

CCG-C-25-15828

**PHASE II GROUND INVESTIGATION FOR
SITE AT HALE VIEW ROAD, HUYTON**

LIVERPOOL, L36 6DD

NOVEMBER 2025



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1.0 INTRODUCTION

CC GEOTECHNICAL LIMITED (CCG) is providing consultancy services to **REVIVAL ARCHITECTURE LIMITED** (the *Client*) in connection with the proposed development of land located on Hale View Road, Huyton, L36 6DD.

It is understood that the site is to be developed for residential use by the construction of 2nr private houses, each constructed in traditional brick elevations under pitched roofs, each with front and rear private gardens.

The existing and proposed site configurations are as illustrated on **REVIVAL ARCHITECTURE LIMITED** architectural drawings contained within Appendix A.

The proposed development falls within the administrative jurisdiction of **KNOWSLEY METROPOLITAN BOROUGH COUNCIL**.

The development site was the subject to a Phase I Desk Study Report prepared by **SEP Technical** under report reference: **SEP-31371v1**, issued March 2022, which concluded that a Phase II intrusive investigation was required to provide environmental and geotechnical data relevant to the planning, design, and construction of the project.

This report documents the findings of the Phase II investigation. The report was devised to generally comply with the relevant principles and requirements of a wide range of guidance including BS5930: 2015 “Code of Practice for Site Investigations” and the Land Contamination Risk Management (LCRM) procedure published by the Environment Agency May 2024.

The findings of the investigation are discussed hereunder.

This report should be read in conjunction with the Notes on Limitations, given in Appendix I.

2.0 PURPOSE & AIMS OF THE STUDY & INVESTIGATION

The primary purpose of the Phase II intrusive investigation was to confirm the indications of the desk study with respect to:

- The collation of data based on gas, groundwater and soil contamination, insofar as they may adversely impact on human and/or environmental receptors.
- The collation of data on the geotechnical properties of the substrata, insofar as they would impact on the design and construction of the proposed development.

Ultimately, to provide environmental and geotechnical data relevant to the planning, design, and construction of the project.

3.0 SITE DATA

3.1 Site Location & Description

The study site was re-visited in October 2025. A summary of the walkover is discussed hereunder.

The site is located on the land at the junction of Hale View Road and Olivia Way, Huyton, L36 6DD as illustrated on **CCG** Drawing No. CCG-C-25-15828-1 and Aerial Plate No. CCG-C-25-15828-2 contained within Appendix A.

The **ORDNANCE SURVEY** co-ordinates for the approximate site centre are 345601E 390515N.

The site is situated within a mixed residential context along Hale View Road. It comprises an irregularly shaped parcel of land which extends to the approximate dimensions of c. 35m x 15m; its long axis being on an east–west alignment. The footprint of the site equates to around c. 525m². At the time of undertaking the walkover survey, the site was overgrown with dense vegetation.

The site is bound to the south and southeast by a development of residential properties fronting onto Hale View Road and West View, with associated private garden areas forming the immediate southern boundary. Its northern boundary adjoins existing industrial and storage premises fronting onto Ellis Ashton Street, while its remaining boundaries have an open aspect within a predominantly commercial setting.

The site is devoid of permanent structures.

The topography across the site was seen to be generally uneven, surface cover predominantly comprised dense unmanaged vegetation, creating a heavily overgrown appearance across much of the site, as well as the presence of numerous irregular mounds of soil and ground spoil deposits. No formal hardstanding or structures were observed within the main body of the site.

Given the overgrown nature of the site at the time of undertaking the site walkover survey, it was not possible to determine the presence and/or absence of metal manhole covers associated with buried services (*i.e. gas, water electricity etc.*).

Vehicle / pedestrian access to the site is via Hale view road.

3.2 Published Geology

The geology of the site was researched by reference to the BGS inline records.

3.2.1 Drift Geology

The **BGS** superficial drift mapping data indicates that the site is underlain by natural drift deposits comprising poorly stratified diamictons (*boulder clay*) comprising slightly sandy silt and clay deposits with localised sandstone boulders of glacial origin (*Pleistocene Epoch - Late Quaternary - Devensian Stage*).

3.2.2 Solid Geology

The documented solid geology comprises the Wilmslow Sandstone formation.

The nearest geological line of weakness (fault, inferred), trending on an approximate northeast – southwest alignment, lies 498m south of the study site.

3.3 Radon Protection

The freely available web-based UK Radon Interactive Map (www.ukradon.org) (accessed November 2025) shows the site to be situated within an area where it is believed that less than 1% of the properties within the local area are affected by Radon. Hence, Radon Protection Measures will not be required for new properties in contact with the ground.

3.4 Hydrology and Hydrogeology

Information on hydrology and hydrogeological features of the site may be summarised as follows:

Table 1: Summary of hydrology and hydrogeology

HYDROGEOLOGY AND HYDROLOGY		
Aquifer within Superficial Drift Deposits	On site c. 498m S	Diamictons: Secondary Undifferentiated: Assigned where it is not possible to attribute either category A or B to a rock type. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. Diamictons: Secondary Undifferentiated: Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
Aquifer within Bedrock Deposits	On site c. 498m S	Wilmslow Sandstone Formation: Principal aquifer capable of supporting water supply
Groundwater Abstraction Licences	<1000m	No records
Surface Water Abstraction Licences	<1000m	No records
Potable Water Abstraction Licences	<1000m	No records
Source Protection Zones	<500m	No records
Source Protection Zones (confined aquifer)	<500m	No records
Water Network (OS Mastermap)	<250m	No records
Surface water features	<250m	No records
WFD Surface water body catchments	On Site	On Site: River. Prescott Brook (Logwood Mill Brook)/ Operational catchment: Ditton – Mersey Lower
WFD Surface water bodies	<250m	C .322m E River Prescott Brook (Logwood Mill Brook). Overall rating: Poor. Chemical rating: Fail. Ecological rating Poor. (2019)
WFD Groundwater bodies	<250m	On site: Sankey and Glaze Carboniferous aquifers. Overall rating: Poor. Quantitative:

		Good.
FLOODING		
Risk of Flooding from Rivers and Sea (RoFRaS)	<50m	No records
Historical Flood Events	<250m	No records
Flood Defences	<250m	No records
Areas Benefitting from Flood Defences	<250m	No records
Flood Storage Areas	<250m	No records
Flood Zone 2	<50m	No records
Flood Zone 3	<50m	No records
Surface water flooding: Highest risk	On Site	Negligible
	<50m	1 in 30 year, 0.3m – 1.0m.
Groundwater flooding: Highest risk	On Site	Low
	<50m	Low

For simplified interpretation, the geological succession underlying the site may be regarded as a series of discrete units in terms of their hydrogeological significance, as illustrated hereunder:

Table 2: Hydrogeological Interpretation

UNIT	PROPERTIES	HYDROGEOLOGICAL DESIGNATION
Made / Reworked Ground	If present, likely to be generally granular and permeable and will permit vertical and lateral transmission of groundwater.	Unproductive Aquifer
Diamictons	Assigned where it is not possible to attribute either category A or B to a rock type. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type	Secondary Undifferentiated Aquifer
Wilmslow Sandstone Formation	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers	Principal Aquifers

4.0 PRELIMINARY QUALITATIVE RISK ASSESSMENT

4.1 Introduction

The following Preliminary Conceptual Model (PCM) was formulated using the information discussed above and based on the following assumptions:

- It is understood that the site is to be developed for residential use by the construction of 2nr private houses, each constructed in traditional brick elevations under pitched roofs, and each with front and rear private gardens.
- The existing and proposed site configurations are as illustrated on **REVIVAL ARCHITECTURE LIMITED** architectural drawings contained within Appendix A.
- Drinking water will be from a mains supply.

In constructing the Preliminary Conceptual Model (PCM), **CCG** applied the guidance contained in Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D: 2008 Volume 1 (*Environment Agency and CIEH*). This recommends use of a Risk Matrix which classifies risk based on the product of Probability of a source being present, and the Consequence of receptors being exposed to the source. Guidance tables setting out the classifications of probability and consequence together with a risk matrix are given in Tables 3-8 hereunder. In using this approach **CCG** recommends intrusive investigation of any Risk Classification of “*Moderate*” or above although a precautionary approach is recommended for residential housing developments, irrespective of the Risk Classification.

Table 3: Matrix of consequences against probability to gain a risk classification [CIRIA C552, 2001]

		CONSEQUENCE			
		SEVERE	MEDIUM	MILD	MINOR
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table 4: Classification of Consequence

Classification	Definition	Examples
Severe	Highly elevated concentrations likely to result in “significant harm” to human health as defined by the EPA 1990, Part 2A, if exposure occurs. 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.	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. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity). Explosion, causing building collapse (can also equate to immediate human health risk of buildings are occupied).
Medium	Elevated concentrations which could result in “significant harm” to human health as defined by the EPA 1990, Part 2A if exposure occurs. 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 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. Significant damage to crops, buildings or property.	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. Damage to buildings rendering it unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes.
Mild	Exposure to human health unlikely to lead to “significant harm”. Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality; marginal impact 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 endangers the long-term maintenance of the population. Minor damage to crops, buildings or property.	Exposure could lead to slight short-term effects (e.g. mild skin rash). Surface spalling of concrete.
Minor	No measurable effect on humans. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 5: Classification of Probability Definitions (C552 CIRIA, 2001)

Classification	Definition	Examples
High Likelihood	There is potential contaminant linkage, and an event would appear very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.	a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden. b) Ground/groundwater contamination could be present from chemical works, containing a number of UST's, having been in operation on the same site for over 50 years.
Likely	There is potential contaminant 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.	a) 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 a public open space. b) 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.
Low	There is potential contaminant linkage and circumstances are possible under which an event could occur. However,	a) Elevated concentrations of toxic contaminants are present in soils at depths of >1m in a residential garden

Likelihood	it is by no means certain that even over a long period such an event would take place and is less likely in the shorter term.	<i>or 0.5-1.0m in a public open space.</i> b) <i>Ground/groundwater contamination could be present on a light industrial unit constructed in the 1990's containing a UST in operation over the last 10 years. The tank is known to be single skin. There is no evidence of leakage although there are no records of integrity tests.</i>
Unlikely	There is potential contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.	a) <i>Elevated concentrations of toxic contaminants are present below hardstanding.</i> b) <i>Light industrial units <10 yrs old containing a double-skinned UST with annual integrity testing results available.</i>

Table 6: Description of the Classified Risks

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

4.2 Preliminary Conceptual Model

By application of the risk assessment methodology outlined above, the following PCM was constructed.

Table 7: Preliminary Conceptual Model (PCM)

POLLUTANT LINKAGE	SOURCE	PATHWAY	RECEPTOR	PROBABILITY	CONSEQUENCE	RISK RATING
1	Broad spectrum of heavy metals, aggressive pH, hydrocarbons, PAH's in Made Ground associated with the development of the adjoining area etc.	Soil and / or soil dust ingestion Leaching through Unsaturated zone	Construction workers Future occupants (adults & children) Offsite receptors & Principal Aquifer Water supply pipes	Likely	Medium	Moderate
2	Asbestos containing materials (ACM) in made ground soils associated with the development of the adjoining area etc.	Fibre Inhalation	Construction workers Future occupants (adults & children) Offsite receptors	Unlikely	Severe (ACM)	Moderate / Low
3	Inhalation of vapours associated with potential made ground deposits, etc.	Inhalation	Future occupants (adults & children)	Unlikely	Medium	Low
4	Inhalation of ground gases from onsite or offsite sources i.e., made ground deposits associated with the infilling of nearby historical ponds etc.	Inhalation	Future occupants (adults & children)	Unlikely	Medium	Low
5	pH & Sulphate attack on concrete	Future building	Future building	Likely	Mild	Moderate / Low
6	Organic contamination associated with onsite car parking facilities etc.	Direct contact with water mains Leaching through Unsaturated zone	Future occupants (adults & children) Offsite receptors & Principal Aquifer Water supply pipes	Unlikely	Medium	Low

The contaminants of concern associated with those risks which require intrusive investigation were researched by reference to published industry profiles, and are summarised on Table 8 hereunder:

Table 8: Summary of Contaminants of Concern based on PCM

LINKAGE NO.	METALS	NON-METALS	ORGANICS	GASES	OTHERS
PL1, PL2, PL4, PL5	Cd, Cr (total & hexavalent), Ni, Cu, Zn, Pb, Hg, Se, Mo, Sb	As, sulphates, sulphides, boron, free cyanide	TPHCWG, PAH's, BTEX, Volatiles (by PID), SOM	-	pH Asbestos
PL3	-	-	-	CH ₄ , CO ₂ , CO, H ₂ S	-
PL1-PL5	Cd, Cr, Ni, Cu, Pb, Hg, Se, Zn	As, sulphates	TPHCWG, PAH's, BTEX, Volatiles (by PID), SOM,	CH ₄ , CO ₂ , CO, H ₂ S	pH Asbestos

4.3 Summary of Risks

The foregoing analysis identified several potential risks, and if present, these could adversely impact on human or environmental receptors. Since no previous site investigation has been undertaken, an intrusive phase of investigation was undertaken to determine whether the postulated pollutant linkages are present on site.

5.0 SCOPE OF PHASE II INTRUSIVE INVESTIGATION

Based on the findings of the Phase I desk study and taking account of the potential presence of pollution linkages, an intrusive investigation was undertaken. The Phase II Intrusive Investigation provided for exploratory boreholes to be excavated through made ground into the underlying natural strata to allow for sampling of soils and groundwater if present.

The primary objectives of the investigation were to obtain enough soil and groundwater contamination data to reliably assess risks to human and environmental receptors, and to provide engineering parameters on which suitable foundation solutions could be selected.

6.0 FIELDWORK

6.1 Introduction

A programme of fieldwork investigation was undertaken in October 2025. The programme comprised the following elements:

- The CAT scanning of all exploratory sampling positions using a cable avoidance detector for the presence of buried electrical services prior to the commencement of fieldworks
- The manual excavation of 4nr borehole service avoidance pits extending from ground level (GL) -1.2mbgl
- The sinking of 4nr boreholes (WS1-WS4) following dynamic sampling methods to depths ranging from 4.0-4.5mbgl.
- The installation of 50mm HDPE standpipes within 3/4nr boreholes
- The subsampling of borehole arisings for geotechnical classification testing
- The manual excavation of 6nr sampling locations (P1-P6) for contamination analyses
- The undertaking of 2nr Soil Infiltration Tests (Soakaways) in accordance with BRE Digest 365.
- The reinstatement of all exploratory positions to existing site levels
- The instigation of a gas – groundwater monitoring programme comprising 6nr rounds distributed over a 3-month period

The fieldwork was planned in accordance with BS10175: 2011 and carried out in accordance with BS10175: 2011 and BS5930: 2015.

The layout of the investigation is as annotated on **CCG** Drawing No's. **CCG-C-25-15655-3** 'Investigation Layout Plan' contained within Appendix A.

6.2 Borehole Drilling & Monitoring Installations

6.2.1 Dynamic Sampling Boreholes

A total of 4nr boreholes were sunk following dynamic sampling drilling methods to depths ranging 4.0-4.5mbgl. Each borehole was positioned clear of known buried / overhead services and were scanned using a CAT service detector prior to and during the manual excavation of a service clearance pit to a depth of 1.2mbgl. Regular Bulk samples (B) and Environmental Samples (ES) were

recovered throughout service clearance pits where possible. Drilling tools and equipment were de-contaminated prior to commencement at each location and appropriate Personal Protective Equipment (PPE) regulations were followed.

In this method of investigation, samples of subsoils are recovered by driving and extracting a 1m steel tube. This method of sampling recovers relatively 'undisturbed' soil profiles in Perspex tubes, which are used to line the steel tubes. Standard Penetration Tests (SPT) were undertaken at 1m depth increments in the borehole. The recovered samples were returned to the CCG laboratory for splitting and logging.

The logs of the boreholes, annotated with sampling and standpipe installation details, *in-situ* SPT 'N' and in-lab' HSV ' $Cu(kN/m^2)$ ' values are presented within Appendix B.

6.2.2 Monitoring Installations

Standpipes comprising 50mm diameter HDPE plain and slotted well-tube set in bentonite and non-limestone pea gravel surround, installed at 3nr borehole positions. Each standpipe was fitted with a gas valve connector and was protected by a flush cover set in concrete. Details of standpipe installations are provided on the relevant borehole logs in Appendix B and summarised in the tabulation hereunder:

Table 9: Borehole Installation Details

BOREHOLE	DEPTH OF BOREHOLE (mbgl)	DEPTH OF STANDPIPE [mbgl]	RESPONSE ZONE	
			FROM [mbgl]	TO [mbgl]
WS1	4.40m	4.0m	0.5m	4.0m
WS2	4.5m	4.0m	0.5m	4.0m
WS4	4.0m	4.0m	1.0m	4.0m

The standpipe installations were periodically monitored for flow rate and composition of ground gas using a Geotechnical Instruments GA infra-red analyser. The installations were also monitored for standing water levels with an electronic dip meter.

6.2.3 Soil Infiltration Testing (soakaways)

Soil infiltration testing (2nr) was undertaken in accordance with BRE Digest 365. Each soakaway location (SA1 and SA2) was charged with water, and the rate of fall was monitored at regular time intervals. The soil infiltration rates observed over 2nr cycles were 7.26×10^{-6} at SA1 and 6.98×10^{-6} at SA2. These results indicate that the ground conditions are unsuitable for adoption of soakaway drainage. The logs of the soakaways are provided within Appendix C.

7.0 OBSERVED GROUND CONDITIONS

The stratigraphy of the boreholes was generally consistent with the documented geology. The successions may be generalised as tabulated hereunder:

Table 10: Observed Stratigraphy

Location	STRATIGRAPHY
WS1	MADE GROUND comprising of dark brown very gravelly slightly silty sand, gravel is fine to medium with angular to subangular concrete, brick, limestone and sandstone extending to 1.1mbgl overlying firm brown slightly sandy slightly gravelly silty clay, gravel is fine to medium with subangular to subrounded sandstone and mudstone extending to 2.7mbgl, overlying dark brown sandy silty gravel with a high fine to coarse, angular to subangular sandstone cobble content extending to 3.2mbgl, overlying brown slightly sandy slightly gravelly silty clay, gravel is fine to medium with subangular to sub rounded sandstone and mudstone extending to 3.7mbgl, overlying greyish brown very clayey slightly sandy gravel, gravel is fine to coarse, subrounded mudstone extending to 4mbgl, overlying grey weathered mudstone locally recovered as slightly silty slightly clayey gravel proven to 4.4mbgl
WS2	MADE GROUND comprising brownish grey very sandy slightly silty fine to coarse subangular gravelly deposits of sandstone, brick and concrete, extending to 0.2mbgl, overlying MADE GROUND comprising of dark brown very gravelly silty sand with occasional pockets of clay. Gravel is fine to coarse, angular to sub-angular brick, coal, and cinder fragments and occasional clay pockets, extending to 1.8mbgl, overlying firm brown slightly sandy slightly gravelly silty clay, gravel is fine to medium with subangular to subrounded sandstone and mudstone extending to 3.5mbgl, overlying greyish brown very clayey slightly sandy gravel, gravel is fine to coarse with rounded mudstone extending to 4mbgl, overlying grey weathered mudstone locally recovered as slightly silty slightly clayey gravel, extending to 4.5mbgl
WS3	MADE GROUND comprising of Brown very sandy slightly silty fine to medium gravel with angular to sub-angular concrete and limestone fragments extending to 0.5mbgl, overlying firm brown slightly sandy slightly gravelly silty clay. Gravel is fine to medium subangular sandstone. Extending to 1.2mbgl, overlying loose reddish brown sandy slightly silty fine to coarse gravel with a high cobble content. Gravel and cobbles are angular to subangular sandstone, extending to 2.05mbgl. overlying firm to stiff brown slightly sandy slightly gravelly silty clay. Gravel is fine to medium subangular to subrounded sandstone and mudstone, extending to 3.8mbgl,

	overlying grey weathered mudstone recovered locally as slightly silty slightly clayey gravel, extending to 4.0mbgl
WS4	MADE GROUND comprising of grey very sandy slightly silty fine to coarse gravel. Gravel is angular to subangular limestone, cinders and concrete, extending to 0.7mbgl overlying medium dense reddish brown very sandy slightly silty fine to coarse gravel with a high cobble content. Gravel and cobbles are angular to subangular sandstone, extending to 1.6mbgl overlying soft grey sandy slightly gravelly silty clay. Gravel is fine to medium subangular to subrounded sandstone and mudstone extending to 2.6mbgl, overlying firm brown slightly sandy slightly gravelly silty clay. Gravel is fine to medium subangular to subrounded sandstone and mudstone, extending to 3.8mbgl, overlying grey weathered mudstone, recovered locally as slightly silty slightly clayey gravel, extending to 4.0mbgl.
SA1	MADE GROUND comprising dark brown silty gravelly fine to coarse sand with angular to subangular brick, ash, coal and concrete, extending to 1.1mbgl, overlying MADE GROUND comprising of reddish brown sandy slightly gravelly silty clay. Gravel is fine to medium angular brick, concrete and slate, extending to 1.5mbgl, overlying reddish brown slightly sandy slightly gravelly silty clay, extending to 2.1mbgl.
SA2	MADE GROUND comprising of dark brown silty very gravelly fine to coarse sand. Gravel is fine to coarse angular to subangular brick, concrete, ash and coal, extending to 0.3mbgl, overlying MADE GROUND comprising of sandstone fill, extending to 1.2mbgl, overlying reddish brown gravelly, very clayey fine to coarse sand. Gravel is fine to coarse angular sandstone, extending to 1.7mbgl, overlying brown sandy slightly gravelly silty clay, extending to 2.1mbgl

There was no visual evidence of contamination affecting the made ground mass and/or natural drift deposits at any exploratory position.

