



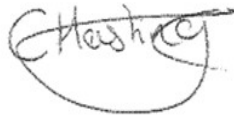
GROUNDTECH
CONSULTING

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SUMMARY

Site Details

Site Location

The site is located circa 2.5km north east of Manchester City Centre and is approximately centred on National Grid Reference 386345, 399200

Site Area

The main feature onsite is a two storey residential dwelling which was constructed as an extension to a semi-detached property (No. 16 Saxon Street) to the south east. The building work was incomplete with a passageway between the extension and the original structure.

Ground Model

Made Ground Soils

Made Ground has been encountered to depths of between 0.8m and 1.5m bgl. The surfacing comprised reworked topsoil to a maximum depth of 0.4m bgl and block paving over sand to 0.2m bgl.

The remainder of the Made Ground consisted of brown variably clayey gravelly sand.

Natural Soils

Very loose to loose brown black clayey Gravel of mixed lithologies and very gravelly clayey Sand was in WS01 and WS02 to depths of between 3.8m and 4.5m bgl.

Medium dense to dense clayey gravelly Sand was observed in WS03 from 0.8m to 2.3m bgl.

Soft to firm to very stiff slightly gravelly Clay was in all of the boreholes from depths of between 2.3m and 4.5m bgl.

Bedrock

Bedrock was not observed in the boreholes.

Groundwater

Groundwater strikes were observed at 3.0m bgl in WS01 and WS02 in the superficial sand deposits and in WS03 in the clay deposits.

Ground Engineering Assessment

Coal Mining

A treated mine shaft is located 1m to the north of the site. In addition, a risk from shallow coal mine workings was considered to be negligible by Sub Surface North West Limited.

Foundations

Shallow foundations are not considered to be a suitable option for the site as Made Ground and poor strength natural soils have been encountered up to 4.5m bgl. The use of Vibro Stone Columns (VSCs) is considered to be a viable option for the proposed residential development however, the overall stability of the neighbouring properties requires consideration and the potential effect of vibration.

As an alternative, driven pile foundations could be used transferring loads through the underlying Made Ground, loose Sand/Gravel and soft Clay to the underlying stiff Clay at circa 6.0m bgl.

Discussions should be had with a specialist vibro/piling contractor to determine whether sufficient ground investigation information is available for design purposes or whether deeper cable percussive boreholes are required.

Concrete Design

The results of laboratory pH and sulphate content indicate that ACEC Class AC-3 and sulphate class DS-3 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

Pavement Design

CBR values of greater than 5% are likely to be achieved in undisturbed natural granular soils for pavement design purposes, unless proven otherwise by in-situ testing at sub-base level by a specialist geotechnical engineer. Untreated Made Ground should be assumed to have a CBR value of less than 2.5%, unless proven otherwise.

SuDS

A falling head test was carried out in WS01 at 2.0m bgl in the natural clayey Gravel deposits. A soil infiltration rate of 2.54×10^{-5} m/s was calculated which indicates that SuDS drainage is a possibility in the natural granular soils.

Constraints

Made Ground and poor natural ground has been encountered to depths of up to 4.5m precluding the use of a shallow foundation solution.

There is a 4.5m exclusion zone surrounding the existing treated mineshaft, this should be accurately mapped via GPS survey to confirm that it does not encroach onto the footprint of the proposed building.

GQRA and Revised (PL) Assessment

Human Health

Geo-environmental testing has recorded elevated concentrations of arsenic, lead, benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene in the Made Ground topsoil and sand. In addition, Chrysotile asbestos fibres were detected in the Made Ground sand of WS02 at 0.7m at a concentration of 0.001mass %.

The proposed development will include private gardens. As contaminated Made Ground has been identified, the risk to human health is considered to be Moderate.

Controlled Waters

Mobile contamination has not been determined as part of this Ground Investigation therefore the risk to controlled waters is Very Low. In addition, there are no surface water features within 250m.

Permanent Ground Gas

Initial gas monitoring has not recorded any methane and relatively low concentrations of carbon dioxide were detected. Interim results place the site in the Green Traffic Light Zone and gas protection measures will not be required. This will be confirmed on completion of the monitoring. In addition, the site is not within an area requiring radon precautions within foundations. The risk from permanent ground gases is Low.

Final Appraisal

The following further work is considered necessary to progress the site to construction phase:

- *Completion of gas monitoring programme.*
- *Issue gas assessment.*
- *Site GPS survey to determine extent of the treated mineshaft exclusion zone.*
- *Demolition Asbestos survey.*
- *Design of remedial strategy, if required.*
- *Detailed foundation design.*
- *Confirmation of the recommendations made within this report with the Regulators.*

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Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
<i>GRO-22035-P01</i>	-	<i>Project Location Plan</i>
<i>GRO-22035-P02</i>	-	<i>Exploratory Hole Location Plan</i>
<i>GRO-22035-P03</i>	-	<i>Generalised Ground Model</i>
<i>GRO-22035-P04</i>	-	<i>Illustrative CSM</i>

1.0 INTRODUCTION

1.1 Project Objectives

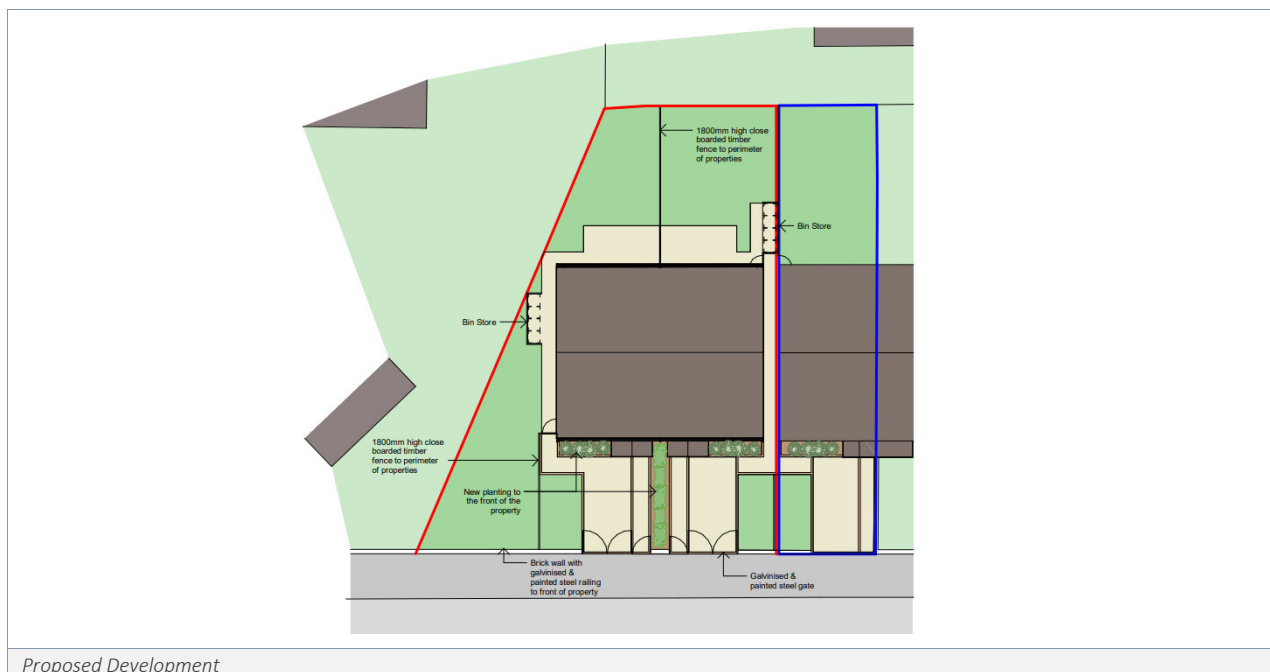
Groundtech Consulting Limited have been instructed by DYSE Structural Engineers on behalf of their Client Sandton London EC1Y Limited to undertake a Geo-Environmental Appraisal for a site at Saxon Street in Manchester.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2013, BS 8576 and BS 22475 to revise the CSM and quantify the level of risk identified in the PRA. The Appraisal has been prepared in accordance with current UK Legislation and to discharge Land Quality pre-commencement planning conditions.

The report has been undertaken to fulfil the requirements of a preliminary risk assessment in accordance with LCRM "Land Contamination Risk Management".

1.2 Proposed Development

The proposed development is residential end use comprising two semi-detached properties.



1.3 Limitations

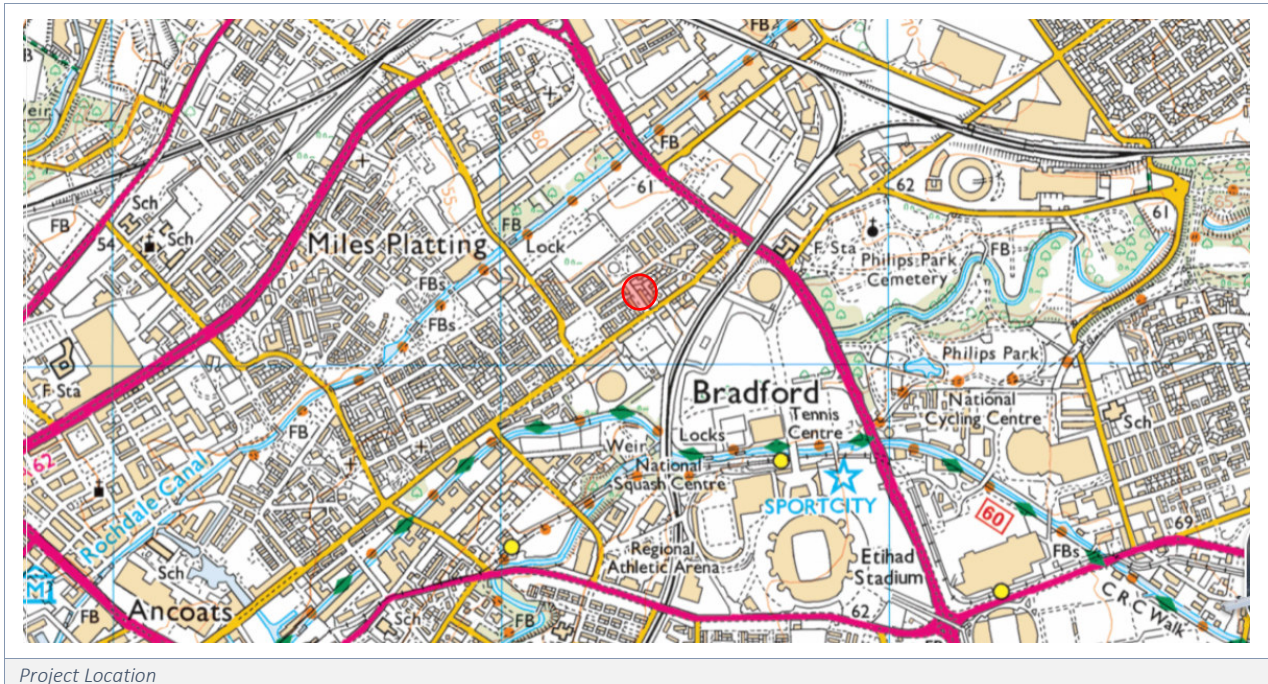
Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

The assessment has been prepared for the exclusive use of the client. No third parties may rely on or reproduce the contents of the report without the written permission of Groundtech Consulting Limited. If any unauthorised third party comes into possession of the report, they rely on it at their own risk and Groundtech Consulting Limited will not be obliged to provide a duty of care.

2.0 SITE SETTING

2.1 Location

The site is located circa 2.5km north east of Manchester City Centre, as shown on the Project Location Plan GRO-22035-P01 and is approximately centred on National Grid Reference 386345, 399200.



Access to the site is gained off Saxon Street to the west.

2.2 Site Description

The site is irregular in shape and circa 0.03ha in area. The site topography is generally level.

Onsite Features

The main feature onsite is a two storey residential dwelling which was constructed as an extension to a semi-detached property (No. 16 Saxon Street) to the south east. The building work was incomplete with a passageway between the extension and the original structure.

The buildings are predominantly surrounded by garden areas with concrete footings present in the northern section of the site.

Vegetation in the form of trees are not present onsite however, they are present in neighbouring gardens.

Site Boundaries and Surrounding Features

The site boundaries are formed by a mixture of brick walls and wooden fencing.

The site is surrounded by residential properties and associated gardens. Saxon Street is to the immediate west and Saxon Street Park is circa 25m north west.

Site photographs are presented in *Appendix 2*.

3.0 PREVIOUS DESK STUDY INFORMATION

A previous Desk Study was carried out at the site by Sub Surface North West Limited report referenced 7281A, dated February 2022. A summary of the key findings is presented below.

Site History

The earliest survey of 1848 shows the site adjacent to a coal pit in a largely undeveloped area. By 1905, the site had been developed as part of an area of back-to-back terraced housing, which was demolished by 1984. In 2001, the site formed a side garden for a house to the south east with an extension built on site by 2010, subsequently separated for the present development.

Geology

The site is underlain by superficial deposits comprising Glacial Till – gravelly sandy silty clays with sand and gravel horizons.

The solid geology is the Pennine Upper Coal Measures Formation – interbedded mudstones, siltstones and mudstone with some coal seams.

