



**GEOENVIRONMENTAL SITE INVESTIGATION REPORT
PHASE II SITE INVESTIGATION
OF LAND AT
SNELL STREET
MANCHESTER**

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June 2021

Ref: M0142 JL (GSI1450) PII Report AF A 170521

Quality Assurance	
Project ID	GSI 1450
Project Name	Snell Street, Manchester
Report Type	Phase II Site Investigation
Report Reference	M0142 JL (GSI1450) PII Report AF A 170521
Appointed by On behalf of (client)	Artel UK Ltd Penrose Manor Ltd
Version	Version 1
Status	Final
Date of First Issue	June 2021
Revision Date	July 2021
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LIST OF ACRONYMS

Acronym	Meaning
BGS	British Geological Survey
BH	Borehole
CDM	Construction Design and Management
CL:AIRE	Contaminated Land: Applications In Real Environments
CLR	Contaminated Land Report
COSHH	Control Of Substances Hazardous to Health
CSM	Conceptual Site Model
DCP	Dynamic Cone Penetrometer
DEFRA	Department for Environment Foods and Rural Affairs
DP	Dynamic Probe
DoE	Department of Environment
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	Generic Acceptance Criteria
HP	Hand Pit
HA	Hand Auger
LPA	Local Planning Authority
LQM	Land Quality Management
mbgl	Metres Below Ground Level
MP	Mackintosh Probe
NPPF	National Planning Policy Framework
NGR	National Grid Reference
OS	Ordnance Survey
SGV	Soil Guideline Value
SSV	Soil Screening Value
WSV	Water Screening Value
SPOSH	Significant Possibility of Significant Harm
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
TP	Trial Pit
TT	Trial Trench
WS	Windowless Sample / Window Sample

1.0 INTRODUCTION

1.1 Instruction

- 1.1.1 GeoCon Site Investigations Ltd (GeoCon) have been commissioned by Artal UK Ltd (AUK) on behalf of Penrose Manor Ltd (PML) to undertake a Phase II geoenvironmental site investigation on land at Snell Street, Manchester.
- 1.1.2 It is understood that a Phase II Site Investigation is required to assist with a planning application for a proposed residential development at the site.
- 1.1.3 It is understood that this is required following the results of a Phase I Preliminary Risk Assessment carried out by Geocon in April 2021 referenced M0142 CO (GSI450) PI Report AF A 300321 which should be referred to in conjunction with this report.
- 1.1.4 This report is therefore provided to establish the potential for contamination at the site as a result of current and historic land uses both on site and within influencing distance of the site, to understand the type nature and extent of contamination present, and to identify the anticipated ground conditions and any potential geological and or geotechnical impact on the proposed development.
- 1.1.5 This report is written in accordance with the guidance set out in Land Contamination Risk Management (LCRM), Guiding Principles for Land Contamination (GPLC) 1 – 3, and the National Planning Policy Framework (NPPF).

1.2 Scope of Works

- 1.2.1 Prior to commencing the site works the proposed scope of investigation was as follows, however the proposed scope will be subject to change dependent upon site conditions, access, restrictions and obstructions. The actual works undertaken following the completion of the site works and any on site amendments are detailed in section 3.0.

Phase II

- One day's windowless sampling at approximately five locations to a nominal depth of up to 5.00mbgl or refusal.
- Insitu environmental and geotechnical sampling, and insitu geotechnical testing.
- Full supervision of all works by engineering geologist including sampling and detailed geotechnical descriptions to BS5930, EN ISO 14688-1 EN ISO 14688-2 and EN ISO 14689 of all strata types encountered within the exploratory holes.
- The installation of three No. gas and groundwater monitoring wells to a nominal depth of 3.00mbgl.
- Subsequent groundwater monitoring on six occasions over a three month period in accordance with CIRIA 665 commencing approximately one week after the completion of the ground investigation.
- A suite of chemical laboratory analysis.
- A suite of geotechnical laboratory analysis.
- Production of an interpretative report.

1.3 Reliance and Limitations

- 1.3.1 This report has been prepared using published information and information provided by AUK and their professional advisers which has been made available to GeoCon at the time of writing only. GeoCon accepts no liability for any changes resulting from new information which has become available since this time.

- 1.3.2 This report is provided for the sole use of the client and their professional advisors and is confidential to them unless agreed otherwise in writing. This report may only be used and relied on once the work has been paid for in full. GeoCon owes no duty of care and has no liability to any third party who is not authorised by GeoCon to use this report. Any unauthorised third parties using information contained in this report do so at their own risk.
- 1.3.3 This assessment has been carried out to determine the potential risks posed to future end users, along with other key receptors, resulting from potential contamination at the site, based on the proposed development. Should any revisions in the development proposals result in a change any assessment parameters detailed in this report, a re-assessment of the risk should be carried out.
- 1.3.4 Whilst this report may reference observations made regarding the presence of features/ issues such as invasive species, ACM, site drainage and evidence of structural abnormalities, this report does not constitute specialist surveys on these matters. Should further specialist surveys be carried out in this regard, the findings of these should be reported to GeoCon so that we may determine if this has any impact on the findings of this report.
- 1.3.5 The assessment and interpretation of the factual data obtained as part of this Phase II Site Investigation has been undertaken in accordance with standard consulting practise and with current national and international guidance.
- 1.3.6 This report presents the observations made during the Phase II Site Investigation and the factual data obtained. The conclusions and recommendations in this report are limited to those which can be made based on the findings of the survey and information provided by third parties. GeoCon assumes all third party data to be true and correct. No responsibility can be accepted by GeoCon for inaccuracies in the information provided by any other party.
- 1.3.7 This report is written in the context of an agreed scope of works and should not be used in a different context. Furthermore new information, improved practises, and changes in legislation may require the reinterpretation of the report in whole or in part after its original issue. GeoCon reserve the right to alter their conclusions and recommendations in the light of further information that may become available. This report is provided for the sole use of the client and their professional advisors and is confidential to them unless agreed otherwise in writing.
- 1.3.8 Ground conditions can be variable and change rapidly, especially in areas of Made Ground, however it is assumed that the ground conditions encountered and observed are typical and representative of the site as a whole. Most specifically with regard to this limited investigation, the ground conditions have been determined from a limited number of exploratory holes formed across the site, therefore only a small percentage of the total area of the site has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced. Conclusions drawn from the ground investigation should be read in this context. GeoCon cannot accept responsibility for any situations resulting from locally unforeseen ground conditions occurring between exploratory holes.
- 1.3.9 In addition, subsurface conditions including contaminant concentrations and groundwater levels may vary spatially with time. This factor should be given due consideration in the event that the information contained within this report is used after any significant period of time has elapsed.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

2.1.1 The site is located at land off Snell Street, Manchester, at approximate National Grid Reference NGR: 385640, 398170 (centre of the site).

2.1.2 A site location plan is presented as Drawing No. GSI 1450/01 in Appendix A.

2.2 Site Reconnaissance

2.2.1 A site reconnaissance was carried out on the 31st March 2021. Details from the site walkover are included in the site description below.

2.3 Site Description

2.3.1 The site is a generally rectangular shaped piece of land with an approximate area of 0.12Ha.

2.3.2 The topography of the site is generally dipping gently to the south.

2.3.3 The site is currently occupied by a masonry warehouse structure with associated hardstanding, comprising of concrete. The site boundary, in particular the eastern boundary, has become overgrown with grass and shrubs.

2.3.4 An approximate distribution of the surface covering is given below in Table 2.1: Site Surface Covering

Table 2.1: Site Surface Covering

Type of Surface Cover	Distribution (%)
Soft Ground (grassed and landscaped areas)	5
Hardstanding	55
Roadways	0
Buildings	40
Water (ponds, streams)	0

2.3.5 The site is bounded by Snell Street to the west, and residential properties to the north, east and south.

2.3.6 Access to the site is via Snell Street to the southwest.

2.4 Surrounding Area

2.4.1 The current surrounding land use to the site is generally residential properties in all directions.

2.4.2 The topography of the surrounding area is generally dipping to the south.

2.5 Future Site Usage

2.5.1 It is currently proposed to construct a series of nine new terraced two storey masonry and pitched roof properties at the site which includes the demolition of the existing structure on site.

2.5.2 A proposed development plan has been provided by AUK, drafted by Calderpeel Architects, dated 5th October 2021, referenced 20096 (FE) 001.

2.5.3 This assessment has been carried out with reference to this proposed development plan, any changes to the proposed development may result in this assessment requirement updating

3.0 GROUND INVESTIGATION

3.1 General

- 3.1.1 The intrusive investigation was carried out on 12th April 2021.
- 3.1.2 The specification and scope of works for the ground investigation has been provided by AUK.
- 3.1.3 The ground investigation has been carried out in accordance with BS5930 and the UK Specification for Ground Investigation Second Edition 2012.
- 3.1.4 All strata descriptions were undertaken in accordance with BS5930 Amendment 1; EN ISO 14688 -1; EN ISO 14688 -2; and EN ISO 14689.
- 3.1.5 The actual ground investigation comprised the formation of:
 - One days windowless sampling at four locations.
 - Insitu geotechnical and geoenvironmental testing and sampling.
 - Full supervision of all works by engineering geologist including sampling and detailed geotechnical descriptions to BS5930, EN ISO 14688-1 EN ISO 14688-2 and EN ISO 14689 of all strata types encountered within the exploratory holes.
 - The installation of three No. gas and groundwater monitoring wells.
 - Subsequent groundwater monitoring on six occasions over a three month period in accordance with CIRIA 665 commencing approximately one week after the completion of the ground investigation.
 - A suite of geotechnical laboratory analysis.
 - A suite of chemical laboratory analysis.
 - Production of an interpretative report.
- 3.1.6 The ground investigation was carried out to determine the geotechnical and geoenvironmental properties of the soils and rock beneath the site for a proposed residential development at the site.
- 3.1.7 The locations of the exploratory holes were specified by GeoCon and were positioned to gain key information beneath the site in relation to the proposed development.
- 3.1.8 All locations were checked against buried service location plans and then scanned with a Cable Avoidance Tool (CAT) and Genny prior to excavation, and a permit to dig was then issued. Each location was then continued by hand down to a minimum of 1.20mbgl to clear any buried services or other subsurface obstructions. All locations were then checked again with a CAT at the base of the hand excavated inspection pit by GeoCon prior to commencement of drilling.
- 3.1.9 All access permissions were arranged by AUK prior to the ground investigation commencing.
- 3.1.10 An exploratory hole location plan is presented in Appendix A as drawing number GSI1450/02.

3.2 Windowless Sample Boreholes

- 3.2.1 Four windowless sample boreholes were drilled at the site referenced WS01 to WS04, and were drilled at the site to depths of between 4.90 and 5.45mbgl.
- 3.2.2 The windowless sample boreholes were drilled using a tracked windowless sample rig in order to facilitate geoenvironmental sampling and to gain an understanding of the environmental and geotechnical properties of the soils and rock beneath the site, and to facilitate the installation of groundwater monitoring standpipes.
- 3.2.3 The windowless sample boreholes were drilled using 100mm diameter barrel reducing in size with depth. to achieve the target depths.

3.2.4 All windowless sample borehole logs are presented in Appendix B.

3.3 Sampling and Insitu Testing

3.3.1 The environmental and geotechnical sampling regime and insitu testing regime included the following:

- Environmental samples for subsequent chemical analysis were taken from each strata type, with a minimum of three samples taken from the upper 1.00 m.
- Small disturbed samples taken from each strata type.
- Insitu Standard Penetration Tests (SPTs) were carried out at 1.00 m intervals to collate insitu strength information (relative density) for the soils beneath the site.
- Groundwater samples for subsequent chemical analysis were taken from any exploratory holes where sufficient groundwater was available to collect a sample.

3.3.2 Soil samples were collected for environmental and geotechnical analysis by the engineering geologist on site based on physical and visual inspection in addition to standard sampling.

3.3.3 All samples were stored in pre-chilled cool-boxes prior to immediate dispatch to laboratory. Where there has been a delay in transporting the samples to the laboratory, samples have been kept in a cool dark storage unit inside cool boxes packed with ice, which is regularly replaced to maintain sample quality.

3.3.4 The environmental samples were subsequently transported to a chemical laboratory in plastic tubs, glass jars and soils vials. The geotechnical samples were subsequently transported to a geotechnical laboratory in prepared bulk bags and plastic tubs.

3.3.5 Groundwater samples were collected in a range of glass jars and plastic bottles with all necessary preservatives where required, and were subsequently transported to a chemical laboratory.

3.4 Installations and Backfill

3.4.1 Three of the windowless sample boreholes were installed with combined gas and ground water monitoring standpipes. The details of the gas and ground water monitoring standpipes are summarised below in Table 3.1: Gas and Groundwater Monitoring Installations.

Table 3.1: Gas and Groundwater Monitoring Installations

BH ID	Installation Depth (mbgl)	Response Zone (mbgl)	Installation Date	Strata
WS01	2.00	0.50 – 2.00	12/04/2021	Made Ground
WS02	3.00	1.00 – 2.00	12/04/2021	Till
WS03	3.00	1.10 – 3.00	12/04/2021	Till

3.4.2 Full details of the installations and backfill are presented on the relevant exploratory hole logs.

3.4.3 All monitoring standpipes are constructed using 50mm slotted pipe with a Geosock filter and gravel surround medium within the response zone, and 50mm plain pipe with a bentonite seal above the response zone (minimum 0.50m thick).

3.4.4 All remaining exploratory holes were backfilled with arisings and made level at the surface to a similar condition as prior to the work.

3.5 Groundwater

3.5.1 Where groundwater was encountered a waiting period of 20 minutes was allowed to monitor any change (rise or fall) in the levels of each groundwater strike.

3.6 Groundwater Monitoring

3.6.1 Groundwater monitoring is currently ongoing.

3.7 Laboratory Testing

3.7.1 Chemical laboratory testing was subsequently carried out on selected samples of soil. Further details of the chemical laboratory testing are given within Section 5.0 – Chemical Testing and Results.

3.7.2 All chemical laboratory testing has been scheduled by GeoCon.

3.7.3 Geotechnical laboratory testing was subsequently carried out on selected samples of soil. Further details of the geotechnical laboratory testing are given within Section 7.0 – Geotechnical Testing and Results.

3.7.4 All geotechnical laboratory testing has been scheduled by GeoCon.

3.8 Restrictions

3.8.1 No restrictions were encountered during this site investigation that would have prevented parts of the site being accessed and consequently resulting in any of the exploratory locations being abandoned.

4.0 GROUND CONDITIONS

4.1 Geology

- 4.1.1 The British Geological Survey Map Sheet 85 Manchester and online mapping shows the site to be underlain by the geological succession outlined below Table 4.1: Published Geology.

Table 4.1: Published Geology

Geology	Description /strata
Artificial	None recorded
Superficial	Till
Bedrock	Manchester Marls Formation and Collyhurst Sandstone Formation

- 4.1.2 There are no known artificial deposits recorded underlying the site.
- 4.1.3 The superficial geology recorded underlying the site is shown to be Till. No BGS description is currently available for Till; however, these deposits are generally comprised of sandy gravelly clay with cobbles and varying silt sand and gravel content.
- 4.1.4 The bedrock geology beneath the site is shown to be the Manchester Marls Formation to the west, underlain by the Collyhurst Sandstone Formation, which outcrops to the east. The Manchester Marls Formation which is generally described as *'Red marl (calcareous mudstone and siltstone) with thin beds of fossiliferous marine limestone and dolomite; locally green; sandy in places especially in top part; local breccias and pebbly beds'*, (BGS online lexicon of rock units general description). The Collyhurst Sandstone Formation is generally described as *'a soft red sandstone with abundant beds of "millet seed" sand grains alternating with beds of fine-grained sharp sand with some interbedded grey sandstones locally'*. (BGS online lexicon of rock units general description).

