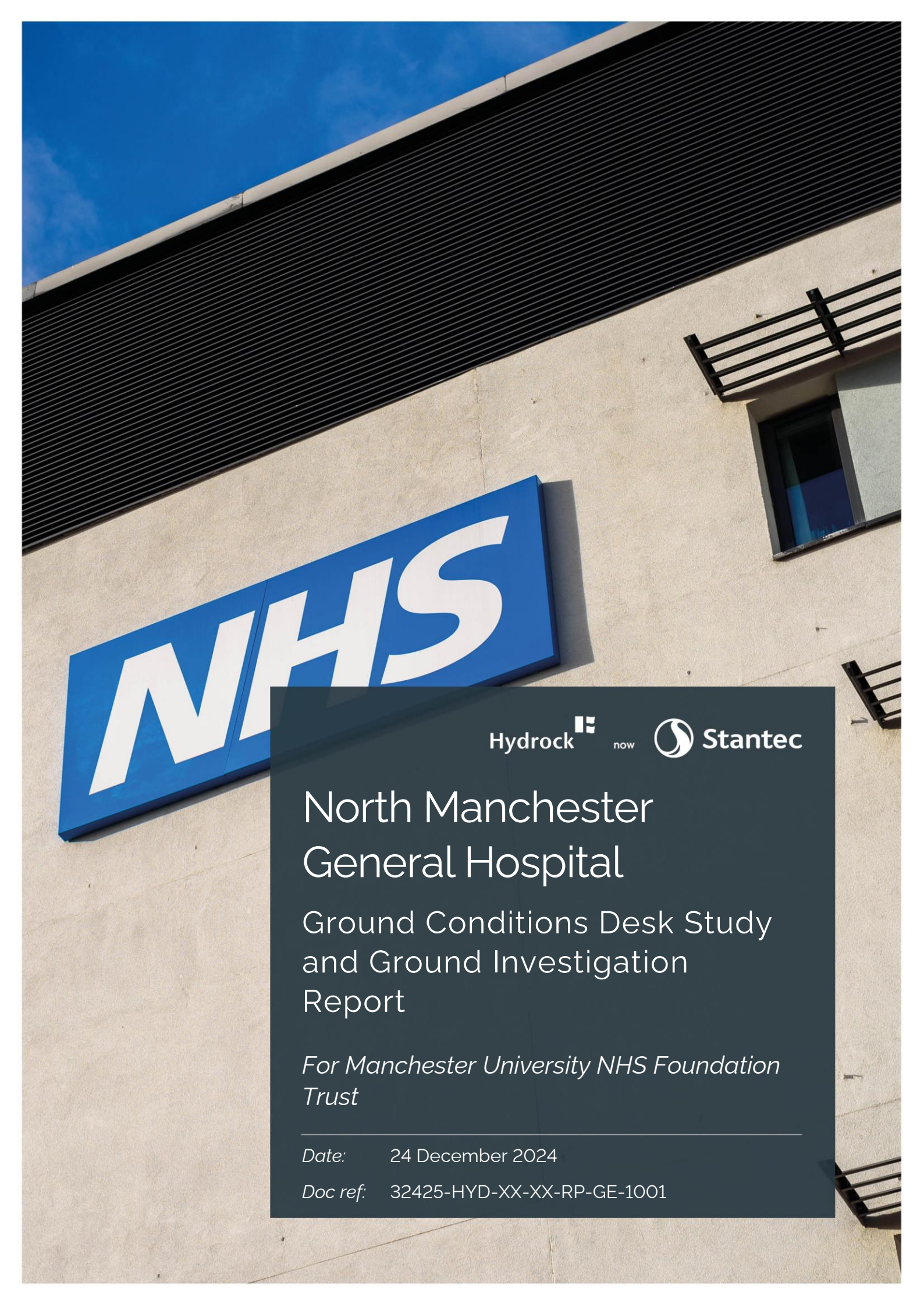


The background of the entire page is a photograph of a building's exterior. A large, blue, three-dimensional NHS logo is mounted on a light-colored concrete wall. Above the logo, a dark, ribbed metal fascia runs horizontally across the top of the frame. To the right, a window with a black metal balcony railing is visible. The sky is a clear, bright blue.

Hydrock  now

 Stantec

North Manchester General Hospital

Ground Conditions Desk Study and Ground Investigation Report

*For Manchester University NHS Foundation
Trust*

Date: 24 December 2024

Doc ref: 32425-HYD-XX-XX-RP-GE-1001

Document control sheet

<i>Issued by</i>	Hydrock Consultants Limited 100 Barbirolli Square Manchester M2 3AB United Kingdom	T +44 (0)161 804 5550 E stoke@hydrock.com hydrock.com
<i>Client</i>	Manchester University NHS Foundation Trust	
<i>Project name</i>	North Manchester General Hospital	
<i>Project title</i>	Ground Conditions Desk Study and Ground Investigation Report	
<i>BIM reference</i>	32425-HYD-XX-XX-RP-GE-1001	
<i>Project reference</i>	32425	
<i>Date</i>	24/12/2024	

Document production record		
<i>Issue Number</i>	P01	<i>Name</i>
<i>Prepared by</i>	Emily Wareing BSc (Hons) MSc FGS and Annabel Edwards BSc (Hons) FGS	
<i>Checked by</i>	Russell Sumner BSc (Hons) CSci FGS, Richard Harper CEng MICE and Rob Crookes MGeol (Hons) CGeol FGS RSoBRA (HH & PG)	
<i>Approved by</i>	Paul Eastwood BSc (Hons) MSc CGeol FGS RoGEP	

Document revision record			
<i>Issue Number</i>	<i>Status</i>	<i>Date</i>	<i>Revision Details</i>
P01	S2	24/12/2024	First Issue

Hydrock Consultants Limited (Hydrock) has prepared this report in accordance with the instructions of the above-named Client, under the terms of appointment for Hydrock, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock's appointment.

Contents

Executive summary	iv
1. Introduction	1
2. Desk study (and field reconnaissance)	5
3. Initial conceptual site model	17
4. Ground investigations	21
5. Ground investigation records and data	24
6. Geotechnical assessment	29
7. Geo-environmental assessment.....	33
8. Waste and materials management	41
9. Uncertainties and limitations	46
10. Recommendations for further work.....	48
11. References	49

Tables

Table 2.1: Site referencing information	5
Table 2.2: Site description	6
Table 2.3: Site history review.....	8
Table 2.4: Geology	10
Table 2.5: Aquifer system	11
Table 2.6: Groundwater abstractions	11
Table 2.7: Surface water discharges	13
Table 2.8: Regulatory information within 500m of the site	14
Table 2.9: Natural soil chemistry	15
Table 2.10: Non-specialist UXO screening (for the purposes of ground investigation)	16
Table 3-1: Possible Pollutant Linkages (for Risk Levels of Moderate or Greater).....	20
Table 4.1: Summary of site works.....	21
Table 4.2: Summary of monitoring installations	21
Table 4.3: Geo-environmental analyses of soils	22
Table 4.4: Geo-environmental analyses of waters.....	22
Table 4.5: Summary of sample numbers for geotechnical tests.....	23
Table 5.1: Strata encountered	24
Table 5.2: Groundwater level data summary	25
Table 5.3: Range of ground gas data	25
Table 5.4: Volume change potential	26
Table 5.5: PSD results summary	26
Table 5.6: Soil strength results and derived values.....	27
Table 5.7: Summary of compressibility	28
Table 5.8: Aggressive chemical environment concrete classification.....	28
Table 6.1: Geotechnical parameters recommended for design of Category 1 Structures (EC7).....	29
Table 7.1: Residual risks following risk assessment.....	39

Figures

Figure 2.1: Site location	5
Figure 2.2: Extract from the Ordnance Survey Map	5
Figure 2.3: Site entrance from Crescent Drive.	7
Figure 2.4: Linear patching of the tarmac car park surface indicating buried utilities.	7
Figure 2.5: Slope adjacent to the eastern car park.	7
Figure 2.6: General view of the car park adjoining Crescent Drive.	7
Figure 2.7: Superficial deposits	10
Figure 2.8: Solid geology.....	10
Figure 5.1: Undrained shear strength versus depth summary.....	27
Figure 5.2: SPT N ₆₀ value versus depth summary	28

Appendices

<i>Appendix A</i>	<i>Drawings</i>
<i>Appendix B</i>	<i>Field reconnaissance photographs</i>
<i>Appendix C</i>	<i>Historical ordnance survey maps</i>
<i>Appendix D</i>	<i>Desk study research information</i>
<i>Appendix E</i>	<i>Exploratory hole location plan, exploratory hole logs and photographs</i>
<i>Appendix F</i>	<i>Geotechnical test results and geotechnical plots</i>
<i>Appendix G</i>	<i>Site monitoring data and ground gas risk assessment</i>
<i>Appendix H</i>	<i>Contamination test results and GQRA</i>
<i>Appendix I</i>	<i>Waste assessment</i>
<i>Appendix J</i>	<i>Geotechnical risk register</i>
<i>Appendix K</i>	<i>Plausible source-pathway-receptor contaminant linkages</i>
<i>Appendix L</i>	<i>Climate Change Considerations for C-S-M</i>

Executive summary

Site information and setting	
Objectives	The works have been commissioned to assist with clearing anticipated planning conditions and to aid the design of the development
Client	Manchester University NHS Foundation Trust
Site name and location	North Manchester General Hospital, M8 5XL
Proposed development	The site development proposals are understood to comprise a new waste transfer compound with a modular welfare unit, waste compactors, storage areas, car parking, roads, and affiliated infrastructure. A limited amount of cut and fill earthworks have been proposed to form site levels.
Site description	The site is irregular in shape and covers an approximate area of 0.16 hectares.
Desk study summary	
Topography	Site levels are generally flat, with a steep slope on the eastern site boundary.
Hydrology	The River Irk flows north to south and lies approximately 250m east of the site.
Site History	The site was previously open fields until circa 1950, where the northern site area was utilised as allotment gardens. The existing car park at the site was constructed circa 1987.
Geology and Hydrogeology	Made Ground & Artificial Deposits: Car park construction (not included in aquifer classification system). Superficial: Till, Devensian (Secondary Undifferentiated aquifer), and Glaciofluvial Sheet Deposits (Secondary A Aquifer). Bedrock: Chester Formation (Principal Aquifer), and Manchester Marls Formation (Secondary B Aquifer). Shallow groundwater may be present perched on cohesive horizons within the Glaciofluvial Sheet Deposits, but due to the site topography the granular soils are anticipated to be well drained and dry. Groundwater will be likely at depth within the Chester Formation; Glacial Till may act as a confining layer above. Groundwater underlying the site is unlikely to be in hydraulic continuity with the River Irk.
Geotechnical hazards	Landscaped Made Ground underlies the north of the site, whilst Made Ground (tarmacadam) covers the surface of the car parking areas. An unnamed fault intersects the centre of the site in an east to west orientation.
UXO risk	A non-specialist UXO assessment indicates a low bomb risk.
Preliminary conceptual site model based on desk study	
Potential contaminant sources	Potential on-site sources of contamination: » Made Ground, associated with historical construction of the existing car park and imported fill, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials and PAH (S01). » Ground gases (carbon dioxide and methane) from organic materials in the Made Ground/superficial deposits (S02). » Petroleum hydrocarbons potentially associated with uncontrolled spillages and poor condition of the existing hardstanding (S03). There are no specific off-site sources of contamination.
Potential contaminant linkages (for receptors for which there is or will be a pathway)	Based on historical and current land uses, the possible pollutant linkages (for risk levels of moderate or greater) on an unremediated redeveloped site, as determined by the desk study and walk-over, are:

Source(s)	potential Impact on	Receptor(s)
Made Ground, associated with historical construction of the existing car park and imported fill to form a level site at the top of the slope, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, and PAH (S01).		People (neighbours, site end users). Groundwater: Secondary A aquifer within the Glaciofluvial Sheet Deposits and Principal aquifer status of the Chester Formation.
Petroleum hydrocarbons potentially associated with uncontrolled spillages and poor condition of the existing hardstanding (S03).		Water supply pipes

Ground model proven by investigation

Ground and groundwater conditions encountered by investigation	The ground conditions as proven by the investigation undertaken at the site comprise: » Surface hardstanding of bituminous bound pavement; over » Made Ground – between ground level and 2.6m below ground level (bgl), comprising brown slightly clayey sandy gravel of brick, sandstone, mudstone and concrete, with occasionally fragments of metal and wood; over » Glaciofluvial Sheet Deposits – between 1.4m and 13.1m bgl, comprising orange/brown sand, occasionally sandy clay and sandy silt; over » Glacial Till – from 7.5mbgl to an unproven depth, comprising stiff sandy gravelly clay, a sand band was encountered in CP101 between 14.3m and 15m bgl. Groundwater was not encountered during the investigation. Water levels recorded post-fieldwork ranged from 1 66.24 m OD to 68.15m OD in the Glaciofluvial Sheet Deposits. A deeper groundwater unit is likely present within the Chester Formation underlying the Glacial Till. There is olfactory evidence of petroleum hydrocarbon contamination in shallow soils at CP101 associated with contaminant point sources (uncontrolled spillages and poor condition of the existing hardstanding).
--	---

Summary of geotechnical conclusions

Groundwork	Following breaking out of hardstanding, excavation of shallow soils should be readily undertaken by conventional plant and equipment. Temporary trench support, or battering of excavation sides, is recommended for all excavations that are to be left open for any length of time and will definitely be required where manned entry is required.
Foundations	Shallow pad foundations are considered suitable for the modular office/welfare building. Allowable net bearing pressure of 70 kN/m² should be available for pad foundations. The pad foundations should be founded at least 300mm into the re-engineered structural fill or the underlying Glaciofluvial Sheet Deposits (at approximately 2.2m depth in the area of the proposed building).
Roads and pavements	For road / pavement design, a design CBR of 2.5 % is recommended.
Sustainable drainage	Soakaway drainage is considered unsuitable for this site due to spatial constraints.
Buried concrete	Design Sulfate Class - DS-3 and ACEC Class AC-3 for the Made Ground and DS-1, AC1 for the natural deposits. Equivalent to Design Chemical Class DC-1 for a 50 year design life.

Summary of geo-environmental assessment

Human Health	Based on the data comparison against the GAC the results indicate that all chemicals of potential concern (CoPC) are below the relevant GAC and therefore all relevant contaminant linkages are incomplete. The presence of asbestos fibres in the Made Ground are not considered a risk to Human Health for the proposed site end use. However, should suspected asbestos containing
--------------	---

	materials be identified during the groundworks, work should pause and Hydrock be consulted at the earliest opportunity.
Phytotoxicity	Results indicate that all CoPC are below the relevant phytotoxic GAC, therefore the contaminant linkage is incomplete.
Controlled waters	There is not considered to be a risk to controlled waters from on-site sources.
Ground gases or vapours:	Low risk from ground gases (subject to final monitoring round) and CS1 conditions apply. The site is not in a Radon affected area.
Construction materials:	Plastic or bitumastic products may be at risk from high concentrations of VOCs and petroleum hydrocarbons, but confirmation should be sought from manufactures.
Potable water supply pipes	The site is Brownfield with organic contaminants present and barrier pipe is considered suitable for this site. However, confirmation should be sought from the water supply company at the earliest opportunity.

Enabling works

Proposed mitigation measures	Remedial measures may be considered necessary at the site, subject to the outcome of the slope stability assessment. Low height retaining walls (up to 0.5m height) may be required to accommodate levels differences across the site. These will need design by the structural engineer or by the appointed design and build Contractor. Barrier pipe may be required for potable water supply, and confirmation should be sought from manufacturers as to the suitability of plastic or bitumastic products in the Made Ground. If CS1 conditions are confirmed no ground gas protection measures will be required, however this is subject to the final conclusions following completion of the monitoring commission.
Earthworks	A limited amount of cut and fill earthworks have been proposed to form the site levels; supplementary earthworks testing may be required and an earthworks specification will be necessary to ensure the appropriate management and reuse of the existing soils.
Waste management	Excavated soils to be disposed of as waste, are likely to be classed as non-hazardous.

Future considerations

Further work	Following the ground investigation works undertaken to date, the following further works will be required: » detailed topographical survey of the slope adjacent to the site to enable the slope stability assessment; » a slope stability assessment needs to be undertaken prior to final design and construction; » completion and reporting of the ongoing gas monitoring, hence the conclusions in this report are provisional, subject to the completion of monitoring; » discussion and agreement with utility providers regarding the materials suitable for pipework, potentially including full UKWIR risk assessment; » discussions with regulatory bodies and the warranty provider regarding the conclusions of this report; » production of an appropriate Earthworks Specification; » production of a Materials Management Plan relating to reuse of soils at the site and potential import of soils to the site; and » verification of the earthworks, any remediation (if required), and mitigation works.
--------------	---

This Executive Summary forms part of Hydrock Consultants Limited report number 32425-HYD-XX-XX-RP-GE-1001 and should not be used as a separate document.

1. Introduction

1.1 Terms of reference

In October 2024, Hydrock Consultants Limited (Hydrock) was commissioned by Manchester University NHS Foundation Trust (the Client) to undertake a site investigation, comprising a Phase 1 desk study and Phase 2 preliminary ground investigation at North Manchester General Hospital. The site is located south east of the North Manchester General Hospital, on the eastern side of Crescent Drive; the nearest postcode is M8 5RB.

