Aromatics EC12-EC16	µg/l	90	WHO	-	-	
SVOCs						
Anthracene	µg/l	-	-	0.1 (0.1)	AA (MAC)	
Benzo(a)pyrene	µg/l	0.01	DWS	0.00017 (0.27)	AA (MAC)	
Benzo(b)fluoranthene	µg/l	0.1	DWS	0.00017 (0.017)	AA (MAC	
Benzo(k)fluoranthene	µg/l			0.00017 (0.017)	AA (MAC	
Benzo(ghi)perylene	µg/l			0.00017 (0.0082)	AA (MAC)	
Indeno(123cd)pyrene	µg/l			0.00017	AA	
Fluoranthene	µg/l	-	-	0.0063 (0.12)	AA (MAC)	
Naphthalene	µg/l	-	-	2.0 (130)	AA (MAC)	

Sources

The Water Supply (Water Quality) (Amendment) Regulations 2018: Statutory Instruments No. 706. *In addition, drinking water is required to be wholesome and therefore any substances that taint water supply (odour or taste) will effectively be set a drinking water standard equivalent to the taste/odour objection threshold.*

Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Notes

DWS	Drinking Water Standard: The Water Supply (Water Quality) (Amendment) Regulations 2018
RSL	USEPA Regional Screening Level for tap water (Nov 2022)
WHO	World Health Organisation Drinking Water Guidelines
SW	Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996
AA	Annual average
MAC	Maximum allowable concentration
-	No water standard specified

APPENDIX G

Risk classification methodology

Risk classification methodology

The method of risk evaluation adopted in this document is consistent with CIRIA C552 (2001). Hence, risk is considered to be a function of both the probability (likelihood) of contamination occurring at the study site and also the potential severity (consequence) of the environmental impacts associated with this contamination.

The classification system used to define contaminant probability, consequence and risk is described in the following tables.

Table A: Classification of probability

Classification	Definition
High Likelihood	There is a contaminant linkage and an event that appears either very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage and all the elements are present and in the right place, which means that it is probably that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term, and likely over the long term.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is contaminant linkage but circumstances are such that it is improbable that an event would occur even in the long term.

Table B: Classification of consequence

Classification	Receptor	Definition	Examples
Severe *(acute risks)*	Humans	Short-term (acute) risk to human health likely to result in "significant harm" as defined in the CTL Statutory Guidance	High concentrations of cyanide on the surface of an informal recreation area
	Controlled waters	Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource	Major spillage of contaminants from site into controlled water
	Property	Catastrophic damage to buildings/property	Explosion resulting from methane accumulation, causing building collapse (can also equate to an acute human health risk if buildings are occupied)
	Ecology	A short-term risk to a particular ecosystem, or organism forming part of such eco-system	Potentially significant derogation of a designated site or protected species
Medium *(long-term)*	Humans	Chronic damage to human health ("significant harm" as defined in the Contaminated Land Statutory Guidance)	Concentrations of a contaminant from site exceed the GAC or SSAC
	Controlled waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution)	Leaching of contaminants from a site to a Principal or Secondary Aquifer

Classification	Receptor	Definition	Examples
	Property	Significant damage to sensitive crops, buildings, structures and services	Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
	Ecology	A significant change in a particular ecosystem, or organism forming part of such ecosystem	Death of a species within a designated nature reserve
Mild *(long-term; less sensitive receptors)*	Humans	Contamination present although unlikely to constitute a significant chronic health risk to sensitive receptors	Concentrations of chemical species that exceed the GAC or SSAC for a low sensitive land-use e.g., public open space
	Controlled waters	Pollution of non-sensitive water resources	Pollution of non-classified groundwater
	Property	Damage to sensitive. buildings/structures/services	Aggressive ground conditions leading to potential for long term degradation of buried concrete
	Ecology	Damage to the environment	Localised damage to aquatic habitat causing temporary relocation of certain species
Minor *(long-term; less significant receptors)*	Humans	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.)	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Controlled waters	Potential minor release of contamination to local water features	Short term or low volume release of potentially polluting material to a secondary surface water course of low existing quality
	Property	Easily reparable effects of damage to buildings, structures and services. Harm which may result in a financial loss, or expenditure to resolve.	The loss of plants in a landscaping scheme. Discolouration of concrete
	Ecology	Short term, localised damage may occur; consequences are spatially and temporally limited	Short term or localised disruption to in-situ flora or fauna; no lasting effects

Table C: Risk classification (comparison of consequence and probability)

Probability (likelihood)		Consequence (severity)			
		Severe	***Medium***	***Mild***	***Minor***
	High likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk