



Appendix B Factual Report



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CONSULTING

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Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
<i>GRO-22292-P01</i>	-	<i>Project Location Plan</i>
<i>GRO-22292-P02</i>	-	<i>Exploratory Hole Location Plan</i>
<i>GRO-22292-P03</i>	-	<i>HDP106 – Foundation Cross Section</i>
<i>GRO-22292-P04</i>	-	<i>TP103 – Foundation Cross Section</i>
<i>GRO-22292-P05</i>	-	<i>TP105 – Foundation Cross Section</i>
<i>GRO-22292-P06</i>	-	<i>TP106 – Foundation Cross Section</i>

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Waterman I&E and their consultant McGoff to undertake a Factual Geo-Environmental Appraisal of a site at Rochdale Road in Manchester.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2013, BS 8576 and BS 22475.

1.2 Proposed Development

The proposed development comprises the erection of a part 11, part 13 storey building to form residential apartments together with the erection of two blocks of 3 storey duplexes to form 237 No. residential homes in total with associated commercial floor, basement car parking, landscaping and public realm, and associated engineering and infrastructure works following the demolition of existing buildings and structures.

1.3 Limitations

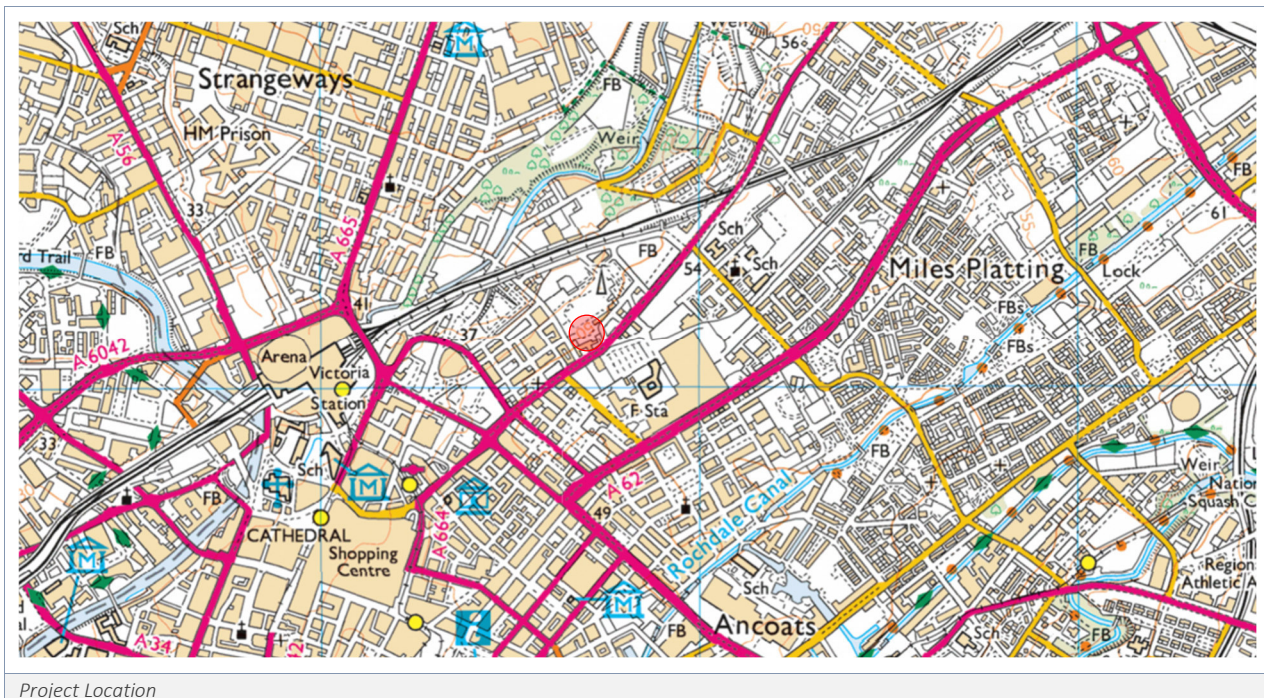
Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

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2.0 SITE SETTING

2.1 Location

The site is located circa 0.5 miles north east of Manchester City Centre, as shown on the Project Location Plan *GRO-22292-P01* and is approximately centred on National Grid Reference 384709, 399141.



Access to the site is gained off Rochdale Road to the south.

