

Circle Square Building 3

Piling Risk Assessment

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Ref: CS3-CUR-03-XX-RP-G-0004

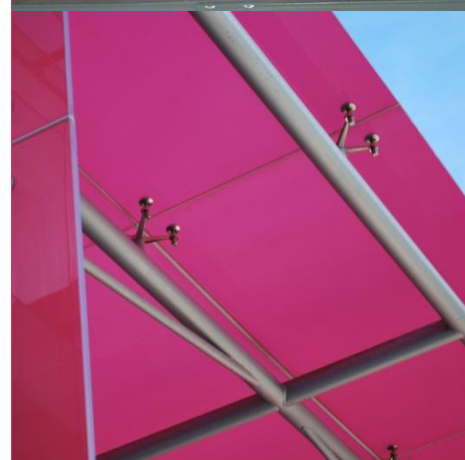
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Client Name: Bruntwood Circle Square 12 Ltd

Client Address: York House, York Street, Manchester, M2 3BB

Site Address: Circle Square Development, Brancaster Rd, Manchester, M60 7HB



Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

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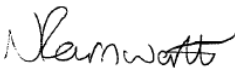


Piling Risk Assessment

Rev	Description	Issued by	Checked	Date

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Author	Signature	Date
R Tidsey BSc (Hons) Geo-Environmental Engineer		18 November 2022

Reviewed	Signature	Date
N Farnworth BSc (Hons) MCIWEM Senior Geo-Environmental Engineer		18 November 2022

Reviewed & Authorised	Signature	Date
R Allen BSc (Hons) MSc FGS MCIWEM C.WEM CEng Principal Engineer		18 November 2022

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1.0 Introduction

In November 2022 Curtins were instructed by Bruntwood Sci Tech to undertake a Piling Risk Assessment of a site called Building No. 3 Circle Square, Newman Street, Manchester, M60 7HB where piled foundations are proposed.

The proposed development on site comprises a 14-storey office development with ground floor commercial uses, along with road development off Newman Street, soft landscaping including an area of public open space on the west of site and hardstanding around the existing sub stations in the south west of the site. The proposed development plans are included within *Appendix A* of this report.

The geology underlying the site corresponds with a Principal 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.

This report has been written to address this recommendation and the pre-commencement planning condition requirement for a piling risk assessment.

It is understood that current development proposals include the use of Continuous Flight Auger (CFA) Piles to a maximum depth of circa 15m 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:

- Curtins (2022) Circle Square, Building 3 Phase 1 Preliminary Risk Assessment Report Ref. 080-CUR-00-XX-RP-GE-001 P02 (Ref.2).
- Curtins (2022) Circle Square, Building 3 Phase 2 Ground Investigation Report Ref. CS3-CUR-03-XX-RP-G-0002 (Ref.3).

- Curtins (2022) Circle Square, Building 3 Remediation Strategy Report Ref. CS3-CUR-03-XX-RP-G-0003 (Ref.4).

It is assumed that the client is in receipt of these reports and that they will also be submitted to and accepted by Manchester City 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.

2.1 The Site Setting

The site is centred at the approximate national grid reference SJ 84382 97366 and is 0.96ha in area. A site location plan is presented in *Figure 2.1*.

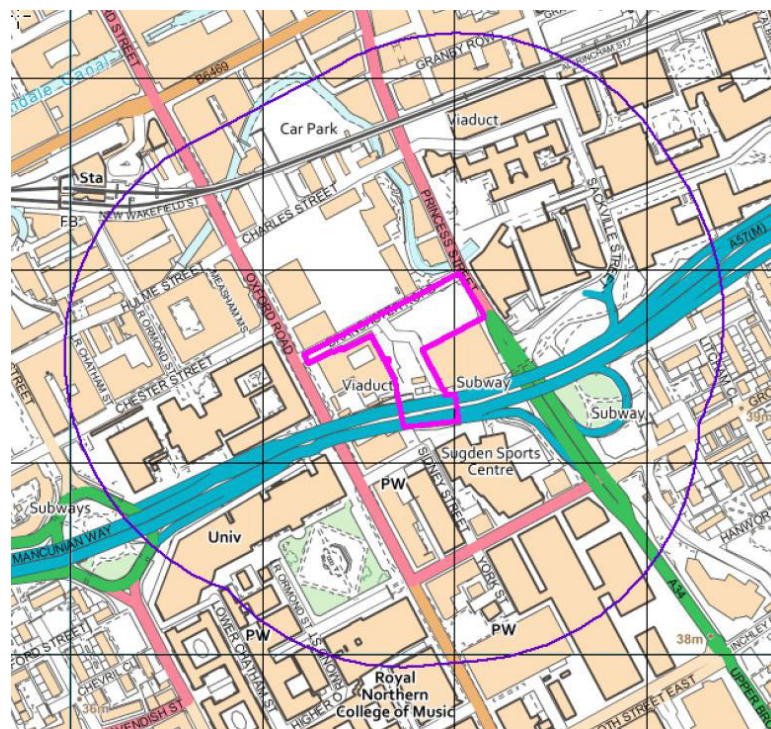


Figure 2.1 – Site Location Plan (site boundary shown in pink. 250m buffer in purple).
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The site is located south of Newman Street. The site was previously used as a construction site compound by John Sisk & Co, with the remainder capped with hardstanding. The southern-most area of the main site is lined with temporary board fence separating the site from another site along Cloak Street and the NCP car park further south.

Two substations are present to the southwest of the main site directly west of the existing NCP car park off site, understood to be retained as part of the proposed development.

The site boundary includes Newman Street, Cloak Street and the land west of the NCP car park, extending south of the substations to be retained. The site is bounded to the west by Manchester Technology Centre and Hatch. Part of the southern boundary of the site is under the A57 overpass. The site's topography is generally level.

2.2 Site History

Earliest mapping (1840's) shows the site as developed; northeast part of the site is occupied by a timer yard and two smaller yards. The rest of the site is residential terraced housing and streets. By 1923, a school and church are present in the southwest of the site. By 1948, terraced housing is demolished except the furthest west extent. Timber yard is replaced with Medlock (rubber) works with a clothing factory immediately west. Four unnamed buildings still exist near the church building on the site.

By 1954, the buildings in the south of the site are demolished and St Augustine's School is noted in the furthest south of the site. By 1969, the A57 (Mancunian Way) is present that encroaches the south of the site. By 1987, the works in the northeast of the site is no longer marked. By 1990, Armstrong House is developed on site. The previous works remains an unnamed building with area of car parking.

