

**CCG-C-25-15775**

**PHASE I GEOENVIRONMENTAL REPORT  
FOR LAND AT ROPEMAKER COURT  
MOSS LANE EAST  
GREATER MANCHESTER  
M14 4PL  
OCTOBER 2025**

Prepared for:

**SPINNAKER ESTATES**

via

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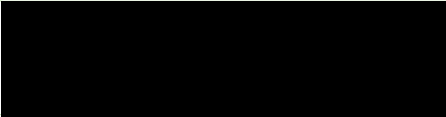
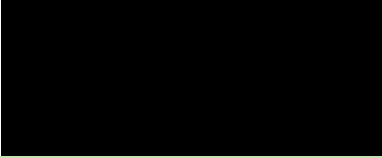
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## DOCUMENT CONTROL FORM

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| Reference Number:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CCG-C-25-15775                                                                                   |  |  |
| Main Author:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Anthony Gerrard BSc (Hons) MSc FGS                                                               |  |  |
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| For and behalf of CC GEOTECHNICAL LTD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                  |  |  |
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## 1.0 INTRODUCTION

CC GEOTECHNICAL LIMITED (CCG) is providing consultancy services to SPINNAKER ESTATES (the *Client*) via CUMMING GROUP in connection with the proposed redevelopment of land at Ropemaker Court, Moss Lane East, Greater Manchester, M14.

It is understood that an existing multi-storey block providing ground floor commercial space with student accommodation on upper floors, located at the junction of Moss Lane East (B5219) and Heald Grove, is to be retained for continued commercial / residential land use.

It is further understood that the land to the rear of the existing building is to be developed by the construction of a student amenity block, 2nr amenity pavilions, and 3nr bicycle storage facilities.

The proposed site layout is as annotated on CUMMING GROUP architectural drawings contained herein.

The proposed development falls within the administrative jurisdiction of MANCHESTER CITY COUNCIL.

This Phase I Desk Study was required to research the history of the site in relation to any potential risks to the integrity of the proposed structure, or the health of construction workers / future worker occupants / future site users (*adults and children*) and, if appropriate, to enable the planning of an intrusive phase of investigation. It was devised to generally comply with the relevant principles and requirements of a wide range of guidance including BS5930:1999 as amended 2007: “*Code of Practice for Site Investigations*”, BS10175: 2011 “*Investigation of Potentially Contaminated Sites - Code of Practice*”, and the ‘Environment Agency Report ‘*Land Contamination Risk Management*’ (LCRM) procedures, July 2023,

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

## 2.0 PURPOSE & AIMS OF THE STUDY

The primary aim of the Phase I Desk Study was to assess whether the site is likely to be affected by contamination to an extent that it may pose a risk to human health and/or the built environment and/or the wider natural environment or is affected by any other natural or man-made features which may impact on the proposed redevelopment.

Specific tasks undertaken to achieve these objectives were as follows:

- Undertaking of a review of available historical mapping, environmental databases, and Environment Agency data
- Undertaking of a site walkover inspection
- Development of Preliminary Conceptual Model
- Development of a Phase 2 intrusive investigation strategy

## 3.0 SITE DATA

### 3.1 Site Location

The site is located immediately to the south and east of public pavements extending along Moss Lane East and Heald Grove, Greater Manchester, M14 4PL as illustrated on CCG Drawing No. CCG-C-15775-1 and Aerial Plate No. CCG-C-15775-2 contained within Appendix A.

The ORDNANCE SURVEY coordinates for the site centre are 384962 395632. The approximate site centre stands at an elevation of around 38.5maOD.

### 3.2 Site Description & Walkover Observations

The site was visited during October 2025 on completion of a review of relevant historical and environmental mapping data (contained within Appendix D).

It was observed that that the site is situated within a mixed residential / commercial context. It comprises an irregularly shaped parcel of land which extends to the approximate dimensions of c. 113m x 70m; its long axis being on a north – south alignment. The footprint of the site equates to around c. 4845 m<sup>2</sup>.

The site is bound to the north and west by public pavements extending along Moss Lane East and Heald Grove, respectively, with a combination of single storey - 4-storey developments fronting onto Wilmslow Road, adjoining the eastern site boundary. The southern site

boundary is adjoined by further student accommodation blocks which are seen to be readily accessible *via* Great Western Street.

The external topography across the site was seen to be sensibly flat with surface cover generally consisting of hard pavement cover with areas comprising communal species grassed lawns.

Given that the site is currently utilised for mixed residential / commercial use there is a potential for the presence of buried services (*i.e. gas, electricity, water mains etc.*) to be present beneath the site.

At the time of undertaking a site walkover survey, there was no visual evidence of the presence of native and/or non-native plant species within, or on land adjoining, the study site

Access to the site is currently from the public pavements extending along Wilmslow Road to the east.

The information obtained from the visit is summarised in Table 1 hereunder.

**Table 1: Summary of Walkover Observations**

| FEATURE                       | OBSERVATION                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Current Use of Land           | Educational / commercial land use                                                                                                                                                                                                                                                                                                                        |
| Context                       | Commercial / residential context                                                                                                                                                                                                                                                                                                                         |
| Topography / Surfaces         | The surface topography across the site was seen to be generally flat with surface cover generally consisting of poorly maintained hard pavement cover with isolated pockets of mixed perennial grasses and ruderal herbs established within the failed areas.                                                                                            |
| Dimensions                    | c. 31m x 22m; its long axis being on a north – south alignment. The footprint of the site equates to around c. 654m <sup>2</sup> .                                                                                                                                                                                                                       |
| Access                        | Access to the site is currently from the public pavements extending along Wilmslow Road to the east.                                                                                                                                                                                                                                                     |
| Services                      | Given that the site was previously utilised for commercial use there is a potential for the presence of buried services ( <i>i.e. gas, electricity, water mains etc.</i> ) to be present beneath the site. As shown within the appended photographs, 2nr rectangular metal covers associated with buried services are present within the pavement cover. |
| Material storage              | None observed                                                                                                                                                                                                                                                                                                                                            |
| Waste disposal                | None observed                                                                                                                                                                                                                                                                                                                                            |
| Other potential contamination | Contaminants associated with former land uses & remnants of historical demolition debris<br>Hydrocarbons associated with on-site car parking facilities                                                                                                                                                                                                  |
| Ecology*                      | At the time of undertaking a site walkover survey, there was no visual evidence of the presence of native and/or non-native plant species within, or on land adjoining, the study site                                                                                                                                                                   |

*\*These comments on the ecology are for initial preliminary assessment only and are based on observations undertaken by a person who is a trained ecologist but who has not undertaken a comprehensive Phase I Habitat Survey or similar.*

#### 4.0 SITE HISTORY & POTENTIALLY CONTAMINATIVE USES / RISKS OF UXO

The history of the site and its immediate surrounds was investigated by consultation with a range of archive resources. Geographical information, historical mapping, and environmental data were primarily based on a GroundSure Environmental Report (Reference No. CMAPS-AAG-1244185-4165-021025, dated October 2025), presented in Appendix D.

A summary of the historical mapping data is given hereunder:

**Table 2: Historical Map Review**

| YEAR                                                           | SCALE                                                                      | ON SITE                                                                                                                                                                                                                                                                                                                                                                                                       | ADJACENT TO SITE                                                                                                                                                                                            | <250M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1846-1849<br>1848<br>1880-1883<br>1891<br>1891<br>1893<br>1896 | 1:10,560<br>1:1,056<br>1:10,560<br>1:2,500<br>1:500<br>1:2,500<br>1:10,560 | Northern section of the site developed for what appears to be commercial / light industrial land uses with a development of unspecified building being erected within the NE section of the site around c. 1891.<br><br>Southern section of the site undeveloped until around c. 1891, after which the site has been developed as a tram depot (Manchester Carriage & Tramway Depot) with associated sidings. | Public pavements extending along the W & N site boundaries.<br>Land adjacent the NE section of the site developed for commercial land use (Moss House)<br>Land to the S/SE fully developed as a tram depot. | Land to the NW, N, NE & E developed for mixed commercial / light industrial & recreational land use.<br><br>80m W/SW development of residential properties fronting onto Parkfield Street<br>c. 100m S. Laundry & associated drying ground<br>Land to the NE developed for residential land use<br>100m S/ SE land developed for residential land use.<br>c. 50m W/SW land developed for residential land use by 1891<br>c. 100-250m S/SE land fully developed for mixed residential land use<br>c. 150m E. Oaklands House & associated grounds |

|                                                               |                                                                 |                                                                                                    |                                                                                                                                                                   |                                                                                                                                                                                                                                          |
|---------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1905<br>1908                                                  | 1:10,560<br>1:2,500                                             | Land at the junction of Moss Lane East & Heald Grove redeveloped for continued commercial land use | Depository adjoining the SE site boundary                                                                                                                         | Significant redevelopments of land fronting onto Wilmslow Rd to the E of the site with redevelopments being associated with residential land use.<br>Additional residential properties erected on land c. 80m S/SW & W of the study site |
| 1915-1918                                                     | 1:10,560                                                        | No significant change                                                                              | No significant change                                                                                                                                             | No significant change                                                                                                                                                                                                                    |
| 1922<br>1923                                                  | 1:2,500<br>1:10,560                                             | Building extending along the W section of the site named Whitworth Park Factory (handkerchiefs)    | No significant change                                                                                                                                             | Site of nearby Oakland House renamed Fielden School<br>200m N. St. Mary's Hospital & associated grounds                                                                                                                                  |
| 1933<br>1933-1934<br>1934-1938<br>1938                        | 1:2,500<br>1:10,560<br>1:10,560<br>1:10,560                     | No significant change                                                                              | Land to the S of site renamed Coach Works<br>Land S of the building fronting onto Moss Lane East developed for commercial land use (Depository)                   | c. 20m NE. Daimler Motors Works<br>c. 50m SE. Theatre<br>c. 80m NE. Britania Quilt Works<br>200m NE. Condor Works (clothing)<br>c. 120m N. Unspecified works<br>c. 200m NE. St Gabriel's Church                                          |
| 1946-1950                                                     | 1:1,250                                                         | No significant change                                                                              | No significant change                                                                                                                                             | Land c. 50m E renamed Depository<br>c. 120m S. Bakery<br>c. 130m NE. Motor Vehicle works                                                                                                                                                 |
| 1950<br>1950-1951<br>1951<br>1955<br>1955-1956                | 1:2,500<br>1:1,250<br>1:1,250<br>1:2,500<br>1:10,560            | No significant change                                                                              | No significant change                                                                                                                                             | No significant change                                                                                                                                                                                                                    |
| 1965-1968                                                     | 1:10,560                                                        | No significant change                                                                              | No significant change                                                                                                                                             | No significant change                                                                                                                                                                                                                    |
| 1970<br>1973-1976                                             | 1:1,250<br>1:10,000                                             | Insufficient mapping data                                                                          | No significant change                                                                                                                                             | Daimler Motors Works & Britania Quilt Works no longer shown, the site of redeveloped by the construction of a large irregular shaped motor vehicle repair workshop                                                                       |
| 1980-1983<br>1983-1987<br>1985-1989<br>1989-1991<br>1988-1991 | 1:10,000<br>1:1,250<br>1:10,000<br>1:1,250<br>1:10,000          | Site appears to have been partially redeveloped for continued commercial land use (factory)        | Land adjoining the S/SE site boundary cleared of former structures                                                                                                | Land c. 80m > 230m S cleared of all former structures<br>Some residential properties c. 130m SW demolished with land being taken over as allotment gardens<br>c. 100m E. Garage                                                          |
| 1991<br>1991-1992<br>1993<br>1993-1994<br>1993-1994<br>1994   | 1:2,500<br>1:1,250<br>1:1,250<br>1:1,250<br>1:1,250<br>1:10,000 | No significant change                                                                              | Land adjoining the S site boundary redeveloped for commercial land use (Job Centre) with 2nr adjoining electrical substations                                     | Land c. 80 > 200m S redeveloped for mixed residential / commercial land use.<br><br>c. 80m S. Children's Centre with associated grounds.<br>Nearby motor vehicle repair workshop renamed garages                                         |
| 2001<br>2003<br>2010<br>2025                                  | 1:10,000<br>1:1,250<br>1:10,000<br>1:10,000                     | No significant change shown upon 2001 – 2010 mapping data                                          | Land to the SE site boundary redeveloped for commercial land use (Manchester?)<br>Land adjoining the NE site boundary shown to comprise PH with an adjoining Bank | Land extending along Wilmslow Road shown to be redeveloped on 2003 mapping data for commercial land use<br>10m W. Heald Court<br>50m S. Club                                                                                             |

In addition to the above, an appended 'Zetica UXO' Bomb Risk Map (Reference No. 384972-395672, dated October 2025, contained with Appendix D) shows the site to be within an area where it is believed that between c. 15 to 49 bombs per 1000 acres may have been deposited during World War II. However, UXO mapping data also shows that there were no facilities such as military installations, utilities, industry, and/or airfields etc. within the local area which the German Luftwaffe may have deemed to be viable targets. In addition, there are no records regarding the identification of unexploded ordinance within, or within 250m of, the study site since the end of WW2 hostilities.