7.1 Groundwater Regime

Water was encountered within all borehole locations (WS1 to WS4). At WS1, water was struck at 3.0mbgl, rising to 1.5mbgl. At WS2, water was struck at 2.7mbgl, rising to 1.5mbgl. At WS3, water was struck at 2.7m and remained static. At WS4 water was struck at 2.5mbgl and remained static.

8.0 LABORATORY TESTING

8.1 Soil Classification Testing

The following programme of soil geotechnical testing was undertaken at the **UKAS** laboratory of **CCG**.

- Determination of soil moisture content in accordance with BS: 1377: Part 2: 1990 (5nr)
- Determination of Atterberg Limits in accordance with BS: 1377: Part 2: 1990 (5nr)
- Particle Size Distribution BS 1377-2:1990 (a) (3nr)

The soil engineering test results are presented in Appendix D.

8.2 Contamination Analyses

A programme of soil chemical analyses was undertaken at a **UKAS / MCERTS** accredited laboratory:

- 6nr subsamples of soils were analysed to a broad range of contaminants including metals, non-metals, speciated PAH's, speciated TPH's and MTBE/BTEX
- 1nr extracted water sample was analysed to a broad range of contaminants including metals, non-metals, speciated PAH's, speciated TPH's and MTBE/BTEX

The soil contamination test results and certificates are presented in Appendix E.

9.0 RISK ASSESSMENT FOR THE PROTECTION OF HUMAN HEALTH

9.1 Generic Quantitative Risk Assessment (Tier 2 / GQRA)

An assessment of the soil analysis data was carried out in accordance with the guidance presented in CLR11 and in accordance with current guidance and legislation.

The Human Health Risk Assessment was carried out in accordance with the **CCG** methodology for assessing soil contamination data as contained in Appendix F, and since it is proposed that the site be developed for '*Residential*' land use with associated front and rear private gardens, the assessment was based on criteria contained in publication LQM/CIEH S4UL's for Human Health Risk Assessment (2015) (**CCG** licence S4UL3233), applicable to '*Residential Land*' scenario With plant uptake. This document does not provide criteria for Lead, for which the results were compared to the C4SL published by DEFRA SP1010 Development of Category 4 Screening Levels.

9.2 Assessment of Contamination Data

Based on a Soil Organic Matter content of 2.5%, the assessment of the soil data is summarised in the tabulations hereunder.

9.2.1 Assessment of Metal Data

The assessment of the metal data is presented hereunder:

Table 11: Assessment of Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Cadmium	11	0.4	-	-
Chromium (Hexavalent)	910	24	-	-
Chromium (aqua regia extractable)	6.0	< 1.8	-	-
Copper	2400	130	-	-
Lead	200	160	-	-
Mercury	1.2	0.5	-	-
Nickel	180	43	-	-
Zinc	3700	140	-	-

The above assessment confirms that no soil contaminant exceeds its respective soil guideline criteria and therefore no risk to human health is indicated.

9.2.2 Assessment of Non-Metal Data

The assessment of the non-metal data is presented hereunder:

Table 12: Assessment of Non-Metal Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Arsenic	37	20	-	-
Boron	290	2.2	-	-
Selenium	250	1.4	-	-
Cyanide (free)	22	< 1.0	-	-

The above assessment confirms that no soil contaminant exceeds its respective soil guideline criteria and therefore no risk to human health is indicated.

9.2.3 Assessment of Polycyclic Aromatic Hydrocarbon [PAH's] Data

The assessment of the Polycyclic Aromatic Hydrocarbon (PAH's) data is presented hereunder:

Table 13: Assessment of PAH Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Naphthalene	5.6	0.38	-	-
Acenaphthylene	420	< 0.05	-	-
Acenaphthene	510	0.16	-	-
Fluorene	400	0.16	-	-
Phenanthrene	220	2	-	-
Anthracene	5400	0.41	-	-
Fluoranthene	560	2.4	-	-
Pyrene	1200	2.2	-	-
Benz(a)anthracene	11	1.1	-	-
Chrysene	22	1.2	-	-
Benzo(b)fluoranthene	3.3	1.3	-	-
Benzo(k)fluoranthene	93	0.59	-	-
Benzo(a)pyrene	2.7	1.1	-	-
Indeno(123-cd)pyrene	36	0.52	-	-
Dibenzo(ah)anthracene	0.28	0.11	-	-
Benzo(ghi)perylene	340	0.65	-	-

The above assessment confirms that no soil contaminant exceeds its respective soil guideline criteria and therefore no risk to human health is indicated.

9.2.4 Assessment of Total Petroleum Hydrocarbon [TPH's] Data

The assessment of TPH data is presented hereunder:

Table 14: Assessment of Hydrocarbon Data

Contaminant	LQM / CIEH S4UL (mg/kg)	Maximum (mg/kg)	Exceedances	
			(mg/kg)	Location
Aromatic EC5-EC7	140	0.031	-	-
Aromatic EC7-EC8	290	< 0.010	-	-
Aromatic EC8-EC10	83	< 0.020	-	-
Aromatic EC10-EC12	180	< 1.0	-	-
Aromatic EC12-EC16	330	5.2	-	-
Aromatic EC16-EC21	540	12	-	-
Aromatic EC21-EC35	1500	49	-	-
Aliphatic EC5-EC6	78	< 0.010	-	-
Aliphatic EC6-EC8	230	< 0.010	-	-
Aliphatic EC8-EC10	65	< 0.010	-	-
Aliphatic EC10-EC12	330	< 1.0	-	-
Aliphatic EC12-EC16	2400	5.8	-	-
Aliphatic EC16-EC35	92000	46	-	-
Aliphatic EC35-EC44	92000	< 10.0	-	-

The above assessment confirms that no soil contaminant exceeds its respective soil guideline criteria and therefore no risk to human health is indicated.

9.2.5 Assessment of BTEX / MTBE Data

All BTEX / MTBE compounds were reported to be below their limit of detection and therefore no risk to human health is indicated.

9.2.6 Assessment of Asbestos Data

No asbestos containing materials (ACM's) were identified in the soils recovered from the site. Hence no potential risk to human health is indicated.

9.2.7 Summary of Human Health Risk Assessment

The above human health risk assessment identified no exceedances against their respective soil guideline criteria for 'Residential' with plant uptake land use. Based on these findings, there is no potential risk to end users (future residents) and construction workers.

Notwithstanding the above, contractors must remain aware that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including *inter alia* humans, animals, controlled waters, or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon **CCG** to site to determine the nature of the exposure and to determine an appropriate course of action. Any such incidents will be fully documented in a detailed site Remediation Report.

10.0 ASSESSMENT OF RISKS TO THE BUILT ENVIRONMENT

10.1 SPECIFICATION OF BURIED CONCRETE

The data obtained in the investigations was assessed against the guidance given in BRE Special Digest 1: 2005, as summarised hereunder:

Table 15: Design Chemical Class Based on Soil Data

CONCRETE SPECIFICATION DATA SHEET		
Is the site Brownfield or Greenfield?	Brownfield	
Is the water table static or mobile?	Mobile	
Highest water-soluble Sulphate results	290mg/l	Design Sulphate Class of DS-1 Class of AC-1
Lowest pH result	7.9	
Intended Working Life	100 years	Adopt Design Chemical Classification of DC-1

Table 16: Design Chemical Class Based on water Data

CONCRETE SPECIFICATION DATA SHEET	
Is the site Brownfield or Greenfield?	Brownfield

Is the water table static or mobile?	Mobile	
Highest water-soluble Sulphate results	77.1mg/l	Design Sulphate Class of
Lowest pH result	6.9	DS-1 Class of AC-1
Intended Working Life	100 years	Adopt Design Chemical Classification of DC-1

Based on the foregoing assessment, concrete in the ground should be specified to conform to the compositional requirements of Design Chemical Class DC-1, as defined in BRE Special Digest 1: 2005.

10.2 ASSESSMENT OF RISK FROM GROUND GASES

Standpipes were constructed such that response zones were within permeable strata. Using the data gathered in the monitoring programme, a gas risk assessment was undertaken following **CCG** methodologies. The ground gas risk assessment methodology conforms to current UK guidance on the assessment of risks posed by ground gases.

The potential sources of gas identified in the desk study were generally considered as sources of *Low* generation potential, and high sensitivity, resulting in a programme of monitoring comprising of 6nr rounds distributed over a 3-month period.

A gas risk assessment was undertaken in accordance with current UK guidelines set out in CIRIA C665 2007 “*Assessing Risk Posed by Hazardous Gases to Buildings*”. The CIRIA risk assessment methodology uses typical maximum soil gas concentrations and worse case borehole flow rates to define a “*Characteristic Situation*” for the shallow gas regime.

The volumetric gas flow rate used by the risk assessment is termed “*Gas Screening Value (GSV)*” in the guidance and is defined below.

Where: *GSV (litres/hr) = borehole flow rate (litres/hr) x gas concentration.*

There are also two stages to the assessment method proposed in CIRIA C665; compliance with a GSV Threshold Value and secondly, compliance with additional factors such as maximum permissible gas concentration. A summary of the gas monitoring data is presented hereunder and presented in Appendix G.

Table 17: Summary of Gas Monitoring Data

Position No Monitoring Visits	WS1 1	WS2 1	WS4 1
Highest CH ₄ (%)	Nil	Nil	Nil
Highest CO ₂ (%)	2.6	0.8	0.4
Lowest O ₂ (%)	9.4	19.0	20.3
Highest H ₂ S (ppm)	Nil	Nil	Nil
Highest CO (ppm)	Nil	Nil	Nil
Highest Flow (l/hr)	<0.1	<0.1	<0.1
Water Levels (m)	2.08	1.74	1.92
Highest PID response	0.0	0.0	0.0
Pressure Range (mb)	999		

After 1 round of monitoring, a preliminary Gas Screening Value (GSV) of 0.0026l/hrs is calculated for CO₂. CH₄ has not been detected thus far during the monitoring programme. Using this preliminary GSV value, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation (CS) 1.

It should be noted that the Characteristic Situation classification is to be confirmed following completion of the monitoring programme (5nr rounds remain), and the completed monitoring programme will be reported in an Addendum to this report.

Results thus far from the monitoring regime are provided in Appendix G.

11.0 CONTROLLED WATERS RISK ASSESSMENT

11.1 Assessment of Groundwater Analysis Metals, Non-Metals & Polycyclic Aromatic Hydrocarbon (PAH) Data

Groundwater Analysis was prepared on a water recovered from WS4. The sample was analysed for a broad range of contaminants including speciated PAH and TPH concentrations. The results were assessed against Environmental Quality Standards (AA-EQS) for freshwater as shown hereunder.

Table 18: Assessment Groundwater Analysis of Data

Contaminant	TP01 Result (ug/l)	AA-EQS (ug/l)
Naphthalene	< 0.01	2.4
Acenaphthylene	< 0.01	-
Fluorene	< 0.01	-
Phenanthrene	< 0.01	-
Anthracene	< 0.01	-
Fluoranthene	< 0.01	0.1
Pyrene	< 0.01	-
Benzo[a]anthracene	< 0.01	0.05
Chrysene	< 0.01	-
Benzo[b]fluoranthene	< 0.01	0.03
Benzo[k]fluoranthene	< 0.01	0.03
Benzo[a]pyrene	< 0.01	0.05
Indeno(123-cd)pyrene	< 0.01	0.02
Benzo(ghi)perylene	< 0.01	0.02
Arsenic	< 0.01	25
Boron	< 0.01	1000
Cadmium	< 0.01	5
Copper	< 0.01	40
Lead	< 0.01	20
Mercury	< 0.01	1
Nickel	< 0.01	150
Selenium	< 0.01	-
Cyanide	< 0.01	-
pH	< 0.01	-
Sulphate	< 0.01	400000

The assessment confirms that no contaminants in the Groundwater Analysis prepared from window sample borehole WS4 exceed their respective guideline criteria, indicating no potential risk to controlled waters.

11.2 Assessment of Groundwater Analysis Hydrocarbon Data

Speciated hydrocarbon results were assessed by comparison with AA-EQS values for inland waters. In case of determinands not covered by AA-EQS values, results were compared to EQS Freshwater Criteria values or where no EQS Freshwater Criterion is available, then WHO guidelines for Drinking Water are adopted.

Table 19: Assessment of Groundwater Analysis Hydrocarbon Data

Contaminant	TP01 Result (ug/l)	AA-EQS (ug/l)	WHO (ug/l)
Aromatic EC5-EC7 (benzene)	< 1.0	10	10
Aromatic EC7-EC8 (toluene)	< 1.0	-	700
Aromatic EC8-EC10 (ethyl benzene)	< 1.0	-	300
Aromatic EC10-EC12	< 10	-	100
Aromatic EC12-EC16	< 10	-	100
Aromatic EC16-EC21	< 10	-	90
Aromatic EC21-EC35	< 10	-	90
Aliphatic EC5-EC6	< 1.0	-	15000
Aliphatic EC6-EC8	< 1.0	-	15000
Aliphatic EC8-EC10	< 1.0	-	300
Aliphatic EC10-EC12	< 10	-	300
Aliphatic EC12-EC16	< 10	-	300
Aliphatic EC16-EC21	< 10	-	(300)*
Aliphatic EC21-EC35	< 10	-	(300)*

The above assessment confirms that no contaminant exceeds its respective AA-EQS / WHO guideline criteria. Hence no risk to controlled waters and/or human health is indicated.

11.3.1 Assessment of Groundwater BTEX / MTBE Compound Data

All BTEX / MTBE compounds are reported to be below their respective limit of detection. Hence no risk to controlled waters and/or human health is indicated.

11.4 Summary of Controlled Waters Risk Assessment

The assessment confirms that no contaminants in the Groundwater Analysis prepared from window sample borehole WS4 exceed their respective AA-EQS guideline criteria, indicating no potential risk to controlled waters.

15.0 POST INVESTIGATION CONCEPTUAL MODEL

Based on the findings of the investigation, a conceptual model could be constructed illustrating proven pollution linkages and summarising the conceptual remediation recommendations discussed above, as tabulated hereunder.

Table 20: Conceptual Model

Source	Pathway	Receptor	Remedial Options
The above human health risk assessment confirms no exceedances, hence no potential risk to human health is indicated. Notwithstanding the above, contractors must remain aware that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including inter alia humans, animals, controlled waters, or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon CCG to site to determine the nature of the exposure and to determine an appropriate course of action.	dermal, ingestion pathways	Construction workers	No remedial works area required under areas of permanent hard standing since the permanent hard cover will close all potential contamination pathways. It is recommended that site levels within newly created rear gardens be reduced by a minimum of 200mm below finished garden level, or to the surface of undisturbed natural drift deposits, whichever is the lesser, with site levels being reconstructed by the placement of clean imported topsoil. All imported topsoil utilised with rear / front / communal areas should be placed under a strict validation regime comprising 1nr analyses per 50m³, with a minimum of 4nr analyses per material source.

16.0 PRELIMINARY NEW WATER MAINS SUPPLY

The specification for new water mains at this site was based on the criteria specified in Paper 10/WM/03/21 'Guidance for the selection of Water Supply Pipes to be used in Brownfield Sites' published by UK Water Industry Research (UKWIR) January 2011.

The assessment indicates that the soil concentrations of pertinent hydrocarbon contaminant species are below the permitted threshold concentrations specified by the UKWIR for the adoption of PE water mains and therefore PE mains may be deployed. Good practice requires that mains be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below pipe underside.

Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply, and for drainage and sewerage under pressure.

Notwithstanding the above preliminary assessment, the developer should contact the relevant water supply company (**UNITED UTILITIES**) to obtain concurrence with the recommendations given above and may be required to return a completed Risk Assessment.

17.0 FOUNDATIONS & FLOOR SLABS RECOMMENDATIONS

17.1 Introduction

It is understood that the site is to be developed for residential land use by the construction of 2nr private houses, each constructed of traditional brick elevations under pitched roofing materials together with associated front and rear private gardens. The development will include construction of a new hard paved estate road.

The existing and proposed site configurations are as illustrated on **REVIVAL ARCHITECTURE LTD** architectural drawings contained within

Appendix A.

This intrusive ground investigation confirms the presence of made ground deposits at all exploratory locations, typically comprising dark brown to grey very gravelly silty sands and very sandy silty gravels containing angular to sub-angular fragments of concrete, brick, cinders, sandstone, limestone, and mudstone, locally with cobbles. These materials are underlain by natural brown to grey sandy and slightly gravelly silty clay with fine to medium sub-angular to sub-rounded sandstone and mudstone gravel, locally including thin interbedded layers of clayey or silty gravel, proven to depths between 4.0mbgl and 4.5mbgl.

17.2 Foundations & Floor Slabs

Variable ground conditions have been encountered. Taking account of the SPT`N` values recorded in the boreholes, foundations should bear at a minimum depth of 1.4mbgl. Reinforced strips should be adopted and may be designed on an Allowable Bearing Pressure (ABP) of 50kN/m². The natural clay soil underlying the foundations is of low shrinkability and there is no evidence of desiccation affecting these soils. Notwithstanding this, should tree planting be planned then foundation depths may require adjustment in accordance with the guidance contained in NHBC Chapter 4.2.

Fully suspended beam and block ground floor slabs are strongly recommended. Should ground bearing slabs be considered then they should be constructed on ground prepared as follows:

- Removal of all organic soils to min depth 300mm below slab underside
- Thorough compaction at reduced level
- Placement and compaction of DTp Type 1 subbase layers

As an alternative, piled ground beam foundations may be considered with 150mm diameter bottom driven steel cased piles supporting a notional 500mm x 450mm rc ground beam. For the purposes of preliminary design, 150mm diameter piles driven to the mudstone at 4mbgl will carry a SWL of 120kN. Beam and block floors will be adopted with piled ground beam foundations

17.3 Excavations

Excavations may be undertaken by light hydraulic excavators. Excavations in excess of 1.2mbgl within sand deposits will require side support.

17.4 Groundwater Management

Water was observed at all borehole locations. In these conditions, a prudent contractor would allow for pumping to maintain dry working conditions during foundation construction / service installations particularly during heavy and/or prolonged periods of precipitation.

18.0 CONCLUSIONS & RECOMMENDATIONS

The conclusions and recommendations hereunder are based on the salient sections of the report and should not be referred to in isolation of the relevant sections of the text. All recommendations are subject to Regulatory Authority review.

