

Eliza Yard

Piling Risk Assessment

Ref: 076740-CUR-00-XX-RP-GE-002

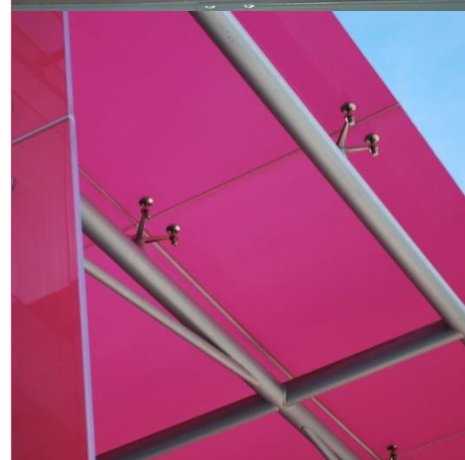
Revision: P01

Issue Date: 31 January 2023

Client Name: Manchester Life

Client Address: Unit 5, Royal Mill, 17 Redhill Street, Manchester, M4 5BA

Site Address: Jersey Street, Manchester M4 6JW



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Piling Risk Assessment

Rev	Description	Issued by	Checked	Date

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1.0 Introduction

In January 2023 Curtins were instructed by Manchester Life to undertake a Piling Risk Assessment of a site located off Jersey Street, Manchester, M4 6JW where piled foundations are proposed.

The proposed development on site comprises a construction of several structures comprising residential high-rise buildings with some commercial use to the ground floor. The proposed development plans are included within *Appendix A* of this report.

The bedrock geology underlying the site (Manchester Marls Formation) corresponds with a Secondary B Aquifer classification, and as such a piling risk assessment (PRA) has been produced in order to identify the risks associated with a piled foundation solution, should piles be installed in/on the bedrock.

This report has been written to address this recommendation and support discharge of a related-commencement planning condition requirement for a piling risk assessment where applicable.

It is understood that the preferred piling methodology is Continuous Flight Auger (CFA) Piles to a depth of between 20-25m bgl.

1.1 Scope

This piling risk assessment provides an overview of the site's ground and groundwater conditions and considers the potential risks associated with the adoption of Continuous Flight Auger (CFA) to groundwater.

The report identifies appropriate risk management and monitoring protocols that can be adopted to ensure any residual risk is brought within adequate and practicable limits.

1.2 References

In preparation of this report reference has been made to the following key guidance document:

- Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater & Contaminated Land Centre report NC/99/73 (EA Report 2001) (Ref. 1).

Reference is also made to the following geo-environmental reports undertaken for the site:

- E3P (2020) Phase I Geoenvironmental Site Assessment Land at Jersey Street, Ancoats, Manchester Report Ref. 13-729-R1 (Ref.2).
- E3P (2020) Parcel B Phase II Geoenvironmental Site Assessment Land at Jersey Street, Ancoats, Manchester Report Ref. 13-350-R3 (Ref.3).

- Curtins (2021) Interpretive Geo-Environmental and Geotechnical Letter Report for Back of Ancoats, Plot B Ref. 076740-CUR-00-XX-RP-GE-002-V01 (Ref.4).
- E3P (2020) Parcel B Ground Gas Addendum Report Land at Jersey Street, Ancoats, Manchester Report Ref. 13-729-R3-B (Ref.5).

It is assumed that the client is in receipt of these reports and that they will also be submitted to and accepted by Manchester Council to discharge relevant planning conditions.

2.0 The Site

This section of the report summarises the site setting, history, geology, hydrogeology, hydrology and environmental conditions at the site with reference to the geo-environmental reports referenced previously. It is not the intention of this report to duplicate these reports, with the information below providing the background information to support the piling risk assessment and recommendations. For further background information the full reports should be consulted.

E3P previously carried out a ground investigation in 2019 and report for Plot B to provide preliminary characterisation of the geo-environmental and geotechnical site conditions (Ref.1 and 2). Curtins have undertaken a supplementary intrusive investigation in 2021 (Ref.4). The information provided within these reports are summarised below.

2.1 The Site Setting

The site hereby known as 'Ancoats Plot B', located off Jersey Street, Manchester M4 6JW. It must be noted that this ground investigation is part of a wider site, including Plots A, B and C, this letter report refers only to Plot B. A site location plan is presented in *Figure 2.1* with the site boundary outlined in red and Labelled B.

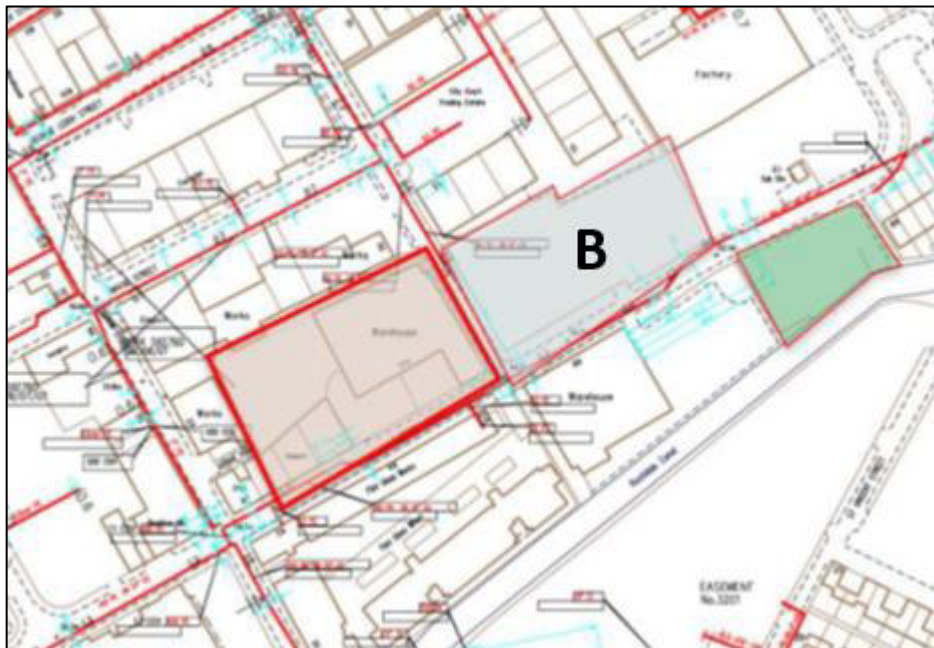


Figure 2.1 – Site Location Plan (Site Boundary shown in Red).