The site currently consists of areas utilised as car parking, bordered by deciduous woodland. The car park herein referred to as 'the site' relates to a flat car park at the top of the slope, which reduces in levels from the crest in the west at 77m AOD to toe in the east at 72m AOD. A second area of car parking lies outside of the red line boundary for this site (to the east) and lies below the level of 'the site' by circa 5m. This second area of car parking although not part of the site discussed throughout this report, should be noted as lying within the NHS Foundation Trust's land boundary and is made available for ground investigation. A site location plan (Hydrock Drawing 32425-HYD-XX-XX-DR-GE-1000) is presented in Appendix A

Hydrock understands that the proposed development is to comprise a new waste transfer compound with a modular welfare unit, waste compactors, storage areas, car parking, roads and affiliated infrastructure. A proposed development layout (Sheppard Robson Drawing 23130-SRA-NM171-00-DR-A-SK004-S2-P02) is presented in Appendix A. A limited amount of cut and fill earthworks have been proposed to form the site levels, as shown on Hydrock drawing 32425-HYD-XX-XX-DR-D-0200 presented in Appendix A.

The investigation works have been undertaken in accordance with Hydrock's proposal referenced (32425-HYD-XX-XX-FP-GE-1001, dated 4 October 2024) and the Client's instructions to proceed (email from Nicola Harman, Senior Capital Works Manager, dated 10 October 2024).

1.2 Objectives

The works have been commissioned to assist with clearing anticipated planning conditions and to aid the design of the development.

The objectives of the Phase 1 Desk Study are to formulate a preliminary ground model and an initial Conceptual Site Model (CSM) of the site to identify and make a preliminary assessment of any potential geo-environmental and geotechnical risks to the proposed development.

The objectives of the Phase 2 Ground Investigation are:

- » to resolve any geotechnical and geoenvironmental uncertainties identified in the Phase 1 Desk Study by refining and updating the preliminary ground model, based on the conditions met in accordance with the principles of Environment Agency (EA) 'Land Contamination: Risk Management' (LCRM) (2023);
- » to identify any geo-environmental mitigation requirements to enable development to progress; and
- » to provide preliminary geotechnical recommendations for design.

1.3 Scope

The site investigation includes a Phase 1 Desk Study and a Phase 2 Ground Investigation.

The scope of the Phase 1 Desk Study comprises:

- » a field reconnaissance (walkover) to determine the nature of the site and its surroundings including current and former land uses, topography, and hydrology;
- » acquisition and review of:
 - » historical Ordnance Survey maps, to identify any; former potentially contaminative uses shown at the site and immediately surrounding it, and an assessment of the associated contamination risks;
 - » a third-party environmental report to identify any; flooding warning areas, local landfills, pollution incidents, abstractions, environmental permits etc. All of which may have had the potential to have environmental impact on the site;
 - » topographical, geological and hydrogeological maps;
 - » British Geological Survey (BGS) archive records;
 - » site specific UXB risk maps;
 - » a site-specific Coal Authority 'Consultants Coal Mining Report';
 - » the Coal Authority's Interactive Viewer;
- » development of a preliminary ground model representing ground conditions at the site;
- » development of an initial Conceptual Site Model (iCSM), including identification of potential contaminant linkages;
- » a qualitative assessment of any geo-environmental risks identified; and
- » identification of any plausible geotechnical hazards.

The scope of the Phase 2 Ground Investigation comprises:

- » a preliminary ground investigation including windowless sampling and cable percussive boring, to:
 - » obtain data on the ground and groundwater conditions of the site;
 - » allow collection of samples for geotechnical and chemical laboratory analysis;
 - » allow geotechnical field tests to be undertaken;
 - » install gas and groundwater monitoring wells;
- » gas concentration and groundwater level monitoring;
- » groundwater sampling if encountered during the ground investigation;
- » geotechnical and chemical laboratory analysis;
- » updating of the preliminary ground model;
- » preparation of a geotechnical risk register;
- » presentation of an initial geotechnical design recommendations;
- » formulation of an updated Conceptual Site Model (CSM), including identification of any plausible contaminant linkages;
- » completion of a generic quantitative risk assessment of any identified chemical contaminants to establish 'suitability for use' under the current planning regime;
- » discussion of any potential environmental liabilities associated with land contamination (soil, water and gas); and
- » identification of outline mitigation requirements to ensure the site is 'suitable for use'.

1.4 Available information

The following documents, reports etc have been provided to Hydrock by the Client for use in the preparation of this report:

- » Sheppard Robson, n.d. drawing number: 23130-SRA-NM171-00-DR-A-02804 - Services Overlay;
- » Sheppard Robson, December 2023, drawing number: 23130-SRA-NM171-00-DR-A-SK004-P02 - WP Waste Transfer Compound Sketch Layout, North Manchester General Hospital, for Manchester University NHS Foundation Trust;
- » Wernick Refurbished Buildings, June 2024, (drawing number not provided), 2 Bay Indicative Foundation Plan 12.0m;
- » HM Land Registry, February 2020, Official copy of title plan, Title number GM778969, OS map reference SD8492SE, scale 1:2500 reduced from 1:1250;
- » Recom Solutions, September 2024, document reference: 50028-RCM-CD-XX-RFI-W-002, NMGH - Waste Compound Rev 1, Request for Information Client's Tracker; and
- » Manchester City Council, 2024, document reference: NMGH-WP1- 23130-Waste Compound, Draft Planning Conditions.

Additionally, the following drawings are available from the Hydrock Civils and Structures team:

- » Hydrock, March 2024. Finished Levels And Earthwork Volumes drawing ref: 32425-HYD-XX-XX-DR-D-0200.
- » Hydrock, March 2024. External Works Plan drawing ref: 32425-HYD-XX-XX-DR-D-0700.

Where relevant, the above documents have been used for information purposes to inform this report.

1.5 Regulatory context and guidance

The investigation work has been carried out in general compliance with recognised best practice, including (but not limited to) BS 5930:2015+A1:2020, BS 10175:2011+A2:2017 and the AGS (2006) 'Good Practice Guidelines for Site Investigations'.

The geo-environmental section of this report is written in broad accordance with BS 10175:2011+A2:2017 and EA LCRM (2023).

The methods used follow a risk-based approach, the first stage of which is a Phase 1 desk study and field reconnaissance, with any potential geo-environmental risks assessed qualitatively. This is done using the 'source-pathway-receptor contaminant linkage' concept to assess risk as introduced in the Environmental Protection Act 1990 (EPA, 1990). Any potential geotechnical risks are also assessed from the Phase 1 desk study and site reconnaissance stage.

Phase 2 comprises intrusive ground investigation work and testing. The factual information from the desk study and the ground investigation are used to develop the Conceptual Site Model (CSM). This CSM is based on a ground model of the site physical conditions and an exposure model of the possible contaminant linkages. The CSM forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines. This GQRA might lead to more Detailed Quantitative Risk Assessment (DQRA).

Professional judgement is then used to evaluate the findings of the risk assessments and to provide recommendations for the development.

The geotechnical section of this report is prepared in general accordance with BS EN 1997-1+A1:2013, BS EN 1997-2:2007 and BS 8004:2015+A1:2020. This report constitutes a Ground

Investigation Report (GIR) as described in Part 2 of Eurocode 7 (BS EN 1997-2) (EC7). However, it is not intended to fulfil the requirements of a Geotechnical Design Report (GDR) as specified in EC7.

The geo-environmental and geotechnical aspects are discussed in separate sections. Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation and these two main aspects are inter-related. Designers should take all aspects of the investigation into account.

Remaining uncertainties and recommendations for further work are listed in Section 9 and Section 10.

2. Desk study (and field reconnaissance)

2.1 Data

A number of desk study sources have been used to assemble the following information. These are presented in Appendix C and Appendix D, and include:

- » Third-party environmental report (Groundsure report, reference HYD-TPI-OG5-LMV-ZFP);
- » Historical Ordnance Survey mapping;
- » BGS Onshore GeoIndex (GeoIndex (onshore) - British Geological Survey (bgs.ac.uk));
- » BGS Maps Portal- Sheet 85 (1:50,000), Manchester, Solid and Drift;
- » DEFRA Magic Map Application (<https://magic.defra.gov.uk/magicmap.aspx>);
- » Coal Authority 'Consultants Coal Mining Report' (Reference: HYD-VQH-L5Q-MV3-LG4);
- » Coal Authority's Interactive Viewer (<https://datamine-cauk.hub.arcgis.com/>).
- » Environment Agency River catchment data (England | Catchment Data Explorer);
- » Environment Agency flood data (<https://flood-map-for-planning.service.gov.uk/>); and
- » Zetica UXB Risk Maps (<https://zeticauxo.com/downloads-and-resources/risk-maps/>);

2.2 Site referencing

Table 2.1: Site referencing information

Item	Brief Description
Site name	North Manchester General Hospital
Site address	Land south-east of North Manchester General Hospital, Crescent Drive, Crumpsall. The nearest postcode is M8 5XL.
Site location and grid reference	The site is located south-east of the main North Manchester General Hospital campus, in Crumpsall, Manchester. The site lies circa 4km north of Manchester city centre. The National Grid Reference of the approximate centre of the site is 385021 402117. The site is approximately 0.16 Ha in area and measures approximately 100m by 25m and is irregular but elongated in shape along a north-east to south-west axis.
Site boundaries	The site is bound by a mature treeline and lies south-east of the main hospital site, but still within the land ownership boundary of the hospital trust. Crescent Drive runs parallel to the east of the site, and provides access to the site.



Figure 2.1: Site location
(Reproduced with permission from Groundsure)



Figure 2.2: Extract from the Ordnance Survey Map.
(OS licence AC0000817865).

A site location plan (Hydrock Drawing 32425-HYD-XX-XX-DR-GE-1000) is presented in Appendix A.

2.3 Site description and field reconnaissance survey

A field reconnaissance survey was undertaken on 22 October 2024 to visually identify assess potential geotechnical hazards, contaminant sources for future investigation and identification of possible source-pathway-receptor linkages. The weather during the field reconnaissance survey was overcast but dry.

A description of the site is presented in Table 2.2 and selected photographs are presented in Figure 2.3 to Figure 2.6. Additional photographs are presented in Appendix B.

Table 2.2: Site description

Item	Brief Description
Site access	The site was accessed from Crescent Drive in the west of the site.
Site area	The site is elongated in shape, in a north-east to south-west orientation and has an area of approximately 0.16 ha.
Elevation, topography, and any geomorphic features	The site is generally level at 77m AOD and sits at the top of the slope which forms part of the Irk Valley. Adjacent to the east of the site is vegetated slope, the crest at 77m AOD and the toe at 72m AOD, adjacent to the northern site area extending 15m in length from crest to toe and in the south 10m in length from crest to toe. The slope based on the dimensions in the south is sloping at an angle of 27° and north at 19°. During the walkover linear cracks running parallel to the existing slope were not recorded, (which could be indicative of movement associated with slope instability). Mature trees at the crest of the slope appear to be straight, if angled they could indicate slope movement. The remainder of the slope is heavily vegetated restricting access to assess if other indicators or drivers of slope instability were present i.e. burrowing animals, evidence of creep.
Site boundaries and surrounding land	Construction works are presently underway to the west of the site, across Crescent Drive which runs parallel to the west of the site. The site is bound on all sides by 2m high palisade fence and a mature tree associated with deciduous woodland are present north, south and on the slope to the east.
Present land use	The site is presently covered by hardstanding and utilised as car parking. Visible linear scarring of the tarmacadam surface can be observed which indicates the presence of potential utilities buried within this area (assumed to be a gas main, although pressure is unknown). There is a lighting pole and small cabin (associated with utilities) in the north. There is visible patching across the car park and the surface is in a general poor condition.
Vegetation	A mature deciduous treeline borders the site. The site overall is hardstanding with no mature trees planted directly within the red line boundary.
General site sensitivity	The site is within a generally commercial area and lies within the land ownership boundary of the Manchester University NHS Foundation Trust.

A site walkover plan (Hydrock Drawing 32425-HYD-XX-XX-DR-GE-1001) is presented in Appendix A.



Figure 2.3: Site entrance from Crescent Drive.



Figure 2.4: Linear patching of the tarmac car park surface indicating buried utilities.



Figure 2.5: Slope adjacent to the eastern car park.



Figure 2.6: General view of the car park adjoining Crescent Drive.

2.4 Site history

A study of historical Ordnance Survey maps (Appendix C) has been undertaken to identify any former land uses at the site and surrounding areas which may have geotechnical or geo-environmental implications for the proposed development. The key findings are summarised in Table 2.3.

Table 2.3: Site history review

Reference	Key features on site	Key features off-site
OS Map ¹ 1848: 1:10,560	The site comprises open fields with an Allotment Gardens in the northern site area.	The River Irk lies circa 250m east of the site. Crumpsall Cotton Mill lies circa 500m east of the site, and a print works is situated circa 200m south of the cotton mill. Crumpsall Vale Dye Works lie circa 550m north of the site in Blackley, adjacent to the River Irk. A bleach works is also located circa 450m north-east of the site, adjacent to the River Irk. Circa 800m south-east of the site is a print works and Smedley Paper Mill. A further print works is located at Bowker Bank c. 1.5km north-west of the site. C. 1.5km north-west of the site is a bleach works. Sand pits (where sandstone has been mined at surface level) are also recorded on the map 800m north and 1.1km north of the site.
OS Map 1891: 1:10,560	The site lies on the east boundary of Manchester Workhouse.	Manchester Workhouse occupies the land immediately to the west of the site. Prestwich Union Workhouse is located circa 300m north of the site. A hospital lies between the two workhouses, circa 200m north of the site. A brick works has been constructed circa 400m west of the site. The print works circa 200m to the south of the cotton mills is now also a dye works. Ashenhurst Works are located on the northern bank of the River Irk, circa 1km north of the site. Crumpsall Vale Dye works and Blackley Logwood Mill to the north of the site are now a chemical works on the River Irk.
OS Map 1893: 1:2,500 and OS Map 1891-1894: 1:10,560	The north of the site features unlabelled tracks. A deciduous treeline runs parallel to the western site boundary separating the site from the Manchester Workhouse buildings.	The hospital north of site details this is for treatment of infectious diseases. The Manchester Workhouse features a mortuary in the centre of the buildings. A Jewish cemetery is present approximately 30m to the south west of the site. A railway line has been constructed circa 700m west of the site running in a north-west to south-east orientation. Smedley Paper Mill is now Smedley Dye Works.
OS Map 1906: 1:10,560 and OS Map 1906-1907: 1:10,560	No significant change.	Ashenhurst Works and Bowker Bank Print Works are labelled as disused. The railway line to the west of the site is labelled the Radcliffe Line.

¹ Ordnance Survey Historical Map Information provided by Groundsure

Reference	Key features on site	Key features off-site
OS Map 1909: 1:2,500	No significant change.	An additional building has been constructed immediately north of the Manchester Workhouse which is thought to be an extension to the hospital.
OS Map 1915-1916: 1:10,560	No significant change.	Manchester Workhouse is now Crescent Road Institution. Prestwich Union Workhouse is renamed Delaunay's Road Institution.
OS Map 1932: 1:2,500 and OS Map 1931-1933: 1:10,560	No significant change.	Crescent Road Institution and Delaunay's Road Institution is now Crumpsall Institution (Manchester Public Assistance Committee), and the hospital adjacent has now been rebuilt into Nurses homes. Engineering works have been constructed circa 200m east of the site, which comprise a series of engine sheds, and tramlines. Storage tanks are recorded in the north of the works, circa 250m north-east from the site. A coal wharf has been established to the north of Crumpsall Train Station. Waterside Bleach Works and Heaton Vale Dye Works have been constructed circa 2km north-west of the site, and to the north of the River Irk.
OS Map 1938: 1:10,560	No significant change.	A refuse destructor has been mapped circa 225m east of the site.
OS Map 1949-1951: 1:2,500	A small building possibly a greenhouse is shown close to the centre south of the Allotment Gardens.	The southern area of Crumpsall Institution is now Springfield Hospital, and the northern area is Crumpsall Hospital.
OS Map 1956: 1:10,560, OS Map 1966-1968: 1:10,560 and OS Map 1969-1970: 1:2,500	No significant change.	No significant change.
OS Map 1975-1977: 1:10,000	No significant change.	No significant change.
OS Map 1978-1983: 1:1,250 and OS Map 1985-1988: 1:10,000	The site is no longer recorded as allotment gardens.	The slope to the immediate east of the site has been cut into, to create two further plateaus of similar size to the plateau which the site occupies. The hospital is now known as North Manchester General Hospital.
OS Map 1987-1992: 1:1,250 and OS Map 1992: 1:1,250	The site is now labelled as car parking,	No significant change.
OS Map 2001: 1:10,000	No significant change.	Partial demolition of the southern zone of the hospital.
OS Map 2003: 1:1,250 and OS Map 2010: 1:10,000	No significant change.	No significant change.
OS Map 2024: 1:10,000	No significant change, site remains an area of car parking.	Further demolition in the southern area of the North Manchester General Hospital, creating more open space between existing buildings.

2.5 Geology

The geology of the site area is shown on the 1:10,000 British Geological Survey (BGS) map extract reproduced as part of the Groundsure report and is summarised below:

Table 2.4: Geology

Ref. for Figures	Location	Stratigraphic Name	Description
Artificial Deposits			
1	On site (northern zone only)	Landscaped ground	Artificial deposits associated with previous construction activities at the site.
Superficial Deposits (Figure 2.7)			
2 & 4 (shown in lilac)	On site	Glaciofluvial Sheet Deposits, Devensian.	Intergranular in nature predominantly sand and gravel with inclusion of clay bands
1 & 3 (shown in blue)	On site	Till, Devensian.	Unsorted angular gravels and sandy gravelly clay.
Solid Geology (Figure 2.8)			
1 2 & 4 (shown in grey)	On site	Chester Formation.	Reddish brown and pinkish red medium grained sandstone with common quartzite pebbles towards the base of formation.
3 (shown in orange)	On site	Manchester Marls Formation.	Reddish brown gypsiferous mudstone.