By 2006, the building in the northeast of the site is demolished and the area remains derelict. The site was cleared by 1990 and a new unnamed building constructed with the remainder of the site is occupied by car parking relating to Armstrong House. The building was demolished circa 2017. By 2021, Armstrong House has been demolished and two small building is present in the middle of the site near the NCP car park which are believed to be electrical substations. The site remains in this layout in present day.

2.3 Hydrogeology and Hydrology

The site, corresponding with the underlying solid geology, is underlain by a Principal Aquifer within the bedrock (Chester Formation, Sandstone) described as:

Layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, Principal aquifers are aquifers previously designated as a major aquifer.

The site is not situated within a Source Protection Zone (SPZ). There is a Zone III SPZ recorded over 100m west of the site. There are four groundwater abstraction points located within 500m of the site. The nearest being 222m southwest of the site relating to heating and general use for 'schools and colleges'. There are no potable groundwater abstraction points within 1.5km of the site.

The BGS record superficial Glacial Till, overlying the Chester Formation.

The nearest surface water feature identified by the Envirocheck report (Ref.1) is 7m to the northeast which is the River Medlock flowing west recorded as River Quality E.

There are no surface water abstractions within 1km.

There are several discharge consents within 250m of the site, the nearest being 173m northeast of the site and relates to United Utilities Water Ltd storm tank and overflow outages into the River Medlock.

2.4 Ground Conditions

The following sections present a summary of the ground conditions identified during the Curtins 2017 intrusive investigation. The exploratory hole logs are presented in *Appendix B*.

2.4.1 Made Ground

The surface covering across the site was either granular or concrete surface cover. Concrete was identified in WS101, WS104 and WS105 with a thickness of 0.10m. A variable gravel/sandy clay surfacing in the remaining boreholes.

Beneath surface coverings of granular or concrete was underlain by a dark brown/dark grey sandy gravelly clay with cobbles. Gravels/cobbles comprised of brick, concrete, sandstone. Locally, fragments of tarmac, mudstone, quartzite, siltstone, ash, charcoal and wood were also recorded. Made ground was encountered in all exploratory holes. The depth of made ground varied across the site of between 1.60m to 7.50m bgl. Deeper made ground was described as 'reworked' ground, comprising soft dark brown slightly silty, gravelly clay in BHA and BHB. WS102, WS104 and WS105 recorded similar soils from depths of 2.70m to 4.50m bgl.

Deeper Made Ground from 2.60m to 7.50m bgl in BHA and BHB was recorded to be 'Reworked Ground'. The Reworked Ground was also encountered within WS102, WS104 and WS105. These soils were recorded as either a soft dark brown slightly silty, gravelly clay, with gravel is fine to medium and subrounded to sub-angular of brick, sandstone, and siltstone. Or a cohesive soil comprising soft to firm, orangish brown, slightly silty sandy clay.

WS101 encountered deeper concrete from ground level to 0.20m bgl and a buried obstruction at 1.45m bgl most likely concrete.

No potential olfactory contamination was observed during the intrusive investigation works. All exploratory boreholes recorded ash within the Made Ground soils.

The following obstructions were encountered within made ground soils during site works detailed in *Table 2.1* below.

Table 2.1 – Obstructions Encountered

Location Number	Depth Encountered (m bgl)	Obstruction Description
WS01	0.30	Concrete. Thickness not identified.
WS01A	0.30	Concrete. Thickness not identified.
WS01B	0.25	Concrete. Thickness not identified.
WS02	0.75	Concrete. Thickness not identified.
WS02A	0.70	Concrete. Thickness not identified.
WS04	0.60	Concrete. Thickness not identified.
WS04A	0.55	Concrete. Thickness not identified.
WS101	1.45	Concrete boulder/slab

2.4.2 Natural Deposits

Superficial Soils

Where natural soils were encountered following progression through made ground, deposits indicative of glacial till deposits were recorded.

Glacial till deposits were predominately cohesive and recorded beneath made ground, from 1.60m to 7.50m bgl. Soils are typically recorded as firm or stiff dark brown or brown slightly gravelly silty clay. Gravels are typically recorded as fine and medium, subrounded sandstone, siltstone, mudstone and coal.

BH01 recorded a thin layer (0.20m) of orangish brown fine to coarse sand from 7.10m to 7.30m bgl. BHB recorded granular Glacial Till deposits from 10.50m to 11.00m bgl (23.71m to 23.21m AOD). The granular material comprised dense, dark grey sand and gravel with frequent cobbles. Gravel is rounded siltstone and sandstone and cobbles of siltstone.

Bedrock (Chester Formation)

The bedrock (Chester Formation) comprised of a medium strong locally weak, reddish-brown medium to coarse grained arenaceous sandstone from 9.50m to 11.00m bgl. The surface was heavily weathered in BHA (8.20m to 9.50m bgl), recovered as very dense reddish brown slightly gravelly medium and coarse sand. The quality of the rock improved with depth.

The base of the sandstone was not proven during the investigation. The boreholes were terminated at a depth of 25.0m bgl.

2.4.3 Groundwater

Groundwater strikes were recorded during drilling and in post investigation monitoring, in the made ground and superficial geology. The following considerations are given to the underlying groundwater regime:

- Water levels are typically recorded within the Made Ground.
- Groundwater strikes were also recorded within the Glacial Till at various depths.
- This is considered to represent perched groundwater.
- Perched water is likely to be encountered in excavations <2m bgl, and management by pumping from sumps should be possible.
- No groundwater level monitoring was undertaken within the bedrock stratum.

2.5 Contamination Risk Assessments and Remediation

A programme of environmental chemistry testing was undertaken on soil samples obtained of the Made Ground (13 no.) and natural soils (4 no.) during the Phase 2 Ground Investigation. A further programme of environmental chemistry testing was undertaken on soil samples obtained of the Made Ground (5 no.) during the additional ground investigations as reported in Curtins Remediation Strategy. Samples were tested for a broad suite of contamination as identified in the Phase 2 & Remediation Strategy report. Further investigation near the existing sub-station includes additional samples (1 no. made ground and 2 no. natural) and tested for PCBs and TPHs.

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

2.5.1 Soils

The initial Phase 2 investigation environmental chemistry results were compared with Generic Assessment Criteria for soils with respect to human health for a '*Commercial*' end use for a conservative 1% SOM for Made Ground and natural soils. No exceedances were identified.