The site is located off Jersey Street, Manchester M4 6JW. The site currently operates as a car park with concrete hardstanding covering the entire site. The site is generally level.

2.2 Site History

Parcel B formerly had the canal branch (Bengal Arm) running east west along the northern boundary which was also infilled in the mid / late 1950's.

Earliest mapping of Plot B has featured a wharf that later became corporation yard and a number of smaller industrial units. Plot B was redeveloped in the late 50s, featuring a factory building in the west with a timber yard to the east.

2.3 Hydrogeology and Hydrology

The site, corresponding with the underlying solid geology, is underlain by a Secondary B Aquifer within the bedrock (Manchester Marl Formation) described as:

Red marl (calcareous mudstone and siltstone) with thin beds of fossiliferous marine limestone and dolomite; locally green; sandy in places especially in top part; local breccias and pebbly beds.

The site is not situated within a Source Protection Zone (SPZ). There are no active groundwater abstraction points located within 1km of the site.

The BGS record superficial Glacial Till, overlying the Manchester Marl Formation.

The nearest surface water feature is approximately 40m to the south which is the Rochdale Canal.

There are no surface water abstractions within 1km.

There are no discharge consents within 250m of the site.

2.4 Ground Conditions

The following sections present a summary of the ground conditions identified during the E3P 2019 and Curtins 2021 intrusive investigation. The exploratory hole logs are presented in *Appendix B*.

2.4.1 Made Ground

Made Ground soils were recorded in all exploratory hole locations from ground level to 2.50m bgl. The surface covering was a concrete slab with occasional rebar in the majority of locations, underlain by a gravelly black ash with frequent cobbles.

Made Ground description were highly variable but generally the gravel consisted of ash, mudstone, concrete, brick and asphalt, and cobbles of brick. In several locations a strong hydrocarbon odour and sheen was encountered, predominantly in the north and east of site where the historically infilled canal was located.

Anthropogenic fragments typically comprise brick, concrete, ash and clinker.

Obstructions were encountered in window sample boreholes WS-B1 to WS-B3 and WS-B5 to WS-B6A between 0.30m and 0.70m bgl (50.05m and 49.75m AOD).

2.4.2 Natural Deposits

Superficial Soils

Glacial Till was recorded in exploratory holes where progressed through the Made Ground, from depths of between 0.60m and 5.45m bgl. Soils were predominantly cohesive and typically comprised of firm to very stiff brown slightly gravelly Clay. The cable percussive boreholes investigated to depths in excess of 10m bgl, with a maximum proven depth of 13.80m bgl.

Soft black organic (fibrous) slightly sandy slightly gravelly Clay recorded in TP-B5 from 1.20 to 1.70m bgl.

Residual Soils

Residual soils were encountered in one of the exploratory holes on site (R-B1) from 17.00m to 20.00m bgl (33.55-30.55m AOD). These deposits were described as highly weathered extremely weak light grey and brown MUDSTONE recovered as a stiff sandy clay.

Bedrock (Manchester Marl Formation)

The Manchester Marl Formation bedrock was recorded underlying the Glacial Till, or in the case of R-B1, the residual soils from between 18.50 to 20.00m bgl (37.95-30.55m AOD). The bedrock was described as an extremely weak to weak Mudstone with closely to medium spaced thin laminations of fine-grained sandstone. In some cases, thick bands of fine-grained Sandstone was present.

2.4.3 Groundwater

Groundwater was encountered in trial pits TP-B2, TB-B3 and TP-B6 between elevations of 49.40m to 49.00m AOD.

2.5 Unexploded Ordnance

The site is located in Manchester, noted to be within a UXO Moderate Risk Area. The contractor should undertake their own risk assessment prior to commencement of piling activities.

2.6 Contamination Risk Assessments and Remediation

E3P Contamination Risk Assessment

E3P 2019 site investigation obtained 32 soil samples, which comprised of Made Ground and natural soils, and undertook environmental chemistry testing. Samples were tested for a broad suite of contamination as identified in the E3P Phase II Report (Ref. 3).

Contamination risk assessments and recommendations undertaken by E3P are summarised below.

2.6.1 Soils

The E3P 2019 site investigation environmental chemistry results were compared with Generic Assessment Criteria for soils with respect to human health for a '*Residential end use*'. Several exceedances were identified including elevated metals, non-volatile PAHs, and non-volatile TPH compounds, all within the Made Ground samples.

E3P submitted eight samples for asbestos analysis of which six samples were positive for asbestos.

E3P have analysed the current risk to human health as a Moderate Risk which with mitigation can be reduced to Low. E3P mitigation recommendations included a 300mm cover system within landscaped areas and PPE for construction workers (Ref. 3).