Figure 2.7: Superficial deposits.
(Reproduced with permission from Groundsure)



Figure 2.8: Solid geology.
(Reproduced with permission from Groundsure)

A fault indicated by the dashed line in Figure 2.8 intersects the site in a north-west to south-east trend and is shown on the BGS sheet map 85 (1:50,000 Manchester) with downthrow to the east. The BGS mapping indicates that at least 10.0m of superficial coverage will overly the bedrock, with the toe of the slope likely sat upon the deeper Glacial Till. Therefore, fault surfaces associated with the recorded fault is not anticipated to pose a significant geotechnical risk to currently proposed end use.

The geological mapping shown in Figure 2.7 would suggest that the slope adjacent to the east is likely to comprise Made Ground over Glaciofluvial Sheet Deposits (likely sand and gravels with

some clay bands). Underlying the site the Glaciofluvial Sheet Deposits are likely to extend beyond the base of the slope circa 72m AOD with Glacial Till present at depth below circa 10.0m.

Although Landscaped Ground (artificial) is shown in the north it appears associated with the wider North Manchester General Hospital site to the west, however artificial Made Ground is anticipated to be present associated with the grading of the existing slope to form the car park.

2.6 Hydrogeology

2.6.1 Aquifer designations

Based on the inferred geological sequence presented in Section 2.5 and the Environment Agency's interactive aquifer designation map, the aquifer system presented in Table 2.5 applies.

Table 2.5: Aquifer system

Stratum	Aquifer designation	Comments
Landscaped Ground	Unclassified/ unproductive	Artificial ground not included in the classification system. Likely to be moderate to high porosity because of unconsolidated nature, but permeability is likely to be low.
Superficial Deposits		
Glaciofluvial Sheet Deposits, Devensian	Secondary A Aquifer	Intergranular permeability. Dominated by moderate to high permeability layers of sand and occasional gravel, interbedded with low permeability clay. Groundwater flow is likely to be variable and discontinuous as water migrates around low permeability areas.
Till, Devensian	Secondary Undifferentiated	Predominantly clay of low permeability, possibly interbedded with occasional discrete layers of sand and gravel. Overall, this unit is likely to be anisotropic in nature with horizontal permeability greater than vertical permeability (i.e. $k_h > k_v$) where granular beds/lenses are present.
Solid Geology		
Chester Formation	Principal Aquifer	Moderate to high porosity sandstone, moderate to high permeability and with high secondary permeability from fracturing within the sandstone. Large water storage capacity due to its high porosity.
Manchester Marls Formation	Secondary B Aquifer	Limited porosity and permeability in the cohesive nature and low porosity of the mudstones, will prevent downward migration/percolation of groundwater vertically between layers of strata towards the base of the units. The Manchester Marl Formation are therefore considered to have a poor water storage potential.

2.6.2 Groundwater abstraction

There are two active licensed groundwater abstractions within 1000m of the site; they are listed in Table 2.6.

Table 2.6: Groundwater abstractions

Location relative to site	Purpose of abstraction
800m north	Industrial; General cooling (low loss) at British Cables Company Ltd, Blackley.
930m north-west	Industrial; General cooling (low loss) at British Cables Company Ltd, Blackley.

2.6.3 Groundwater source protection zones and groundwater vulnerability

The site is not within a groundwater Source Protection Zone (SPZ).

2.6.4 Groundwater levels, recharge, and flow

Shallow groundwater may be present perched on cohesive horizons within the Glaciofluvial Sheet Deposits. Given the site lies at the top of the slope which is shown to be underlain by the Glaciofluvial Sheet Deposits, the granular soils are anticipated to be well drained and dry, therefore shallow groundwater body in the granular soil is likely absent.

Groundwater will be likely at depth within the Chester Formation, however the Glacial Till at depth may act as a confining layer for groundwater in the Chester Formation. The presence of low permeability clays within the Glaciofluvial Sheet Deposits and the deeper Glacial Till may limit downward migration of potential contaminants into the principal aquifer.

Although the site includes granular Glaciofluvial Sheet Deposits, it is anticipated that they are unsuitable for soakaway infiltration, given the potential risk of slope instability if infiltrating water is released into potential loose and dry granular soils.

The site is positioned at the edge of the River Irk valley, the river being some 250m east of site, with associated alluvium likely to be in hydraulic continuity mapped to within 70m to the east of site. Granular superficial deposits are present on site (glaciofluvial deposits) which appear to be underlain by, and separated from the alluvium by, Glacial Till. While the till may be mostly impermeable clays it could comprise more permeable strata, and a limited groundwater pathway is likely to exist to either the alluvium or bedrock aquifers below. Additionally, there could be unmapped linkages of the granular superficals. As such, the fate of groundwater below the site is considered likely to be the River Irk.

2.6.5 Groundwater quality

The groundwater body beneath the site (Manchester and East Cheshire Permo-Triassic Sandstone Aquifers) is currently (2019, Cycle 3) classified under the Water Framework Directive as 'poor'.

The water body is currently given a 'poor' status due to 'chemical saline intrusion' conditions.

2.6.6 Groundwater flooding

The environmental data report indicates a moderate risk of groundwater flooding. However, given that the site lies at the crest of a slope which geological mapping indicates is underlain by well drained granular soils, with groundwater likely present at depth within the Glaciofluvial Sheet Deposits, groundwater flooding is not anticipated to pose a risk to the site.

2.7 Hydrology

2.7.1 Surface water system and drainage

There is only one surface water feature recorded in the vicinity of the site; the River Irk (Wince to Irwell) lies 250m east of the site and is orientated north to south.

2.7.2 Surface water abstractions and discharges

There are no active licensed surface water abstractions within 1km of the site.

There are 4 active licensed surface water discharges within 1km of the site; they are listed in Table 2.7.

Table 2.7: Surface water discharges

Location Relative to Site	Purpose of Discharge
360m east	Sewage storm overflow, discharge to River Irk.
500m south-east	Sewage storm overflow, discharge to River Irk.

2.7.3 Surface water quality

Reference to the Environment Agency web site shows the site is located within the catchment known as the Roch Irk Medlock. The specific river water body being the Irk (Wince to Irwell). The current (2019, Cycle 3) overall status under the Water Framework Directive is described as 'moderate'.

The reason for the water body currently having a 'moderate' status is due to poor numbers of invertebrates, and hazardous chemicals suspended in water. The water body has elevated concentrations of metals including copper, iron, manganese and zinc.

Hazardous chemicals identified within this water body include mercury compounds, perfluorooctane sulphonate (PFOS) and polybrominated diphenyl ethers (PDBE). The objectives for the hazardous chemical status of the following are to be 'good' are: 2039 for PFOS (this is noted however to be technically infeasible as no solution for this is available), 2040 for mercury compounds and 2063 for PDBE. Mercury and its compounds, and PDBE are expected to achieve this 'good' status under natural conditions whilst dilution takes place in the outlined chemical recovery time.

2.7.4 Surface water flooding

The desk study information indicates the proposed development is in Flood Zone 1 (with a low probability of flooding from rivers or the sea).

The risk from surface water flooding (pluvial flooding) is recorded as negligible on the site.

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regard to drainage and flooding.

2.8 Mining and mineral extraction

The site is within an area defined by the Coal Authority (CA) as a Coal Mining Reporting Area.

A 'Consultants Coal Mining Report' was obtained from The Coal Authority and is included in Appendix D.

There are no Coal Authority records of mine entries, probable workings, or past underground workings on the site, or in a 20m buffer zone around the site. The Coal Authority hold no records for underground workings underneath the site or surrounding area, therefore the risk posed by past coal mining is considered to be very low.

Historical mapping has indicated previous excavation of sandpits from surface level, in the wider Crumpsall area related to past quarrying operations of the sandstones of the Chester Formation. These pits have since been backfilled, and are not present on site or in proximity. The backfilled quarry is unlikely to pose a geotechnical risk to the subject site.

The environmental data report contains records of a landslide, associated with the excavation to form Abraham Moss Landfill, 300m south of site within a former clay pit. Due to the distance between the site and landslide it does not pose a geotechnical risk to the site, but is indicative of the hazard associated with the granular glaciofluvial superificials.

2.9 Natural ground instability

Shallow clays may be present, associated with the Glaciofluvial Sheet Deposits, which could be affected by shrink-swell ground movements in clays as a result of changes in moisture content from removal or growth of trees.

Given the site location at the crest of a slope, which is likely made up of granular soils and well drained, shallow groundwater within the granular Glaciofluvial Deposits is not anticipated to be present therefore the risk from running sands and collapsable ground is considered to be low.

Sloping ground is present to the east of the site, onsite observation found the trees at the crest of the slope to generally be straight and there were no obvious signs of cracking of the hardstanding across the car park running parallel to the crest of the slope. However, as part of the ground investigation and more detailed design the stability of the slope will require assessment to ensure that loading of the slope by proposed site structures will not lead to future instability or failure.

2.10 Landfill and waste management

There is one pertinent waste site recorded within 500m of the site; a historical landfill at Abraham Moss Centre 300m south-south-west. No records of waste type or operational dates are provided.

2.11 Regulatory Information

Information in the Groundsure Report (Appendix D), relating to various regulatory controls has been reviewed, with a summary presented below in Table 2.8.

Table 2.8: Regulatory information within 500m of the site

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
Discharge Consents	356m east.	Sewage discharges, sewer storm overflow to River Irk (2 records). Permit number: NPSWQD010702. Permit active.	No.	Due to being down gradient of the site.
	360m east.	Sewage discharges, sewer storm overflow to River Irk (2 records). Permit number: 01MAN0135. Permit revoked 2014.	No.	Due to being down the hydraulic gradient of the site, the distance from the site, and the inactive status of this permit.
	445m east.	Sewage discharges, sewer storm overflow to River Irk (3 records). Permit number: 01MAN0073. Permit revoked 2015.	No.	
	493m-497m south-east.	Sewage discharges, sewer storm overflow to River Irk (3 records). Permit number: 01MAN0008. Permit active.	No.	Due to being down the hydraulic gradient of the site, and the distance from the site.
	494m-497m south-east.	Sewage discharges, sewer storm overflow to River Irk (2 records). Permit number: 016993737. Permit active.	No.	
	494m south-east.	Sewage discharges, sewer storm overflow to River Irk (2 records). Permit number: 01MAN0123. Permit revoked 2019.	No.	Due to being down the hydraulic gradient of the site, the distance from the

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
	494m south-east.	Sewage discharges, sewer storm overflow to River Irk. Permit number: 01MAN0116. Permit revoked 2005.	No,	site, and the inactive status of this permit.
	496m south-east.	Sewage discharges, sewer storm overflow to River Irk. Permit number: NPSWQD010701. Permit active.	No,	Due to being down the hydraulic gradient of the site, and the distance from the site.
Licensed Industrial Activities	270m north-west	Medium combustion plant, North Manchester General Hospital. Permit number: QP3209BD. Permit effective since July 2021 (remains active).	No.	Due to its distance from site, and activities expected to be undertaken in accordance with permit and thus does not pose risk to the proposed development.
Pollution Incidents	469m south	July 2002, other pollutant, Category 3 – minor incident (air impact)	No.	Due to its distance from the site, time since the event and the Category 3 classification of the incident.
Control of major accident hazards sites (COMAH)	N/A	No entries on COMAH sites were recorded within 500m of the site.	No.	N/A
Registered radioactive substances	275m north-west.	Pennine Acute Hospitals NHS Trust. Disposal of radioactive waste (8 records). Permit last issued 2020.	No.	Disposal and management of radioactive waste is anticipated to be undertaken in accordance with permits.
Notification of installations handling hazardous substances	N/A	No entries on notification of installations handling hazardous substances were recorded within 500m of the site.	No	N/A

2.12 Natural soil chemistry

Information contained within the environmental report (Appendix D) gives indicative (estimated) concentration values for the natural soils at the site for a selection of Contaminants of Potential Concern (CoPC). These have been reproduced in Table 2.9.

Table 2.9: Natural soil chemistry

Element	Arsenic	Cadmium	Chromium	Lead	Nickel
Concentration (mg/kg)	15 - 25	1.8	60 - 90	100	15 - 30

The data in Table 2.9 is considered within the geo-environmental assessment and has been assessed against Hydrock's Generic Assessment Criteria (GAC) for soil chemistry with regards to human health for the intended commercial end use criteria. There are no exceedances with regards to human health.

2.13 Radon

The guidance indicates that the site is not in a Radon Affected Area and no radon protection measures are required.

2.14 Coal Tar

The existing car park was laid in the 1980s when coal tar was still utilised within bituminous products. The coal tar will be bound within the bituminous materials if present and is not anticipated to pose an environmental risk.

From a waste disposal aspect, coal tar can contain elevated petroleum hydrocarbons which can lead to the waste bituminous material being classified as hazardous. As part of the ground investigation the bituminous hardstanding should be inspected for tarry inclusions. Benzo(a)pyrene analysis should be carried out; levels above 50mg/kg are used as a key indicator of the presence of coal tar (as defined in the guidance note produced by the Association of Directors of Environment, Economy Planning and Transport (ADEPT) entitled "Managing Reclaimed Asphalt – Highways and Pavements", 2019-1, dated August 2019).

2.15 Unexploded ordnance (UXO)

In general accordance with CIRIA Report C681 (Stone et al 2009) a non-specialist UXO screening exercise has been undertaken for the purposes of ground investigation and is presented in Table 2.10.

Table 2.10: Non-specialist UXO screening (for the purposes of ground investigation)

Data	Comment	Further Assessment Required
Site History	There is no indication of former military use from the desk study	No
Post War Development	There is no evidence of bomb damage or ruins on historical mapping post 1945.	No
Geology Type	The ground conditions comprise a thin covering of superficial deposits, over the Chester Formation (sandstone). It is unlikely UXO would remain undetected.	No
Surface Cover during WWII	The surface cover during WWII on site comprised open fields, however the adjacent area comprised a significant proportion of bituminous bound pavement, concrete and buildings. The land below the site has also been artificially landscaped prior to creation of the existing car park. As such, it is unlikely UXO would remain undetected.	No
Indicator of Aerial Delivered UXO	Screening against the regional bomb risk map (Manchester) Appendix D indicates the site to be in an area where the bomb risk is moderate.	Yes

Given the site lies within an area of moderate UXO risk a Zetica preliminary UXO risk assessment was ordered from Zetica and is presented in Zetica (Appendix D). The preliminary UXO risk assessment confirmed the UXO risk level as low for the following reasoning:

- » No significant military activity affecting the Site has been identified;
- » No readily available records have been found indicating that the Site was bombed; and
- » While always prudent, a detailed desk study is not considered essential in this instance.

3. Initial conceptual site model

3.1 Introduction

The initial Conceptual Site Model (CSM) incorporates evidence from the site walkover and the Desk Study carried out at the site. The formulation of an initial CSM is a key component of the LCRM methodology, and incorporates: a ground model of the site physical conditions; and an exposure model of the possible contaminant linkages. It forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines.

3.2 Ground model

The preliminary ground model presented in Section 2 provides an understanding of the ground conditions and is the basis for preparing the preliminary geotechnical hazard assessment (Section 3.3) and the preliminary geo-environmental exposure model (Section 3.4).

3.3 Geotechnical hazard identification

3.3.1 Context

The preliminary geotechnical hazard identification has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents CS 641 and CD 622.

The following section sets out the identified geotechnical hazards and the development elements potentially affected.

3.3.2 Plausible geotechnical hazards

Plausible geotechnical hazards identified at the site are:

- » Uncontrolled Made Ground (variable strength and compressibility).
- » Shrinkage / swelling of the clay fraction of soils under the influence of vegetation- if shallow cohesive soils are present associated with the Glaciofluvial Sheet Deposits.
- » Variable lateral and vertical changes in ground conditions.
- » Attack of buried concrete by aggressive ground conditions.
- » Changing groundwater conditions- should shallow perched groundwater be present upon low permeability horizons within the Glaciofluvial Sheet Deposits.
- » Loose Made Ground, leading to difficulty with excavation and collapse of side walls.
- » Slope stability issues – associated with structures loading the crest of the slope adjacent to the east of the site.

3.3.3 Potential development elements affected

Development elements potentially affected by geotechnical hazards are:

- » Buildings – foundations.
- » Buildings – floor Slabs
- » Roads and pavements.
- » Services.
- » General slopes.
- » Retaining walls.
- » Construction staff, vehicles and plant operators.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately during design.

The above plausible geotechnical hazards and development elements affected have been carried forward for investigation and assessment. The investigation is presented in Section 4 and the assessment is presented in Section 5.5.1.

3.4 Geo-environmental exposure model

3.4.1 Context

The preliminary exposure model is used to identify geo-environmental hazards and to establish potential contaminant linkages, based on the source-pathway-receptor (SPR) approach.

A viable contaminant linkage requires all the components of an SPR to be present. If only one or two are present, there is no linkage and no further assessment is required.

3.4.2 Potential contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from an on-site or off-site source.

3.4.2.1 Potential on-site sources of contamination

- » Made Ground, associated with historical construction of the existing car park and imported fill to form a level site at the top of the slope, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials and PAH (S01).
- » Ground gases (carbon dioxide and methane) from organic materials in the Made Ground (S02).
- » Petroleum hydrocarbons potentially associated with uncontrolled spillages and poor condition of the existing hardstanding (S03).