4.2 General

- 4.2.1 A generalised summary of the ground conditions encountered, depths to base, and thickness recorded from the exploratory hole records is presented below in Table 4.2: Summary of Ground Conditions.

Table 4.2: Summary of Ground Conditions

Geology / Strata	Depth (mbgl)				Thickness (m)		Locations encountered
	Top		Base		Min	Max	
	Min	Max	Min	Max			
Made Ground	0.00	-	0.50	2.30	0.50	2.30	WS01, WS02, WS03, WS04
Till	0.50	2.30	4.90	5.45	2.60	4.95	WS01, WS02, WS03, WS04
Groundwater	Strike depth (mbgl)		Rest Level (mbgl)		Locations encountered		
	Min	Max	Min	Max			
Seepage	-	-	-	-	Not encounterd		
Strike	2.60	4.50	-	-	WS02, WS03, WS04		
SWL only (no obvious strike)	-	-	-	-	Not encounterd		

- 4.2.2 The general ground conditions encountered have been summarised below.
- 4.2.3 Detailed strata descriptions are presented on the windowless sample borehole logs presented in Appendix B.

- 4.2.4 The actual ground conditions encountered across the site were generally uniform and comprised Made Ground overlying Till deposits.

4.3 Made Ground

- 4.3.1 Made ground was encountered in all exploratory hole locations from ground level to depths of between, 0.50 and 2.30mbgl. The Made Ground generally comprised hardstanding overlying layers of granular and cohesive made ground materials.

Hardstanding:

- 4.3.3 Hardstanding was encountered in WS01, WS03, and WS04 from ground level to depths of between 0.14 and 0.32mbgl, and generally comprised concrete.

Granular Made Ground:

- 4.3.4 Granular made ground materials were encountered in WS01, WS03, and WS04 from ground level or beneath the hardstanding to depths of between 0.65 and 2.40mbgl, and generally comprised sandy gravel or gravelly sand, with fragments of tile, glass, wood, brick, ash, concrete and limestone.

Cohesive Made Ground:

- 4.3.5 Cohesive made ground materials were encountered WS02, and WS03, from ground level or beneath the granular material to depths of between 0.50 and 1.10 mbgl, and generally comprised soft to firm sandy gravelly clay, with fragments of coal, glass, brick, tile, mudstone, and porcelain.

4.4 Superficial Deposits (Till)

- 4.4.1 Soils considered to represent Till deposits were encountered in all exploratory hole locations directly beneath the Made Ground, and were proven to depths of between 4.90 and 5.45mbgl.
- 4.4.2 The Till deposits generally comprised firm becoming stiff, slightly sandy slightly gravelly clay.

4.5 Bedrock

- 4.5.1 Bedrock was not encountered during this ground investigation.

4.6 Groundwater

- 4.6.1 Groundwater was encountered in three of the four exploratory holes formed across the site. Further details are as follows:-

- WS02 – strike at 4.50mbgl remaining stable after 20 minutes.
- WS03 – strike at 2.80mbgl remaining stable after 20 minutes.
- WS04 – strike at 2.60mbgl remaining stable after 20 minutes.

4.7 Groundwater Monitoring

- 4.7.1 A groundwater monitoring regime has been carried out at the site to establish the ground water levels beneath the site, which included monitoring on six occasions. Table 4.3: Groundwater Monitoring Results, overleaf presents the details of the groundwater monitoring regime.

Table 4.3: Groundwater Monitoring Results

Exploratory Hole ID	Date of Visit											
	30/04/2021		13/05/2021		24/05/2021		10/06/2021		25/06/2021		05/07/2021	
	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)	Base of Hole (mbgl)	Standing Water Level (SWL) (mbgl)
WS01	2.04	Dry	2.04	Dry	2.04	Dry	2.04	Dry	N/R	N/R	2.04	Dry
WS02	3.00	2.30	3.00	1.18	3.00	2.20	3.00	1.71	N/R	N/R	2.83	1.92
WS03	3.00	1.10	3.00	1.12	3.00	1.10	3.00	1.22	3.00	1.18	3.00	1.27

N/R = Not recorded

4.8 Obstructions

4.8.1 No obstructions were encountered during this ground investigation.

4.9 Contamination

4.9.1 No visual or olfactory evidence of contamination was encountered or observed during this ground investigation, in particular no obvious visual or olfactory evidence of mobile contamination was observed during the ground investigation.

5.0 CHEMICAL TESTING AND RESULTS

5.1 General

- 5.1.1 All samples were sent to a UKAS accredited chemical testing laboratory, and MCERTS were used where available. The analytical strategy focussed on a general suite of potential contaminants and the analytical suites are summarised in Table 5.1: Summary of Chemical Testing Suite.

Table 5.1: Summary of Chemical Testing Suite

Testing	Comment	No. of soil samples analysed	No. of leachate samples analysed
General metals suite including: Arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, phenol, selenium, zinc, pH, and water soluble sulphate	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
Speciated PAH	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
TPH CWG	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	2
Asbestos Screen	General analysis of soils beneath the site to achieve general site coverage, and targeting former uses on site and off site within influencing distance	4	-

- 5.1.2 All chemical testing results are presented in Appendix F.

5.2 Chemical Results

- 5.2.1 All chemical results have initially been compared against screening criteria for a residential end use with plant uptake.
- 5.2.2 Total Organic Carbon (TOC) was not analysed, therefore, a worst case scenario of 1% SOM has been used where appropriate in the chemical assessment below.
- 5.2.3 Only detectable concentrations of contaminants reported above the screening criteria are presented below in Table 5.2: Summary of Soil Chemical Testing Results.

Table 5.2: Summary of Soil Chemical Testing Results

Analyte	No. Of samples analysed	Screening value (mg/kg) (where applicable)	Analyte concentration range (mg/kg)	No of Samples exceeding screening value
Summary of soil results				
Arsenic	4	11	7 – 204	2
Lead	4	210	50 - 721	3
Mercury	4	1.2	<0.17 – 4.66	1

5.2.4 Four samples were analysed for asbestos screen. No fibres were detected in any of the samples.

5.3 Groundwater Testing

5.3.1 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.

5.3.2 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.

6.0 GENERIC QUANTITATIVE RISK ASSESSMENT

6.1 Criteria for Interpretation

- 6.1.1 The regime for contaminated land was set out in Part IIA of the Environmental Protection Act (EPA) 1990, as inserted by S.57 of The Environment Act 1995 and came into effect in England on 1st April 2000 as The Contaminated Land (England) Regulations 2000 (SI 2000/227). These regulations were subsequently updated with the provision of The Contaminated Land (England) Regulations 2006 (SI 2006/1380), which consolidated the previous regulations and amendments and added in provisions regarding radioactive contaminated land. These regulations came into force on 4th August 2006. This modified the wording for “Contaminated Land” under Part IIA of the EPA. Section 78A (2) defines contaminated land as “land which appears to be in such a condition, by reason of substances in, on or under the land, that:

- Significant harm is being caused, or there is a significant possibility of significant harm being caused (SPOSH).

6.2 Human Health Receptors

- 6.2.1 An initial Generic Quantitative Risk Assessment (GQRA) for human health has been undertaken by comparison of the soil analytical results with published guidance criteria. These can be classified as Generic Assessment Criteria (GAC) and are widely referred to by consultants, Regulatory Authorities and other professionals within the industry and include the following:

- Current published Soil Guideline Values (SGVs) published by the Environmental Agency (EA).
- Land Quality Management (LQM) have published a series of GACs via the CLEA v1.04 software which are applicable to the UK for common analytes. The GAC's can be applied to a wide range of land contamination problems, which can be used as initial screening criteria in order to assess potentially contaminated land.
- ATRISK Soil SSV's (Soil Screening Values) at 1% SOM for a sand soil derived by Atkins in line with the Environment Agency 2009 guidance (SR2, SR3, SR4, SR7) using the CLEA v1.04 and CLEA v1.06 software; and WSV's (Water Screening Values) for Human Health using the RBCA v2.5 software. The modelling inputs were made compliant with the SR3 residential conceptual site model and follow the guidance provided within SR3 where possible.
- Contaminated Land: Applications in Real Environments (CL:AIRE) 'The Soil Generic Assessment Criteria for Human Health Risk Assessment' GAC's via the CLEA v1.06 software (updated version of the v1.04 update after the release of LQM GAC's).
- Defra C4SL's: Development of Category 4 Screening Levels for assessment of land affected by contamination.

- 6.2.2 It should be noted that the above guidance criteria are generally restricted with depth i.e. the values quoted with reference to human health are generally only applicable in the top 1.00m of soil and do not (dependant on the conceptual site model and conditions identified on site) necessarily identify significant harm. Further detailed quantitative risk assessment (DQRA) may be required.

- 6.2.3 A list of the screening criteria used for soils is presented in Appendix D. The GQRA has been evaluated using a probability / consequence matrix, which is provided in Appendix E.

6.3 Risk to Human Health

- 6.3.1 The majority of the chemical analytes analysed recorded levels below the relevant screening criteria for a residential end usage with the exception of arsenic, lead, and mercury.
- 6.3.2 Elevated concentrations of the above analytes are listed overleaf in Table 6.1: Chemical Analytes Exceeding Screening Criteria.

Table 6.1: Chemical Analytes Exceeding Screening Criteria

Exploratory Hole Location	Depth Range (mbgl)	Analyte Concentration Result (mg/kg)
Analyte = Arsenic - Screening Criteria = 37mg/kg		
WS01	0.50	101
WS01	1.00	204
Analyte = Lead - Screening Criteria = 210mg/kg		
WS01	0.50	378
WS01	1.00	721
WS03	0.70	218
Analyte = Maercury - Screening Criteria = 1.2mg/kg		
WS03	0.70	4.66

- 6.3.3 Based on the above, contamination does appear to be present beneath parts of the site within the made ground. The elevated levels of contamination may represent either localised hotspots of contamination or could be representative of the site as a whole. At this stage it is not possible to determine the full extent of the soil contamination.
- 6.3.4 It is understood that the proposed development comprises residential properties with private gardens and associated hardstanding and infrastructure.
- 6.3.5 Therefore, a pollutant linkage is considered to be present and the risk to human end users are considered to be **moderate**.
- 6.3.6 Risks to construction workers are considered to be **low to moderate**. All construction workers should wear appropriate Personal Protective Equipment (PPE) including gloves and dust masks. Provisions should be made for water on site to 'damp down' any dust in dry conditions.
- 6.3.7 In areas where site soils are to be exposed at the surface such as areas of landscaping then these areas will need remedial action. Alternatively, additional sampling and analysis and further risk assessment could be undertaken to potentially reduce the volumes of soils requiring remedial action / removal from site and potentially delineate and reduce this area for remedial action.
- 6.3.8 A watching brief should be maintained during construction to ensure that any unsuitable materials are removed at the time.
- 6.3.9 Should any erroneous materials or previously unidentified contamination be encountered during construction then further sampling and analysis may be required.
- 6.3.10 The above recommendations should be agreed in principle with the Local Planning Authority prior to development to avoid any delays or complications at a later stage.

6.4 Risk to Controlled Waters

Groundwater

- 6.4.1 The site is underlain by Secondary B Aquifer for the superficial deposits, and Principal Aquifer for the bedrock deposits.
- 6.4.2 There are no source protection zones within 1000m of the site. There is one groundwater abstraction noted 727m to the southwest with fourteen noted between 1000-2000m from site.

- 6.4.3 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.
- 6.4.4 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.
- 6.4.5 Therefore, based on the above information, the results of the soil and leachate testing, the generally impermeable geology directly underlying the site, and considering that natural attenuation, dilution and dispersion will take place, the risks to groundwater and drinking waters are considered to be **very low**.

Surface Water

- 6.4.6 The nearest surface water course is the Ashton Canal located 194m to the northwest, and topographically up gradient of the site. The nearest surface river is the River Medlock, located 204m to the east.
- 6.4.7 There are three pollution incidents, all recorded as category three minor incidents, in 1993-1996 to the canal, with no/ unknown pollutants.
- 6.4.8 There are two licenced surface water abstraction points within 1000m of the site. The nearest to the site is located approximately 653m to the northeast for Tar Distillers, from the Ashton Canal. The second entry is located 658m to the north for an unrecorded abstraction from the Ashton Canal. There are a further six licensed surface water abstraction points between 1000 and 2000m of the site for cooling, dust suppression and unrecorded uses.
- 6.4.9 All leachate chemical results have initially been compared to Drinking Water Standards (DWS) and Environmental Quality Standards (EQS) to assess risk to controlled waters, and against Water Screening Values to assess risk to human health.
- 6.4.10 No exceedances have been identified of the sample results tested in comparison with the relevant screening criteria values.
- 6.4.11 Therefore, based on the above information, the results of the soil and leachate testing, the generally impermeable geology directly underlying the site, and considering that natural attenuation, dilution and dispersion will take place, the risks to surface waters are considered to be **very low**.

6.5 Ground Gas Risk Assessment

General

- 6.5.1 There is one historical landfill site located 234m to the southeast, dated in 1986 for inert and industrial waste, there are four areas of potential infilling located 201m from site. There is a large area of artificial ground noted in BGS mapping located 55m southwest.
- 6.5.2 Made ground was also encountered beneath the site and was proven to depths of up to 2.30mbgl.
- 6.5.3 Ground gas monitoring standpipes have been installed to a maximum depth of 3.00mbgl with response zones placed within the made ground and natural deposits (where the made ground was less than 3.00m thick) beneath the site.
- 6.5.4 It is considered that hazardous ground gasses if present would migrate vertically upwards through the permeable sands beneath the site into the proposed development.

Results

- 6.5.5 The monitoring period has been carried between the 30th April 2021 and the 5th July 2021.
- 6.5.6 The following ground gas risk assessment was carried out in accordance with CIRIA 665, CIRIA 149 and BS 8485.
- 6.5.7 The full results of the gas monitoring regime are presented Appendix G, and are summarised below.

- 6.5.8 It should be noted that WS01 and WS02 could not be access on one occasion due to access issues.
- 6.5.9 Where possible, monitoring has been carried out under a minimum of two occasions where low and falling atmospheric pressure were present together.
- 6.5.10 Methane concentrations ranged between 0.0 and 0.2% v/v; Carbon dioxide concentrations ranged between 0.3 and 4.1% v/v; oxygen concentrations ranged between 18.0 and 21.0% v/v; and flows were recorded between 0.1 and 0.5l/hr during the monitoring period.
- 6.5.11 In the case of any negative flows, it should be assumed that any negative flows can become positive and therefore the any negative GSV's should be taken as positive.
- 6.5.12 Based on these recorded values a maximum Gas Screening Values (GSVs) for methane were calculated at 0.0005l/hr; and a maximum GSV for carbon dioxide were calculated at 0.006/hr.