Hydrogeology

The superficial deposits are classified as a Secondary Undifferentiated Aquifer whilst the bedrock is a Secondary A Aquifer.

There are no Source Protection Zones within 500m. The nearest groundwater abstraction point is 614m to the north however, there are no potable water abstraction within 1km.

Hydrology

There are no watercourses or surface water bodies identified within 250m.

Environmental Setting

A coal pit was located close to site in 1848 and an historical gas works was situated approximately 85m to the south east.

Landfill sites have been identified 186m to the south east and 215m to the south.

Coal Mining Appraisal

A Geological and Mining Appraisal was carried out by Sub Surface North West Limited referenced 7281, dated August 2021. A summary is provided below.

The Geological and Mining Appraisal indicates there are two mineshafts in close proximity to the site; a treated mineshaft located approximately 1m to the north of the site and an untreated mineshaft with a 'best plot' position located approximately 1m to the west of the site. The untreated mineshaft has not been located by previous site investigations and consequently needs to be treated as a potential risk to the development. Based on the CIRIA C758D guidance, a minimum 5m departure zone should be applied to the 'best plot' which potentially places the mineshaft within the site. However, in addition a no-build exclusion zone of the order of an 18m radius needs to be applied to the area surrounding the untreated mineshaft which significantly impacts the site, regardless of the potential position of the mineshaft.

Given the above, it was considered that without location and treatment, the untreated mineshaft presents a significant risk and requires a no-build exclusion zone that potentially encompasses the whole site and

therefore would make further development unfeasible. In addition, a no-build exclusion zone would be also required surrounding the treated mineshaft which is recommended as 4.5m from the centre of the cap, and therefore also encroaches significantly onto the northern area of the site.

With regard to shallow mine workings, the site is anticipated to be underlain by some 18m to 20m of Glacial Till drift deposits underlain by Coal Measures strata bedrock. The 0.5m thick Bradford Three Quarters Coal seam is identified as underlying the site at a depth of approximately 15m below rockhead, this in turn is underlain by another 26m of bedrock before the 1.4m thick Bradford Four Foot Coal seam is anticipated, this seam was evidently worked in the area.

Surface instability arises when the collapse of mine workings migrates upwards through the roof strata and back to the surface or near surface level. There is considered to be a potential for this if there is less than ten times the unworked thickness of the coal seam in intact rock strata above the mined coal seam. Given the above, Sub Surface North West Limited consider there to be negligible risk of instability relating to mine workings within shallow coal seams underlying the site.

A Mining Assessment was also undertaken at the site by Wardell Armstrong. They concluded that based on the available documentary evidence, it is considered that the mine shafts referred to by The Coal Authority as 386399-008 and 386399-009 are mis-plots of the same shaft. The mine shaft was located and fully treated in the 1980s and the development layout at that time adjusted to accommodate the location of the treated shaft.

Based on the above assessment, Wardell Armstrong consider that the risk to the currently proposed single residential development at the site is low and can proceed as planned using traditional shallow foundations.

Notwithstanding this, as with many parts of the former Lancashire coalfield there is always the possibility of unrecorded mine shafts being present on or within influencing distance of the site and during the development of the site a close vigilance should be maintained during soil stripping etc, for anomalous ground, such as circular areas of fill material or brickwork that may represent an unrecorded shaft or relict mining feature. Should such a feature be identified all work should be suspended and it should be reported for investigation and stabilisation as appropriate.

4.0 SCOPE OF INVESTIGATION AND RATIONALE

4.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain a watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Identify realistic pollution linkages to groundwater.
Obtain relevant geotechnical parameters for preliminary foundation design to address both ULS and SLS conditions.
Determine soil infiltration rates through carrying out falling head tests.
Determine if targeted supplementary investigation in areas of concern is required and for remedial design.
Install monitoring standpipes for gas and groundwater monitoring.
Assess the identified pollution linkages in the CSM.

4.2 Scope of Works

The following scope of works was completed on 5th April 2022:

- 3 No. windowless sample boreholes were advanced to depths of between 5.0m and 6.45m bgl using a Dando Terrier windowless sampling borehole rig.
- 1 No. falling head test was carried out in WS01.

The exploratory hole locations are presented on Groundtech Plan GRO-22035-P02, and the borehole logs are presented in *Appendix 3*.

The falling head test results are in *Appendix 4*.

The exploratory holes were positioned to establish the stratification beneath the site, and target any areas of concern as summarised in the table below:

Location	Target Rationale
WS01 to WS03	Footprint of the proposed dwelling.

The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- BS 5930 'Code of Practice for Site Investigations' 2015.
- BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.
- BS EN ISO 14689:2002 'Geotechnical investigation and testing – Identification and classification of rock'.

4.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples taken are summarised in the table below:

Soil Sample	Number
<i>Environmental Sample</i>	<i>6</i>
<i>Disturbed Sample</i>	<i>13</i>

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed to obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for chemical analysis were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature.

The sample locations and depths are recorded on the exploratory logs.

4.4 Geo-Environmental Analysis

To inform the Generic Quantitative Risk Assessment, the following geo-environmental testing was scheduled to assess the risk from contamination on the site. The testing is based on the potential sources identified in the PRA and observations during the ground investigation.

Contaminants of Concern	Matrix	Number
<i>Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc and pH.</i>	<i>Soil</i>	<i>3</i>
<i>Speciated PAHs</i>	<i>Soil</i>	<i>3</i>
<i>Asbestos Screening</i>	<i>Soil</i>	<i>3</i>
<i>Asbestos Quantification</i>	<i>Soil</i>	<i>1</i>

The Geo-Environmental Laboratory Testing Results are presented in *Appendix 5*.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' 1990. The following tests were scheduled:

British Standard	Test Method	Number
<i>Part 2</i>	<i>Water Content</i>	<i>2</i>
<i>Part 2</i>	<i>Plasticity Index Analysis</i>	<i>2</i>
<i>Part 3</i>	<i>pH Value</i>	<i>2</i>
<i>Part 3</i>	<i>Water Soluble Sulphate Content</i>	<i>2</i>
<i>BRE SD1</i>	<i>BRE Full Suite</i>	<i>2</i>

The Geotechnical Laboratory Testing Results are presented in *Appendix 6*.

4.5 Gas and Groundwater Monitoring

Gas and groundwater monitoring installations were constructed in the boreholes. The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth (m bgl)	Response Zone (m bgl)	Targeted Strata	Reason
WS01	5.0	2.0 – 5.0	Natural Strata	Ground Gas
WS02	5.0	1.0 – 5.0	Natural Strata	Ground Gas
WS03	5.0	2.0 – 5.0	Natural Strata	Ground Gas

Permanent gas and flow rate monitoring was carried out using a GFM 436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4) as the percentage volume in air (%v/v).
- Hydrogen sulphide (H_2S) and carbon monoxide (CO) as the percentage volume in air (%v/v).
- Lower Explosive Limit (%LEL) of methane.
- Atmospheric and borehole pressure, including pressure trend.
- Flow measurements (l/hr).
- Weather and ground surface conditions.

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes.

Interim permanent gas and groundwater monitoring results are presented in *Appendix 7*.

5.0 GROUND MODEL

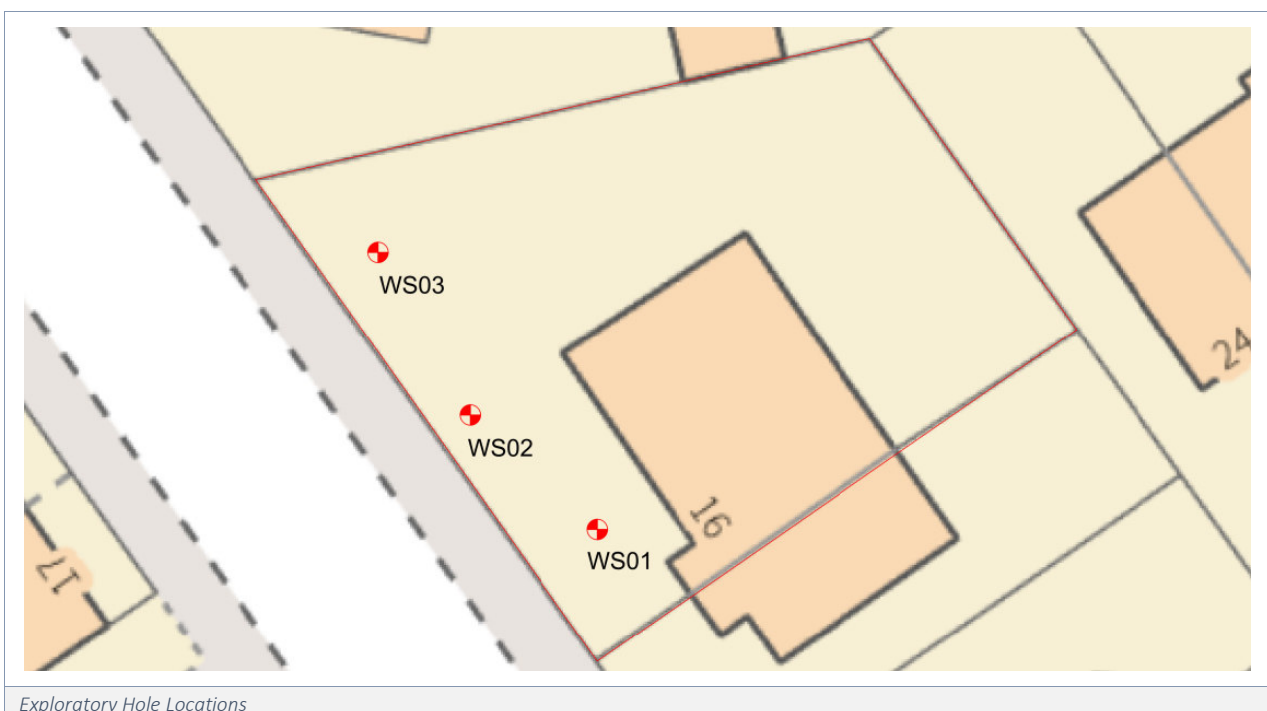
5.1 Made Ground

Made Ground has been encountered to depths of between 0.8m and 1.5m bgl.

Dark brown sandy topsoil with gravel of mixed lithologies including brick, concrete, ceramics and fabrics was in WS01 and WS02 to a maximum depth of 0.4m bgl. Block paving over sand was in WS03 to 0.2m bgl.

One main Made Ground population was encountered during the investigation as described below:

- *Brown variably clayey gravelly sand was in WS01 (0.4m to 1.5m), WS02 (0.3m to 1.1m) and WS03 (0.2m to 0.8m). The gravel is of mixed lithology including brick and rare ash.*



5.2 Natural Ground

The natural strata encountered generally confirmed the published geological records.

Four main natural stratification encountered during the investigation and are described below:

- *Very loose to loose brown black clayey Gravel of mixed lithologies including coal and mudstone was in WS01 (1.5m to 2.5m) and WS02 (1.1m to 1.9m).*
- *Loose light brown very gravelly clayey Sand was present in WS01 (1.5m to 4.5m), WS02 (1.9m to 3.8m).*
- *Medium dense to dense clayey gravelly Sand was observed in WS03 from 0.8m to 2.3m bgl.*

- *Soft to firm to very stiff slightly gravelly Clay was in all of the boreholes from depths of between 2.3m and 4.5m bgl.*

5.3 Bedrock

Bedrock was not observed in the boreholes.

5.4 Groundwater

Groundwater strikes were observed at 3.0m bgl in WS01 and WS02 in the superficial Sand deposits and in WS03 in the Clay soils.

5.5 Watching Brief

A watching brief was maintained during the ground investigation for visual and olfactory evidence of contamination.

No significant evidence of contamination was noted.

5.6 Excavation Stability

No evidence of spalling or collapse was noted during excavation of the hand dug trial pits.

5.7 Borehole Progress

Slow progress while advancing the boreholes was noted from depths of 5.0m bgl where SPT refusals were recorded in the Coal Measures deposits.

6.0 GROUND ENGINEERING

6.1 Geotechnical Testing Results

Comparison of water content and the value of 0.4 times the Liquid Limit in accordance with BRE Digest 412 'Desiccation in Clay Soils' suggests significant desiccation has taken place when 0.4 times the Liquid Limit is greater than the actual water measured water content. This is a rudimentary method but also a good guide.

The results of the PI analysis will be forwarded on once we receive them.

6.2 Assessment Background

The ground engineering investigation has been undertaken to formulate an accurate ground model in order to undertake preliminary foundation design. The ground model has been constructed with a moderate to high level of confidence, the ground model has evolved from the information obtained by the PRA.

It is proposed to construction 2 No. semi-detached houses with associated parking and external works. The site is currently occupied by residential properties which will need to be demolished as part of the enabling works. All foundations should be grubbed up and the topsoil stripped and stockpiled separately.

Made Ground has been encountered to depths of between 0.8m and 1.5m bgl. Very loose to loose Sand and Gravel was identified in WS01 and WS02 to depths of up to 4.5m bgl while medium dense to dense Sand was in WS03 to 2.3m bgl. The Sands and Gravels were underlain by soft to firm to very stiff slightly gravelly Clay.