Table 21: Conclusions & Recommendations

Soil Contamination	The above human health risk assessment confirms no exceedances, hence no potential risk to human health is indicated. Notwithstanding the above, contractors must remain aware that disturbance of the ground may uncover unanticipated features which may give rise to considerations of contamination as far as the exposed conditions may have the potential to impact on receptors including <i>inter alia</i> humans, animals, controlled waters, or the fabric of buildings. Any such encounters will require the contractor to halt work, isolate the risk area, and summon CCG to site to determine the nature of the exposure and to determine an appropriate course of action. No remedial works area required under areas of permanent hard standing since the permanent hard cover will close all potential contamination pathways. It is recommended that site levels within newly created rear gardens be reduced by a minimum of 200mm below finished garden level, or to the surface of undisturbed natural drift deposits, whichever is the lesser, with site levels
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	being reconstructed by the placement of clean imported topsoil. All imported topsoil utilised with rear / front / communal areas should be placed under a strict validation regime comprising 1nr analyses per 50m³, with a minimum of 4nr analyses per material source.
Controlled Waters	The assessment confirms that no contaminants in the Groundwater Analysis prepared from window sample borehole WS4 exceed their respective AA-EQS guideline criteria, indicating no potential risk to controlled waters.
Concrete Specification	Based on the foregoing assessment, concrete in the ground should be specified to conform to the compositional requirements of Design Chemical Class DC-1 , as defined in BRE Special Digest 1: 2005.
Water Mains	The assessment indicates that the soil concentrations of pertinent hydrocarbon contaminant species are below the permitted threshold concentrations specified by the UKWIR for the adoption of PE water mains and therefore PE mains may be deployed. Good practice requires that mains be laid in a remediated alignment comprising of clean granular fill extending to 600mm + pipe diameter and to 300mm below pipe underside. Pipes should be laid in accordance with BS EN 12201-2 'Plastic piping systems for water supply, and for drainage and sewerage under pressure. Notwithstanding the above preliminary assessment, the developer should contact the relevant water supply company (United Utilities) to obtain concurrence with the recommendations given above and may be required to return a completed Risk Assessment.
Gas Risk Assessment	After 1 round of monitoring, a preliminary Gas Screening Value (GSV) of 0.0026l/hrs is calculated for CO₂. CH₄ has not been detected thus far during the monitoring programme. Using this preliminary GSV value, the risk to the proposed development was assessed in line with Situation A as defined in CIRIA C665, and on this basis the site complies with Characteristic Situation (CS) 1. It should be noted that the Characteristic Situation classification is to be confirmed following completion of the monitoring programme (5nr rounds remain), and the completed monitoring programme will be reported in an Addendum to this report.
Soakaway drainage	The results of 2nr tests carried out in accordance with BRE Digest 365 indicate that the ground conditions are unsuitable for adoption of soakaway drainage.
Groundwater Management	Groundwater was observed at all borehole locations. In these conditions, a prudent contractor would allow for pumping to maintain dry working conditions during foundation construction / service installations particularly during heavy and/or prolonged periods of precipitation.
Foundations & Ground Floor Slabs	See Section 17.0 for full discussion
Excavations	Excavations may be undertaken by light hydraulic excavators. Excavations more than 1.2mbgl will require side support.
Further Work	• Complete the ongoing gas – groundwater monitoring programme (5nr rounds remain) • Update Gas Risk Assessment (GSV Value and Characteristic Situation)



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Consulting Geotechnical and Geoenvironmental Engineers

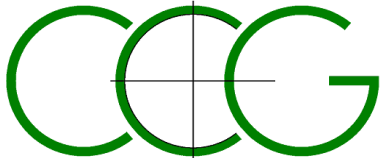
APPENDIX A

DRAWINGS



DO NOT SCALE

Notes: Study Site



CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client:
Revival Architecture

Project:
Hale View Road, Huyton, L36 6DD

Title:
Aerial Photograph

Scale:
NTS

Issue:
01

Drawn by:
SHM

Date:
November 2025

Project No.
CCG-C-25-15828

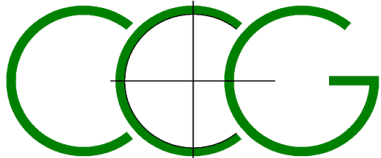
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DO NOT SCALE

Notes: Study Site



CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client:
Revival Architecture Ltd.

Project:
Hale View Road, Huyton, L36 6DD

Title:
Site Location

Scale:
NTS

Issue:
01

Drawn by:
DG

Date:
November 2025

Project No.
CCG-C-25-15828

Drawing No.
02

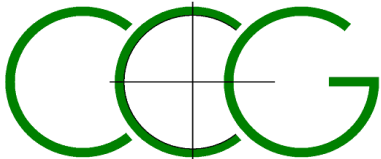
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LEGEND

-  Dynamic Sampling Borehole Locations
-  Soakaway Testing Locations
-  Contamination Sampling Locations

Note: Not to Scale (NTS)



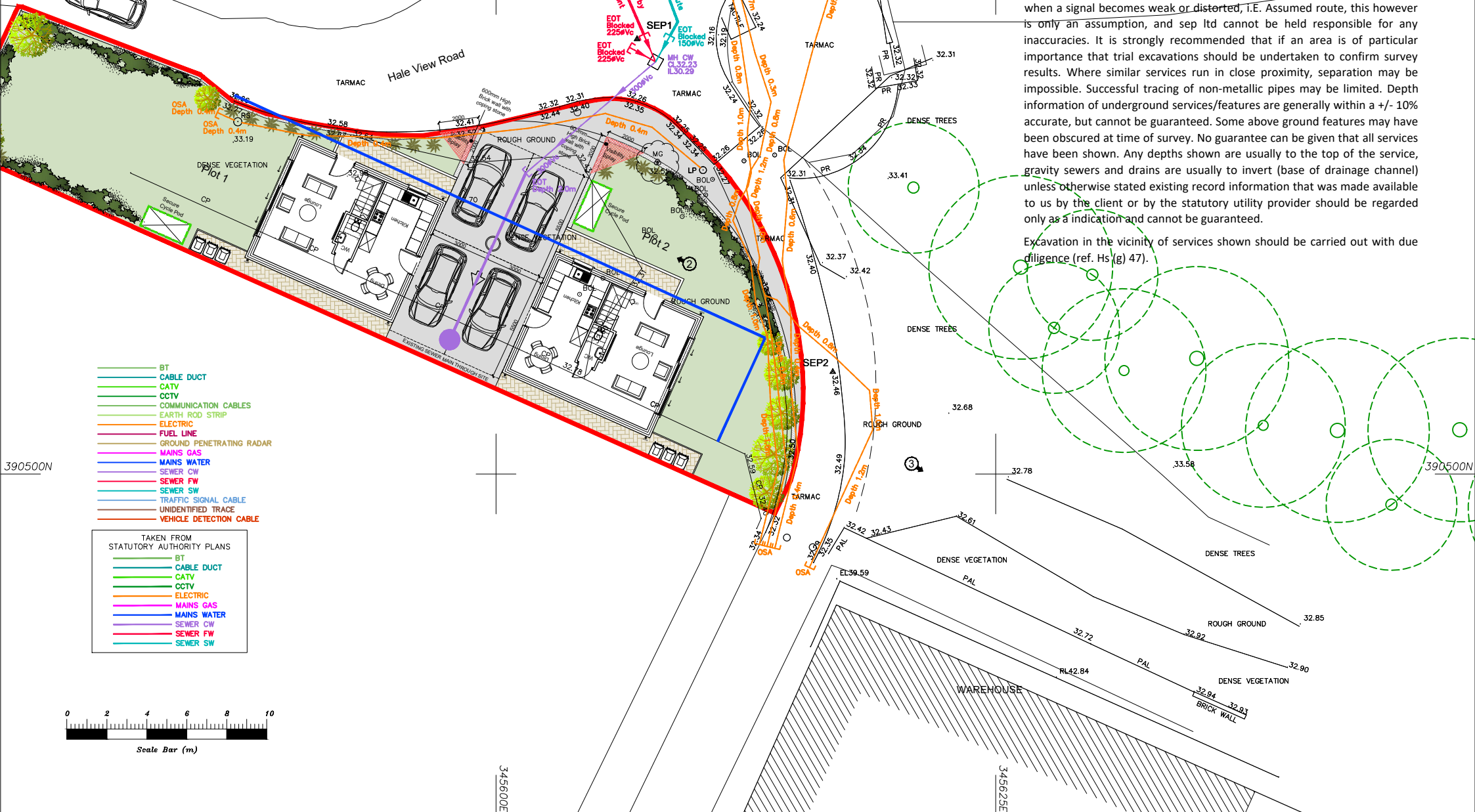
CC GEOTECHNICAL LIMITED
UNIT 1 DELTIC WAY
KNOWSLEY INDUSTRIAL ESTATE
LIVERPOOL
L33 7BA
0151 545 2750

Client: Revival Architecture Ltd	
Project: PHASE II GROUND INVESTIGATION—HALE VIEW ROAD, HUTON	
Title: INVESTIGATION LAYOUT PLAN	
Scale: NTS	Drawing No: 3
Created by: NE	Date: 03/11/25
Project No. CCG-C-25-15828	Drawing No. 15828-3

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SURVEY STATIONS			
Name	Easting	Northing	Height
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SEP2	345616.854	390505.115	32.469

390525N



Sep Ltd, disclaimer:

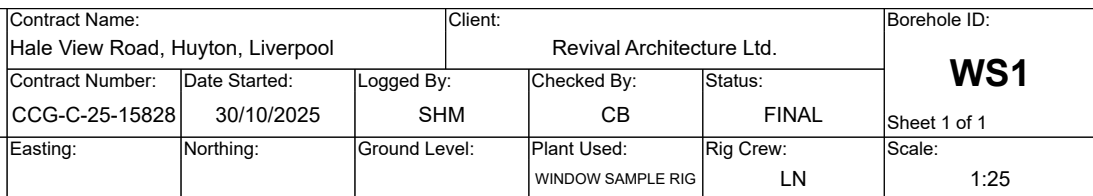
At sep ltd we use skilled and experienced staff, modern up to date electromagnetic and radar technology and techniques to locate and trace all sub surface utilities, however the performance of the techniques employed in non-invasive surveys can be adversely affected by factors outside of sep ltd control. Therefore whilst sep ltd uses best endeavours, on a usual heavy built up site, 85% completeness is probably all that can be expected, therefore a surveyor may recommend a certain route a utility may take when a signal becomes weak or distorted, I.E. Assumed route, this however is only an assumption, and sep ltd cannot be held responsible for any inaccuracies. It is strongly recommended that if an area is of particular importance that trial excavations should be undertaken to confirm survey results. Where similar services run in close proximity, separation may be impossible. Successful tracing of non-metallic pipes may be limited. Depth information of underground services/features are generally within a +/- 10% accurate, but cannot be guaranteed. Some above ground features may have been obscured at time of survey. No guarantee can be given that all services have been shown. Any depths shown are usually to the top of the service, gravity sewers and drains are usually to invert (base of drainage channel) unless otherwise stated existing record information that was made available to us by the client or by the statutory utility provider should be regarded only as a indication and cannot be guaranteed.

Excavation in the vicinity of services shown should be carried out with due diligence (ref. Hs (g) 47).



APPENDIX B

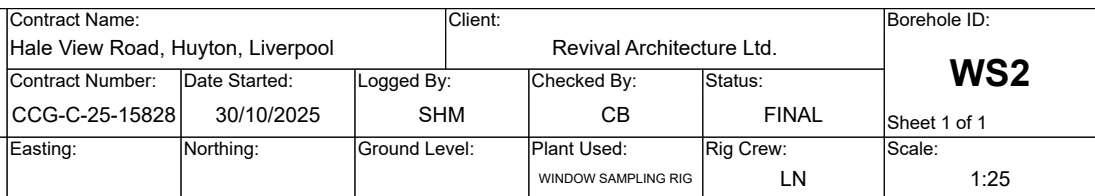
BOREHOLE LOGS



Samples & In Situ Testing	Strata Details	Groundwater
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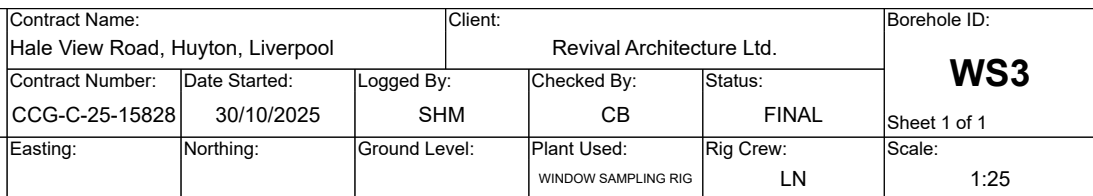
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Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
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					0.50	4.00	SLOTTED	50						
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														



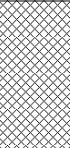
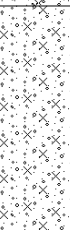
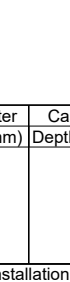
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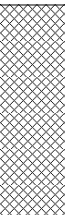
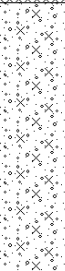
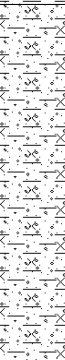
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Service avoidance pit dug to 1.2mbgl. Borehole drilling commenced from pit base.					
Chiselling					Installation				Water Strikes					
									Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	2.70			0		Risen to 1.5m
					0.00	1.00	PLAIN	50						
					1.00	4.00	SLOTTED	50						
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Weather: DRY	Termination: Refusal.	SPT Hammer: N/R, Energy Ratio: N/R
--------------	-----------------------	------------------------------------

Samples & In Situ Testing			Strata Details					Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation	
0.40	B			(0.50)		Brown very sandy slightly silty fine to medium coarse GRAVEL. Gravel is angular to sub-angular concrete and limestone (MADE GROUND).			
0.80	B	HVP=50		0.50		Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular sandstone.	1		
		HVP=90		(0.70)					
1.20 - 2.00	U	SPT(S)N=9 (1,3/1,3,3,2)		1.20		Loose reddish brown sandy slightly silty fine to coarse GRAVEL. High cobble content. Gravel and cobbles are angular to sub-angular sandstone.			
				(0.85)					
-2.00 - 3.00	U	SPT(S)N=8 (2,2/2,2,2,2)		2.05		Firm to stiff brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular to sub-rounded sandstone and mudstone.	2		
		HVP=90							
-3.00 - 4.00	U	SPT(S)N=10 (2,3/2,3,2,3) HVP=90		(1.75)			3		
		HVP=80							
		SPT(S)N=100 (7,13/100 for 185mm)		3.80		Grey weathered MUDSTONE. Locally recovered as slightly silty slightly clayey gravel.			
				4.00		End of Borehole at 4.00m	4		
							5		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Service avoidance pit dug to 1.2mbgl. Borehole drilling commenced from pit base.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
									2.70			0		
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	Contract Name: Hale View Road, Huyton, Liverpool				Client: Revival Architecture Ltd.			Borehole ID: WS4						
	Contract Number: CCG-C-25-15828		Date Started: 30/10/2025		Logged By: SHM	Checked By: CB	Status: FINAL	Sheet 1 of 1						
	Easting:		Northing:		Ground Level:	Plant Used: WINDOW SAMPLING RIG	Rig Crew: LN	Scale: 1:25						
Dynamic Sampling Borehole Log														
Weather: DRY					Termination: Refusal.					SPT Hammer: N/R, Energy Ratio: N/R				
Samples & In Situ Testing					Strata Details					Groundwater				
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description				Water Strike	Backfill/Installation			
0.30	B			(0.70)		Grey very sandy slightly silty fine to coarse GRAVEL. Gravel is angular to sub-angular limestone, cinders and concrete (MADE GROUND).								
0.70	B			0.70		Medium dense reddish brown very sandy slightly silty fine to coarse GRAVEL. High cobble content. Gravel and cobbles are angular to sub-angular sandstone.				1				
1.20 - 2.00	U	SPT(S)N=11 (2,5/5,3,2,1)		(0.90)										
				1.60		Soft grey sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular to sub-rounded sandstone and mudstone.				2				
2.00 - 3.00	U	SPT(S)N=8 (2,2/2,2,2,2) HVP=30		(1.00)										
				2.60		Firm brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular to sub-rounded sandstone and mudstone								
3.00 - 4.00	U	SPT(S)N=9 (1,2/2,2,2,3) HVP=90		(1.20)						3				
		HVP=60												
		HVP=60		3.80		Grey weathered MUDSTONE. Locally recovered as slightly silty slightly clayey gravel.								
		SPT(S)N=50 (7,15/50 for 195mm)		4.00		End of Borehole at 4.00m				4				
										5				
Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Service avoidance pit dug to 1.2mbgl. Borehole drilling commenced from pit base.					
Chiselling					Installation				Water Strikes					
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)	Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	
				0.00	1.00	PLAIN	50	2.70			0		Risen 1.5	
				1.00	4.00	SLOTTED	50							
CC GEOTECHNICAL LTD 0151 545 2750 www.ccgeotechnical.com														



APPENDIX C

SOAKAWAY LOGS

	Contract Name: Hale View Road, Huyton, Liverpool		Client: Revival Architecture Ltd.			Trial Pit ID: SA1				
	Contract Number: CCG-C-25-15828	Date Started: 30/10/2025	Logged By: SHM	Checked By: CB	Status: FINAL	Sheet 1 of 1				
Trial Pit Log	Easting:	Northing:	Ground Level:	Plant Used: JCB 3CX	Date Printed: 13/11/2025	Scale: 1:25				
	Weather: DRY		Hole Termination: As Scheduled.		Stability: STABLE					
Samples & In Situ Testing			Strata Details				Water	Backfill		
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description				
0.15	B			0.20		Brownish grey very sandy slightly silty fine to coarse GRAVEL. Gravel is subangular limestone (MADE GROUND).	1			
0.50	B			(0.90)		Dark greyish brown silty gravelly fine to coarse grained SAND. Gravel is fine to coarse angular to subangular brick, ash, coal, concrete and sandstone (MADE GROUND).				
1.20	B			1.10 (0.40)		Reddish brown sandy slightly gravelly silty CLAY. Gravel is fine to medium angular brick, slate, concrete and sandstone (MADE GROUND).				
1.70	B			1.50 (0.60)		Reddish brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone and mudstone.	2			
				2.10	End of Trial Pit at 2.10m					
							3			
Dimensions:					General Remarks:					
Final Depth: 2.10m										
← Length (m) → 1.40m ↑ Width (m) ↓ 0.40m Orientation: ° ←										
Inclination: °					Water Strikes					
					Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
					CC GEOTECHNICAL LTD 0151 545 2750 www.ccgteotechnical.com					

	Contract Name: Hale View Road, Huyton, Liverpool		Client: Revival Architecture Ltd.			Trial Pit ID: SA2																										
	Contract Number: CCG-C-25-15828	Date Started: 30/10/2025	Logged By: SHM	Checked By: CB	Status: FINAL	Sheet 1 of 1																										
Trial Pit Log	Easting:	Northing:	Ground Level:	Plant Used: JCB 3CX	Date Printed: 13/11/2025	Scale: 1:25																										
	Weather: DRY		Hole Termination: As Scheduled.		Stability: STABLE																											
Samples & In Situ Testing			Strata Details				Water	Backfill																								
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description																										
0.10	B			0.10		Dark brown very gravelly silty SAND. Gravel is fine to medium coarse angular to sub-angular concrete, cinders, limestone and sandstone (MADE GROUND)	1																									
0.60	B			(1.30)		Dark brown very sandy silty GRAVEL. High cobble content. Gravel is fine to coarse coarse angular to sub-angular sandstone and concrete (MADE GROUND).																										
1.40	B			1.40		Brown very gravelly silty fine to medium grained SAND. Medium cobble content. Gravel is fine to coarse subangular sandstone.	2																									
2.00	B			(0.60)																												
				2.00		Brown sandy slightly gravelly silty CLAY. Gravel is fine to medium sub-angular to sub-rounded sandstone and mudstone.	3																									
				2.10		End of Trial Pit at 2.10m																										
Dimensions:			General Remarks:																													
Final Depth: 2.10m			← Length (m) → 1.50m ↑ Width (m) ↓ 0.40m Orientation: ° ← <table><tr><th colspan="6">Water Strikes</th></tr><tr><th>Strike (m)</th><th>Casing (m)</th><th>Sealed (m)</th><th>Time (mins)</th><th>Rose to (m)</th><th>Remarks</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						Water Strikes						Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks												
Water Strikes																																
Strike (m)	Casing (m)	Sealed (m)							Time (mins)	Rose to (m)	Remarks																					
Inclination: °																																

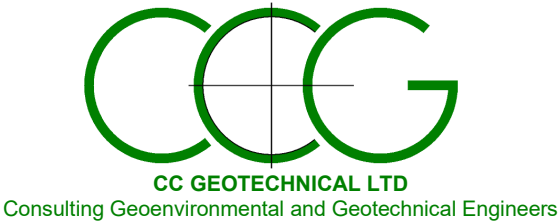


APPENDIX D

GEOTECHNICAL DATA

Units 1 & 2
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Email: enquiries@ccgeotechnical.com
www.ccgeotechnical.com



LABORATORY REPORT

CONTRACT NUMBER: CCG-C-25-15828

CONTRACT TITLE: HALE VIEW ROAD, HUYTON

CLIENT: REVIVAL ARCHITECTURE
Suite 203 Queens Dock Business Centre, 67-83 Norfolk Street, Liverpool L1 0BG

DATE RECEIVED: 31/10/25
DATE COMMENCED: 31/10/25
DATE COMPLETED: 04/11/25
REPORT DATE: 04/11/25

Test Description	Qty
Determination of Moisture Content BS 1377-2:1990 (a)	5
Determination of Liquid & Plastic Limits BS 1377-2:1990 (a)	5
Particle Size Distribution BS 1377-2:1990 (a)	3

Notes: Observations and interpretations are not accredited by UKAS
All testing undertaken at laboratory permanent facilities
denotes non-accredited test
a denotes UKAS accredited test
s denotes test undertaken by approved subcontractor
Test results only relate to the samples tested

This report is issued in accordance with the requirements of the United Kingdom Accreditation Services and EN ISO/IEC 17025:2017. The results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories: Chris Bolan (Managing Director) – Daniel Kerfoot (Laboratory Manager)



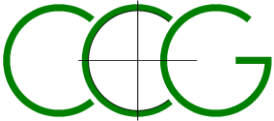
SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
WS01	U	1.40	1.40	16	-	-	-	27	14	13	90	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone and mudstone. (BS1377Pt2:3.2,4.4,5)
WS01	U	2.80	2.80	-	-	-	-	-	-	-	-	-	Y	Dark brown sandy slightly silty GRAVEL with high cobble content. Gravel and cobbles are angular to subangular sandstone. (BS1377Pt2:9.2)
WS02	U	2.10	2.10	19	-	-	-	28	14	14	91	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone and mudstone. (BS1377Pt2:3.2,4.4,5)
WS03	U	0.80	0.80	16	-	-	-	28	14	14	93	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone. (BS1377Pt2:3.2,4.4,5)
WS03	U	1.70	1.70	-	-	-	-	-	-	-	-	-	Y	Reddish brown sandy slightly silty GRAVEL with high cobble content. Gravel and cobbles are angular to subangular sandstone. (BS1377Pt2:9.2)
WS03	U	2.30	2.30	18	-	-	-	27	14	13	92	CL	Y	Brown slightly sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone and mudstone. (BS1377Pt2:3.2,4.4,5)
WS04	U	1.10	1.10	-	-	-	-	-	-	-	-	-	Y	Reddish brown very sandy slightly silty GRAVEL with high cobble content. Gravel and cobbles are angular to subangular sandstone. (BS1377Pt2:9.2)
WS04	U	1.80	1.80	22	-	-	-	24	15	9	96	CL	Y	Grey sandy slightly gravelly silty CLAY. Gravel is fine to medium subangular to subrounded sandstone and mudstone. (BS1377Pt2:3.2,4.4,5)

SITE: HALE VIEW ROAD, HUYTON (CCG-C-25-15828)
CLIENT: REVIVAL ARCHITECTURE

DATE: 04.11.25

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS





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PARTICLE SIZE DISTRIBUTION

Job Ref

CCG-C-25-15828

Borehole/Pit No.