Taking into account the above observations and given that the site has remained continually developed since around 1891, through to present day, it is concluded that the risk of the potential presence of unexploded ordinance at this site is 'Low'.

## 5.0 ENVIRONMENTAL SETTING

### 5.1 Documented Geology

The geology of the site was researched by reference to Crofts. R.G. *et.al.* (2012): '*The Geology of the Manchester district—a brief explanation of the geological map, sheet 85 Manchester*' Memoirs of The Geological Survey of Great Britain. London: Her Majesties Stationery Office, and the **BRITISH GEOLOGICAL SURVEY (BGS)** 1:50, 000 scale Sheet 085 Manchester (2010 - 2011), and 1:10, 000 scale (Solid and Drift Editions) geological mapping data.

The **BGS** 1:10, 000 Scale Drift Geological map indicate that the site is underlain with impermeable diamictons (*formerly known as boulder clay*) consisting of poorly stratified gravel sands silt and clay deposits of post glacial origin (*Pleistocene Epoch - Late Quaternary - Devensian Sub Age*).

The solid bedrock geology underlying the study site is documented to comprise the Chester Formation (formerly the Chester Pebble Beds) of the Sherwood Sandstone Group, comprising red – brown horizontally-bedded conglomerate with subordinate lenticular beds of trough cross-bedded pebbly sand with localised argillaceous mudstone bedding of the Early Triassic Period (*Mesozoic Era Olenekian Age*).

There are no records pertaining to the presence of geological lines of weakness (*i.e. coal seams, geological faults etc.*) within, or within 500m of, the study site.

The appended environmental report states that the site is located within an area where it is believed that less than 1% of the properties within the local area are affected by naturally occurring Radon. Hence Radon protection measures for developments in contact with the ground are not required.

Geological Information obtained from the GroundSure Environmental Report is presented in Appendix D, and summarised hereunder:

**Table 3: Summary of Geological Data from GroundSure Report**

| GEOLOGY                                     |                      |                                                                                                                                                                                                            |
|---------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data                                        | Distance             | Comments                                                                                                                                                                                                   |
| Artificial Ground                           | N/A                  | If present, artificial ground and/or reworked ground deposits associated with the development of the site & its immediate surroundings                                                                     |
| Superficial Deposits / Drift Geology        | On Site              | Diamictons of glacial origin                                                                                                                                                                               |
| Permeability of Diamictons                  | Maximum Permeability | High                                                                                                                                                                                                       |
|                                             | Minimum Permeability | Low                                                                                                                                                                                                        |
| Bedrock and Solid Geology                   | On Site              | Chester Formation                                                                                                                                                                                          |
| Permeability of Bedrock: On Site            | Maximum Permeability | High                                                                                                                                                                                                       |
|                                             | Minimum Permeability | Moderate                                                                                                                                                                                                   |
| Geological Lines of Weakness                | On Site              | No records                                                                                                                                                                                                 |
|                                             | <250m                | No records                                                                                                                                                                                                 |
| Radon Affected Area                         | On Site              | The appended environmental report states that the site is located within an area where it is believed that less than 1% of the properties within the local area are affected by naturally occurring Radon. |
| Radon Protection                            | On Site              | Full Radon Protection Measures will not be required for new structures in contact with the ground.                                                                                                         |
| MINING, GROUNDWORKINGS AND NATURAL CAVITIES |                      |                                                                                                                                                                                                            |
| Data                                        | Distance             | Comments                                                                                                                                                                                                   |
| BritPits                                    | <500m                | No records                                                                                                                                                                                                 |
| Surface ground workings                     | <250m                | 5m E Depository 1923<br>181m NW Pond – 1905 - 1956                                                                                                                                                         |
| Underground workings                        | <1000m               | No records                                                                                                                                                                                                 |
| Underground mining extents                  | <500m                | No records                                                                                                                                                                                                 |
| Historical Mineral Planning Areas           | <500m                | No records                                                                                                                                                                                                 |
| Non-coal mining                             | <500m                | No records                                                                                                                                                                                                 |
| The Coal Authority non-coal mining          | <500m                | No records                                                                                                                                                                                                 |
| Researched mining                           | <500m                | No records                                                                                                                                                                                                 |
| Mining record office plans                  | <500m                | No records                                                                                                                                                                                                 |
| BGS mine plans                              | <500m                | No records                                                                                                                                                                                                 |
| Coal mining                                 | On site              | On site The site is located within a coal mining area as defined by the Coal Authority. A Consultants Coal Mining Report is recommended to further assess coal mining issues at the site.                  |
| Brine areas                                 | On site              | No records                                                                                                                                                                                                 |
| Gypsum areas                                | On site              | No records                                                                                                                                                                                                 |
| Tin mining                                  | On site              | No records                                                                                                                                                                                                 |
| Clay mining                                 | On site              | No records                                                                                                                                                                                                 |
| Natural cavities                            | <500m                | No records                                                                                                                                                                                                 |
| Mining cavities                             | <1000m               | No records                                                                                                                                                                                                 |
| Reported recent incidents                   | <500m                | No records                                                                                                                                                                                                 |
| Historical incidents                        | <500m                | No records                                                                                                                                                                                                 |
| National karst database                     | <500m                | No records                                                                                                                                                                                                 |
| HAZARDS                                     |                      |                                                                                                                                                                                                            |
| Data                                        | Distance             | Comments                                                                                                                                                                                                   |
| Maximum shrink swell clays                  | On site              | Very Low                                                                                                                                                                                                   |
| Maximum running sands                       | On site              | Very Low                                                                                                                                                                                                   |
| Maximum compressible deposits               | On site              | Negligible                                                                                                                                                                                                 |
| Maximum collapsible deposits                | On site              | Very Low                                                                                                                                                                                                   |
| Maximum landslides                          | On site              | Very Low                                                                                                                                                                                                   |
| Maximum ground dissolution of soluble rocks | On site              | Negligible                                                                                                                                                                                                 |

## 5.2 Historical Coal Mining

The appended environmental report states that the site is located within an area which may be underlain with productive coal seams which

may have been worked in the pasted. Based on this observation a **COAL AUTHORITY 'Consultants Mining Report'** (Report Ref' No. 51003528761001, dated October 2025) was procured. A summary of which is presented hereunder:

1. There are no records relating to historical coal mining activities within, or within 500m of, the study site
2. There are no records relating to the presence of spin roadway at shallow depth (<30mbgl) and/or unrecorded shallow mine workings beneath the site and/or the adjoining area from which coal may have been extracted using underground mining methods
3. There are no historical mine entries within, or within 100m of, the study site
4. There are no records relating to the presence coal related outcrops within the surrounding area
5. There are no records relating to the presence of open cast works from which coal may have been extracted using open cast methods, within, or within 500m of, the study site
6. There are no records relating to the migration of mine related gases within, or within 500m of the study site

Based on the above assessment and taking into account the nature of the underlying bed rock formation (Chester Formation), it is concluded that the site is not at risk at the surface of instability arising from historical shallow coal mining activities. Hence, no intrusive ground investigation associated with historical coal mining activities are proposed.

### 5.3 Hydrology and Hydrogeology

Information on hydrology and hydrogeology obtained from a GroundSure Environmental Report is presented in Appendix D, and summarised hereunder:

**Table 5: Summary of Hydrology and Hydrogeological Data from GroundSure Environmental Report**

| HYDROGEOLOGY AND HYDROLOGY                    |         |                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aquifer within Drift Deposits                 | On site | <b>Diamictons Secondary Undifferentiated Aquifer:</b> 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 | <b>Chester Formation - Principal:</b> 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                               |
| Groundwater Abstraction Licenses              | <1000m  | No records                                                                                                                                                                                                                                                                                                     |
| Surface Water Abstraction Licenses            | <1000m  | No records                                                                                                                                                                                                                                                                                                     |
| Potable Water Abstraction Licences            | <1000m  | No records                                                                                                                                                                                                                                                                                                     |
| Source Protection Zones                       | <500m   | On site Zone III - Total catchment                                                                                                                                                                                                                                                                             |
| Source Protection Zones (confined aquifer)    | <500m   | No records                                                                                                                                                                                                                                                                                                     |
| Water Network (OS Mastermap)                  | <200m   | No records                                                                                                                                                                                                                                                                                                     |
| Surface water features                        | <250m   | No records                                                                                                                                                                                                                                                                                                     |
| WFD Surface water body catchments             | On Site | On site Irwell / Manchester Ship Canal (Irk to confluence with Upper Mersey - Irwell)                                                                                                                                                                                                                          |
| WFD Surface water bodies                      | <250m   | No records                                                                                                                                                                                                                                                                                                     |
| WFD Groundwater bodies                        | <250m   | On site Manchester and East Cheshire Permo-Triassic Sandstone Aquifers<br>Overall rating: Poor [2019]                                                                                                                                                                                                          |
| 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         | <100m   | No records                                                                                                                                                                                                                                                                                                     |
| Flood Storage Areas                           | <250m   | No records                                                                                                                                                                                                                                                                                                     |
| Flood Zone II                                 | <50m    | No records                                                                                                                                                                                                                                                                                                     |
| Flood Zone III                                | <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 | Moderate-High                                                                                                                                                                                                                                                                                                  |
|                                               | <50m    | Moderate-High                                                                                                                                                                                                                                                                                                  |

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 6: 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 |
| Chester 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 Aquifer                  |

## 6.0 FURTHER ENVIRONMENTAL DATA

Environmental data was researched using several sources including Environment Agency Maps and GroundSure Envirosight Report presented in Appendix D and is summarised hereunder in Table 6. This environmental data has been used to carry out a Preliminary Qualitative Risk Assessment (Tier 1) and formulate the preliminary conceptual model as discussed in Section 8.0 of this report.

**Table 7: Summary of Environmental Data**

| POTENTIALLY CONTAMINATIVE USES IDENTIFIED FROM 1:10,000 SCALE MAPPING |          |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data                                                                  | Distance | Comments                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Historical industrial land uses                                       | <250m    | On site Unspecified Commercial/Industrial 1934<br>On site Unspecified Factory 1915 – 1923<br>5m E Depository 1923<br>16m N Infirmary<br>50m NE Quilt Works<br>58m NE Unspecified Works<br>68m S Laundry<br>72m S Laundry<br>79m E Unspecified Works<br>174m N Hospital<br>177m N Hospital<br>184m N Hospital<br>189m N Hospital<br>191m N Hospital<br>215m NW Boat House<br>236m NE Unspecified Laboratory<br>243m NW Boat House |
| Historical tanks                                                      | <250m    | No records                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Historical energy features                                            | <250m    | 17m S Electricity Substation<br>27m S Electricity Substation                                                                                                                                                                                                                                                                                                                                                                     |
| Historical petrol stations                                            | <250m    | No records                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Historical garages                                                    | <250m    | On site Garage 1991<br>12m W Garage<br>49m NE Garage<br>51m NE Motor Repair Works<br>52m E Motor Repair Works<br>52m NE Garage<br>56m NE Motor Repair Works<br>57m E Motor Repair Works<br>57m E Garage<br>65m NE Garage<br>77m SE Garage<br>80m NE Motor Repair Works<br>81m E Garage<br>88m SE Garage<br>89m NE Motor Repair Works                                                                                             |
| Historical military land                                              | <250m    | No records                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Records of Current Industrial Land Use                                |          |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Data                                                                  | Distance | Comments                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Recent industrial land uses                                           | <250m    | 22m S Electricity Sub Station<br>86m E Shell<br>131m SW Electricity Sub Station<br>147m E Diamond Telecommunications<br>211m SE Industrial Estate<br>236m E Electricity Sub Station                                                                                                                                                                                                                                              |
| National Geographic Database (NGD) - Current or recent tanks          | <250m    | No records                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Current or recent petrol stations                                     | <250m    | 46m W. – Obsolete<br>98m SE – Obsolete<br>117m E – Shell – Open                                                                                                                                                                                                                                                                                                                                                                  |