2.6.2 Controlled Waters

E3P had taken water samples for groundwater analysis from WS109 dated November 2019 and WS106 dated December 2019. Several exceedances were identified against Drinking Water Standards and in absence of these values the Environmental Surface Water Quality values. Exceedances include heavy metals, naphthalene and TPHs.

The risk to groundwater within the E3P report (Ref. 3) had determined that because the site is underlain by low-permeable cohesive deposits and the underlying aquifer is Secondary B the risk to controlled waters is considered Low Risk.

2.6.3 Ground Gas

E3P have completed six gas monitoring visits between 9th December 2019 and 7th April 2022. The findings are summarised within the ground gas addendum letter (Ref.5).

The E3P report has stated the concentration of methane (CH₄) was at 0.1% v/v in all boreholes during all visits. Maximum Carbon dioxide (CO₂) was recorded at 1.8% v/v in WS106 on the sixth monitoring visit. A maximum flow was recorded at 6.9 l/hr within WS106 on the second visit however on evaluation it is likely due to a flooded borehole.

Boreholes WS101, WS106 and WS109 were flooded during all visits which is likely the result of the elevated CO₂ and flows. WS102 was not included within the monitoring period due to the well being reported as 'destroyed'.

The E3P report has concluded the GSV of none flooded wells is below <0.07 therefore the site is classified as a Characteristic Situation 1 (CS-1) and no ground gas protection measures are required.

2.6.4 Aggressive Ground Conditions

The E3P 2019 site investigation chemical analyses for pH and soluble sulphate content showed that, except for one sample, soils meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

E3P noted elevated sulphate concentrations within TT103A Made Ground deposits at 1.50m bgl which increases the classification to DS-2 AC-1s. E3P have assumed that upon completion of site enabling works it will, in all likelihood, be DS1 AC1s.

Curtins Contamination Risk Assessment

During Curtins 2021 site investigation a programme of environmental chemistry testing was undertaken on soil samples obtained of the Made Ground (8 no.) and natural soils (5 no.) during the Phase 2 Ground Investigation. Samples were tested for a broad suite of contamination as identified in the Interpretive Geo-Environmental and Geotechnical Letter Report.

Contamination risk assessments and recommendations undertaken by Curtins[NF1] are summarised below.

2.6.5 Soils

The Curtins Phase 2 investigation environmental chemistry results were compared with Generic Assessment Criteria for soils with respect to human health for a '*Residential without Home Ground Produce*' end use for a 6% w/w SOM for Made Ground and 1% w/w SOM for natural soils. Several exceedances were identified including lead, PAHs and VOCs.

No suspected asbestos containing materials (ACMs) were identified in the exploratory hole logs and no asbestos fibres were positively identified during laboratory screening.

Therefore the risk to human health is considered to be Moderate/Low.

2.6.6 Controlled Waters

The site is underlain by a Secondary B Aquifer and the nearest surface water feature is noted 40m south of the site.

Given the lack of free phase contamination observed during the site investigation the risk to the underlying Secondary B Aquifer and surface water features are considered to be a Low Risk.

2.6.7 Aggressive Ground Conditions

The site has been classified in accordance with BRE Special Digest 1. Based on Curtins 2021 laboratory test results it was considered that the Design Sulphate Classes and ACEC classes of DS-1 AC-1 being appropriate for the Made Ground, Superficial deposits and Bedrock.

3.0 Piling Risk Assessment

It is understood that at the current design stage, the adoption of CFA piles at a depth of between c.20 to 25m bgl and socketed into sandstone bedrock is considered to be the preferred piling solution. This method has been selected with consideration of minimal ground vibration, as well as groundwater protection aspects.

CFA piles essentially involve driving a large auger into the ground, with soils within the radius of the auger brought to surface and replaced with concrete on withdrawal of the auger. The displacement of the surrounding ground is governed by the speed of rotation of the auger relative to the speed of vertical penetration. Theoretically, it is possible to adjust the speeds so that the volume of soils displaced laterally and removed as arisings is equal to the volume of concrete placed.

Within the EA Report (2001), the six Source-Pathway-Receptor scenarios are identified as:

- 1. Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer;*
- 2. Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface;*
- 3. Direct contact of site workers and others with contaminated soil arising which have been brought to the surface;*
- 4. Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration);*
- 5. The driving of solid contaminants down into an aquifer during pile driving; and*
- 6. Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.*

This piling risk assessment tabulated overleaf address aspects 1, 4, 5 and 6 above only, in keeping with the objectives of this report (assessing the risk to groundwater). Other aspects should be appropriately dealt with through engineering design and suitable on-site management. The risk assessment methodology follows that presented in *Appendix C*.

Piling Risk Assessment

TABULATED RISK ASSESSMENT: CFA Piles

Aspect	Potential Consequence	Potential Probability	Potential Risk	Risk Management Options Available	Resultant Risk
1. Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer.	Mild Pollution of non-classified groundwater resources. Site overlies a Secondary B aquifer associated with the Manchester Marl Formation.	Likely - No visible evidence of gross contamination identified in shallow soils. - Risk to groundwater considered to be Low from ground investigation. - CFA piling method essentially self-sealing with concrete and therefore no resultant pathway.	Low	Not required.	Low
4. Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration).	Mild Damage to sensitive buildings/structures/services or the environment.	Unlikely Soluble sulphate concentrations in soils generally meet a Design Sulphate class of DS-1 AC-1 for Made Ground soils and natural soils.	Very Low	Not required.	Very Low
5. The driving of solid contaminants down into an aquifer during pile driving.	Mild Pollution of non-classified groundwater resources. Site overlies a Secondary B aquifer associated with the Manchester Marl Formation.	Unlikely Above considerations, plus: Low likelihood as arisings brought to surface in CFA methods, with speed of auger rotation to be matched with downward force to avoid driving soils down.	Low	Speed of auger rotation to be matched with downward force to avoid driving soils down.	Low
6. Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.	Mild Pollution of non-classified groundwater resources. Site overlies a Secondary B aquifer associated with the Manchester Marl Formation.	Low Likelihood Above considerations but accounting for potential for 'bleeding' of concrete.	Low	Cement content of the concrete will need to be closely monitored so that this in itself does not 'bleed' into groundwater.	Low