Conclusions and Recommendations

- 6.5.13 Based on the above information to date, this site has been categorised as falling under Characteristic Situation (CS) 1 – very low risk.
- 6.5.14 As such no specific remedial action is required with respect to gas protection.
- 6.5.15 The site would be classed as Green under the NHBC traffic light system.
- 6.5.16 It is recommended that the above conclusions should be agreed with the local Planning Authority to gain their approval prior to commencing with the construction of the new development.
- 6.5.17 Following the installation of any gas resistant membranes the local authority may require verification to prove the membrane has been installed correctly.
- 6.5.18 With regards carbon monoxide: Information provided by the World Health Organisation (WHO) provides air quality guidelines for Europe 2000, which provides time weighted average exposures that have been determined in such a way that the carboxyhaemoglobin (COHb) level of 2.5% is not exceeded. These are as follows:
- 87ppm for 15 minutes
 - 52ppm for 30 minutes
 - 26ppm for one hour
 - 9ppm for eight hours
- 6.5.19 In addition, recommended WHO European guidelines for indoor air quality is as follow:
- 6ppm for twenty four hours so as not to exceed 2% COHb for chronic exposure.
- 6.5.20 Carbon monoxide concentrations were recorded between 1 and 2 ppm.
- 6.5.21 Based on the above, the risks from carbon monoxide are considered to be **very low** .
- 6.5.22 Therefore, based on the above results, no protection is considered necessary against carbon monoxide.
- 6.5.23 With regards hydrogen sulphide: Information taken directly from the HSE (Health & Safety Executive) Online provides the following:
- 0.0047 ppm is the recognition threshold of human smell, the concentration at which 50% of humans can detect the characteristic odour of hydrogen sulphide.
 - 10-20 ppm is the borderline concentration for eye irritation.
 - 50-100 ppm leads to eye damage.
 - At 150-250 ppm the olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger.

- 320-530 ppm leads to pulmonary edema with the possibility of death.
- 530-1000 ppm causes strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing.
- Concentrations over 1000 ppm cause immediate collapse with loss of breathing, even after inhalation of a single breath.

6.5.24 Hydrogen sulphide concentrations were recorded as 1 ppm.

6.5.25 Based on the above, the risks from hydrogen sulphide are considered to be **very low**.

6.5.26 Therefore, based on the above results, no protection is considered necessary against hydrogen sulphide.

6.6 Plants and Native Grasses

6.6.1 Any plants that may be grown at the site in areas of landscaping may potentially be at risk from phytotoxic elements in any artificial soils beneath the site. Guideline screening values are currently available for copper, nickel and zinc which are considered to be the most harmful to plant life.

6.6.2 All three chemical analytes recorded levels below the relevant phytotoxic screening criteria. Given the above and the generally low potential for contamination and the results of the wider soil analysis, the risks to plants and native grasses are considered to be very low. Any remaining residual risks will be mitigated by the remedial measures set out in Section 6.3 above.

6.7 Buried Services and Utilities

6.7.1 Any organic contamination present in the soils or groundwater beneath the site would pose a risk of premature failure to below ground services via chemical reaction. Based on the chemical analysis carried out during this ground investigation, the risks to buried services and pipelines are considered to be low.

6.7.2 It is the responsibility of the utility providers to confirm the risk status and determine what materials should be used in the provision of any newly proposed buried services and utilities based on the results of the chemical analysis with this report. A copy of this report should therefore be provided to the utility contractors.

6.7.3 It is recommended that prior to the placement of any newly proposed buried services, that adequate testing of the soils of which the pipes / cables will be laid in is carried out to determine the suitability of those soils for the utility provider's equipment.

6.8 Updated Conceptual Site Model

6.8.1 Following the results of the site investigation and above assessment, an updated CSM has been produced overleaf as Table 6.2: Updated Conceptual Site Model.

Table 6.2: Updated Conceptual Site Model

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Pollutant Linkage	Probability	Consequence	Risk Classification	Action / Mitigation
Made Ground both on site and within influencing distance of the site Current and former land uses both on site and within influencing distance of the site	Arsenic, Lead and Mercury	Inhalation Dermal Contact	Human health: Including current site users.	Potentially active	Low	Mild	Low	Remediation will be required to render the site suitable for a residential with plant uptake end use.
	Arsenic, Lead and Mercury	Ingestion Inhalation Dermal Contact	Human health: Including future site users.	Potentially active	Likely	Medium	Moderate	
	Arsenic, Lead and Mercury	Inhalation	Human health: Including neighbouring residents.	Potentially active	Likely	Mild	Low to moderate	
	Arsenic, Lead and Mercury	Ingestion Inhalation Dermal Contact	Human health: Including constructions workers	Potentially active	Low	Medium	Low to Moderate	
Made Ground on site Current and former land uses on site	None identified	Lateral and vertical migration and leaching of contaminants into surface water bodies via permeable strata and features.	Local water courses and associated flora and fauna	Inactive	-	-	Very Low	No further action.
Made Ground on site Current and former land uses on site	None identified	Lateral and vertical migration and leaching of contaminants into local groundwater	Underlying Aquifer (Drinking water and baseflow to rivers)	Inactive	-	-	Very Low	No further action.

Potential Sources	Contaminants of Concern	Potential Pathway	Potential Receptor	Pollutant Linkage	Probability	Consequence	Risk Classification	Action / Mitigation
Made Ground beneath the site Current and former site uses	None identified	Plant uptake	Plants and vegetation	Inactive	-	-	Very Low	No further action.
Landfill sites Potentially infilled Land (ponds, quarries, reservoirs etc) Made Ground (on and off-site sources)	Hazardous ground gases including CO ₂ , CH ₄ , CO, H ₂ S Vapours	Inhalation	Human health animals and plants: Including current site users, future site users, neighbouring residents and constructions workers	Considered potentially active	Unlikely	Minor	Very low	No further action.
		Explosion	Buildings	Considered potentially active	Unlikely	Minor	Very low	

6.9 Further Work

- 6.9.1 Given the presence of contamination recorded at the site, it is likely that the Local Authority will require a Remediation Strategy to outline the proposed methodology for remediation of the site in order to make it suitable for use.

7.0 GEOTECHNICAL TESTING AND RESULTS

7.1 General

- 7.1.1 This geotechnical investigation was undertaken to provide details of the ground conditions, soils strengths, engineering properties of the soils and rock beneath the site, and subsequent advice on suitable foundation solutions.
- 7.1.2 At this stage the precise construction details have not been provided to GeoCon, however it is understood the site is to be redeveloped with a series of nine new terraced two storey residential properties.
- 7.1.3 It should be noted that GeoCon have not been provided with any further details regarding the structural loading at this stage.

7.2 Geotechnical Testing

- 7.2.1 In-situ Standard Penetration Tests (SPTs) were undertaken in accordance with BS1377 (1990) within the window sample boreholes. A summary of the insitu testing is given below in Table 7.1: Insitu Geotechnical Testing:

Table 7.1: Insitu Geotechnical Testing

Strata	SPT N Value vs Depth Range	Locations Encountered
Made Ground	1.00 – 1.45: N = 8 2.00 – 2.45: N = 3	WS01, WS02, WS03, WS04
Till	1.20 – 1.65: N = 6 to 10 2.00 – 2.45: N = 11 to 18 3.00 – 3.45: N = 11 to 27 4.00 – 4.45: N = 17 to 37 4.45 – 4.90: N = 42 5.00 – 5.45: N = 39 to 40	WS01, WS02, WS03, WS04

- 7.2.2 A programme of geotechnical laboratory testing was undertaken in accordance with BS1377 (1990) 'Methods of tests for soils for civil engineering purposes. The geotechnical testing regime has been summarised below in Table 7.2: Geotechnical Laboratory Analysis.

Table 7.2: Geotechnical Laboratory Analysis

BS 1377 Test Number	Test Description	Quantity Analysed
BS 1377 1990: Part 2. Clause 3.2	Moisture content	5
BS 1377 1990: Part 2. Clause 4.3, 5.3 & 5.4	Atterberg Limits	5
BS 1377 1990: Part 3. Clause 5.3 & BRE CP2/79	BRE SD 1	5

- 7.2.3 The results of the BRE SD1 geotechnical testing are presented in Appendix D, with the Moisture content and Atterberg limit geotechnical testing are presented in Appendix F.

Plasticity Index

- 7.2.4 Atterberg limit testing was carried out on selected samples of cohesive soils taken from the site to establish the plasticity index of the clay beneath the site. The results of this testing is presented below in Table 7.3: Atterberg Limits Testing Results.

Table 7.3: Atterberg Limits Testing Results

Test	Range
Moisture Content (%)	15 – 18
Liquid Limit (%)	38 – 46
Plastic Limit (%)	18 – 22
Plasticity Index (%)	20 – 24
Modified plasticity index (%)	19.20 – 23.04

7.2.5 Based on these results the clay beneath the site can be classed as intermediate plasticity.

7.2.6 Chapter 4.2 'Building near Trees' of the NHBC standards indicates that from the testing results, the modified plasticity index is between 19.20 and 23.04% and therefore, the clay beneath the site is of low to medium volume change potential.

BRE SD 1

7.2.7 Five soil samples were analysed for BRE SD 1 suite to assess the risk to buried concrete at the site, which includes total sulphate, water soluble sulphate, pH and total sulphur. The results of the testing are summarised below in Table 7.4: Summary of BRE SD 1 Results.

Table 7.4: Summary of BRE SD 1 Results

Test	Soil Test - Results Range
Total sulphate (%)	0.02 – 0.45
Water soluble sulphate (mg/l)	10 – 548
Total sulphur (%)	0.01 – 0.52
pH	6.55 – 8.49
Total Potential Sulphate (%)	0.03 – 1.56
Potential amount of Oxidisable Sulphate Present (%)	0.01 – 1.11

7.2.8 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive Ground).

7.2.9 The above results indicate that pyrite is likely to be present within the soils beneath the site.

8.0 GEOTECHNICAL ASSESSMENT

8.1 General

- 8.1.1 It is understood that the proposed development will comprise the construction of a series of nine new terraced two storey residential properties.
- 8.1.2 At this stage GeoCon have not been provided with any loadings for the proposed development.
- 8.1.3 The recommendations given below assume that ground levels intended for the redevelopment will be similar to those existing at present. If ground levels are subject to significant change as part of the proposed development, then the recommendations in this report may require reinterpretation.

8.2 Geotechnical Model

- 8.2.1 Four windowless sample boreholes were formed over the area to be taken up by the proposed residential development.
- 8.2.2 The ground conditions encountered within the exploratory holes are summarised below in Table 8.1: Summary of Ground Conditions.

Table 8.1: Summary of Ground Conditions

Stratum	Depth Range to Base of Stratum (mbgl) (Thickness Range)	Strength/Consistency	Notes
Made Ground			
Made Ground	0.50 to 2.30m (0.50 to 2.30m)	SPT 'N' values obtained: 1.00 – 1.45: N = 8 2.00 – 2.45: N = 3	Made Ground was recorded in all locations, with concrete hardstanding in WS01, WS03 and WS04 WS01 to between 0.14 – 0.32mbgl. underlain by granular and cohesive made ground Granular made ground materials were encountered in WS01, WS03, and WS04 from ground level or beneath the hardstanding to depths of between 0.65 and 2.40mbgl, and generally comprised sandy gravel or gravelly sand, with fragments of tile, glass, wood, brick, ash, concrete and limestone. Cohesive made ground materials were encountered WS02, and WS03, from ground level or beneath the granular material to depths of between 0.50 and 1.10 mbgl, and generally comprised soft to firm sandy gravelly clay, with fragments of coal, glass, brick, tile, mudstone, and porcelain.
Natural Strata			
Till	4.90 to 5.45m (2.60 to 4.95m)	Firm to stiff consistency. SPT 'N' values obtained: 1.20 – 1.65: N = 6 to 10 2.00 – 2.45: N = 11 to 18 3.00 – 3.45: N = 11 to 27 4.00 – 4.45: N = 17 to 37 4.45 – 4.90: N = 42 5.00 – 5.45: N = 39 to 40	Described in the field as an slightly sandy slightly gravelly clay. Encountered directly beneath the Made Ground in all locations. <u>Atterberg & Moisture Content Tests (4no. samples analysed)</u> Moisture Contents – 15 to 18% Plastic Limits – 18 to 22% Liquid Limits – 38 to 46% Plasticity Indices* - 19.20 to 23.04% The Atterberg Limit tests indicate that the clay is of intermediate plasticity and of low to medium volume change potential.
* - Corrected for fines content in accordance with NHBC Chapter 4.2.			

- 8.2.3 The liquid and plastic limits of four samples within the clay deposits have been determined. The results of the testing yielded liquid limits of between 38 and 46% in association with plastic limits of between 18% and 22%.
- 8.2.4 These results demonstrate that this cohesive soil may be generally classified as clay of intermediate plasticity. In addition, the NHBC classification indicates that the clay revealed at this site possesses a low to medium volume change potential.
- 8.2.5 Groundwater was encountered in three of the four exploratory holes formed across the site. Further details are as follows:-
- WS02 – strike at 4.50mbgl remaining stable after 20 minutes.
 - WS03 – strike at 2.80mbgl remaining stable after 20 minutes.
 - WS04 – strike at 2.60mbgl remaining stable after 20 minutes.

8.3 Foundations

- 8.3.1 The made ground in its current setting would not be suitable for the construction of shallow foundations due to the risk of unacceptable total and differential settlement occurring. These soils are present in a weak and variable condition such that excessive total and or differential settlement could occur under moderately light surface loading.
- 8.3.2 Where made ground is either not present or present only at shallow depths, it would be possible to adopt strip or spread foundations in the underlying glacial clays, which generally consists of firm sandy clay. It is considered that this material will provide a suitable bearing stratum, provided that the foundations are placed within a single soil type, and where cohesive generally described as being present in a firm (or higher) insitu condition. It is considered that strip or spread foundations constructed within this material at a minimum depth of say 2.50m could be designed assuming an allowable increase in load given below in Table 8.2: Allowable Increase in Stress.

Table 8.2: Allowable Increase in Stress

Foundation Type	Strip Footings (m)			Spread Foundation (m ²)		
Foundation Width (m)	0.60	0.90	1.20	1	2	3
Foundation Depth (m)	2.50			2.50		
Allowable Increase in Stress (kN/m ²)	110	105	100	140	135	125

- 8.3.3 The allowable increase in stress given above assumes a factor of safety of 3 against general shear failure, with cohesion of 45N/m² at the foundation depths. Settlements at the above loading intensities should remain within tolerable limits for the type of structure proposed provided that the underlying soils are carefully inspected immediately final trimming has taken place. Should any soft or weak material be encountered they should be locally removed and replaced with lean-mix concrete or compacted granular soil.
- 8.3.4 Once excavated, the formation may be subject to heave, which may result in settlement when the new foundation loads are applied. The designer should ensure that any settlement would remain within serviceable limits for the new and existing structures.
- 8.3.5 Foundation depths may need to be increased where they are within influencing distance of trees. Heave precautions may also be required. Advice on these issues is given in NHBC Standards Chapter 4.2.

8.4 Floor Slabs

- 8.4.1 Suspended floorslabs should be used at this site due to the presence and thickness of made ground soils immediately beneath the site.

8.5 Concrete

- 8.5.1 A review of the pH and sulphate concentrations indicates that all concrete used in the foundations at this site should be designed to “Design Sulphate Class” DS-4, and the “Aggressive Chemical Environment for Concrete” (ACEC) class AC-4.