|                                                 |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 |                 | 226m W - Obsolete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Electricity cables                              | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Gas pipelines                                   | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Sites determined as Contaminated Land           | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Control of Major Accident Hazards (COMAH)       | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Regulated explosive sites                       | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Hazardous substance storage/usage               | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical licensed industrial activities (IPC) | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Licensed industrial activities (Part A(1))      | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Licensed pollutant release (Part A(2)/B)        | <250m           | 82m SW Save, Moss Lane - Status: Historical Permit - Permit Type: Part B<br>90m E Moss Side Service Station, - Status: Historical Permit - Permit Type: Part B<br>93m E Rusholme Service Station - Status: Current Permit - Permit Type: Part B<br>101m E Green Bros Ltd, Condor Wks - Status: Historical Permit - Permit Type: Part B<br>115m SE Rusholme Serv Stn - Status: Historical Permit - Permit Type: Part B<br>249m E Manchester Garages Ltd - Status: Historical Permit - Permit Type: Part B |
| Radioactive Substance Authorisations            | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Licensed Discharges to controlled waters        | <250m           | 154m NW - Permit Number: 016982917 - Permit Version: 2<br>154m NW - Permit Number: 016982917 - Permit Version: 3<br>154m NW - Permit Number: 016982917 - Permit Version: 1<br>238m SE - Permit Number: 01MAN0382 - Permit Version: 1                                                                                                                                                                                                                                                                     |
| Pollutant release to surface waters (Red list)  | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pollutant release to public sewer               | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| List 1 Dangerous Substances                     | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| List 2 Dangerous Substances                     | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pollution Incidents (EA/NRW)                    | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pollution inventory substances                  | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pollution inventory waste transfers             | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Pollution inventory radioactive waste           | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>WASTE AND LANDFILL</b>                       |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Data</b>                                     | <b>Distance</b> | <b>Comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Active or recent landfill                       | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical landfill (BGS records)               | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical landfill (LA/mapping records)        | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical landfill (EA/NRW records)            | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical waste sites                          | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Licensed waste sites                            | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Waste exemptions                                | <250m           | 227m N St. Marys Hospital - WEX132662 / Use of waste in construction<br>249m S Rusholme Health Centre - WEX331639 / Sorting and de-naturing of controlled drugs for disposal<br>249m SE 58, Wilmslow Road - WEX331625 / Sorting and de-naturing of controlled drugs for disposal                                                                                                                                                                                                                         |
| <b>ENVIRONMENTAL DESIGNATIONS</b>               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Data</b>                                     | <b>Distance</b> | <b>Comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Sites of Special Scientific Interest (SSSI)     | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Conserved wetland sites (Ramsar sites)          | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Special Areas of Conservation (SAC)             | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Special Protection Areas (SPA)                  | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| National Nature Reserves (NNR)                  | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Local Nature Reserves (LNR)                     | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Designated Ancient Woodland                     | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Biosphere Reserves                              | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Forest Parks                                    | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Marine Conservation Zones                       | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Green Belt                                      | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Proposed Ramsar sites                           | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Possible Special Areas of Conservation (PSAC)   | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Potential Special Protection Areas (pSPA)       | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Nitrate Sensitive Areas                         | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Nitrate Vulnerable Zones                        | <500m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>RAILWAY INFRASTRUCTURE AND PROJECTS</b>      |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Data</b>                                     | <b>Distance</b> | <b>Comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Underground railways                            | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Railway tunnels                                 | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical railway and tunnel features          | <100m           | On site Tramway Sidings 1893                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Royal Mail tunnels                              | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Historical railways                             | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Railways                                        | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Crossrail 2                                     | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| HS2                                             | <250m           | No records                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## 7.0 PREVIOUS SITE INVESTIGATIONS / REPORTS

Searches and consultations have established that no previous ground investigation works have been undertaken on this site.

## 8.0 PRELIMINARY QUALITATIVE RISK ASSESSMENT (TIER 1)

### 8.1 Introduction

Based on the foregoing study, there is a potential for the presence of contamination associated with the historic developments on the site and/or immediately adjoining the study site, and previous land uses and hence a preliminary risk assessment was undertaken.

The risk assessment methodologies adopted by **CCG** are based on current available guidance from several sources and are included in Appendix D.

The Tier 1 Risk Assessment and Preliminary Conceptual Model (PCM) were formulated using the information discussed above and based on the following assumptions:

- It is understood that an existing multi-storey block providing ground floor commercial space with student accommodation on upper floors, located at the junction of Moss Lane East (B5219) and Heald Grove, is to be retained for continued commercial / residential land use.

It is further understood that the land to the rear of the existing building is to be developed by the construction of a student amenity block, 2nr amenity pavilions, and 3nr bicycle storage facilities.

- 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 8 - 11 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 8: 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 9: Classification of Consequence**

| Classification | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Severe</b>  | Highly elevated concentrations <b>likely</b> to result in “significant harm” to human health as defined by the EPA 1990, Part 2A, if exposure occurs.<br><br>Equivalent to EA <b>Category 1</b> 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.<br><br>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.<br><br>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.<br><br>Major fish kill in surface water from large spillage of contaminants from site.<br><br>Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity).<br><br>Explosion, causing building collapse (can also equate to immediate human health risk of buildings are occupied). |
| <b>Medium</b>  | Elevated concentrations which could result in “significant harm” to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Significant harm to humans is defined in circular 01.2006 as                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | <p>human health as defined by the EPA 1990, Part 2A if exposure occurs.</p> <p>Equivalent to EA <b>Category 2</b> pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce.</p> <p>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.</p> <p>Significant damage to crops, buildings or property.</p> | <p>death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>Damage to buildings rendering it unsafe to occupy e.g. foundation damage resulting in instability.</p> <p>Ingress of contaminants through plastic potable water pipes.</p> |
| <b>Mild</b>  | <p>Exposure to human health <b>unlikely</b> to lead to "significant harm."</p> <p>Equivalent to EA <b>Category 3</b> pollution incident including minimal or short-lived effect on water quality; marginal impact on amenity value, agriculture, or commerce.</p> <p>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.</p> <p>Minor damage to crops, buildings or property.</p>                                     | <p>Exposure could lead to slight short-term effects (e.g. mild skin rash).</p> <p>Surface spalling of concrete.</p>                                                                                                                                                                                |
| <b>Minor</b> | <p>No measurable effect on humans.</p> <p>Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems.</p> <p>Repairable effects of damage to buildings, structures, and services.</p>                                                                                                                                                                                                                                                                                                                                                                                  | <p>The loss of plants in a landscaping scheme.</p> <p>Discoloration of concrete.</p>                                                                                                                                                                                                               |

**Table 10: Classification of Probability Definitions (C552 CIRIA, 2001)**

| Classification         | Definition                                                                                                                                                                                                                                                                      | Examples                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>High Likelihood</b> | 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.                                                                            | <p>a) Elevated concentrations of toxic contaminants are present in soils in the top 0.5m in a residential garden.</p> <p>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.</p>                                                                                                                                                          |
| <b>Likely</b>          | 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. | <p>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.</p> <p>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.</p>                             |
| <b>Low Likelihood</b>  | There is potential contaminant linkage and circumstances are possible under which an event could occur. However, 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.                                  | <p>a) Elevated concentrations of toxic contaminants are present in soils at depths of &gt;1m in a residential garden or 0.5-1.0m in a public open space.</p> <p>b) 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.</p> |
| <b>Unlikely</b>        | There is potential contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.                                                                                                                                  | <p>a) Elevated concentrations of toxic contaminants are present below hardstanding.</p> <p>b) Light industrial units &lt;10 yrs old containing a double-skinned UST with annual integrity testing results available.</p>                                                                                                                                                                                                                                   |

**Table 11: Classification Definitions (C552 CIRIA, 2001)**

| CLASSIFICATION   | DEFINITION                                                                                                                                                                                                                                                                                                                                                              |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Very High</b> | There is a high probability that severe harm could arise to a designated receptor from an identified hazard. Or there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required. |
| <b>High</b>      | 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.                                                               |
| <b>Moderate</b>  | 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 severe, 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. |
| <b>Moderate / Low</b> |                                                                                                                                                                                                      |
| <b>Low</b>            | 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                               |
| <b>Very Low</b>       | 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.                                                              |

## 8.2 Preliminary Conceptual Model

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

**Table 12: Preliminary Conceptual Model (PCM)**

| POLLUTANT LINKAGE | SOURCE                                                                                                                                                               | PATHWAY                                                                                  | RECEPTOR                                                                                                   | PROBABILITY | CONSEQUENCE  | RISK RATING           |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------|--------------|-----------------------|
| <b>1</b>          | Broad spectrum of heavy metals, aggressive pH, hydrocarbons, PAH's in Made Ground associated with the development, & redevelopment of the site & adjoining area etc. | Soil and / or soil dust ingestion<br>Dermal contact<br>Leaching through Unsaturated zone | Construction workers<br>Future worker inc:<br>residing student<br>Maintenance Workers<br>Offsite receptors | Likely      | Medium       | <b>Moderate</b>       |
| <b>2</b>          | Broad spectrum of heavy metals, aggressive pH, hydrocarbons, PAH's in Made Ground associated with the development, & redevelopment of the site & adjoining area etc. | Fibre Inhalation                                                                         | Construction workers<br>Future worker inc:<br>residing student<br>Maintenance Workers<br>Offsite receptors | Likely      | Severe (ACM) | <b>High</b>           |
| <b>3</b>          | Inhalation of vapours associated with on-site made ground deposits etc.                                                                                              | Inhalation<br>Leaching through Unsaturated zone                                          | Construction workers<br>Future worker inc:<br>residing student<br>Maintenance Workers<br>Offsite receptors | Unlikely    | Medium       | <b>Moderate</b>       |
| <b>4</b>          | Inhalation of ground gases from onsite or offsite sources i.e., made ground deposits etc.                                                                            | Inhalation                                                                               | Future worker occupants / residing student                                                                 | Unlikely    | Medium       | <b>Moderate</b>       |
| <b>5</b>          | pH & Sulphate attack on concrete                                                                                                                                     | Future building                                                                          | Future building                                                                                            | Likely      | Mild         | <b>Moderate / Low</b> |
| <b>6</b>          | Organic contamination associated with historical on-site land uses                                                                                                   | Direct contact with water mains<br>Leaching through Unsaturated zone                     | Potable water supply<br>Future occupants<br>Offsite receptors & Principal Aquifer                          | Unlikely    | Medium       | <b>Moderate</b>       |

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

**Table 13: 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, VOCs,' SVOCs' PCB's | -                                                        | pH<br>Asbestos |
| PL3                | -                                                           | -                                             | -                                                                 | CH <sub>4</sub> , CO <sub>2</sub> , CO, H <sub>2</sub> S | -              |
| PL1-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, VOCs,' SVOCs' PCBs' | CH <sub>4</sub> , CO <sub>2</sub> , CO, H <sub>2</sub> S | pH<br>Asbestos |

## 8.3 Summary of Risks

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

## 9.0 AIMS AND PROPOSED SCOPE OF PHASE II INTRUSIVE INVESTIGATION

Based on the findings as discussed above, and considering the sensitivity of the proposed end use, it is recommended that an intrusive investigation be undertaken. The Phase II Intrusive Investigation should include for exploratory holes to be sunk through made ground into the underlying natural strata.

The primary objectives of a ground investigations are to obtain enough data to reliably ascertain ground conditions on site, and to aid confirmation of the potential pollution linkages identified within the Preliminary Conceptual Model above. Sufficient soil and groundwater/soil leachate contamination data should be obtained to reliably allow the Preliminary Conceptual Model to be tested and

refined by the performance of a quantitative risk assessment.

Using the guidance contained in BS10175: 2011 and R&D Technical Report P5-0066/TR: 2000 and taking into account the nature of the proposed external redevelopment works, it is proposed that 3nr boreholes be sunk within the footprint of the proposed extension, with 2nr boreholes being sunk within the footprint of the 2nr proposed amenity pavilions with each borehole being sunk using light dynamic sampling methods to a notional depth of 5mbgl with associated *in-situ* testing and sampling,

Given the potential for the presence of made ground deposits of an unknown composition and thickness it is recommended that 3nr boreholes (WS01 – WS03) be utilised for the installation of standpipes, thus enabling a programme of ground gas monitoring to be undertaken. To comply with CIRIA C665 for a “Low” risk site, it is proposed that gas monitoring is undertaken as a minimum on 4nr occasions, distributed over a 1-month period.

The prime objective of any intrusive ground investigation is to provide reliable soil / groundwater, and/or soil leachate, contamination data and to assess the potential risk to human health and sensitive environmental receptors.