A treated mine shaft is located 1m to the north of the site. A second untreated mineshaft with a 'best plot' position was potentially located approximately 1m to the west of the site. Wardell Armstrong concluded that based on the available evidence, it is considered that these mine shafts referred to by The Coal Authority as 386399-008 and 386399-009 are mis-plots of the same shaft. The mine shaft was located and fully treated in the 1980s.

Although the mineshaft located approximately 1m to the north of the site has been treated in the 1980s, a no-build exclusion zone is still required surrounding the mineshaft. The required exclusion zone comprises an area of 4.5m from the centre of the cap, this encroaches onto the northern area of the site. The exclusion zone is will largely comprise the rear gardens of the properties and is unlikely to affect the proposed development, however this should be determined accurately via onsite surveying to confirm that the property does not encroach into the exclusion zone.

In addition, a risk from shallow coal mine workings was considered to be negligible by Sub Surface North West Limited.

6.3 Geotechnical Parameters

The geotechnical test results have been evaluated to derive geotechnical parameters for the soils underlying the site. A 'depth to SPT N' value graph is presented on Groundtech Plan *GRO-22035-P03* in *Appendix 8* to provide a generalised ground model for the site.

Characterisation of the geotechnical parameters above has been undertaken to select a characteristic value, which is a cautious estimate of the value affecting the occurrence of the limit state.

The characteristic values of the granular and cohesive strata have been selected based on correlation with SPT values. The characteristic values for Ultimate Limit State (ULS) selected are presented in the table below:

Stratum	Parameter	Selected Characteristic Value
<i>Very loose to loose Sand and Gravel</i>	<i>Drained angle of friction (ϕ')</i>	<i>28°</i>
<i>Medium dense to dense Sand</i>	<i>Drained angle of friction (ϕ')</i>	<i>36°</i>
<i>Soft to firm Clay</i>	<i>Undrained Shear Strength (c_u)</i>	<i>20kN/m²</i>
<i>Stiff to very stiff Clay</i>	<i>Undrained Shear Strength (c_u)</i>	<i>150kN/m²</i>

6.4 Preliminary Foundation Design

Made Ground has been encountered to depths of up to 1.5m bgl and very loose to loose Gravel / Sand and soft and soft to firm Clay have been observed to depths of 4.5m bgl. Based on the ground conditions encountered, traditional shallow foundations are not considered to be a viable option for the proposed residential development.

At this stage, allowable loads of the proposed structure are not available.

Vibro Stone Columns (VSCs)

Ground Improvement with vibro stone columns using bottom feed techniques could be used as a foundation solution however, the overall stability of the neighbouring properties requires consideration and the potential effect of vibration. This should be discussed with a specialist contractor.

A preliminary design resistance for ultimate limit state and serviceability limit state conditions will be provided by the specialist vibro contractor in their detailed design, however it is likely that foundations for the proposed building could be designed to provide an allowable bearing capacity of 150kN/m².

A preliminary design resistance for ultimate limit state and serviceability limit state conditions will be provided by the specialist vibro contractor in their detailed design. The specialist contractor should provide fitness for purpose cover for the treated zones and depth of treatment.

The depth of foundations is to be a minimum of 0.35m below the surface of the vibro treated ground as the integrity of the columns is not validated to this depth. The reinforced concrete foundation should be designed to span between the centres of adjacent stone columns.

If the shear strength of the clay is considered to be too low, then an alternative to Vibro Stone Columns is considered to Controlled Modulus Columns (CMCs).

Discussions should be had with a specialist vibro contractor to determine whether sufficient ground investigation information is available for design purposes or whether deeper cable percussive boreholes are required.

Pile Foundations

An alternative solution for the proposed two-storey development is considered to be pile foundations transferring loads through the underlying Made Ground, very loose to loose natural Sand and Gravel, and soft Clay to end bear within the stiff Clay deposits at circa 6.0m bgl. When permanent and variable actions are available, the utilisation factor can be confirmed or otherwise in accordance with EC7.

The requirement for reinforcement should be taken into consideration in the detailed design and Equilibrium Limit State conditions should be satisfied.

Driven piles are considered to be the most suitable type of pile for the development, this should be discussed with the preferred piling contractor and a check undertaken to confirm lateral stability is not an issue. Consideration should be given to the effects of vibrations on nearby buildings and therefore bottom driven piles may be the best solution. Good workmanship will be required when installing the piles to ensure the assumptions in the design by calculation are met.

Discussions should be had with a specialist piling contractor to determine whether sufficient ground investigation information is available for design purposes or whether deeper cable percussive boreholes are required.

Piled Solution – Design by Calculation

Preliminary design by calculation has been carried out using due skill and care using the global factor of safety method for pile design. The preliminary design by calculation is based on the following ground model:

- *Made Ground to 1.5m*
- *Loose Gravel / Sand to 4.5m*
- *Stiff Clay to 6.0m*

For a 225mm driven pile 6.0m in length, an allowable load of 85kN can be achieved. If greater loads are required, the diameter of the piles should be increased and/or the piles installed in groups.

The ground conditions indicate downdrag will potentially be an issue and should be taken into consideration by the detailed design when the finished site levels are available.

An appropriate working platform should be constructed in accordance with BR470 guidance.

Design Validation

The piling type, length, depth of reinforcement and design should be discussed with a specialist piling contractor. They can then undertake the detailed design including drawings and specifications to provide fitness for purpose design.

The piling works should be carried out in accordance with Execution Standard BS EN 12699:2015 'Execution of special geotechnical works. Displacement piles'. If driven piles are the preferred installation method, they will be driven to sett using pile driving formulae in accordance with Eurocode 7.

6.5 Building Near Trees

Foundation excavations are unlikely to encounter cohesive strata in the vicinity of existing, proposed or recently removed trees and heave precautions will not be required.

All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings.

6.6 Floor Slabs

Greater than 600mm of Made Ground is present beneath the site therefore suspended floor slabs will be required and should be designed in accordance with the chosen foundation solution.

6.7 Construction

Instability of the Made Ground and loose Sand / Gravel is a possibility and should be considered in the groundworks method statements. Excavations should not be exposed to adverse weather conditions for any substantial period of time.

Tracked high specification plant is recommended to maintain the build programme. Breaking equipment will also be required to penetrate areas of hardsurfacing and during the demolition process.

Groundwater should not be encountered within foundation excavations.

6.8 Concrete Classification

Made Ground

Water soluble sulphate testing was undertaken on three samples of the Made Ground. The range of soluble sulphate (SO_4) recorded is 28.5mg/l to 66.5mg/l and associated pH values ranged between 7.8 and 9.1 indicating slightly alkaline conditions.

For a dataset containing less than five results, the highest sulphate test result should be taken as the characteristic value along with the lowest of the pH results. For the Made Ground, the characteristic water soluble sulphate concentration is 66.5mg/l and the pH value is 5.6.

Natural Strata

Water soluble sulphate testing was also undertaken on two samples of the natural ground. The range of soluble sulphate (SO_4) recorded is 74.4mg/l to 438mg/l and associated pH values ranged between 7.9 and 8.6 indicating slightly alkaline conditions.

A similar sized dataset is available therefore, the characteristic water soluble sulphate concentration is 438mg/l and the pH value is 7.9.

Natural granular deposits are present beneath the site therefore, the groundwater is considered to be mobile.

The results of laboratory pH and sulphate content indicate that ACEC Class AC-1 and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

The concentrations of magnesium, chloride and nitrate have not affected the above concrete classification.

Pyrite Potential

Additional testing was undertaken to determine if the natural Gravel and Clay underlying the site is pyritic. One sample of natural Gravel and one sample of Clay was tested for total sulphur and total sulphate which was used to determine the total amount of oxidisable sulphides in the sample. If the amount of oxidisable sulphates is greater than 0.3% SO_4 , pyrite is probably present. The total amount of oxidisable sulphates in the samples was determined to be greater than 0.3% SO_4 and it is therefore potentially pyritic.

Consideration should be given to increasing the concrete classification. The calculated total potential sulphate (TPS SO₄ %) of between 0.348% and 1.263% indicates that the concrete class should be increased to ACEC Class AC-3 and sulphate class DS-3.

6.9 Pavement Design

CBR values of greater than 5% are likely to be achieved in undisturbed natural granular soils for pavement design purposes, unless proven otherwise by in-situ testing at sub-base level by a specialist geotechnical engineer. As a minimum, the subgrade should be proof rolled prior to construction. Some reengineering of the subgrade is required prior to highway construction to achieve the required design CBR value.

Untreated Made Ground should be assumed to have a CBR value of less than 2.5%, unless proven otherwise. Highways Agency document HD25 'Interim Advice Note 73/06 Revision 1' (2009) states that where a subgrade has a CBR value lower than 2.5%, it is considered unsuitable support for a pavement foundation since it would tend to deform under construction traffic and must be improved.

The soils are considered to be frost susceptible due to the fines content and highway construction should be a minimum thickness of 450mm to mitigate the risk.

6.10 Sustainable Urban Drainage System (SuDS)

A falling head test was carried out in WS01 at 2.0m bgl in the natural clayey Gravel deposits. A soil infiltration rate of 2.54×10^{-5} m/s was calculated which indicates that SuDS drainage is a possibility in the natural granular soils.

This would be subject to the results of in-situ testing in accordance with BRE Digest 365 'Soakaway Testing' 2016.

7.0 LAND QUALITY

7.1 Geo-Environmental Testing Results - Soils

Samples of Made Ground have been tested for a range of relevant Contaminants of Concern. In accordance with LCRM (Land Contamination Risk Management), a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the concentrations as derived through Geo-Environmental analysis.

The GQRA process comprises the comparison of the actual concentrations measured on site with Generic Assessment Criteria (GACs) for the protection of human health.

The GACs used for the assessment of soil concentrations have been derived using the CLEA model. The GACs used and their ranking of importance are listed below:

- *Soil Guideline Values (SGVs) which demonstrate minimal risk.*
- *LQM/CIEH S4ULs which use the same toxicological data as the SGVs but different exposure criteria.*
- *C4SLs which demonstrate low risk.*

In deriving the GACs for use on Brownfield sites, we have assumed a 1.0% Soil Organic Matter unless the results indicate otherwise.

The proposed end-use for the site is a residential development comprising housing with private domestic gardens and associated driveways. We have therefore undertaken the GQRA on the basis that the proposed development site falls under the Residential (with Plant Uptake) land-use scenario as defined in SR3 (EA, 2009b).

The strata or sources of contamination targeted by the laboratory testing scheduled is summarised in the table below:

Strata	Number of Samples Tested	Locations
<i>Granular Made Ground (Population 1)</i>	2	WS02 and WS03
<i>Topsoil Made Ground (Population 2)</i>	1	WS01

A summary of the Geo-Environmental Testing results is presented below and the GQRA Screening Values are presented in *Appendix 9*:

Contaminant	Metals		Exceedances	Locations
	Range (mg/kg)	Screening Values		
<i>Arsenic</i>	28 – 33	32	1	WS02 at 0.7m
<i>Cadmium</i>	<0.2	10	0	-
<i>Chromium</i>	33 – 39	910	0	-
<i>Hexavalent Chromium</i>	<4.0	21	0	-
<i>Copper</i>	210 – 290	2400	0	-
<i>Lead</i>	240 – 310	200	3	WS01 at 0.2m WS02 at 0.7m WS03 at 0.6m
<i>Mercury</i>	0.5 – 0.8	1	0	-

Nickel	34 – 43	130	0	-
Selenium	<1.0	350	0	-
Zinc	190 - 230	3700	0	-
Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range (mg/kg)	Screening Values	Exceedances	Locations
Naphthalene	<0.05	2.3	0	-
Acenaphthylene	<0.05	170	0	-
Acenaphthene	0.27 – 0.98	210	0	-
Fluorene	0.22 – 0.79	170	0	-
Phenanthrene	2.3 – 8.9	95	0	-
Anthracene	0.58 – 2.7	2400	0	-
Fluoranthene	3.1 – 10.0	280	0	-
Pyrene	3.1 – 9.2	620	0	-
Benzo(a)anthracene	1.8 – 5.6	7.2	0	-
Chrysene	1.8 – 4.4	15	0	-
Benzo(k)fluoranthene	0.77 – 2.3	77	0	-
Benzo(b)fluoranthene	1.8 – 4.6	2.6	1	WS03 at 0.6m
Benzo(a)pyrene	2.1 – 5.0	2.2	2	WS01 at 0.2m WS03 at 0.6m
Indeno(123cd)pyrene	0.93 – 2.3	27	0	-
Dibenzo(ah)anthracene	0.27 – 0.71	0.24	3	WS01 at 0.2m WS02 at 0.7m WS03 at 0.6m
Benzo(ghi)perylene	1.2 – 2.5	320	0	-
Others				
Organic Matter		5.6 – 8.9 %		
Asbestos Screen				
Position	Depth (m bgl)	Result		
WS01	0.20	Not detected		
WS02	0.70	Chrysotile Fibres at 0.001mass %		
WS03	0.60	Not detected		

7.2 Generic Quantitative Risk Assessment - Soils

The site is currently occupied by a residential dwelling surrounded by garden areas. Made Ground has been encountered to depths of up to 1.5m bgl and generally consisted of reworked topsoil overlying clayey gravelly sand. Samples of the topsoil and sand have been tested for a suite of contaminants including metals, PAHs and asbestos.