WS01

Site Name

HALE VIEW ROAD, HUYTON

Sample No.

1

Specimen Description

Dark brown sandy slightly silty GRAVEL with high cobble content

Depth, m

2.80

Specimen Reference

Specimen Depth

m

Sample Type

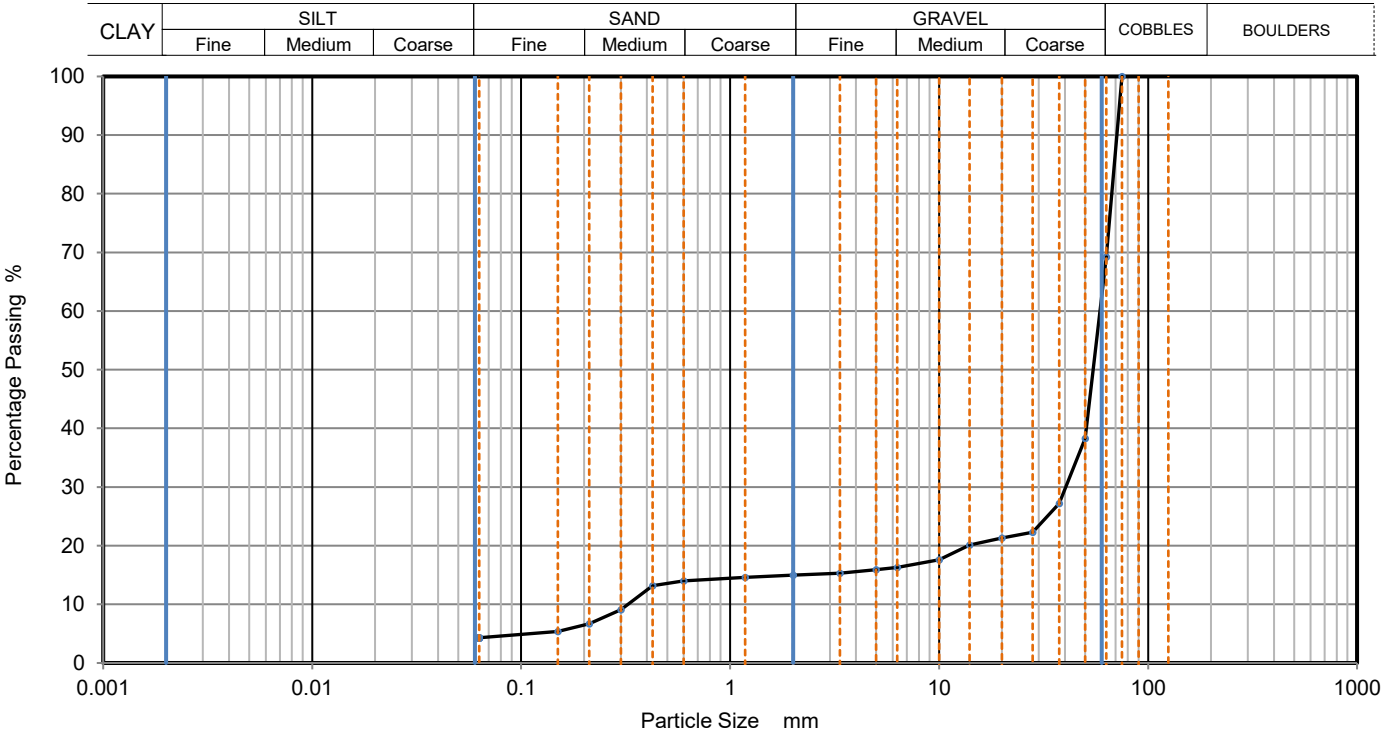
U

Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

CCGL202511040



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
75	100		
63	69		
50	38		
37.5	27		
28	22		
20	21		
14	20		
10	18		
6.3	16		
5	16		
3.35	15		
2	15		
1.18	15		
0.6	14		
0.425	13		
0.3	9		
0.212	7		
0.15	5		
0.063	4		

Dry Mass of sample, g

Sample Proportions	% dry mass
Very coarse	31
Gravel	54
Sand	11
Fines <0.063mm	4

Grading Analysis		
D100	mm	75
D60	mm	58.8
D30	mm	40.3
D10	mm	0.324
Uniformity Coefficient		180
Curvature Coefficient		85

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1 Sheet
JE	DK	DK	04/11/2025 12:14	



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PARTICLE SIZE DISTRIBUTION

Job Ref

CCG-C-25-15828

Borehole/Pit No.

WS03

Site Name

HALE VIEW ROAD, HUYTON

Sample No.

1

Specimen Description

Reddish brown sandy slightly silty GRAVEL with high cobble content

Depth, m

1.70

Specimen Reference

Specimen Depth

m

Sample Type

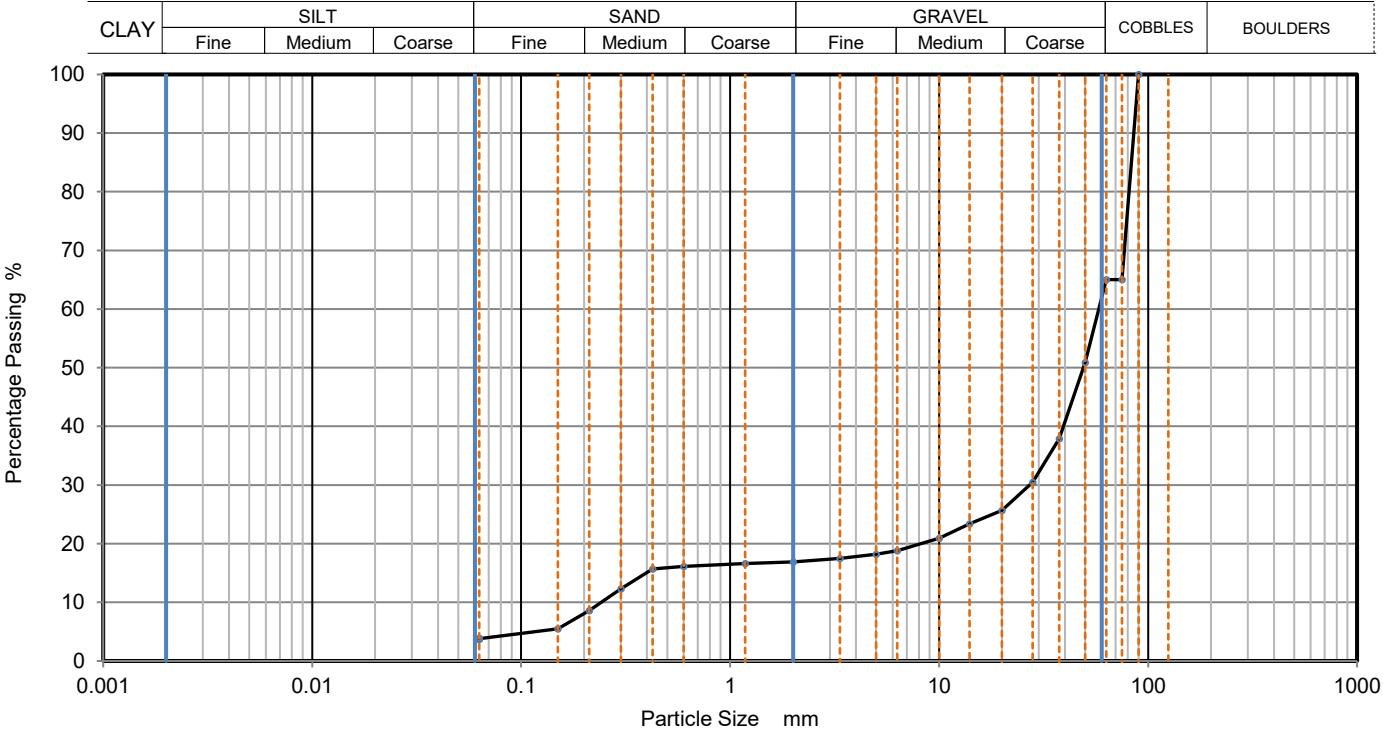
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Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

CCGL202511041



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
90	100		
75	65		
63	65		
50	51		
37.5	38		
28	31		
20	26		
14	23		
10	21		
6.3	19		
5	18		
3.35	18		
2	17		
1.18	17		
0.6	16		
0.425	16		
0.3	12		
0.212	9		
0.15	6		
0.063	4		

Dry Mass of sample, g

Sample Proportions	% dry mass
Very coarse	35
Gravel	48
Sand	13
Fines <0.063mm	4

Grading Analysis		
D100	mm	90
D60	mm	58
D30	mm	27.1
D10	mm	0.242
Uniformity Coefficient		240
Curvature Coefficient		52

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1 Sheet
JE	DK	DK	04/11/2025 12:14	



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PARTICLE SIZE DISTRIBUTION

Job Ref

CCG-C-25-15828

Borehole/Pit No.

WS04

Site Name

HALE VIEW ROAD, HUYTON

Sample No.

1

Specimen Description

Reddish brown very sandy slightly silty GRAVEL with high cobble content

Depth, m

1.10

Specimen Reference

Specimen Depth

m

Sample Type

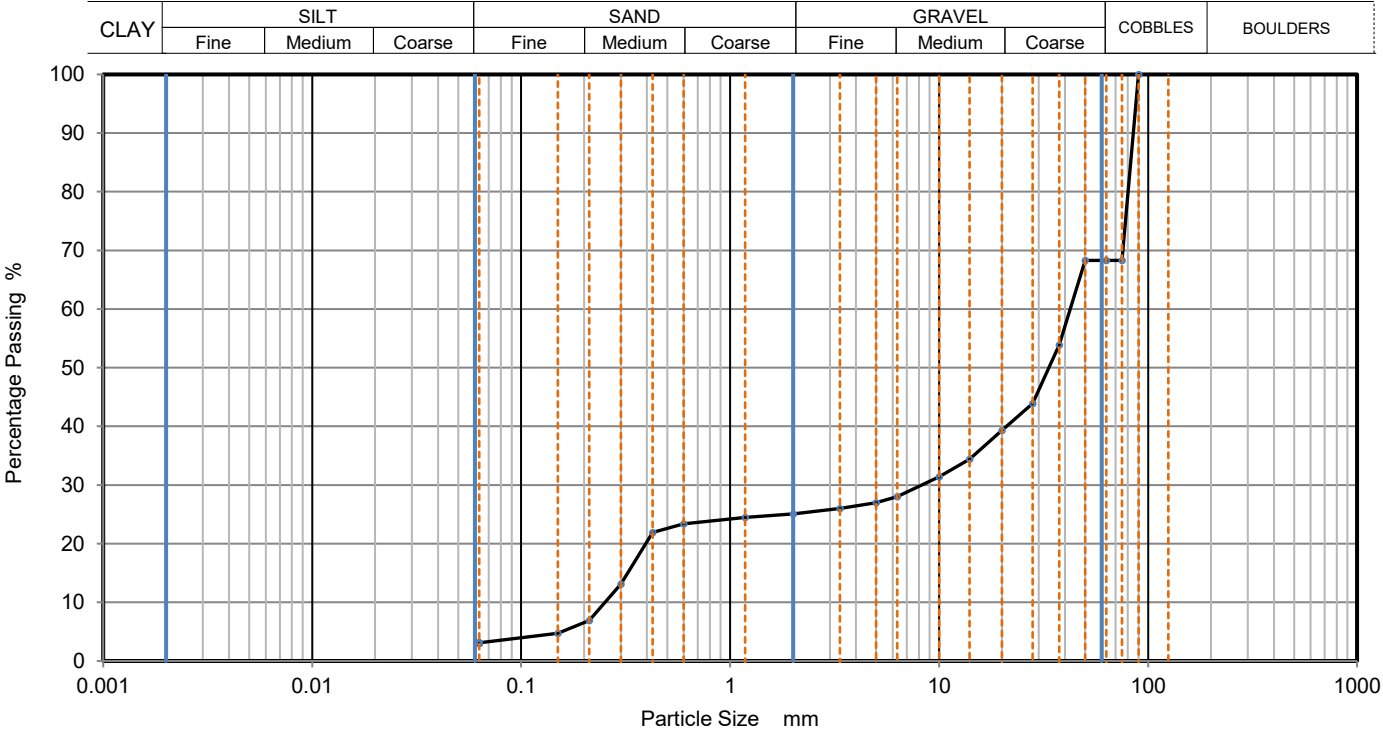
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Test Method

BS1377:Part 2:1990, clause 9.2

KeyLAB ID

CCGL202511042



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
90	100		
75	68		
63	68		
50	68		
37.5	54		
28	44		
20	39		
14	34		
10	31		
6.3	28		
5	27		
3.35	26		
2	25		
1.18	25		
0.6	23		
0.425	22		
0.3	13		
0.212	7		
0.15	5		
0.063	3		

Dry Mass of sample, g

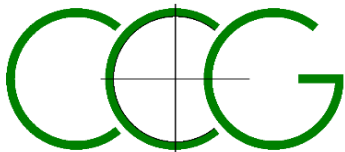
Sample Proportions	% dry mass
Very coarse	32
Gravel	43
Sand	22
Fines <0.063mm	3

Grading Analysis	
D100	mm 90
D60	mm 42.4
D30	mm 8.27
D10	mm 0.252
Uniformity Coefficient	170
Curvature Coefficient	6.4

Remarks

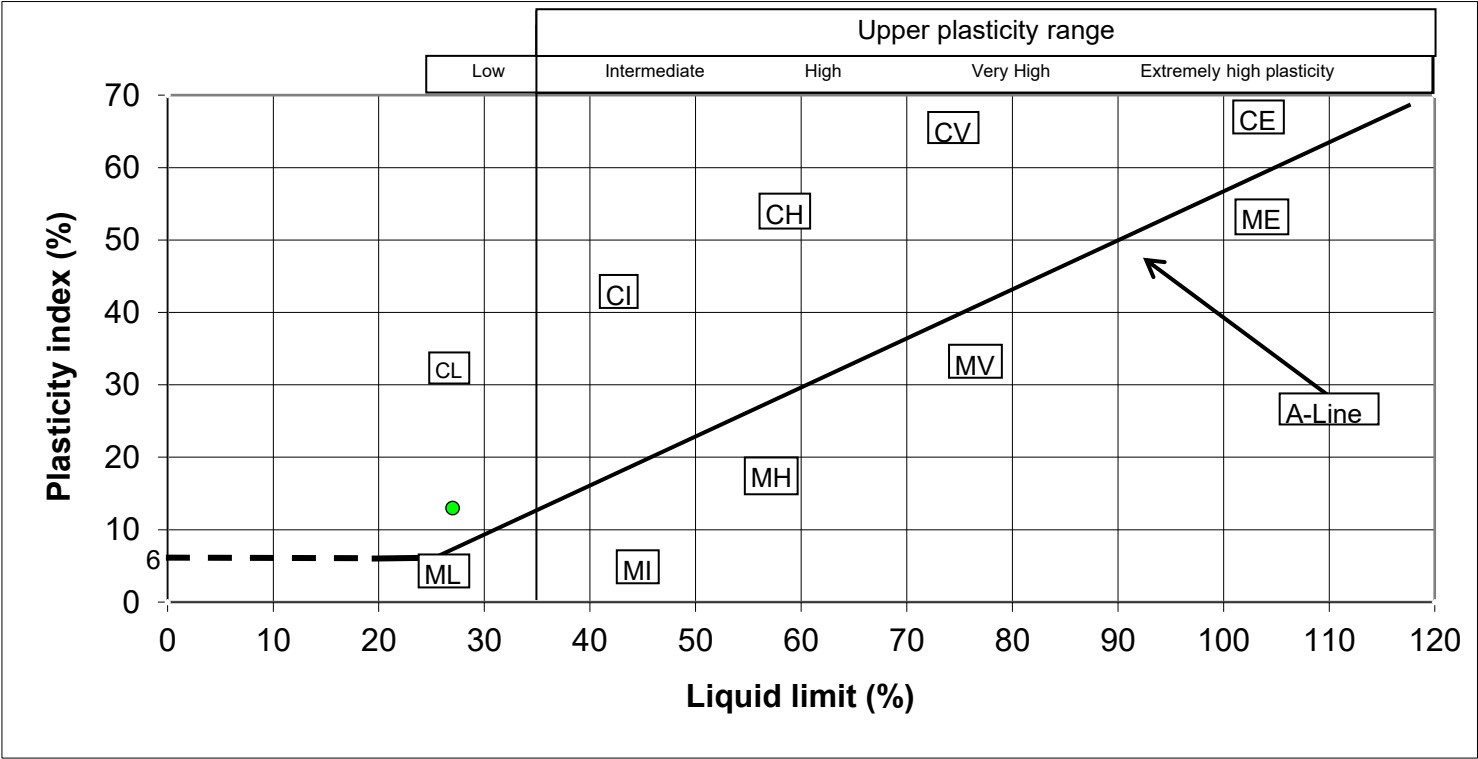
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 1 Sheet
JE	DK	DK	04/11/2025 12:14	



ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.