The proposed scope of works is summarised in Table 14 hereunder:

**Table 14: Proposed Scope of Works**

| RISK                                                                                                         | METHOD OF ASSESSMENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Is the superficial ground impacted by contamination to the extent it may present a risk to human health?     | Using the guidance contained in BS10175: 2011 and R&D Technical Report P5-0066/TR: 2000 and taking into account the nature of the proposed external redevelopment works, it is proposed that 3nr boreholes be sunk within the footprint of the proposed extension, with 2nr boreholes being sunk within the footprint of the 2nr proposed amenity pavilions with each borehole being sunk using light dynamic sampling methods to a notional depth of 5mbgl with associated <i>in-situ</i> testing and sampling,<br><br>Broad spectrum contamination analyses will be performed on selective subsamples of recovered soil (5nr analyses) to suite in Table 11                                                                                                                                                                                                                                                                                                       |
| What are the geotechnical properties of the ground?                                                          | Standard Penetration Test's (SPT's) to be carried out at regular depth increments throughout the boreholes, with HSV tests being carried out in cohesive strata on recovered soils, if encountered.<br><br>A programme of soil / rock engineering laboratory testing will be carried out. The <i>in-situ</i> tests and soil engineering test data will be used in formulating suitable foundation solutions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Is the site affected by migrating gas from made ground                                                       | Given the potential for the presence of made ground deposits of an unknown composition and thickness it is recommended that 3nr boreholes (WS01 – WS03) be utilised for the installation of standpipes, thus enabling a programme of ground gas monitoring to be undertaken. To comply with CIRIA C665 for a “Low” risk site, it is proposed that gas monitoring is undertaken as a minimum on 4nr occasions, distributed over a 1-month period.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Does the site pose a risk to the underlying Principal Aquifer                                                | Soil water samples will be recovered from the standpipes and will be analysed to the suite proposed in Table 11.<br><br>In the event that water does not accumulate in the standpipes, soil leachate analyses will be undertaken to the suite in Table 7.<br><br>The results will be assessed against Drinking Water Standards and Environmental Quality Standards.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Is the site at risk arising from the potential presence of unexploded ordnance?                              | An appended 'Zetica UXO' Bomb Risk Map (Reference No. 384972-395672, dated October 2025, contained with Appendix D) shows the site to be within an area where it is believed that between c. 15 to 49 bombs per 1000acre may have been deposited during World War II. However, the above, the UXO mapping data also shows that there were no facilities such as military installations, utilities, industry, and/or airfields etc. within the local area which the German Luftwaffe deemed to be viable targets. Plus, there are no records regarding the identification of unexploded ordnance, within, or within 250m, of the study site since the end of hostilities.<br><br>Taking into account the above observations and given that the site has remained continually developed since around 1891, through to present day, it is concluded that the risk associate with the potential presence of unexploded ordnance at this site is considered to be 'Low'. |
| Is the site at risk at the surface of instability associated with shallow historical coal mining activities? | Based on the discussion presented within Section 5.2, it is concluded that the site is not at risk at the surface of instability arising from historical shallow coal mining activities. Hence, no intrusive ground investigation associated with historical coal mining activities are proposed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

The layout of the proposed intrusive investigation is as annotated on **CCG** Drawing No. CCG-C-25-15775-3 'Site Investigation Plan' contained herein.

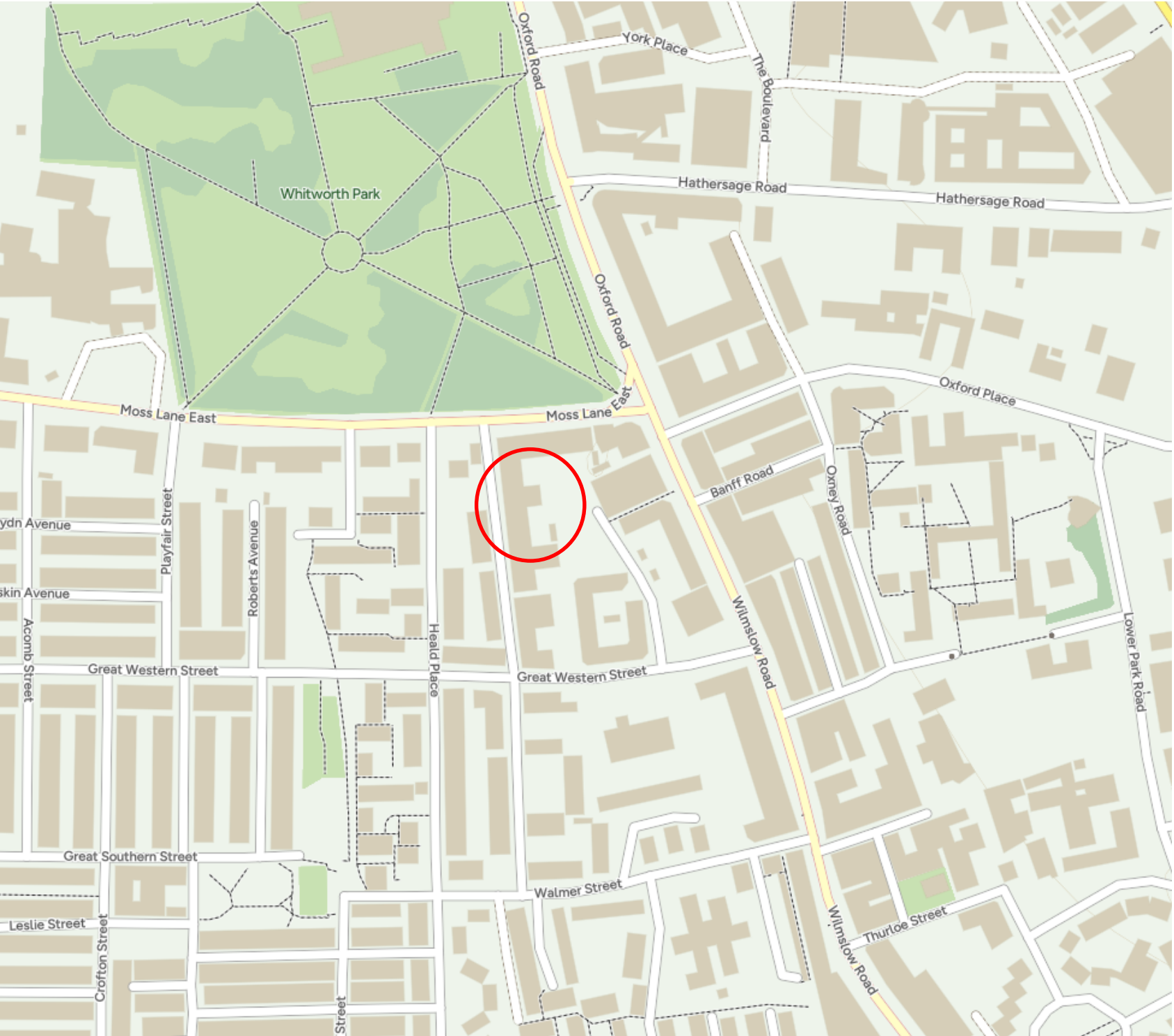
Given the potential for the presence of buried services at this site, it is recommended that a service utility pack is procured prior to undertaking and intrusive investigation works.

Given that the site is to be redeveloped for mixed residential / commercial use with areas of proposed communal landscaping, contamination data obtained as part of the above recommended Phase II intrusive investigation will be based on criteria contained in publication LQM/CIEH S4UL's for Human Health Risk Assessment (2015) (**CCG** Licence No. S4UL3233), applicable to the “Residential” land use

scenario Without plant uptake. Given this document does not provide criteria for Lead contaminants, it is proposed that Lead results are compared to the C4SL published by DEFRA SP1010 Development of Category 4 Screening Levels for '*Residential Land*' use.

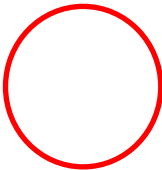
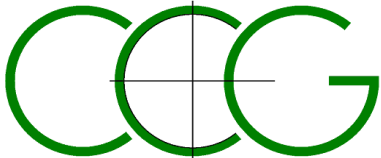
**APPENDIX A: DRAWINGS:**

**25-15772– SITE LOCATION PLAN  
25-15772 – AERIAL PLATE  
ARCHITECTURAL DRAWINGS**



DO NOT SCALE

Notes: Study Site



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

Client:  
Spinnaker Estates via Cumming Group

Project:  
Ropemaker Court, Moss Lane East,  
Greater Manchester, M14

Title:  
Site Location

Scale:  
NTS

Issue:  
01

Drawn by:  
DG

Date:  
Oct' 2025

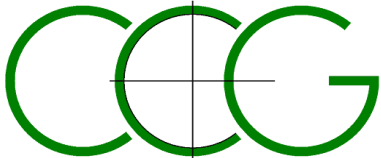
Project No.  
CCG-C-25-15775

Drawing No.  
01



DO NOT SCALE

Notes: Study Site



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

Spinnaker Estates via Cumming Group

Project:  
Ropemaker Court, Moss Lane East,  
Greater Manchester, M14

Title:  
Aerial Photograph

Scale:  
NTS

Issue:  
01

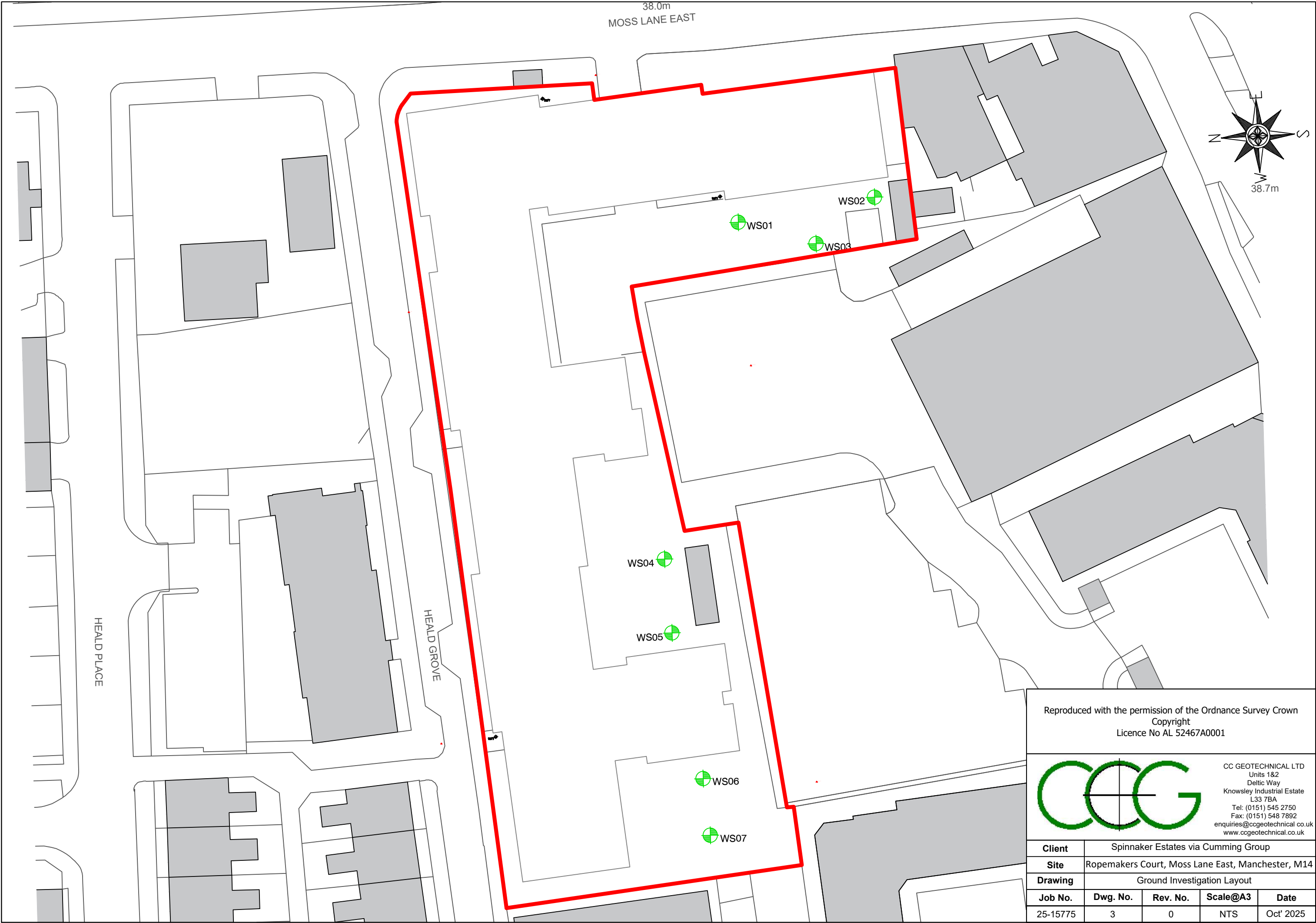
Drawn by:  
DG

Date:  
Oct' 2025

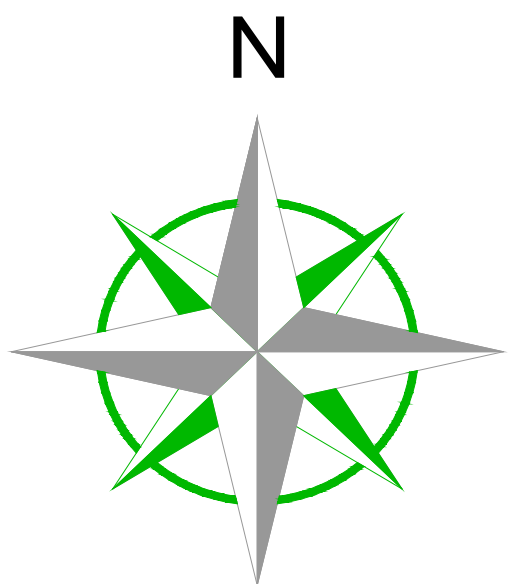
Project No.  
CCG-C-25-15775

Drawing No.  
02

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Station Information:

| Station | Easting (m) | Northing (m) | Level (m) |
|---------|-------------|--------------|-----------|
| GH1     | 384988.097  | 395584.100   | 38.409    |
| GH2     | 384980.503  | 395642.131   | 38.438    |
| GH3     | 384960.009  | 395683.027   | 38.178    |
| GH4     | 384930.728  | 395695.205   | 37.954    |
| S6      | 384933.171  | 395650.803   | 37.706    |
| S7      | 384936.088  | 395590.780   | 37.621    |

**OS Note:**  
The Ordnance Survey tile is to be used as a guide only.  
OS Buildings  Surveyed Buildings   
This survey has been orientated to the Ordnance Survey (OS) National Grid (OSGB36(15)) via Global Navigational Satellite Systems (GNSS) and the OS Active Network (OS Net). A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.  
The survey has been correlated to this point and a further one or more OSGB36(15) points established to create a true O.S. bearing for angle orientation.  
No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.  
Please refer to Survey Station Table to enable establishment of the on-site grid.