The additional site investigation where samples were taken outside the building footprint were compared against the Public Open Space Park end use with a SOM of 2.5% for Made Ground. No exceedances were identified.

No asbestos containing materials (ACMs) were identified during the investigation works. However during the laboratory analysis, three samples identified asbestos during the initial site investigation, with asbestos quantification confirming amosite loose fibres below <0.001%. Asbestos was not identified within the samples taken outside the building footprint.

A **Moderate/Low** risk rating is identified to construction workers, from soils and dust from inhalation and ingestion at this stage.

2.5.2 Controlled Waters

The nearest surface water feature is noted 7m northeast of the site. Given the marginally elevated concentrations of contaminants and no free phase contamination within the soils or water, the likelihood of shallow groundwater migrating to the water feature is unlikely. On this basis, the risk to surface water features was considered **Low**.

Two groundwater samples were taken from the window sample boreholes during the 2022 investigation. With respect to EQS, elevated concentrations of cyanide, copper, chromium, nickel and PAHs were recorded in WS102 and marginally elevated concentrations of copper and lead were recorded in WS105. However given the River Medlock is confined by a stone/concrete/brick retaining wall, limiting the likelihood of migration from perched water to the river water. On this basis and given the site is not situated within a Source Protection Zone (SPZ), the risk to groundwater and surface water is considered **Low** and **Very Low** respectively.

2.5.3 Ground Gas

Six monitoring visits were completed between 26th June and 30th August 2019 with a further six visits completed between 17th March and 16th June 2022 due to inability to access boreholes during the first round.

Methane was recorded at a maximum concentration of 4.8% v/v in one location. A maximum peak gas flow of 67.8l/hr was recorded with a maximum steady state gas flow of <0.1l/hr recorded. Carbon dioxide was recorded between 0.6% v/v to 0.9% v/v during the gas monitoring visits. The 'borehole' Q_{hg} for the development site was derived, recording a maximum Q_{hg} of 0.0048 l/hr for carbon dioxide, using a maximum steady state air flow rate of 0.1 l/hr and methane concentrations of 4.8% v/v (WS102, 4th visit), corresponding with a Characteristic Situation 2 (CS-2) ground gas regime.

This corresponds with a Characteristic Situation 2 (CS-2) ground gas regime. Subsequently gas protection measures are required.

2.5.4 Aggressive Ground Conditions

The site has been classified in accordance with BRE Special Digest 1. Based on the 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 and Superficial deposits.

3.0 Piling Risk Assessment

At the current design stage, the adoption of CFA piles at a maximum depth of c.15m bgl 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.	Medium Pollution of sensitive water resources in groundwater. Site overlies a Principal aquifer associated with the Chester Formation.	Unlikely - No evidence of free product or 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).		Unlikely Soluble sulphate concentrations in soils generally meet a Design Sulphate class of DS-1 AC-1 for Made Ground soils and natural soils.	Low	Not required.	Low
5. The driving of solid contaminants down into an aquifer during pile driving.		Low Likelihood 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.	Moderate / Low	Speed of auger rotation needs 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.		Low Likelihood Above considerations but accounting for potential for 'bleeding' of concrete.	Moderate / 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 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.*

It is further concluded that based on the building cover on site and paving proposals in the central courtyard infiltration of rainwater will be prevented across the site. On this basis there is considered to be a very low risk from leaching of contaminants in made ground through rainfall infiltration. Soil leachability tests are not considered necessary ahead of the development.

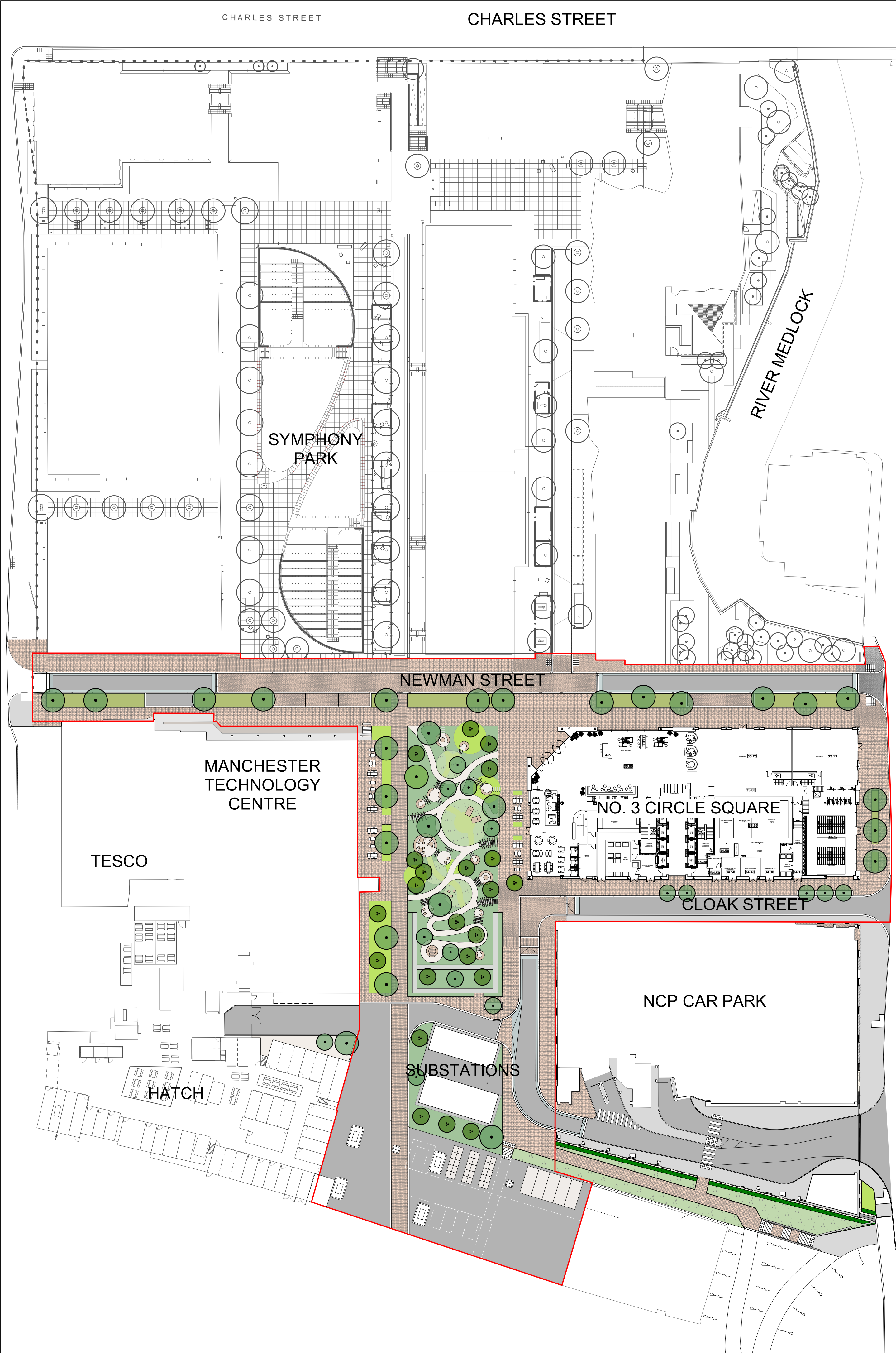
This document should be forwarded to the Planning Authority for discharge of the relevant planning condition before piling works commence to disclose that there is a low risk to groundwater from the proposed use of CFA piling on site where the above risk management measures are adhered to and to detail as to why soil leachability tests are not considered necessary ahead of the development.