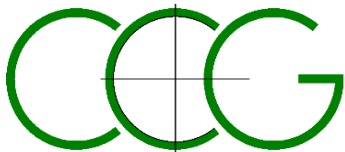


BH	Sample Depth	Liquid limit	Plasticity index
WS01	1.40	27.0	13.0



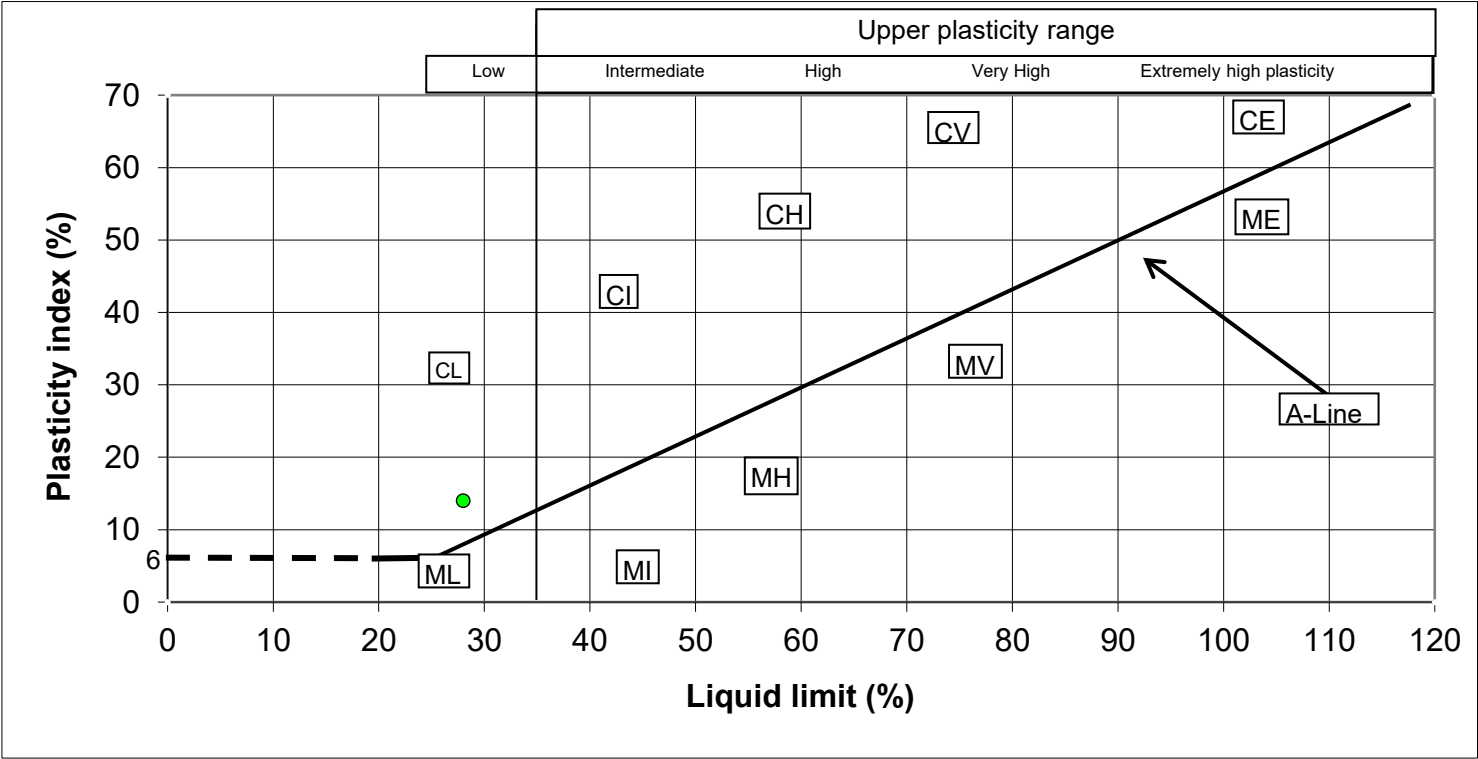
APPROVED BY	DK
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CLIENT: REVIVAL ARCHITECTURE	SITE: HALE VIEW ROAD, HUYTON (CCG-C-25-15828)
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ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.

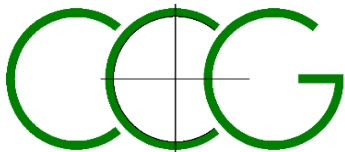


BH	Sample Depth	Liquid limit	Plasticity index
WS02	2.10	28.0	14.0



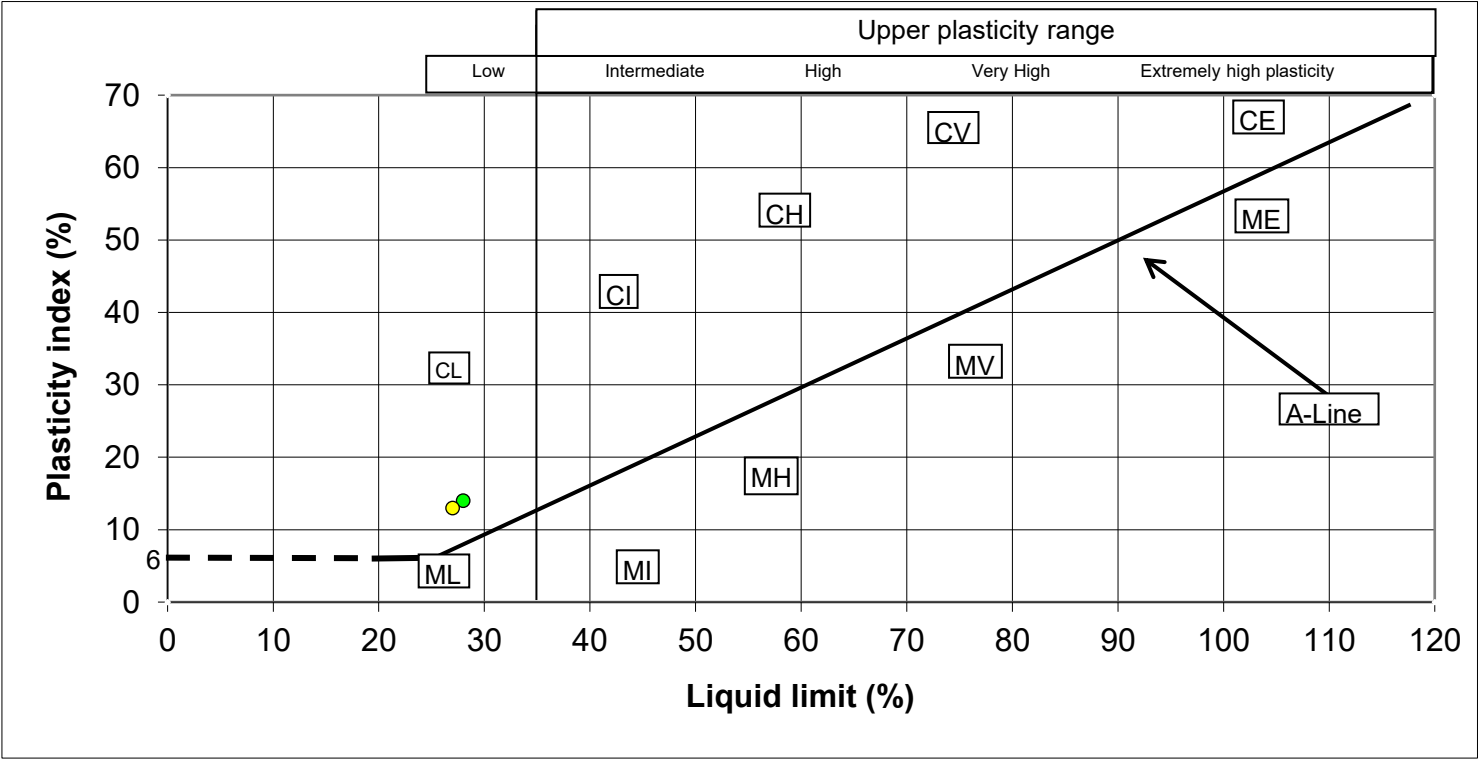
APPROVED BY	DK
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CLIENT: REVIVAL ARCHITECTURE	SITE: HALE VIEW ROAD, HUYTON (CCG-C-25-15828)
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ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
WS03	0.80	28.0	14.0
WS03	2.30	27.0	13.0



APPROVED BY	DK
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CLIENT: REVIVAL ARCHITECTURE	SITE: HALE VIEW ROAD, HUYTON (CCG-C-25-15828)
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APPENDIX E

CHEMICAL DATA

CC Geotechnical
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e: sean.hughesmccall@ccgeotechnical.com

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

t: 01923 225404

f: 01923 237404

e: info-i2analytical@normecgroup.com

Analytical Report Number : 25-059626

Project / Site name:	Hale View Road, Huyton	Samples received on:	03/11/2025
Your job number:	CCG C 25 15828	Samples instructed on/ Analysis started on:	03/11/2025
Your order number:	CCG PO 15828	Analysis completed by:	10/11/2025
Report Issue Number:	1	Report issued on:	11/11/2025
Samples Analysed:	10 soil samples		



Signed:

Rachel Chappell
Key Account Manager
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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

Analytical Report Number: 25-059626
Project / Site name: Hale View Road, Huyton
Your Order No: CCG PO 15828

Lab Sample Number	738891	738892	738893	738894	738895
Sample Reference	P1	P2	P3	P4	P5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.30	0.30	0.30	0.30	0.30
Date Sampled	31/10/2025	31/10/2025	31/10/2025	31/10/2025	31/10/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	28.9	28.1	45.2	46.7	30.2
Moisture Content	%	0.01	NONE	9.7	11	11	8	14
Total mass of sample received	kg	0.1	NONE	0.7	0.8	0.7	0.8	0.7

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM	WEM	WEM	WEM
Analysis completed	N/A	N/A	N/A	07/11/2025	07/11/2025	07/11/2025	07/11/2025	07/11/2025

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	10.4	8.7	10.9	8.9	7.9
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.282	0.123	0.225	0.106	0.046
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	580	310	950	250	140
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	290	156	473	126	71.8
Sulphide	mg/kg	1	MCERTS	29	5.8	20	27	2.9
Organic Matter (automated)	%	0.1	MCERTS	4.6	7.5	3.4	2.4	4.2

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.17	0.16	0.38	0.09	0.23
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.16	0.16	0.14	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.16	0.14	0.13	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	2	1.4	0.89	0.27	0.61
Anthracene	mg/kg	0.05	MCERTS	0.41	0.26	0.21	0.05	0.12
Fluoranthene	mg/kg	0.05	MCERTS	2.4	1.8	1.3	0.52	0.75
Pyrene	mg/kg	0.05	MCERTS	2.2	1.8	1.3	0.54	0.76
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.1	0.89	0.67	0.34	0.37
Chrysene	mg/kg	0.05	MCERTS	1.2	0.99	0.76	0.43	0.49
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.3	1.2	0.82	0.53	0.61
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.59	0.42	0.43	0.2	0.23
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.1	0.9	0.7	0.41	0.37
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.52	0.42	0.4	0.24	0.18
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.11	0.14	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.65	0.53	0.51	0.28	0.22

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	14.1	11.1	8.58	3.92	4.93
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Analytical Report Number: 25-059626
Project / Site name: Hale View Road, Huyton
Your Order No: CCG PO 15828

Lab Sample Number	738891	738892	738893	738894	738895
Sample Reference	P1	P2	P3	P4	P5
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.30	0.30	0.30	0.30	0.30
Date Sampled	31/10/2025	31/10/2025	31/10/2025	31/10/2025	31/10/2025
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	3.4	4.8	3.1	2.7	4.5
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	20	13	13	17
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	1.3	2.2	0.9	0.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.3	0.2	0.2	0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	24	20	20	18	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	68	130	60	49	89
Lead (aqua regia extractable)	mg/kg	1	MCERTS	98	160	79	62	70
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.5	< 0.3	< 0.3	< 0.3
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	2.3	3.4	2.7	2.6	2.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	43	23	22	25
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.4	1	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	140	110	96	78	100

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0	5.8	4.8	< 2.0
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	16	15	< 8.0
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0	30	14	20
TPHCWG - Aliphatic >EC35 - EC40 _{EH_CU_1D_AL}	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
TPHCWG - Aliphatic >EC5 - EC40 _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10	52	34	20

TPHCWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	0.025	0.031	< 0.010
TPHCWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	MCERTS	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
TPHCWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.02	MCERTS	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0	5.2	< 2.0	< 2.0
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10	12	< 10	< 10
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	39	18	49	< 10	< 10
TPHCWG - Aromatic >EC35 - EC40 _{EH_CU_1D_AR}	mg/kg	10	NONE	17	< 10	23	< 10	< 10
TPHCWG - Aromatic >EC5 - EC40 _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	56	18	90	< 10	< 10

TPH Total >EC5 - EC40 _{EH_CU+HS_1D_TOTAL}	mg/kg	10	NONE	56	18	140	34	20
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VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	24	31	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	8.5	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

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

Analytical Report Number: 25-059626
Project / Site name: Hale View Road, Huyton
Your Order No: CCG PO 15828

Lab Sample Number	738896	738897	738898	738899	738900
Sample Reference	P6	WS1	WS2	WS3	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.30	1.20	2.20	1.70	1.80
Date Sampled	31/10/2025	Deviating	Deviating	Deviating	Deviating
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	40.6	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	12	25	9.7	16
Total mass of sample received	kg	0.1	NONE	1	1	0.5	0.6	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	WEM	-	-	-	-
Analysis completed	N/A	N/A	N/A	07/11/2025	-	-	-	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.1	7.9	7.8	8.2	6.8
Free Cyanide	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	0.059	-	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	58	110	540	48	130
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	0.0552	0.271	0.0238	0.066
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	28.9	55.2	271	23.8	66
Sulphide	mg/kg	1	MCERTS	4.2	-	-	-	-
Organic Matter (automated)	%	0.1	MCERTS	4.5	-	-	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.15	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	0.59	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	0.13	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	0.8	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	0.86	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.44	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	0.53	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.72	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.29	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.5	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.29	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.07	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.35	-	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	5.73	-	-	-	-
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Analytical Report Number: 25-059626
Project / Site name: Hale View Road, Huyton
Your Order No: CCG PO 15828

Lab Sample Number	738896	738897	738898	738899	738900
Sample Reference	P6	WS1	WS2	WS3	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix	N/A	N/A	N/A	N/A	N/A
Depth (m)	0.30	1.20	2.20	1.70	1.80
Date Sampled	31/10/2025	Deviating	Deviating	Deviating	Deviating
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	5.1	-	-	-	-
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	17	-	-	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.2	-	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	86	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	69	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	2.5	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120	-	-	-	-

Petroleum Hydrocarbons

TPHCWG - Aliphatic >EC5 - EC6 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	-
TPHCWG - Aliphatic >EC6 - EC8 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	-
TPHCWG - Aliphatic >EC8 - EC10 _{HS_ID_AL}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	-
TPHCWG - Aliphatic >EC10 - EC12 _{EH_CU_ID_AL}	mg/kg	1	MCERTS	< 1.0	-	-	-	-
TPHCWG - Aliphatic >EC12 - EC16 _{EH_CU_ID_AL}	mg/kg	2	MCERTS	< 2.0	-	-	-	-
TPHCWG - Aliphatic >EC16 - EC21 _{EH_CU_ID_AL}	mg/kg	8	MCERTS	< 8.0	-	-	-	-
TPHCWG - Aliphatic >EC21 - EC35 _{EH_CU_ID_AL}	mg/kg	8	MCERTS	25	-	-	-	-
TPHCWG - Aliphatic >EC35 - EC40 _{EH_CU_ID_AL}	mg/kg	10	NONE	< 10	-	-	-	-
TPHCWG - Aliphatic >EC5 - EC40 _{EH_CU+HS_ID_AL}	mg/kg	10	NONE	25	-	-	-	-

TPHCWG - Aromatic >EC5 - EC7 _{HS_ID_AR}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	-
TPHCWG - Aromatic >EC7 - EC8 _{HS_ID_AR}	mg/kg	0.01	MCERTS	< 0.010	-	-	-	-
TPHCWG - Aromatic >EC8 - EC10 _{HS_ID_AR}	mg/kg	0.02	MCERTS	< 0.020	-	-	-	-
TPHCWG - Aromatic >EC10 - EC12 _{EH_CU_ID_AR}	mg/kg	1	MCERTS	< 1.0	-	-	-	-
TPHCWG - Aromatic >EC12 - EC16 _{EH_CU_ID_AR}	mg/kg	2	MCERTS	< 2.0	-	-	-	-
TPHCWG - Aromatic >EC16 - EC21 _{EH_CU_ID_AR}	mg/kg	10	MCERTS	< 10	-	-	-	-
TPHCWG - Aromatic >EC21 - EC35 _{EH_CU_ID_AR}	mg/kg	10	MCERTS	< 10	-	-	-	-
TPHCWG - Aromatic >EC35 - EC40 _{EH_CU_ID_AR}	mg/kg	10	NONE	< 10	-	-	-	-
TPHCWG - Aromatic >EC5 - EC40 _{EH_CU+HS_ID_AR}	mg/kg	10	NONE	< 10	-	-	-	-

TPH Total >EC5 - EC40 _{EH_CU+HS_ID_TOTAL}	mg/kg	10	NONE	25	-	-	-	-
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VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Benzene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Toluene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	-

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

Analytical Report Number : 25-059626

Project / Site name: Hale View Road, Huyton

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
738891	P1	None Supplied	0.3	Brown loam and sand with gravel and stones
738892	P2	None Supplied	0.3	Brown loam and sand with gravel and stones
738893	P3	None Supplied	0.3	Brown loam and sand with vegetation and stones
738894	P4	None Supplied	0.3	Brown loam and sand with gravel and stones
738895	P5	None Supplied	0.3	Brown clay and sand with gravel and stones
738896	P6	None Supplied	0.3	Brown clay and sand with gravel
738897	WS1	None Supplied	1.2	Brown clay and sand
738898	WS2	None Supplied	2.2	Brown clay and sand
738899	WS3	None Supplied	1.7	Brown clay and sand
738900	WS4	None Supplied	1.8	Brown clay and sand

Analytical Report Number : 25-059626

Project / Site name: Hale View Road, Huyton

Water matrix abbreviations:

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

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	In-house method	L010-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID in soil	Determination of total petroleum hydrocarbons in soil by GC-FID with carbon banding aliphatic and aromatic	In-house method	L076B	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazine followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
Total petroleum hydrocarbons with carbon banding by HS-GC/MS in soil	Determination of total petroleum hydrocarbons in soil by HS-GC/MS with carbon banding aliphatic and aromatic	In-house method	L088-PL	W	MCERTS

Analytical Report Number : 25-059626

Project / Site name: Hale View Road, Huyton

Water matrix abbreviations:

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

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil (Summed Bands)	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic (Summed Bands).	Calculation	L076B/L088-PL	D/W	NONE
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

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

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

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

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

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

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

The result for sum should be interpreted with caution

Analytical Report Number : 25-059626

Project / Site name: Hale View Road, Huyton

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

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

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS1	N/A	S	738897	a	Moisture Content	L019B	a
WS1	N/A	S	738897	a	Sample Preparation	L019B	a
WS1	N/A	S	738897	a	Soil Descriptions	L019B	a
WS1	N/A	S	738897	a	Stones content of soil	L019B	a
WS1	N/A	S	738897	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WS1	N/A	S	738897	a	pH in soil (automated)	L099-PL	a
WS2	N/A	S	738898	a	Moisture Content	L019B	a
WS2	N/A	S	738898	a	Sample Preparation	L019B	a
WS2	N/A	S	738898	a	Soil Descriptions	L019B	a
WS2	N/A	S	738898	a	Stones content of soil	L019B	a
WS2	N/A	S	738898	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WS2	N/A	S	738898	a	pH in soil (automated)	L099-PL	a
WS3	N/A	S	738899	a	Moisture Content	L019B	a
WS3	N/A	S	738899	a	Sample Preparation	L019B	a
WS3	N/A	S	738899	a	Soil Descriptions	L019B	a
WS3	N/A	S	738899	a	Stones content of soil	L019B	a
WS3	N/A	S	738899	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WS3	N/A	S	738899	a	pH in soil (automated)	L099-PL	a
WS4	N/A	S	738900	a	Moisture Content	L019B	a
WS4	N/A	S	738900	a	Sample Preparation	L019B	a
WS4	N/A	S	738900	a	Soil Descriptions	L019B	a
WS4	N/A	S	738900	a	Stones content of soil	L019B	a
WS4	N/A	S	738900	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WS4	N/A	S	738900	a	pH in soil (automated)	L099-PL	a

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Analytical Report Number : 25-059999

Project / Site name:	Hale View road, Huyton	Samples received on:	05/11/2025
Your job number:	CCG C 25 15828	Samples instructed on/ Analysis started on:	05/11/2025
Your order number:	CCG PO 15828	Analysis completed by:	11/11/2025
Report Issue Number:	1	Report issued on:	11/11/2025
Samples Analysed:	1 water sample		



Signed:

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

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

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

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

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

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

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

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

Analytical Report Number: 25-059999
Project / Site name: Hale View road, Huyton

Your Order No: CCG PO 15828

Lab Sample Number	740801			
Sample Reference	WS4			
Sample Number	None Supplied			
Water Matrix	Other water			
Depth (m)	None Supplied			
Date Sampled	04/11/2025			
Time Taken	1600			
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	

General Inorganics

pH (L099)	pH Units	N/A	NONE	6.9
Free Cyanide (Low Level)	µg/l	1	NONE	< 1.0
Sulphate as SO ₄	mg/l	0.045	NONE	77.1
Sulphide	µg/l	5	NONE	< 5.0
Total Organic Carbon (TOC)	mg/l	0.1	NONE	8.68
Hardness - Total	mgCaCO ₃ /l	1	NONE	420

Speciated PAHs

Naphthalene	µg/l	0.01	NONE	< 0.01
Acenaphthylene	µg/l	0.01	NONE	< 0.01
Acenaphthene	µg/l	0.01	NONE	< 0.01
Fluorene	µg/l	0.01	NONE	< 0.01
Phenanthrene	µg/l	0.01	NONE	< 0.01
Anthracene	µg/l	0.01	NONE	< 0.01
Fluoranthene	µg/l	0.01	NONE	< 0.01
Pyrene	µg/l	0.01	NONE	< 0.01
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01
Chrysene	µg/l	0.01	NONE	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	NONE	< 0.16
-------------------	------	------	------	--------