Building Survey Legend:

|                                                      |                                                                           |
|------------------------------------------------------|---------------------------------------------------------------------------|
| <b>SHt 1.00</b><br><b>HtH 2.12</b>                   | Sill Height from FFL<br>Head Height from FFL                              |
| <b>SL 51.03m</b><br><b>HL 52.82m</b>                 | Sill Level from defined datum<br>Head Level from defined datum            |
| <b>Susp Cht: 2.00</b><br><b>Struct Cht: 3.00</b>     | Suspended Ceiling Height from FFL<br>Structural Ceiling Height from FFL   |
| <b>Susp Cht: 30.00m</b><br><b>Struct Cht: 31.00m</b> | Suspended Ceiling Level from datum<br>Structural Ceiling Level from datum |
| <b>IFL: 100.00m</b><br><b>+100.00m</b>               | Internal Floor Level (General)<br>Internal Floor Level (Specific)         |

 Insertion Point for overlay drawings of other floors or details.

Incoming Services

| Rev | Date     | Description      | Drawn | Q. Ref. |
|-----|----------|------------------|-------|---------|
|     | 22/08/24 | Site Layout Plan | SHD   |         |

  
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- ☐ Topographical Surveys
- ☐ Site Engineering
- ☐ Utility / CCTV Surveys
- ☐ Bathymetric Surveys
- ☐ Measured Building Surveys
- ☐ 3D Laser Scanning
- ☐ 3D Revit & BIM Models
- ☐ Area, Lease & Fire Plans

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|                                                                                                                |                                                                                                                              |                                                                                                      |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| St Albans<br>Unit 6, The Courtyard<br>Alban Park<br>St Albans<br>Hertfordshire<br>AL4 0LA<br>t. (01727) 854481 | Newcastle<br>24 Riverside Studios<br>Amdurth Road<br>Newcastle Bus. Park<br>Newcastle-U-Tyne<br>NE4 7YL<br>t. (01912) 736391 | Central London<br>27 Cornwell Terrace Mews<br>Reports Park<br>London<br>NW1 5LL<br>t. (0207) 2241806 |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|

CLIENT

**Alternative Real Estate Advisors, London**

PROJECT

**Ropemaker Court**  
**500 Moss Lane, Rusholme,**  
**Manchester, M14 4PL**

TITLE

**Site Layout Plan**

|                   |                   |
|-------------------|-------------------|
| SCALE             | DATE              |
| <b>A1@ 1: 200</b> | <b>22/08/2024</b> |
| DRAWN             | QUALITY REF       |
| <b>SHD</b>        |                   |

|                  |               |
|------------------|---------------|
| Level datum      | See Notes     |
| Grid orientation | GNSS Verified |
| Job number       | 40564A        |

|                  |          |
|------------------|----------|
| Drawing No.      | Rev.     |
| <b>40564A_01</b> | <b>0</b> |

Comments

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

All dimensions should be checked on site prior to design and construction.

Some services may have been omitted due to parked vehicles.

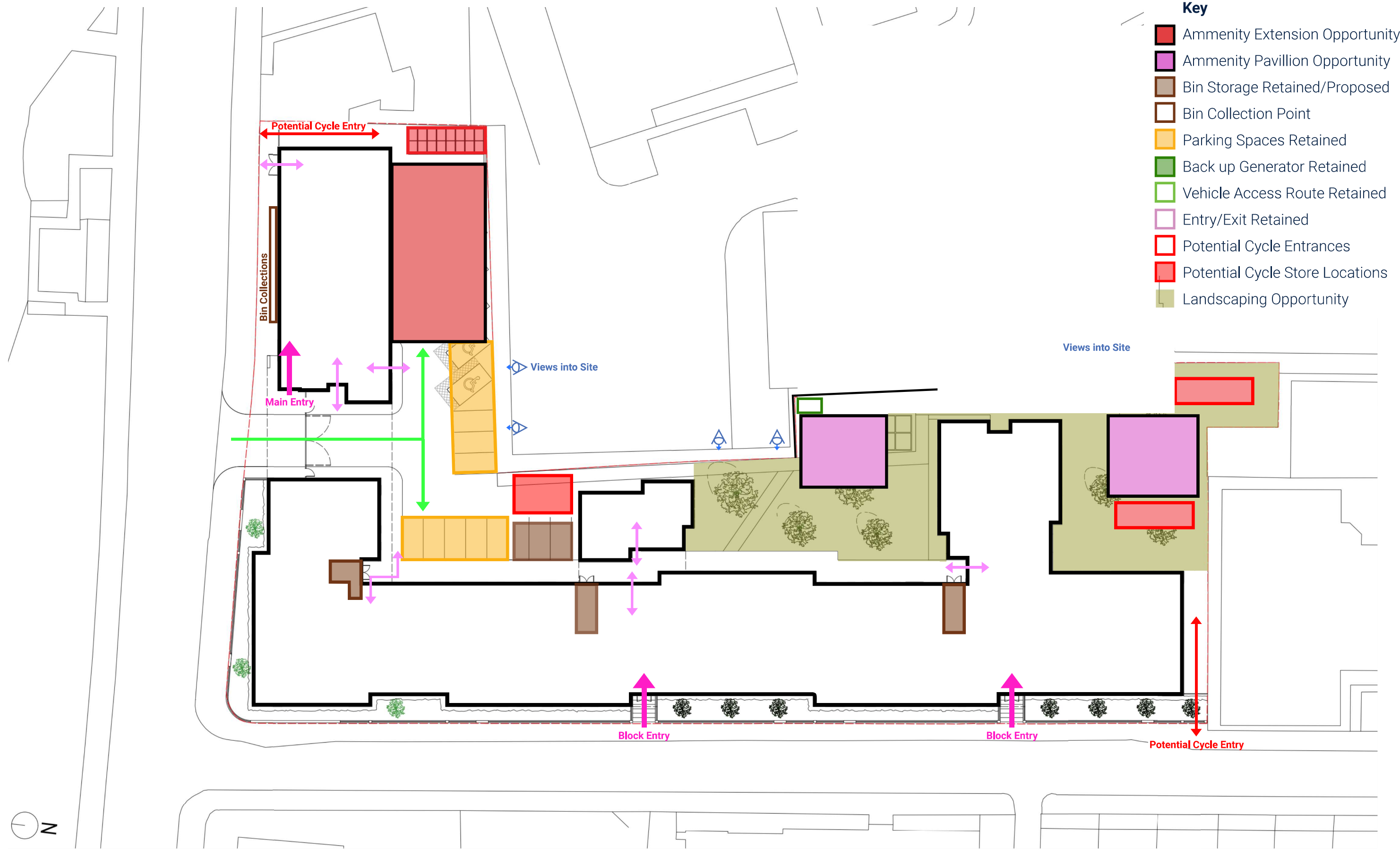
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.

Notes:

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# 02 Evaluation

## 2.4 Opportunities



Building Level: 56.24m.  
Date Recorded June 2021



Building Level: 53.36m.  
Date Recorded June 2021

Building Level: 47.67m.  
Date Recorded June 2021

Datum: 35.00m.  
Elevation 1 - June 2021

Building Level: 50.53m.  
Date Recorded June 2021

Building Level: 53.36m.  
Date Recorded June 2021

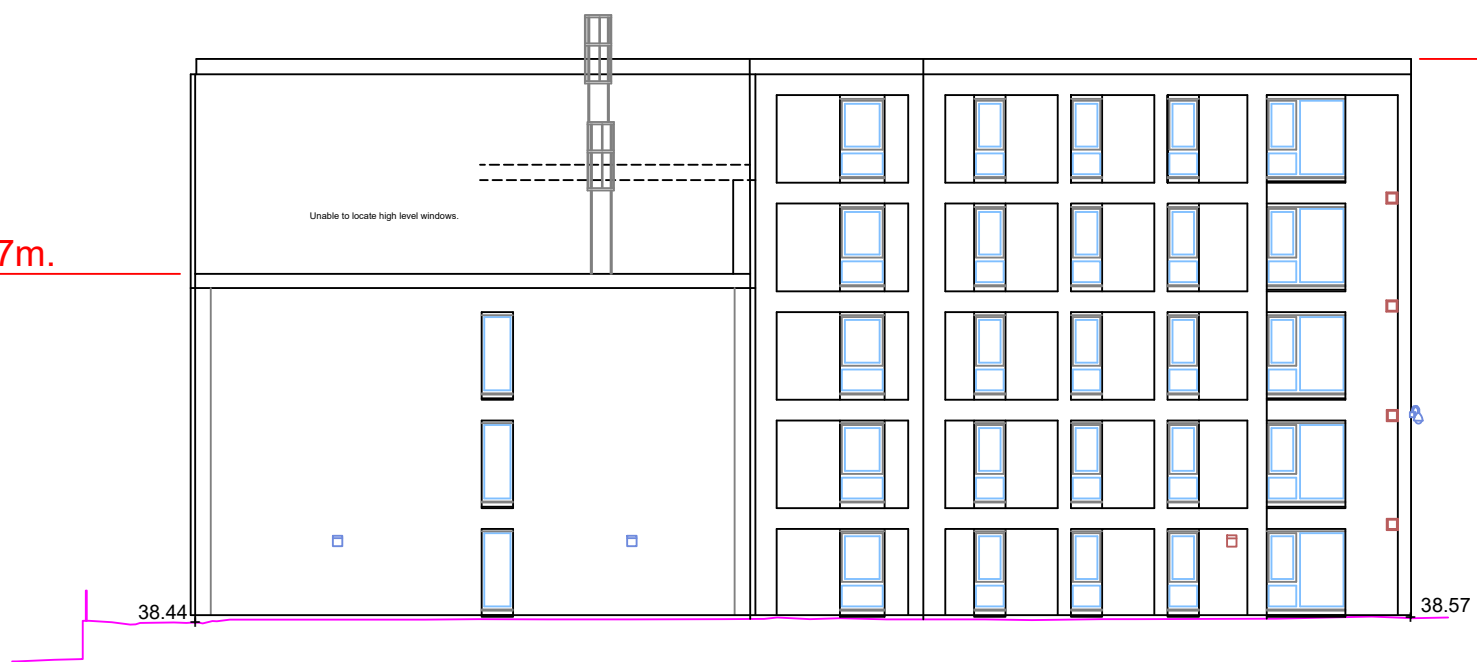
Building Level: 56.24m.  
Date Recorded June 2021



Datum: 35.00m.  
Elevation 5 - June 2021

Building Level: 47.67m.  
Date Recorded June 2021

Building Level: 53.36m.  
Date Recorded June 2021



Datum: 35.00m.  
Elevation 2 - June 2021

Building Survey Legend:

|                     |                                                                  |
|---------------------|------------------------------------------------------------------|
| Sht 1.00            | Sill Height from FFL.                                            |
| Hht 2.12            | Head Height from FFL.                                            |
| SL 51.03m           | Sill Level from defined datum.                                   |
| HL 52.82m           | Head Level from defined datum.                                   |
| Susp Cht: 2.00      | Suspended Ceiling Height from FFL.                               |
| Struct Cht: 3.00    | Structural Ceiling Height from FFL.                              |
| Susp Celi: 30.00m   | Suspended Ceiling Level from datum.                              |
| Struct Celi: 31.00m | Structural Ceiling Level from datum.                             |
| IFL: 100.00m        | Internal Floor Level (General).                                  |
| +100.00m            | Internal Floor Level (Specific).                                 |
| Insertion Point     | Insertion Point for overlay drawings of other floors or details. |

|                   |     |       |  |
|-------------------|-----|-------|--|
| Incoming Services |     |       |  |
| Elec              | Gas | Water |  |
|                   |     |       |  |
|                   |     |       |  |

| Rev | Date | Description | Drawn | Q. Ref. |
|-----|------|-------------|-------|---------|
|-----|------|-------------|-------|---------|



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- Topographical Surveys
- Site Engineering
- Utility / CCTV Surveys
- Bathymetric Surveys
- Measured Building Surveys
- 3D Laser Scanning
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|                                                                                                                |                                                                                                                              |                                                                                              |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
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|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                                    |  |               |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------|--|---------------|--|
| CLIENT                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  | Alternative Real Estate Advisors, London                           |  |               |  |
| PROJECT                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | Ropemaker Court<br>500 Moss Lane, Rusholme,<br>Manchester, M14 4PL |  |               |  |
| TITLE                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | Existing Survey.<br>Building Heights (June 2021)                   |  |               |  |
| SCALE                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | DATE                                                               |  |               |  |
| A1@ 1: 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  | 28/08/2024                                                         |  |               |  |
| DRAWN                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  | QUALITY REF                                                        |  |               |  |
| LA                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                                    |  |               |  |
| Level datum                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                    |  | See Notes     |  |
| Grid orientation                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                    |  | GNSS Verified |  |
| Job number                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |                                                                    |  | 40564A        |  |
| Drawing No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | 40564A_14_P                                                        |  | Rev.          |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |                                                                    |  | 0             |  |
| Comments<br>This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.<br>All dimensions should be checked on site prior to design and construction.<br>Some services may have been omitted due to parked vehicles.<br>Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only. |  |                                                                    |  |               |  |
| Notes:                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                                    |  |               |  |
| Copyright Greenhatch Group. 08/17/18                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                                    |  |               |  |

## **APPENDIX B: 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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2. the consequences of use of this document by any party with whom an agreement has not been executed.