2.2 Site Description

The site is irregular in shape, approximately 0.8 hectares in area and is generally topographically level.

Onsite Features

The site is currently occupied by a disused car park and two warehouse buildings.

One of the warehouse buildings is located in the north east corner of the site which was formerly occupied by A1 Tyres. The building is of brick construction with corrugated ACM roofing and guttering. The unit is made up of four smaller areas separated by partitioning walls with entrance being gained through a roller shutter door that is permanently open.

The second warehouse building is situated in the south east of the site and is made up of two units. Both units are of brick construction with ACM corrugated roofing and guttering. The southernmost unit is accessed via a mechanical roller shutter door and the western unit is accessed through a manual roller shutter door. The western part of the warehouse was formerly used as a paint spraying booth and historically as a garage for trains. There is an inspection pit located in the east of the unit which is approximately 2.0m in depth.

The remaining areas of the site are occupied by a disused car park.

A geophysical survey has previously been undertaken by SEP Geophysical to determine if any obstructions were present beneath the site. Two areas of the concrete hardsurfacing running east to west had previously been broken out during the geophysics investigation, exposing railway sidings below.

The wall along the northern boundary of the site can be viewed from the adjacent car park. This shows several bricked-up arches along the façade as well as a number of open archways to the north east. The open arches show a complex structure of walls, tunnels and infrastructure beneath the site. The bricked-up arches are generally inaccessible but there is the possibility of a similar complex structure being present beneath the bulk of the site.

Boundaries and Surrounding Land Uses

The north of the site is bound by a brick wall with a vertical drop of c.10m onto the MCR car park below. The west of the site is also bounded by a brick wall with a vertical drop c.5m onto Gould Street. The south of the site is bound by a metal fence c.3m high. The eastern site boundary is formed by a brick wall and metal fence c.0.5m and 3.0m in height respectively.

The site is surrounded by following features/land uses:

- *North* - *Industrial units followed by railway lines.*
- *East* - *Car parks followed by commercial units.*
- *South* - *Car park followed by Manchester Central Community Fire Station*
- *West* - *Hampton by Hilton hotel followed by further commercial units.*

Site photographs are presented in *Appendix 2*.

3.0 SCOPE OF INVESTIGATION AND RATIONALE

3.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain a watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Determine soil infiltrations rates.
Determine the modulus of subgrade reaction.
Determine the geometrics of existing foundations.
Install monitoring standpipes for gas and groundwater monitoring.

3.2 Detailed UXO Risk Assessment

A detailed UXO Risk Assessment was acquired for the site and a copy is presented in *Appendix 3*.

3.3 Scope of Works

The following scope of works was completed between the dates of 26th September and 19th October 2022:

- *Service clearance by a specialist utility company.*
- *Surveying of all exploratory hole locations.*
- *Concrete coring of all borehole and window sample locations.*
- *23 No. trial pits (TP101 to TP123) were excavated to a maximum depth of 4.2m bgl.*
- *7 No. cable percussive boreholes (BH101 to BH107) were drilled to a maximum depth of 26.0m bgl.*
- *3 No. boreholes had rotary core follow on (BH101, BH102 and BH106) to a maximum depth of 36.0m bgl.*
- *5 No. windowless sample boreholes (WS101 to WS105) were drilled to a maximum depth of 3.0m bgl.*
- *3 No. soil percolation tests were carried out at 2.0m bgl in TP101, TP112 and TP114.*
- *5 No. plate load tests were carried out at 0.5m bgl in TP102 and TP113 to TP116.*
- *6 No. hand dug pits (HDP101 to HDP106) were excavated to a maximum depth of 1.2m bgl.*

The exploratory hole locations are presented on Groundtech Plan GRO-22292-P02, and the logs are presented in *Appendix 4*.

The results of the soil infiltration testing are in *Appendix 5* and the plate load test results are in *Appendix 6*.