8.6 Groundwater and Excavations

- 8.6.1 Groundwater may represent a particular problem to the construction of the proposed development at this site. It should be recognized that slight seepages and minor water entries may combine in any long trench excavations to create a significant volume of water which may cause local problems during the construction phase. Any minor groundwater seepages or significant standing water within excavations made upon this site may be removed by using a simple form of de-watering. Such a system could include the excavation of sumps from which the water could be pumped. Advice on Groundwater Control is given in CIRIA Report No 515 – Groundwater Control Design and Practice.
- 8.6.2 Foundation excavations should be feasible using conventional plant.
- 8.6.3 The stability of the excavation faces cannot be guaranteed, thus temporary support to the excavation faces may become necessary. Alternatively, subject to space constraints, excavations could be battered back to a suitable angle of repose. However, if there is a requirement to protect nearby structures or services, appropriate supports may still be required. Advice on excavation support is given in CIRIA Report No 97 – Trenching Practice.

8.7 Road Pavement

- 8.7.1 Any new pavements will require assessment of the existing sub grade in terms of its California Bearing Ratio (CBR) to facilitate the actual pavement design.
- 8.7.2 It is recommended that CBR testing is carried out at the site along any proposed access roads prior to construction to confirm the CBR design value.

8.8 Sustainable Drainage

- 8.8.1 In accordance with National Planning and Policy Framework (NPPF) the Planning Authority are likely to insist that surface water drainage from any new-build or redevelopment complies with current design practices for Sustainable Urban Drainage (SUD's) construction of separate drainage systems for foul and surface water. Surface water shall be required to be attenuated reducing the discharge of water from the site requiring treatment and disposal. A 20% reduction in surface water discharge rates off the site is to be expected – allowing for the 1 in 100 year storm event and allowing for climate change.
- 8.8.2 Based on the ground conditions encountered it is unlikely that sustainable drainage would be suitable at the site, however due to the thickness of made ground overlying the natural deposits, it may not be practical or feasible. If sustainable drainage is to be considered, it is recommended that soak-away testing is carried out in accordance with BRE 365 at the site to establish the sites suitability for sustainable drainage.
- 8.8.3 Indicative infiltration testing has been carried out as part of this site investigation and is discussed further in Section 9.0.

8.9 Existing Structures

- 8.9.1 Any existing structures and foundations if found should be grubbed up and replaced with a suitable engineered granular backfill and should be compacted in layers.

8.10 Material Re-Use

- 8.10.1 The largely concrete Made Ground may be suitable for re-cycling, but probably at an off-site specialist facility.
- 8.10.2 Any site won soils / materials may be available for reuse across the site subject to the appropriate classification, analysis and engineered solution.

9.0 INDICITIVE INFILTRATION TESTING AND RESULTS

9.1 General

- 9.1.1 Indicative infiltration testing was carried out at one location (WS04) at the site to provide infiltration rates where possible and to determine whether a sustainable drainage system is suitable for use at this site to deal with surface water runoff. Whilst we note that falling head tests, as carried out within the borehole, are not in accordance with BRE Digest 365 entitled 'Soakaway design', they do provide a measure of the permeability of strata across the soil profile most likely to be affected.
- 9.1.2 Indicative falling head testing was undertaken in WS04 following the principals of Geohydraulic field testing as presented in BS5930: 2015, A1-2020.
- 9.1.3 The water level monitoring commenced immediately after the borehole had been filled. The water was allowed to drain naturally from the borehole, with measurements taken over a suitable time period with an electronic dip tape.
- 9.1.4 No natural groundwater was encountered in the borehole prior to carrying out the test.
- 9.1.5 The borehole dimensions are presented below in Table 9.1: Borehole Dimensions:

Table 9.1: Borehole Dimensions

Hole ID	Diameter (m)	Depth (mbgl)	Test depth range (mbgl)
WS04	0.05	5.00	0.00 – 5.00

9.2 Filling

- 9.2.1 A slotted pipe was placed in the centre of the borehole to allow water level measurements to be taken at regular timed intervals.
- 9.2.2 Based on the underlying soils beneath the site, the water level showed a relatively constant level of drainage through the made ground, which then ceased upon natural strata, over the time period however, this was not completed within the time allowed of 1 hour, therefore the test was terminated.

9.3 Backfill

- 9.3.1 The borehole was filled with 50mm diameter slotted pipe to maintain the integrity of the hole and prevent collapse during the test.
- 9.3.2 On completion, the pipe was removed, and the borehole backfilled with airings to a similar standard as that prior to the works and made safe and level at the surface.

9.4 Testing

- 9.4.1 It should be noted that the water level recorded at the start of the tests has been taken to be the proposed drain invert level.
- 9.4.2 The test data obtained (tabulated and graphed) is presented in Appendix F.
- 9.4.3 The test was undertaken between a response zone of 1.00 to 5.00 mbgl, with an average borehole diameter of 0.05m. Volume outflow between 75% and 25% effective depth was incomplete. Therefore, although the soils exhibit some permeability, no reliable infiltration measurement is considered to be calculated.

9.5 Soakaway Conclusions and Recommendations

- 9.5.1 Whilst the results indicate that the subsurface possesses some limited permeability, based on the results from the testing undertaken, a calculation of infiltration rate was not able to be undertaken. Consequently, whilst we acknowledge some water infiltration would be possible, we do not consider the soils likely capable of providing sufficient capacity for an infiltration based sustainable drainage systems to be employed at this site.
- 9.5.2 Should soakaway systems be required as part of the design then full scale soakage testing in accordance with BRE365 should be undertaken to facilitate design, noting that the siting and scale of such a system would be limited due to the proximity of current and proposed buildings along with the limited potential for infiltration from the shallow surface soils. Further advice is provided within BRE365 and this document should be referred to for further guidance.
- 9.5.3 We envisage therefore, that stormwater disposal via connection to the existing urban drainage system is a preferred option.

10.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

10.1 Waste Soils Characterisation

- 10.1.1 Any excavation works may potentially produce waste soils for which appropriate waste management will be required. Any soils requiring removal and disposal from site would require appropriate classification testing prior to disposal and the results would need to be confirmed with the landfill operator. Isolated hotspots if encountered may need to be taken off as Non-Hazardous or Hazardous waste. Any off-site disposal of soil requires careful management and due consideration of appropriate legislation, guidance and Duty of Care responsibilities.
- 10.1.2 A Hazardous Waste Assessment should be carried out on any materials requiring removal and disposal from site.
- 10.1.3 Waste Acceptance Criteria (WAC) testing has been carried out on one sample of materials potentially requiring disposal from site. The results of the WAC testing are presented within Appendix C and should be presented to the landfill operator for their confirmation of waste category.

10.2 Imported Fill

- 10.2.1 Any imported fill will be subject to specific quality requirements, particularly in any proposed areas of landscaping. Allowance should be made for the testing of imported fill materials prior to emplacement to ensure suitability should the materials be delivered with no testing certification.

10.3 Construction Activities

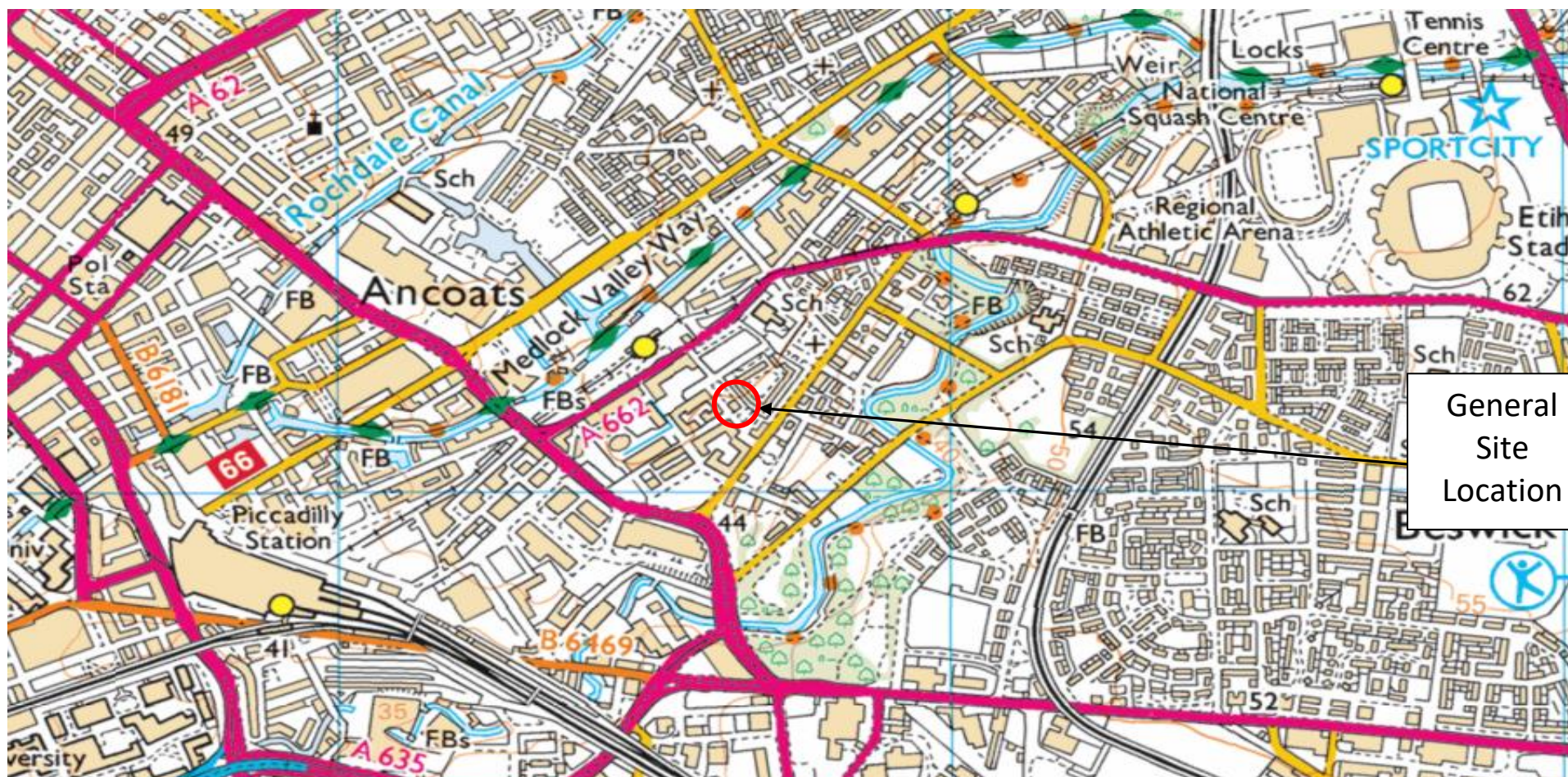
- 10.3.1 Due consideration should be given to the suppression of noise, dust and vibration emissions from the site during construction.

11.0 REFERENCES

- AGS: *A clients guides and tool kit*
- Atkins: *AtRisk Soil Screening Values and Water Screening Values*
- British Geological Survey (BGS): *1:50'000 geological maps of the area*
- British Geological Survey (BGS): *Open geoscience online mapping tool*
- BS 5930: *code of Practise for Site Investigation Amendment 2*
- BS 10175: *Code of Practise for the Investigation of Potentially Contaminated Sites*
- BRE 211 Radon: *Guidance on protective measures for new buildings*
- CIRIA 552: *Contaminated Land Risk Assessment; A Guide to Good Practise 2001*
- CIRIA 665: *Assessing the Risks Posed by Hazardous Ground Gases for Buildings 2007*
- Coal Authority: *Coal authority mining report and Cheshire brine subsidence report*
- *Contaminated Land: Applications in Real Environments (CL:AIRE): 'The Soil Generic Assessment Criteria for Human Health Risk Assessment' GAC's.*
- David Norbury: *Soil and Rock Descriptions in Engineering Practise*
- Department of the Environment: *DOE industry profiles*
- EN ISO 14688-1: *Geotechnical investigation and testing -- Identification and classification of soil -- Part 1: Identification and description*
- EN ISO 14688-2: *Geotechnical investigation and testing -- Identification and classification of soil -- Part 2: Principles for a classification*
- EN ISO 14689: *Geotechnical investigation and testing -- Identification and classification of rock -- Part 1: Identification and description*
- Environment Agency (EA): *EA Online & What's in my back yard*
- Environment Agency (EA): *Soil Guideline Values (SGVs)*
- Land Quality Management (LQM): *Generic Screening Criteria (GACs)*
- Landmark: *Envirocheck report and Envirocheck analysis online historical mapping tool.*
- Ordnance survey: *OS Landranger map for the area; OS open data online mapping tool*
- Planning Policy 23: *Planning and Pollution Control, Office of The Deputy Prime Minister 2004*
- R&D Publication CLR 8: *Assessment of risks to human health from land contamination.*
- R&D Publication CLR 10: *The Contaminated Land Exposure Model (CLEA)*
- R&D Publication CLR 11: *Model Procedure for the Management of Contaminated Land DEFRA 2004*
- UK Specification for Ground Investigation Second Edition 2012

APPENDIX A

DRAWINGS



General
Site
Location



GeoCon Site Investigations Ltd
Suite 2 Marple House,
39 Stockport Road,
Marple,
Stockport,
SK6 6BD.
Tel: 0844 504 3901, Fax: 0844 504 3902,
Email: info@geoconsiteinvestigations.com
Web: www.geoconsiteinvestigations.com



SITE NAME/CONTRACT
Snell Street, Manchester

DRAWING NO.
GSI 1450/01

SCALE
N.T.S

TITLE
Site Location Plan

DATE
March 2021

DRAWN BY
AD

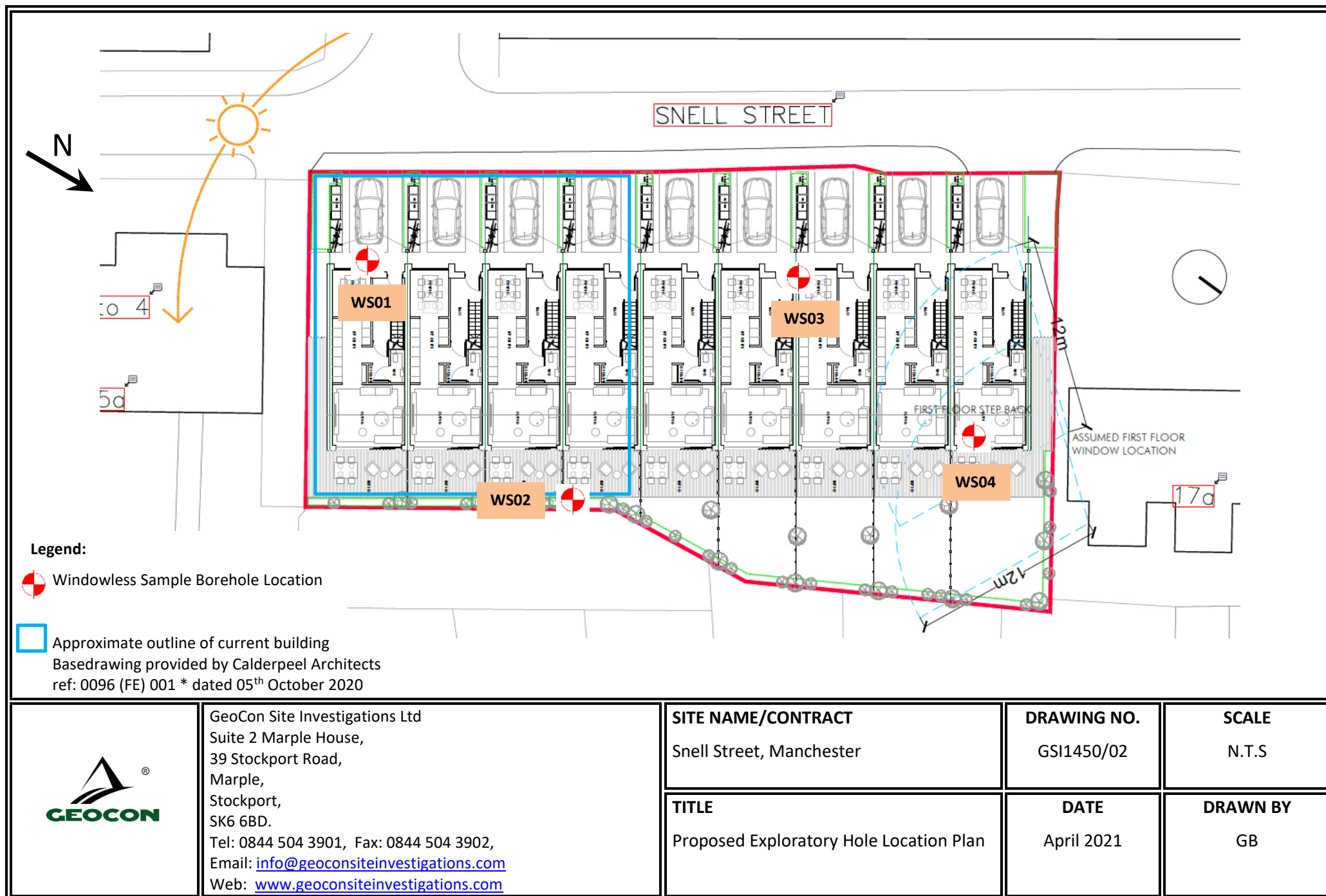


PROPOSED SITE PLAN
9 UNITS - TOTAL 13,167 SQFT

CHESHIRE	SURREY	SHEFFIELD	MANCHESTER	LIVERPOOL
Market Court 20-24 Church St Altrincham WA14 4DW 0161 929 7622	100 High St Esher Surrey KT10 9QJ 01372 203 335	Electric Works 3 Concourse Way Sheffield S1 2BJ 0114 250 7983	All Work and Social XYZ Building 2 Hardman Boulevard M3 3AQ 0161 929 7622	AvenueHQ 17 Mann Island Liverpool L3 1BP 0151 662 0122