4.0 Summary and Recommendations

The risk assessment presented herein has concluded that there is a Low risk to contamination of groundwater beneath the site to the underlying Secondary B Aquifer from the use of CFA piling, providing that the following risk management measures are put in place:

- *Speed of auger rotation needs to be matched with downward force to avoid driving soils down; and*
- *Cement content of the concrete will need to be closely monitored so that this in itself does not 'bleed' into groundwater.*
- *Suitable sulphate resistant concrete should be used for all substructures to remain in contact with Made Ground soils meeting a DS-1 DS class and AC-1 ACEC class in accordance with BRE Special Digest 1:2005 Concrete in Aggressive Ground guidance.*

The following considerations should also be taken into account:

- *The piling contractor should prepare and submit relevant method statements for approval prior to piling works commencing;*
- *Where arisings are generated, they should be classified, handled and disposed of in compliance with relevant best practice and regulatory requirements;*
- *The piling contractor should make allowance for the provision of appropriate PPE based on chemical analysis results within the Phase 2 Ground Investigation Report;*
- *The piling contractor undertaking excavations should undertake their own risk assessments with regard to UXO risk at the site; and*
- *In the event of uncovering any areas of unexpected contamination during the piling works, including odorous or stained soils, works should be ceased with the advice of the appointed environmental consultant sought immediately.*

This document should be forwarded to the Planning Authority for discharge of a relevant planning condition where applicable, before piling works commence to disclose that there is a low risk to groundwater from the proposed use of CFA piling on site where the above risk management measures are adhered to.

5.0 References

1. Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater & Contaminated Land Centre report NC/99/73 (EA Report 2001).
2. E3P (2020) Phase I Geoenvironmental Site Assessment Land at Jersey Street, Ancoats, Manchester Report Ref. 13-729-R1 (Ref.2).
3. E3P (2020) Parcel B Phase II Geoenvironmental Site Assessment Land at Jersey Street, Ancoats, Manchester Report Ref. 13-350-R3 (Ref.3).
4. Curtins (2021) Interpretive Geo-Environmental and Geotechnical Letter Report for Back of Ancoats, Plot B Ref. 076740-CUR-00-XX-RP-GE-002-V01 (Ref.4).
5. E3P (2020) Parcel B Ground Gas Addendum Report Land at Jersey Street, Ancoats, Manchester Report Ref. 13-729-R3-B (Ref.5).

Appendix A – Drawings

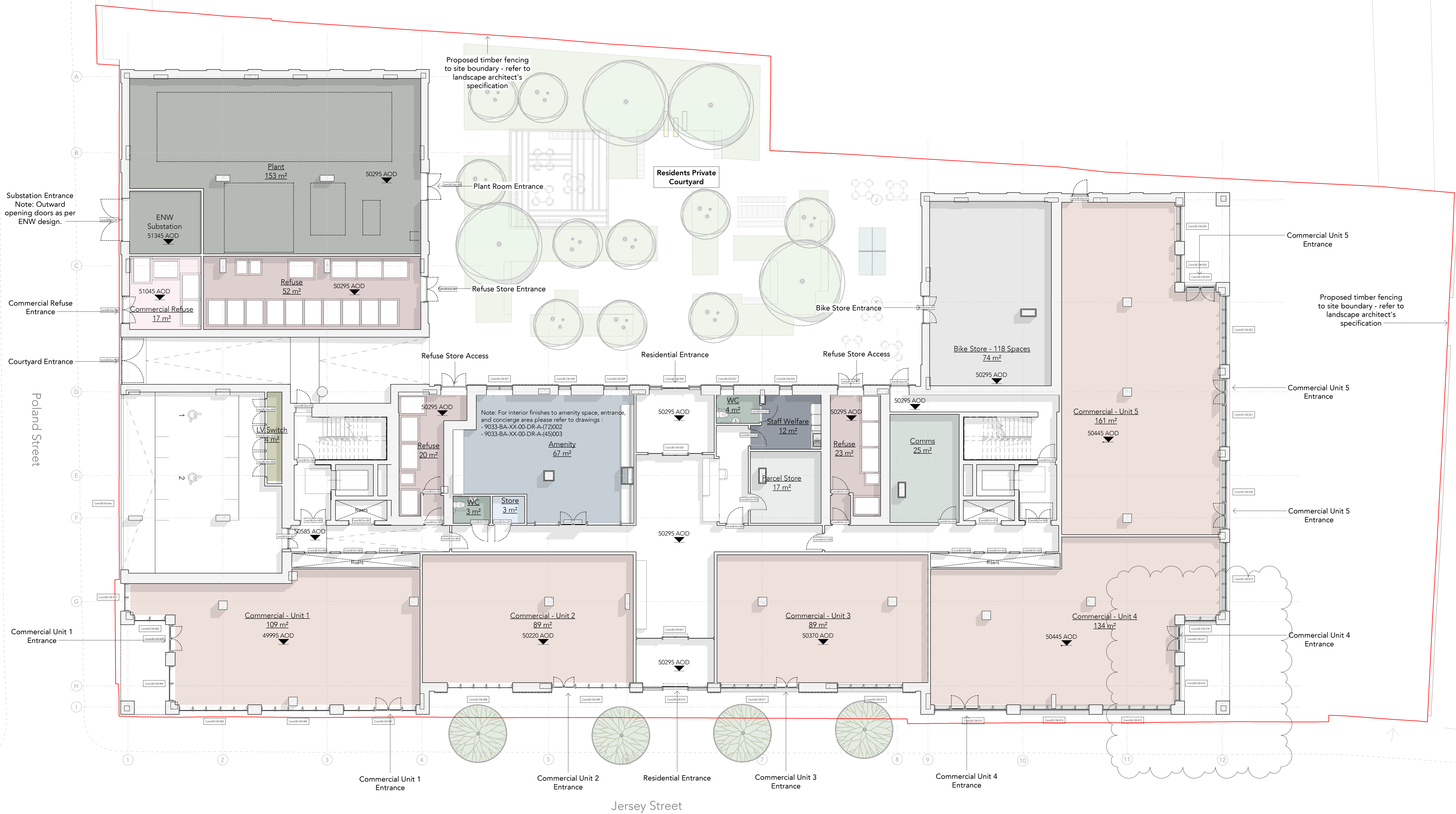
- Development Plans
- Curtins Exploratory Hole Location Plan