3.4.2.2 Potential off-site sources of contamination

There is no specific off-site source of contamination identified on proximity to the site for the following reasons:

- » The engineering works, bleach works, dye works, engine sheds and tanks associated with the railway depot are 200m east of the site and the site is upgradient;
- » Any contamination associated with the cemetery 30m south west will migrate east away from the site given its presence similar to the site at the crest of slope further south;
- » Although a historical landfill is present 300m south, the Glaciofluvial Sheet Deposits it overlies are separated from those below the site by low permeability Glacial Till, therefore it is considered unlikely that a granular pathway is present for ground gas to reach the site;
- » Although imported ground has been utilised to form the wider North Manchester General Hospital to the west, the volume/percentage of degrading organics within the infill is anticipated to be low, therefore not posing a ground gas risk to site; and
- » Given the granular nature of the Glaciofluvial Sheet Deposits, any dissolved or leachable contamination associated with processes formerly associated with hospital will migrate vertically whereby the significant depth they may be present underneath the subject site will be such whereby they do not pose risk to onsite receptors.

3.4.3 Potential receptors

The following potential receptors in relation to the proposed land use have been identified.

- » People (neighbours, site end users) (R01).

- » Development end use (office building/parking) (R02).
- » Groundwater: Secondary A aquifer within the Glaciofluvial Sheet Deposits and Principal aquifer status of the Chester Formation (R03).
- » Surface water: River Irk, 250m east, potentially in hydraulic continuity with groundwater below the site (R04).
- » Water supply pipes (R05).

3.4.4 Potential pathways

The following potential pathways have been identified.

- » Ingestion, skin contact, inhalation of dust and outdoor air by people (P01).
- » Ground gas ingress via permeable soils and/or construction gaps (P02).
- » Petroleum hydrocarbon vapour ingress via permeable soils and/or construction gaps (P03).
- » Migration of contaminant via leachate or dissolved phase migration through the unsaturated zone in the Made Ground and Glaciofluvial Sheet Deposits (P04).
- » Surface water via base flow from groundwater (P05).
- » Direct contact (P06).

Health and safety risks to site development contractors and maintenance workers have not been assessed as part of this study and will need to be considered separately.

The above sources, pathways and receptors have been considered as part of the Preliminary Risk Assessment in accordance with LCRM (2023), are considered to be plausible in the context of this site and have been carried forward for investigation and assessment. The investigation is presented in Section 5 and the assessment is presented in Section 7. An assessment of the Source – Pathway – Receptor linkages is undertaken following the assessment (Section 7.2) and is presented in Appendix K (Table K.2).

3.4.5 Potential implications of climate change

Climate change has the potential to change the risk profile for conceptual site models and associated contaminant linkages. The impact of climate change on the CSM is site-specific, and a qualitative assessment of the potential impact of climate change on the CSM for this site is summarised below. The assessment has primarily utilised the guidance in Environment Agency (2010)² and SoBRA (2022)³ which set out the UK context to climate change and land contamination. Both guidance documents advocate a “what if” scenario approach in the context of changes in ambient temperatures, an increase in the frequency of extreme rainfall/storm events and heatwaves/droughts, and long-term changes in groundwater and sea levels.

Those “what if” scenarios that are relevant to this CSM are:

- » Increased long-term rainfall leading to increased infiltration and seasonally higher groundwater and water levels in surface waters- *the slope is anticipated to be well drained and made granular slopes therefore groundwater is likely at a depth whereby it will remain unimpacted by infiltrating water, the site is also at the crest of the slope and not in proximity to the River Irk therefore higher water levels in the Irk will not impact the site.*
- » Rising sea-level leading to rise in groundwater levels and/or saline intrusion. - *the site is not within close proximity to the coast.*

² Environment Agency, 2010. Guiding Principles for Land Contamination. Part 2. FAQs, technical information, detailed advice and references, March 2010.

³ SoBRA, 2022. Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change, Society of Brownfield Risk Assessment, August 2022.

- » Increased frequency and/or magnitude of extreme rainfall events leading to short-term surface flooding, surface water run-off, groundwater flooding, and/or land-based erosion. - *the existing vegetation coverage on the slope will protect it from increased rainfall. Additional drainage and introduction into the slope should be avoided to ensure future instability does not occur,*
- » Increased frequency and/or magnitude of storm events leading to short-term drops in barometric pressure and/or high winds. -*the Made Ground underlying the site is anticipated to contain a very low degradable organic content and therefore pose a very low ground gas risk.*
- » Occurrence of extreme cold and hot weather events leading to changes in ground conditions such as soil temperature, evapo(trans)piration, and soil moisture (for example freeze-thaw effects and desiccation), decreased infiltration and fall in groundwater and surface water levels. -*shallow soils underlying the site will be protected from extreme changes in moisture content by hardstanding across the entirety of the proposed development, also there is not expected to be extensive depths of clay soils susceptible to desiccation from moisture change.*
- » Long-term decrease in rainfall leading to lower infiltration and fall in groundwater and surface water levels. -*the presence of dissolved phase contamination in shallow groundwater is considered unlikely and therefore drops in groundwater table causing volatilization or increase in smear zone thickness is not anticipated to occur.*

3.4.6 Possible Pollutant Linkages

Based on historical and current land uses, the possible pollutant linkages (for risk levels of moderate or greater) on an unremediated redeveloped site, as determined by the desk study and walk-over, are summarised in Table 3-1 below.

Table 3-1: Possible Pollutant Linkages (for Risk Levels of Moderate or Greater)

Source(s)	◀ potential Impact on ▶	Receptor(s)
Made Ground, associated with historical construction of the existing car park and imported fill to form a level site at the top of the slope, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials and PAH (S01).		People (neighbours, site end users). Groundwater: Secondary A aquifer within the Glaciofluvial Sheet Deposits and Principal aquifer status of the Chester Formation.
Petroleum hydrocarbons potentially associated with uncontrolled spillages and poor condition of the existing hardstanding (S03).		Water supply pipes

4. Ground investigations

4.1 Site works

The fieldwork took place between 30/10/24 and 31/10/24. The ground investigation locations were surveyed in using a Total Station GPS survey instrument and are shown on the Exploratory Hole Location Plan (Hydrock Drawing 32425-HYD-XX-XX-DR-GE-1003) in Appendix E.

The logs, including details of ground conditions, soil sampling, in situ testing and any installations, are also presented in Appendix E.

The weather conditions during the Hydrock fieldwork and for the previous week were cold and overcast, with occasional rain showers.

Table 4.1: Summary of site works

Activity	Method	No.	Name	Depth Max. / Range (m bgl)	In situ tests	Rationale
Drilling, Pitting and Probing						
Boreholes	Cable percussive	2	CP101 - CP102	10.00 – 15.30	SPT	To compare deeper ground conditions at the top and base of the slope and allow collection of samples.
	Windowless sampler	5	WS101 – WS105	5.00	SPT	For general site coverage to assess shallow ground conditions and allow collection of samples.

Wells for monitoring groundwater levels and ground gas concentrations, and to facilitate the sampling of groundwater, were installed in three of the windowless sampler boreholes and both cable percussion boreholes. A summary of the monitoring well installations is presented in Table 4.2.

Table 4.2: Summary of monitoring installations

Location	Ground level (m OD)	Standpipe / piezometer diameter	Screen top and base depth (m bgl)	Screen top and base elevation (m OD)	Strata targeted
CP101	77.68	50	4.00 to 10.00	73.68 to 67.68	Glaciofluvial Sheet Deposits
CP102	71.16	50	2.00 to 7.00	69.16 to 64.16	Glaciofluvial Sheet Deposits
WS101	77.10	50	1.00 to 2.00	76.10 to 75.10	Made Ground
WS104	78.29	50	1.50 to 4.00	76.79 to 74.29	Glaciofluvial Sheet Deposits
WS105	77.66	50	1.00 to 2.50	76.66 to 75.16	Made Ground

4.2 Geo-environmental testing

4.2.1 Sampling strategy and protocols

Exploratory hole positions were determined by reference to the site conditions and uncertainties identified in the Initial Conceptual Model.

Samples were taken, stored and transported in general accordance with BS 10175:2011+A2:2017.

4.2.2 Geo-environmental monitoring

Gas monitoring boreholes have been monitored on three occasions. The results are presented in Appendix G. Monitoring is ongoing and this report will be updated on completion of the monitoring commission.

4.2.3 Geo-environmental laboratory analyses

The chemical test certificates for testing undertaken as part of Hydrock's investigation are provided in Appendix H and summarised in the table below. Wherever possible, UKAS and MCERTS accredited procedures have been used.

The geo-environmental analyses undertaken on soils are summarised in Table 4.3.

Table 4.3: Geo-environmental analyses of soils

Determinand Suite	Made Ground
Hydrock minimum suite of determinands for solids ⁴	6
Speciated aliphatic and aromatic banding Total petroleum hydrocarbons by HS-GC/MS and GC/FID (Hydrock Tier 2 TPH Suite)	2
Asbestos quantification	2
WAC testing	2

The soils chemical test data are interpreted and assessed in Sections 7.

The geo-environmental analyses undertaken as part of Hydrock's investigation on waters, are summarised in Table 4.4.

Table 4.4: Geo-environmental analyses of waters

Determinand Suite	Ground-water
Hydrock minimum suite of determinands for waters ⁵	2
Speciated aliphatic and aromatic banding Total petroleum hydrocarbons by HS-GC/MS and GC/FID (Hydrock Tier 2 TPH Suite)	2

The groundwater chemical test data are interpreted and assessed in Section 7.

⁴ The Hydrock minimum suite of determinands for waters comprises As, B (water soluble), Be, Cd, Cr (total), Cr(VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polynuclear aromatic hydrocarbons (PAH, by GC-FID), total phenols, fraction of organic carbon and free and "complex" cyanide species, if high total cyanide is detected

⁵ Hydrock minimum waters/soil leachate analysis suite comprising — Ag, Al, As, B, Ba, Cd, Co, Cr (III), Cr(VI), Cu, Fe, Hg, Mn, Mo, Na, Ni, Pb, Sb, Se, Sn, Zn, V, cyanide (total), phenols (total), ammonium, bromate, chloride, fluoride, nitrate, nitrite, sulfate, PAH (speciated), pH, EC and hardness

4.3 Geotechnical testing

4.3.1 Geotechnical laboratory testing

The geotechnical tests undertaken by Hydrock are summarised in Table 4.5 and the test certificates are provided in Appendix F. Wherever possible, UKAS accredited procedures have been used.

Table 4.5: Summary of sample numbers for geotechnical tests

Test	Made Ground	Glaciofluvial Sheet Deposits
Natural moisture content	4	4
Atterberg limits	2	1
Particle size distribution (sieve)	3	4
Sulfate and aggressive chemical environment classification for buried concrete classification (full BRE SD1 suite)	8	2
Single stage undrained triaxial compressive strength	-	1
Small shear box test	-	1
Organic Matter	1	1

The geotechnical test data are summarised in Section 5.5 and interpreted in Section 6.

4.4 Constraints

There is a dense wooded area with a very steep slope between the two car parks where hand pits HP101 – HP103 were to be undertaken to inform the shallow strata present. The hand dug pits were unable to be completed due to associated access and safety constraints. This area is not within the development boundary.

5. Ground investigation records and data

5.1 Physical ground conditions

5.1.1 Summary of strata encountered

The following section presents a summary of the properties of the ground and groundwater conditions encountered, based on field observations, interpretation of the field data and laboratory test results, taking into account drilling, excavation and sampling methods, transport, handling and specimen preparation.

Details of the Hydrock ground investigation works are provided in the exploratory hole logs in Appendix E, and a summary of the ground model is presented in Table 5.1, with the individual strata described in the sections below.

Table 5.1: Strata encountered

Stratum	Depth to top (m bgl)	Depth to base (m bgl)	Thickness (m) (range)	Thickness (m) (average)
Surface Cover – bituminous bound pavement hardstanding	Ground level	0.08	0.05 to 0.08	0.07
Made Ground	0.05	2.60	1.40 to 2.60	1.87
Glaciofluvial Sheet Deposits	1.40	13.10	5.70 to 10.90	8.30
Glacial Till	7.50	>10.0 - >15.30	>2.20 - >2.5	Unproven

5.1.2 Surface covering

During the field reconnaissance bituminous bound pavement hardstanding was noted covering 100% of the car park site and noted to be in poor condition, including service trench scars and repair patching. In the areas outside of the development area, i.e. on the slopes between car parks where the hand pits were due to be progressed, the surface comprised vegetated and bare earth.

During the intrusive investigation bituminous bound pavement was found in all locations, resting directly on a granular Made Ground. The thickness of the cores recovered ranged from 0.05m to 0.08m, with an average thickness of 0.07m being recorded.

5.1.3 Made Ground

Made Ground is present across the site to depths between 1.40 and 2.6m bgl, in areas associated with former construction.

It generally consists of brown slightly clayey sandy gravel of brick, sandstone, mudstone and concrete, with occasionally fragments of metal and wood. A hydrocarbon odour was recorded in CP101 and organic odours recorded in WS103 and WS104.

5.1.4 Glaciofluvial Sheet Deposits

Glaciofluvial Sheet Deposits were encountered underlying the Made Ground across the whole site. The deposits consisted of orange/brown sand, occasionally sandy clay, and sandy silt and were recorded at thicknesses between and. The deposits are thicker on site (where proven) i.e., 10.9m at CP101, and are thinner at the toe of the slope to the south east i.e. 5.7m at CP102.

5.1.5 Glacial Till

Glacial Till was encountered underlying the Glaciofluvial Sheet Deposits in both cable percussive boreholes. At CP101 the deposits consisted of stiff brown slightly sandy slightly gravelly clay from 13.10m to 15.30m, with a band of brown fine and medium sand between 14.3m and 15.0m bgl. At CP102 very stiff slightly sandy slightly gravelly clay was recorded from 7.50 to the base of the hole at 10.0m bgl. As such, the full thickness of the Glacial Till was not confirmed during this investigation.

5.2 Visual and olfactory evidence of contamination (soil)

In addition to the more common man-made constituents (metal, brick etc), described above in Section 5.1.3, on one occasion hydrocarbon odour was recorded; in CP101, in the hand pit arisings of the Made Ground strata from 0.08 to 1.0m bgl. The odour was not considered likely to be representative of the whole strata, and no sheen was noted on the soils, but the exact depth could not be determined.

5.3 Groundwater

5.3.1 Groundwater observations and levels

Groundwater was not encountered during the investigation.

Groundwater levels recorded during post-fieldwork monitoring are summarised in Table 5.2.

Table 5.2: Groundwater level data summary

Stratum	Date range	Location	Post-fieldwork monitoring	
			Depth to groundwater (range) (m bgl)	Groundwater elevation (range) (m OD)
Made Ground	13/11/24 – 10/12/24	WS101	Dry / Damp at base	-
		WS105	Dry / Damp at base	-
Glaciofluvial Sheet Deposits	13/11/24 – 10/12/24	CP101	9.24 - 10.12	67.56 – 68.15
		CP102	4.85 - 4.92	66.24 – 66.31
		WS104	Dry	-

No visual or olfactory evidence of petroleum hydrocarbons or other contamination was noted in the groundwater samples.

5.4 Ground gases (carbon dioxide and methane)

Records from the gas monitoring boreholes are presented in Appendix G and summarised in Table 5.3.

To date three monitoring visits have been undertaken, with one visit remaining as part of the current commission. The data are assessed in Section 7.6.

Table 5.3: Range of ground gas data

Stratum	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Steady flow rate (L/hr)	Comment
Made Ground	<0.1 – 0.1	5.2 – 9.1	3.4 – 15.8	<0.1	Elevated carbon dioxide concentrations in all locations on both visits.
Glaciofluvial Sheet Deposits	<0.1 – 0.1	11.1 – 13.8	2.8 – 9.4	<0.1	

5.5 Geotechnical data

5.5.1 Introduction

Laboratory test results are contained in Appendix F with *in situ* test results shown on the relevant exploratory hole log or datasheet in Appendix E. The following sections summarise the main findings and provide interpretation where appropriate.

5.5.2 Plasticity

The volume change potentials in terms of BRE Digest 298 with respect to building near trees have been determined from the results of plasticity index tests on samples of soil. These are summarised in Table 5.4.

Table 5.4: Volume change potential

Stratum	No. of tests	Plasticity Index			Modified Plasticity Index			Plasticity designation	Volume Change Potential
		Min.	Max.	Av.	Min.	Max.	Av.		
Made Ground	2	12	20	16	11	17	14	Low to medium	Low
Glaciofluvial Sheet Deposits	1	19	19	19	18	18	18	Low to medium	Low

5.5.3 Particle size distribution

Particle Size Distribution test (PSDs) results are summarised in Table 5.5 and summary descriptions and PSD plots of the material analysed are presented in Appendix F.

Table 5.5: PSD results summary

Stratum	No. of tests	Silt/Clay %	Sand %	Gravel %	General description
Made Ground	2	41 - 60	27 - 28	13 - 31	Slightly sandy slightly gravelly CLAY.
Glaciofluvial Sheet Deposits	5	6 - 58	42 - 92	0 - 2	Very sandy to sandy CLAY and clayey SAND.

5.5.1 Soil strength

Table 5.6 summarises information pertaining to the shear strength of the soils according to geological stratum. Factual results are summarised for laboratory tests, field tests (e.g. hand shear vane) and uncorrected Standard Penetration Tests (SPT N_{60}). Where the SPT N_{60} is used to infer shear strength by published correlation, this is also tabulated. A shear strength versus depth profile is summarised in Figure 5.1, and plots are presented in Appendix F.

A SPT ' N_{60} ' value versus depth profile is summarised in Figure 5.2.