Metals

A slightly elevated concentration of arsenic of 33mg/kg was recorded in WS02 at 0.7m bgl when compared to the screening value of 32mg/kg. This was within the Made Ground comprising gravelly sand.

Lead was elevated above the residential with plant uptake screening value of 200mg/kg in all three samples of Made Ground that were tested at levels between 240mg/kg and 310mg/kg.

The elevated metals are likely to be associated with ash present within the Made Ground.

PAHs

Elevated concentrations of benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene were recorded in the reworked topsoil and Made Ground sands.

Again, these elevations are likely to be associated with ash within the Made Ground matrix.

No other PAHs were elevated.

Asbestos

Three samples of Made Ground were screened for the presence of asbestos. Chrysotile asbestos fibres were detected in WS02 at 0.7m bgl within the Made Ground sand deposits. The asbestos may be linked to the residential properties that have been demolished onsite historically.

No asbestos was detected in the other two samples of Made Ground that were screened.

7.3 Permanent Ground Gases

Monitoring standpipes were installed in three of the windowless sample boreholes during the Ground Investigation works. A single monitoring visit has been conducted to date with three more scheduled. A full gas assessment will be issued upon completion of the monitoring.

During the monitoring period to date, no methane (CH₄) has been recorded within the standpipes. Detectable levels of carbon dioxide (CO₂) were recorded within the standpipes, up to a maximum level of 2.9% v/v together with associated oxygen (O₂) concentrations (minimum 14.6% v/v).

In addition, no positive gas flow rates were recorded during the visits.

Groundwater levels were recorded within the standpipes ranging from 2.04m to 2.43m bgl during the monitoring period.

The atmospheric pressure was 1009mb during the monitoring visit and was carried out during a period of steady barometric pressure.

Characterisation of the Gas Screening Value (GSV)

Based upon the initial results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to gas screening values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates. In addition, individual “hazardous gas flow rates” (Q_{hg}) have been derived for each monitoring point. As no methane has been detected, no GSV has been calculated.

$$GSV \text{ (l/hr)} = \text{max borehole flow rate (l/hr)} \times \text{max gas concentration (\%)}$$

For this assessment, the maximum recorded concentration of carbon dioxide of 2.9% v/v. As no positive gas flow rates were recorded, the limit of detection of the gas monitor of 0.1 l/hr has been used to calculate the GSV.

$$\text{Carbon Dioxide GSV} = 0.029 (2.9\%) \times 0.1 = 0.0029 \text{ l/hr}$$

Based on the site being developed with low-rise housing, the Boyle and Witherington, 2006 method has been used to carry out the assessment. This is a risk-based approach that is designed to allow an identification of gas protection for a low-rise housing development by comparing the measured gas emission rates to generic 'traffic lights' scenarios. The traffic lights include 'typical maximum concentrations' and are provided for initial screening purposes and risk-based gas screening values for consideration in situations where the typical maximum concentrations are exceeded.

When considering the results, in accordance with CIRIA C665 (Situation B – Low-rise housing with a ventilated underfloor void (min 150mm) and Table 8.7 – NHBC Traffic light system for 150mm void) it can be seen that the GSV value for carbon dioxide is below the assessment GSV of less than 0.78 l/hr and falls within the Green Traffic Light Zone.

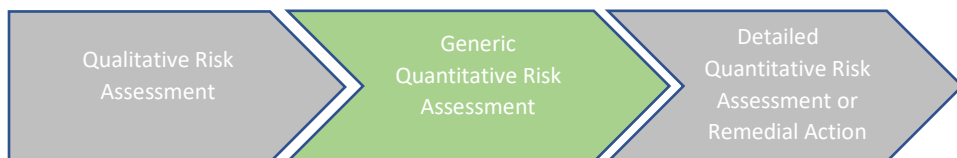
Radon Gas

The site is not located in an area requiring radon precautions in foundations.

7.4 Revised Pollution Linkage Assessment

A pollution linkage assessment has been undertaken based on the findings of the Ground Investigation and testing to identify any realistic pollution linkages in order to quantify the risks to human health and controlled waters. An illustrative revised CSM is presented on *GRO-22065-P04* and the risk classification has been estimated in accordance with the CIRIA C552 assessment criteria outlined in *Appendix 10*.

Human Health Pollution Linkage Assessment

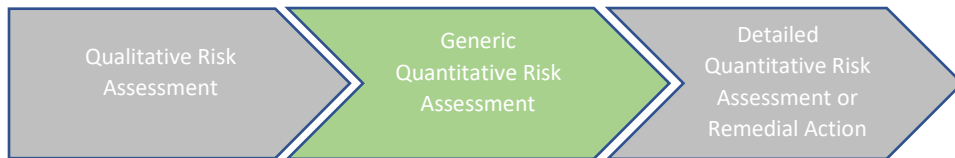


- The table below represents the second stage in the land quality risk assessment process - **the Generic Quantitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL1	Contaminated Soils	Ingestion of soil and dust. Dermal contact with soil.	Low Likelihood	Medium	Moderate	<i>Pollution Linkage 1 refers to proposed site users coming into contact with contaminated soils on the site.</i> <i>The site has been occupied by residential properties, with the initial properties being demolished by the mid-1980s. Made Ground was encountered to a maximum depth of 1.5m bgl and generally consisted of reworked topsoil and sand. No visual or olfactory evidence of contamination was noted during the Ground Investigation works.</i> <i>Geo-environmental testing has recorded elevated concentrations of arsenic, lead, benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene in the Made Ground topsoil and sand. In addition, Chrysotile asbestos fibres were detected in the Made Ground sand of WS02 at 0.7m at a concentration of 0.001mass %. The JIWG combined hazard, exposure and receptor ranking is Low.</i> <i>The proposed development is for new residential housing with private garden areas. As elevated CoC have been determined together with Chrysotile asbestos fibres, a plausible pollution linkage is considered to exist.</i>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL2	Contaminated Soils	Inhalation of vapour.	Unlikely	Medium to Severe	Low	<i>This pollution linkage refers to volatile vapours migrating into confined spaces within the proposed development. No sources of volatiles were identified through the Ground Investigation and geo-environmental testing therefore no pollution linkage is considered to exist.</i>
PL3	Contaminated Soils	Inhalation of soil dust by adjacent site users.	Unlikely	Medium	Low	<i>Pollution Linkage 3 relates to contamination on the subject site affecting adjacent site users. Mobile contamination has not been identified and a realistic pollution linkage does not exist.</i>
PL4	Contaminated Soils	Attacking potable water supply pipe.	Unlikely	Medium	Low	<i>Pollution Linkage 4 refers to the possible contaminants permeating potable water pipes and consumption by the future site end users of the tainted water supply. Made Ground has been encountered to a maximum depth of 1.5m bgl however, no organic contamination was identified. Therefore, a viable pollution linkage is not considered to exist.</i>
PL5	Ground Gas	Migration and accumulation of ground gas in internal spaces.	Unlikely	Medium to Severe	Low	<i>Limited Made Ground has been encountered beneath the site which is considered to be inert. Initial monitoring has not recorded any methane and relatively low concentrations of carbon dioxide was detected. Initial results place the site in the Green Traffic Light Zone and gas protection measures will not be required. This will be confirmed on completion of the monitoring.</i> <i>The site is not within an area requiring radon precautions within foundations.</i>

Controlled Waters Pollution Linkage Assessment



- The table below represents the second stage in the land quality risk assessment process – **Generic Quantitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL6	Contaminated Soils	Impaction of groundwater from soil contamination (diffuse and point). Impaction of groundwater from groundwater plume.	Unlikely	Mild	Very Low	The site is currently occupied by a residential property. Made Ground is present beneath the site to depths of up to 1.5m bgl. Elevated concentrations of arsenic, lead and PAHs have been recorded in the Made Ground topsoil and sand however, no mobile contamination has not been identified. Geological maps indicate that the site is underlain by Glacial Till (Secondary Undifferentiated Aquifer) and the bedrock is the Pennine Upper Coal Measures Formation (Secondary A Aquifer). The site is not within 500m of a SPZ and the groundwater is not considered to be a sensitive resource. There are no active potable groundwater abstractions within 1000m of the site. As a potential source of mobile contamination has not been identified, a plausible pollution linkage is not considered to exist.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL7	Contaminated Soils	Migration of soil and groundwater contamination impacting surface waters.	Unlikely	Mild	Very Low	Pollution Linkage 7 refers to the impaction of surface water features from contaminated soils and groundwater. No surface water features are present within 250m. In addition, no significant sources of mobile contamination have been identified through the desk-based study and Ground Investigation therefore, a pollution linkage is not considered to exist.

7.5 Outline Remedial Strategy

Made Ground has been encountered beneath the site to depths of up to 1.5m bgl. Elevated concentrations of arsenic, lead and PAHs have been recorded within the reworked topsoil materials and Made Ground sand. In addition, asbestos was detected in one of the Made Ground sand samples that was screened. Elevated lead and PAHs were recorded in the reworked topsoil materials onsite and therefore may not be suitable for reuse, additional testing of the topsoil will be required to confirm its suitability.

Cover System

It is proposed to develop the site residentially and will include private garden areas. Within the proposed garden areas formed off Made Ground, a cover system comprising 600mm of clean subsoil and topsoil is recommended over a contamination demarcation barrier. Validation will be required to ensure that the imported soils are suitably clean for the proposed residential end use and the appropriate thickness is placed.

Groundwater

Remediation with respect to controlled waters is not considered to be necessary.

Ground Gas

Based on the results of the preliminary gas monitoring, no gas protection measures will need to be installed within the proposed dwellings. This will be confirmed or otherwise by the full gas assessment.

In addition, radon precautions are not required.

Watching Brief

A watching brief should be in place during ground works and construction. If previously unidentified contamination is encountered, work should cease in that area and Groundtech Consulting contacted for advice.

Specification and Liaison

A Remediation Specification should be prepared for the proposed development and approval gained from the Local Authority.

Regulatory compliance should be obtained pre-commencement to avoid delays during the construction phase which will have cost implications.

7.6 Asbestos in Soils

Asbestos has been detected in one of the three samples screened from across the site and is associated with the Made Ground sand from WS02 at 0.7m bgl. Chrysotile asbestos fibres were detected at a concentration of 0.001mass %.

Where soils will be disturbed as part of the ground works, in accordance with the Joint Industry Working Group (JIWG) decision support tool for CAR2012 work categories, the combined hazard and exposure ranking is *Low* for the concentration of asbestos detected. The work is classified as non-licensed, and CAR does not apply.

The JIWG tables are presented in *Appendix 11*. This should be used as an aid to classify risk and recommend the level of protection required, the final decision on how asbestos within the soils should be managed should be made by the contractor.

7.7 Health and Safety - Construction and Ground Workers

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

PL	Potential Source	Pollution Linkage	Likelihood	Severity	Level of Risk
PL8	Made Ground	Ingestion, direct contact, inhalation of dusts.	Unlikely to Low Likelihood	Medium	Moderate to Low
PL8	Asbestos	Inhalation of fibres.	Unlikely to Low Likelihood	Medium	Moderate to Low

Slightly elevated concentrations of arsenic, lead and PAHs have been recorded in the Made Ground soils. In addition, asbestos was detected in one of the Made Ground samples from WS02 at 0.7m bgl. Site personnel should wear gloves when handling Made Ground and avoid hand to mouth activities, welfare facilities should be available to wash hands. The risk should be communicated through a site induction and information noticeboards.

General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

7.8 Waste Classification by Assessment

We have reviewed the testing results and inputted them into the HazWasteOnline model which allows users to code and classify waste as defined in the EWC (European Waste Catalogue 2002) based on EC Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste (1st edition 2015)-Technical Guidance”).

This is a useful tool as waste producers have the legal responsibility to classify any waste they produce.

Three samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3. The results are in the Waste Classification Report presented in *Appendix 12*.

Based on the HazWasteOnline assessment tool, the Made Ground soils have been classified as Non-Hazardous for waste disposal purposes.

Asbestos was detected in WS02 at 0.7m bgl at a concentration of 0.001mass % which is below the Hazardous threshold of 0.1mass %.

Total testing was not undertaken on the natural soils and are assumed to be Non-Hazardous.

7.9 Waste Acceptance Criteria (WAC) Results

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste) led to the establishment of a methodology for classifying wastes. Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. There are three different WAC, these are for:

- *Inert waste*
- *Non-Hazardous waste*
- *Hazardous waste*

Waste Acceptance Criteria (WAC) testing was outside the scope of this investigation and the guidance given below is general.

The possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- *They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source) and*
- *There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.*

If any organic contaminated material is encountered during the construction phase, it is possible that this may be classified as Hazardous, and testing should be undertaken at that time.

Materials should be segregated and where necessary sufficient time is allowed to further classify the material properly, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is recommended that where possible, the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

The reuse of soils on the site this should be done in accordance with the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE CoP). Any re-use scheme should be designed to minimise disposal costs.