Planning Development Boundary

1 0 1 2 3 4 5 m
SCALE 1:100

- Plant
- Refuse
- Commercial Refuse
- LV Switch Room
- Amenity
- WC
- Store
- Commercial Unit
- Staff Welfare
- Parcel Store
- Comms
- Bike Store



T7	23/05/22	PB	Tender Addendum - bridge removal/levels update
T6	20/05/22	PB	Bridge removal - Planning NMA
T5	22/02/14	CM	Nb walls in clubroom removed
T4	22/10/21	CM	Tender addendum
T3	29/07/21	CM	Updated following client comment
T2	16/07/18	CM	Revised partition types
T1	02/07/21	CM	Tender Issue
T0	07/05/21	PB	Planning Issue

Rev Date Isss Details

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Project Title Eliza Yard
Client Manchester Life Development Company 2
Location Manchester

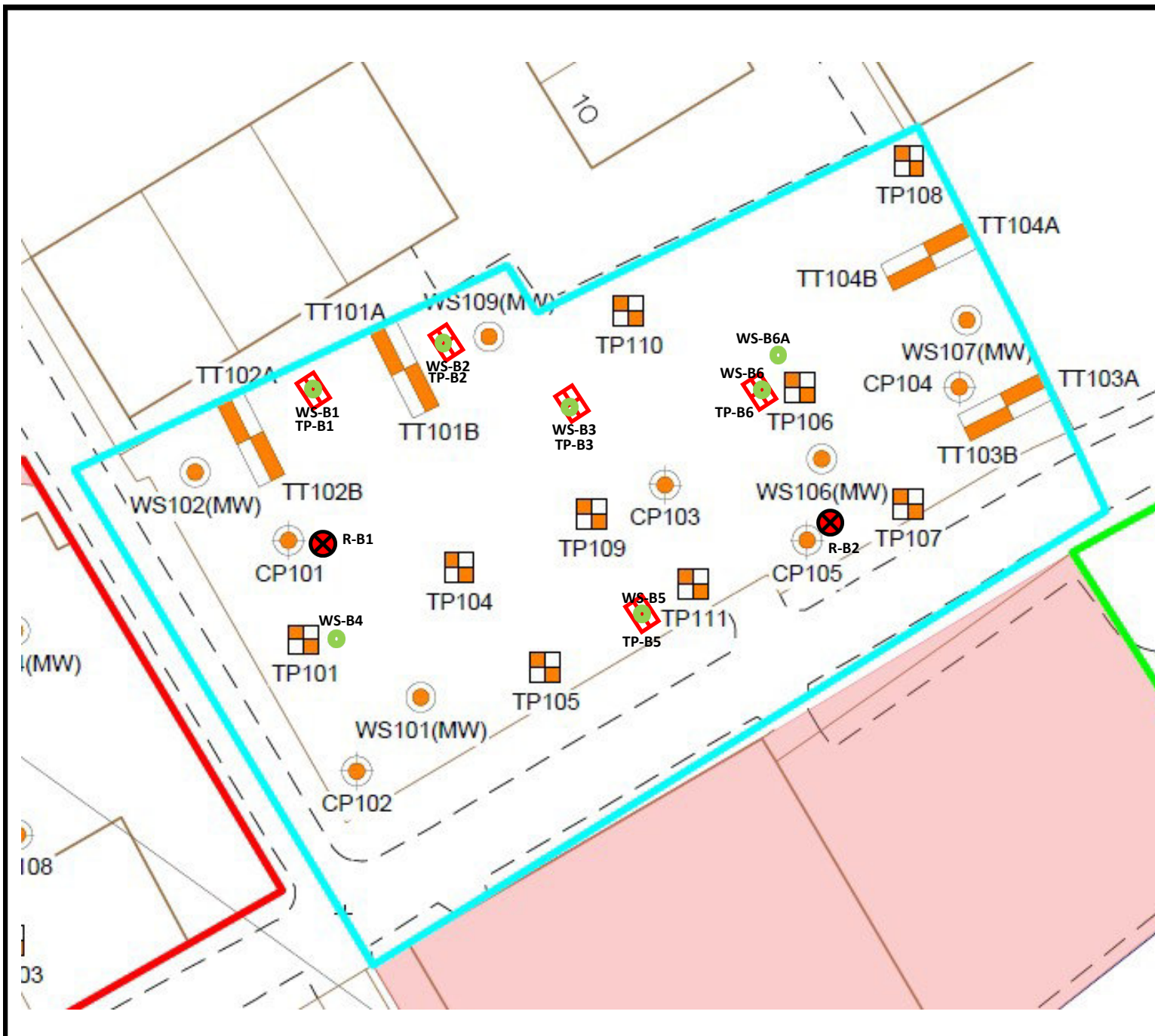
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Job No: 9033
Status TENDER