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

Location	Target Rationale
BH101, BH102, and BH106	Proposed building footprint
BH103 and BH104	Contamination and depth to natural ground

TP101, TP111, TP112, TP114, TP115, TP116, TP119, WS101 to WS105	Site coverage
TP108 to TP110, TP118, TP120 to TP123	Trial pit to establish the level of the brick arch below
TP103 and TP106	Foundations of existing warehouse building
TP105	Foundation of existing western boundary wall
TP118	Void
TP102	Contamination of ground next to former inspection pit
HDP101 to HDP105	Ground conditions inside the existing warehouse building
HDP101	Foundations of existing warehouse building
BH106 and BH107	Foundations for 3 rd party land
TP104 and HDP106	Foundation of 3 rd party boundary wall

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

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

3.4 Soil Sampling

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

The samples obtained are summarised in the table below:

Soil Sample	Number
Environmental Sample	152
Disturbed Sample	131
Bulk Sample	105
Undisturbed UT100 Sample	11

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan was set out in the Waterman I&E Specification and was designed to obtain samples from all required strata using the correct methodology.

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

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

3.5 Geo-Environmental Analysis

The following geotechnical testing was scheduled by Waterman I&E.

British Standard	Test Method	Number
<i>Part 2</i>	<i>Water Content</i>	<i>16</i>
<i>Part 2</i>	<i>Plasticity Index Analysis</i>	<i>16</i>
<i>Part 2</i>	<i>Particle Size Distribution</i>	<i>16</i>
<i>Part 2</i>	<i>Sedimentation</i>	<i>8</i>
<i>Part 4</i>	<i>Dry Density/Moisture Content Relationship</i>	<i>3</i>
<i>Part 7</i>	<i>Undrained Shear Strength in Triaxial Compression</i>	<i>9</i>
<i>ISRM</i>	<i>Unconfined compressive strength</i>	<i>6</i>
<i>ISRM</i>	<i>Point Load</i>	<i>23</i>
<i>-</i>	<i>BRE Full Suite</i>	<i>9</i>

The Geotechnical Testing Results are presented in *Appendix 7*.

3.6 Gas and Groundwater Monitoring

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

Location	Depth (m bgl)	Response Zone (m bgl)	Targeted Strata
<i>BH101</i>	<i>3.0</i>	<i>1.0 – 3.0</i>	<i>Made Ground</i>
<i>BH101</i>	<i>36.0</i>	<i>22.0 – 36.0</i>	<i>Weathered Sandstone</i>
<i>BH102</i>	<i>8.0</i>	<i>6.0 – 8.0</i>	<i>Made Ground</i>
<i>BH102</i>	<i>35.5</i>	<i>32.0 – 35.5</i>	<i>Sandstone</i>
<i>BH103</i>	<i>10.0</i>	<i>6.0 – 10.0</i>	<i>Made Ground and Clay</i>
<i>BH104</i>	<i>6.0</i>	<i>4.0 – 6.0</i>	<i>Made Ground</i>
<i>BH105</i>	<i>7.0</i>	<i>4.5 – 7.0</i>	<i>Made Ground</i>
<i>BH106</i>	<i>4.0</i>	<i>1.0 – 4.0</i>	<i>Made Ground and Clay</i>
<i>BH107</i>	<i>2.0</i>	<i>1.0 – 2.0</i>	<i>Made Ground</i>
<i>WS101</i>	<i>3.4</i>	<i>1.0 – 3.4</i>	<i>Made Ground</i>
<i>WS102</i>	<i>3.0</i>	<i>1.0 – 3.0</i>	<i>Made Ground</i>
<i>WS103</i>	<i>2.0</i>	<i>1.0 – 2.0</i>	<i>Made Ground</i>
<i>WS105</i>	<i>2.0</i>	<i>1.0 – 2.0</i>	<i>Made Ground</i>

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

- *Oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) as the percentage volume in air (%v/v).*
- *Hydrogen sulphide (H₂S) and carbon monoxide (CO) as the percentage volume in air (%v/v).*
- *Lower Explosive Limit (%LEL) of methane.*
- *Atmospheric and borehole pressure, including pressure trend.*
- *Flow measurements (l/hr).*
- *Weather and ground surface conditions.*

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

Interim permanent gas and groundwater monitoring results are presented in *Appendix 8*.

3.7 Groundwater Sampling

During the return visit, the installations were purged to a minimum three times the volume of the water column in the borehole prior to sampling. Purging was undertaken at a slower rate than the well development, and the sampling at a slower rate again.

The method of sampling selected was using a low flow pump due to the contamination identified during the site investigation.

A water meter was used to test the pH, temperature and conductivity before sampling until equilibrium conditions were met, as per BS 10175 guidelines. The in-situ multiparameter data is included in *Appendix 9*.