5.0 References

1. Curtins (2022) Circle Square, Building 3, Manchester, Phase 2 Intrusive Investigation Report, Ref. CS3-CUR-03-XX-RP-G-0002-C01.
2. 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).
3. Curtins (2022) Circle Square, Building No. 3, Phase 1 Preliminary Risk Assessment, Ref. 080355-CUR-00-XX-DR-GE-001-P02.

Appendix A – Drawings

- Development Plans
- Curtins Exploratory Hole Location Plan



KEY - LEVELS

	PROPOSED LEVELS
	EXISTING LEVELS RETAINED
	PROPOSED GRADIENTS

KEY - HARDWORKS

	CONCRETE SETT PAVING Location: To pedestrian and occasional vehicle areas within streets Size: 300x100x80mm Laying: Reverse Stretcher Bond Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	CONCRETE SETT PAVING Location: To pedestrian and light vehicle areas within streets Size: 100x300x80mm, 150x300x80mm, 300x200x80mm Laying: Reverse Stretcher Bond Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	CONCRETE SETT PAVING Location: To occasional heavy vehicle areas within streets Size: 300x100x80mm Laying: 45°Herringbone - Longitudinal Type / Colour: Kellen / Volcanoo Finish: Washed finish Notes: Flexible Construction
	TARMACADAM To vehicle areas To engineers details and specification
	TARMACADAM To pedestrian areas (Cloak Street footpath) To engineers details and specification
	GRANITE SETTS Location: Edging bands within vehicular carriageway Size: 100x100x100mm setts Laying: Rigidly Laid Type / Colour: Hardscape Kobra Granite Setts, or Acceptable Equivalent Finish: Rigidly Laid
	RESIN BOUND GRAVEL Location: To Symphony Gardens paths Laying: 50mm thick Type / Colour: Sureset Mulberry Finish: As supplied Notes: Fermeable
	GRANITE TACTILE CORDUROY PAVING Location: At bottom and top of steps Size: 400mm x 400mm x 80mm (D) Laying: Stack Bond Type / Colour: Kobra grey (contrasting to surrounding paving) Notes: N/A
	GRANITE TACTILE BLISTER PAVING Location: Crossings Size: 400mm x 400mm x 80mm (D) Laying: Stack Bond Type / Colour: Kobra grey (contrasting to surrounding paving) Notes: N/A
	GRANITE STEPPING STONES Location: Symphony Gardens Size: 900 x 200 x 50mm (TBC) Laying: Concrete haunching Type / Colour: Hardscape Kobra Granite (TBC) Finish: Fine Picked (TBC)
	GRANITE STEPS WITH CORTEN RETAINING EDGE Location: Symphony Gardens Size: 1000 x 200 x 50mm (TBC) Laying: Concrete haunching Type / Colour: Hardscape Kobra Granite (TBC) Finish: Fine Picked (TBC) Edging: Corten steel edge to retain levels and feather into adjacent planting. Details TBC
	UPSTAND GRANITE KERB Location: Sitewide - to vehicular carriageway Laid: 60mm upstand Size: 255 (w) x 900 (l) x 240mm Colour: Hardscape Kobra Granite Finish: Picked
	FLUSH GRANITE KERB Location: Sitewide - to vehicular carriageway Laid: Flush Size: 255 (w) x 900 (l) x 180mm Colour: Hardscape Kobra Granite Finish: Picked
	FLUSH METAL EDGING Location: Symphony Gardens Paths Laid: Flush Size: 6 (w) x 1000 (l) x 100mm Material: Corten Steel Metal Edging

KEY - FURNITURE

	BESPOKE TIMBER BENCHES Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER SEATS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER TABLES AND SEATS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	BESPOKE TIMBER SUNLOUNGERS Location: Symphony Gardens Size: TBC Material: Treated FSC Timber Supplier: TBC
	FREESTANDING METAL TABLES AND CHAIRS Location: Spill out from buildings Size: TBC Material: Powder coated steel TBC Supplier: TBC

THIS DRAWING IS COPYRIGHT PROTECTED AND MAY NOT BE REPRODUCED IN WHOLE OR PART WITHOUT WRITTEN AUTHORITY FROM THE OWNER.

- NOTES:**
- Do not scale from this drawing.
 - Always work to noted dimensions.
 - All dimensions are in millimetres unless otherwise stated.
 - All setting out, levels and dimensions to be agreed on site.
 - The dimensions of all materials must be checked on site before being laid out.
 - This drawing must be read with the relevant specification clauses and detail drawings.
 - Order of construction and setting out to be agreed on site.