Project: Origin: Zone: Level: Type: Desc: Number: Rev:

9033-BA-XX-00-DR-A- (04)000-T7



Key

EP3 2019 Investigation

Location Symbols

-  WS101 Approximate Window Sample Probehole Location
-  TP101 Approximate Trial Pit Location
-  TT101 Approximate Slit Trench Location
-  No Access
-  Parcel A
-  Parcel B

Curtins 2021 Investigation

-  Rotary Cored Boreholes
-  Window Samples
-  Machine Excavated Trial Pit

Scope of Works

2no Rotary Geobore S boreholes to max 30m bgl.

6no Window Sample boreholes up to 3m bgl.

Machine Excavated Trial Pits advanced where window samples encountered shallow obstructions.

Back of Ancoats - Parcel B

Exploratory Hole Location Plan



Appendix B – Exploratory Hole Logs

- Exploratory Hole Logs



Borehole Log

Borehole No.

R-B1

Sheet 1 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.55

Scale
1:40

Client: Manchester Life

Dates: 04/02/2021 - 08/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.65	ES		0.20	50.35		MADE GROUND: Concrete.	1
					0.70	49.85		MADE GROUND: Black gravelly fine to coarse sand with low cobble content. Gravel is angular to subangular fine to coarse of brick and concrete. Cobbles are angular of brick.	
					0.80	49.75		MADE GROUND: Concrete.	
					1.20	49.35		MADE GROUND: Black slightly gravelly slightly clayey fine to coarse sand. Gravel is angular to subangular fine to coarse of brick, glass and concrete.	
								Stiff to Very stiff brownish grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mudstone and sandstone.	
									2
									3
									4
									5
									6
									7
									8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B1

Sheet 2 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.55

Scale
1:40

Client: Manchester Life

Dates: 04/02/2021 - 08/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00		N=48 (2,4/7,10,13,18)					9
		12.50		N=52 (4,8/52 for 245mm)					10
		14.00		50 (6,10/50 for 200mm)					11
		15.50		N=41 (2,6/6,10,11,14)					12
									13
									14
									15
									16

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B1

Sheet 3 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.55

Scale
1:40

Client: Manchester Life

Dates: 04/02/2021 - 08/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		16.80 - 17.00	D	50 (10,14/50 for 105mm)	16.70	33.85		Very stiff brownish grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone and mudstone.	17
		17.00			17.00	33.55			
		18.50	50 (7,14/50 for 105mm)					Highly weathered extremely weak light grey and brown MUDSTONE, recovered as a stiff sandy clay.	18
		20.00	50 (7,9/50 for 170mm)	20.00	30.55		Highly weathered extremely weak light grey and brown MUDSTONE.	20	
		21.50		21.50	29.05		Weak reddish brown fine grained SANDSTONE.	22	
		23.00		23.00	27.55		Extremely weak to weak brown mottled grey MUDSTONE with closely to medium spaced thin laminations of fine grained sandstone.	23	
Continued on next sheet								24	

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B2

Sheet 1 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.45

Scale
1:40

Client: Manchester Life

Dates: 02/02/2021 - 04/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.25	50.20		MADE GROUND: Concrete.	
					0.60	49.85		MADE GROUND: Black slightly gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of scrap metal, concrete, brick, ash and glass. Slight hydrocarbon odour.	
					0.75	49.70		MADE GROUND: Concrete.	
								MADE GROUND: Dark brown slightly sandy gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to medium of brick.	1
					1.30	49.15		Stiff to very stiff greyish brown sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone, mudstone and calcite.	2
									3
									4
									5
									6
									7
									8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. No SPT taken at 17m due to sample stuck in casing. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B2

Sheet 2 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.45

Scale
1:40

Client: Manchester Life

Dates: 02/02/2021 - 04/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00		N=60 (4,6/60 for 255mm)					9
		12.50		50 (25 for 125mm/50 for 85mm)				From 11.40 to 12.50m no recovery.	10
		14.00		50 (25 for 115mm/50 for 60mm)				From 13.00 to 14.00m no recovery.	11
		15.50						From 14.75 to 17.00m no recovery.	12
		15.50	D	N=50 (4,7/50 for 245mm)	15.50	34.95		Very stiff greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone.	13
								Continued on next sheet	14
									15
									16

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. No SPT taken at 17m due to sample stuck in casing. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B2

Sheet 3 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.45

Scale
1:40

Client: Manchester Life

Dates: 02/02/2021 - 04/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					18.50	31.95		From 17.90 to 18.00m recovered as non-intact core of subangular cobbles. From 18.00 to 18.50m no recovery.	17
					20.00	30.45		Weathered very weak reddish brown fine grained SANDSTONE. 18.50 to 20.00m 0 - 10 degrees medium spaced, locally very closely spaced, planar rough.	18
								Highly weathered extremely weak light grey and brown MUDSTONE. 20.00 to 20.12m 1 No. discontinuity 10 degrees, planar rough. From 20.12 to 20.19m recovered as non-intact core of angular coarse gravel. 20.19 to 20.37m 1 No. discontinuity 0 - 10 degrees, planar to undulating rough. From 20.37 to 21.50m no recovery.	19
								21.50 to 22.02m 5 - 15 degrees medium spaced to closely spaced, planar to undulating rough and incipient fractures 10 - 20 degrees extremely closely spaced, planar. From 22.02 to 23.00m no recovery.	20
								23.00 to 23.10m 1 No. discontinuity 0 - 10 degrees, planar smooth. From 23.10 to 24.50m no recovery.	21
									22
									23
									24