### **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.

**APPENDIX C: 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:

Significant harm is being caused or there is a significant possibility of such harm being caused;  
or  
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."

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. Except for 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 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 satisfactorily 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 meets, 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 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 potential 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.

#### 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:

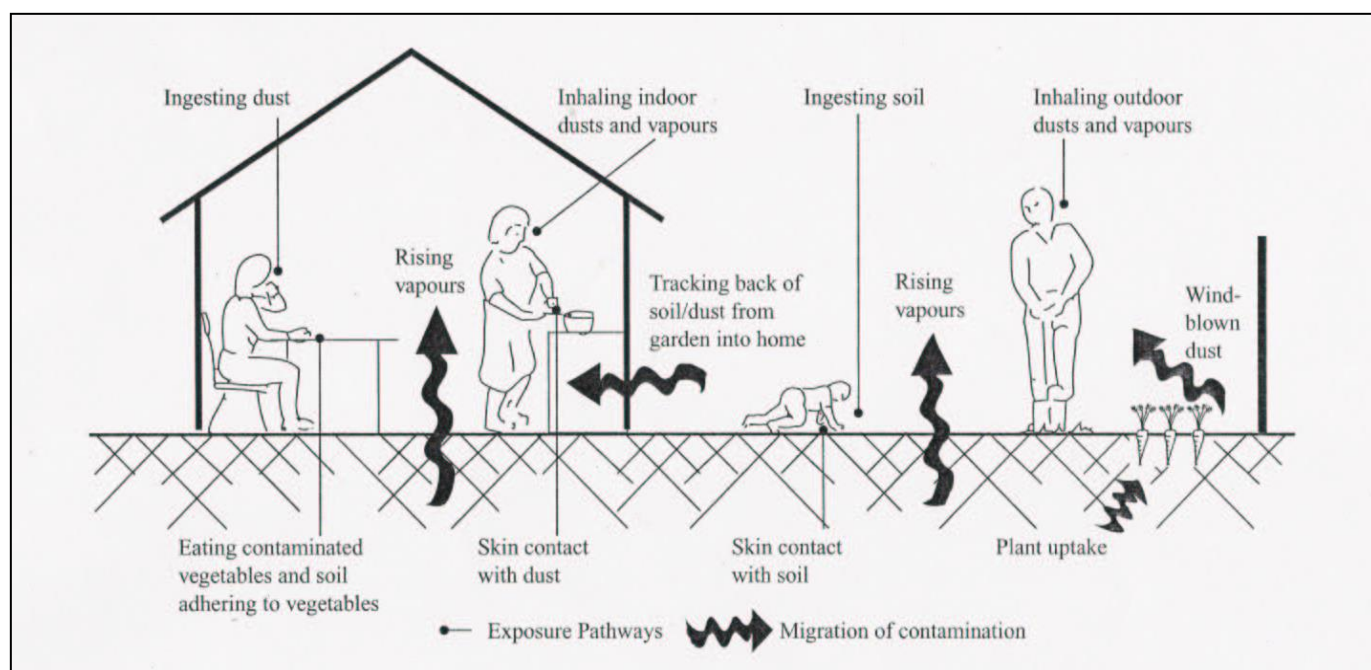
USEPA 2006: Data Quality Assessment: Statistical Methods for Practitioners

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 1.04."

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set 'default' exposure pathway. 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 may be 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 2.00mbgl 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 principal 'default' land use types and makes a series of 'default' assumptions about 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 m<sup>2</sup>), 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 kinds of workplace and work-related activities. This generic scenario assumes a typical commercial or light industrial property consisting of a three-storey building at which employees spend most time indoors and are involved in office based 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 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 hereunder.

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

GAC's are derived based on 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 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 v1.04 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 analysis 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. 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, which is to say, any waters contained in underground strata."

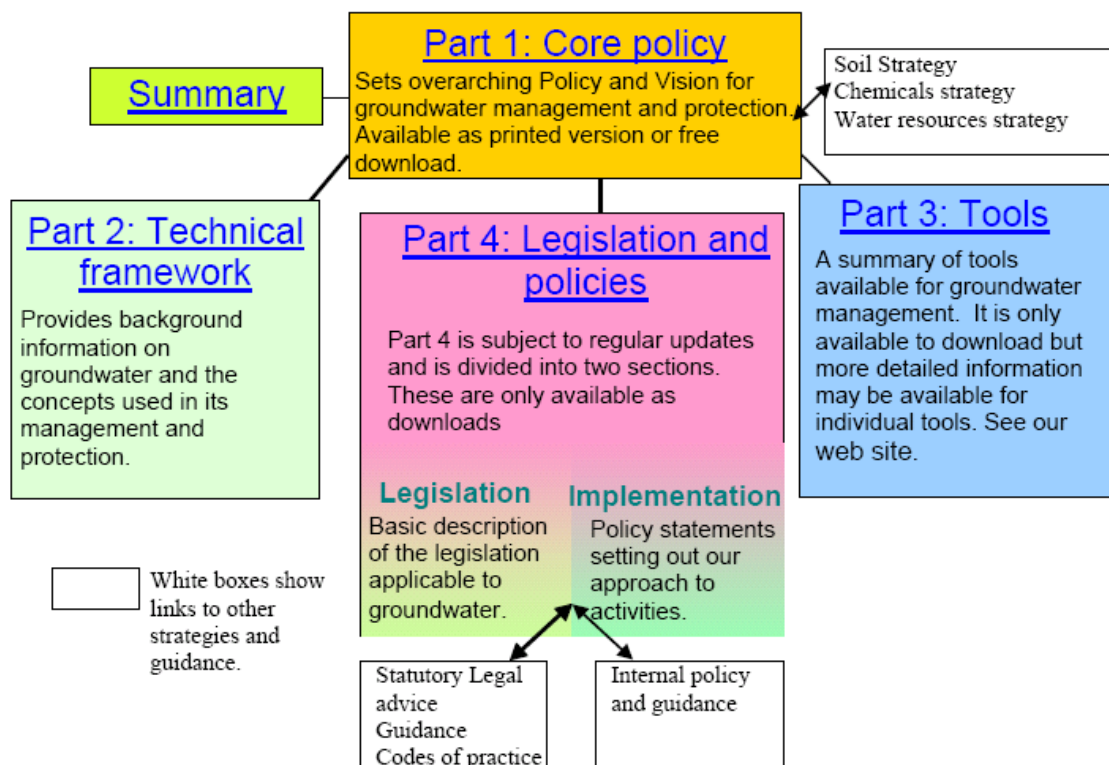
Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes 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 enough to impact on the receptor, ignoring dilution, dispersion, and attenuation along the pathway. The "pore water" concentration is determined from:

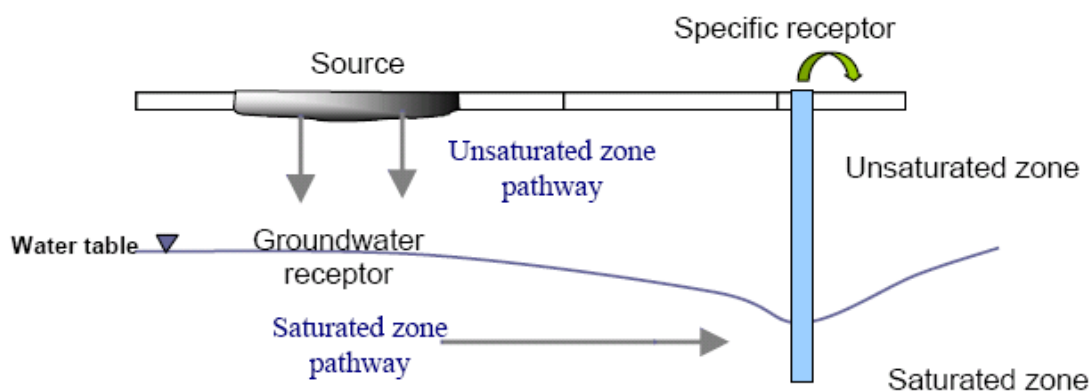
- measured "pore water" concentrations or perched water quality
- ii) soil leaching tests
- iii) theoretical calculations based on soil/water partitioning equations

**Level 2** considers dilution by the receiving groundwater or surface water body and whether this is enough 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 enough 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

##### 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;<br>- Degassing of dissolved gases in groundwater;<br>- 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 odourise is added to permit detection of leaks. Typically, 90% CH <sub>4</sub> , but 1 to 27% C <sub>2</sub> -C <sub>4</sub> alkanes, May             |

| Gas                         | Source                                                                                                                                                                                                                                                                                                                                                       | Comments                                                                                                                                                                           |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                             |                                                                                                                                                                                                                                                                                                                                                              | also contain other trace gases e.g., CO, helium, and CO <sub>2</sub> (from degradation of CH <sub>4</sub> in the ground).                                                          |
| Other Anthropogenic Sources | <ul style="list-style-type: none"> <li>- Degradation of leaked or spilled hydrocarbons or other industrial chemicals;</li> <li>- Anaerobic degradation of organic contaminants in groundwaters (e.g., silage liquor);</li> <li>- Reactions between monitoring well construction components and environment;</li> <li>- Burial grounds/cemeteries.</li> </ul> | 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 dredging's.                                                                                                                                                                                          |                                                                                                                                                                                    |
| 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" (Scythe 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 <ul style="list-style-type: none"> <li>- high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide;</li> <li>- chemical degradation of rocks (e.g., carbonates) producing carbon dioxide;</li> <li>- carbon dioxide production in root zone of soils by plants.</li> </ul>              | 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

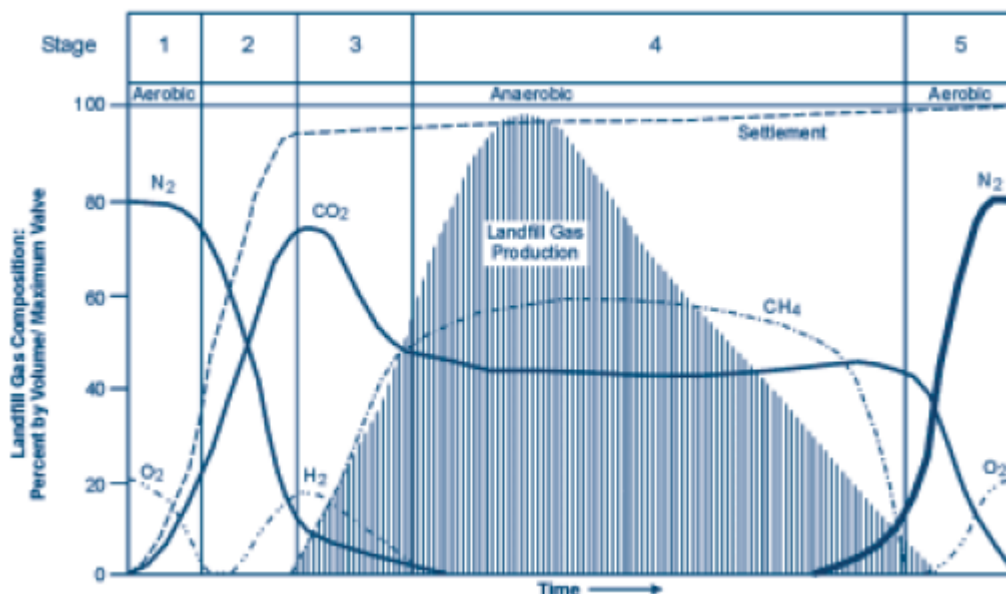
Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper 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 reduce 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 affect 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 like 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, December 2007) "Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments"

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 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:

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

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 <sub>4</sub> or CO <sub>2</sub> ) (l/hr) <sup>1</sup> | 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 hereunder:

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

Notes:

- 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;
- 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 gas being considered;
- The Typical Maximum Concentration can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so;
- The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment considering 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 BS8485:2007, which supersedes the guidance included within CIRIA C665, is used for selection of gas protection measures.

BS8485: 2007 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 BS8485:2007 Table 2 as presented hereunder:

| Characteristic gas | NHBC traffic | Required gas protection |
|--------------------|--------------|-------------------------|
|--------------------|--------------|-------------------------|

| situation, CS | light   | 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 housing<sup>1</sup>. 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

<sup>1</sup> 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.