KEY - SOFTWORKS

	MATURE TREE PLANTING Location: Sitewide Size: 45-55cm girth mature single-stem specimens. Individual trees will vary in size. Full planting plan and specification TBC
	SEMI-MATURE TREE PLANTING Location: Sitewide Size: 20-45cm girth mature single-stem specimens. Individual trees will vary in size. Full planting plan and specification TBC
	MULTI-STEM TREE PLANTING Location: Sitewide Size: Multi-stem ornamental specimens. Individual trees will vary in size. Full planting plan and specification TBC
	EXISTING HEDGE PLANTING Location: To south of MSCP
	BIODIVERSE PLANTING Location: Sitewide Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	ORNAMENTAL PLANTING Location: Sitewide Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	SUDS PLANTING Location: Newman Street and Princess Street planting beds Notes: 300mm topsoil over 150mm subsoil Full planting plan and specification TBC
	WILDFLOWER LAWN Location: Symphony Gardens Notes: Pregrown wildflower turf laid on 150mm subsoil Full planting plan and specification TBC
	MOWN PATHS THROUGH WILDFLOWER LAWN Location: Symphony Gardens Notes: Pregrown wildflower turf laid on 150mm subsoil Full planting plan and specification TBC

Revision	Date	Description	Drawn	Apprvd.
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Planit I.E. Limited
E: info@planit-ie.com W: planit-ie.com

MANCHESTER
2 Back Grafton St, Altrincham, WA14 1DY
T: 0161 928 9281

LEEDS
No.1 Aire Street, Leeds Station, Leeds, LS1 4PR
T: 0113 824 6413

LIVERPOOL
Tempest 5.3, 12 Tithebarn Street, Liverpool, L2 2DT
T: 0151 363 1230

LONDON
Unit 6 Waterside, 44-48 Wharf Road, London, N1 7UX
T: 0207 253 5678

STANDISH
Standish Gatehouse, Stonehouse, Gloucestershire, GL10 3BZ
T: 0145 360 7080

Client Bruntwood

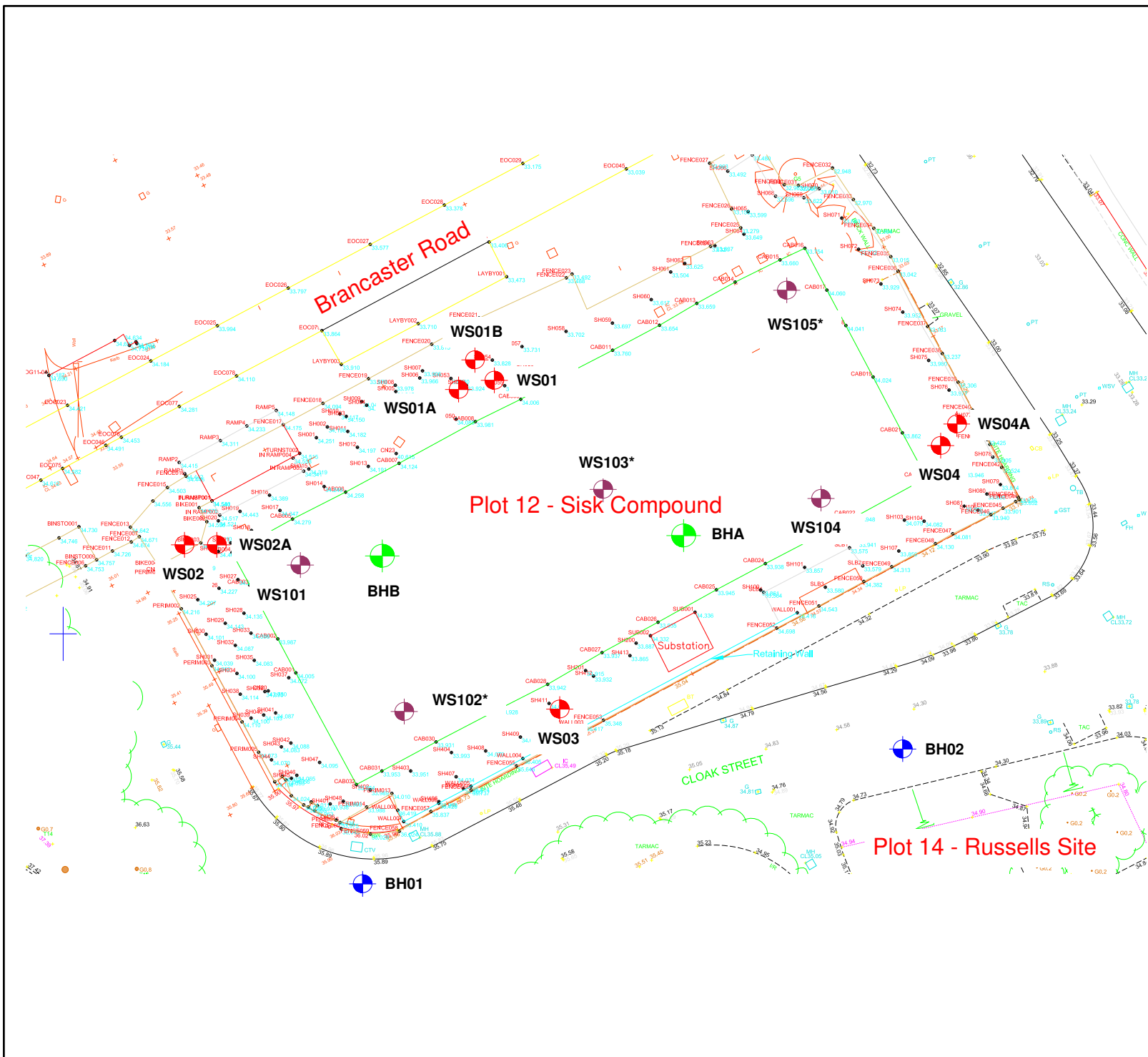
Project No 3 Circle Square, Manchester

Drg Title Landscape Masterplan wider context

Created on 15-12-21 Created by CL Approved by LH

Scale 1:500 Workstage A1 Information

Drg No 1502a-PLA-XX-XX-DR-L-0001 Suitability S1 Revision P01



PREVIOUS BOREHOLES



CABLE PERCUSSIVE BOREHOLE LOCATIONS
WITH ROTARY (CORED) FOLLOW ON



WINDOW SAMPLE BOREHOLE LOCATIONS



CABLE PERCUSSIVE BOREHOLE LOCATION
AUGUST 2020 INVESTIGATION

2022 INVESTIGATION BOREHOLES



WINDOW SAMPLE BOREHOLE LOCATIONS

Rev:	Description:	Date:	By:	Chkd:
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Curtins Consulting Ltd.
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

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Status:

INFORMATION

Project:

CIRCLE SQUARE, PLOT 12

Drg Title:

EXPLORATORY HOLE LOCATION PLAN
(ADDITIONAL GI)