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	0.15	NONE	1.35
Cadmium (dissolved)	µg/l	0.02	NONE	< 0.02
Chromium (dissolved)	µg/l	0.2	NONE	0.9
Copper (dissolved)	µg/l	0.5	NONE	1.1
Lead (dissolved)	µg/l	0.2	NONE	0.2
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05
Nickel (dissolved)	µg/l	0.5	NONE	2.6
Selenium (dissolved)	µg/l	0.6	NONE	< 0.6
Zinc (dissolved)	µg/l	0.5	NONE	6.2

Boron (dissolved)	µg/l	10	NONE	270
Chromium (hexavalent)	µg/l	5	NONE	< 5.0

Analytical Report Number: 25-059999
Project / Site name: Hale View road, Huyton

Your Order No: CCG PO 15828

Lab Sample Number				740801
Sample Reference				WS4
Sample Number				None Supplied
Water Matrix				Other water
Depth (m)				None Supplied
Date Sampled				04/11/2025
Time Taken				1600
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Petroleum Hydrocarbons

TPH - Aliphatic >EC5 - EC6 _{HS_1D_AL}	µg/l	1	NONE	< 1.0
TPH - Aliphatic >EC6 - EC8 _{HS_1D_AL}	µg/l	1	NONE	< 1.0
TPH - Aliphatic >EC8 - EC10 _{HS_1D_AL}	µg/l	1	NONE	< 1.0
TPH - Aliphatic >EC10 - EC12 _{EH_1D_AL_MS}	µg/l	10	NONE	< 10
TPH - Aliphatic >EC12 - EC16 _{EH_1D_AL_MS}	µg/l	10	NONE	< 10
TPH - Aliphatic >EC16 - EC21 _{EH_1D_AL_MS}	µg/l	10	NONE	< 10
TPH - Aliphatic >EC21 - EC35 _{EH_1D_AL_MS}	µg/l	10	NONE	< 10
TPH - Aliphatic >EC5 - EC35 _{HS+EH_1D_AL_MS}	µg/l	10	NONE	< 10

TPH - Aromatic >EC5 - EC7 _{HS_1D_AR}	µg/l	1	NONE	< 1.0
TPH - Aromatic >EC7 - EC8 _{HS_1D_AR}	µg/l	1	NONE	< 1.0
TPH - Aromatic >EC8 - EC10 _{HS_1D_AR}	µg/l	1	NONE	< 1.0
TPH - Aromatic >EC10 - EC12 _{EH_1D_AR_MS}	µg/l	10	NONE	< 10
TPH - Aromatic >EC12 - EC16 _{EH_1D_AR_MS}	µg/l	10	NONE	< 10
TPH - Aromatic >EC16 - EC21 _{EH_1D_AR_MS}	µg/l	10	NONE	< 10
TPH - Aromatic >EC21 - EC35 _{EH_1D_AR_MS}	µg/l	10	NONE	< 10
TPH - Aromatic >EC5 - EC35 _{HS+EH_1D_AR_MS}	µg/l	10	NONE	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	NONE	< 3.0
Benzene	µg/l	1	NONE	< 1.0
Toluene	µg/l	1	NONE	< 1.0
Ethylbenzene	µg/l	1	NONE	< 1.0
p & m-xylene	µg/l	1	NONE	< 1.0
o-xylene	µg/l	1	NONE	< 1.0

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

Analytical Report Number : 25-059999

Project / Site name: Hale View road, Huyton

Water matrix abbreviations:

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

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW, GW, Hg - SW, PW, Al - SW, PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	NONE
Sulphide in water	Determination of sulphide in water by ion selective electrode	In-house method	L029-PL	W	NONE
Total Organic Carbon in water	Determination of total organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe, Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE
Total Hardness of water	Determination of total hardness of water by calculation from calcium and magnesium. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045B	W	NONE
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS with carbon banding aliphatic and aromatic	In-house method	L070B	W	NONE
Total Petroleum Hydrocarbons with carbon banding in water by GC-MS/HS-GC-MS	Determination of total petroleum hydrocarbons in water by GC-MS/HS-GC-MS with carbon banding aliphatic and aromatic (Summed Bands)	Calculation	L070B/L088-PL	W	NONE
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	NONE
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5-diphenylcarbazide, followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method by continuous flow analyser	L080-PL	W	NONE
Free cyanide (low level) in water	Determination of free cyanide in water by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Total Petroleum Hydrocarbons in water by HS-GC/MS	Determination of total petroleum hydrocarbons in water by headspace HS-GC/MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	NONE
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	NONE
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	NONE

Analytical Report Number : 25-059999

Project / Site name: Hale View road, Huyton

Water matrix abbreviations:

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

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	NONE

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

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

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

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

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

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

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

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

The result for sum should be interpreted with caution



APPENDIX F

CONTAMINATION ASSESSMENT TABLES (HUMAN HEALTH RISK ASSESSMENT)

METALS DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: **CCG-C-25--15828**

Site name: **Hale View Road, Huyton**

Prepared by: **SHM**

Authorised by: **CB**

Proposed land use: **Residential with plant uptake**

SOM % used: **2.5**



= **Threshold exceeded**



= **Below Limit of detection**

n/t

= **Not tested**

Contaminants			Metals							
			Cadmium	Chromium III	Chromium VI	Copper	Lead	Mercury (elemental)	Nickel	Zinc
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Limit of Detection			0.5	5.0	0.8	5.0	5.0	0.5	5.0	5.0
Human Health Risk Assessment (GAC)			11	910	6	2400	200	1.2	180	3700
Sample Location	Sample Depth (m)	Sample type								
P1	0.3	Soil	0.4	24	< 1.8	68	98	< 0.3	24	140
P2	0.3	Soil	0.3	20	< 1.8	130	160	0.5	43	110
P3	0.3	Soil	0.2	20	< 1.8	60	79	< 0.3	23	96
P4	0.3	Soil	0.2	18	< 1.8	49	62	< 0.3	22	78
P5	0.3	Soil	0.2	19	< 1.8	89	70	< 0.3	25	100
P6	0.3	Soil	0.2	20	< 1.8	86	69	< 0.3	27	120
Human Health Risk Assessment (GAC)			11	910	6	2400	200	1.2	180	3700



SEMI-METALS, NON-METALS, INORGANICS AND OTHER DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: CCG-C-25--15828

Site name: Hale View Road, Huyton

Prepared by: SHM

Authorised by: CB

Proposed land use: Residential with plant uptake

SOM % used: 2.5

 = Threshold exceeded

 = Below Limit of detection

n/t = Not tested

			Semi/non-metals				Inorganics		Other	
Contaminants			Arsenic	Boron	Selenium	Cyanide (free)	Sulphate (water soluble)	Sulphate (water soluble)	pH (units)	Soil Organic Matter %
Units			mg/kg	mg/kg	mg/kg	mg/kg	g/l	mg/l	units	units
Limit of Detection			1.0	0.5	1.0	1.0	0.02	20.0	0.1	0.1
Human Health Risk Assessment (GAC)			37	290	250	22	NA	NA	NA	NA
Sample Location	Sample Depth (m)	Sample type								
P1	0.3	Soil	13	1.2	1.4	< 1.0	-	290	10.4	4.6
P2	0.3	Soil	20	1.3	1	< 1.0	-	156	8.7	7.5
P3	0.3	Soil	13	2.2	< 1.0	< 1.0	-	473	10.9	3.4
P4	0.3	Soil	13	0.9	< 1.0	< 1.0	-	126	8.9	2.4
P5	0.3	Soil	17	0.4	< 1.0	< 1.0	-	71.8	7.9	4.2
P6	0.3	Soil	17	0.6	< 1.0	< 1.0	-	28.9	8.1	4.5
Human Health Risk Assessment (GAC)			37	290	11	22	NA	NA	NA	NA



SPECIATED PAH'S DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: CCG-C-25--15828

Site name: Hale View Road, Huyton

Prepared by: SHM

Authorised by: CB

Proposed land use: Residential with plant uptake

SOM % used: 2.5

 = Threshold exceeded = Below Limit of detection

n/t = Not tested

			PAH's																
Contaminants			Acenaphthene	Acenaphthylene	Anthracene	Benz[a]anthracene	Benzo[a]pyrene	Benzo[b]fluoranthene	Benzo[ghi]perylene	Benzo[k]fluoranthene	Chrysene	Dibenzo[ah]anthracene	fluoranthene	fluorene	Indeno[123-cd]pyrene	Napthalene	Pheanthrene	Pyrene	Total PAH's
Units			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
Limit of Detection			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4
Human Health Risk Assessment (GAC)			510	420	5400	11	2.7	3.3	340	93	22	0.28	560	400	36	5.6	220	1200	NA
Sample Location	Sample Depth (m)	Sample type																	
P1	0.3	Soil	0.16	< 0.05	0.41	1.1	1.1	1.3	0.65	0.59	1.2	0.11	2.4	0.16	0.52	0.17	2	2.2	14.07
P2	0.3	Soil	0.16	< 0.05	0.26	0.89	0.9	1.2	0.53	0.42	0.99	0.14	1.8	0.14	0.42	0.16	1.4	1.8	11.21
P3	0.3	Soil	0.14	< 0.05	0.21	0.67	0.7	0.82	0.51	0.43	0.76	< 0.05	1.3	0.13	0.4	0.38	0.89	1.3	8.64
P4	0.3	Soil	< 0.05	< 0.05	0.05	0.34	0.41	0.53	0.28	0.2	0.43	< 0.05	0.52	< 0.05	0.24	0.09	0.27	0.54	3.9
P5	0.3	Soil	< 0.05	< 0.05	0.12	0.37	0.37	0.61	0.22	0.23	0.49	< 0.05	0.75	< 0.05	0.18	0.23	0.61	0.76	4.94
P6	0.3	Soil	< 0.05	< 0.05	0.13	0.44	0.5	0.72	0.35	0.29	0.53	0.07	0.8	< 0.05	0.29	0.15	0.59	0.86	5.72
Human Health Risk Assessment (GAC)			510	420	11	11	2.7	3.3	340	93	22	0.28	560	400	36	5.6	220	1200	NA



BTEX DATA SUMMARY AND RISK ASSESSMENT SHEET

Job number: **CCG-C-25--15828**

Site name: **Hale View Road, Huyton**

Prepared by: **SHM**

Authorised by: **CB**

Proposed land use: **Residential with plant uptake**

SOM % used: **2.5**

 = **Threshold exceeded**

 = **Below Limit of detection**

n/t = **Not tested**

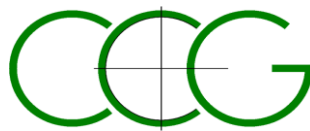
			BTEX			
Contaminants			Benzene	Toluene	Ethylbenzene	Total Xylenes
Units			µg/kg	µg/kg	µg/kg	µg/kg
Limit of Detection			10	10	10	10
Human Health Risk Assessment (GAC)			170	290000	110000	130000
Sample Location	Sample Depth (m)	Sample type				
P1	0.3	Soil	< 5.0	< 5.0	< 5.0	< 5.0
P2	0.3	Soil	< 5.0	< 5.0	< 5.0	< 5.0
P3	0.3	Soil	24	< 5.0	< 5.0	< 5.0
P4	0.3	Soil	< 5.0	31	8.5	< 5.0
P5	0.3	Soil	< 5.0	< 5.0	< 5.0	< 5.0
P6	0.3	Soil	< 5.0	< 5.0	< 5.0	< 5.0
Human Health Risk Assessment (GAC)			170	11	110000	130000



APPENDIX G

GAS / GROUNDWATER MONITORING DATA

GAS AND WATER MONITORING RESULTS



	Date:	04-Nov-25											
	Visit Number	1											
	Atmos Press mb	999											
	Pressure Trend	Steady											
	Air Temp °C	15											
	Cloud cover	Overcast											
	Wind velocity	Breeze											
	Precipitation	DRY											
	State of Ground	DRY											
WS1	CH4 (%):	Nil											
	CO2 (%):	2.6											
	O2 (%):	9.4											
	H2S (ppm):	Nil											
	CO (ppm):	0.0											
	PID (ppm):	0.0											
	Flow (l/hr):	<0.1											
	Water Level (mbgl):	2.08											
WS2	CH4 (%):	Nil											
	CO2 (%):	0.8											
	O2 (%):	19.0											
	H2S (ppm):	Nil											
	CO (ppm):	0.0											
	PID (ppm):	0.0											
	Flow (l/hr):	<0.1											
	Water Level (mbgl):	1.74											
WS4	CH4 (%):	Nil											
	CO2 (%):	0.4											
	O2 (%):	20.3											
	H2S (ppm):	Nil											
	CO (ppm):	0.0											
	PID (ppm):	0.0											
	Flow (l/hr):	<0.1											
	Water Level (mbgl):	1.92											

CCG-CMS-FO-129

Issue 2

Job No: CCG-C-24-14574

Site: Royal Mail NW Hub, Warrington

Instrument:

GFM436



SOIL INFILTRATION DATA

allowance for infiltration through soakaway base: **100%**available on-site infiltration test results: ☒ Yes ☐ No

use soakage trial pit table below

internal surface area of trial pit ' a_{p50} ' [m^2] = 3.95storage volume between 75-25% ' V_p ' [m^3] = 0.56time for water to fall from 75-25% ' t_p ' [min] = 327.00soil infiltration rate ' f ' [m/s] = 7.26E-06

SOAKAGE TRIAL PIT DATA

soakage trial pit width ' W_t ' [m] = **0.50**soakage trial pit length ' L_t ' [m] = **2.50**total depth from ground level ' D_{tb} ' [m] = **2.00**depth to pipe invert level ' D_{tp} ' [m] = **1.10**soakage trial pit effective depth ' D_{teff} ' [m] = 0.90free volume in infill aggregate [%] = **100**

NOTE: faces of excavation assumed to be vertical

Soil Description

0.00 - 1.1mbgl - Dark Brown silty gravelly fine to coarse SAND. Gravel is fine to coarse, angular to subangular brick, ash, coal and concrete (MADE GROUND)

1.1 - 1.5mbgl - Reddish brown sandy slightly gravelly silty CLAY. Gravel is fine to medium angular brick, slate and concrete (MADE GROUND)

1.5 - 2.1mbgl - Reddish brown slightly sandy slightly gravelly CLAY.

* Results extrapolated from linear trend

SOAKAGE TRIAL PIT INFILTRATION TEST RESULTS

water level measurement N ^o :		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18*	19*
Soakage Trial 1	time [min] =	0	1	2	3	4	5	10	20	30	60	120	180	240	300					
	depth to water [m] =	1.10	1.10	1.15	1.20	1.20	1.21	1.28	1.32	1.35	1.41	1.50	1.59	1.62	1.65					
Soakage Trial 2	time [min] =	0	1	2	3	4	5	10	20	30	60	120	180	240	300	360				
	depth to water [m] =	1.10	1.10	1.15	1.18	1.19	1.20	1.25	1.28	1.32	1.37	1.46	1.53	1.58	1.61	1.65				

calculations are based on BRE Guidelines (Digest 365)



SOIL INFILTRATION DATA

allowance for infiltration through soakaway base: **100%**available on-site infiltration test results: ☒ Yes ☐ No

use soakage trial pit table below

internal surface area of trial pit ' a_{p50} ' [m^2] = 3.95storage volume between 75-25% ' V_p ' [m^3] = 0.56time for water to fall from 75-25% ' t_p ' [min] = 339.88soil infiltration rate ' f ' [m/s] = 6.98E-06

SOAKAGE TRIAL PIT DATA

soakage trial pit width ' W_t ' [m] = **0.50**soakage trial pit length ' L_t ' [m] = **2.50**total depth from ground level ' D_{tb} ' [m] = **2.00**depth to pipe invert level ' D_{tp} ' [m] = **1.10**soakage trial pit effective depth ' D_{teff} ' [m] = 0.90free volume in infill aggregate [%] = **100**

NOTE: faces of excavation assumed to be vertical

Soil Description

0.00 - 0.3mbgl - Dark brown silty very gravelly fine to coarse SAND. Gravel is fine to coarse angular to subangular brick, coal, ash and concrete (MADE GROUND)

0.3 - 1.7- Reddish brown gravelly very clayey fine to coarse SAND. Gravel is fine to coarse. (MADE GROUND)

1.7 - 2.1- Brown sandy slightly gravelly silty CLAY.

* Results extrapolated from linear trend

SOAKAGE TRIAL PIT INFILTRATION TEST RESULTS

water level measurement N ^o :		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18*	19*
Soakage Trial 1	time [min] =	0	1	2	3	4	5	10	20	30	40	50	60	120	180	240	300			
	depth to water [m] =	1.10	1.10	1.16	1.21	1.21	1.27	1.32	1.37	1.40	1.46	1.52	1.60	1.68	1.70	1.72	1.75			
Soakage Trial 2	time [min] =	0	1	2	3	4	5	10	20	30	40	50	60	120	180	240	300	360		
	depth to water [m] =	1.10	1.10	1.50	1.90	1.20	1.25	1.29	1.35	1.38	1.40	1.46	1.53	1.59	1.65	1.68	1.71	1.78		

calculations are based on BRE Guidelines (Digest 365)



APPENDIX H

CURRENT CONTAMINATED LAND GUIDANCE / LEGISLATION & RISK ASSESSMENT METHODOLOGIES

CURRENT CONTAMINATED LAND LEGISLATION / GUIDANCE & ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

LEGISLATION OVERVIEW

This report includes hazard identification and risk assessment in line with the risk-based methods referred to in relevant UK legislation and guidance. Government environmental policy is based upon a "suitable for use approach". When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment given the current use and circumstances of the land.

Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

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

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused;
- or
- (b) Pollution of controlled waters is being, or is likely to be, caused."

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

*"the entry into controlled waters of **any** poisonous, noxious or polluting matter or **any** solid waste matter".*

In order to assist in establishing if there is a "significant possibility of significant harm" there must be a "significant pollutant linkage" for potential harm to exist. That means there must be a source(s) of contamination, sensitive receptors present and a connection or pathway between the two. This combination of source-pathway-receptor is termed a "pollutant linkage or SPR linkage."

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations, especially DEFRA Circular 01/2006 Contaminated Land (this replaces DETR Circular 02/2000). Part IIA defines the duties of Local Authorities in dealing with it. With the exception of situations of very high pollution risk, Part IIA places contaminated land responsibility on the planning and redevelopment process. In situations where there is very high pollution risk direct action from the Local Authority is usually necessary. Planning Policy Statement 23 (PPS23) provides guidance on the planning process and requires that sites which have been developed shall not be capable of being determined "contaminated land" under Part IIA.

The criteria for assessing levels of pollutants and hence determining whether a site represents a hazard are based on a range of techniques, models and guidance. Within this context it is relevant to note that Government objectives are:

- (a) to identify and remove unacceptable risks to human health and the environment;
- (b) to seek to bring damaged land back into beneficial use;
- (c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to remediation of contaminated land. The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore should be assessed on a site-by-site basis.

The "suitable for use" approach then consists of three elements:

- (a) ensuring that land is suitable for its current use - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where such risks no longer arise; the contaminated land regime provides the regulatory mechanisms to achieve this;
- (b) ensuring that land is made suitable for any new use, as planning permission is given for that new use - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and
- (c) limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought - in other words, recognising that the risks from contaminated land can be satisfactory assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby running the risk of distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

The mere presence of pollutants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the current and proposed end use of the site.

RISK ASSESSMENT METHODOLOGY

Current practice recommends that the determination of potential liabilities that could arise from land contamination be carried out using the process of risk assessment, whereby "risk" is defined as:

- "(a) The probability, or frequency, or occurrence of a defined hazard; and
- (b) The magnitude (including the seriousness) of the consequences."

The UK's approach to the assessment of environmental risk is set out in by the Department of the Environment (2000) publication "A Guide to Risk Assessment and Risk Management for Environmental Protection." This established an iterative, systematic staged process which comprises:

- (a) Hazard identification
- (b) Hazard assessment
- (c) Risk estimation
- (d) Risk evaluation
- (e) Risk Assessment

At each stage during the investigation process the above steps are repeated as more detailed information becomes available for the site.

CLR11- 'Model Procedures for the Management of Land Contamination', a document published by the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) outlines a tiered approach to the assessment of risks posed by contaminated land, as summarised hereunder:

Tier 1: Preliminary Risk Assessment

A Preliminary Risk Assessment is usually undertaken as part of a desk study, outlines potential risks posed by potential contamination to all receptors by defining plausible "pollution linkages" and developing a preliminary conceptual model (PCM). The purpose of this model is to define all possible complete pollution linkages, where the requisite source – pathway – target elements are present, and these elements being defined as:

- a contaminant (source) is a hazardous substance or agent, present at levels that have the potential to cause harm or damage a receptor
- a pathway is the means by or through which a contaminant comes into contact with, or otherwise affects, the receptor
- a receptor (target) is an entity (human being, aquatic environment, flora and fauna etc) that is vulnerable to the adverse effects of the contaminant

This relationship is termed a "pollution linkage". It should be recognised that for a health or environmental risk to exist, all three elements of the relationship or linkage must be present, i.e.