BS8485:2007 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 BS8485:2007 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.<br><br>There must 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.<br><br>Mechanically assisted systems come in two forms: extraction and positive pressurization. |
|                                                                                                                                                                                                                                           | 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   |                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                                                                           | Ventilated car park (basement or undercroft)                                                                                                                           | 4     |                                                                                                                                                                                                                                                                                                                                                                                                            |
| b) Barriers                                                                                                                                                                                                                               |                                                                                                                                                                        |       |                                                                                                                                                                                                                                                                                                                                                                                                            |
| Floor slabs                                                                                                                                                                                                                               |                                                                                                                                                                        |       | It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum.<br><br>Breaches in floor slabs such as joints must be effectively sealed against gas ingress in order to maintain these performances.                                                                                                                                                         |
| Block and beam floor slab                                                                                                                                                                                                                 |                                                                                                                                                                        | 0     |                                                                                                                                                                                                                                                                                                                                                                                                            |
| 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 handheld 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 |                                                                                                                                                                        |       |                                                                                                                                                                                                                                                                                                                                                                                                            |
| It is possible to test ventilation systems by installing monitoring probes for post installation validation.                                                                                                                              |                                                                                                                                                                        |       |                                                                                                                                                                                                                                                                                                                                                                                                            |
| 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                                                                                  |                                                                                                                                                                        |       |                                                                                                                                                                                                                                                                                                                                                                                                            |

Polymeric Materials > 1200 g (proportional to thickness) but their physical properties mean that they are more robust and resistant to damage.

BS8485:2007 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 enough.

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 D: COMMERCIAL ENVIRONMENTAL DATA**

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## Order Details

**Date:** 02/10/2025  
**Your ref:** CMAPS-AAG-1244185-4165-021025  
**Our Ref:** CMAPS-AAG-1244185-4165-021025EDRGEO

## Site Details

**Location:** 384962 395632  
**Area:** 0.49 ha  
**Authority:** [Manchester City Council](#) ↗



**Summary of findings**

[p. 2 >](#) **Aerial image**

[p. 9 >](#)

**OS MasterMap site plan**

[p.14 >](#) **Insight User Guide** ↗

Contact us with any questions at:

[info@groundsure.com](mailto:info@groundsure.com) ↗

01273 257 755

## Summary of findings

| Page                    | Section                  | <a href="#">Past land use &gt;</a>                           | On site | 0-50m | 50-250m | 250-500m | 500-2000m |
|-------------------------|--------------------------|--------------------------------------------------------------|---------|-------|---------|----------|-----------|
| <a href="#">15 &gt;</a> | <a href="#">1.1 &gt;</a> | <a href="#">Historical industrial land uses &gt;</a>         | 2       | 4     | 17      | 30       | -         |
| <a href="#">18 &gt;</a> | <a href="#">1.2 &gt;</a> | <a href="#">Historical tanks &gt;</a>                        | 0       | 0     | 0       | 7        | -         |
| <a href="#">18 &gt;</a> | <a href="#">1.3 &gt;</a> | <a href="#">Historical energy features &gt;</a>              | 0       | 2     | 0       | 19       | -         |
| 19                      | 1.4                      | Historical petrol stations                                   | 0       | 0     | 0       | 0        | -         |
| <a href="#">20 &gt;</a> | <a href="#">1.5 &gt;</a> | <a href="#">Historical garages &gt;</a>                      | 1       | 4     | 14      | 5        | -         |
| 21                      | 1.6                      | Historical military land                                     | 0       | 0     | 0       | 0        | -         |
| Page                    | Section                  | <a href="#">Past land use - un-grouped &gt;</a>              | On site | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">22 &gt;</a> | <a href="#">2.1 &gt;</a> | <a href="#">Historical industrial land uses &gt;</a>         | 3       | 7     | 24      | 40       | -         |
| <a href="#">25 &gt;</a> | <a href="#">2.2 &gt;</a> | <a href="#">Historical tanks &gt;</a>                        | 0       | 0     | 0       | 14       | -         |
| <a href="#">26 &gt;</a> | <a href="#">2.3 &gt;</a> | <a href="#">Historical energy features &gt;</a>              | 0       | 2     | 0       | 25       | -         |
| 27                      | 2.4                      | Historical petrol stations                                   | 0       | 0     | 0       | 0        | -         |
| <a href="#">27 &gt;</a> | <a href="#">2.5 &gt;</a> | <a href="#">Historical garages &gt;</a>                      | 1       | 6     | 18      | 7        | -         |
| Page                    | Section                  | <a href="#">Waste and landfill &gt;</a>                      | On site | 0-50m | 50-250m | 250-500m | 500-2000m |
| 30                      | 3.1                      | Active or recent landfill                                    | 0       | 0     | 0       | 0        | -         |
| 30                      | 3.2                      | Historical landfill (BGS records)                            | 0       | 0     | 0       | 0        | -         |
| 31                      | 3.3                      | Historical landfill (LA/mapping records)                     | 0       | 0     | 0       | 0        | -         |
| 31                      | 3.4                      | Historical landfill (EA/NRW records)                         | 0       | 0     | 0       | 0        | -         |
| 31                      | 3.5                      | Historical waste sites                                       | 0       | 0     | 0       | 0        | -         |
| <a href="#">31 &gt;</a> | <a href="#">3.6 &gt;</a> | <a href="#">Licensed waste sites &gt;</a>                    | 0       | 0     | 0       | 4        | -         |
| <a href="#">33 &gt;</a> | <a href="#">3.7 &gt;</a> | <a href="#">Waste exemptions &gt;</a>                        | 0       | 0     | 3       | 14       | -         |
| Page                    | Section                  | <a href="#">Current industrial land use &gt;</a>             | On site | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">35 &gt;</a> | <a href="#">4.1 &gt;</a> | <a href="#">Recent industrial land uses &gt;</a>             | 0       | 1     | 5       | -        | -         |
| 36                      | 4.2                      | National Geographic Database (NGD) - Current or recent tanks | 0       | 0     | 0       | -        | -         |
| <a href="#">36 &gt;</a> | <a href="#">4.3 &gt;</a> | <a href="#">Current or recent petrol stations &gt;</a>       | 0       | 1     | 3       | 0        | -         |
| 37                      | 4.4                      | Electricity cables                                           | 0       | 0     | 0       | 0        | -         |
| 37                      | 4.5                      | Gas pipelines                                                | 0       | 0     | 0       | 0        | -         |



| 37             | 4.6              | Sites determined as Contaminated Land                       | 0                        | 0     | 0       | 0        | -         |
|----------------|------------------|-------------------------------------------------------------|--------------------------|-------|---------|----------|-----------|
| 37             | 4.7              | Control of Major Accident Hazards (COMAH)                   | 0                        | 0     | 0       | 0        | -         |
| 37             | 4.8              | Regulated explosive sites                                   | 0                        | 0     | 0       | 0        | -         |
| 38             | 4.9              | Hazardous substance storage/usage                           | 0                        | 0     | 0       | 0        | -         |
| 38             | 4.10             | Historical licensed industrial activities (IPC)             | 0                        | 0     | 0       | 0        | -         |
| 38             | 4.11             | Licensed industrial activities (Part A(1))                  | 0                        | 0     | 0       | 0        | -         |
| <b>38 &gt;</b> | <b>4.12 &gt;</b> | <b><u>Licensed pollutant release (Part A(2)/B) &gt;</u></b> | 0                        | 0     | 6       | 1        | -         |
| 39             | 4.13             | Radioactive Substance Authorisations                        | 0                        | 0     | 0       | 0        | -         |
| <b>39 &gt;</b> | <b>4.14 &gt;</b> | <b><u>Licensed Discharges to controlled waters &gt;</u></b> | 0                        | 0     | 4       | 0        | -         |
| 40             | 4.15             | Pollutant release to surface waters (Red List)              | 0                        | 0     | 0       | 0        | -         |
| 40             | 4.16             | Pollutant release to public sewer                           | 0                        | 0     | 0       | 0        | -         |
| 41             | 4.17             | List 1 Dangerous Substances                                 | 0                        | 0     | 0       | 0        | -         |
| 41             | 4.18             | List 2 Dangerous Substances                                 | 0                        | 0     | 0       | 0        | -         |
| 41             | 4.19             | Pollution Incidents (EA/NRW)                                | 0                        | 0     | 0       | 0        | -         |
| 41             | 4.20             | Pollution inventory substances                              | 0                        | 0     | 0       | 0        | -         |
| 41             | 4.21             | Pollution inventory waste transfers                         | 0                        | 0     | 0       | 0        | -         |
| 42             | 4.22             | Pollution inventory radioactive waste                       | 0                        | 0     | 0       | 0        | -         |
| Page           | Section          | <b><u>Hydrogeology &gt;</u></b>                             | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| <b>43 &gt;</b> | <b>5.1 &gt;</b>  | <b><u>Superficial aquifer &gt;</u></b>                      | Identified (within 500m) |       |         |          |           |
| <b>45 &gt;</b> | <b>5.2 &gt;</b>  | <b><u>Bedrock aquifer &gt;</u></b>                          | Identified (within 500m) |       |         |          |           |
| <b>47 &gt;</b> | <b>5.3 &gt;</b>  | <b><u>Groundwater vulnerability &gt;</u></b>                | Identified (within 50m)  |       |         |          |           |
| 48             | 5.4              | Groundwater vulnerability- soluble rock risk                | None (within 0m)         |       |         |          |           |
| 48             | 5.5              | Groundwater vulnerability- local information                | None (within 0m)         |       |         |          |           |
| <b>49 &gt;</b> | <b>5.6 &gt;</b>  | <b><u>Groundwater abstractions &gt;</u></b>                 | 0                        | 0     | 0       | 0        | 25        |
| 56             | 5.7              | Surface water abstractions                                  | 0                        | 0     | 0       | 0        | 0         |
| 56             | 5.8              | Potable abstractions                                        | 0                        | 0     | 0       | 0        | 0         |
| <b>56 &gt;</b> | <b>5.9 &gt;</b>  | <b><u>Source Protection Zones &gt;</u></b>                  | 1                        | 0     | 0       | 0        | -         |
| 56             | 5.10             | Source Protection Zones (confined aquifer)                  | 0                        | 0     | 0       | 0        | -         |
| Page           | Section          | <b><u>Hydrology &gt;</u></b>                                | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |

| 57             | 6.1             | Water Network (OS MasterMap)                         | 0                                      | 0     | 0       | -        | -         |
|----------------|-----------------|------------------------------------------------------|----------------------------------------|-------|---------|----------|-----------|
| 57             | 6.2             | Surface water features                               | 0                                      | 0     | 0       | -        | -         |
| <b>58 &gt;</b> | <b>6.3 &gt;</b> | <b><u>WFD Surface water body catchments &gt;</u></b> | 1                                      | -     | -       | -        | -         |
| <b>58 &gt;</b> | <b>6.4 &gt;</b> | <b><u>WFD Surface water bodies &gt;</u></b>          | 0                                      | 0     | 0       | -        | -         |
| <b>59 &gt;</b> | <b>6.5 &gt;</b> | <b><u>WFD Groundwater bodies &gt;</u></b>            | 1                                      | -     | -       | -        | -         |
| Page           | Section         | River and coastal flooding                           | On site                                | 0-50m | 50-250m | 250-500m | 500-2000m |
| 60             | 7.1             | Risk of flooding from rivers and the sea             | None (within 50m)                      |       |         |          |           |
| 60             | 7.2             | Historical Flood Events                              | 0                                      | 0     | 0       | -        | -         |
| 60             | 7.3             | Flood Defences                                       | 0                                      | 0     | 0       | -        | -         |
| 61             | 7.4             | Areas Benefiting from Flood Defences                 | 0                                      | 0     | 0       | -        | -         |
| 61             | 7.5             | Flood Storage Areas                                  | 0                                      | 0     | 0       | -        | -         |
| 62             | 7.6             | Flood Zone 2                                         | None (within 50m)                      |       |         |          |           |
| 62             | 7.7             | Flood Zone 3                                         | None (within 50m)                      |       |         |          |           |
| Page           | Section         | <u>Surface water flooding &gt;</u>                   |                                        |       |         |          |           |
| <b>63 &gt;</b> | <b>8.1 &gt;</b> | <b><u>Surface water flooding &gt;</u></b>            | 1 in 30 year, 0.3m - 1.0m (within 50m) |       |         |          |           |
| Page           | Section         | <u>Groundwater flooding &gt;</u>                     |                                        |       |         |          |           |
| <b>65 &gt;</b> | <b>9.1 &gt;</b> | <b><u>Groundwater flooding &gt;</u></b>              | Moderate-High (within 50m)             |       |         |          |           |
| Page           | Section         | Environmental designations                           | On site                                | 0-50m | 50-250m | 250-500m | 500-2000m |
| 66             | 10.1            | Sites of Special Scientific Interest (SSSI)          | 0                                      | 0     | 0       | 0        | 0         |
| 66             | 10.2            | Conserved wetland sites (Ramsar sites)               | 0                                      | 0     | 0       | 0        | 0         |
| 66             | 10.3            | Special Areas of Conservation (SAC)                  | 0                                      | 0     | 0       | 0        | 0         |
| 66             | 10.4            | Special Protection Areas (SPA)                       | 0                                      | 0     | 0       | 0        | 0         |
| 67             | 10.5            | National Nature Reserves (NNR)                       | 0                                      | 0     | 0       | 0        | 0         |
| 67             | 10.6            | Local Nature Reserves (LNR)                          | 0                                      | 0     | 0       | 0        | 0         |
| 67             | 10.7            | Designated Ancient Woodland                          | 0                                      | 0     | 0       | 0        | 0         |
| 67             | 10.8            | Biosphere Reserves                                   | 0                                      | 0     | 0       | 0        | 0         |
| 68             | 10.9            | Forest Parks                                         | 0                                      | 0     | 0       | 0        | 0         |
| 68             | 10.10           | Marine Conservation Zones                            | 0                                      | 0     | 0       | 0        | 0         |
| 68             | 10.11           | Green Belt                                           | 0                                      | 0     | 0       | 0        | 0         |