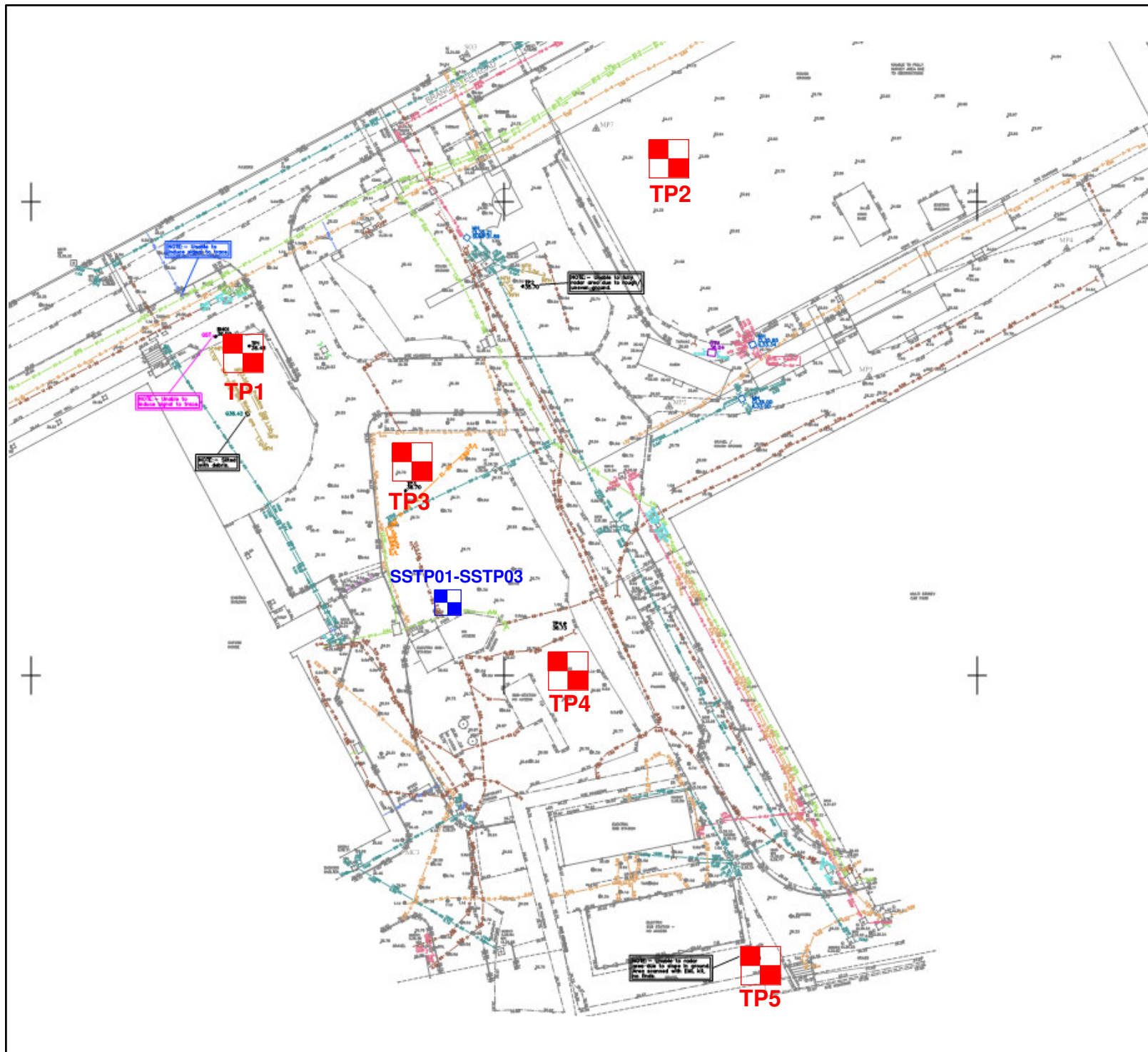
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NTS	A3	14/03/2022	PN	NF

Drg No:	Rev:
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CS12-CUR-12-XX-DR-GE-80004

P01

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-  MACHINE EXCAVATED TRIAL PITS
-  SAMPLES TAKEN FROM SAME TRIAL PIT AT DIFFERENT DEPTHS SSCP01 - SSCP03

Rev:	Description:	Date:	By:	Chkd:
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Curtins Consulting Ltd.
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

CIRCLE SQUARE BUILDING 3, MANCHESTER

Drg Title:

EXPLORATORY HOLE LOCATION PLAN

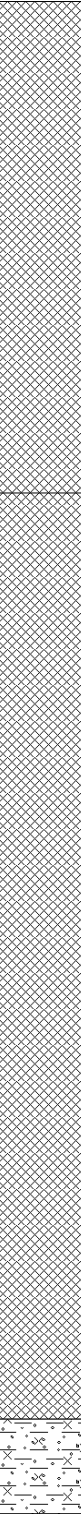
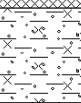
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Drg No: CS12-CUR-12-XX-DR-GE-80005	Rev: P01
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Appendix B – Exploratory Hole Logs

- Exploratory Hole Logs

					Borehole Log			Borehole No. BHA Sheet 1 of 2	
Project Name: Circle Square Plot 12				Project No. 069467.304		Co-ords: 384393596.13 - 397356537.25		Hole Type CP	
Location: Manchester				Level: 34.21		Scale 1:40		Logged By RT	
Client: John Sisk & Son Ltd				Dates: 04/08/2020 - 04/08/2020					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.20		N=8 (3,1/2,2,2,2)	2.60	31.61		MADE GROUND of firm dark grey very gravelly clay with occasional cobbles. Gravel is medium to coarse and sub-angular to angular of concrete, timber, brick, metal, ceramic, siltstone and sandstone. Cobbles are sub-angular of brick and concrete. <i>Grey concrete boulder along the southern side of the hand pit. Between 0.60 - 0.80m bgl.</i>	1
		2.00		N=6 (2,3/2,1,2,1)					2
		3.00		N=7 (2,1/1,2,2,2)					3
		4.00		N=5 (2,2/1,1,2,1)					4
		5.00		N=8 (2,1/2,2,1,3)					5
		6.00		N=6 (1,2/2,1,2,1)					6
	7.50		N=11 (2,2/2,3,3,3)	7.50	26.71		Firm dark brown slightly gravelly silty CLAY. Gravel is fine to medium and sub-rounded of coal, sandstone and siltstone.	8	
Continued on next sheet									

Remarks
Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 7.50m, strike rose to 7.00m after 20minutes. Chiseling for an hour between 9.00m to 10.00m. Borehole complete at 10.10m bgl within sandstone bedrock.
Document Reference: CS12-CUR-12-XX-RP-GE-80002 Rev.P01.