After a cut and fill balance plan/volume calculation has been carried out, a U1 and T5 exemption could be registered. This will allow the use of the following soils without a waste permit or under Dow CoP MMP:

- *1,000 tonnes (c.600m³) of non-hazardous soil.*
- *5,000 tonnes (c.3,000m³) of natural sand and gravels.*
- *50,000 tonnes (c.25,000m³) of bituminous material to be used in roadways.*
- *5,000 tonnes (c.3,000m³) of crushed concrete / stone.*

8.0 FINAL APPRAISAL

8.1 Land Quality

The site has been occupied by residential dwellings, with the initial properties being demolished by the mid-1980s. Made Ground was encountered to a maximum depth of 1.5m bgl and generally consisted of reworked topsoil and sand. No visual or olfactory evidence of contamination was noted during the Ground Investigation works.

Geo-environmental testing has recorded elevated concentrations of arsenic, lead, benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene in the Made Ground topsoil and sand. In addition, Chrysotile asbestos fibres were detected in the Made Ground sand of WS02 at 0.7m at a concentration of 0.001mass %.

The proposed development will include private gardens. As contaminated Made Ground has been identified, the risk to human health is considered to be *Moderate*.

Mobile contamination has not been determined as part of this Ground Investigation therefore the risk to controlled waters is *Very Low*. In addition, there are no surface water features within 250m.

Initial gas monitoring has not recorded any methane and relatively low concentrations of carbon dioxide were detected. Interim results place the site in the Green Traffic Light Zone and gas protection measures will not be required. This will be confirmed on completion of the monitoring. In addition, the site is not within an area requiring radon precautions within foundations. The risk from permanent ground gases is *Low*.

The Made Ground soils have been classified as Non-Hazardous for waste disposal purposes.

8.2 Ground Engineering

Shallow foundations are not considered to be a suitable option for the site as Made Ground and poor strength natural soils have been encountered up to 4.5m bgl. The use of Vibro Stone Columns (VSCs) is considered to be a viable option for the proposed residential development however, the overall stability of the neighbouring properties requires consideration and the potential effect of vibration. As an alternative, pile foundations transferring loads to the stiff to very stiff clays could be used.

Discussions should be had with a specialist vibro/piling contractor to determine whether sufficient ground investigation information is available for design purposes or whether deeper cable percussive boreholes are required.

The position of the treated mineshaft to the north should be accurately determined and the no build exclusion zone of 4.5m should be mapped to confirm that it does not encroach into the footprint of the proposed residential property.

The results of laboratory pH and sulphate content indicate that ACEC Class AC-3 and sulphate class DS-3 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

A falling head test was carried out in WS01 at 2.0m bgl in the natural clayey Gravel deposits. A soil infiltration rate of 2.54×10^{-5} m/s was calculated which indicates that SuDS drainage is a possibility in the natural granular soils.

8.3 Required Supplementary Investigation

The following further work is considered necessary to progress the site to construction phase:

Completion of gas monitoring programme.

Issue gas assessment.

Site GPS survey to determine extent of the treated mineshaft exclusion zone.

Demolition Asbestos survey.

Design of remedial strategy, if required.

Detailed foundation design.

Confirmation of the recommendations made within this report with the Regulators.

9.0 RELEVANT INDUSTRY REFERENCES

- British Standards Institution. *Investigation of Potentially Contaminated sites - code of practice*. BS 10175:2017.
- British Standards Institution '*Code of Practice for Site Investigations*' BS 5930:2015
- British Standards Institution "*Geotechnical investigation and testing – Identification and classification of soil*" BS EN ISO 14688:2002.
- British Standards Institution "*Geotechnical investigation and testing – Identification and classification of rock*" BS EN ISO 14689:2002.
- BRE Report BR211 '*Radon – Guidance on protective measures for new buildings*' 2015 Edition.
- BRE Special Digest 1: "*Concrete in Aggressive Ground*" 3rd Ed 2005.
- CIRIA 552 "*Contaminated Land Risk Assessment – A guide to good practice*" 2001.
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APPENDIX 1 - Plans



GROUNDTECH CONSULTING 	CLIENT SANDTON LONDON EC1Y LIMITED	DATE MAY 2022				Status		Notes SITE LOCATION
	PROJECT TITLE SAXON STREET, MANCHESTER	SCALE NTS				Preliminary		
	PLAN TITLE PROJECT LOCATION PLAN	PLAN NUMBER GRO-22035-P01				Draft		
						Issued		
						For Comment		
			Rev.	Details	Date	Approved		



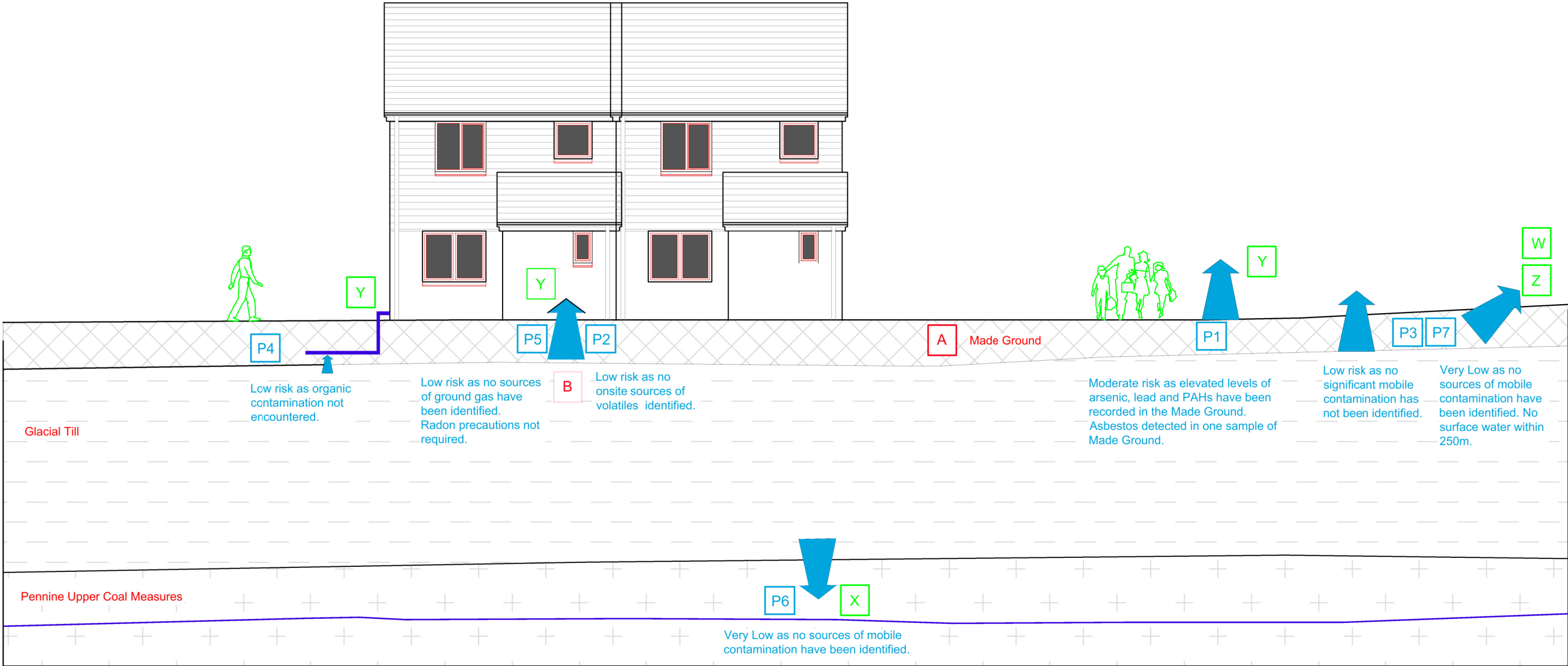
GROUNDTECH CONSULTING	CLIENT SANDTON LONDON EC1Y LIMITED	DATE APRIL 2022				Status		Notes  Approximate Windowless Sample Borehole Position: 
	PROJECT TITLE SAXON STREET, MANCHESTER	SCALE NTS				Preliminary		
	PLAN TITLE EXPLORATORY HOLE LOCATION PLAN	PLAN NUMBER GRO-22035-P02				Draft		
						Issued 		
						For Comment		
						Approved		
			Rev.	Details	Date			



SOURCES
A. Contaminated soils / Made Ground. B. Ground gas.

POLLUTION LINKAGES
P1. Ingestion of soil and dust. P2. Inhalation of vapour. P3. Inhalation of soil dust by adjacent site users. P4. Attacking of potable water supply pipe. P5. Migration and accumulation of ground gas in internal places. P6. Impaction of groundwater from soil contamination. P7. Migration of soil and groundwater contamination impacting surface waters.

RECEPTORS
W. No surface water features within 250m X. Groundwater within the Secondary A Aquifer Y. Site end users Z. Adjacent site users



GROUNDTECH CONSULTING 	CLIENT	DATE				Status		Notes
	SANDTON LONDON EC1Y LIMITED	MAY 2022				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	SAXON STREET, MANCHESTER	NTS				Issued		
	PLAN TITLE	PLAN NUMBER				For Comment		
	ILLUSTRATIVE CSM	GRO-22035-P04	Rev.	Details	Date	Approved		





APPENDIX 2 - Site Photographs



Photograph 1 – Northern extent of the site



Photograph 2 – Western extent off Saxon Street



Photograph 3 – Eastern overgrown garden area



Photograph 4 – Residential properties onsite



APPENDIX 3 - Exploratory Hole Logs





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS01

Sheet 2 of 2

Project Name: SAXON STREET

Project No.
GRO-22035

Co-ords: -

Hole Type
WS

Location: MANCHESTER

Level:

Scale
1:25

Client: SANDTON LONDON EC1Y LIMITED

Dates: 05/04/2022 -

Logged By
CJH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		5.00		N=50 (5,5/50 for 245mm)				End of borehole at 5.00 m	
									6
									7
									8
									9
									10

Remarks

1. Location cleared using hand held CAT scanner. 2. Hand dug pit to 1.20m bgl. 3. Groundwater encountered at 3.0m bgl. 4. Monitoring standpipe installed to 5.0m bgl (2.0m plain, 3.0m slotted).





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS02

Sheet 1 of 2

Project Name: SAXON STREET

Project No.
GRO-22035

Co-ords: -

Hole Type
WS

Location: MANCHESTER

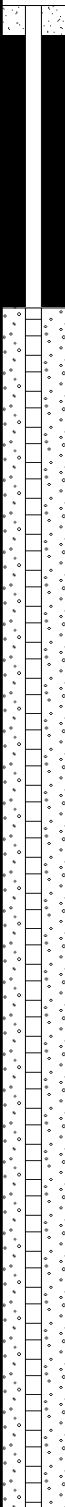
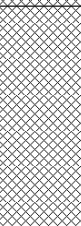
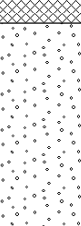
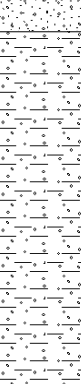
Level:

Scale
1:25

Client: SANDTON LONDON EC1Y LIMITED

Dates: 05/04/2022 -

Logged By
CJH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30			MADE GROUND: Dark brown gravelly sandy topsoil. Gravel is angular to subangular fine to coarse of mixed lithologies including brick, concrete, ceramic and fabrics. Sand is fine to coarse.	1
		0.70	ES					MADE GROUND: Brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and rare ash.	
		1.20		N=1 (1,0/0,0,1,0)	1.10			Very loose black angular medium GRAVEL of mixed lithologies including coal.	
		1.50	D						2
		2.00			1.90				
		2.00	D	N=9 (1,2/2,2,2,3)				Loose light brown very gravelly clayey fine to medium SAND. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone.	
		3.00							3
		3.00	D	N=3 (0,0/0,1,1,1)					
					3.80				
		4.00						Soft to firm brown slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of mixed lithologies.	4
		4.00	D	N=4 (0,0/0,0,2,2)					5

Continued on next sheet

Remarks

1. Location cleared using hand held CAT scanner. 2. Hand dug pit to 1.20m bgl. 3. Groundwater encountered at 3.0m bgl. 4. Monitoring standpipe installed to 5.0m bgl (1.0m plain, 4.0m slotted).





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS02

Sheet 2 of 2

Project Name: SAXON STREET

Project No.
GRO-22035

Co-ords: -

Hole Type
WS

Location: MANCHESTER

Level:

Scale
1:25

Client: SANDTON LONDON EC1Y LIMITED

Dates: 05/04/2022 -

Logged By
CJH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		5.00		N=50 (5,7/50 for 240mm)				Becoming very stiff from 5.0m bgl	
		5.50	D						
		5.70		N=50 (6,9/50 for 231mm)					
					6.45			End of borehole at 6.45 m	

Remarks

1. Location cleared using hand held CAT scanner. 2. Hand dug pit to 1.20m bgl. 3. Groundwater encountered at 3.0m bgl. 4. Monitoring standpipe installed to 5.0m bgl (1.0m plain, 4.0m slotted).