- if there is no contaminant, or contaminant present at levels below those considered to be harmful or damaging to a receptor, then there can be no adverse effect on a receptor
- if there is no receptor present that can be adversely affected by a contaminant, no harm or damage can arise
- even where both a contaminant and a receptor are present, no harm or damage will occur if there is no pathway by or through which a linkage between the two can be established

The absence of one or more of each component (source, pathway, receptor) would prevent a pollutant linkage being established and there would be no significant environmental risk.

The PCM is subject to continual refinement as additional data becomes available. As part of a Phase I Investigation (Desk Study and site walk over) a PCM is formed. Based on the PCM, potential pollutant linkages can be assessed. If the PCM and hazard assessment indicate that a pollution linkage is not of significance then no further assessment or action is required due to this linkage. For each significant and possible linkage a risk assessment is carried out. The linkages which potentially pose significant risks may require a variety of responses ranging from immediate remedial action or risk management or, more commonly, further investigation and risk assessment. This next stage is usually termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the PCM and assess the level of risk from each pollutant linkage. Risk assessment will usually include Tier 2 Generic Quantitative Risk Assessment and / or, if necessary, a Tier 3 Detailed Quantitative Risk Assessment.

Tier 2: Generic Quantitative Risk Assessment (GQRA)

GQRA requires an intrusive investigation in order to characterise the site assisting in the re-assessment of the source-pathway receptor linkage. The conceptual model should be refined accordingly.

Upon completion of an intrusive investigation it must be decided whether Generic Assessment Criteria (GAC) are suitable for assessing the risk posed by observed contamination at the site. If GAC are deemed unacceptable for risk assessment purposes or cannot be developed, a Tier 3 Detailed Quantitative Risk Assessment (DQRA) is required.

If GQRA reveals that unacceptable risks are not present then no further action is required. If GQRA identifies a possibility of risk, a decision must be made whether further work is required or necessary for the purposes of risk assessment. If further risk assessment is deemed not suitable not required an Options Appraisal should be undertaken. If further risk assessment is required, the scope nature of further risk assessment must be decided – it is possible that a Tier 3 DQRA will be undertaken in this scenario.

Where the Environment Agency have published an SGV for a contaminant, this will be used in the GQRA. For contaminants where an SGV has not been published and an S4UL has been published by LQM/CIEH S4UL's, then this S4UL will be used.

Where an SGV or an S4UL is not available, and a DEFRA C4SL is available, then this C4SL will be used. In house derived GAC's will only be used for contaminants where there is no SGV or LQM S4UL or DEFRA C4SL.

Tier 3: Detailed Quantitative Risk Assessment (DQRA)

DQRA is used when pollutant linkages require further assessment. DQRA is often undertaken for pollutant linkages where GAC are unavailable or inappropriate for or more conservative than the actual circumstances of the site. Site specific data is used to create Site Specific Assessment Criteria (SSAC) and enable a more accurate assessment of the risks. Further investigation may or may not be required to formulate SSAC depending on the site specific conditions and information already obtained.

If DQRA reveals that unacceptable risks are not present then no further action is required. If DQRA identifies a possibility of risk, a decision must be made whether further work is required or necessary for the purposes of risk assessment. If further risk assessment is deemed not suitable not required an Options Appraisal should be undertaken. If further risk assessment is required, the scope and nature of further risk assessment must be decided at this point.

NOTE: A Tier 1 Preliminary Risk Assessment is undertaken as part of a Desk Study Report and a Preliminary Conceptual Model is developed for all pollutant linkages. However, the methodologies for assessing the risks to human health, risks to controlled waters and risk posed by ground gas using quantitative techniques vary considerably, therefore GQRA and DQRA for human health, controlled waters and ground gas must be undertaken separately. The risk assessment methodologies where quantitative assessment is used for risks to human health, risks to controlled waters and risks posed by ground gas, if relevant, are described hereunder.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED TO HUMAN HEALTH

Background

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the EA published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. These reports (CLR7-10) together with associated "SGV" documents have since been withdrawn (August 2008) and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Updated Technical Background to the CLEA model Science Report SC050021/SR3
- Environment Agency : 2008: Human Health Toxicological Assessment of Contaminants in Soil SC050021/SR2

Additional guidance on statistical assessment replacing CLR 7 is provided in:

- CL:AIRE :2008 Guidance on Comparing Data With a Critical Concentration

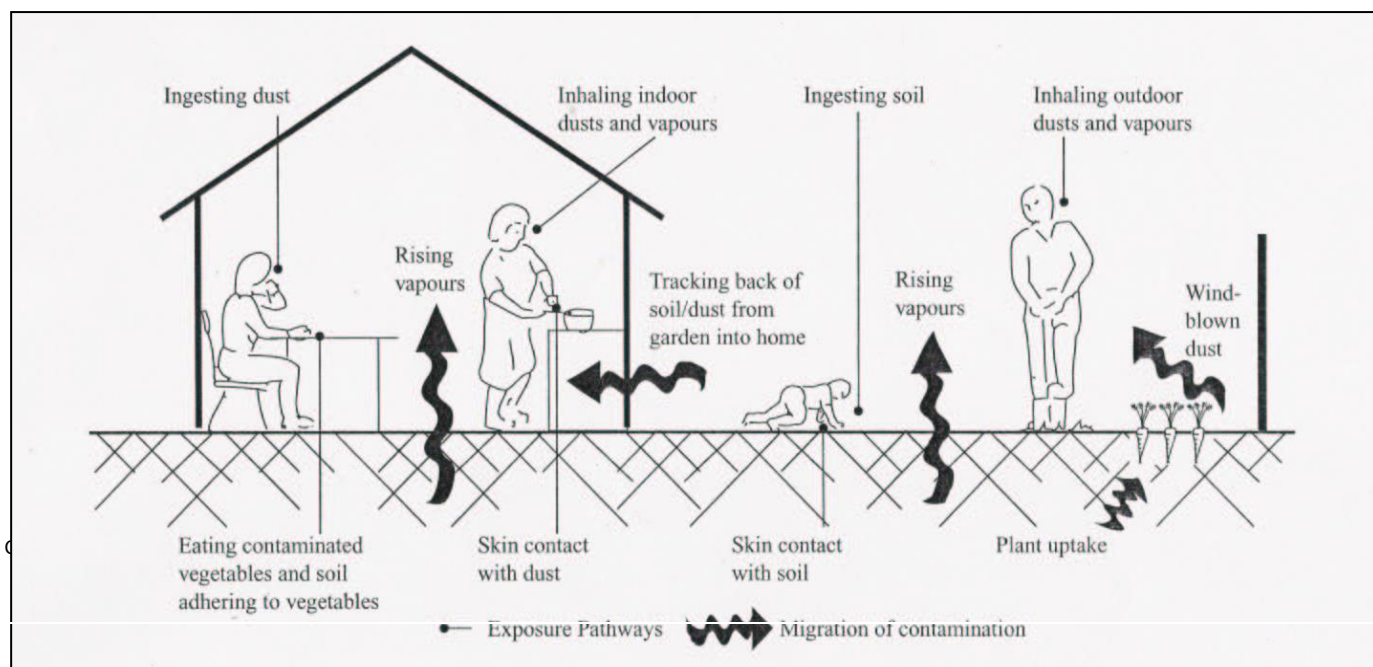
Other guidance/software used in spatial / statistical assessment is provided in:

- USEPA 2006: Data Quality Assessment: Statistical Methods for Practitioners
- Spatial Analysis and Decision Assistance (SADA) – The University of Tennessee

A different approach to the statistical appraisal of data is required depending on whether the assessment of risk is to assess whether land is Contaminated Land in accordance with regulations, or whether the assessment is to determine whether the site is suitable for new development in according with Planning guidance. This is discussed further in CL:AIRE :2008 "Guidance on Comparing Data With a Critical Concentration".

A program for the derivation of GAC's based on the above guidance is provided by the Environment Agency and is entitled "CLEA Software Version 1.06".

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set 'default' exposure pathways. Ten human exposure pathways are covered in the CLEA model as presented below:



(

Ingestion

- ingestion of outdoor soil
- ingestion of indoor dust
- ingestion of home grown produce
- ingestion of soil attached to home grown produce

Dermal Contact

- dermal contact with outdoor soil
- dermal contact with indoor dust

Inhalation

- inhalation of outdoor dust
- inhalation of indoor dust
- inhalation of outdoor soil vapour
- inhalation of indoor soil vapour

It should be noted that there are other potential exposure pathways on some sites not included in the CLEA model e.g. certain organic compounds can pass through plastic water pipes into drinking water supply.

Where contaminated water is present at a depth less than 2mbgl and there is a potential risk of inhalation of vapours (only when volatile compounds are present) the risk from inhalation of vapours from soil water will be assessed using a UK compliant version of BP Risc v4.02.

The presence and/or significance of each of the above exposure pathways are dependent on the type of land use being considered and the nature of the contaminant under scrutiny. Accordingly, the CLEA model considers for principle 'default' land use types and makes a series of 'default' assumptions with regard to human exposure frequency, duration and critical human target groups for each land use considered:

- residential
- allotments
- commercial / industrial land use

The above land use categories defined in the CLEA are detailed below:

Residential: This generic scenario assumes a typical residential property consisting of a two-storey house built on a ground-bearing slab with a private garden consisting of lawn, flowerbeds, and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden area.

Allotments: This generic scenario assumes a plot of open space (about 250 m²), commonly made available by the local authority to tenants to grow fruit and vegetables for their own consumption. There are usually several plots to a site and the overall site area may cover more than a hectare. The tenants are assumed to be parents or grandparents and that young children make occasional accompanied visits to the plot.

Commercial/Industrial: There are many different kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a threestorey building at which employees spend most time indoors and are involved in officebased or relatively light physical work.

Human Health Risk Assessment Methodology

Assessment of risk for the protection of human health is undertaken using the methodology as outlined previously, and summarised hereunder:

- Tier 1 Preliminary Risk Assessment
- Tier 2 Generic Quantitative Risk Assessment
- Tier 3 Detailed Quantitative Risk Assessment

The Tier 1 Preliminary Risk Assessment is undertaken as part of the desk study report and includes the development of a Preliminary Conceptual Model. Tier 2 and Tier 3 Quantitative Risk Assessments are undertaken in order to develop and refine the Preliminary Conceptual Model aiding a more detailed assessment of the risk posed by contaminants revealed by site investigation and soil / soil water chemical analyses.

The methods used by **CC GEOTECHNICAL LTD** to derive assessment criteria, to statistically analyse chemical data and to compare chemical data to the derived assessment criteria are discussed herunder.

Derivation of Generic Assessment Criteria (GAC) and Site Specific Assessment Criteria (SSAC)

GAC's are derived on the basis of the proposed land use and the associated applicable exposure pathways. It should be noted that there are difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be 'unacceptable' and the GAC value does not necessarily equate to the level for "significant possibility of significant harm" as defined in Part IIA of The Environmental Protection Act (1990) to determine whether land is "contaminated." This ultimately requires detailed 'toxicological' information of the health effects of individual contaminants and also a scientific judgement on what constitutes an 'unacceptable' risk. The primary purpose of the CLEA derived GAC's are as 'minimal risk thresholds' for the assessment of human health risks in relation to land use.

Minimal risk thresholds calculated using generic input parameters for each of the above land uses are termed Generic Assessment Criteria (GAC) and are used for Generic Quantitative Risk Assessment (GQRA). However, further assessment may

be required taking into consideration site specific factors such as the way the land is used, the soil type, the building characteristics and the exact nature of the receptor, to determine whether there is a significant possibility of risk to human health to site users. Such an assessment is known as a Detailed Quantitative Risk Assessment (DQRA) and the resultant threshold concentrations are known as Site Specific Assessment Criteria (SSAC). Such assessments should be conducted with the agreement of the local authority (or the Environment Agency) since it is the authority that determines whether land is Contaminated Land or whether Planning Permission for a new development may be granted.

For the purposes of this report, assessment criteria have been derived in accordance with current guidance based on the conceptual model for the proposed land use using the CLEA v1.06 software. These criteria are not intended to indicate whether the site may be contaminated land nor do they replace any published soil guideline values. However, the values are intended to provide guidance for the local authority on whether the site may be considered uncontaminated. If, based on the site's proposed future use, the site would be considered by the local authority to be uncontaminated and therefore, on the basis of soil concentrations, fit for purpose, then no further risk assessment based on soil concentrations and the risk to human health would be necessary. However, should these criteria be exceeded or the conceptual site model vary from the model used in the risk assessment to derive these values then the risk assessment should be updated accordingly.

For contaminants routinely analysed where inhalation is a significant pathway (naphthalene, phenanthrene, Aromatic EC5-EC7, Aromatic EC7-EC8, Aromatic EC8-EC10, Aromatic EC10-EC12, Aromatic EC12-EC16, Aliphatic EC5-EC6, Aliphatic EC8-EC10, Aliphatic EC10-EC12, Aliphatic EC12-EC16), plots of the GAC as a function of Soil Organic Matter (SOM) are used to determine if they pose a potential risk to human health, which are presented hereunder. Where there is an exceedance further assessment may be undertaken.

Statistical Assessment of Soil Contamination Data & Comparison of Contamination Data to Threshold Values

In any site investigation only a small fraction of the soil on the site is analysed. Therefore the mean derived from the contamination data for a contaminant may not be the same as the true mean for the contaminant distribution on the site. To improve the reliability of any assessment a statistical analyses is undertaken in line with the CL:AIRE document "Guidance on Comparing Soil Contamination Data with a Critical Concentration".

Statistical assessment of soil data is undertaken using programs based on the guidance in the CL:AIRE document or the USEPA software ProUCL v4.0.

Where the number of results in a dataset is less than four, a statistical assessment is not undertaken, and the assessment is performed by comparison of the maximum value(s) with a Health Criteria Value (HCV), such as Generic Assessment Criteria value(s).

For the Planning situation, the regulator needs to check whether the concentration of contaminants is low compared to the HCV. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is lower than the HCV.

For the Part IIA scenario the regulator needs to determine whether the concentration of contaminants is greater than the HCV. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is higher than the HCV. However, the regulator may proceed with determination if there is just a 51% probability, "on the balance of probabilities".

The Outlier Test used in the statistical assessment may not be able identify separate populations if numerous populations are present. In order to ensure that this is not the case a spatial assessment of the data will be undertaken using SADA.

If the screening levels are exceeded then more sophisticated quantitative risk assessment or remedial action may be undertaken. The benefits of undertaking a quantitative risk assessment must be weighed against the likelihood that it will bring about cost savings in the proposed remediation.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED TO CONTROLLED WATER

Definition of Controlled Waters

The term 'controlled waters' is defined in Section 104 of the Water Resources Act 1991 as:

"Territorial Waters...which extend seawards for three miles..., coastal waters..., inland freshwaters, waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata."

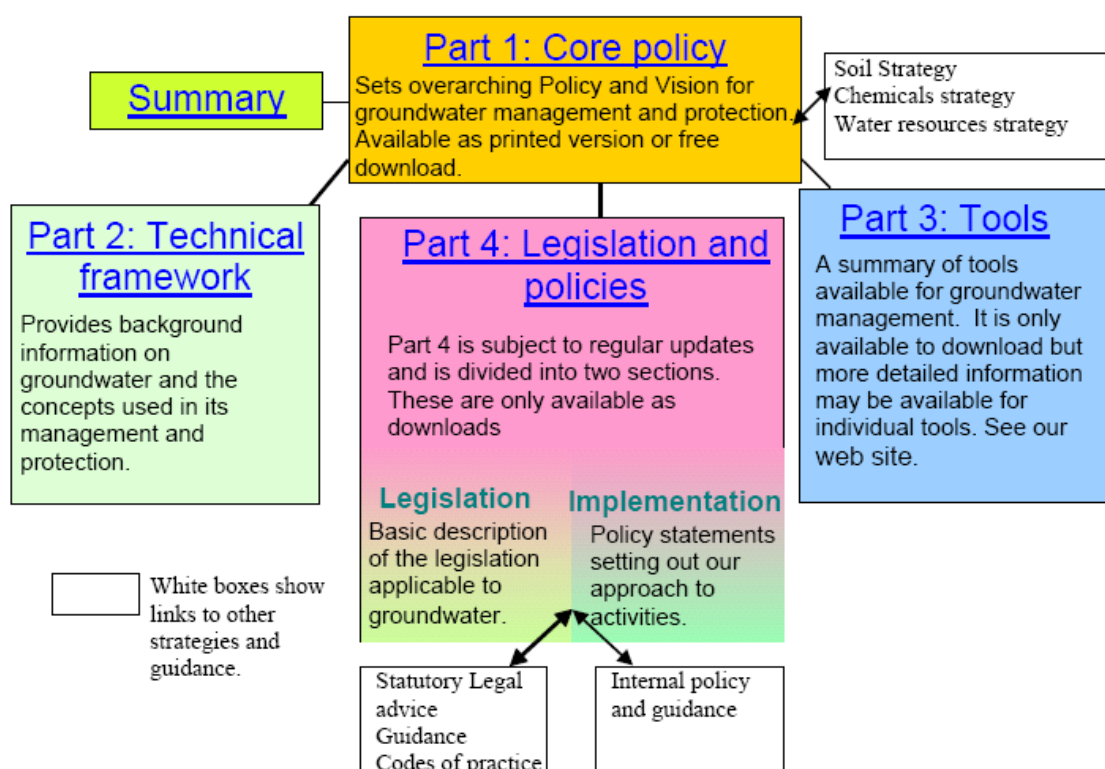
Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes of Part IIA of the Environmental Protection Act 1990, the Environment Agency recommends that the groundwater within the saturated zone only is considered as the receptor (rather than soil / pore water).

Environment Agency Guidance

Legislation and guidance surrounding the protection of controlled waters in the UK is abundant and can be complex. The Environment Agency's overall position on groundwater is "To protect and manage groundwater resources for present and future generation in ways that are appropriate for the risks that we identify" (Groundwater Protection : Policy and Practice GP3, 2006). In brief, the core objectives of the existing legislation serve to enforce this position.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document was influential as it provided a focus for key developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was then revised in 1998, since which there have been substantial changes in legislation, driven by Europe. Key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991. Further to legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the forthcoming Environment Agency Policy document entitled *Groundwater Protection : Policy and Practice (GP3)*, a draft version of which was available for public consultation (Parts 1 to 3) ending July 2006 with Part 4 issued in March 2008. Part 4 includes a section on key groundwater legislation and the Environment Agency's interpretation of it.

The following gives a breakdown of the structure of the document (taken from the Environment Agency GP3 draft consultation document, 2006)



Controlled Water Risk Assessment Methodology

The risk posed to controlled water is assessed by **CC GEOTECHNICAL** in accordance with current guidance as outlined hereunder.

In order for a developer of a potentially contaminated site to fulfil their obligations under the legislation, a site assessment would be required to be undertaken in order to identify any potential risks to controlled waters and to derive suitable clean-up criteria if necessary to ensure the protection of controlled waters. The general approach for Groundwater Protection is detailed further in Part 3 of GP3.

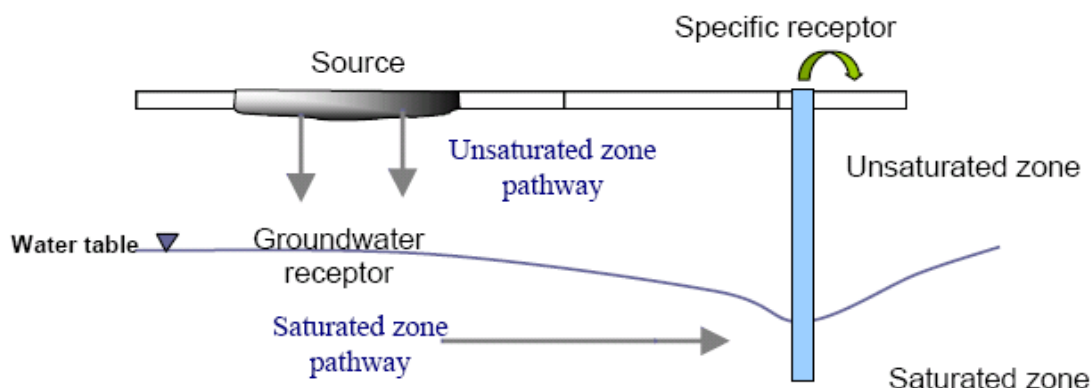
When assessing groundwater impact the Environment Agency advocate the application of their framework methodology "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" Environment Agency (2006). The methodology has four levels of assessment as described below:

- **Level 1** considers whether contaminant concentrations in "pore water" in contaminated soil are sufficient to impact on the receptor, ignoring dilution, dispersion and attenuation along the pathway. The "pore water" concentration is determined from:
 - i) measured "pore water" concentrations or perched water quality
 - ii) soil leaching tests
 - iii) theoretical calculations based on soil/water partitioning equations
- **Level 2** considers dilution by the receiving groundwater or surface water body and whether this is sufficient to reduce contaminant concentrations to acceptable levels. The remedial target is defined as the target concentration multiplied by a dilution factor (DF).
- **Levels 3 and 4** consider whether natural attenuation (including dispersion, retardation and degradation) of the contaminant as it moves through the unsaturated and saturated zones to the receptor are sufficient to reduce contaminant concentrations to acceptable levels. The remedial target is defined as target concentration multiplied by a dilution factor (DF) and attenuation factor (AF). In **Level 3** simple analytical models are used to calculate the significance

of attenuation. The Environment Agency has released a "Remedial targets worksheet v3.1" to carry out basic calculations using a conservative approach up to **Level 3** using basic principles assuming a simple migration of contaminants from the source zone into the aquifer receptor. **Level 4** assessment uses more sophisticated numerical models, and allows for the introduction of additional geological horizons and is used mainly to determine whether soil contaminants will reach their target within a specified timeframe. Use of such software should only be used once agreement has been obtained from the Environment Agency.