Table 5.6: Soil strength results and derived values

Stratum	No. of tests	SPT N ₆₀ (N-value) (range)	c _u (kPa)	c' (kPa)	phi' (°)	Method
Made Ground	2	-	-	-	32 - 34	PSD (BS 8004:2015) with angular to subangular particles.
	7	2 - 28	-	-	27-34	SPT – windowless sampler borehole.
	3	2 - 15	-	-	27-31	SPT – cable percussion.
Glaciofluvial Sheet Deposits	19	1 – 25	-	-	27 - 34	SPT – windowless sampler borehole.
	14	5 - 31	-	-	28 - 35	SPT – cable percussion.
	5	-	-	-	33 – 35	PSD (BS 8004:2015) with angular to subangular particles.
	1	-	-	3	30	Shear box test
Glacial Till	5	14 – 30	60 - 130	-	-	SPT – cable percussion.
	1	-	85	-	-	Unconsolidated undrained triaxial

*An f_1 value of 5 has been used based on a plasticity index of 20. (Tomlinson (2001), after Stroud)).

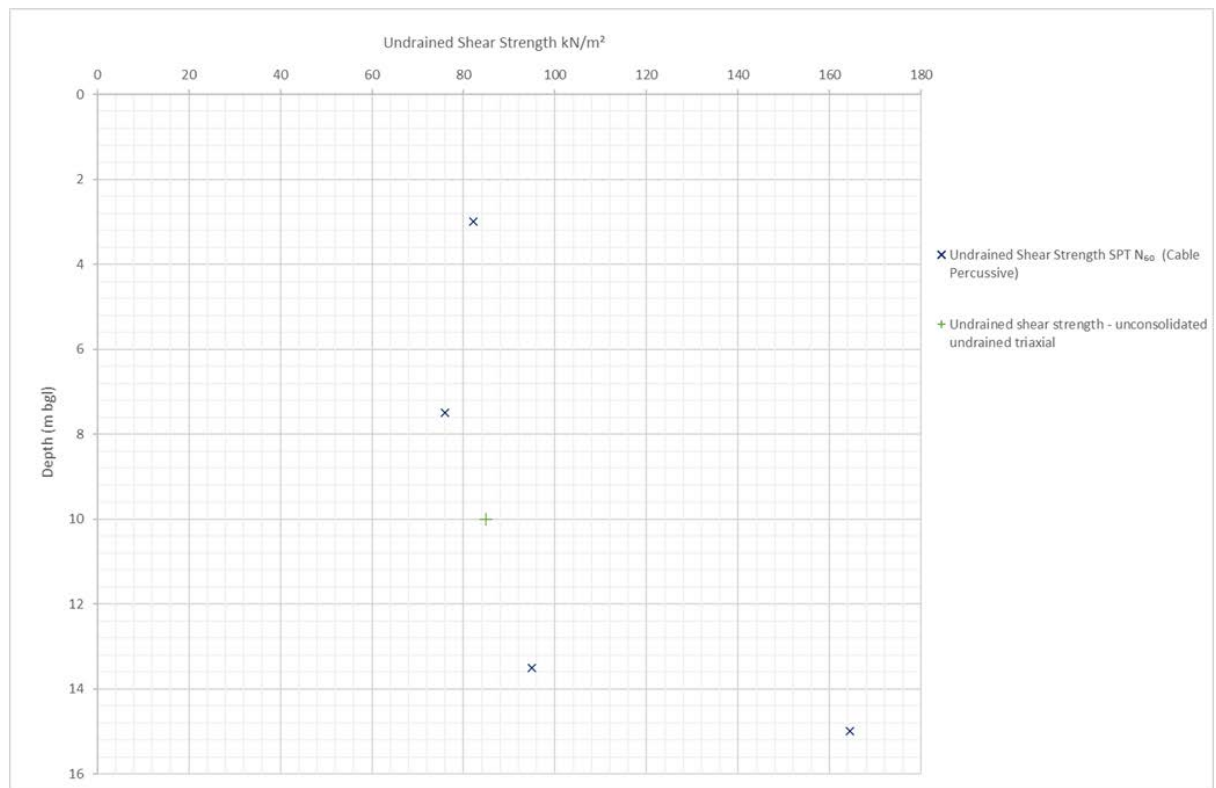


Figure 5.1: Undrained shear strength versus depth summary

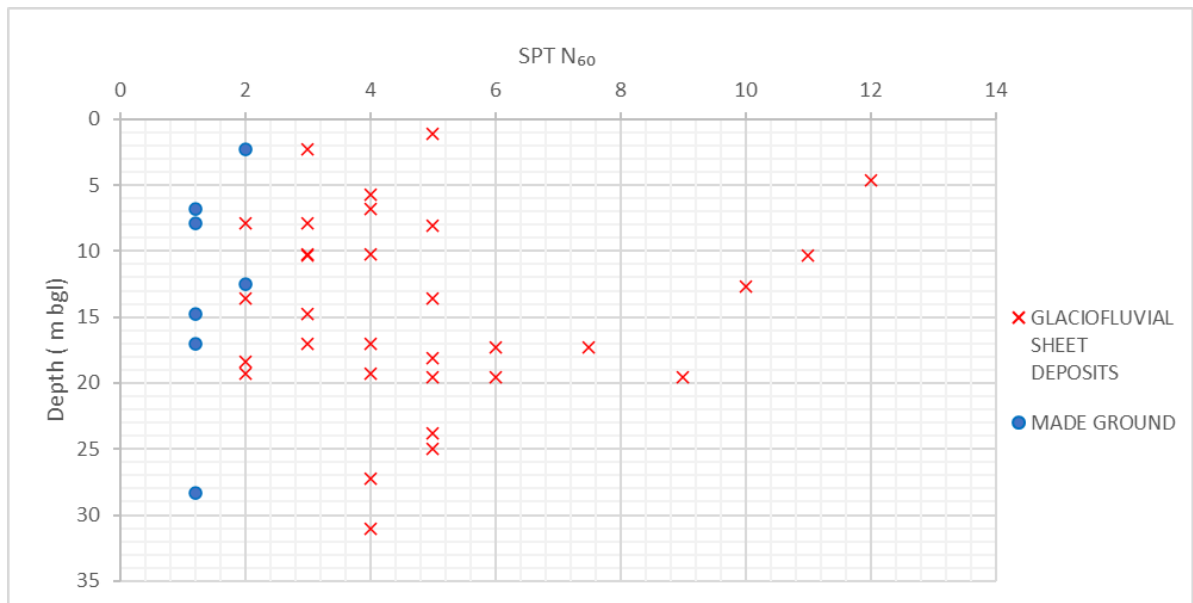


Figure 5.2: SPT N_{60} value versus depth summary

5.5.2 Compressibility

Table 5.7 presents a summary of the derived parameters for coefficient of consolidation and compressibility. The data indicates that the material is generally of medium to high compressibility over the pressure ranges tested.

Table 5.7: Summary of compressibility

Stratum	No. of tests / results	Method	Coefficient of volume compressibility (m_v) (m^2/MN)	Coefficient of consolidation (C_v) (m^2/yr)
Glaciofluvial Sheet Deposits	1	Correlation with SPT N_{60} [*]	0.12	-
Glacial Till	4	Correlation with SPT N_{60} [*]	0.13 – 0.06	-

^{*} An f_2 value of 0.55 has been used based on a plasticity index of 19. (Tomlinson (2001), after Stroud)).

5.5.3 Sulfate content

In accordance with BRE (Special Digest 1), the Design Sulfate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in Table 5.8. The assessment summary sheet is presented in Appendix F.

Table 5.8: Aggressive chemical environment concrete classification

Stratum	No. tests	DS	ACEC
Made Ground	6	DS-2	AC-2
Groundwater	2	DS-2	AC-2

6. Geotechnical assessment

6.1 Geotechnical categorization of the proposed development

Eurocode 7, Section 2 advocates the use of geotechnical categorization of the proposed structures to establish the design requirements.

The proposed development is shown on Sheppard Robson drawing 23130-SRA-NM171-00-DR-A-SK004 P02 in Appendix A. This comprises a single storage container, skips, welfare unit building, compactors, waste bins and vehicle parking.

Based on the above, for the purposes of this investigation, the proposed structures have been classed as Geotechnical Category 1.

Following ground investigation and as part of the assessment provided in the following section, the preliminary geotechnical hazard identification undertaken in Section 3.3 has been updated.

Assessment has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HE-DMRB-G CS 641 and CD 622. The preliminary Geotechnical Risk Register following investigation is provided in Appendix J (Table J.3) and will need to be updated during future design works.

6.2 Characteristic design values

For design of Category 1 structures in accordance with BS EN ISO 1997-1 (EC 7), the geotechnical parameters summarised in Table 6.1 are considered appropriate for design.

These values have been determined from laboratory testing, *in situ* testing and by professional judgement using published data together with knowledge and experience of the ground conditions. Care should be exercised in using these assumed soil strength parameters for any purpose beyond the scope of this report because it may be that additional sampling and testing is required for certain purposes. The reader should refer to the original test results summarised in Section 5 and provided in Appendix E and Appendix F.

Table 6.1: Geotechnical parameters recommended for design of Category 1 Structures (EC7)

Parameter	Bulk unit weight kN/m ³	Effective angle of internal friction °	Effective cohesion kN/m ²	Undrained shear strength kN/m ²	Coefficient of compressibility m ² /MN
Stratum	γ^a	$\phi'^{b\ c}$	c'^d	c_u^e	m_v^f
Made Ground	19	28	0	-	-
Glaciofluvial Sheet Deposits	20	29	0	-	0.14
Glacial Till	20	26	0	60	0.15 – 0.07

^a Measured as part of the triaxial strength test and estimated based on the recommendations of BS 8004-2015.

^b Internal friction (ϕ') values for the granular *in situ* material derived from SPT data following the recommendations of Peck et al., (1967).

^c Internal friction (ϕ') values for the cohesive *in-situ* material derived from BS 8004-2015, where ϕ_{cv}' is derived from plasticity index. The use of ϕ_{cv}' in the analysis is considered to provide a conservative estimate of ϕ' .

^d BS 8002:1994 Code of practice for Earth retaining structures, British Standards Institution.

^e Site measurements and laboratory data.

^f Laboratory data.

6.3 Groundwork

6.3.1 Site preparation

The site has always been a car park with no other developments and no buried man-made obstructions were encountered by this investigation. However, underground services are present across the site.

6.3.2 Groundworks

Following breaking out of hardstanding, excavation of shallow soils should be readily undertaken by conventional plant and equipment.

Temporary trench support, or battering of excavation sides, is recommended for all excavations that are to be left open for any length of time and will definitely be required where man entry is required.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be obtained from the Construction Design and Management Regulations (2015); Construction Information Sheet 47: Inspections and Reports (2005) and HSG47: Avoiding Danger from Underground Services.

To ensure no loads are imposed on the sides of the excavation, spoil should not be placed immediately adjacent to the excavation. Spoil should be placed a suitable distance from the side of the excavation (as assessed by a competent person). Similarly, no loads from soil, equipment, materials, or plant should be placed at the top of the perimeter slope, until appropriate assessment of stability has been made and any necessary remedial actions.

6.3.3 Earthworks/reuse of site-won materials

A limited amount of cut and fill earthworks have been proposed to form the site levels, as shown on Hydrock drawing 32425-HYD-XX-XX-DR-D-0200 presented in Appendix A. At this stage, Hydrock is not aware of proposals for extensive earthworks at the site.

Should extensive earthworks be required, supplementary earthworks testing and an earthworks Specification will be necessary to ensure the appropriate management and reuse of the existing soils.

If significant earthworks are required, the works may be Category 2 in accordance with BS EN ISO 1997-1 (EC 7) and further geotechnical design may be necessary. Once site proposals have been further defined more specific consideration will need to be given to the reuse of materials and reference should be made back to this office.

6.4 Slope stability

The proposed development is to be constructed at the crest of an existing slope which forms part of the Irk Valley. The existing slope is approximately 6-7m in height and slope gradients of up to approximately 27° (or 1v:2h).

Although no visual indicators of slope instability were recorded during the site walkover, the proposed development is anticipated to increase the loading at the crest of the slope which may adversely affect the long-term stability of the slope.

Based on the recorded ground conditions and the existing slope gradient, separate geotechnical analysis, beyond the scope of this report, will be required to fully assess the stability of the slopes.

6.5 Retaining walls

No significant retaining wall are required as part of the proposed works, however, low height retaining walls (up to 0.5m height) may be required to accommodate levels differences across the site. Where retaining walls are required, it is envisaged that retaining walls will be constructed as modular reinforced concrete, gabions; or crib lock walls.

Using the design parameters provided in Table 6.1, the retaining walls will need design by the structural engineer or by the appointed design and build Contractor.

6.6 Foundation recommendations

The proposed development will comprise a number of temporary storage containers which shall be positioned on a service yard comprising a reinforced concrete slab. However, it is understood that shallow foundations will be required for the proposed modular building/welfare facility which are to be designed by the supplier.

The Made Ground is considered unsuitable in its present condition for use as founding soils on the basis of its unpredictable nature and likely deposition in an uncontrolled manner and should be fully penetrated by all new foundations or excavated, screened, processed and re-engineered to create the development platform.

Pad foundations are considered suitable to support the loads for the proposed building. The pad foundations should be founded at least 300mm into the re-engineered structural fill or the underlying Glaciofluvial Sheet Deposits (at approximately 2.2m depth in the area of the proposed building).

On the basis that an appropriate Earthworks Specification is followed, including all comments relating to over-excavation, proof-rolling and removal of soft spots, then a permissible net bearing pressure (for a pad foundation of up to 2m by 2m) of 70kN/m² for the re-engineered fill or Glaciofluvial Sheet Deposits is recommended.

6.7 Roads and pavements

No CBR tests were undertaken as part of the ground investigation but given the former use as a car park, it is considered likely that an equilibrium CBR of 2.5% will be achievable over the majority of the site.

Proof rolling of the formation level will be required and any loose or soft spots should be removed and replaced with an engineered fill, in accordance with a suitable Specification. The formation level will also need to be protected during inclement weather from deterioration; all slopes should be trimmed to falls to shed rain water and the surface sealed to limit infiltration.

Prior to the placement of the founding materials and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 to confirm that the ground conditions at time of construction are consistent with the previous design parameters.

6.8 Drainage

Soakaways or infiltration as part of a Sustainable Urban Drainage System (SUDS) have been eliminated as a drainage solution due to the lack of space available within the development footprint, and the potential for instability of sloping ground below the level of the proposed development.

6.9 Buried concrete

Based on guidelines provided in BRE Special Digest 1 (BRE 2005) and the information presented in Section 5.5.3:

- » The shallow soils (Made Ground) can be classified as Design Sulfate Class DS-3 and ACEC Class AC-3.
- » The deeper natural deposits (Glaciofluvial Sheet Deposits) are classified as DS-1, AC-1.

The designer should check and confirm the classification of concrete using the information presented in Appendix E and Appendix F during the design.

7. Geo-environmental assessment

7.1 Objectives

The objectives of the geo-environmental assessment present in the following sections are to:

- » undertake a generic quantitative risk assessment in accordance with LCRM using published generic assessment criteria;
- » screen out contaminant linkages that don't potentially pose an unacceptable risk to defined receptors;
- » identify whether the ground conditions are suitable for the proposed land use from a land contamination perspective;
- » identify contaminant linkages that potentially pose an elevated risk or are associated with a level of uncertainty that warrants further consideration.

7.2 Updated conceptual model

7.2.1 Updated ground model

The initial CSM developed from the desk study and field reconnaissance survey Section 2 has been updated using the findings of the ground investigation and is presented in Section 5. The updated CSM is the basis for the geo-environmental assessment presented in this section.

7.2.2 Updated exposure model

Following the ground investigation, the plausible contaminant sources, receptors and pathways identified in the preliminary geo-environmental exposure model Section 3.4 have been updated or confirmed as follows.

Sources

No sources have been removed from, or added to, the exposure model

Receptors

No receptors have been removed from, or added to, the exposure model.

Pathways

Using the updated ground model and updated exposure model, generic risk assessment is undertaken as presented below.

7.3 Risk assessment approach

Using the updated CSM, a Stage 1 Tier 2 generic quantitative risk assessment (GQRA) for identified receptors based on all media sampled has been undertaken in accordance with the principles of LCRM.

Firstly, the risks associated with the identified potential contaminant linkages have been estimated using standardised methods (typically involving comparison of site data with published 'screening values'). Secondly, where screening values are exceeded, the result has been evaluated in an authoritative review of the findings with other pertinent information to determine whether or not the exceedance is or is not acceptable in the site-specific circumstances.

The data sets used in the assessment comprise the analytical results obtained by Hydrock as listed in Section 5.

In cases where potentially unacceptable risks are indicated and/or the land is potentially unsuitable for its intended use, actions such as more advanced stages of risk assessment (Tier 3, detailed quantitative risk assessment (DQRA)) or remediation are proposed (see Section 10).

7.4 Human health risk assessment

7.4.1 Generic Assessment Criteria

The soil screening values used are Generic Assessment Criteria (GAC) (i.e. derived in accordance with EA CLEA guidance (2009) using the updated exposure model detailed in Defra SP1010 (2014), with the exception of published C4SLs. The term 'GAC' used in this report is inclusive of all generic soil screening values.

Based on the proposed development, generic assessment criteria (GAC) based commercial end use CLEA land use scenarios have been adopted.

GAC are selected based on the following hierarchy:

- » Category 4 Screening Levels (C4SL), where available.
- » SoBRA Acute GAC for free cyanide, as acute dose toxicity is the primary risk driver.
- » Hydrock GAC, derived by Hydrock as detailed in Appendix H.