| 68                      | 10.12                     | Proposed Ramsar sites                                 | 0                        | 0     | 0       | 0        | 0         |
|-------------------------|---------------------------|-------------------------------------------------------|--------------------------|-------|---------|----------|-----------|
| 68                      | 10.13                     | Possible Special Areas of Conservation (pSAC)         | 0                        | 0     | 0       | 0        | 0         |
| 69                      | 10.14                     | Potential Special Protection Areas (pSPA)             | 0                        | 0     | 0       | 0        | 0         |
| 69                      | 10.15                     | Nitrate Sensitive Areas                               | 0                        | 0     | 0       | 0        | 0         |
| 69                      | 10.16                     | Nitrate Vulnerable Zones                              | 0                        | 0     | 0       | 0        | 0         |
| 70                      | 10.17                     | SSSI Impact Risk Zones                                | 0                        | -     | -       | -        | -         |
| 70                      | 10.18                     | SSSI Units                                            | 0                        | 0     | 0       | 0        | 0         |
| Page                    | Section                   | <a href="#">Visual and cultural designations &gt;</a> | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 71                      | 11.1                      | World Heritage Sites                                  | 0                        | 0     | 0       | -        | -         |
| 72                      | 11.2                      | Area of Outstanding Natural Beauty                    | 0                        | 0     | 0       | -        | -         |
| 72                      | 11.3                      | National Parks                                        | 0                        | 0     | 0       | -        | -         |
| <a href="#">72 &gt;</a> | <a href="#">11.4 &gt;</a> | <a href="#">Listed Buildings &gt;</a>                 | 0                        | 1     | 3       | -        | -         |
| <a href="#">73 &gt;</a> | <a href="#">11.5 &gt;</a> | <a href="#">Conservation Areas &gt;</a>               | 0                        | 0     | 1       | -        | -         |
| 73                      | 11.6                      | Scheduled Ancient Monuments                           | 0                        | 0     | 0       | -        | -         |
| 73                      | 11.7                      | Registered Parks and Gardens                          | 0                        | 0     | 0       | -        | -         |
| Page                    | Section                   | <a href="#">Agricultural designations &gt;</a>        | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">74 &gt;</a> | <a href="#">12.1 &gt;</a> | <a href="#">Agricultural Land Classification &gt;</a> | Urban (within 250m)      |       |         |          |           |
| 75                      | 12.2                      | Open Access Land                                      | 0                        | 0     | 0       | -        | -         |
| 75                      | 12.3                      | Tree Felling Licences                                 | 0                        | 0     | 0       | -        | -         |
| 75                      | 12.4                      | Environmental Stewardship Schemes                     | 0                        | 0     | 0       | -        | -         |
| 75                      | 12.5                      | Countryside Stewardship Schemes                       | 0                        | 0     | 0       | -        | -         |
| Page                    | Section                   | <a href="#">Habitat designations &gt;</a>             | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">76 &gt;</a> | <a href="#">13.1 &gt;</a> | <a href="#">Priority Habitat Inventory &gt;</a>       | 0                        | 5     | 13      | -        | -         |
| 77                      | 13.2                      | Habitat Networks                                      | 0                        | 0     | 0       | -        | -         |
| 77                      | 13.3                      | Open Mosaic Habitat                                   | 0                        | 0     | 0       | -        | -         |
| 78                      | 13.4                      | Limestone Pavement Orders                             | 0                        | 0     | 0       | -        | -         |
| Page                    | Section                   | <a href="#">Geology 1:10,000 scale &gt;</a>           | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">79 &gt;</a> | <a href="#">14.1 &gt;</a> | <a href="#">10k Availability &gt;</a>                 | Identified (within 500m) |       |         |          |           |
| <a href="#">80 &gt;</a> | <a href="#">14.2 &gt;</a> | <a href="#">Artificial and made ground (10k) &gt;</a> | 0                        | 0     | 2       | 2        | -         |

| 82 >  | 14.3 >  | <a href="#">Superficial geology (10k) &gt;</a>           | 2                        | 0     | 0       | 0        | -         |
|-------|---------|----------------------------------------------------------|--------------------------|-------|---------|----------|-----------|
| 83    | 14.4    | Landslip (10k)                                           | 0                        | 0     | 0       | 0        | -         |
| 84 >  | 14.5 >  | <a href="#">Bedrock geology (10k) &gt;</a>               | 2                        | 0     | 1       | 1        | -         |
| 85    | 14.6    | Bedrock faults and other linear features (10k)           | 0                        | 0     | 0       | 0        | -         |
| Page  | Section | <a href="#">Geology 1:50,000 scale &gt;</a>              | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 86 >  | 15.1 >  | <a href="#">50k Availability &gt;</a>                    | Identified (within 500m) |       |         |          |           |
| 87    | 15.2    | Artificial and made ground (50k)                         | 0                        | 0     | 0       | 0        | -         |
| 87    | 15.3    | Artificial ground permeability (50k)                     | 0                        | 0     | -       | -        | -         |
| 88 >  | 15.4 >  | <a href="#">Superficial geology (50k) &gt;</a>           | 1                        | 0     | 0       | 0        | -         |
| 89 >  | 15.5 >  | <a href="#">Superficial permeability (50k) &gt;</a>      | Identified (within 50m)  |       |         |          |           |
| 89    | 15.6    | Landslip (50k)                                           | 0                        | 0     | 0       | 0        | -         |
| 89    | 15.7    | Landslip permeability (50k)                              | None (within 50m)        |       |         |          |           |
| 90 >  | 15.8 >  | <a href="#">Bedrock geology (50k) &gt;</a>               | 1                        | 0     | 1       | 1        | -         |
| 91 >  | 15.9 >  | <a href="#">Bedrock permeability (50k) &gt;</a>          | Identified (within 50m)  |       |         |          |           |
| 91    | 15.10   | Bedrock faults and other linear features (50k)           | 0                        | 0     | 0       | 0        | -         |
| Page  | Section | <a href="#">Boreholes &gt;</a>                           | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 92 >  | 16.1 >  | <a href="#">BGS Boreholes &gt;</a>                       | 0                        | 0     | 75      | -        | -         |
| Page  | Section | <a href="#">Natural ground subsidence &gt;</a>           |                          |       |         |          |           |
| 96 >  | 17.1 >  | <a href="#">Shrink swell clays &gt;</a>                  | Very low (within 50m)    |       |         |          |           |
| 97 >  | 17.2 >  | <a href="#">Running sands &gt;</a>                       | Very low (within 50m)    |       |         |          |           |
| 98 >  | 17.3 >  | <a href="#">Compressible deposits &gt;</a>               | Negligible (within 50m)  |       |         |          |           |
| 99 >  | 17.4 >  | <a href="#">Collapsible deposits &gt;</a>                | Very low (within 50m)    |       |         |          |           |
| 100 > | 17.5 >  | <a href="#">Landslides &gt;</a>                          | Very low (within 50m)    |       |         |          |           |
| 101 > | 17.6 >  | <a href="#">Ground dissolution of soluble rocks &gt;</a> | Negligible (within 50m)  |       |         |          |           |
| Page  | Section | <a href="#">Mining and ground workings &gt;</a>          | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 103   | 18.1    | BritPits                                                 | 0                        | 0     | 0       | 0        | -         |
| 104 > | 18.2 >  | <a href="#">Surface ground workings &gt;</a>             | 0                        | 1     | 6       | -        | -         |
| 104   | 18.3    | Underground workings                                     | 0                        | 0     | 0       | 0        | 0         |
| 104   | 18.4    | Underground mining extents                               | 0                        | 0     | 0       | 0        | -         |



| 105                      | 18.5                       | Historical Mineral Planning Areas                            | 0                        | 0     | 0       | 0        | -         |
|--------------------------|----------------------------|--------------------------------------------------------------|--------------------------|-------|---------|----------|-----------|
| 105                      | 18.6                       | Non-coal mining                                              | 0                        | 0     | 0       | 0        | 0         |
| <a href="#">105 &gt;</a> | <a href="#">18.7 &gt;</a>  | <a href="#">JPB mining areas &gt;</a>                        | Identified (within 0m)   |       |         |          |           |
| 105                      | 18.8                       | The Coal Authority non-coal mining                           | 0                        | 0     | 0       | 0        | -         |
| 106                      | 18.9                       | Researched mining                                            | 0                        | 0     | 0       | 0        | -         |
| 106                      | 18.10                      | Mining record office plans                                   | 0                        | 0     | 0       | 0        | -         |
| 106                      | 18.11                      | BGS mine plans                                               | 0                        | 0     | 0       | 0        | -         |
| <a href="#">106 &gt;</a> | <a href="#">18.12 &gt;</a> | <a href="#">Coal mining &gt;</a>                             | Identified (within 0m)   |       |         |          |           |
| 107                      | 18.13                      | Brine areas                                                  | None (within 0m)         |       |         |          |           |
| 107                      | 18.14                      | Gypsum areas                                                 | None (within 0m)         |       |         |          |           |
| 107                      | 18.15                      | Tin mining                                                   | None (within 0m)         |       |         |          |           |
| 107                      | 18.16                      | Clay mining                                                  | None (within 0m)         |       |         |          |           |
| Page                     | Section                    | Ground cavities and sinkholes                                | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 108                      | 19.1                       | Natural cavities                                             | 0                        | 0     | 0       | 0        | -         |
| 108                      | 19.2                       | Mining cavities                                              | 0                        | 0     | 0       | 0        | 0         |
| 108                      | 19.3                       | Reported recent incidents                                    | 0                        | 0     | 0       | 0        | -         |
| 108                      | 19.4                       | Historical incidents                                         | 0                        | 0     | 0       | 0        | -         |
| Page                     | Section                    | <a href="#">Radon &gt;</a>                                   |                          |       |         |          |           |
| <a href="#">110 &gt;</a> | <a href="#">20.1 &gt;</a>  | <a href="#">Radon &gt;</a>                                   | Less than 1% (within 0m) |       |         |          |           |
| Page                     | Section                    | <a href="#">Soil chemistry &gt;</a>                          | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| <a href="#">112 &gt;</a> | <a href="#">21.1 &gt;</a>  | <a href="#">BGS Estimated Background Soil Chemistry &gt;</a> | 3                        | 0     | -       | -        | -         |
| <a href="#">112 &gt;</a> | <a href="#">21.2 &gt;</a>  | <a href="#">BGS Estimated Urban Soil Chemistry &gt;</a>      | 3                        | 6     | -       | -        | -         |
| 113                      | 21.3                       | BGS Measured Urban Soil Chemistry                            | 0                        | 0     | -       | -        | -         |
| Page                     | Section                    | <a href="#">Railway infrastructure and projects &gt;</a>     | On site                  | 0-50m | 50-250m | 250-500m | 500-2000m |
| 114                      | 22.1                       | Underground railways (London)                                | 0                        | 0     | 0       | -        | -         |
| 114                      | 22.2                       | Underground railways (Non-London)                            | 0                        | 0     | 0       | -        | -         |
| 115                      | 22.3                       | Railway tunnels                                              | 0                        | 0     | 0       | -        | -         |
| <a href="#">115 &gt;</a> | <a href="#">22.4 &gt;</a>  | <a href="#">Historical railway and tunnel features &gt;</a>  | 1                        | 0     | 0       | -        | -         |
| 115                      | 22.5                       | Royal Mail tunnels                                           | 0                        | 0     | 0       | -        | -         |



|     |      |                     |   |   |   |   |   |
|-----|------|---------------------|---|---|---|---|---|
| 115 | 22.6 | Historical railways | 0 | 0 | 0 | - | - |
| 116 | 22.7 | Railways            | 0 | 0 | 0 | - | - |
| 116 | 22.8 | Crossrail 2         | 0 | 0 | 0 | 0 | - |
| 116 | 22.9 | HS2                 | 0 | 0 | 0 | 0 | - |

## Recent aerial photograph



Capture Date: 07/04/2023

Site Area: 0.49ha



## Recent site history - 2022 aerial photograph



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Capture Date: 18/10/2022

Site Area: 0.49ha



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Capture Date: 11/06/2015

Site Area: 0.49ha