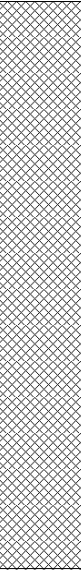
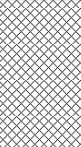
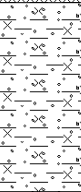
						Borehole Log			Borehole No. BHA Sheet 2 of 2	
Project Name: Circle Square Plot 12						Project No. 069467.304		Co-ords: 384393596.13 - 397356537.25		Hole Type CP
Location: Manchester						Level: 34.21		Scale 1:40		
Client: John Sisk & Son Ltd						Dates: 04/08/2020 - 04/08/2020		Logged By RT		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					8.20	26.01		Very dense reddish-brown slightly gravelly medium to coarse SAND. Gravel is fine to coarse and sub-rounded of sandstone (Weathered Sandstone).	9	
		9.00		50 (8,9/50 for 170mm)	9.50	24.71			10	
		10.00		50 (25 for 60mm/50 for 50mm)	10.10	24.11		End of borehole at 10.10 m		
									13	
									14	
									15	
									16	

Remarks

Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 7.50m, strike rose to 7.00m after 20minutes. Chiseling for an hour between 9.00m to 10.00m. Borehole complete at 10.10m bgl within sandstone bedrock.

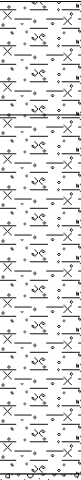
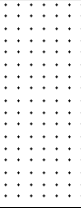
Document Reference: CS12-CUR-12-XX-RP-GE-80002 Rev.P01.



					Borehole Log			Borehole No. BHB Sheet 1 of 2			
Project Name: Circle Square Plot 12					Project No. 069467.304		Co-ords: 384372306.03 - 397359534.19		Hole Type CP		
Location: Manchester					Level: 32.02		Scale 1:40		Logged By RT		
Client: John Sisk & Son Ltd					Dates: 05/08/2020 - 05/08/2020						
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		1.20		N=14 (3,3/4,3,3,4)		29.02		MADE GROUND of firm dark grey very gravelly clay with occasional cobbles. Gravel is medium to coarse and sub-angular to angular of concrete, timber, brick, metal, ceramic, siltstone and sandstone. Cobbles are sub-angular of brick and concrete.	1		
		2.00		N=12 (4,3/2,3,3,4)					2		
		3.00		N=5 (2,1/2,1,1,1)					3		
				4.00		N=5 (2,2/1,1,2,1)	3.80	28.22		MADE GROUND of soft blackish-brown very gravelly clay. Gravel is medium to coarse and sub-angular of brick, concrete, sandstone and siltstone.	4
		5.00		N=7 (2,2/2,1,2,2)			5				
		6.00		N=10 (3,3/3,2,3,2)			6				
		7.50		N=10 (3,3/2,3,3,2)	7.00	25.02		Firm dark brown very silty gravelly CLAY. Gravel is fine to medium and sub-rounded of coal, wood fragments, sandstone and siltstone.	7		
Continued on next sheet								8			

Remarks
Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 3.00m and 10.50m, strike at 3.00m did not rise after 20minutes, strike at 10.50m rose to 8.50m after 20minutes. Chiseling for an hour between 11.50m to 12.00m. Borehole complete at 12.10m bgl within sandstone bedrock. Document Reference: CS12-CUR-12-XX-RP-GE-80002 Rev.P01.



					Borehole Log			Borehole No. BHB Sheet 2 of 2	
Project Name: Circle Square Plot 12					Project No. 069467.304		Co-ords: 384372306.03 - 397359534.19		Hole Type CP
Location: Manchester					Level: 32.02		Scale 1:40		Logged By RT
Client: John Sisk & Son Ltd					Dates: 05/08/2020 - 05/08/2020				
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		9.00		N=11 (3,2/3,3,2,3)	8.60	23.42		Reddish-brown slightly gravelly sand. Gravel is fine to medium of sandstone. Between 8.50 - 8.60m bgl. Firm dark brown slightly gravelly CLAY. Gravel is fine to medium and rounded of sandstone and siltstone.	9
		10.50		N=40 (6,8/9,10,11,10)	10.50	21.52			
		11.00		50 (25 for 30mm/50 for 25mm)	11.00	21.02		Reddish-brown SANDSTONE bedrock.	
		12.00		50 (25 for 35mm/50 for 30mm)	12.10	19.92			End of borehole at 12.10 m
Remarks Service inspection pit excavated from GL to 1.20m. Groundwater encountered at 3.00m and 10.50m, strike at 3.00m did not rise after 20minutes, strike at 10.50m rose to 8.50m after 20minutes. Chiseling for an hour between 11.50m to 12.00m. Borehole complete at 12.10m bgl within sandstone bedrock. Document Reference: CS12-CUR-12-XX-RP-GE-80002 Rev.P01.									



Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10			MADE GROUND: Concrete over, light brown, compact, slightly cobbley sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
		0.20			0.20			MADE GROUND: Concrete boulder (required breaking out).	
		0.40			0.40			MADE GROUND: Brown, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick. (BRICK FILL)	
		0.50	ES		0.50			MADE GROUND: Very stiff, brown, sandy very gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone. Brick cobbles present from 0.9 to 1.0m bgl.	1
		1.20			1.20				
		1.20 - 1.65	D	50 (25 for 95mm/50 for 170mm)	1.20 - 1.65				
					1.47			Large obstruction at 1.45m bgl which could not be advanced through.	
								End of borehole at 1.47 m	

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole refused at 1.40m bgl on obstruction in Made ground, attempted re-drilling and also refused at 1.40m bgl. Borehole backfilled with arisings.





Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.10			MADE GROUND: Roadstone over, light brown, compact, slightly cobbly sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
		1.20			0.90			MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.20 - 1.65	D	N=14 (5,6/4,3,4,3)	1.60			MADE GROUND: Firm, brown, slightly sandy very gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone.	1
		2.00			1.80			MADE GROUND: Firm, dark greyish brown, slightly gravelly very sandy clay. Sand is fine to medium. Gravel is fine to coarse, angular to subangular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone.	
								Organic matter and buried vegetation from 1.70 to 1.80m bgl.	
								MADE GROUND: Firm, brown and orangish brown, andy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular to subangular brick, charcoal, sandstone and mudstone.	2
		2.90	D	N=13 (3,3/3,4,3,3)	2.70			Firm, orangish brown, slightly silty sandy CLAY. Sand is fine. (POSSIBLY REWORKED)	
					3.00			End of borehole at 3.00 m	3
									4

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole aborted in possibly re-worked natural soil due to anomaly readings from UXO magnetometer. Borehole installed with ground gas/water monitoring well in shallower Made Ground strata to 2.0m bgl.