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. No SPT taken at 17m due to sample stuck in casing. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

R-B2

Sheet 4 of 4

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
CP+RC

Location: Ancoats, Manchester

Level: 50.45

Scale
1:40

Client: Manchester Life

Dates: 02/02/2021 - 04/02/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					24.50	25.95		Moderately weathered weak brown thinly laminated MUDSTONE. From 24.50 to 24.60m recovered as non-intact core of clayey angular to subangular fine to coarse gravel. 24.60 to 27.70m 0 - 10 degrees closely spaced to medium spaced, locally very closely spaced, planar smooth and incipient fractures 10 -20 degrees extremely closely spaced, planar.	25
								From 25.95 to 26.00m no recovery.	26
								At 26.42m clayey infill.	
								From 27.00 to 27.50m highly weathered extremely weak.	27
								From 27.50 to 28.00m very weak.	
								From 27.70 to 27.74m recovered as non-intact core of angular fine to medium gravel. 27.74 to 28.00m 1 No. discontinuity 5 degrees, planar smooth.	28
								From 28.00 to 28.07m recovered as non-intact core of clayey angular fine to coarse gravel. 28.07 to 29.50m 0 - 10 degrees closely spaced to medium spaced, locally very closely spaced, planar smooth.	
								From 29.50 to 30.00m no recovery.	29
					30.00	20.45		End of borehole at 30.00 m	30
									31
									32

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush. No SPT taken at 17m due to sample stuck in casing. SPT and Rotary Core details displayed on two separate logs - Borehole Log and Rotary Core Log.





Borehole Log

Borehole No.

WS-B1

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.46

Scale
1:40

Client: Manchester Life

Dates: 25/01/2021 - 25/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	50.26		MADE GROUND: Concrete.	
								MADE GROUND: Reddish brown brick layer with angular to subangular fine to medium gravel.	
					0.70	49.76		End of borehole at 0.70 m	
									1
									2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 0.70m. No groundwater encountered. Terminated at 0.70m due to brick foundations.





Borehole Log

Borehole No.

WS-B2

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.49

Scale
1:40

Client: Manchester Life

Dates: 25/01/2021 - 25/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	50.19		MADE GROUND: Concrete.	
					0.50	49.99		MADE GROUND: Reddish brown brick layer with angular to subangular fine to medium gravel. End of borehole at 0.50 m	
									1
									2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 0.50m. No groundwater encountered. Terminated at 0.50m due to brick foundations.





Borehole Log

Borehole No.

WS-B3

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.50

Scale
1:40

Client: Manchester Life

Dates: 28/01/2021 - 28/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20	50.30		MADE GROUND: Concrete.	
					0.45	50.05		MADE GROUND: Brown sandy angular to subangular fine to coarse gravel of brick. Sand is fine to coarse. End of borehole at 0.45 m	
									1
									2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 0.45m. No groundwater encountered. Terminated at 0.45m due to brick foundations.





Borehole Log

Borehole No.

WS-B4

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.51

Scale
1:40

Client: Manchester Life

Dates: 25/01/2021 - 25/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES	N=4 (1,0/1,1,1,1)	0.20	50.31		MADE GROUND: Concrete.	1
		0.40						MADE GROUND: Dark brown gravelly fine to coarse sand with low cobble content. Gravel are angular to subangular fine to coarse of ash, brick and concrete. Cobbles are angular of brick.	
		1.20			1.00	49.51		MADE GROUND: Black sandy angular to subangular fine to coarse gravel of brick and ash. Sand is fine to coarse.	
		1.50			1.30	49.21		From 1.20 to 1.30m slightly clayey.	
		2.00	ES	N=15 (3,3/3,4,4,4)				Soft to firm brown mottled dark grey slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine of sandstone.	
					3.45	47.06		End of borehole at 3.45 m	2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered.





Borehole Log

Borehole No.

WS-B5

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.53

Scale
1:40

Client: Manchester Life

Dates: 28/01/2021 - 28/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15	50.38		MADE GROUND: Concrete.	
					0.35	50.18		MADE GROUND: Dark brown sandy angular fine to coarse gravel of brick with high cobble content. Sand is fine to coarse. Cobbles are angular of brick. End of borehole at 0.35 m	
									1
									2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 0.35m. No groundwater encountered. Terminated at 0.35m due to solid foundations.





Borehole Log

Borehole No.

WS-B6

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.40

Scale
1:40

Client: Manchester Life

Dates: 28/01/2021 - 28/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30	50.10		MADE GROUND: Concrete. ----- End of borehole at 0.30 m	1
									2
									3
									4
									5
									6
									7
									8

Remarks

Location area scanned for services. Unable to advance past 0.30m with concrete corer due to snagging.





Borehole Log

Borehole No.

WS-B6A

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740

Co-ords: -

Hole Type
WS

Location: Ancoats, Manchester

Level: 50.40

Scale
1:40

Client: Manchester Life

Dates: 28/01/2021 - 28/01/2021

Logged By
ZH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.60	ES		0.30	50.10		MADE GROUND: Concrete.	1
					0.50	49.90		MADE GROUND: Dark brownish grey sandy angular to subangular fine to coarse gravel of brick and concrete. Sand is fine to coarse.	
					0.65	49.75		MADE GROUND: Black gravelly fine to coarse sand. Gravel is angular to subangular fine to coarse of brick and ash. Strong hydrocarbon odour.	
								End of borehole at 0.65 m	
									2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 0.65m. No groundwater encountered. Terminated at 0.65m due to concrete obstruction.