SNELL STREET
BROOKFINCH

PROPOSED SITE PLAN
DWG: 20096 (FE) 001 *
DATE: 05.10.20
SCALE: 1:200 @ A3
DRAWN: AG



APPENDIX B

**WINDOWLESS SAMPLE BOREHOLE
LOGS**



Windowless Sample Borehole Log

Project Name: Snell Street, Manchester		Client: Penrose Manor Ltd		Date: 12/04/2021	
Location: Snell Street, Manchester		Contractor:			
Project No. : GSI 1450		Crew Name:		Drilling Equipment:	
Borehole Number WS04	Hole Type WS	Level	Logged By GB	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.32			0.32			Grey reinforced CONCRETE [rebar approx 5mm diameter].	
		0.80			0.80			Grey slightly silty sandy subangular to subrounded fine to medium GRAVEL of concrete and limestone [Sub-base].	
		0.85	ES					<i>Becomes clayey</i>	
		1.00	D					Firm grey mottled brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine mudstone and sandstone.	1
		1.00	ES						
		1.00	SPT	N=10 (1,1/2,2,3,3)					
		2.00	D						
		2.00	SPT	N=14 (3,3/4,4,3,3)				<i>Becomes stiff</i>	2
		3.00	SPT	N=14 (2,3/4,4,3,3)					3
		4.00	SPT	N=20 (3,4/5,5,5,5)					4
		5.00	SPT	N=39 (8,8/9,10,10,10)					5
		5.45			5.45			End of Borehole at 5.450m	6
									7
									8
									9
									10

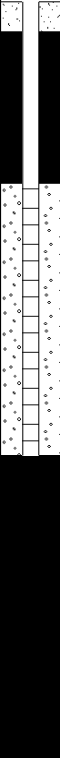
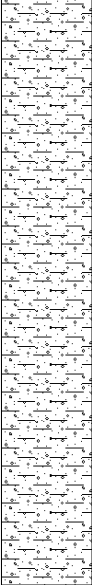
Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
Concrete cored out and hand dug service pit excavated to 1.20m bgl prior to drilling. Falling head test undertaken within the borehole.	



Windowless Sample Borehole Log

Project Name: Snell Street, Manchester		Client: Penrose Manor Ltd		Date: 12/04/2021	
Location: Snell Street, Manchester		Contractor:			
Project No. : GSI 1450		Crew Name:		Drilling Equipment:	
Borehole Number WS03	Hole Type WS	Level	Logged By GB	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			Grey reinforced CONCRETE [rebar approx 5mm diameter].	
		0.70	ES		0.65			Grey slightly silty sandy subangular to subrounded fine to medium GRAVEL of concrete and limestone [Sub-base].	
		1.00	SPT	N=8 (1,2/2,2,2,2)	1.10			Firm dark greyish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium brck, mudstone, coal and porcelain	1
		1.50	D					Firm grey mottled brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine mudstone and sandstone.	
		1.50	ES					<u>Becomes stiff</u>	
		2.00	SPT	N=18 (3,3/4,4,5,5)					2
		2.50	D						
		3.00	D						3
		3.00	SPT	N=16 (3,3/3,4,4,5)					
		4.00	SPT	N=26 (4,5/6,6,7,7)					4
					5.00			End of Borehole at 5.000m	5
									6
									7
									8
									9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
Concrete cored out and hand dug service pit excavated to 1.20m bgl prior to drilling.	



Windowless Sample Borehole Log

Project Name: Snell Street, Manchester		Client: Penrose Manor Ltd		Date: 12/04/2021	
Location: Snell Street, Manchester		Contractor:			
Project No. : GSI 1450		Crew Name:		Drilling Equipment:	
Borehole Number WS02	Hole Type WS	Level	Logged By GB	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.25	ES		0.50		Soft dark brown slightly sandy slightly gravelly CLAY with fine roots. Gravel is subangular to subrounded coal, glass and brick and tile.	1		
		0.90	D				Firm grey mottled brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine mudstone and sandstone.			
		1.00	SPT	N=6 (1,1/1,2,2,1)			Becomes brown mottled grey			
		1.50	D				Becomes stiff			
		2.00	SPT	N=11 (2,2/2,3,3,3)	2			Firm grey mottled brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine mudstone and sandstone. (TILL)	2	
		3.00	SPT	N=27 (5,4/7,7,6,7)				Becomes brown mottled grey		
		4.00	SPT	N=17 (3,4/4,5,4,4)				Becomes stiff		
		5.00	SPT	N=40 (8,8/10,10,10,10)						
					5.00				5	
					5.45					
End of Borehole at 5.450m									6	
									7	
									8	
									9	
									10	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
Hand dug service pit excavated to 1.20m bgl prior to drilling.	



Windowless Sample Borehole Log

Project Name: Snell Street, Manchester		Client: Penrose Manor Ltd		Date: 12/04/2021	
Location: Snell Street, Manchester		Contractor:			
Project No. : GSI 1450		Crew Name:		Drilling Equipment:	
Borehole Number WS01	Hole Type WS	Level	Logged By GB	Scale 1:50	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.14			CONCRETE.	
		0.50	ES		0.40			Grey sandy GRAVEL of angular to subrounded fine to coarse tile.	
					0.70			<i>Cobble of brick</i>	
		1.00	ES		0.90			Black sandy GRAVEL of angular to subrounded fine to medium blue glass, tile and wood.	
		1.00	SPT	N=8 (2,2/2,2,2,2)				<i>Cobble of brick</i>	1
								Dark grey slightly gravelly fine SAND. Gravel is angular to subrounded fine to medium brick and glass.	
		2.00	SPT	N=3 (0,1/0,1,1,1)				Orangish red slightly silty gravelly fine SAND. Gravel is angular to subrounded fine to medium brick, ash, tile and glass.	2
		2.50	D		2.30			Soft brownish orange CLAY.	
		2.60	D		2.40			Firm brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subrounded to rounded fine mudstone and sandstone.	
		3.00	SPT	N=11 (2,3/3,2,3,3)				<i>Becomes stiff</i>	3
		4.00	SPT	N=37 (7,9/10,9,9,9)					4
		4.45	SPT	N=42 (10,10/11,11,10,10)	4.90			End of Borehole at 4.900m	5
									6
									7
									8
									9
									10

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks	
Concrete cored out and hand dug service pit excavated to 1.20m bgl prior to drilling. No groundwater encountered.	

APPENDIX C
CHEMICAL TESTING RESULTS

Final Test Report

Envirolab Job Number: 21/05212
Issue Number: 1

Date: 26-May-21

Client: Geocon Site Investigations Ltd
Suite 2 Marple House,
39 Stockport Road,
Marple
Stockport
UK, SK6 6BD

Project Manager: Use - Mailing list/Use - Mailing list 2
Project Name: Snell Street, Manchester
Project Ref: GSI 1450
Order No: PO 21/024

Date Samples Received: 14-Apr-21
Date Instructions Received: 13-May-21
Date Analysis Completed: 25-May-21

Notes - Soil analysis

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones >10mm are removed or excluded from the sample prior to analysis and reported results corrected to a whole sample basis.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis.

Notes - General

This report shall not be reproduced, except in full, without written approval from Envirolab.

Subscript "A" indicates analysis performed on the sample as received. "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve, unless asbestos is found to be present in which case all analysis is performed on the sample as received.

All analysis is performed on the dried and crushed sample for samples with Matrix Code 7 and this supercedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples from outside the European Union and this supercedes any "D" subscripts

For complex, multi-compound analysis, quality control results do not always fall within chart limits for every compound and we have criteria for reporting in these situations.

If results are in italic font they are associated with such quality control failures and may be unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid

Predominant Matrix Codes: 1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample

Secondary Matrix Codes: A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal, E = contains roots/twigs.

IS indicates Insufficient sample for analysis, NDP indicates No Determination Possible and NAD indicates No Asbestos Detected.

Analytical results reflect the quality of the sample at the time of analysis only. Opinions and interpretations expressed are outside the scope of our accreditation.

Please contact us if you need any further information.

Prepared by:



Melanie Marshall
Laboratory Coordinator

Approved by:



Richard Wong
Client Manager

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/05212
Issue Number: 1
Date: 26 May, 2021

Client: Geocon Site Investigations Ltd
Suite 2 Marple House,
39 Stockport Road,
Marple
Stockport
UK
SK6 6BD

Project Manager: Use - Mailing list/Use - Mailing list 2
Project Name: Snell Street, Manchester
Project Ref: GSI 1450
Order No: PO 21/024
Date Samples Received: 14/04/21
Date Instructions Received: 13/05/21
Date Analysis Completed: 25/05/21

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
% Stones >10mm _A	21.1	13.1	41.6	<0.1	3.5	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	7.96	8.49	6.55	-	7.79	-	-	pH	0.01	A-T-031s
pH BRE _D ^{M#}	-	8.49	6.55	7.45	-	8.16	8.07	pH	0.01	A-T-031s
Ammonium NH4 BRE (water sol 2:1) _D	-	<1.00	1.29	<1.00	-	<1.00	1.63	mg/l	1	A-T-033s
Chloride BRE, SO4 equiv. (water sol 2:1) _D ^{M#}	-	144	<7	10	-	12	<7	mg/l	7	A-T-026s
Nitrate BRE, SO4 equiv. (water sol 2:1) _D	-	63.8	2.3	1.4	-	0.8	<0.4	mg/l	0.4	A-T-026s
Sulphate (water sol 2:1) _D ^{M#}	0.58	0.55	<0.01	-	0.04	-	-	g/l	0.01	A-T-026s
Sulphate BRE (water sol 2:1) _D ^{M#}	-	548	<10	31	-	54	30	mg/l	10	A-T-026s
Sulphate BRE (acid sol) _D ^{M#}	-	0.45	0.03	<0.02	-	0.03	<0.02	% w/w	0.02	A-T-028s
Sulphur BRE (total) _D	-	0.52	0.02	0.02	-	0.02	0.01	% w/w	0.01	A-T-024s
Magnesium BRE (water sol 2:1) _D	-	7	<1	5	-	9	6	mg/l	1	A-T-SOLMETS
Cyanide (total) _A ^{M#}	<1	<1	<1	-	<1	-	-	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	-	<0.2	-	-	mg/kg	0.2	A-T-050s
Arsenic _D ^{M#}	101	204	7	-	21	-	-	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	0.9	1.7	0.5	-	1.4	-	-	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	86	143	32	-	75	-	-	mg/kg	1	A-T-024s
Chromium _D ^{M#}	25	79	11	-	146	-	-	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	-	-	-	-	-	mg/kg	1	A-T-040s
Lead _D ^{M#}	378	721	50	-	218	-	-	mg/kg	1	A-T-024s
Mercury _D	0.80	0.40	<0.17	-	4.66	-	-	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	17	31	10	-	43	-	-	mg/kg	1	A-T-024s
Selenium _D ^{M#}	2	2	<1	-	<1	-	-	mg/kg	1	A-T-024s
Zinc _D ^{M#}	133	64	47	-	115	-	-	mg/kg	5	A-T-024s
Leachate Prep BS EN 12457-1 (2:1) (2 no) _A	*	*	-	-	-	-	-			A-T-001
pH (leachable) _A [#]	7.48	7.52	-	-	-	-	-	pH	0.01	A-T-031w
Sulphate (leachable) _A [#]	3090	2320	-	-	-	-	-	mg/l	1	A-T-026w
Cyanide (total) (leachable) _A [#]	0.019	0.008	-	-	-	-	-	mg/l	0.005	A-T-042wTCN
Phenols (total by HPLC) (leachable) _A	<0.01	<0.01	-	-	-	-	-	mg/l	0.01	A-T-050w
Arsenic (leachable) _A [#]	480	1310	-	-	-	-	-	µg/l	1	A-T-025w
Cadmium (leachable) _A [#]	<5	<5	-	-	-	-	-	µg/l	1	A-T-025w
Copper (leachable) _A [#]	721	213	-	-	-	-	-	µg/l	1	A-T-025w
Chromium (leachable) _A [#]	65	61	-	-	-	-	-	µg/l	1	A-T-025w
Lead (leachable) _A [#]	445	146	-	-	-	-	-	µg/l	1	A-T-025w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
Mercury (leachable) _A [#]	<0.5	<0.5	-	-	-	-	-	µg/l	0.1	A-T-025w
Nickel (leachable) _A [#]	111	30	-	-	-	-	-	µg/l	1	A-T-025w
Selenium (leachable) _A [#]	109	239	-	-	-	-	-	µg/l	1	A-T-025w
Zinc (leachable) _A [#]	446	47	-	-	-	-	-	µg/l	1	A-T-025w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
Asbestos in Soil (inc. matrix) ^										
Asbestos in soil [#]	NAD	NAD	NAD	-	NAD	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	-	N/A	-	-			A-T-045