Borehole Log

Borehole No.

WS103

Sheet 1 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			MADE GROUND: Roadstone over, light brown, compact, slightly cobblely sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
					0.50			MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.00	ES					MADE GROUND: Stiff, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and concrete.	1
		1.20		N=15 (5,3/3,4,4,4)					
					1.50				
		1.60	ES					MADE GROUND: Medium dense, black, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
					1.70			MADE GROUND: Medium dense, orangish brown, fine to medium sand.	
					1.85			MADE GROUND: Very soft, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	2
		2.00 2.00 - 2.45	D	N=1 (0,0/0,1,0,0)				MADE GROUND: Very soft, dark grey, slightly silty sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
					2.20				
					3.00			MADE GROUND: Very soft, wet, dark grey, slightly silty clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular ash, charcoal, sandstone and mudstone. <i>Core barrell pushed off line and getting stuck on cobbles in Made Ground at 1.0m bgl.</i>	3
					3.60			MADE GROUND: Very soft, wet, dark grey, slightly sandy slightly gravelly silty clay. Sand is fine to medium. Gravel is fine to coarse, angular ash, charcoal, sandstone and mudstone.	
		4.00		N=3 (0,0/0,1,1,1)					4

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 3.00m bgl. Borehole terminated at 4.00m bgl after core barrell knocked off line and stuck in Made Ground at 1.00m bgl. Borehole installed with ground gas/water monitoring well in Made Ground to 4.00m bgl.





Borehole Log

Borehole No.

WS103

Sheet 2 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

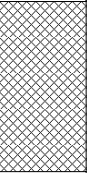
Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		4.00 - 4.45	D		4.45			End of borehole at 4.45 m	
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 3.00m bgl. Borehole terminated at 4.00m bgl after core barrell knocked off line and stuck in Made Ground at 1.00m bgl. Borehole installed with ground gas/ water monitoring well in Made Ground to 4.00m bgl.





Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES	N=50 (25 for 95mm/50 for 255mm)	0.30			MADE GROUND: Concrete over, light brown, compact, slightly cobbly sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	1
		0.70			0.70			MADE GROUND: Brown, slightly cobbly gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.00			1.00			MADE GROUND: Yellowish brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, concrete, tarmac, sandstone and mudstone.	
		1.20			1.20			MADE GROUND: Very stiff, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, concrete, sandstone and mudstone.	
		1.70	D	N=4 (3,2/2,1,1,0)	1.70			MADE GROUND: Very stiff, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	2
		2.00			2.00			Abundant ash and tarmac from 1.90 to 2.0m bgl. MADE GROUND: Loose, black, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
		2.80 - 3.00			2.80			Firm, orangish brown, slightly silty sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to medium, subangular mudstone and siltstone. (POSSIBLY REWORKED)	
					3.45			End of borehole at 3.45 m	3
									4

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 2.30m bgl from 3.0m bgl despite re-drilling. Borehole backfilled with arising.





Borehole Log

Borehole No.

WS105

Sheet 1 of 2

Project Name:	Circle Square Building 3 (Formerly Plot 12)	Project No.	B080355.300	Co-ords:	-	Hole Type	WS
Location:	Circle Square, Manchester	Level:		Scale	1:20	Logged By	TW
Client:	Bruntwood Circle Square 12 Ltd	Dates:	02/03/2022 - 02/03/2022				

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			MADE GROUND: Concrete over, light brown, compact, slightly cobbley sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular sandstone, concrete and roadstone. Cobbles of concrete. (SUBBASE)	
					1.00			MADE GROUND: Light brown, compact, slightly cobbley gravelly sand. Sand is fine to medium. Gravel is fine to coarse, angular brick, tarmac, concrete, sandstone, mudstone, quartzite and siltstone. Occasional cobbles of brick and quartzite. (BRICK FILL)	
		1.20		N=29 (5,5/5,7,7,10)				MADE GROUND: Stiff, dark greyish brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone. Occasional cobbles of brick.	1
								<u>Layer of ash from 1.50 to 1.70m bgl.</u>	
		1.75	ES					<u>Green and brown sand band with white Made Ground material (unknown composition) from 1.70 to 1.80m bgl.</u>	
		2.00		N=1 (1,0/0,1,0,0)				<u>Becoming very soft at 2.0m bgl.</u>	2
					2.70			MADE GROUND: Very soft, wet, brown, sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, angular brick, charcoal, sandstone and mudstone.	
		3.00 3.00 - 3.45	D	N=3 (1,0/0,1,1,1)					3
					3.70			MADE GROUND: Very loose, black, wet, slightly clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse, angular brick, ash, charcoal, sandstone and mudstone.	
		4.00	ES		3.90				4
Continued on next sheet									

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 3.20m bgl from 4.0m bgl despite re-drilling. Borehole installed with ground gas/water monitoring well in Made Ground to 3.00m bgl.





Borehole Log

Borehole No.

WS105

Sheet 2 of 2

Project Name: Circle Square Building 3
(Formerly Plot 12)Project No.
B080355.300

Co-ords: -

Hole Type
WS

Location: Circle Square, Manchester

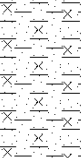
Level:

Scale
1:20

Client: Bruntwood Circle Square 12 Ltd

Dates: 02/03/2022 - 02/03/2022

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		4.00 4.00 - 4.45	D	N=6 (0,0/2,1,2,1)	4.45			Soft, orangish brown, slightly silty sandy CLAY. Sand is fine. (POSSIBLY REWORKED)	
								End of borehole at 4.45 m	
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater encountered at 2.00m bgl. Borehole collapsed twice to 3.20m bgl from 4.0m bgl despite re-drilling. Borehole installed with ground gas/water monitoring well in Made Ground to 3.00m bgl.



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.

Our Locations

Birmingham

2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol

Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge

50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff

3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas

Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin

11 Pembroke Lane
Dublin 2
D02 CX82
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh

1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow

Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal

Units 24-25 Riverside Place
K Village
Kendal
LA9 7FH
T. 01539 724 823
kendal@curtins.com

Leeds

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool

51-51 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London

40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester

Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham

56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com