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS03

Sheet 1 of 2

Project Name: SAXON STREET

Project No.
GRO-22035

Co-ords: -

Hole Type
WS

Location: MANCHESTER

Level:

Scale
1:25

Client: SANDTON LONDON EC1Y LIMITED

Dates: 05/04/2022 -

Logged By
CJH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.08			MADE GROUND: Block paving.	
					0.20			MADE GROUND: Orange grey fine to medium sand.	
		0.60	ES					MADE GROUND: Brown very gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of mixed lithologies including brick and rare ash.	
					0.80				
		1.20		N=46 (4,13/12,12,9,13)					
		1.50	ES						
					1.80				
		2.00						Dense black brown very gravelly fine to medium SAND. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone.	1
		2.00	D	N=29 (2,2/7,6,7,9)					
					2.30				
								Medium dense light brown very gravelly clayey fine to medium SAND. Gravel is angular to subangular fine to coarse of mixed lithologies including coal and mudstone.	2
								Firm to stiff brown slightly gravelly CLAY. Gravel is angular to subrounded fine to medium of mixed lithologies.	
		3.00	D	N=2 (1,0/0,0,1,1)					3
		3.00							
								Becoming soft from 3.0m bgl.	
		4.00	D	N=16 (2,2/3,3,4,6)					4
		4.00						Becoming stiff from 4.0m bgl.	
									5

Continued on next sheet

Remarks

1. Location cleared using hand held CAT scanner. 2. Hand dug pit to 1.20m bgl. 3. Groundwater encountered at 3.0m bgl. 4. Monitoring standpipe installed to 5.0m bgl (2.0m plain, 3.0m slotted).





GROUNDTECH
CONSULTING

Borehole Log

Borehole No.

WS03

Sheet 2 of 2

Project Name: SAXON STREET

Project No.
GRO-22035

Co-ords: -

Hole Type
WS

Location: MANCHESTER

Level:

Scale
1:25

Client: SANDTON LONDON EC1Y LIMITED

Dates: 05/04/2022 -

Logged By
CJH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		5.00		N=50 (5,6/50 for 233mm)				Becoming very stiff from 5.0m bgl	
		5.50	D						
		5.70		N=50 (5,8/50 for 240mm)					
					6.45			End of borehole at 6.45 m	

Remarks

1. Location cleared using hand held CAT scanner. 2. Hand dug pit to 1.20m bgl. 3. Groundwater encountered at 3.0m bgl. 4. Monitoring standpipe installed to 5.0m bgl (2.0m plain, 3.0m slotted).





APPENDIX 4 – Falling Head Test Results

SAXON STREET, MANCHESTER
GRO-22035
SANDTON LONDON EC1Y LIMITED

VARIABLE HEAD PERMEABILITY TEST



Sheet 1 of 2

Date of Test: 05/04/2022 Type of Test: Falling Head Position: WS01 Engineer: Connor Hastings Weather: Sunny, clear

Test Measurements

Depth below top of casing/standpipe to:

(i) bottom of borehole:	2.00	m
(ii) bottom of casing:	1.50	m
(iii) top of filter material:	-	m
(iv) centre of piezometer tip:	-	m
(v) initial groundwater level:	-	m
Height of casing/standpipe above surface	-	m
Elevation of casing/standpipe (AOD)	-	m
Diameter of casing/standpipe	0.10	m
Length of filter	0.50	m
Diameter of filter	0.10	m

Test Data

Time Elapsed (mins)

Depth to Water Level (m)

0	0.10
1	0.36
2	0.45
3	0.59
4	0.82
5	1.07
10	1.36
15	1.53
20	1.77
23	2.00

VARIABLE HEAD PERMEABILITY TEST

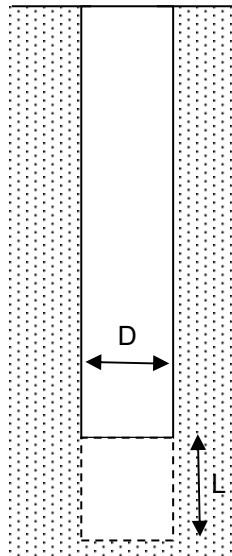
Sheet 2 of 2

Borehole BH1

By: CJH Checked: RW

Variable Head Permeability Test in accordance with BS 5930

Calculation of Intake Factor (F)



Area of base (A) = 0.01 m²

Diameter (D) = 0.10 m

Length (L) = 0.50 m

$$F = \frac{2 \pi L}{\ln \left\{ \left(\frac{L}{D} \right) + \sqrt{1 + \left(\frac{L}{D} \right)^2} \right\}}$$

$$F = \frac{3.142}{2.312}$$

$$F = 1.359$$

Calculation of Infiltration Rate

At time = 1 mins (t₁) Depth to water = 0.36 m

t₁ = 60 sec

Depth to base of borehole = 2.00 m

Depth of Water (H₁) = 1.64 m

At time = 23 mins (t₂) Depth to water = 2.00 m

t₂ = 1380 sec

Depth to base of borehole = 2.00 m

Depth of Water (H₂) = 0.00 m

$$k = \frac{A}{F(t_2 - t_1)} \ln \frac{H_1}{H_2}$$

$$k = \frac{0.01}{1793} \ln \frac{1.64}{0.005}$$

$$k = 2.54E-05 \text{ m/s}$$



APPENDIX 5 - Geo-Environmental Testing

Connor Hastings
Groundtech Consulting Ltd
First Floor, Lloyd House
Oxford Court
Greenfold Way
WN7 3XJ

t: 07449819886

e: cjh@groundtechconsulting.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 : 22-52575

Replaces Analytical Report Number: 22-52575, issue no. 1
Additional analysis undertaken.

Project / Site name:	Saxon Street	Samples received on:	14/04/2022
Your job number:	GRO 22035	Samples instructed on/ Analysis started on:	20/04/2022
Your order number:		Analysis completed by:	16/05/2022
Report Issue Number:	2	Report issued on:	17/05/2022
Samples Analysed:	5 soil samples		


Signed:

Anna Goc
Junior 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: 22-52575
Project / Site name: Saxon Street

Lab Sample Number				2243885	2243886	2243887	2243888	2243889
Sample Reference				WS01	WS02	WS03	WS01	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.70	0.60	3.00	2.00
Date Sampled				05/03/2022	05/03/2022	05/03/2022	05/03/2022	05/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
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	21	21	24	5.3	15
Total mass of sample received	kg	0.001	NONE	1	1	1	0.5	0.5

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	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	SFS	SFS	SFS	N/A	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.1	7.8	7.9	7.9	8.6
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	0.027	0.159
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	130	74	57	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.067	0.037	0.029	0.074	0.44
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	66.5	37	28.5	74.4	438
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	4	30
Total Sulphur	%	0.005	MCERTS	-	-	-	0.125	0.474
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	-	-	-	5.7	11
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	0.57	1.06
Organic Matter (automated)	%	0.1	MCERTS	5.7	5.6	6.9	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	< 2.0	< 2.0

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	0.63	0.27	0.98	-	-
Fluorene	mg/kg	0.05	MCERTS	0.37	0.22	0.79	-	-
Phenanthrene	mg/kg	0.05	MCERTS	3.5	2.3	8.9	-	-
Anthracene	mg/kg	0.05	MCERTS	0.78	0.58	2.7	-	-
Fluoranthene	mg/kg	0.05	MCERTS	3.8	3.1	10	-	-
Pyrene	mg/kg	0.05	MCERTS	3.9	3.1	9.2	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.1	1.8	5.6	-	-
Chrysene	mg/kg	0.05	MCERTS	2	1.8	4.4	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.1	1.8	4.6	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.77	0.99	2.3	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.3	2.1	5	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.99	0.93	2.3	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.32	0.27	0.71	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.2	1.2	2.5	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	24.9	20.3	60.3	-	-
-----------------------------	-------	-----	--------	------	------	------	---	---

Analytical Report Number: 22-52575
Project / Site name: Saxon Street

Lab Sample Number				2243885	2243886	2243887	2243888	2243889
Sample Reference				WS01	WS02	WS03	WS01	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.70	0.60	3.00	2.00
Date Sampled				05/03/2022	05/03/2022	05/03/2022	05/03/2022	05/03/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	28	33	32	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 4.0	< 4.0	< 4.0	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	33	37	39	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	210	290	230	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	240	310	280	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.7	0.5	0.8	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	43	39	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	190	230	220	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	12	7.7
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	6.1	3.9

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 22-52575
Project / Site name: Saxon Street
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
2243886	WS02	0.70	110	Loose Fibrous Debris	Chrysotile	0.001	0.001

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

Analytical Report Number : 22-52575

Project / Site name: Saxon Street

* 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 *
2243885	WS01	None Supplied	0.2	Brown loam and gravel with brick and clinker
2243886	WS02	None Supplied	0.7	Brown clay and loam with gravel and vegetation.
2243887	WS03	None Supplied	0.6	Brown clay and loam with gravel and vegetation.
2243888	WS01	None Supplied	3	Brown clay and sand with gravel.
2243889	WS03	None Supplied	2	Brown clay and sand with gravel.

Analytical Report Number : 22-52575

Project / Site name: Saxon Street

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
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
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
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
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
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
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
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

Analytical Report Number : 22-52575

Project / Site name: Saxon Street

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
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	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

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' 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.

Sample Deviation Report



Analytical Report Number : 22-52575

Project / Site name: Saxon Street

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.

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS01	None Supplied	S	2243885	c	Hexavalent chromium in soil	L080-PL	c
WS01	None Supplied	S	2243885	c	Organic matter (Automated) in soil	L009-PL	c
WS01	None Supplied	S	2243885	c	Speciated EPA-16 PAHs in soil	L064-PL	c
WS01	None Supplied	S	2243885	c	pH in soil (automated)	L099-PL	c
WS01	None Supplied	S	2243888	c	Ammoniacal Nitrogen as N in soil	L082-PL	c
WS01	None Supplied	S	2243888	c	Ammonium as NH4 in soil	L082-PL	c
WS01	None Supplied	S	2243888	c	Chloride, water soluble, in soil	L082-PL	c
WS01	None Supplied	S	2243888	c	Water Soluble Nitrate (2:1) as N in soil	L078-PL	c
WS01	None Supplied	S	2243888	c	pH in soil (automated)	L099-PL	c
WS02	None Supplied	S	2243886	c	Hexavalent chromium in soil	L080-PL	c
WS02	None Supplied	S	2243886	c	Organic matter (Automated) in soil	L009-PL	c
WS02	None Supplied	S	2243886	c	Speciated EPA-16 PAHs in soil	L064-PL	c
WS02	None Supplied	S	2243886	c	pH in soil (automated)	L099-PL	c
WS03	None Supplied	S	2243887	c	Hexavalent chromium in soil	L080-PL	c
WS03	None Supplied	S	2243887	c	Organic matter (Automated) in soil	L009-PL	c
WS03	None Supplied	S	2243887	c	Speciated EPA-16 PAHs in soil	L064-PL	c
WS03	None Supplied	S	2243887	c	pH in soil (automated)	L099-PL	c
WS03	None Supplied	S	2243889	c	Ammoniacal Nitrogen as N in soil	L082-PL	c
WS03	None Supplied	S	2243889	c	Ammonium as NH4 in soil	L082-PL	c
WS03	None Supplied	S	2243889	c	Chloride, water soluble, in soil	L082-PL	c
WS03	None Supplied	S	2243889	c	Water Soluble Nitrate (2:1) as N in soil	L078-PL	c
WS03	None Supplied	S	2243889	c	pH in soil (automated)	L099-PL	c