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
PAH-16MS										
Acenaphthene _A ^{M#}	0.09	<0.01	0.63	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.03	<0.01	<0.01	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.25	<0.02	0.90	-	<0.02	-	-	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.86	<0.04	1.24	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.73	<0.04	1.13	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.91	<0.05	1.30	-	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.26	<0.05	0.39	-	<0.05	-	-	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.34	<0.07	0.48	-	<0.07	-	-	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.91	<0.06	1.33	-	<0.06	-	-	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.06	<0.04	0.08	-	<0.04	-	-	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	2.10	<0.08	3.56	-	<0.08	-	-	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.12	<0.01	0.47	-	<0.01	-	-	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.30	<0.03	0.45	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.04	<0.03	0.29	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	1.51	<0.03	3.34	-	<0.03	-	-	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	1.70	<0.07	3.10	-	<0.07	-	-	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	10.2	<0.08	18.7	-	<0.08	-	-	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
PAH 16MS (leachable)										
Acenaphthene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Acenaphthylene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Anthracene (leachable) _A	0.09	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(a)anthracene (leachable) _A	0.04	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(a)pyrene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(b)fluoranthene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(ghi)perylene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Benzo(k)fluoranthene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Chrysene (leachable) _A	0.23	0.09	-	-	-	-	-	µg/l	0.02	A-T-019w
Dibenzo(ah)anthracene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Fluoranthene (leachable) _A	0.12	0.07	-	-	-	-	-	µg/l	0.02	A-T-019w
Fluorene (leachable) _A	0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Indeno(123-cd)pyrene (leachable) _A	<0.02	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Naphthalene (leachable) _A	0.06	<0.02	-	-	-	-	-	µg/l	0.02	A-T-019w
Phenanthrene (leachable) _A	0.12	0.06	-	-	-	-	-	µg/l	0.02	A-T-019w
Pyrene (leachable) _A	0.15	0.08	-	-	-	-	-	µg/l	0.02	A-T-019w
Total PAH 16MS (leachable) _A	0.83	0.30	-	-	-	-	-	µg/l	0.02	A-T-019w

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	2	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	2	2	-	-	-	-	-	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	71	53	-	-	-	-	-	mg/kg	1	A-T-055s
Total Aliphatics _A	75	55	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	2	1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C10-C12 _A	2	<1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C12-C16 _A	11	1	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	30	5	-	-	-	-	-	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	69	19	-	-	-	-	-	mg/kg	1	A-T-055s
Total Aromatics _A	114	26	-	-	-	-	-	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	189	82	-	-	-	-	-	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	-	-	-	-	-	mg/kg	0.01	A-T-022s

Envirolab Job Number: 21/05212

Client Project Name: Snell Street, Manchester

Client Project Ref: GSI 1450

Lab Sample ID	21/05212/1	21/05212/2	21/05212/4	21/05212/5	21/05212/7	21/05212/8	21/05212/9	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS01	WS01	WS02	WS02	WS03	WS03	WS04			
Depth to Top	0.50	1.00	0.25	0.90	0.70	1.50	0.85			
Depth To Bottom										
Date Sampled	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21	12-Apr-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4A	4AD	6AE	6A	6A	3A	3A			
TPH CWG (leachable)										
Ali >C5-C6 (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Ali >C6-C8 (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Ali >C8-C10 (leachable) _A	17	11	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C10-C12 (leachable) _A	<10	<10	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C12-C16 (leachable) _A	<10	<10	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C16-C21 (leachable) _A	51	11	-	-	-	-	-	µg/l	10	A-T-055w
Ali >C21-C35 (leachable) _A	732	364	-	-	-	-	-	µg/l	20	A-T-055w
Total Aliphatics (leachable) _A	800	386	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C5-C7 (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C7-C8 (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C8-C10 (leachable) _A	77	59	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C10-C12 (leachable) _A	16	11	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C12-C16 (leachable) _A	329	135	-	-	-	-	-	µg/l	10	A-T-055w
Aro >C16-C21 (leachable) _A	2090	788	-	-	-	-	-	µg/l	10	A-T-055w
Total Aromatics (leachable) _A	5640	2008	-	-	-	-	-	µg/l	20	A-T-055w
TPH (Ali & Aro >C5-C35) (leachable) _A	6440	2394	-	-	-	-	-	µg/l	20	A-T-055w
BTEX - Benzene (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - Toluene (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - Ethyl Benzene (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - o Xylene (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
BTEX - m & p Xylene (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
MTBE (leachable) _A	<1	<1	-	-	-	-	-	µg/l	1	A-T-022w
Aro >C21-C35 (leachable) _A	3128	1015	-	-	-	-	-	µg/l	20	A-T-055w

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

APPENDIX D
CHEMICAL SCREENING CRITERIA



GeoCon Site Investigations Ltd

GENERIC SCREENING CRITERIA

FOR

GENERIC QUANTITATIVE RISK ASSESSMENT

June 2018

Atkins ATRISK SSV's Screening Criteria - SOILS

June 2018

Compound	Residential WITH consumption of home-grown vegetables				Residential WITHOUT consumption of home-grown vegetables				Commercial				Allotments		Public Open Space - Residential				Public Open Space - Parks			
	1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND	
	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref
Metals																						
Antimony	141	J	222	J	473	J	473	J	4650	J	4650	J	58.3	J	749	J	749	J	3090	J	3090	J
Arsenic	37	J	37	J	39.9	J	39.9	J	635	J	635	J	49	J	79.1	J	79.1	J	168	J	168	J
Barium	56.8	J	110	J	1340	J	1340	J	22000	J	22000	J	18.1	J	2680	J	2680	J	5770	J	5770	J
Beryllium	1.71	J	1.71	J	1.72	J	1.72	J	14	J	14	J	17.8	J	2.19	J	2.19	J	2.19	J	2.19	J
Boron	290	B	290	B	11000	B	11000	B	240000	B	240000	B	45	B	21000	B	21000	B	46000	B	46000	B
Cadmium (pH 6, 7, 8)	22.1	J	22.1	J	149	J	149	J	410	J	410	J	3.9	J	219	J	219	J	882	J	882	J
Chromium III	910	B	14300	J	910	B	16700	J	8600	B	208000	J	12600	J	30600	J	30600	J	83500	J	83500	J
Chromium VI	6	B	3.63	J	6	B	3.62	J	33	B	19.7	J	73.9	J	4.62	J	4.62	J	132	J	132	J
Copper	4730	J	4790	J	9060	J	9060	J	106000	J	106000	J	1450	J	16400	J	16400	J	45200	J	45200	J
Lead	200	H	200	J	310	H	313	J	1100	H	2310	J	19.1	J	625	J	625	J	1340	J	1340	J
Mercury (elemental)	0.0863	J	1.44	J	0.0863	J	1.44	J	7.95	J	102	J	316	J	1020	J	2590	J	61.2	J	282	J
Mercury (Inorganic)	180	J	180	J	244	J	244	J	3600	J	3600	J	94.1	J	474	J	474	J	1110	J	1110	J
Mercury (methyl)	8.81	J	15.8	J	10	J	20.3	J	350	J	405	J	9.27	J	53.1	J	53.1	J	94.3	J	96.9	J
Molybdenum	95.2	J	97.4	J	673	J	673	J	17000	D	17600	J	17	J	1360	J	1360	J	2880	J	2880	J
Nickel	136	J	136	J	188	J	188	J	1770	J	1770	J	67.3	J	347	J	347	J	804	J	804	J
Selenium	375	J	375	J	595	J	595	J	13000	J	13000	J	143	J	1370	J	170	J	2550	J	2550	J
Vanadium	136	J	138	J	357	J	357	J	7490	J	7490	J	33.2	J	818	J	818	J	1550	J	1550	J
Zinc	20000	J	20300	J	47000	J	47000	J	730000	B	1100000	J	5230	J	93700	J	93700	J	201000	J	201000	J
Non-Metals																						
Free-Cyanide (Total)	34	J	34	J	34	J	34	J	373	J	373	J	34	J	34	J	34	J	34	J	34	J
Phenol and Chlorophenols																						
Phenol	267	J	1200	J	570	J	2330	J	685	J	3170	J	331	J	685	J	3170	J	685	J	3170	J
Chlorophenols	0.87	B	4.5	B	94	B	150	B	3500	B	4300	B	0.7	B	620	B	620	B	1100	B	1100	B
Pentachlorophenol	0.22	B	1.2	B	27	B	31	B	400	B	400	B	0.19	B	60	B	60	B	110	B	120	B
Poly Aromatic Hydrocarbons (PAH) (1.0% SOM)																						
Acenaphthene	608	J	2760	J	2680	J	6730	J	83600	J	83600	J	680	J	14700	J	14800	J	28600	J	30100	J
Acenaphthylene	170	B	920	B	2900	B	5000	B	83000	B	83000	B	160	B	15000	B	15000	B	29000	B	30000	B
Anthracene	10200	J	26200	J	34300	J	37700	J	535000	J	535000	J	11300	J	74100	J	74100	J	150000	J	152000	J
Benzo(a)anthracene	4.52	E	8.54	E	4.52	E	9.04	E	131	E	131	E	15.1	E	28.7	E	37.7	E	28.7	E	12.2	E
Benzo(a)pyrene	1.51	J	2.05	J	2.17	J	2.21	J	26.1	J	26.1	J	2.4	J	4.04	J	4.04	J	8.6	J	8.99	J
Benzo(b)fluoranthene	7.72	E	9.86	E	7.72	E	10.3	E	142	E	142	E	18.6	E	35.5	E	40.7	E	35.5	E	13	E
Benzo(ghi)perylene	96.2	E	103	E	96.2	E	104	E	1440	E	1440	E	342	E	451	E	490	E	451	E	154	E
Benzo(k)fluoranthene	84.4	E	100	E	84.4	E	104	E	1430	E	1430	E	227	E	381	E	430	E	381	E	137	E
Chrysene	585	E	927	E	585	E	1010	E	140010	E	140010	E	1170	E	3010	E	3570	E	3010	E	1160	E
Dibenzo(ah)anthracene	0.838	E	1	E	0.838	E	1.03	E	14.3	E	14.3	E	2.57	E	3.96	E	4.48	E	3.96	E	1.42	E
Fluoranthene	983	J	2980	J	4880	J	5050	J	72200	J	72200	J	1010	J	9870	J	9870	J	20200	J	20300	J

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Screening Criteria SOILS



GeoCon Site Investigations Ltd

GENERIC SCREENING CRITERIA

FOR

GENERIC QUANTITATIVE RISK ASSESSMENT

June 2018

Compound	Residential WITH consumption of home-grown vegetables				Residential WITHOUT consumption of home-grown vegetables				Commercial				Allotments		Public Open Space - Residential				Public Open Space - Parks			
	1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND		1 % SOM SAND		6 % SOM SAND	
	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref	mg/kg	Ref
RDX	120	B	540	B	13000	B	13000	B	210000	B	210000	B	85	B	26000	B	27000	B	49000	B	53000	B
Styrene	9.42	E	43	D	9.42	E	170	D	3300	D	11000	D	8.7	D	4220	E	4220	E	4220	E	1260	E
Tetrachloroethene	0.455	E	6.15	E	0.455	E	6.89	E	75.8	E	823	E	8.7	E	4340	E	4240	E	4340	E	1150	E
Total Cresols (2-, 3- and 4-methylphenol)	80	D	400	D	80	D	6900	D	160000	D	180000	D	63	D	-	-	-	-	-	-	-	-
Trans 1,2 Dichloroethene	0.0952	J	0.986	J	0.0965	J	1.01	J	9.51	J	76.1	J	4.8	J	3550	J	4030	J	918	J	2700	J
Tributyl tin oxide	0.28	J	1.52	J	2.16	J	8.2	J	119	J	199	J	0.271	J	30.1	J	30.3	J	46.2	J	54.8	J
Trichloroethene	0.00156	J	0.0201	J	0.00159	J	0.0209	J	0.149	J	1.49	J	0.076	J	33.1	J	36.5	J	11	J	32	J
Trichloro methane	0.91	B	3.4	B	1.2	B	4.2	B	99	B	350	B	1.7	B	2500	B	2500	B	2600	B	3100	B
Trichloromethyl benzene	0.000214	J	0.00222	J	0.000294	J	0.00434	J	0.025	J	0.247	J	0.00068	J	0.18	J	0.183	J	0.199	J	0.309	J
Vinyl chloride	0.000284	J	0.00138	J	0.000305	J	0.00152	J	0.0309	J	0.117	J	0.00217	J	3.45	J	3.5	J	3.68	J	5.36	J
Pesticides																						
Aldrin	5.7	B	7.1	B	7.3	B	7.5	B	170	B	170	B	9.6	B	18	B	18	B	30	B	31	B
Dieldrin	0.97	B	3.5	B	7	B	7.4	B	170	B	170	B	0.96	B	18	B	18	B	30	B	31	B
Atrazine	3.3	B	17.4	B	610	B	620	B	9300	B	9400	B	2.7	B	1200	B	1200	B	2300	B	2400	B
Dichlorvos	0.032	B	0.14	B	6.4	B	6.6	B	140	B	140	B	0.022	B	16	B	16	B	26	B	27	B
Alpha-Endosulfans	7.4	B	41	B	160	B	410	B	5600	B	8400	B	6.8	B	1200	B	1200	B	2400	B	2500	B
Beta-Endosulfans	7	B	39	B	190	B	440	B	6300	B	8700	B	6.4	B	1200	B	1200	B	2400	B	2500	B
Alpha-Hexachlorocyclohexane	0.23	B	1.2	B	6.9	B	11	B	170	B	180	B	0.21	B	24	B	24	B	47	B	48	B
Beta-Hexachlorocyclohexane	0.085	B	0.46	B	3.7	B	3.8	B	65	B	65	B	0.077	B	8.1	B	8.1	B	15	B	16	B
Gamma-Hexachlorocyclohexane	0.06	B	0.33	B	2.9	B	3.5	B	67	B	70	B	0.054	B	8.2	B	8.2	B	14	B	15	B
Polychlorinated Biphenols (PCB)																						
Sum of PCDDs, PCDFs and dioxin-like PCBs	0.008	A	-	-	0.008	A	-	-	0.24	A	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzenes																						
Chlorobenzene	0.46	B	2.4	B	0.46	B	2.4	B	56	B	290	B	32	B	11000	B	14000	B	1300	B	2900	B
1,2-Dichlorobenzene	23	B	130	B	24	B	130	B	2000	B	11000	B	540	B	90000	B	98000	B	24000	B	51000	B
1,3-Dichlorobenzene	0.4	B	2.3	B	0.44	B	2.5	B	30	B	170	B	1.5	B	300	B	300	B	390	B	470	B
1,4-Dichlorobenzene	61	B	350	B	61	B	350	B	4400	B	25000	B	88	B	17000	B	17000	B	36000	B	36000	B
Hexachlorobenzene	1.8	B	4.9	B	4.1	B	6.7	B	110	B	120	B	2.5	B	16	B	16	B	30	B	30	B
Pentachloro benzene	5.8	B	22	B	19	B	38	B	640	B	830	B	7	B	100	B	100	B	190	B	190	B
1,2,3-Trichlorobenzene	1.5	B	8.6	B	1.5	B	8.8	B	102	B	590	B	28	B	1800	B	1800	B	770	B	1600	B
1,2,4-Trichlorobenzene	2.6	B	15	B	2.6	B	15	B	220	B	1300	B	320	B	15000	B	19000	B	1700	B	4000	B
1,3,5-Trichlorobenzene	0.33	B	1.9	B	0.33	B	1.9	B	2.3	B	130	B	28	B	1700	B	1800	B	380	B	860	B
1,2,3,4-Tetrachlorobenzene	15	B	78	B	24	B	120	B	1700	B	4400	B	26	B	830	B	830	B	1500	B	1600	B
1,2,3,5-Tetrachlorobenzene	0.66	B	3.7	B	0.75	B	4.3	B	49	B	240	B	2.2	B	78	B	79	B	110	B	130	B
1,2,4,5-Tetrachlorobenzene	0.33	B	1.6	B	0.73	B	3.5	B	42	B	96	B	0.37	B	13	B	13	B	25	B	26	B