During the groundwater sampling, no sheen was noted on the samples that were recovered.

Samples were sent to the UKAS Accredited laboratory the same day sampling was carried out in general accordance with BS593010 and BS5667-1111.

Groundwater was not encountered in BH101, BH104, and BH106 therefore no groundwater samples were obtained.

3.8 Vapour Survey - Photo Ionisation Detector

The onsite monitoring was carried out in line CIRIA C6658 to aid targeting samples for VOC laboratory analysis.

Soil was collected for onsite testing. A plastic bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested for Total Volatile Organic Compounds (TVOCs) using a Photo Ionisation Detector (PID).

Results of the PID readings are presented on the exploratory hole logs and in *Appendix 10*.

4.0 GROUND MODEL

4.1 Made Ground

Made Ground was encountered beneath the site between the minimum depths of 0.9m and a maximum of 7.8m bgl. Deep Made Ground was generally encountered across the central area of the site and the shallower Made Ground was observed locally in BH101 in the southernmost area of site, WS101 in the north east area, and in BH106 and BH107 on the third party land.

The full extent of the Made Ground in all trial pits except for TP107, WS101 to WS105, HDP101 to HDP106, and BH104 was not able to be determined due to encountering obstructions or collapse of exploratory holes due to the loose nature of the Made Ground.

The surfacing of the site generally comprised the following populations:

- *Tarmac surfacing was encountered in TP108, TP109, TP113, and TP120 to TP122 to a maximum depth of 0.07m bgl.*
- *Concrete surfacing was present in TP101 to TP103, TP105 to TP107, TP110 to TP112, TP114 to TP119, TP123, HP101 to HP105, WS101, WS103 to WS105, and BH101 to BH105 to a maximum depth of 0.3m bgl. Concrete was also present beneath the tarmac surfacing in TP109, TP122 and WS102 to 0.5m bgl.*
- *Dark brown clayey sandy gravel was in TP104 and HDP106 to a maximum depth of 0.85m bgl and in BH106 and BH107 from ground level to a depth of 3.0m and 2.0m bgl respectively.*

Four main Made Ground populations were encountered during the investigation and are described below:

Locations	Depth (m bgl)	Strata
TP101, TP103, TP106, TP109, TP110, TP112, TP115, TP116, TP118, TP120, BH102, BH106, BH107, WS101, WS102, WS104, WS105	0.07 – 3.0	Dark brown and black sandy gravel
TP102, TP105, TP107, TP108, TP109, TP111, TP112, TP116, TP119, TP120, TP122, BH102, BH103, BH105, WS103, HDP101, HDP102, HDP103, HDP104, HDP105	0.20 – 7.8	Dark brown and black gravelly sand
TP102, TP104, TP106 to TP108, TP111, TP112, TP113, TP114, TP118, BH101, BH104, HDP101, HDP102, HDP106	0.07 – 6.0	Orange brown, orange red, brown and grey variably clayey gravelly sand
TP108, TP111, TP114, TP116, TP120, BH102, WS101	0.3 – 7.8	Soft to firm brown sandy gravelly clay

Other, locally present, Made Ground populations were encountered during the Ground Investigation as described below:

- *In TP113 and TP121, between the depths of 0.07m and 2.1m bgl, blue green clayey sandy gravel was encountered. A strong hydrocarbon odour was also present.*
- *Black sandy very gravelly clay was encountered in WS102 in the south east of the site between 1.8m and 2.2m bgl.*

The minor constituents within the Made Ground included brick, clinker, ash, wood, concrete, glass, coal, ceramics, plastic, metal, sandstone and limestone.

Obstructions were encountered across the site within the Made Ground as described below:

- *In-situ steel beams were present in TP109 at 1.2m, TP115 at 0.6m and TP122 at 0.6m bgl.*
- *The top of a brick arch was identified in TP110 at 0.5m bgl.*

The Made Ground is predominantly associated with the raising of site levels to create the car park.

4.2 Natural Ground

The natural strata encountered generally confirmed the published geological records. Two main natural strata were encountered during the investigation and are described below:

- *Soft to firm through to stiff grey brown sandy gravelly Clay was observed in TP107, WS101, BH101, BH102, BH103, BH105, BH106, BH107 between the depths of 2.0m and 20.20m bgl.*
- *Very dense orange brown and red brown clayey gravelly Sand was in BH101, BH102, BH105 and BH106 from depths of between 17.0m and 22.3m to a maximum depth of 25.8m bgl.*

4.3 Bedrock

Extremely weak to weak, residually weathered red brown Sandstone was recovered as gravelly medium to coarse sand in BH101, BH102, and BH106 between the depths of 18.5m and 36.0m bgl

Rock core photographs are presented in *Appendix 2*.