APPENDIX 6 - Geotechnical Testing



APPENDIX 7 – Interim Permanent Gas Monitoring Results

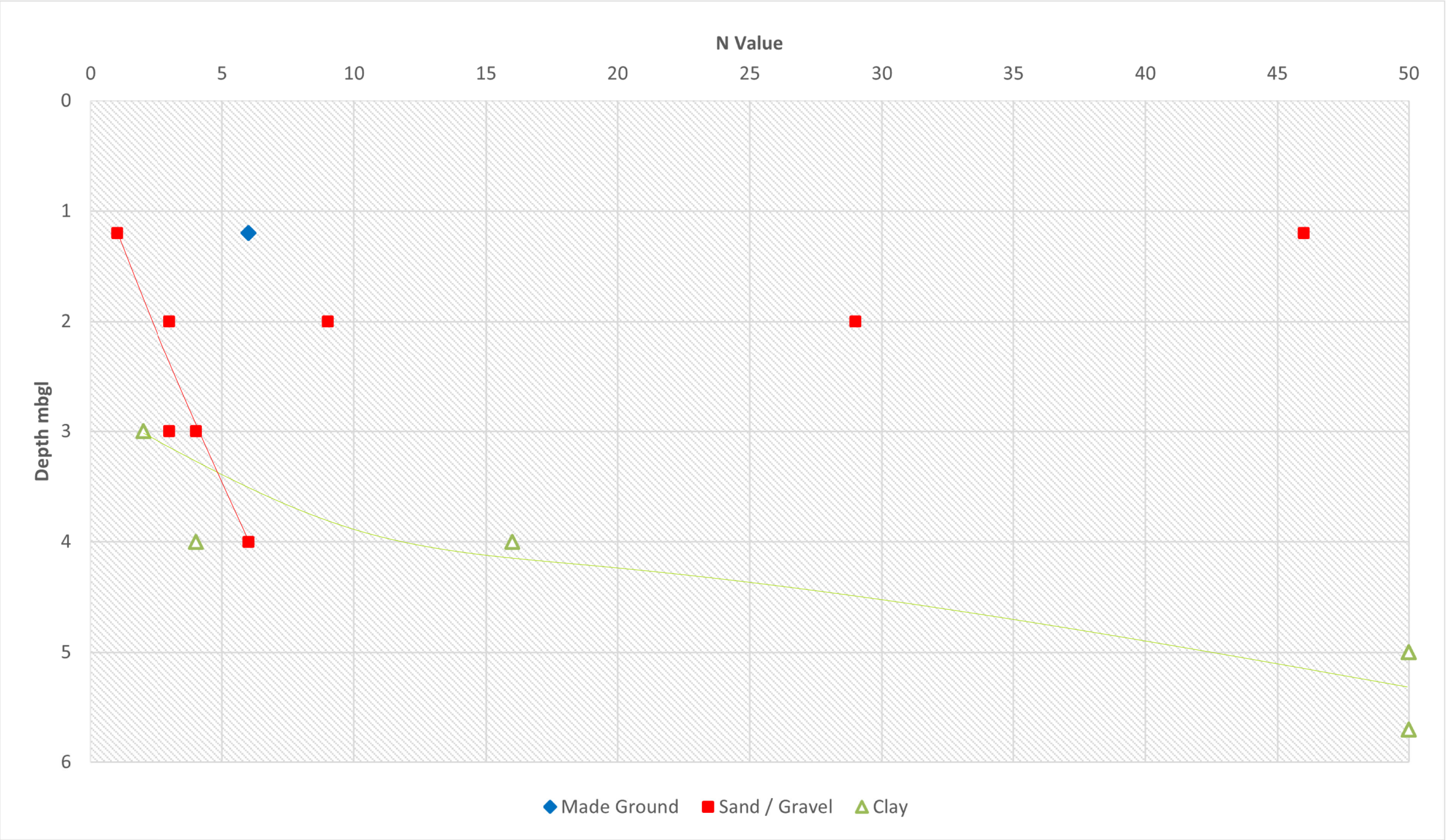
SITE NAME:	SAXON STREET, MANCHESTER	ENGINEER:	Jack Perkins
CLIENT:	SANDTON LONDON EC1Y LIMITED	DATE:	19/04/2022
JOB NO:	GRO-22035		

Pressure Trend:	Steady	Weather:	Sunny			Equipment:	GFM 436
Ambient:	O ₂ (%v/v)	CH ₄ (%v/v)	CO ₂ (%v/v)	LEL	H ₂ S (ppm)	CO (ppm)	
Start	20.4	0.0	0.0	0.0	0.0	0.0	
Finish	20.4	0.0	0.0	0.0	0.0	0.0	

BH Ref.	Gas Flow Rate (l/hr)		Borehole Pressure (mb)	Methane (%v/v)			Carbon Dioxide (%v/v)		Oxygen (%v/v)		Hydrogen Sulphide (ppm)		Carbon Monoxide (ppm)		Q _{hg} CO ₂ (l/hr)	Q _{hg} CH ₄ (l/hr)	Atmos Press (mb)	PID (ppm)	Sheen (Y/N)	Depth to Water (m bgl)
	Peak	Steady		Peak	Steady	LEL	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady						
WS01	0.0	0.0	0.00	0.0	0.0	0.0	0.5	0.5	18.2	18.3	0.0	0.0	0.0	0.0	0.0005	0.0000	1009	-	N	2.21
WS02	0.0	0.0	0.00	0.0	0.0	0.0	0.5	0.1	19.5	20.1	0.0	0.0	0.0	0.0	0.0005	0.0000	1009	-	N	2.04
WS03	0.0	0.0	0.00	0.0	0.0	0.0	2.9	2.1	14.6	16.3	0.0	0.0	0.0	0.0	0.0029	0.0000	1009	-	N	2.43
Notes:																				



APPENDIX 8 – Generalised Ground Model





APPENDIX 9 - Generic Screening Values

Generic Assessment Criteria (GAC)								GROUNDTECH CONSULTING	
Proposed End Use	Unit	Residential with Plant Uptake			Commercial			Source	
SOM	%	1	2.5	6	1	2.5	6		
Arsenic	mg/kg	32	32	32	640	640	640	SGVs	
Beryllium	mg/kg	1.7	1.7	1.7	12	12	12	LQM SAULs	
Boron (water soluble)	mg/kg	290	290	290	240000	240000	240000	LQM SAULs	
Cadmium	mg/kg	10	10	10	230	230	230	SGVs	
Chromium (Total)	mg/kg	910	910	910	8600	8600	8600	LQM SAULs	
Chromium (VI)	mg/kg	21	21	21	49	49	49	DEFRA C4SLs	
Copper	mg/kg	2400	2400	2400	68000	68000	68000	LQM SAULs	
Lead	mg/kg	200	200	200	2300	2300	2300	DEFRA C4SLs	
Organic Mercury	mg/kg	1.2	1.2	1.2	26	26	26	LQM SAULs	
Nickel	mg/kg	130	130	130	980	980	980	LQM SAULs	
Selenium	mg/kg	350	350	350	13000	13000	13000	SGVs	
Vanadium	mg/kg	410	410	410	9000	9000	9000	LQM SAULs	
Zinc	mg/kg	3700	3700	3700	730000	730000	730000	LQM SAULs	
Aliphatic EC 5 - 6	mg/kg	42	78	160	3200 (304) ^{sof}	5900 (558) ^{sof}	12000 (1150) ^{sof}	LQM SAULs	
Aliphatic EC 6 - 8	mg/kg	100	230	530	7800 (144) ^{sof}	17000 (322) ^{sof}	40000 (736) ^{sof}	LQM SAULs	
Aliphatic EC 8 - 10	mg/kg	27	65	150	2000 (78) ^{sof}	4800 (190) ^{sof}	11000 (451) ^{sof}	LQM SAULs	
Aliphatic EC 10 - 12	mg/kg	130 (48) ^{sof}	330 (118) ^{sof}	760 (283) ^{sof}	9700 (48) ^{sof}	23000 (118) ^{sof}	47000 (283) ^{sof}	LQM SAULs	
Aliphatic EC 12 - 16	mg/kg	1100 (24) ^{sof}	2400 (59) ^{sof}	4300 (142) ^{sof}	59000 (24) ^{sof}	82000 (59) ^{sof}	90000 (142) ^{sof}	LQM SAULs	
Aliphatic EC 16 - 35	mg/kg	65000 (8.48) ^{sof}	92000 (21) ^{sof}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM SAULs	
Aliphatic EC 35 - 44	mg/kg	65000 (8.48) ^{sof}	92000 (21) ^{sof}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM SAULs	
Aromatic EC 5 - 7	mg/kg	70	140	300	26000 (1220) ^{sof}	46000 (2260) ^{sof}	86000 (4710) ^{sof}	LQM SAULs	
Aromatic EC 7 - 8	mg/kg	130	290	660	56000 (869) ^{sof}	110000 (1920) ^{sof}	180000 (4360) ^{sof}	LQM SAULs	
Aromatic EC 8 - 10	mg/kg	34	83	190	3500 (613) ^{sof}	8100 (1500) ^{sof}	17000 (3580) ^{sof}	LQM SAULs	
Aromatic EC 10 - 12	mg/kg	74	180	380	16000 (364) ^{sof}	28000 (899) ^{sof}	34000 (2150) ^{sof}	LQM SAULs	
Aromatic EC 12 - 16	mg/kg	140	330	660	36000 (169) ^{sof}	37000	38000	LQM SAULs	
Aromatic EC 16 - 21	mg/kg	260 ^f	540 ^f	930 ^f	28000 ^f	28000 ^f	28000 ^f	LQM SAULs	
Aromatic EC 21 - 35	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM SAULs	
Aromatic EC 35 - 44	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM SAULs	
Benzene	mg/kg	0.33	0.33	0.33	95	95	95	SGVs	
Toluene	mg/kg	610	610	610	4400	4400	4400	SGVs	
Ethyl Benzene	mg/kg	350	350	350	2800	2800	2800	SGVs	
Xylene - o	mg/kg	250	250	250	2600	2600	2600	SGVs	
Xylene - m	mg/kg	240	240	240	3500	3500	3500	SGVs	
Xylene - p	mg/kg	230	230	230	3200	3200	3200	SGVs	
MTBE (methyl tert-butyl ether)	mg/kg	49	84	160	7900	13000	24000	CL-AIRE 2010	
Acenaphthene	mg/kg	210	510	1100	84000 (57) ^{sof}	97000 (141) ^{sof}	100000	LQM SAULs	
Acenaphthylene	mg/kg	170	420	920	83000 (86.1) ^{sof}	97000 (212) ^{sof}	100000	LQM SAULs	
Anthracene	mg/kg	2400	5400	11000	520000	540000	540000	LQM SAULs	
Benz(a)anthracene	mg/kg	7.2	11	13	170	170	180	LQM SAULs	
Benzo(a)pyrene	mg/kg	2.2	2.7	5*	35	35	77*	DEFRA C4SL*/LQM	
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	44	44	45	LQM SAULs	
Benzo(ghi)perylene	mg/kg	320	340	350	3900	4000	4000	LQM SAULs	
Benzo(k)fluoranthene	mg/kg	77	93	100	1200	1200	1200	LQM SAULs	
Chrysene	mg/kg	15	22	27	350	350	350	LQM SAULs	
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.3	3.5	3.6	3.6	LQM SAULs	
Fluoranthene	mg/kg	280	560	890	23000	23000	23000	LQM SAULs	
Fluorene	mg/kg	170	400	860	63000 (30.9) ^{sof}	68000	71000	LQM SAULs	
Indeno(123-cd)pyrene	mg/kg	27	36	41	500	510	510	LQM SAULs	
Naphthalene	mg/kg	2.3 f	5.6 f	13 f	190 ^f (76.4) ^{sof}	460 ^f (183) ^{sof}	1100 ^f (432) ^{sof}	LQM SAULs	
Phenanthrene	mg/kg	95	220	440	22000	22000	23000	LQM SAULs	
Pyrene	mg/kg	620	1200	2000	54000	54000	54000	LQM SAULs	



APPENDIX 10 - CIRIA Risk Assessment Methodology

Contaminated Land Risk Assessment

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification ➡ Hazard Assessment ➡ Risk Estimation ➡ Risk Evaluation

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process.

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552:

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

The severity is also classified using a system based on CIRIA C552. The terms and definitions are:

- **Severe:** Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse;

- **Medium:** Chronic damage to human health ('significant harm' as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve;
- **Mild:** Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment;
Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.
- **Minor:** harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.
Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

- **Very high:** There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required;
- **High:** Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term;
- **Moderate:** It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term;
- **Low:** It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild;
- **Very Low:** There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.



APPENDIX 11 - JIWG Receptor Decision Tool

Decision Support Tool for Receptor Risk Ranking

Stage 1		Score
Hazard Identification		
Select ACM type (run model for each type to generate 'Worst Case' output)	Free dispersed fibres/fibre bundles	2
Extent of degradation of ACMs	Disaggregated (dominated by loose fibrous material; extreme degradation in ACM and/or free asbestos fibres/fibre bundles)	4
Friability and degree of bonding by matrix (ACM matrix, not ground materials)	Friable ACM or ACM with fibres not linked in any matrix (free dispersed fibres/fibre bundles)	4
Distribution of Visible Asbestos Across Affected Area	No visible ACMs/fibre bundles	0
Asbestos fibre type	Chrysotile alone	0
Sub-total		10
Hazard ranking		Low

No warranty, expressed or implied, or reliance, is provided in relation to the use of this tool.

It is contingent on users to satisfy themselves that the output from the tool is relevant and appropriate to the assessment being made.

Stage 2		Score
Emission Factors		
Amount of asbestos fibre in selected ACM/fibre type as % of host material	Trace quantities - <0.0001 to <0.001 %wt/wt	0
Respirable fibre index for ACM - RIVM report 711701034 (2003)	Low	2
Activity type and effect on deterioration of ACMs	Minimal disturbance, no deterioration expected	1
Best description of primary host material matrix	Coarse to Fine Sand	2
Sub-total		5
Exposure ranking		Low

Stage 3		Score	
Pathway and Receptor Sensitivity			
Receptor category	Residential	No score required	
Age of Receptor	Infant (under 5)	4	
Duration of exposure/site occupancy	< 1 hour in any single day (e.g. frequent but short exposure event)	1	
Receptor ranking		5	Medium
Combined hazard, exposure and receptor ranking			Low
Pathway: Distance of Receptor from Source	In or within 10m of area of disturbance	4	
Pathway: Depth to impacted material	Material buried at depth, unlikely to be disturbed except for deeper construction related excavation	B	
Pathway ranking		4B	Very Low
Overall ranking			Negligible

Project Reference	GRO-22035
Site Name	SAXON STREET
Client	SANDTON LONDON EC1Y LIMITED
Run by	RW
Date	23-May-22
Reviewed by	RW
Characterisation of scenario being evaluated	
Interpretation of scenario ranking by DST	



Joint Industry **Working Group**

Asbestos in Soil and Construction & Demolition Materials

Project Reference

GRO-22035

Site Name

SAXON STREET, MANCHESTER

Client

Run by

RW

Date

23-May-22

Scenario details

Decision Support Tool for CAR2012 Work Categories

Stage 1

Hazard Factors

Score

Select ACM type (run model for each type to generate 'Worst Case' output)

Free dispersed fibres/fibre bundles

2

Extent of degradation of ACMs at outset of work

Disaggregated (dominated by loose fibrous material; extreme degradation in ACM and/or free asbestos fibres/fibre bundles)

4

Friability and degree of bonding by matrix (ACM matrix, not ground materials)

Friable ACM or ACM with fibres not linked in any matrix (free dispersed fibres/fibre bundles)

4

Distribution of Visible Asbestos Across Affected Area

No visible ACMs/fibre bundles

0

Amount of asbestos fibre in selected ACM/fibre type as % of host material

Trace quantities - <0.0001 to 0.001 %wt/wt

0

Sub-total

0

Note: the asbestos licensing regime is unaffected by the type of asbestos fibre present in ACMs

Hazard ranking

Negligible

No warranty, expressed or implied, or reliance, is provided in relation to the use of this tool.