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Screening Criteria SOILS

Compound / Analyte	Source Reference	Residential WITH consumption of home-grown vegetables			Residential WITHOUT consumption of home-grown vegetables			Commercial			Allotments			Public Open Space - Residential			Public Open Space - Parks		
		1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Metals																			
Antimony	A	141	-	222	437	-	437	4650	-	4650	-	-	58.3	749	-	749	3090	-	3090
Arsenic	C	-	-	37	-	-	40	-	-	640	-	-	43	-	-	79	-	-	170
Barium	A	56.8	-	110	1340	-	1340	22000	-	22000	-	-	18.1	2680	-	2680	5770	-	63
Beryllium	C	-	-	1.7	-	-	1.7	-	-	12	-	-	35	-	-	2.2	-	-	532
Boron	C	-	-	290	-	-	11000	-	-	240000	-	-	45	-	-	21000	-	-	46000
Cadmium (pH 6, 7, 8)	C	-	-	11	-	-	85	-	-	190	-	-	1.9	-	-	120	-	-	532
Chromium III	C	-	-	910	-	-	910	-	-	8600	-	-	18000	-	-	1800	-	-	33000
Chromium VI	C	-	-	6	-	-	6	-	-	33	-	-	1.8	-	-	7.7	-	-	220
Copper	C	-	-	2400	-	-	7100	-	-	68000	-	-	520	-	-	12000	-	-	44000
Lead	B	-	-	210	-	-	330	-	-	6000	-	-	84	-	-	760	-	-	1400
Mercury (elemental)	C	-	-	1.2	-	-	1.2	-	-	58	-	-	21	-	-	16	-	-	30
Mercury (Inorganic)	C	-	-	40	-	-	56	-	-	1100	-	-	19	-	-	120	-	-	240
Mercury (methyl)	C	-	-	11	-	-	15	-	-	320	-	-	6	-	-	40	-	-	68
Molybdenum	A	95.2	-	97.4	-	-	673	-	-	17600	-	-	17	1360	-	1360	2880	-	2880
Nickel	C	-	-	180	-	-	180	-	-	980	-	-	230	-	-	230	-	-	3400
Selenium	C	-	-	250	-	-	430	-	-	12000	-	-	88	-	-	1100	-	-	1800
Vanadium	C	-	-	410	-	-	1200	-	-	9000	-	-	91	-	-	2000	-	-	5000
Zinc	C	-	-	3700	-	-	40000	-	-	730000	-	-	620	-	-	81000	-	-	170000
Non-Metals / Inorganics																			
Free-Cyanide (Total)	A	34			34			373			34			34			34		
Phenol and Chlorophenols																			
Phenol	C	280	550	1100	750	1300	2300	760	1500	3200	66	140	280	760	1500	3200	760	1500	3200
Chlorophenols	C	0.87	2	4.5	94	150	210	3500	4000	4300	0.13	0.3	0.7	620	620	620	1100	1100	1100
Pentachlorophenol	C	0.22	0.52	1.2	27	29	31	400	400	400	0.03	0.08	0.19	60	60	60	110	120	120
Poly Aromatic Hydrocarbons (PAH)																			
Acenaphthene	C	210	510	1100	3000	4700	6000	84000	97000	100000	34	85	200	15000	15000	15000	29000	30000	30000
Acenaphthylene	C	170	420	920	2900	4600	6000	83000	97000	100000	28	69	160	15000	15000	15000	29000	30000	30000
Anthracene	C	2400	5400	11000	31000	35000	37000	520000	540000	540000	380	950	2200	74000	74000	74000	150000	150000	150000
Benzo(a)anthracene	C	7.2	11	13	11	14	15	170	170	180	2.9	6.5	13	29	29	29	49	56	62
Benzo(a)pyrene	C	2.2	2.7	3	3.2	3.2	3.2	35	35	36	0.97	2	3.5	5.7	5.7	5.7	11	12	13
Benzo(b)fluoranthene	C	2.6	3.3	3.7	3.9	4	4	44	44	45	0.99	2.1	3.9	7.1	7.2	7.2	13	15	16
Benzo(ghi)perylene	C	320	340	350	360	360	360	3900	4000	4000	290	470	640	640	640	640	1400	1500	1600
Benzo(k)fluoranthene	C	77	93	100	110	110	110	1200	1200	1200	37	75	130	190	190	190	370	410	440
Chrysene	C	15	22	27	30	31	32	350	350	350	4.1	9.4	19	57	57	57	93	110	120
Dibenzo(ah)anthracene	C	0.24	0.28	0.3	0.31	0.32	0.32	3.5	3.6	3.6	0.14	0.27	0.43	0.57	0.57	0.57	1.1	1.3	1.4
Fluoranthene	C	280	560	890	1500	1600	1600	23000	23000	23000	52	130	290	3100	3100	3100	6300	6300	6400
Fluorene	C	170	400	860	2800	3800	4500	63000	68000	71000	27	67	160	9900	9900	9900	20000	20000	20000
Indeno(123-cd)pyrene	C	27	36	41	45	46	46	500	510	510	9.5	21	39	82	82	82	150	170	180
Naphthalene	C	2.3	5.6	13	2.3	5.6	13	190	460	1100	4.1	10	24	4900	4900	4900	1200	1900	3000
Phenanthrene	C	95	220	440	1300	1500	1500	2200	22000	23000	15	38	90	3100	3100	3100	6200	6200	6300
Pyrene	C	620	1200	2000	3700	3800	3800	54000	54000	54000	110	270	620	7400	7400	7400	15000	15000	15000
PAH (Total 16)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum Hydrocarbons (TPH CWG)																			
MTBE	A	27.6	-	220	33.3	-	318	3140	-	22400	-	-	108	73600	-	75000	70800	-	117000
Benzene	C	0.087	0.17	0.37	0.38	0.7	1.4	27	47	90	0.017	0.034	0.075	72	72	73	90	100	110
Toluene	C	130	290	660	880	1900	3900	56000	110000	180000	22	51	120	56000	56000	56000	87000	95000	100000
Ethylbenzene	C	47	110	260	83	190	440	5700	13000	27000	16	39	91	24000	24000	25000	17000	22000	27000
o-Xylene	C	60	140	330	88	210	480	6600	15000	33000	28	67	160	41000	42000	43000	17000	24000	33000
m-Xylene	C	59	140	320	82	190	450	6200	14000	31000	31	74	170	41000	42000	43000	17000	24000	32000
p-Xylene	C	56	130	310	79	180	430	5900	14000	30000	29	69	160	41000	42000	43000	17000	24000	31000
TPH Aliphatic EC5-6	C	42	78	160	42	78	160	3200	5900	12000	730	1700	3900	57000	59000	60000	95000	130000	180000
TPH Aliphatic EC6-8	C	100	230	530	100	230	530	7800	17000	40000	2300	5600	13000	60000	61000	62000	150000	220000	320000
TPH Aliphatic EC8-10	C	27	65	150	27	65	150	2000	4800	11000	320	770	1700	13000	13000	13000	14000	18000	21000
TPH Aliphatic EC10-12	C	130	330	760	130	330	770	9700	23000	47000	2200	4400	7300	13000	13000	13000	21000	23000	24000
TPH Aliphatic EC12-16	C	1100	2400	4300	1100	2400	4400	59000	82000	90000	11000	13000	13000	13000	13000	13000	25000	25000	26000
TPH Aliphatic EC16-35	C	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	260000	270000	270000	250000	250000	250000	450000	480000	490000
TPH Aliphatic EC35-44	C	65000	92000	110000	65000	92000	110000	1600000	1700000	1800000	260000	270000	270000	250000	250000	250000	450000	480000	490000
TPH Aromatic EC5-7	C	70	140	300	370	690	1400	26000	46000	86000	13	27	57	56000	56000	56000	76000	84000	92000
TPH Aromatic EC7-8	C	130	290	660	860	1800	3900	56000	110000	180000	22	51	120	56000	56000	56000	87000	95000	100000
TPH Aromatic EC8-10	C	34	83	190	47	110	270	3500	8100	17000	8.6	21	51	5000	5000	5000	7200	8500	9300
TPH Aromatic EC10-12	C	74	180	380	250	590	1200	16000	28000	34000	13	31	74	5000	5000	5000	9200	9700	10000
TPH Aromatic EC12-16	C	140	330	660	1800	2300	2500	36000	37000	38000	23	57	130	5100	5100	5000	10000	10000	10000
TPH Aromatic EC16-21	C	260	540	930	1900	1900	1900	28000	28000	28000	46	110	260	3800	3800	3800	7600	7700	7800
TPH Aromatic EC21-35	C	1100	1500	1700	1900	1900	1900	28000	28000	28000	370	820	1600	3800	3800	3800	7800	7800	7900



GeoCon Site Investigations Ltd
GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

January 2020

Compound / Analyte	Source Reference	Residential WITH consumption of home-grown vegetables			Residential WITHOUT consumption of home-grown vegetables			Commercial			Allotments			Public Open Space - Residential			Public Open Space - Parks		
		1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM	1 % SOM	2.5% SOM	6 % SOM
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH Aromatic EC>35-44	C	1100	1500	1700	1900	1900	1900	28000	28000	28000	370	820	1600	3800	3800	3800	7800	7800	7900
TPH Aliphatic + Aromatic EC>44-70	C	1600	1800	1900	1900	1900	1900	28000	28000	28000	1200	2100	3000	3800	3800	3800	7800	7800	7900



GeoCon Site Investigations Ltd

GENERIC SCREENING CRITERIA FOR GENERIC QUANTITATIVE RISK ASSESSMENT

June 2018

Atkins ATRISK SSV's Screening Criteria - WATERS

Compound	WSV's Residential		WSV's Commercial		DWS		EQS	
	mg/l	Ref	mg/l	Ref	µg/l	Ref	µg/l	Ref
Metals								
Antimony					5	F		
Arsenic					10	F	50	G
Barium								
Beryllium								
Boron					1000	F	2000	G
Cadmium (pH 6, 7, 8)					5	F	1.5	G
Chromium III					50	F	4.7	G
Chromium VI							3.4	G
Copper					2000	F	1	G
Lead					10	F	14	G
Mercury (elemental)	0.00463	J	0.428	J				
Mercury (Inorganic)								
Mercury (methyl)	45.5	J	5660	J	1	F	0.07	G
Molybdenum								
Nickel					20	F	34	G
Selenium					10	F		
Vanadium							100	G
Zinc					5000	F	20	G
Non-Metals								
Free-Cyanide (Total)					50	F	1	G
Phenol and Chlorophenols								
Phenol	1690	J	269000	J	0.5	F	7.7	G
Chlorophenols								
Pentachlorophenol							1	G
Poly Aromatic Hydrocarbons (PAH) (1.0% SOM)								
Acenaphthene	375	J	-	-				
Acenaphthylene								
Anthracene							0.1	G
Benzo(a)anthracene	0.0536	J	-	-				
Benzo(a)pyrene	0.0638	J	-	-	0.01	F	0.27	G
Benzo(b)fluoranthene					0.1	F	0.017	G
Benzo(ghi)perylene					0.1	F	0.00082	G
Benzo(k)fluoranthene					0.1	F	0.017	G
Chrysene								
Dibenzo(ah)anthracene	0.0237	J	-	-				
Fluoranthene							0.12	G
Fluorene								
Indeno(123-cd)pyrene					0.1	F		
Naphthalene	0.952	J	99.8	J			130	G
Phenanthrene								
Pyrene								
PAH (Total 16)					0.1	F		
Petroleum Hydrocarbons (TPH CWG)								
MTBE	352	J	33800	J				
Benzene	0.0888	J	8.46	J	1	F	50	G
Toluene	96.4	J	9090	J			74	G
Ethylbenzene	13.4	J	1250	J			200	G
o-Xylene	5	J	503	J			30	G
m-Xylene	4.1	J	413	J			30	G
p-Xylene	4.29	J	432	J			30	G
TPH Aliphatic EC5-6	1.9	J	198	J				
TPH Aliphatic EC6-8	1.4	J	144	J				
TPH Aliphatic EC8-10	0.0296	J	2.9	J				
TPH Aliphatic EC10-12	0.0228	J	2.23	J				
TPH Aliphatic EC12-16	0.00547	J	-	-				
TPH Aliphatic EC16-35								
TPH Aliphatic EC35-44								
TPH Aromatic EC5-7	0.0888	J	8.46	J				
TPH Aromatic EC7-8	96.4	J	9090	J				

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Screening Criteria WATERS

GENERIC SCREENING CRITERIA FOR GENERIC QUANTITATIVE RISK ASSESSMENT

Compound	WSV's Residential		WSV's Commercial		DWS		EQS	
	mg/l	Ref	mg/l	Ref	µg/l	Ref	µg/l	Ref
TPH Aromatic EC8-10	0.985	J	96.5	J				
TPH Aromatic EC10-12	3.87	J	380	J				
TPH Aromatic EC12-16	10.5	J	-	-				
TPH Aromatic EC16 – 21								
TPH Aromatic EC21-35								
VOC and SVOC								
1,1,1-Trichloroethane	13.1	J	1270	J			100	G
1,1,1,2-Tetrachloroethane	1.05	J	96.7	J				
1,1,2,2-Tetrachloroethane	6.89	J	650	J				
1,2-Dichloroethane	0.0373	J	3.54	J	3	F	10	G
1,1,2 Trichloroethane	2.23	J	208	J			400	G
1,1-Dichloroethane	11.4	J	1110	J				
1,1-Dichloroethene	0.683	J	65.6	J				
1,2,4-Trimethylbenzene	0.11	J	9.83	J				
1,2-Dichloropropane	0.0969	J	11.1	J				
2-Chloronaphthalene	0.695	J	62.7	J				
2-Methylphenol	11000	J	-	-				
2,4-Dichloro-o-cresol	1960	J	-	-				
2,4-Dimethylphenol	291	J	30900	J				
2,4-Dinitrotoluene	3250	J	-	-				
2,4,6-Trinitrotoluene								
2,6-Dinitrotoluene	921	J	-	-				
2,6-bis(1,1-dimethyl)-4-(1-methylpropyl)-phenol	13.2	J	-	-				
3-Methylphenol	17900	J	-	-				
4-Methylphenol	12000	J	-	-				
Biphenyl	64.4	J	-	-			25	G
Bis (2-ethylhexyl) phthalate								
Bromobenzene	0.941	J	87.7	J				
Bromodichloromethane	0.0725	J	6.82	J	100	F		
Bromoform	15.9	J	1770	J	100	F		
Butyl benzyl phthalate							51	G
Carbon disulphide								
Carbon tetrachloride	0.0229	J	3.31	J				
Chlorobenzene	13.7	J	1300	J				
Chloroethane	41.5	J	4180	J				
Chloroform / Trichloromethane	3.88	J	369	J	100	F		
Chloromethane	0.0531	J	5.5	J				
Cis 1,2 Dichloroethene	0.548	J	54.6	J				
DDD	7.18	J	-	-			0.025	G
Dibromochloromethane	0.394	J	38.7	J	100	F		
Dichloromethane	13.6	J	1500	J			20	G
Diethyl Phthalate	4340	J	-	-			1000	G
Di-n-butyl phthalate	230	J	-	-			40	G
Di-n-octyl phthalate								
Dinoseb	0.11	J	>52	J				
Formaldehyde	21.6	J	2360	J			50	G
Hexachlorobutadiene							0.6	G
Hexachloroethane	0.0388	J	>50	J				
HMX								
Isopropylbenzene	3.89	J	389	J				
Methyl tert-butyl ether	352	J	33800	J				
Nicotine	573	J	58900	J				
Prochloraz							40	G
Propylbenzene	12.3	J	1100	J				
RDX								
Styrene	38.6	J	3530	J			500	G
Tetrachloroethene	1.66	J	174	J	10	F	140	G
Total Cresols (2-, 3- and 4-methylphenol)								
Trans 1,2 Dichloroethene	0.676	J	65.7	J				
Tributyl tin oxide	0.423	J	54.5	J			0.0015	G
Trichloroethene	0.222	E	20.7	E	10	F		
Trichloromethane	3.88	E	369	E			2.5	G



GeoCon Site Investigations Ltd
GENERIC SCREENING CRITERIA
FOR
GENERIC QUANTITATIVE RISK ASSESSMENT

June 2018

Screening Criteria Reference Guide:

Soil GAC Source Reference	
A	UK (CLEA) Soil Guideline Value 2009
B	LQM/CIEH S4ULs for Human Health Risk Assessment Values 2015
C	UK (CLEA) Soil Guideline Value 2002
D	CL:AIRE GAC Values December 2009
E	AtRisk Soil Screening Values and Water Screening Values Produced by Atkins 2011
F	UK Drinking Water Standards (DWS)
G	Environment Agency, Environmental Quality Standards (EQS) 2015
H	Defra C4SL's 2014
I	NHBC Technical Extra 15 - 2014
J	Atkins AtRisk SSV's and WSV's Produced by Atkins 2017
Abbreviations	
SOM	Soil Organic Matter
N/P	No pathway - no risk is posed by this substance under the specific land-use scenario
MTBE	Methyl Tertiary Butyl Ether - a petroleum fuel additive which is a common groundwater contaminant

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References

APPENDIX E

RISK EVALUATION MATRIX

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008) sets out a methodology for the estimation of risk.