The potential risks to human health arising from the presence of volatile contaminants in groundwater have been assessed in accordance with the SoBRA GW GAC guidance (2017). This is a preliminary approach whereby GAC have been developed using the CLEA v1.071 model for indoor air and outdoor inhalation pathways only, assuming a residential or commercial end-use. Exclusion screening distances for assessing vapour intrusion risk are also considered as an additional line of evidence where appropriate. Human health risk from the consumption of potable water (if relevant) is addressed by the Controlled Waters Risk Assessment with the adoption of drinking water guidelines and standards as the assessment criteria (see Section 7.5).

7.4.2 Data sets

The data set(s) used in this report is based on the conceptual site model and the proposed development, and is taken to be the entire area of the site, with the data comprising only Made Ground soils.

GAC based on a soil organic matter (SOM) of 1% have been adopted for all soils as a conservative measure. Assessment sheets are presented in Appendix H.

7.4.3 Assessment results

Soil data assessment sheets are presented in Appendix H. Based on the data comparison against the 1% SOM generic assessment criteria (GAC) for commercial CLEA land use scenario, the results indicate that all chemicals of potential concern (CoPC) are below the relevant thresholds. TPH CWG results were found above the LOD in Made Ground where tested, at CP101 and WS101, but far below the commercial GACS.

No visible asbestos containing materials were noted during the investigation. Non-visible trace asbestos loose fibres were detected in two samples of Made Ground, from WS104 at 0.50m bgl and WS105 at 0.60m bgl. In the former Chrysotile loose fibres were recorded, and in the latter Chrysotile and Amosite fibres were detected. In both samples the quantification % asbestos (wt/wt) by hand picking/weighing was <0.001. The presence of asbestos fibres in soil requires further consideration.

7.4.4 Risk evaluation

The results indicate that all chemicals of potential concern (CoPC) are below the relevant thresholds and therefore all relevant contaminant linkages are incomplete.

Although a hydrocarbon odour was observed at CP101 during the ground investigation, no reported concentrations of contaminants in soil exceed the GAC for commercial end use. On this basis the risk to human health and the environment is considered to be acceptable.

Should free-phase hydrocarbons be encountered during construction, works should be paused and Hydrock should be consulted prior to continuation of the works.

7.4.4.1 Asbestos

No visible asbestos containing materials have been identified in the soil samples, however, there is one exploratory hole location where chrysotile and amosite asbestos fibres were detected, and another where only chrysotile asbestos fibres were detected. Both locations are within the Made Ground at concentrations below the limit of quantification (<0.001% wt/wt).

It is plausible for low concentrations of loose chrysotile and amosite asbestos fibres to be present in the Made Ground, and for further isolated and random fragments of related asbestos containing materials to also be present, however, there is no evidence that asbestos is present at concentrations that would pose an unacceptable risk to human health.

The relevant risk factors applicable to the site, based on potential for inhalation of airborne fibres, are considered below:

- » No visible evidence of asbestos materials was noted in the exploratory holes, suggesting that asbestos materials are only present as very minor constituents in the soil (if at all).
- » Where asbestos was identified by laboratory testing, the concentration was reported as being at or less than the limit of quantification (0.001% wt/wt).
- » Only chrysotile (white) asbestos fibres were identified in both locations. Chrysotile is the least hazardous of the three common asbestos types, and most commonly associated with asbestos cement products. The presence of amosite in trace concentrations at one location could be a result of cross-contamination of chrysotile asbestos cement products during manufacturing.
- » Although the impacted soils might be excavated and disturbed, with consequent potential for fibre release during groundworks, future disturbance is likely to be minimal due to the requirement to import a clean topsoil/subsoil growing medium in landscaped areas or hardstanding cover (buildings, access roads, and car parking).
- » The materials in which asbestos was identified were of mixed composition but included some clay or silt content. The likelihood of asbestos fibres being released from cohesive materials is less than might be the case for loose material such as sand or coarse aggregate.

As such the presence of asbestos fibres in the Made Ground are not considered a risk to Human Health for the proposed site end use. However, should suspected asbestos containing materials be identified during the groundworks, work should pause and Hydrock be consulted at the earliest opportunity.

7.5 Controlled Waters Risk Assessment

7.5.1 Generic Assessment Criteria

The risks to groundwater and surface water from contaminants on site have been assessed in accordance with the Environment Agency (2006) Remedial Targets Methodology (RTM) Levels 1-2. In doing so the compliance point for the assessment is set as the groundwater directly beneath the site on a precautionary basis.

Site contaminant concentrations are compared with relevant screening values (Water Quality Targets (WQTs)), which are linked to the CSM.

Acceptable WQT are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)). In this instance, site concentrations have been compared against DWS and EQS on the basis that:

- » The site is underlain by the Chester Formation which is classified as a Principal Aquifer; and
- » The fate of groundwater below the site is considered likely to be the River Irk.

The values adopted are detailed in Appendix H and the use of these values in this assessment is considered as a first screening for potential risks of pollution of Controlled Waters. More detailed assessment may be required, with this identified in Section 7.5.2.

There are no UK drinking water WQT for petroleum hydrocarbon fractions in water. The Water Supply Regulations 1989 and the Private Water Supply Regulations 1991 both contained a prescribed concentration of 10 µg/L for 'dissolved or emulsified hydrocarbons (after extraction with petroleum ether); mineral oils'. This was removed when these Regulations were updated in 2000 and 2009 respectively. However, 10 µg/L is used in this report as an initial screening assessment noting that any exceedance has no direct regulatory significance.

In some instances, the reporting limit (or detection limit) quoted by the laboratory may be greater than the WQT that it is being assessed against. As the current exercise is an initial screening assessment, further assessment of these elements has not been undertaken if all concentrations are reported to be below that limit.

7.5.2 *Assessment results*

Groundwater data assessment sheets are presented in Appendix H. Based on the data comparison against the WTV the results indicate that the chemicals of potential concern (CoPC) require further assessment are cadmium, cobalt, copper, manganese, nickel, sodium and zinc. These are associated with CP101 and CP102, both screened within the Glaciofluvial sands.

TPH CWG results were found below limit of detection in both CP101 and CP102.

7.5.3 *Risk evaluation*

The EQS for cadmium, cobalt, copper, manganese, nickel, sodium and zinc are exceeded.

Whilst there are exceedances of the water quality targets; these exceedances are considered not to represent a significant risk of pollution of Controlled Waters from an on-site source as there is no evidence of anthropogenic accumulations of these substances on the site. They potentially represent inflow from an off-site source within the local urban environment. The exceedance of manganese can be attributed to reducing conditions.

The presence of hardstanding across the site will limit infiltration that could lead to leaching, and the lack of detectable petroleum hydrocarbons in the groundwater at CP101 where odours were noted in the shallow made ground further supports the assertion that leaching of contaminants from Made Ground soils is not occurring on site. The proposed redevelopment maintains hardstanding cover across the site.

As such there is not considered to be a risk to Controlled Waters from on-site sources. Additionally, it would be technically challenging and probably disproportionately costly to remove these contaminants from the water. Therefore, the risks to Controlled Waters do not need further consideration.

7.6 Ground gas risk assessment

7.6.1 Assessment Criteria

The potential risk from ground gas has been assessed in accordance with BS 8485:2015 +A1:2019 and has been based on the relevant data identified and summarised in Section 4.

7.6.2 Data adequacy

As per the BS8576:2013 Decision Matrix for Initial Monitoring, it is judged from the available evidence that the gas generation potential at the site is very low (due to limited Made Ground) and as per Tables 5.5a and 5.5b CIRIA C665, the sensitivity of the development is low (due to commercial end use). Consequently, and in accordance with CIRIA C665 (Table 5.5a and 5.5b) and Figure 6 BS8576:2013, an appropriate minimum monitoring regime is 4 readings over 2 months, provided other monitoring requirements are also met, such as prevailing atmospheric pressure conditions (for example, BS 8485:2015 +A1:2019 and CL:AIRE TB17 advocate that monitoring should include a period of rapidly falling atmospheric pressure).

Hydrock has undertaken three of the four readings required, therefore the conclusions presented below are considered interim, pending a review of the remaining ground gas monitoring results.

7.6.3 Assessment results

The risks associated with the ground gases methane (CH₄) and carbon dioxide (CO₂) have been assessed using BS 8485:2015 +A1:2019.

The assessment guidelines set out in Table 2 of BS 8485 are based on interpretation of the gas concentrations and the gas flow rates. The quantitative assessment has been carried out by comparing the individual gas concentrations and borehole hazardous gas flow rate values (Q_{hg}) in Appendix D with the published CS thresholds (BS 8485 Table 2), in addition to a worst-case GSV assessment in accordance with section 6.3.7 of BS 8485. The assessment is summarised and presented in full in Appendix G.

The appended data assessment includes a ternary plot assessment of the data (assessment of ground gas ratios (O₂ + N₂, CO₂ and CH₄)), undertaken in general accordance with guidance by Wilson et. al. (2018).

7.6.4 Risk evaluation

The calculated borehole hazardous gas flow rates for carbon dioxide and methane indicate CS1 conditions for both methane and carbon dioxide. Whilst carbon dioxide concentrations have been measured at concentrations above 5% on all monitoring visits undertaken to date, assessment of the data using ternary plots indicates the ground gas present is likely to represent microbial respiration of organic material in soil, which is a low risk. This is supported by a lack of flow readings above the limit of detection (0.1 l/hr), which keep the calculated GSVs low despite the elevated carbon dioxide concentrations, including the worst-case scenario GSV (0.0138) that is noted due to the lack of monitoring data during periods of falling atmospheric pressure.

Additionally, it can be noted that given the very low risk of the source, monitoring has been done as a precautionary measure only, and was not required under best practice following the guidance.

As such, the site is provisionally classified as Characteristic Situation 1. This report will be updated, or an addendum issued, following the completion of the final monitoring round of the current commission.

Based on the data to date, subject to the conclusions of the updated report following completion of the gas monitoring commission, confirmation with the LPA and the warranty provider, no mitigation measures are required.

7.7 Phytotoxicity risk assessment

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on the plant population. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference with plant processes, contaminant-induced nutrient deficiencies and chlorosis (yellowing of leaves). Phytotoxicity is a difficult parameter to quantify given that experimental techniques vary widely and variations exist in plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Guidelines for phytotoxicity and general plant health have been published for a limited number of substances for topsoil (BS BS3882:2015), for soils used for grazing/landscaping (ICRCL 70/90), and for agricultural uses (MAFF Code of Good Agricultural Practice). Some of these guidelines focus on reduced yield for agricultural crops, and in general do not define concentrations in soil at which plant health is necessarily significantly compromised. The guidelines are not based on plant uptake and human consumption considerations, this is considered as an exposure route in the derivation of human health GAC.

Reported soil sample results have been screened against these guidelines (where available) and the results are provided in the screening tables in Appendix H.

Results indicate that all CoPC are below the relevant phytotoxic GAC, therefore the contaminant linkage is incomplete.

7.8 Construction materials risk assessment

7.8.1 Water Pipelines

A formal water pipe investigation and risk assessment is beyond the scope of this report. However, the findings of this investigation have been compared to the threshold values in Water UK HBF (2014), Table 1 as far as is practicable.

The site is brownfield and organic contamination (VOCs and petroleum hydrocarbons) has been identified in exceedance of the threshold values in six locations and Hydrock believes barrier pipe is required. However, confirmation should be sought from the water supply company at the earliest opportunity.

Because the requirements from individual water companies can vary, confirmation of pipeline requirements should be sought from the relevant water supply company at the earliest opportunity.

7.8.2 Other construction materials

Plastic pipes for drains and sewers are manufactured from unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) or polyethylene (PE). These materials may be affected by the presence of organic compounds in the soil.

In accordance with the British Plastics Federation Guidance (August, 2018), as the concentrations of PAH, and BTEX are below 100mg/kg and the concentrations of petroleum hydrocarbons (TPH) are below 200 mg/kg, PVC-U, PP or PE pipework is likely to be considered suitable. However hydrocarbon odours were noted within the Made Ground at one location (CP101, 0.2 to 1.0m bgl) and Total PAHs were recorded at 99.7 mg/kg against a threshold of 100mg/kg. As such, the pipework manufacturer should be consulted with regard the suitability of the pipework.

The implications for buried concrete are discussed in Section 6.9.

7.9 Updated Conceptual Site Model

The potential sources, pathways and receptors identified in the desk study (Section 2) have been investigated (Section 5) and assessed (Sections 7.3 to 7.8). The Source-Pathway-Receptor linkage assessment originally developed as the desk study stage has been updated on the basis of the investigation information and generic risk assessment and is presented in Appendix K (Table K.2).

A summary of the Source-Pathway-Receptor (SPR) contaminant linkages for which the risks may be unacceptable and require mitigation (those that are moderate or higher) are discussed in Table 7.1.

The SPR linkages that warrant further assessment and/or mitigation are:

Table 7.1: Residual risks following risk assessment

Contamination Linkage				Comments	
Pollution Linkage	Sources	Pathways	Receptors	General	Mitigation
PL1	Made Ground, associated with historical construction of the existing car park and imported fill to form a level site at the top of the slope, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials and PAH (S01).	Direct Contact (P06)	Water supply pipes (R05)	The shallow granular Made Ground contains contaminants of concern in excess of the UKWIR thresholds.	Installation of "Protectaline" (or similar) pipework at depths within the Made Ground may be necessary. Confirmation of pipeline requirements should be sought from the relevant water supply company at the earliest opportunity. Further testing of Made Ground and natural soils may be necessary.
PL2	Petroleum hydrocarbons potentially associated with uncontrolled spillages and poor condition of the existing hardstanding (S03).				

7.10 Mitigation measures

The outline remediation strategy presented below is provided for guidance only, and does not represent a 'Remediation Options Appraisal', or a 'Remediation Strategy', prepared in accordance with LCRM (2023).

As shown in Table 7.1 (and subject to regulatory agreement), Hydrock consider the following mitigation is required to ensure the site is suitable for use for the proposed end use. The mitigation measures include:

- » Completion of a formal water pipe risk assessment and consultation with the water supply company, and potentially the installation of Protectaline pipework in shallow granular Made Ground (PL1).

The methodology for the remediation should be set out in a Remediation Strategy (which will include the 'Implementation Plan', the 'Verification Plan' and the 'Long Term Monitoring and Maintenance Plan'), which will need to be submitted to the warranty provider and the regulatory authorities for approval.

In addition, the production of a Materials Management Plan and its approval by a Qualified Person will be required to allow reuse of suitable material at the site in accordance with waste regulations.

Verification reports by a competent independent geo-environmental specialist will be required following completion of any remedial works (including ground gas membrane installation).

7.10.1 Gas protection measures

The site is provisionally classified as Characteristic Situation 1 and no gas protection measures are required. However, this evaluation will be updated subject to the completion of the monitoring.

8. Waste and materials management

8.1 Introduction

The Waste Framework Directive (WFD) (2009/98/EC) defines waste as *'any substance which the holder discards or intends to discard.'* In a geo-environmental context, the waste is most often 'soil' and the two main scenarios are offsite disposal of the material as a waste and/or reuse of the material on site. For cost and sustainability reasons, reuse is preferred to off-site disposal.

Section 8.2 below describes the key issues relating to off-site disposal to landfill and Section 8.3 considers requirements relating to reuse of soils and materials management.

8.2 Waste disposal

8.2.1 Principles

Based on the WFD, any material excavated on site may be classified as waste and it is the responsibility of the producer of a material to determine whether or not it is waste. Where off-site disposal is undertaken, the following guidance applies.

Classification is a staged process:

- » A hazardous waste is defined under the WFD as one which possesses one or more of fifteen defined hazardous properties. If a waste is not defined as hazardous, then it is non-hazardous.
- » Where the materials are soil, it is then be assigned using the 'List of Waste Codes', which classifies the material as either:
 - » hazardous (17-05-03), which is defined as *"soil and stones containing hazardous substances"*; or
 - » non-hazardous (17-05-04), which is defined as *"soil and stones other than those mentioned in 17-05-03"*.
 - » Hydrock utilise the proprietary assessment tool, HazWasteOnline™ to undertake this assessment.
- » Waste Acceptance Criteria (WAC) testing is then undertaken (if required), and are only applicable following classification of the waste, and only where the waste is destined for disposal to landfill. The WAC are both qualitative and quantitative. The WAC and the associated laboratory analyses (leaching tests) are not suitable for use in the determination of whether a waste is hazardous or non-hazardous.

It should be noted that some non-hazardous wastes may be suitable for disposal at an inert landfill as non-hazardous waste, subject to meeting the appropriate waste acceptance criteria.

It should be noted that classification must be undertaken on the waste produced, by the waste producer. Necessary sampling frequency to adequately characterise a soil population is defined within WM3.

8.2.2 *HazWasteOnline™ assessment*

As the site is brownfield, in order to inform the preliminary waste characterisation process, Hydrock has undertaken an exercise using the proprietary web-based tool HazWasteOnline™. The output of the HazWasteOnline™ assessment is provided in Appendix I and a summary of the preliminary waste classification is provided below in Section 8.2.4.

8.2.3 *WAC testing*

The site is brownfield and the qualitative WAC tests are provided in Appendix H a summary of the preliminary waste disposal options is provided below in Section 8.2.4.

8.2.4 *Preliminary waste disposal options*

The site is brownfield and based on the site history, the HazWasteOnline™ assessment and the WAC testing, if suitable segregation of different types of waste is put in place, for soils to be disposed of, it is considered that:

- » The 'General' Made Ground is likely to be classified as non-hazardous waste.