4.4 Groundwater

Perched groundwater was observed in BH102 and BH104 at 5.8m bgl and BH103 at 6.5m bgl within the Made Ground.

No groundwater was encountered in the remaining exploratory hole locations.

4.5 Watching Brief

A watching brief was maintained during the Ground Investigation for visual and olfactory evidence of contamination.

Suspected asbestos tiles were encountered in TP111 and TP113 at 1.4m and 2.1m bgl respectively.

Ash and clinker were present as a minor constituent within the Made Ground beneath much of the site. A summary of the olfactory evidence of contamination observed across the site is presented in the table below:

Location	Depth (m bgl)	Stratum	Olfactory Evidence
TP113	0.7 – 2.1	MG: Blue green clayey sandy gravel.	Strong hydrocarbon odour
TP121	0.07 – 1.6	MG: Blue green clayey sandy gravel.	Strong hydrocarbon odour
BH102	5.8 – 7.8	MG: Brown gravelly sand.	Strong hydrocarbon odour
BH103	6.5 – 7.8	MG: Dark brown slightly clayey gravelly sand.	Strong hydrocarbon odour
BH104	5.8 – 6.0	MG: Dark brown slightly clayey gravelly sand.	Strong hydrocarbon odour
BH105	5.0 – 6.8	NO RECOVERY.	Strong hydrocarbon odour

The source of olfactory contamination in TP113 and TP121 is thought to be associated with the backfill material used in this area of site. The source of olfactory contamination identified in the boreholes is thought to be due to the previous use of the site as a garage and for train maintenance.

4.6 Excavation Stability

Evidence of spalling or collapse was noted during excavation of the majority of the trial pits and was generally due to loose Made Ground deposits.

4.7 Excavation Progress

Slow progress when excavating the trial pits and advancing the boreholes was experienced due to obstructions. The table below details the depths and characteristics of the ground where slow excavation and slow drilling progress was experienced.

Location	Depth (m bgl)	Obstruction
TP104	0.40	Concrete and unidentified cable
TP109	2.00	Brick arch
TP110	0.50	Brick arch
TP118	1.00	Void and tunnels
TP121	1.60	Concrete
TP122	0.60	Reinforced concrete and steel beams
TP123	0.50	Sheet of plastic over void
WS103	2.00	Unknown obstruction
WS104	0.80	Assumed brick wall
WS105	2.00	Unknown obstruction
BH104	6.00	Unknown obstruction
BH105	5.00	Concrete
BH107	15.00	Cobble/Boulder

4.8 Loss of Flush

Loss of flush was not recorded whilst completing the rotary boreholes during the investigation.

4.9 Foundation Pits

Seven hand dug pits were excavated (TP103 to TP107, HDP101 and HDP106) to determine the geometrics of existing foundations of the adjacent buildings and boundary walls. A summary of the findings is described in the table below.

Foundation Pit Reference	Depth to Top of Foundation (m bgl)	Extends Out (m)	Thickness of Foundation (m)
TP103	0.10	0.09	0.23
	0.33	0.80	1.00
TP104	0.40	-	-
TP105	1.30	0.60	0.10
TP106 (back wall)	0.60	0.12	0.08
HDP106	0.45	0.27	0.08

Foundations were not encountered in TP107 and HDP101.

The foundation pit in TP104 was not able to be completed due to encountering unidentified cables.

Foundation pit cross-sections are presented on Plans *GRO-22292-P03 to P06* in *Appendix 11*.

5.0 RELEVANT INDUSTRY REFERENCES

British Standards Institution '*Investigation of Potentially Contaminated sites - code of practice*' BS 10175:2017.

British Standards Institution '*Code of Practice for Site Investigations*' BS 5930:2015.

British Standards Institution '*Geotechnical investigation and testing – Identification and classification of soil*' BS EN ISO 14688:2002.

British Standards Institution '*Geotechnical investigation and testing – Identification and classification of Rock*' BS EN ISO 14689:2002.



APPENDIX 1 - Plans