Trial Pit Log

Trialpit No

TP-B1

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740Co-ords: -
Level: 50.46Date
03/02/2021

Location: Ancoats, Manchester

Dimensions
(m):

1.8

Depth
2.00

0.7

Scale
1:40Logged
ZH

Client: Manchester Life

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.15	50.31		MADE GROUND: Concrete.	
	0.35	ES		0.35	50.11		MADE GROUND: Reddish brown and grey sandy brick layer. Sand is fine to coarse.	
							MADE GROUND: Black very gravelly fine to coarse sand with low cobble content. Gravel is angular to subangular fine to coarse of brick and concrete. Cobbles are angular of brick.	
	0.90	ES		0.80	49.66		Firm light yellowish brown sandy CLAY. Sand is fine to coarse.	1
				1.50	48.96		Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone.	
				2.00	48.46		End of pit at 2.00 m	2
								3
								4
								5
								6
								7
								8

Remarks: Trial pit area scanned for services. No groundwater encountered.

Stability: Stable.





Trial Pit Log

Trialpit No

TP-B3

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740Co-ords: -
Level: 50.50Date
03/02/2021

Location: Ancoats, Manchester

Dimensions
(m):

2.1

Depth
2.50

0.7

Scale
1:40Logged
ZH

Client: Manchester Life

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.70	ES		0.20	50.30		MADE GROUND: Concrete.	
							MADE GROUND: Reddish brown and grey sandy brick layer. Sand is fine to coarse.	
	1.10	ES		0.60	49.90		MADE GROUND: Brown and black fine to coarse sand and angular to subangular fine to coarse gravel of brick, ash and clinker with moderate cobble content. Cobbles are angular of brick. Iridescent sheen on water. Strong hydrocarbon odour.	1
				0.80	49.70			
				1.10	49.40			
				1.30	49.20			
							MADE GROUND: Reddish brown brick layer with frequent scrap metal. Strong hydrocarbon odour.	2
							MADE GROUND: Black and brown slightly sandy very gravelly clay. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone and brick.	
							Strong hydrocarbon odour.	
							Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone.	
				2.50	48.00		End of pit at 2.50 m	

Remarks: Trial pit area scanned for services. Groundwater encountered at 1.10m bgl.

Stability: Stable.





Trial Pit Log

Trialpit No

TP-B5

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740Co-ords: -
Level: 50.53Date
03/02/2021

Location: Ancoats, Manchester

Dimensions
(m):

2

Depth
2.60

0.7

Scale
1:40Logged
ZH

Client: Manchester Life

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.20	50.33		MADE GROUND: Concrete with frequent rebar.	
				0.45	50.08		MADE GROUND: Reddish brown and grey sandy brick layer. Sand is fine to coarse.	
	0.60	ES					MADE GROUND: Black very gravelly fine to coarse sand with low cobble content. Gravel is angular to subangular fine to medium of ash, clinker, brick and glass.	1
	1.20	ES		1.20	49.33		Soft black mottled brown fibrous sightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular fine of sandstone. Organic odour.	
				1.70	48.83		Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium of sandstone.	2
				2.60	47.93		End of pit at 2.60 m	3
								4
								5
								6
								7
								8

Remarks: Trial pit area scanned for services. No groundwater encountered.

Stability: Stable.





Trial Pit Log

Trialpit No

TP-B6

Sheet 1 of 1

Project Name: Man Life Back of Ancoats

Project No.
076740Co-ords: -
Level: 50.40Date
03/02/2021

Location: Ancoats, Manchester

Dimensions
(m):

1.9

Depth
3.00

0.7

Scale
1:40Logged
ZH

Client: Manchester Life

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	1.40	ES		0.25	50.15		MADE GROUND: Concrete.	1
				0.35	50.05		MADE GROUND: Reddish brown and grey brick layer with frequent rebar.	
				0.70	49.70		MADE GROUND: Black sandy angular fine to coarse gravel of brick, ash and clinker with high cobble content. Cobbles are angular of brick. Strong hydrocarbon odour.	
				0.95	49.45		MADE GROUND: Brown sandy subrounded to rounded fine to coarse gravel of stone. Sand is fine to coarse. Strong hydrocarbon odour.	
				1.40	49.00		MADE GROUND: Black sandy gravelly angular cobbles of clinker and brick. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, ash, concrete and clinker. Strong hydrocarbon odour.	
							Soft to firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. Slight hydrocarbon odour.	
				3.00	47.40		End of pit at 3.00 m	3
								4
								5
								6
								7
								8

Remarks: Trial pit area scanned for services. Groundwater encountered at 1.40m bgl.

Stability: Stable.



Appendix C – Risk Assessment Rationale

The qualitative risk assessment of environmental harm is designed to establish connecting links between a hazardous source to a potential receptor via an exposure pathway.

The qualitative risk assessment corresponds with the proposed piling operations on site.

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the hazardous source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of hazard on a site does not necessarily mean there is a risk.

By considering where a viable pathway exists which connects a source with a receptor the risk assessment in Section 3.0 and Table A4.1 identifies where pollutant linkage exists. If there is no pollutant linkage there is no risk and only where a pollutant linkage is established does the risk assessment, consider the level of risk.

The risk assessment considers the likelihood of a particular event taking place (accounting for the presence of the hazard and receptor and the integrity of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances actually occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Piling Risk Assessment

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Piling Risk Assessment

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation or risk management operations.

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