No testing or assessment of the bituminous bound pavement for the presence of coal tar has been undertaken during this commission.

8.2.5 *General waste comments*

It should be noted that:

- » Any soils containing > 0.1% asbestos or visible asbestos containing materials would be considered as hazardous.
- » It is the waste producer's responsibility to segregate the waste at source and waste producers must not mix waste materials/streams or dilute hazardous components, for example by mixing with less or non-hazardous waste on site to meet WAC limit values.
- » The above preliminary assessment has been made on the basis of the soils tested as part of the ground investigation, using WAC testing and the HazWasteOnline™ assessment. However, the formal classification of waste can only be undertaken on the material to be disposed of, and by the waste producer and the receiving landfill as license conditions vary from landfill to landfill.
- » Basic Characterisation should be undertaken in accordance with Environment Agency guidance by the waste producer. Hydrock can assist if required and this report will assist the characterisation. However, Basic Characterisation does not form part of the current commission and would require further assessment and testing on the wastes actually to be disposed.
- » Once the waste producer has undertaken an initial Basic Characterisation on each waste stream, they can manage the soils as part of the on-site processing programme (for example, stockpiling, treatment, screening and separation). The waste producer and landfill operator will then need to agree the suite of compliance testing for regularly generated waste to demonstrate compliance with the initial Basic Characterisation prior to disposal.
- » At the time of disposal, additional testing on the excavated soils to be disposed of, will likely be necessary.
- » Non-hazardous and hazardous soils require pre-treatment (separation, sorting and screening) prior to disposal.
- » The costs for disposal of non-hazardous and hazardous soils are significant compared to disposal of inert material.
- » In addition to disposal costs, landfill tax will be applicable. Non-hazardous and hazardous waste will generally be subject to the Standard Rate Landfill Tax. Inert or inactive waste will generally be subject to the Lower Rate Landfill Tax. The landfill tax value changes each April

and can be found at <https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013>.

- » Before a waste producer can move waste to a landfill site for disposal, they need to check the landfill site has the appropriate permit and must have completed the following⁶:
 - » Duty of care transfer note / Hazardous Waste consignment note, including comment as to if pre-treatment has been undertaken; and
 - » Basic Characterisation of the waste, to include: description of the waste; waste code (using list of wastes); composition of the waste (by testing, if necessary) and; WAC testing (if required).

8.3 Materials management

8.3.1 Introduction

Soils that are to remain on site, should be managed and reused in accordance with a Materials Management Plan (MMP), prepared in accordance with 'The Definition of Waste: Development Industry Code of Practice', Version 2 (CL:AIRE), known as the DoWCoP. Where all aspects of the DoWCoP are followed the soils are considered not to be waste, because they were never discarded in the first place.

Version 2 of the DoWCoP clearly sets out the principles and an outline of the requirements of a MMP. The following compliance criteria must be seen to apply to the MMP for the site:

- Factor 1: Protection of human health and protection of the environment.
- Factor 2: Suitability for use, without further treatment.
- Factor 3: Certainty of Use.
- Factor 4: Fixed Quantity of Material.

The reuse of soils at sites should be considered during the planning and development design process so that compliance with issues such as fixed quantity and certainty of use clearly relate to agreed site levels. Suitability of Use is normally evident from the remediation strategy or the design statement, which form an integral part of a MMP. However, some soils may need to be tested post-excavation to prove they are suitable for use.

Once the MMP is finalised, it must be declared by a Qualified Person (QP). The Declaration is an on-line submission as part of which the QP is required to confirm that the declaration is being made before the relevant works have commenced (i.e. it is not a retrospective application).

Once all material movements have been completed in accordance with the MMP a verification report must be produced, kept for 2 years and provided to the EA on request.

It should be noted that failure to comply with the requirements of the DoWCoP when re-using materials has potentially significant consequences for the waste holder. The risk is that the reused materials are still regarded as a waste that has been illegally deposited. From 1 April 2018, the scope of Landfill Tax has been extended to sites operating without the appropriate environmental disposal permit, and operators of illegal waste sites will now be liable for Landfill Tax. Further information is available at: <https://www.gov.uk/government/publications/landfill-tax-disposals-not-made-at-landfill-sites/landfill-tax-disposals-not-made-at-landfill-sites>.

⁶ ENVIRONMENT AGENCY. November 2010. Guidance on waste acceptance procedures and criteria. Waste acceptance at landfills. The Environment Agency.

If soils are excavated and reused on sites (or moved to another site) without a MMP, exemption, or appropriate Permit in place, anyone who knowingly facilitates the disposal may be *'jointly and severally liable'* to any assessment of tax, fines or prosecution.

8.3.2 *Materials management scenarios*

The materials management scenarios present on site are discussed below.

It should be noted that more than one scenario may apply, dependent upon where the soils are proposed for reuse.

8.3.2.1 *Clean, naturally occurring materials – reused on the site of origin*

Where soils are naturally occurring, uncontaminated and are reused on the site they are excavated (i.e. greenfield site with documented site history, with no Made Ground), they will fall outside the Waste Framework Directive (WFD) (i.e. they will not be a waste when reused on the site of origin).

However, there needs to be certainty of that reuse, and evidence is necessary to support this strategy, for example through information provided during the planning process. The onus is on the developer to demonstrate that the materials are not a waste and will never become a waste. As such, a Materials Re-use Strategy or a Materials Management Plan is recommended to show certainty. Alternatively, if the volume of material is under 1,000 tonnes, then a U1 waste exemption may be applied for from the Environment Agency.

Even if excess soil is not predicted, Hydrock recommend a MMP is undertaken which shows that in the event of excess soils being generated (for example over-excavation or increased bulking), there is an intent to transfer any excess to other, suitable sites using DoWCoP.

It may be noted that some 'clean naturally occurring materials' may still fail the 'suitable for use' test, for example, soils with a naturally high organic content may not be suitable for use because of their propensity to produce ground gases such as methane. Rules regarding other more unusual circumstances such as where natural soils contain an unacceptably high mineral content are described in the DoWCoP.

8.3.2.2 *Clean, naturally occurring materials – transferred to other sites*

Where soils are naturally occurring, uncontaminated and are transferred to other sites (i.e. direct transfer), they will not become waste as long as the transfer is undertaken in accordance with the DoWCoP. A MMP must be prepared for the receiving site and the materials movement must be noted in the MMP of the Donor site. This movement must have been declared to CL:AIRE prior to the works commencing.

8.3.2.3 *Made Ground and other contaminated soils*

On sites where Made Ground or contaminated soils are present, any soils excavated will be a waste as soon as they are excavated (even if they are clean, naturally occurring materials), unless they are subject to reuse in accordance with the DoWCoP. As such, for any brownfield site or a site where Made Ground is present and soils are being moved and reused, the materials could be deemed a waste, subject to either:

- a Materials Management Plan (MMP), to prevent the material being classified as a waste following reuse; or
- an exemption (for limited volumes); or
- an environmental permit, dependant on its status.

Made Ground cannot be moved between sites under DoWCoP alone and would require relevant permits as part of the MMP documentation for the Hub site the material is being treated at.

8.3.2.4 *Recycled materials*

All recycled materials (6F2 etc.) must be produced under the 2013 WRAP 'Quality Protocol: Aggregates from inert waste', whether on site or off-site. If they are not, they will be deemed a waste and can only be used on site under a permit. More information can be found at <https://www.gov.uk/government/publications/quality-protocol-production-of-aggregates-from-inert-waste>.

8.3.2.5 *Geotechnical improvement requirements*

Construction activities carried out on uncontaminated soils solely for the purpose of improving geotechnical properties e.g. lime / cement modification, are not generally regarded as waste treatment operations and do not require a permit.

However, should processing be needed (such as screening, treatment or improvement), that would constitute a waste activity and require a mobile treatment permit. This may be as simple as removing oversize material with an excavator bucket, to using a riddle bucket to remove hardcore to full mechanical screening.

9. Uncertainties and limitations

9.1 Site-specific comments

The gas monitoring undertaken to date and included in this report is insufficient to fully characterise the site in accordance with CIRIA Report C665. Monitoring is ongoing and the conclusions of this report will be updated following completion of the scheduled monitoring.

The hand dug pits HP101 - 103 were unable to be undertaken due to the dense woodland and steep slope in the area between the two car parks.

9.2 General comments

Hydrock Consultants Limited (Hydrock) has prepared this report in accordance with the instructions of Manchester University NHS Foundation Trust (the Client), by e-mail dated 10/10/24 under the terms of appointment for Hydrock, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock's appointment.

This report details the findings of work carried out in October 2024. The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Hydrock has used reasonable skill, care and diligence in the design of the investigation of the site and in its interpretation of the information obtained. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred.

Groundwater data are only representative of the dates on which they were obtained and both levels and quality may vary.

Plans that provide assessment of foundation types and depths are indicative and subject to further design. This design should incorporate a detailed assessment of the influence of trees, influence of cut to fill proposals and geological conditions.

Unless otherwise stated, the recommendations in this report assume that ground levels will remain as existing. If there is to be any re-profiling (e.g. to create development platforms or for flood alleviation) then the recommendations may not apply.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock cannot guarantee its accuracy or completeness.

Hydrock is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

The work has been carried out in general accordance with recognised best practice. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

The work has not been undertaken to meet the requirements of the Geotechnical Design Report (GDR) in accordance with BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design — Part 1). The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

The chemical analyses reported were scheduled for the purposes of risk assessment with respect to human health, plant life and controlled waters as discussed in the report. Whilst the results may be useful in applying the Hazardous Waste Assessment Methodology given in Environment Agency Technical Guidance WM3, they are not primarily intended for that purpose and additional analysis will be required at the time of disposal to fully classify waste. Discussion and comment with regards to waste classification are preliminary and do not form the requirements of 'Basic Characterisation' as required.

Unless otherwise stated, at the time of this investigation the future routes of water supply pipes had not been established. This investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling and chemical testing may be required at a later date once the routes of the supply pipes are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

Whilst the preliminary risk assessment process has identified potential risks to construction workers, consideration of occupational health and safety issues is beyond the scope of this report.

The non-specialist UXO screening has been undertaken for the purposes of ground investigation only (i.e. low risk activity in accordance with CIRIA Report C681). Further assessment should be undertaken with regards to other higher risk activities e.g. construction.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

Any site boundary line depicted on plans does not imply legal ownership of land.

10. Recommendations for further work

Following the ground investigation works undertaken to date, the following further works will be required:

- » detailed topographical survey of the slope adjacent to the site to enable the slope stability assessment;
- » a slope stability assessment needs to be undertaken prior to final design and construction;
- » completion and reporting of the ongoing gas monitoring, hence the conclusions in this report are provisional, subject to the completion of monitoring;
- » discussion and agreement with utility providers regarding the materials suitable for pipework, potentially including full UKWIR risk assessment;
- » discussions with regulatory bodies and the warranty provider regarding the conclusions of this report;
- » production of an appropriate Earthworks Specification;
- » production of a Materials Management Plan relating to reuse of soils at the site and potential import of soils to the site; and
- » verification of the earthworks, any remediation (if required), and mitigation works.

11. References

- ALLEN, D. L., BREWERTON, L. J., COLEBY, L. M., GIBBS, B. R., LEWIS, M. A., MACDONALD, A. M., WAGSTAFF, S. J. and WILLIAMS, A.T. 1997. The physical properties of major aquifers in England and Wales. British Geological Survey Technical Report WD/97/34. 312pp. Environment Agency R and D Publication 8.
- ASSOCIATION OF GROUND INVESTIGATION SPECIALISTS. 2006. Guidelines for Good Practice in Site Investigation. Issue 2. AGS, Beckenham.
- ASSOCIATION OF GROUND INVESTIGATION SPECIALISTS. 2019. Waste Classification for Soils – A Practitioners' Guide. AGS, Beckenham.
- BRE. 1980. Low-rise buildings on shrinkable clay soils: Part 1. BRE Digest 240. Building Research Establishment, Garston.
- BRE. 2016. Soakaway design. BRE DG 365. BRE, Garston.
- BRE. 2000. Specifying Vibro Stone Columns. BR391. BRE, Garston.
- BRE. 2005. Concrete in aggressive ground. BRE Special Digest 1, 3rd Edition. BRE, Garston.
- BRITISH PLASTIC FEDERATION. August 2018. 'Designing Drains and Sewers for Brownfield Sites. Guidance Notes'. BPF Pipes Group (<https://www.bfppipesgroup.com/media/29155/Designing-drains-and-sewers-for-brownfield-sites.pdf>)
- BRITISH STANDARDS INSTITUTION. 2004+A1 2013. Eurocode 7 – Geotechnical design - Part 1: General rules. BS EN 1997-1+A1. Incorporating Corrigendum February 2009. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2007. Eurocode 7 – Geotechnical design - Part 2: Geotechnical investigation and testing. BS EN 1997-2. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2010. Code of practice for earthworks. BS 6031 Incorporating Corrigendum No.1:2010. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2017. Code of Practice for Investigation of Potentially Contaminated sites. BS 10175 Incorporating Amendment No. 2:2017. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2012. Trees in relation to design, demolition and construction – Recommendations. BS 5837. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2015+A1:2020. Code of Practice for Foundations. BS 8004. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2015. Specification for topsoil. BS 3882. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2020. Code of practice for ground investigations. BS 5930+A1 2020, BSI, London.
- BRITISH STANDARDS INSTITUTION. 2019. Concrete – complementary British Standard to BS EN 206-1 – Part 1: Method of specifying and guidance to the specifier. BS 8500-1+A2 2019. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BS 8485:2015 +A1:2019. BSI, London.
- BRITISH STANDARDS INSTITUTION. 2020. Soil Quality – Conceptual Site Models for potentially contaminated sites. BS EN ISO 21365:2020

BRITISH STANDARDS INSTITUTION. 2021. Soil and waste – Guidance on the selection and application of screening methods. BS EN ISO 12404:2021

CARD, G., LUCAS, J., WILSON, S., 2019. Risk and reliability in gas protection design - 20 years on. Ground Engineering, August/September 2019.

CL:AIRE. 2011. The Definition of Waste: Development Industry Code of Practice, Version 2. Contaminated Land: Applications in the Real Environment (CL:AIRE), London.

CL:AIRE, 2017. A Pragmatic Approach to Ground Gas Risk Assessment. Research Bulletin 17, CL:AIRE, Buckinghamshire. ISSN 2047-6450.

CL:AIRE. 2016. CAR-SOIL™ Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance. Contaminated Land: Applications in the Real Environment (CL:AIRE), London.

CL:AIRE, 2018. Ground gas monitoring and 'worst-case' conditions. Technical Bulletin 17, CL:AIRE, Buckinghamshire, August 2018.

CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration. CL:AIRE, Buckinghamshire. ISBN 978-1-905046-35-5.

CLAYTON, C. R. I. 2001. Managing Geotechnical Risk. Improving productivity in UK building and construction. Thomas Telford, London.

CONCRETE SOCIETY, THE. 2013. Concrete industrial ground floors. A guide to design and construction. Technical Report 34 (4th Ed.). The Concrete Society, Camberley.

DLUHC. July 2021. National Planning Policy Framework. DLUHC, London.

DEFRA. 2014. SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. Defra, London.

ENVIRONMENT AGENCY. 2006. Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination. The Environment Agency, Bristol.

ENVIRONMENT AGENCY, 2010. Guiding Principles for Land Contamination. Part 2. FAQs, technical information, detailed advice and references, March 2010.

ENVIRONMENT AGENCY. November 2010. Guidance on waste acceptance procedures and criteria. Waste acceptance at landfills. The Environment Agency.

ENVIRONMENT AGENCY. November 2010. Environment Agency Regulator Position Statement 075 (EARPS075). The Environment Agency.

ENVIRONMENT AGENCY. 2021. Waste classification. Guidance on the classification and assessment of waste (1st Edition v1.2.GB) Technical Guidance WM3. The Environment Agency.

ENVIRONMENT AGENCY. 2023. Land Contamination: Risk Management (LCRM). The Environment Agency.

HATANAKA, M, UCHIDA, A, KAKURAI, M, and AOKI, M. 1980. A consideration on the relationship between SPT N-value and internal friction angle of sandy soils. Journal of Structural and Construction Engineering (Transactions of AIJ). 63. 125-129. 10.3130/aijs.63.125_2.

HEALTH and SAFETY EXECUTIVE. December 2005. Construction Information Sheet 47: Inspections and Reports (CIS 47 (Rev 1)). HSE.

HEALTH and SAFETY EXECUTIVE. 2014. HSG47 - Avoiding danger from underground services (Third edition). HSE.

HEALTH and SAFETY EXECUTIVE. January 2020. EH40/2005 Workplace Exposure Limits (4th edition 2020,). HSE.

HIGHWAYS AGENCY. 2009. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London.

HIGHWAYS AGENCY. 2014. Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. Highway Agency, London.

THE HIGHWAYS AGENCY. 2000. Design Manual, Road and Bridges: CS 641 - Managing the maintenance of highway geotechnical assets. CS 641 Rev O. Highway Agency, London.

THE HIGHWAYS AGENCY. 2019. Design Manual for Roads and Bridges. Managing Geotechnical Risk. CD 622 Rev O. Highway Agency, London.

JOHNSON, R. 2001. Protective measures for housing on gas contaminated land. Building Research Establishment Report BR 414. BRE, Garston.

JONES, H. K., MORRIS, B. L., CHENEY, C. S., BREWERTON, L. J., MERRIN, P. D., LEWIS, M. A., MACDONALD, A. M., COLEBY, L. M., TALBOT, J. C., MCKENZIE, A. A., BIRD, M. J., CUNNINGHAM, J. and ROBINSON, V. K. 2000. The physical properties of minor aquifers in England and Wales. British Geological Survey Technical Report WD/00/04. 234pp. Environment Agency R and D Publication 68.