At Phase I the risk estimation will take the form of a qualitative risk assessment, which will be entirely based on the conceptual model for each potential end-use of the site. Comments on level of uncertainty will also need to be included for each source-pathway-target linkage to allow the confidence in the assessed risks to be understood. The results of the qualitative risk assessment will allow the risk evaluation to be concisely described in the following chapters.

The methodology for risk evaluation is a qualitative method for interpreting the output for the risk estimation stage of the assessment. It involves the classification of the:

The magnitude of probability (i.e. likelihood).

[takes into account both the presence of the hazard and receptor and the integrity of the pathway]

The magnitude of the potential consequence (i.e. severity).

[takes into account both the potential severity of the hazard and the sensitivity of the receptor]

Classification of Probability

Classification	Definition	Examples
High likelihood (Hi)	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor or harm or pollution.	<i>Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.</i> <i>Ground/groundwater contamination could be present from chemical works, containing a number of USTs, having been in operation on the same site for over 50 years</i>
Likely (Li)	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	<i>Elevated concentrations of toxic contaminants are present in soils at depths of 0.5-1.0m in a residential garden, or the top 0.5m in public open space.</i> <i>Ground/groundwater contamination could be present from an industrial site containing a UST present between 1970 and 1990. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.</i>
Low likelihood (Lw)	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	<i>Elevated concentrations of toxic contaminants are present in soils at depths >1m in a residential garden, or 0.5-1.0m in public open space.</i> <i>Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990s containing a UST in operation over the last 10 years – the tank is double skinned but there is no integrity testing or evidence of leakage.</i>
Unlikely (UI)	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.	<i>Elevated concentrations of toxic contaminants are present below hardstanding.</i> <i>Light industrial unit <10 yrs old containing a double skinned UST with annual integrity testing results available.</i>

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

Classification of Consequence

	Definition	Examples
Severe (Sv)	Highly elevated concentrations likely to result in “significant harm” to human health as defined by the EPA 1990, Part 2A, if exposure occurs. A Category 1: Human Health risk is present. Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long - term maintenance of the population. Catastrophic damage to crops, buildings or property.	<i>Significant harm to humans is defined in circular 01/2006 as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</i> <i>Major fish kill in surface water from large spillage of contaminants from site.</i> <i>Highly elevated concentrations of List 1 and substances present in groundwater close to small potable abstraction (high sensitivity).</i> <i>Explosion, causing building collapse (can also equate to immediate human health risk if buildings are occupied).</i>
Medium (Md)	Elevated concentrations which could result in “significant harm” to human health as defined by the EPA 1990, Part 2A if exposure occurs. A Category 2: Human Health risk is present. Equivalent to EA Category 2 pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	<i>Significant harm to humans is defined in circular 01/2006 as death, disease* serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</i> <i>Damage to building rendering it unsafe to occupy e.g. foundation damage resulting in instability.</i> <i>Ingress of contaminants through plastic potable water pipes.</i>
Mild (MI)	Exposure to human health unlikely to lead to “significant harm”. A Category 3 Human Health risk is present. Equivalent to EA Category 3 pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population Minor damage to crops, buildings or property.	<i>Exposure could lead to slight short - term effects (e.g. mild skin rash).</i> <i>Surface spalling of concrete.</i>
Minor (Mr)	No measurable effect on humans. A Category 4: Human Health risk is present. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	<i>The presence of contaminants at such concentrations that protective equipment is required during site works.</i> <i>The loss of plants in a landscaping scheme.</i> <i>Discolouration of concrete.</i>

* For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.

The classification of consequence does not take into account the probability of the consequence being realized. Therefore, there may be more than one consequence for a particular pollutant linkage. Both a severe and medium classification can result in death. Severe relates to short term (acute) risk while medium relates to long

Preliminary Risk Assessment Methodology (After NHBC Guidance for the Safe Development of Housing on Land Affected by Contamination (2008))

term (chronic) risk. Mild relates to significant harm but to less sensitive receptors. Minor classification relates to harm which is not significant but could have a financial cost.

The classification gives a guide as to the severity and consequence of identified risk when compared with other risk presented on the site. It should be noted that if a risk is identified it cannot be classified as “no risk” but as “very low risk”. Differing stakeholders may have a different view on the acceptability of a risk.

Risk Evaluation Matrix

		Consequence			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High likelihood (Hi)	Very high risk (VH)	High Risk (H)	Moderate Risk (M)	Mod/low risk (M/L)
	Likely (Li)	High risk (H)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)
	Low likelihood (Lw)	Moderate risk (M)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)
	Unlikely (UI)	Mod/low risk (M/L)	Low risk (L)	Very low risk (VL)	Very low risk (VL)

Risk Categorizations

Very high risk (VH)	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 to a designated receptor is currently happening. This risk, if realized, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk (H)	Harm is likely to arise to a designated receptor from an identified hazard. Realization of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate risk (M)	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 is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Low risk (L)	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realized, would at worst normally be mild.
Very low risk (VL)	There is a low possibility that harm could arise to a receptor. In the event of such harm being realized it is not likely to be severe.

Reference

Rudland, D J, Lancefield, R M, Mayell, P N; 2001; Contaminated land Risk Assessment. A guide to Good Practice; CIRIA Report C552.

The NHBC (National House-Building Council) the Environment Agency and the Chartered Institute of Environmental Health, 2008, Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66.

APPENDIX F
GEOTECHNICAL TESTING RESULTS



LABORATORY REPORT



4043

Contract Number: PSL21/3128

Report Date: 10 May 2021

Client's Reference: GSI 1450

Client Name: Geocon Site Investigations Ltd
Suite 2, Marple House
39 Stockport Road
Marple
Stockport
SK6 6BD

For the attention of: Ian Walker

Contract Title: Snell Street, Manchester

Date Received: 16/4/2021

Date Commenced: 16/4/2021

Date Completed: 10/5/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins
(Director)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

L Knight
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Snell Street, Manchester

Contract No:

PSL21/3128

Client Ref:**GSI 1450**

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL
Professional Soils Laboratory

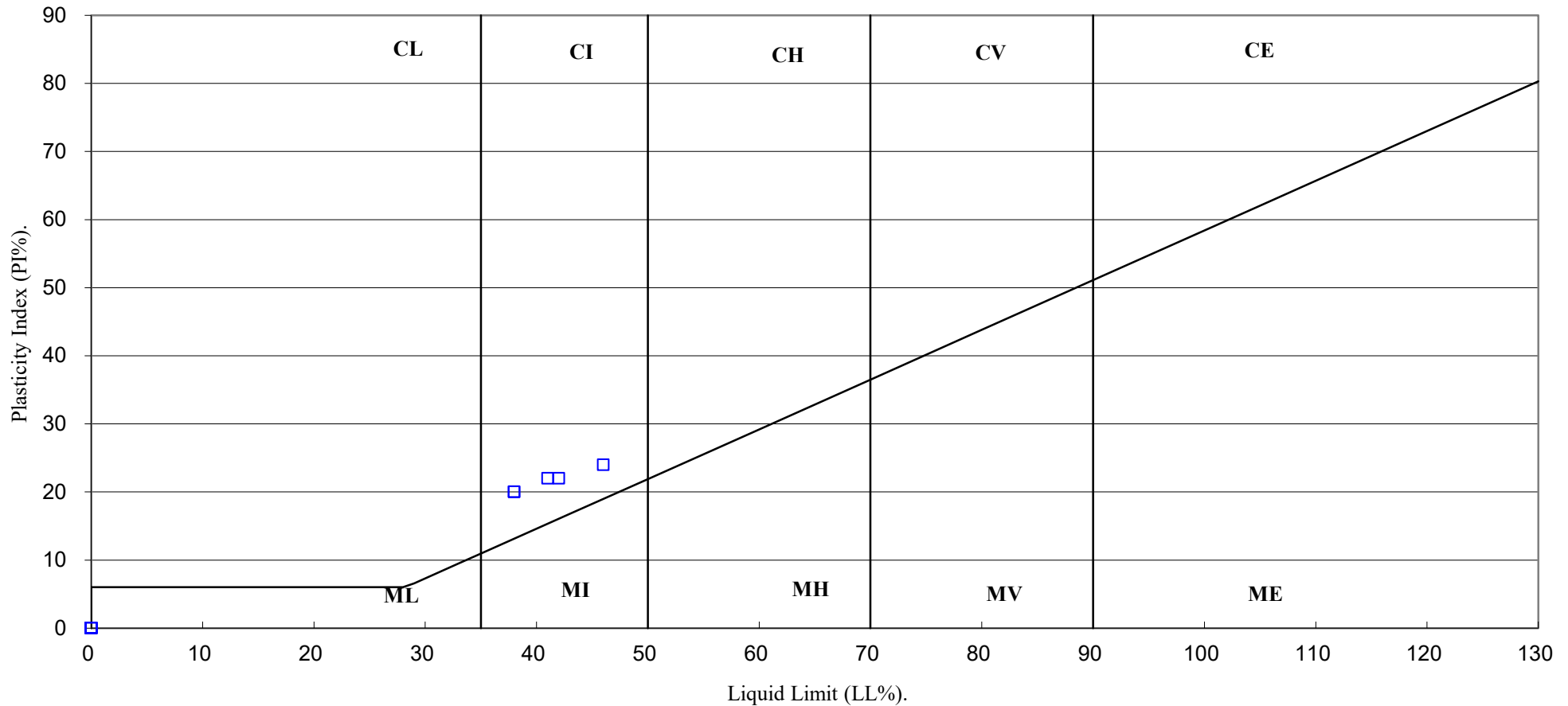
Snell Street, Manchester

Contract No:

PSL21/3128

Client Ref:**GSI 1450**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Snell Street, Manchester

Contract No:

PSL21/3128

Client Ref:

GSI 1450

APPENDIX G

**GAS AND GROUNDWATER
MONITORING RESULTS**

Gas Monitoring Results Sheet



Site: Snell Street, Manchester
 Project Number: GSI 1450
 National Grid Reference:
 Instrument: GA 2000 +

GeoCon Site Investigations Ltd

Monitoring Point Reference	Date	Atmospheric pressure (mb)	Flow Range (l/hr)	Methane (% v/v)		Carbon Dioxide (% v/v)		Oxygen (% v/v)		Methane Gas Screening Value (GSV) (l/hr)	Carbon Dioxide Gas Screening Value (GSV) (l/hr)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Standing Water Level (mbgl)	Well Depth (mbgl)
				Peak	Steady	Peak	Steady	Low	Steady						
WS01	30 April 2021	1010	0.1	0.1	0.1	0.8	0.8	20.6	20.6	0.0001	0.0008	1	1	Dry	2.04
	13 May 2021	1003	0.1	0.1	0.1	0.3	0.3	20.9	20.9	0.0001	0.0003	1	1	Dry	2.04
	24 May 2021	995	0.1	0.1	0.1	0.5	0.5	21.0	21.0	0.0001	0.0005	1	1	Dry	2.04
	10 June 2021	1011	0.1	0.1	0.1	0.5	0.5	20.4	20.4	0.0001	0.0005	1	1	Dry	2.04
	25 June 2021	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	05 July 2021	997	0.1	0.2	0.2	0.5	0.5	20.4	20.4	0.0002	0.0005	1	1	Dry	2.04
WS02	30 April 2021	1010	0.1	0.1	0.1	4.1	4.0	18.5	18.5	0.0001	0.0041	1	1	2.30	3.00
	13 May 2021	1003	0.1	0.1	0.1	2.4	2.4	18.2	18.2	0.0001	0.0024	1	1	1.18	3.00
	24 May 2021	995	0.1	0.1	0.1	3.6	3.6	18.0	18.0	0.0001	0.0036	1	1	2.20	3.00
	10 June 2021	1011	0.1	0.1	0.1	1.9	1.9	19.4	19.4	0.0001	0.0019	1	1	1.71	3.00
	25 June 2021	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	05 July 2021	997	0.1	0.2	0.2	1.1	1.1	19.8	19.8	0.0002	0.0011	1	1	1.92	2.83
WS03	30 April 2021	1010	0.1	0.1	0.1	0.5	0.4	20.5	20.5	0.0001	0.0005	1	1	1.10	3.00
	13 May 2021	1002	0.5	0.1	0.1	1.2	1.1	19.1	19.1	0.0005	0.0060	1	1	1.12	3.00
	24 May 2021	995	0.1	0.1	0.1	1.1	1.1	20.1	20.1	0.0001	0.0011	1	1	1.10	3.00
	10 June 2021	1009	0.1	0.1	0.1	0.9	0.9	19.2	19.2	0.0001	0.0009	1	1	1.22	3.00
	25 June 2021	1004	0.1	0.1	0.1	1.3	1.3	18.6	18.6	0.0001	0.0013	1	1	1.18	3.00
	05 July 2021	997	0.1	0.2	0.2	1.1	1.0	19.4	19.5	0.0002	0.0011	1	2	1.27	3.00
Maximum				0.2		4.1		18.0		0.0005	0.0060	1	2		

Additional Information:

Date	Weather	Air Temperature (°C)	Ground Conditions	Pressure Trend	Comments
30 April 2021	Fine	10.0	Dry	Steady	Wells Purged
13 May 2021	Overcast, raining	10.0	Wet	Rising	EWs collected from WS02 and WS03
24 May 2021	Overcast	11.0	Dry	Rising	-
10 June 2021	Sunny	19.0	Dry	Rising	-
25 June 2021	Overcast	15.0	Dry	Steady	Could not get access to WS01 and WS02.
05 July 2021	Sunny	16.0	Dry	Falling	-

* All monitoring point locations are monitored for a minimum of 60 seconds, and both the peak reading and the steady / rest readings are recorded

Below the detection limit of the gas analyser (0.1units)

* NR = No reading taken

* NR = No reading taken