Three main stages apply to any risk assessment of controlled waters, these are:

- 1. Risk Screening (Tier 1 Preliminary Risk Assessment):** The understanding of the Conceptual Site Model (CSM) is the key to assessing any site. Using a robust CSM, potential pathways or receptors may be screened out from any further assessment at an early stage. For example if the pathway through the unsaturated zone is blocked by the presence of a significant thickness of low permeability clay. A greater understanding of the CSM is achieved with each tier of risk assessment. An example of a basic CSM is given below (taken from the Environment Agency GP3 draft consultation document, 2006):



- 2. Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Level 1):** When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with screening criteria. Published values of screening criteria with which chemical test results can be compared are published in the following guidance:

- Water Supply (Water Quality) Regulations 2000
- The Private Water Supplies Regulations 1991
- Environmental Quality Standards for surface waters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives)
- The Surface Waters (Abstraction for Drinking Water Classification) Regulations 1996
- World Health Organisation Drinking Water Standards 2004

Should the Level 1 assessment indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions
- To carry out more investigation, sampling and analysis
- To conduct a site specific Detailed Quantitative Risk Assessment (DQRA) to determine if the materials are suitable for their proposed use, or devise site specific clean-up level

- 3. Detailed Quantitative Risk Assessment (EA Remedial Targets Methodology Levels 2 to 4):** The decision to carry out a DQRA will be dependant on the extent and implications of the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the previous levels of assessment. The conceptual model will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment, the remainder having been screened out.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria, if derived, will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or *compliance point*. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

BACKGROUND INFORMATION, CURRENT GUIDANCE AND RISK ASSESSMENT METHODOLOGY FOR RISKS POSED BY GROUND GAS

Background

Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment, the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern; methane and carbon dioxide, and does not apply to other ground gases (e.g. radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table 5 below:

Gas	Source	Comments
Landfill Gas	Anaerobic decomposition of degradable waste within landfill sites. Typically 60% methane and 40% carbon dioxide during methanogenic phase.	Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).
Landfill Associated Gases	- Anaerobic degradation of leachate external to the site; - Degassing of dissolved gases in groundwater; - Evolution of gases following interaction between leachate and groundwater	Can result in secondary (external) production of methane or carbon dioxide.
Made Ground	Anaerobic degradation of organic components	Very variable depending on source
Sewer Gas, Cess Pits	Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.	Often characterised by hydrogen sulphide odour.
Mains Gas	Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.	An odouriser is added to permit detection of leaks. Typically 90% CH ₄ , but 1 to 27% C ₂ -C ₄ alkanes, May also contain other trace gases e.g. CO, helium and CO ₂ (from degradation of CH ₄ in the ground).
Other Anthropogenic Sources	- Degradation of leaked or spilled hydrocarbons or other industrial chemicals; - Anaerobic degradation of organic contaminants in groundwaters (e.g. silage liquor); - Reactions between monitoring well construction components and environment; - Burial grounds/cemeteries.	Hydrocarbon spillages often have an 'oily' odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC's. Can degrade to produce methane / carbon dioxide.
Alluvium / Marsh / Peat Gas	Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.	
Geogenic Gas	Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.	Methane most common but can contain carbon dioxide and higher alkanes.
Mine Gases	Various types. Most common is "fire damp" with high methane, produced by the desorption of gas trapped in coal. "Black damp" (Stythe gas) with high carbon dioxide and denser than air. "White damp" is high in carbon monoxide.	Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.
Natural Shallow Ground Gas	Various types - high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide; - chemical degradation of rocks (e.g. carbonates) producing carbon dioxide; - carbon dioxide production in root zone of soils by plants.	Gases can be emitted from ground under falling barometric pressure conditions.

Table 5. Potential Sources of Ground Gases

This Appendix does not provide guidance for the assessment of risk when other gases are present due to 'Other Sources' from the above table (particularly organic compounds such as BTEX and VOC's or for the risk from radon or hydrogen sulphide).

To determine the origin of the gas a range of factors must be considered together, including;

1. Proximity of likely sources
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc)
3. Properties of gases present including:
 - Chemical composition
 - Physical properties
 - Ratios of components e.g. methane : carbon dioxide
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are most likely.

Hazards Associated with Presence of Methane

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there

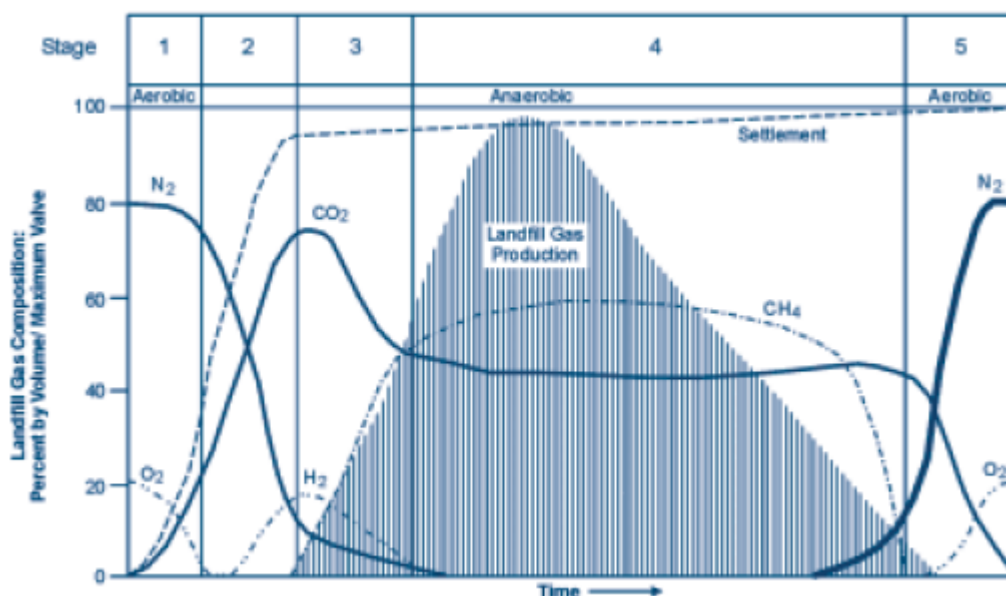
is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Hazards Associated with Presence of Carbon Dioxide

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long Term Occupational Exposure Limit (LTOEL, 8 hour period) and the Short Term Occupational Exposure Limit (STOEL, 15 minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

Parameters Influencing the Rate of Ground Gas Production

The figure below is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:



The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event as marked above, as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;
- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing 'face' for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the commencement of any work on a construction site, and that the ground gas regime is characterised at the worst temporal conditions a site may experience. From this, a risk assessment is carried out to identify the risk at the site from ground gases so that suitable protection measures can be designed and incorporated into a development to prevent a dangerous build-up of gas occurring.

Factors Influencing the Migration and Behaviour of Ground Gases

There are many factors that influence the migration of ground gases which can effect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g. rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

Current Guidance

Previous versions of Building Regulations Approved Document C provided statutory guidance stating that consideration should be given to appropriate action and / or specific solutions in situations where methane concentration exceeded 1%v/v or carbon dioxide concentrations exceeded 5%v/v. The latest Building Regulations Approved Document C (DoE 2004) no longer endorses this approach and recommends the use of a risk based approach to interpreting a gas monitoring survey. This is in line with current EA guidance for landfill gas (LFTGN 03, 2004) which recommends the use of a structured risk based approach similar to that outlined in CLR 11. On this basis, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to "Guidance on the Management of Landfill Gas" (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes;

- **Wilson et al. (CIRIA C665, December 2007) "Assessing Risks Posed by Hazardous Ground Gases for Buildings."**
This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:
 - All development types except low rise housing with gardens (Situation A)
 - Low rise housing with gardens (Situation B)
- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) "Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present."**
This document presents the "Traffic Lights System" detailed below and is relevant only for low rise properties (e.g. bungalows and town houses) that have a ventilated sub-floor void (i.e. Situation B as described in CIRIA C665).
- **British Standard (BS 8485 2015 +A1 2019) "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings"**
This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions.

Further guidance, **Wilson and Card (CIEH) "Ground Gas Handbook for Designers and Regulators"** providing practical guidance on ground gas assessments and the design and evaluation of protection measures, is expected to be published in March 2009.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation.

Ground Gas Risk Assessment Methodology

Assessment of risk posed by ground gas is undertaken using the methodology as outlined previously, and summarised hereunder:

- Tier 1 Preliminary Risk Assessment
- Tier 2 Generic Quantitative Risk Assessment
- Tier 3 Detailed Quantitative Risk Assessment

The methodology used in each of the above assessments with concern to ground gas is discussed hereunder.

Tier 1 Preliminary Risk Assessment

All potential sources of methane and carbon dioxide are identified in the Preliminary Conceptual Model and the generation potential determined. The background information discussed earlier is referred to in order to determine the potential for a source to generate ground gas.

CIRIA C665 provides idealised monitoring frequency / period dependant upon generation potential of gas source and sensitivity of the proposed land use as below:

Idealised Frequency and Period of Monitoring (after Table 5.5a and 5.5b, CIRIA C665)

		Generation Potential of Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4/1	6/2	6/3	12/6	12/12
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with Gardens)	6/3	9/6	12/6	24/12	24/24

Notes

1. First number is the number of readings and the second is the minimum period in months (e.g. 6/2 – six sets of readings over two months).
2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure.

The monitoring programme is decided using the above table prior to the intrusive site investigation. However, if the intrusive investigation reveals that a the potential source is better or worse than anticipated the monitoring programme should be modified accordingly. For example, if the made ground contains no evidence of organic material and comprises entirely granular brick fill, the potential for that made ground to generate ground gas is reduced considerably.

Tier 2 Generic Quantitative Risk Assessment

Generic Quantitative Risk Assessment is undertaken upon completion of the required gas monitoring period.

All three current guidance documents propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\text{GSV (l/hr)} = \frac{[\text{gas well gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

GSV's are compared to typical max concentrations and limiting gas screening values derived for either Situation A - All development except low rise housing with gardens, or Situation B low rise housing with gardens (NHBC Traffic Light System). Table 8.5 from CIRIA C665 is used for comparison of gas screening values for "Situation A Developments" and is presented hereunder:

Characteristic Situation (CIRIA R149)	Comparable Partners in Technology gas Regime (see Box 8.2)	Risk Classification	Gas Screening Value (CH ₄ or CO ₂) (l/hr) ¹	Additional Factors	Typical Source of Generation
1	A	Very low risk	<0.07	Typically methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

Table 8.5 from CIRIA C665 Modified Wilson and Card Classification

Table 8.7 is used for comparison of gas screening values for "Situation B Developments" and is presented herunder:

Traffic Light	Methane ¹		Carbon Dioxide ²	
	Typical max concentration ³ (% by volume)	Gas screening value ^{2,4} (litres/hour)	Typical max concentration ³ (% by volume)	Gas screening value ^{2,4} (litres/hour)
Green	1	0.13	5	0.78
Amber 1	5	0.63	10	1.60
Amber 2	20	1.60	30	3.10
Red				

Notes:

1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decoder as to what Traffic Light is allocated;
2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered;
3. The Typical Maximum Concentration can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

Table 8.7 from CIRIA C665 - NHBC Traffic light system for 150 mm void

Dependant on the outcome of the assessment of risk posed by ground gas it is determined whether gas protection measures are required for the proposed development, and or whether a detailed quantitative risk assessment is required for the site.

Selection & Design of Protective Measures

Table 8.6 and Box 8.4 of CIRIA C665 contain information on the detailed design of protection measures and were initially intended for the purposes of determining then level of protection measures a development requires. These tables and related text include some useful information on the design of gas protection measures, however BS84845:2007, which supersedes the guidance included within CIRIA C665, is used for selection of gas protection measures.

BS8485:2015 +A1 2019 uses a scoring system dependant on the Characteristic Situation / NHBC Traffic Light and proposed end use of the site. The scoring system is summarised in BS8485:2015 + A1 2019 Table 2 as presented hereunder:

Characteristic gas situation, CS	NHBC traffic light	Required gas protection			
		Non-managed property e.g. private housing	Public building (a)	Commercial buildings	Industrial buildings (b)
1	Green	0	0	0	0
2	Amber 1	3	3	2	1 (c)
3	Amber 2	4	3	2	2
4	Red	6 (d)	5(d)	4	3
5			6(e)	5	4
6				7	6

NOTE Traffic light indications are taken from NHBC Report no.:10627-RO1 (04) and are mainly applicable to low-rise residential housing¹. These are for comparative purposes but the boundaries between the traffic light indications and CS values do not coincide.

- a) Public buildings include, for example, managed apartments, schools and hospitals.
- b) Industrial buildings are generally open and well ventilated. However, areas such as office pods might require a separate assessment and may be classified as commercial buildings and require a different scope of gas protection to the main building.
- c) Maximum methane concentration 20% otherwise consider and increase to CS3.
- d) Residential building on higher traffic light/CS sites is not recommended unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.
- e) Consideration of issues such as ease of evacuation and how false alarms will be handled are needed when completing the design specification of any gas protection scheme

¹ The NHBC guidance and CIRIA C665 guidance refers to low rise housing (which is up to three storeys without lifts) that is constructed with a 150mm ventilated sub-floor void.

BS8485:2015 A1 +2019 Table 2 Required gas protection by characteristic gas situation and type of building

Once a score is assigned, a combination of protection systems / elements is chosen from BS8485:2015 +A1 2019 Table 3 shown below:

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
a) Venting/dilution (See Annex A BS8485)			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A	Very good performance	2.5	Ventilation performance in accordance with Annex A (BS8485)
	Good performance	1	If passive ventilation is poor this is generally unacceptable and some form of active system will be required.
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^A		2.5	There have to be robust management systems in place to ensure the continued maintenance of any ventilation system. Active ventilation can always be designed to meet good performance.
Ventilated car park (basement or undercroft)		4	Mechanically assisted systems come in two forms: extraction and positive pressurization.
b) Barriers			
Floor slabs			
Block and beam floor slab		0	It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum. Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.
Reinforced concrete ground bearing slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended floor slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation ^{B,C}		0.5	The performance of membranes is heavily dependent on the quality of design of the installation, resistance to damage after installation, and the integrity of joints.
Proprietary gas resistant membrane to reasonable levels of workmanship /in line with good practice under independent inspection (CQA) ^{B,C}		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail safe.
Permanent monitoring and alarm system ^A	Installed in the underfloor venting/dilution system	2	
	Installed in the building	1	
e) Pathway Intervention			
Pathway intervention		-	This can consist of site protection measures for off-site or on-site sources (see Annex A, BS8485)
NOTE In practice the choice of materials might well rely on factors such as construction method and the risk of damage after installation. It is important to ensure that the chosen combination gives an appropriate level of protection			
A) It is possible to test ventilation systems by installing monitoring probes for post installation validation.			
B) If a 1 200g DPM material is to function as a gas barrier it should be installed according to BRE 212 /BRE 414 being taped and sealed to all penetrations			
C) Polymeric Materials> 1200 g (proportional to thickness) but their physical properties mean that they are more robust and resistant to damage.			

BS8485:2015 + A1 2019 Table 3 Solution Scores

Where the gas situation is 4 or more (and for NHBC Red situations) the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 2 and 3 alone is not sufficient.

For a site which is impacted by migratory gases from an off site source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

CURRENT GUIDANCE ON REMEDIATION

When risk assessment of the site has been completed and it indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA publication CLR11 (2004) "Model Procedures for the Management of Land Contamination." The stages of managing remediation are as follows:

- (a) Options Appraisal and develop Remediation Strategy;
- (b) Develop Implementation Plan and Verification Plan;
- (c) Remediation, Verification and Monitoring.

The Remediation Strategy sets out the remediation targets, identifies technically feasible remedial solutions and presents an evaluation of the options so that these can be assessed enabling that the most suitable solution is adopted. An outline of the proposed remedial method should be presented. Agreement should be sought of the appropriate statutory bodies for the Remediation Strategy before proceeding to the next stage.

The Implementation Plan is a detailed method statement setting out how the remediation is to be carried out including stating how the site will be managed, welfare procedures, health and safety considerations together with practical measures such as details of temporary works, programme of works, waste management licences and regulatory consents required. Agreement should again be sought of the appropriate statutory bodies for this Plan.

The Verification Plan sets out the requirements for gathering data to demonstrate that the remediation has met the required remediation objectives and criteria. The Verification Plan presents the requirements for a wide range of issues including the level of supervision, sampling and testing regimes for treated materials, waste and imported materials, required monitoring works during and post remediation, how compliance with all licenses and consents will be checked etc. Agreement should again be sought of the appropriate statutory bodies for the Verification Plan. On completion of the remediation a Verification Report should be produced to provide a complete record of all remediation activities on site and the data collected as required in the Verification Plan. The Verification Report should demonstrate that the remediation has met the remedial targets to show that the site is suitable for the proposed use.



APPENDIX I

NOTES ON LIMITATIONS

Notes on Limitations For Geoenvironmental and Geotechnical Consultancy Services

General

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The findings and opinions are relevant to the dates when the assessment was undertaken, but should not necessarily be relied upon to represent conditions at a substantially later date. In particular, seasonal groundwater levels, with the effects of precipitation, may affect the conditions found during the investigation. The report should be read in conjunction with the further Notes on Limitations included in Appendix A.

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Phase I Environmental Audits / Desk Studies

The work undertaken to provide the basis of a Phase 1 Desk Study report comprises a study of available documented information from a variety of sources (including the client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in a Desk Study report have been dictated by finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in the report, CC GEOTECHNICAL LTD reserves the right to review such information and to modify the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Factual Ground Investigations

The investigation of the site has been carried out in accordance with the scope and specification instructed by the Client. No interpretations of the data generated by the investigation have been provided or implied. The exploratory holes undertaken in this commission, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. Conditions may exist on the site which have not been detected by the works undertaken. Furthermore, the number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered.

Interpretative Phase II Environmental Audits

The investigation of the site has been carried out with the intention of providing sufficient information concerning the type and degree of contamination, and ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated to potential human targets, building materials, the environment (including adjacent land), and surface and groundwater.

The amount of exploratory work and chemical testing undertaken may have been restricted by factors including inter alia the Clients budget, the available timescale, access to all parts of the site, the existence of buried services etc., and where this is the case, a more comprehensive investigation may be required if the site is to be redeveloped, since a number of important engineering and environmental issues may need further assessment.

For those reasons, if costs have been included in relation to site remediation these must be considered as tentative only and must, in any event, be confirmed by a qualified quantity surveyor.

It must be borne in mind, that the exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The number of sampling points and the methods of sampling and testing do not preclude the existence of localised "hotspots" or more widespread contamination where concentrations may be significantly higher than those actually encountered. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

Geoenvironmental Ground Investigations

The investigation of the site has been carried out within the constraints of Client budget, available timeframe, access to all parts of the site, the existence of buried services and a more comprehensive investigation may be required to provide sufficient information regarding the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions, to formulate a reasonable assessment of the environmental risks together with engineering and development implications.

If costs have been included in relation to the site remediation, these must be confirmed by a qualified quantity surveyor.

The exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of the site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site which have not been disclosed by this investigation, and which have therefore not been taken into account in this report. The findings of the investigation are valid for the time of investigation and the passage of time may result in changes to the contamination status of the site, and a reassessment of the site may be required where significant time has elapsed.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, weather, or other effects.

The risk assessment and opinions provided, inter alia, take into consideration currently available guidance relating to acceptable contamination concentrations and no liability can be accepted for the retrospective effects of any future changes or amendments to these values.