UK HEALTH SECURITY AGENCY (UKHSA) and BRITISH GEOLOGICAL SURVEY. December 2022. Indicative Atlas of Radon Potential for Great Britain (Version 3) (<https://www.ukradon.org/information/ukmaps>)

MINISTRY OF HOUSING, COMMUNITIES and LOCAL GOVERNMENT (MHCLG). Internet published Planning practice guidance <https://www.gov.uk/government/collections/planning-practice-guidance>. MHCLG. London

NATHANAIL P., JONES A., OGDEN, R., AND ROBERTSON A. 2014. Asbestos in soil and made ground: a guide to understanding and managing risks. CIRIA Report C733 Contaminated Land: Applications in Real Environments, London.

PECK, R.B., HANSON, W.E., AND THORNBURN, T.H., Foundation Engineering, 2nd Edn, John Wiley, New York, 1967, p.310.

RAWLINS, B. G., McGRATH, S. P., SCHEIB, A. J., CAVE, N., LISTER, T. R., INGHAM, M., GOWING, C. and CARTER, S. 2012. The advanced geochemical atlas of England and Wales. British Geological Survey, Keyworth.

SCIVYER, C. and JAGGS M. 2023. Radon: Guidance on protective measures for new buildings. Building Research Establishment Report BR 211 6th Edition. BRE, Garston.

SHAND, P., EDMUNDS, W.M., LAWRENCE, A.R., SMEDLEY, PAULINE, BURKE, S. 2007. The natural (baseline) quality of groundwater in England and Wales. Environment Agency, 72pp. (RR/07/006)

SoBRA, 2017. Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater. 90pp. Version 1.0.

SoBRA, 2022. Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change, Society of Brownfield Risk Assessment, August 2022.

SoBRA, 2023. The Climate Emergency: Practical Considerations in Brownfield Risk Assessment. Summer Workshop 2022 Report. Version 1.1, June 2023

STONE, K., MURRAY, A., COOKE, S., FORAN, J. and GOODERHAM, L. 2009. Unexploded ordnance (UXO), a guide to the construction industry. CIRIA Report C681. Contaminated Land: Applications in Real Environments, London.

STROUD, M. A. 1975. The standard penetration test in insensitive clays and soft rocks. Proceedings of the European Symposium on penetration testing, 2, 367-375.

TOMLINSON, M.J. 2001. Foundation Design and Construction (6th Edition and 7th Edition). Prentice Hall Press

WASTE AND RESOURCES ACTION PROGRAMME (WRAP). October 2013. Quality Protocol. Aggregates from inert waste. End of waste criteria for the production of aggregates from inert waste.

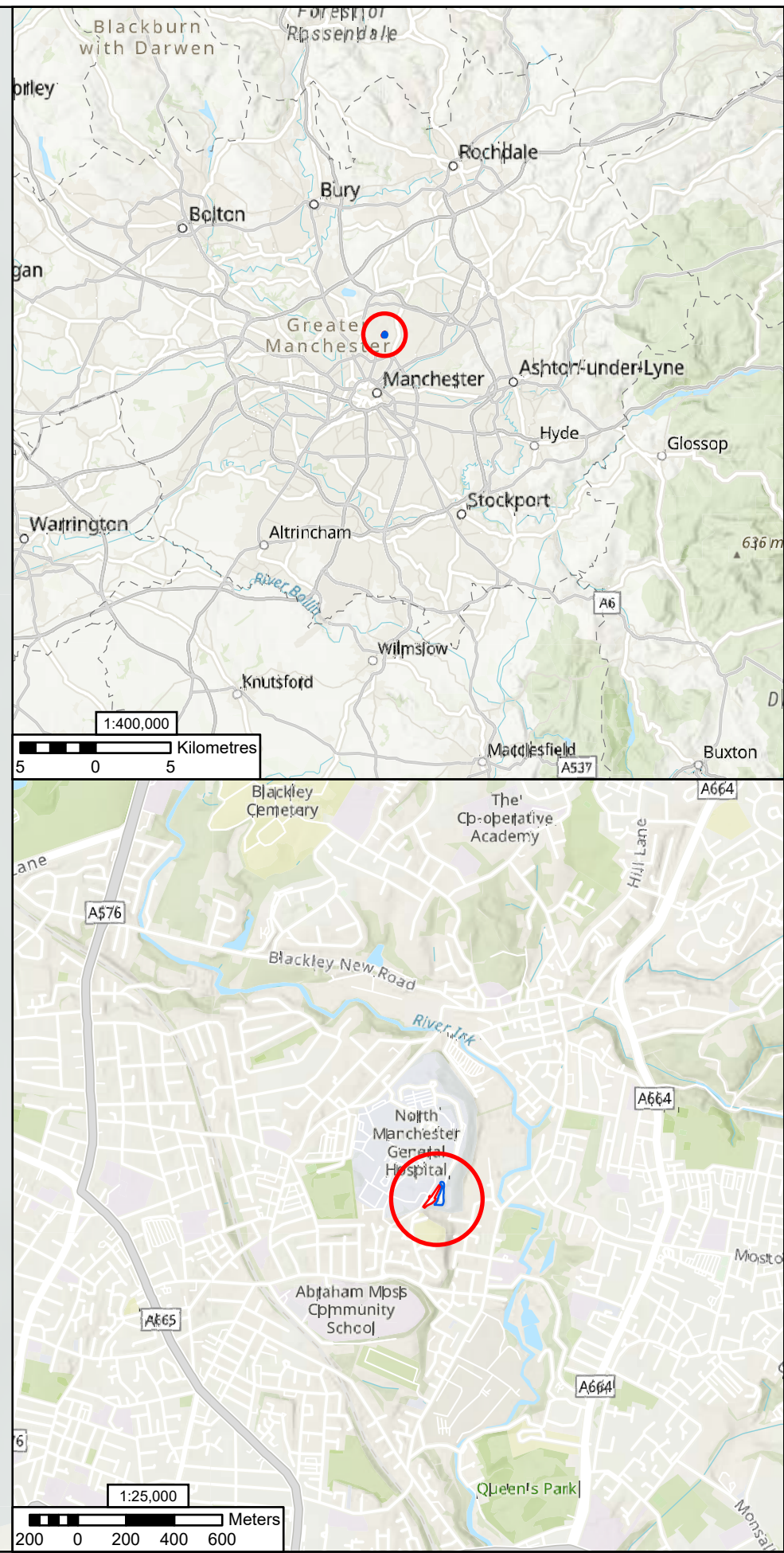
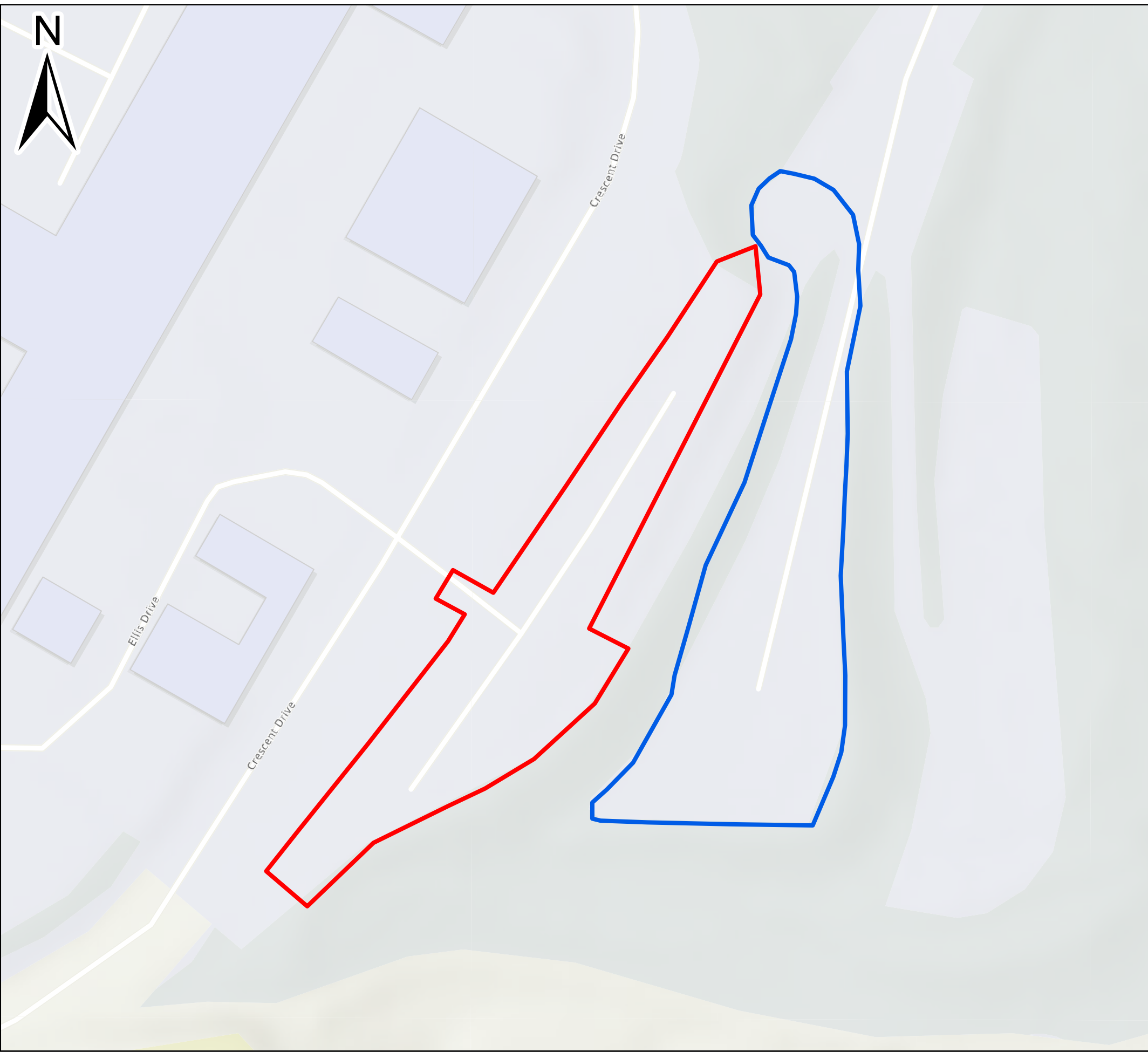
WATER UK HBF. January 2014. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation.

WILSON, S., OLIVER, S., MALLETT, H., HUTCHINGS, H. and CARD, G. 2007. Assessing risks posed by hazardous ground gases to buildings. CIRIA Report C665. Contaminated Land: Applications in Real Environments, London.

WILSON, S., COLLINS, F. and LAVERY, R., G. 30th July 2018. Using ternary plots for interpretation of ground gas monitoring results. Ground Gas Information Sheet No 1 Paper 1.0. Ambisense Limited and EPG Limited.

WILSON, S. and MORTIMER, S., 2017. Piled foundations and pathways for ground gas migration, Environmental Geotechnics, ICE Publishing.

Appendix A Drawings



Site Location Plan

Project: 32425 - North Manchester General Hospital

Figure Ref: 32425-HYD-XX-XX-DR-GE-1000

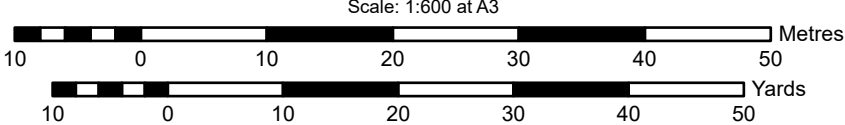
Client: North Manchester General Hospital

Hydrock

now

Stantec

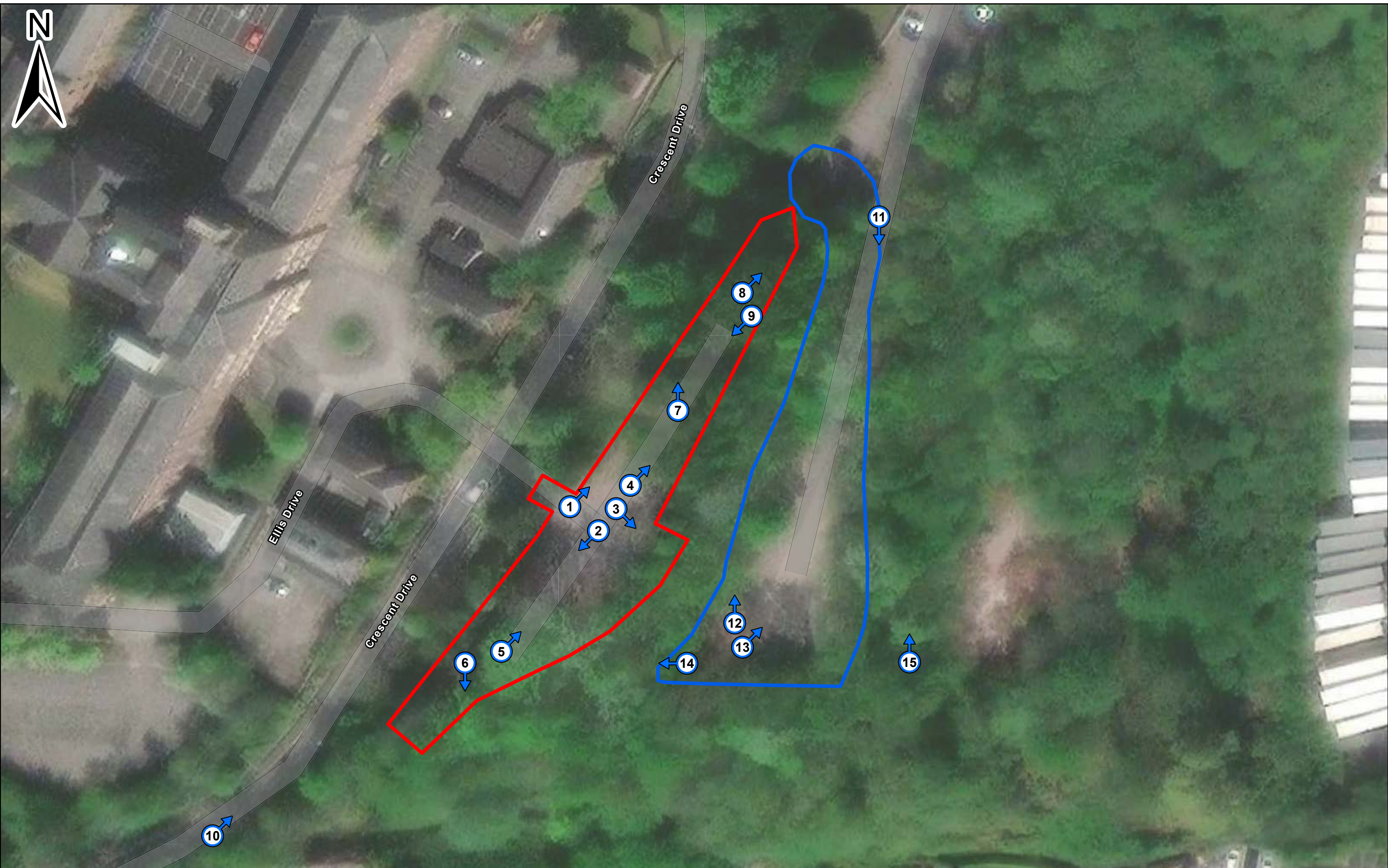
Notes:



LEGEND

Desk Study and development boundary

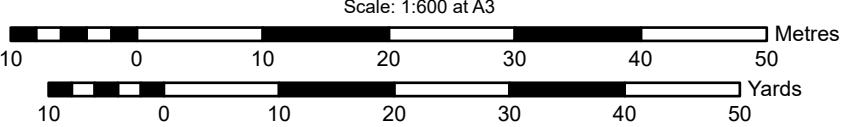
Additional area available for ground investigation of the slope



Photograph Locations
Project: 32425 - North Manchester General Hospital
Figure Ref: 32425-HYD-XX-XX-DR-GE-1001
Client: Manchester University NHS Foundation Trust



Notes: Imagery Credits: Esri Community Maps Contributors, Esri UK, Esri, TomTom, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Maxar, Microsoft



LEGEND

 Photo

 Desk Study Boundary

 Ground Investigation Boundary



1 Waste Compound Proposed Site Plan
SK004 1 : 200

© COPYRIGHT
The copyright in this drawing is vested in Sheppard Robson and no license or assignment of any kind has been, or is, granted to any third party whether by provision of copies or originals or otherwise unless agreed in writing.

DO NOT SCALE FROM THIS DRAWING
The contractor shall check and verify all dimensions on site and report any discrepancies in writing to Sheppard Robson before proceeding work

FOR ELECTRONIC DATA ISSUE
Electronic Data / drawings are issued as "read only" and should not be interrogated for measurement. All dimensions and levels should read, only from those values stated in text on the drawing.

NOTES

REV.	DATE	AMENDMENT
P01	30/11/2023	Issued to Design Team
P02	15/12/2023	Issued to Design Team

KEYPLAN

CLIENT



**SHEPPARD
ROBSON**

27th Floor City Tower Piccadilly Plaza Manchester M1 4BT
T: +44 (0)161 233 8900 E: enquiries@sheppardrobson.co.uk

PROJECT
North Manchester General Hospital

SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	15/12/2023	LH	DB	AS

DESCRIPTION
**WP1 Waste Transfer Compound
Sketch Layout**

STAGE

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	FOR INFORMATION	6512
DRAWING NO.		REV.
23130-SRA-NM171-00-DR-A-SK004		P02