It is contingent on users to satisfy themselves that the output from the tool is relevant and appropriate to the assessment being made.

Stage 2

Exposure Factors

Score

Anticipated airborne fibre concentration - Control Limit or SALI?

<0.001 fibres/ml

0

Anticipated duration of exposure to asbestos

> 2 hours in a 7 day period and Up to 10 hours in a day (e.g. full time occupational exposure)

4

Activity type and effect on deterioration of ACMs during work

Low intensity, no or minimal deterioration expected

0

Best description of primary host material matrix (soil/made ground)

Coarse to Fine Sand

2

Respirable fibre index for ACM - RIVM report 711701034 (2003)

Low

2

Sub-total

8

Exposure ranking

Low

Combined hazard and exposure ranking

8

Very Low

Stage 3

Risk Assessment Outputs

Probable Licensing Status	CAR do not apply
RPE*	None
Dust Suppression**	None
Hygiene/Decontamination***	None

*Where RPE has to be worn continuously for long periods (e.g. more than 1-hour), then powered RPE may be necessary.

**Reduction in control measures possible if natural mitigation factors are present (e.g. raining, wet ground)

***Guide only; suitability of selected personal hygiene measures may be reviewed on a site/contamination-specific basis



APPENDIX 12 – Waste Classification Report

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

- understand the origin of the waste
- select the correct List of Waste code(s)
- confirm that the list of determinands, results and sampling plan are fit for purpose
- select and justify the chosen metal species (Appendix B)
- correctly apply moisture correction and other available corrections
- add the meta data for their user-defined substances (Appendix A)
- check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)



4SYRO-TAGPE-29E17

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

Job name

22-52575_HWOL_Results

Description/Comments

Project

GRO-22035

Site

Saxon Street, Manchester

Classified by

Name:

James Doyle

Date:

24 May 2022 14:31 GMT

Telephone:

0800 1613730

Company:

Groundtech Consulting Limited

PO Box 499 Salford, Manchester M28 8EE

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification:

Course

Hazardous Waste Classification

Date

50% complete

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01--05032022-0.20		Non Hazardous		2
2	WS02--05032022-0.70		Non Hazardous		4
3	WS03--05032022-0.60		Non Hazardous		6

Related documents

#	Name	Description
1	22-52575_HWOL_Results.hwol	.hwol file used to create the Job
2	Example waste stream template for contaminated soils	waste stream template used to create this Job

Report

Created by: James Doyle

Created date: 24 May 2022 14:31 GMT

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Classification of sample: WS01--05032022-0.20

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS01--05032022-0.20	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
21% (no correction)	

Hazard properties

None identified

Determinands

Moisture content: 21% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				28	mg/kg	1.32	36.969	mg/kg	0.0037 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				33	mg/kg	1.462	48.231	mg/kg	0.00482 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<4	mg/kg	2.27	<9.08	mg/kg	<0.000908 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				210	mg/kg	1.126	236.437	mg/kg	0.0236 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	240	mg/kg	1.56	374.356	mg/kg	0.024 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.7	mg/kg	1.353	0.947	mg/kg	0.0000947 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				34	mg/kg	2.976	101.193	mg/kg	0.0101 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				190	mg/kg	2.774	527.088	mg/kg	0.0527 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				9.1	pH		9.1	pH	9.1 pH		
			PH									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.63	mg/kg		0.63	mg/kg	0.000063 %		
		201-469-6	83-32-9									
15	fluorene				0.37	mg/kg		0.37	mg/kg	0.000037 %		
		201-695-5	86-73-7									
16	phenanthrene				3.5	mg/kg		3.5	mg/kg	0.00035 %		
		201-581-5	85-01-8									
17	anthracene				0.78	mg/kg		0.78	mg/kg	0.000078 %		
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		3.8 mg/kg		3.8 mg/kg	0.00038 %		
19	pyrene	204-927-3	129-00-0		3.9 mg/kg		3.9 mg/kg	0.00039 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		2.1 mg/kg		2.1 mg/kg	0.00021 %		
21	chrysene	601-048-00-0	205-923-4		2 mg/kg		2 mg/kg	0.0002 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		2.1 mg/kg		2.1 mg/kg	0.00021 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.77 mg/kg		0.77 mg/kg	0.000077 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		2.3 mg/kg		2.3 mg/kg	0.00023 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.99 mg/kg		0.99 mg/kg	0.000099 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.32 mg/kg		0.32 mg/kg	0.000032 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		1.2 mg/kg		1.2 mg/kg	0.00012 %		
Total:								0.123 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS02--05032022-0.70

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS02--05032022-0.70	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
21% (no correction)	

Hazard properties

None identified

Determinands

Moisture content: 21% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				33	mg/kg	1.32	43.571	mg/kg	0.00436 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				37	mg/kg	1.462	54.078	mg/kg	0.00541 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<4	mg/kg	2.27	<9.08	mg/kg	<0.000908 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				290	mg/kg	1.126	326.508	mg/kg	0.0327 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	310	mg/kg	1.56	483.543	mg/kg	0.031 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.5	mg/kg	1.353	0.677	mg/kg	0.0000677 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				43	mg/kg	2.976	127.979	mg/kg	0.0128 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				230	mg/kg	2.774	638.054	mg/kg	0.0638 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				7.8	pH		7.8	pH	7.8 pH		
			PH									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.27	mg/kg		0.27	mg/kg	0.000027 %		
		201-469-6	83-32-9									
15	fluorene				0.22	mg/kg		0.22	mg/kg	0.000022 %		
		201-695-5	86-73-7									
16	phenanthrene				2.3	mg/kg		2.3	mg/kg	0.00023 %		
		201-581-5	85-01-8									
17	anthracene				0.58	mg/kg		0.58	mg/kg	0.000058 %		
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		3.1 mg/kg		3.1 mg/kg	0.00031 %		
19	pyrene	204-927-3	129-00-0		3.1 mg/kg		3.1 mg/kg	0.00031 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.8 mg/kg		1.8 mg/kg	0.00018 %		
21	chrysene	601-048-00-0	205-923-4		1.8 mg/kg		1.8 mg/kg	0.00018 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		1.8 mg/kg		1.8 mg/kg	0.00018 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.99 mg/kg		0.99 mg/kg	0.000099 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		2.1 mg/kg		2.1 mg/kg	0.00021 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.93 mg/kg		0.93 mg/kg	0.000093 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.27 mg/kg		0.27 mg/kg	0.000027 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		1.2 mg/kg		1.2 mg/kg	0.00012 %		
Total:								0.153 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS03--05032022-0.60

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:	LoW Code:
WS03--05032022-0.60	Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)
24% (no correction)	

Hazard properties

None identified

Determinands

Moisture content: 24% No Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				32	mg/kg	1.32	42.25	mg/kg	0.00423 %		
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				<0.2	mg/kg	1.142	<0.228	mg/kg	<0.0000228 %		<LOD
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				39	mg/kg	1.462	57.001	mg/kg	0.0057 %		
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<4	mg/kg	2.27	<9.08	mg/kg	<0.000908 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				230	mg/kg	1.126	258.954	mg/kg	0.0259 %		
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	280	mg/kg	1.56	436.748	mg/kg	0.028 %		
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.8	mg/kg	1.353	1.083	mg/kg	0.000108 %		
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				39	mg/kg	2.976	116.074	mg/kg	0.0116 %		
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				<1	mg/kg	2.554	<2.554	mg/kg	<0.000255 %		<LOD
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc chromate }				220	mg/kg	2.774	610.312	mg/kg	0.061 %		
	024-007-00-3	236-878-9	13530-65-9									
11	pH				7.9	pH		7.9	pH	7.9 pH		
			PH									
12	naphthalene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.05	mg/kg		<0.05	mg/kg	<0.000005 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				0.98	mg/kg		0.98	mg/kg	0.000098 %		
		201-469-6	83-32-9									
15	fluorene				0.79	mg/kg		0.79	mg/kg	0.000079 %		
		201-695-5	86-73-7									
16	phenanthrene				8.9	mg/kg		8.9	mg/kg	0.00089 %		
		201-581-5	85-01-8									
17	anthracene				2.7	mg/kg		2.7	mg/kg	0.00027 %		
		204-371-1	120-12-7									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	EU CLP index number	EC Number	CAS Number							
18	fluoranthene	205-912-4	206-44-0		10 mg/kg		10 mg/kg	0.001 %		
19	pyrene	204-927-3	129-00-0		9.2 mg/kg		9.2 mg/kg	0.00092 %		
20	benzo[a]anthracene	601-033-00-9	200-280-6		5.6 mg/kg		5.6 mg/kg	0.00056 %		
21	chrysene	601-048-00-0	205-923-4		4.4 mg/kg		4.4 mg/kg	0.00044 %		
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		4.6 mg/kg		4.6 mg/kg	0.00046 %		
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		2.3 mg/kg		2.3 mg/kg	0.00023 %		
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		5 mg/kg		5 mg/kg	0.0005 %		
25	indeno[123-cd]pyrene	205-893-2	193-39-5		2.3 mg/kg		2.3 mg/kg	0.00023 %		
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.71 mg/kg		0.71 mg/kg	0.000071 %		
27	benzo[ghi]perylene	205-883-8	191-24-2		2.5 mg/kg		2.5 mg/kg	0.00025 %		
Total:								0.144 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non GB MCL determinands

■ **chromium(III) oxide (worst case)** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

■ **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

■ **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

■ **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

■ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2; H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {nickel selenate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021

HazWasteOnline Classification Engine Version: 2022.143.5150.9705 (23 May 2022)

HazWasteOnline Database: 2022.143.5150.9705 (23 May 2022)

This classification utilises the following guidance and legislation:

WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit)

Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020

The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK:

2020 No. 1540 of 16th December 2020

GB MCL List - version 1.1 of 09 June 2021



APPENDIX 13 – Relevant Legislative Background

Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act;
- The Contaminated Land (England) Regulations 2000;
- The DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused;
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- **Source** - substances that are potential contaminants or pollutants that may cause harm;
- **Pathway** - a potential route by which contaminants can move from the source to the receptor;
- **Receptor** - a receptor that may be harmed, for example the water environment, humans and water.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the SPR approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below however the list is not exhaustive:

- LCRM – Model Procedures;
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003);
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002;
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002;
- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990;
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002;

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environment Act (1995);
- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012);
- The Environment Protection Act (1990);
- The Contaminated Land (England) Act (2000);
- Contaminated Land (England) Regulations (2012);
- The Water Resources Act (1991);
- The Pollution Prevention and Control (England and Wales) Regulations (2000);
- The Landfill Regulations (England and Wales) Regulations (2002);
- The Landfill (England and Wales) (Amendment) Regulations (2004);
- Health and Safety at Work Act;



APPENDIX 14 – Limitations

Limitations

This contract was completed by Groundtech Consulting on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with due skill and care, taking into consideration the project brief provided, project objectives, agreed scope of works, prevailing site conditions and budget allocation.

Other than that defined in the paragraph above, Groundtech Consulting provides no other accountability or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted industry practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Groundtech Consulting. A third party who relies on this report, does so at their own and sole risk and no liability to such parties is provided by Groundtech Consulting.

It is the understanding of Groundtech Consulting that this report is to be used for the intended purpose as set out in the introduction. The purpose was instrumental in determining the scope and level of the services provided. Should the purpose of the report or the proposed end use of the site change, this report will no longer be directly applicable, and its validity readdressed. No reliance upon the report in the revised situation should be assumed by the client without the permission of Groundtech Consulting.

The report was written in 2022, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change and should be investigated if there is any significant delay in acting on the findings of this report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions in this report should not be relied upon in the future without the written confirmation from Groundtech Consulting that it is safe to do so.

The observations and conclusions outlined in this report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting.

Groundtech Consulting are not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The services provided are based upon Groundtech Consulting observations of existing physical conditions at the site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and Groundtech Consulting assume the information to be correct.

No responsibility can be accepted for errors for third party information presented in this report. Groundtech Consulting were not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Groundtech Consulting are not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable due to its heterogeneous properties and as investigation exploratory locations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. Geo-Environmental testing was carried out for a limited number of parameters [as stipulated in the contract] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawings provided in this report are not meant to be an accurate base plan, but are preliminary and used to present the general relative locations of features on, and surrounding, the site.

